The Effect of Food Security Status on Labor Supply Decisions

by

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(Under the Direction of Travis A. Smith)

Abstract

Existing literature has solidified the positive correlation between food insecurity and unemployment, but has ignored the way individuals change their labor supply in response to feelings of food insecurity. Standard labor theory says that if an individuals' needs are not being met due to a lack of income, they will respond by increasing their demand for income, potentially mediated through increasing their labor supply. To test the hypothesis that food insecurity causes an increase in labor supply we leveraged the panel nature of the Current Population Survey to employ a linear probability model with fixed effects to control for unobserved household characteristics. Households with very low food security in December had a statistically significant 1.52% increased probability of employment and a 1.38% decreased probability of losing employment in January, and a 10.03% increased probability of gaining employment in February, when compared to households with high food security.

Index words: food security, labor decisions, household economics, Current Population Survey,

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Chapter 1

Introduction

Food security is defined as having consistent access to enough food for a healthy and active lifestyle. While most U.S. households fall into this category, in 2017 20% of American households reported anxiety or an inability to access adequate food. These households are considered marginally food secure (MFS), low food secure (LFS) or very low food secure (VLFS). There is an abundance of research linking food insecurity to negative health outcomes and it is considered one of the leading nutrition-related health care issues in the U.S. (Gunderson 2015). Along with poor health, food insecurity is positively associated with unemployment and employment volatility (Hofferth 2004). Employment volatility can be seen across intensive and extensive measures, and increases with the severity of food insecurity (Nord 2002).

Being employed and having a higher income are consistently associated with lower probabilities of food insecurity (Gunderson 2017), meaning if we look at a given snapshot in time we should see higher unemployment rates among food insecure households. In 2017 the average annual unemployment rate in the U.S. was 4.4%, but for people in households with MFS, LFS or VLFS the unemployment rate was 7.5%, 11.2% and 13.1% respectively. These people are also more likely to have incomes under 185% of the Federal Poverty Guideline

(FPG), work part-time jobs, or be out of the labor force due to an inability to work.

Prior research has looked at the effects of teenage employment (Hamersma 2015) and national economic trends (Nord 2014) on food security, and on how participation in welfare programs impacts labor supply (East 2018; Fayaz 2018; Kilkenny 2003; Stacy 2016). But no papers have looked at the impact of food security status (FSS) on household labor decisions. We will attempt to disentangle the simultaneity and endogeneity of food security and employment to isolate food security's effect on employment, to determine if stress over food acquisition is a motivating or limiting factor for employment.

We propose that households experiencing food insecurity in December will be more likely to gain and keep employment in the following months when compared to HFS households. We look at labor supply at the intensive margin to see how employment status changes in response to changes in FSS. We will run an OLS linear probability model to see the average effects food security status has on employment, followed by a fixed effects model to account for unobservable characteristics that might impact both labor supply and food security status. We utilize the short panel nature of the Current Population Survey (CPS) to employ a linear probability model with fixed effects, regressing various employment measures on 30-day FSS. Fixed effects models indicate that 30-day FSS shows stronger results than the 12-month measure. This makes sense given that 30-day FSS is perhaps more salient and could better reflect the households immediate situation (Gregory 2019).

Employment status and food security do have a simultaneous relationship: changes in employment could be caused by food insecurity, or food insecurity could be caused by changes in employment. To address the simultaneity problem we will use lags to see how last month's FSS impacts the current month's labor decisions. The assumption is that future labor decisions cannot affect past food insecurity reports, which seems reasonable.

There is also an endogeneity concern: while food security is correlated with income, it is also a subjective measure and cannot be perfectly predicted by income. We do know that

households with higher incomes are more likely to report being food secure, but prior research suggests the strongest predictor of food security is people's subjective income threshold (Gunderson 2011). In order to address endogeneity in the data we assume each household's threshold for food security is time-invariant, and use a fixed effects model to compare the way the same household responds to different levels of food security over two time periods. Therefore, identification stems from within-household changes of the previous month's FSS on the current month's labor force decisions.

The results from our OLS model without fixed effects report decreased probabilities of employment and increased employment volatility across all food security levels. But when we include individual fixed effects we find very low food security to be a motivating force for employment. People experiencing very low food security have a statistically significant 1.52% increase in the probability of being employed in January, a 1.38% decreased probability of losing employment in January, and a 2.94% increased probability of being employed in March when compared to people with high food security. Very low food secure individuals also have a 10.03% increased probability of *gaining* employment from December to February compared to people with high food security. This is a contribution to literature because up until now food insecurity has only been positivley associated with unemployment, but we will show that once individual heterogeneity is controlled for food insecure households are actually more likely to work.

Understanding how households respond to a lack of access to affordable food (as measured by the food security questionnaire) is important for several reasons. The current administration argues that the Supplemental Nutrition Assistance Program (SNAP) discourages work among recipients and is currently seeking to increase work requirements for able-bodied adults without dependents. By isolating the effects of FSS on labor decisions we can see if groups with high SNAP participation see food stress as a motivating or limiting factor. This will help inform policy decisions on work incentive programs for SNAP

participation, especially when considering how divided current literature is on the effects of SNAP participation on labor supply.

Chapter 2

Background

Food security statistics come from the CPS Food Security Supplement, which is administered every December by the Bureau of Labor Statistics (BLS). The Food Security Supplement asks questions from the U.S. Household Food Security Module (FSM) to measure food security. All questions in the FSM specify the time frame, either 12 months or 30 days, and that a lack of resources caused the behavior. The United States Department of Agriculture (USDA) has definitions for each FSS. Marginally food secure (MFS) households report one or two anxieties over food acquisitions, households with low food security (LFS) report reductions in quality but not quantity of food consumed, and very low food secure (VLFS) households report a reduction in quality and quantity of food consumed. The USDA categorized MFS households as food secure, however research has shown these households have more similar incomes and health outcomes to food insecure households (Gunderson 2011; Coleman-Jensen 2009; Cook 2013). In this paper we treat MFS as its own food security category and chose not to group it with HFS households. This will allow us to see how varying levels of food security impact labor supply, ranging from a slight worry to disrupted eating.

Since all FSM answers are predicated on a lack of resources, labor theory suggests these individuals/households should try to increase their income to meet unmet needs, either

through seeking out welfare benefits or through increasing labor supply. Increasing labor supply could mean joining the labor force, getting a job or working more hours at an existing job. There is also the possibility individuals will respond to the feeling of food insecurity by becoming discouraged or depressed (Casey 2004; Payab 2014), in which case they would not try to increase their incomes, and might even work less. The other reason we might find labor supply doesn't increase is because these individuals are unable to work more, perhaps due to family commitments, a disability or because they are already working as many hours as their employer will give them. No existing literature has attempted to quantify which of these effects has the strongest impact on the labor supply of food insecure individuals.

2.1 Food Insecurity as a Subjective Measure

Food security is subjective: every household has a different idea of what constitutes them as food secure. Prior literature has had difficulty externally validating FSS. Households with higher incomes routinely report food insecurity, and households in extreme poverty often report food security, making it impossible to determine the income level that dictates household FSS. However, in general households with higher incomes are less likely to report being food insecure than households with incomes below 185% FPG. Below we describe several papers that examine the often confounding relationship between income and food security.

Nord and Brent (2002) looks at Food Security Supplement response patterns in high-income food insecure households. According to the CPS food security supplement, 20% of food insecure households are middle/high income households, this paper investigates the extent to which these households are food insecure, or if a problem in measurement methods lead to false identification of food insecurity. Researchers found only a small proportion are misidentified, and that there are real factors causing higher income household food insecurity.

The three biggest causes of food insecurity for high-income households is uneven income throughout the year, multiple economic units residing in the same household or changing household composition during the year. Researchers looked to see if food insecurity affects lower/middle/upper income households in the same way by comparing their FSM answer patterns. Answer patterns between the groups were almost identical, ruling out the idea that middle/higher income respondents randomly answered questions and that food insecurity phenomenon is the same across all levels of income.

Conversely, Gunderson and Ribar (2011) looks at low-income households that still report being food secure. Since food insecurity and income are inversely related, it would be assumed that most households with low income and low food expenditures report food insecurity. However, this paper, using the CPS Food Security Supplement, finds that food insecurity never rises above one half for this population segment, raising questions about the external validity of the measure of food security. Gunderson and Ribar found only a modest correlation between incomes/food expenditures and food security. The strongest predictor of food hardship was people's subjective income threshold. If expenditures were below their subjective threshold they were correlated the strongest with food hardships. This makes sense given that the FSM was created with internal validity as a priority, not external validity. External validation of food security measures is less important when looking at households' unique response to their FSS since we assume their subjective threshold stays constant over time.

2.2 Food Insecurity and Labor

Nord, Coleman-Jensen and Gregory (2014) tests the hypothesis that household food security can be attributed to the national unemployment rate, inflation rate and the price of food relative to other goods and services. Researchers used data from the CPS Food Security

Supplement and from the Bureau of Labor Statistics. They found that these national-level economic indicators accounted for 92% of year-to-year variation in the national prevalence of food insecurity. A 1 percentage point increase in the national unemployment and annual inflation were each associated with a .5 percentage point increase in the prevalence of food insecurity. And a 1% increase in the annual relative price of food was associated with a .6 percentage point increase in the prevalence of food insecurity. This explains why the rate of food insecurity remained stable through the early post-recession period, because falling unemployment was offset by higher inflation and higher relative price of food.

Hamersma and Kim (2015) used the CPS as panel data to estimate a fixed effects model measuring the effect of teenage employment on household FSS. They found that having an employed teen decreased the probability of a family's children having VLFS by a significant 50%. There have also been several studies that specifically look at the effect of the Supplemental Nutrition Assistance Program (SNAP) on labor supply decisions, presenting conflicting results. East (2018) and Hoynes and Schanzenbach (2012) found evidence for labor supply disencentives, consistent with standard labor theory's prediction that SNAP disencentivizes work due to the income effect from guaranteed benefits. However, Fayaz and Meyerhoefer (2018) found that SNAP participation increased the likelihood of employment among low-income adults. Stacy, Scherpf and Jo (2016) also found SNAP had a modest positive effect on labor supply. This paper is motivated by this lack of concensus on the relationship between food security and labor supply.

Rising national unemployment is associated with increased food insecurity on a national level. This means there is an endogeneity problem at the macro level due to the reverse causality of unemployment and food security. We are trying to quantify labor supply's response to food insecurity, but since we know high national unemployment rates cause higher rates of food insecurity in the overall population, it does not make sense to look at the average effect of food insecurity on employment. When looking at national averages, we

would not expect to see food insecure groups increasing employment. However, by using lags and fixed effects, we can see how individual households' labor decisions respond to previous FSS on a micro level.

Chapter 3

Data

This paper will use data from the CPS December Food Security Supplement matched with January, February and March's basic monthly questionnaire to determine if last month's FSS impacts this month's labor supply decisions. Because CPS respondents are surveyed in two waves, this paper leverages the panel nature in order to employ a fixed effects model. Specifically, we narrowed the sample down to 25,290 households that were surveyed in December and January over two consecutive years between 2005 and 2018, and who were under 300% of the federal poverty line.

3.1 The Current Population Survey

The CPS is a monthly survey of around 60,000 households conducted by the Bureau of Labor Statistics (BLS), with the main objective of estimating the unemployment rate in the United States. Households are surveyed for four consecutive months (wave 1), then after eight subsequent months with no contact are surveyed for another four months (wave 2). The CPS consists of a basic monthly survey and several supplement surveys only conducted in certain months. Households who participate in the supplement surveys almost always

respond to the basic monthly survey as well.

The Food Security Supplement of the CPS is administered over one week in December, the week varies from year to year, but is usually given during the week of December 12th. It is the primary source for national and state level statistics on food insecurity in the United States. Respondents are asked questions from the USDA's FSM to determine whether they are food secure or not. In addition to the FSM, the Food Security Supplement has four other sections in order to gather information on food expenditures and strategies used to reduce food stress:

1. Food Spending
2. Minimum Food Spending Needed
3. Food Assistance Program Participation
4. Food Sufficiency and Food Security (This is where the FSM is administered)
5. Ways of Avoiding or Ameliorating Food Deprivation (Coping Strategies)

The FSM uses several screener questions to avoid unnecessary burden on the respondent. If respondents report income above 185% of the poverty line and responded "no" to HES9[1] they were not asked questions about participation in food assistance programs. Households with income over 185% of the poverty line that indicated no food stress on questions HES9 and HESS1[2] were not asked the rest of the questions in the "Food Sufficiency and Food Security" or "Ways of Avoiding or Ameliorating Food Deprivation" sections. These households are considered "highly food secure" and are given a raw score of zero.

[1]HES9: People do different things when they are running out of money for food in order to make their food or their food money go further. In the last 12 months, since December of last year, did you ever run short of money and try to make your food or your food money go further?

[2]HESS1: Which of these statements best describes the food eaten in your household – enough of the kinds of food (I/we) want to eat, enough but not always the kinds of food (I/we) want to eat, sometimes not enough to eat, or often not enough to eat?

For the households that are not screened out, the FSM consists of 10 questions (18 for household with children) to ascertain respondent's FSS. The questions increase in severity, starting with worrying food would run out as the least severe, and ending with how many days a year did household members not eat for an entire day because there wasn't enough money to buy food. All questions in the FSM specify the time frame, either 12 months or 30 days, and that a lack of resources caused the behavior. This means respondents are not reporting changes in eating patterns caused by eating disorders, dieting, mental health etc. This is how we are able to make the assumption that food insecure households have a demand for more income.

Households are then put into three categories depending on the number of affirmative answers. If respondents answer 0-2 questions affirmatively they are considered food secure, 3-5 affirmative answers (3-7 if children present) is low food security, and 6 or more (8 or more if children present) is very low food security. While households who answer two questions affirmatively are technically considered food secure, they can be further classified as marginally food secure. Marginally secure households answered 1-2 questions affirmatively, meaning their eating patterns might not be affected, but they could be stressed about whether or not they will be able to afford adequate amounts of food.

In order to model labor supply responses to FSS, we use CPS data from the basic monthly survey. The basic monthly survey asks about labor force participation and employment status. Respondents report how many hours they usually and actually work per week, how many jobs they have, if they are employed and if they are in the labor force (and why they are not). This is the data used to create labor variables. We have December and January employment data for everyone in our sample, but since the CPS is a rotating panel we only have February and March employment data for 2/3 and 1/3 of our sample, respectively. The bulk of our analysis will focus on changes from December to January, since FSS is more salient, but we will also look at labor supply in February and March to see if there are

delayed effects of FSS.

3.2 Using the CPS as Panel Data

We are using CPS data from two waves to construct our panel. Each wave has one observation of December food security status and four observations of labor supply. That means we will have 8 observations for each household. But, because the CPS is a rotating panel we will have people who entered the survey in October, November and December. Therefore, the entire sample will have entry points for December and January labor supply, but only 2/3 for February and 1/3 for March. Because we have the most data points for January's labor, and it is when FSS is the most salient, the bulk of our regression analysis will take place on January employment status.

We use CPS monthly data collected from October 2005-March 2018. We chose 2005 as the cut off because that was the year the CPS changed the way it defined food security variables. Food security variables from before 2005 were based on only a subset of the items in the scale from 2005 and after, making them incomparable (Current Population Survey, 2017). We will only use the labor statistics recorded during and after the December Food Security Supplement, since we cannot measure the effect of FSS on previous employment.

317,549 households were surveyed in both December and January between 2005 and 2018. We cannot include people who were never surveyed in December because there is no data on the FSS of these households. We also chose to omit households whose last month surveyed was December since it would be difficult to show causation from December of year one to September of year two due to the amount of time between observations. Households might not remember their FSS from eight months prior, and even if they do their memories of food security last year may no longer be relevant to their decision making. We will only run regressions on the actual survey respondent, as opposed to other household members, because

they are the ones answering the questions and have a subjective view of their household's food security threshold.

The CPS surveys addresses, not specific households. So if a family moves during the two-year survey span, the CPS will be administered to whoever moves into their old house. Since we are using the CPS as panel data, we must exclude respondents whose race or sex changed, or whose age changed by more than two years. This would indicate a change in the respondent, so these people should not included for continuity. 20,995 households were removed due to changes in the household respondent. 152,571 households were surveyed in all 8 months. We also chose to include an income threshold of 300% of the FPG. We chose a higher income cutoff than the standard 185% FPG because income and food security are correlated, but do not perfectly predict one another. Hamersma and Kim (2015) also uses 300% FPG as the income cutoff. We omitted respondents whose reported income and family size would unambiguously place them above 300% FPG for the given year. This leaves a final data set 699,512 observations from 87,439 households surveyed between October 2005 and March 2018.

Within this set of data we created two samples, one for extensive labor decisions and one for intensive labor decisions. The sample for analysis at the extensive margin, "Labor Force Sample", consists of individuals whose labor force status was known in all eight survey periods and who were not missing any key variables. Since we won't be running regressions on labor force status, this sample is primarily for examining broad employment trends across food security levels. There are 62,017 households in the "Labor Force Sample", each with observations from eight monthly CPS surveys. So we have 496,136 observations on employment and labor force status to analyze general employment trends.

To examine changes in labor supply at the intensive margin we created an "Employment Sample". This sample consists of people who were in the labor force in all eight survey periods, and who were not missing any key variables and weights did not equal zero (202,320

observations from 25,290 households). This is the sample we will use in our regression analysis to see how FSS impacts employment status. We are not going to analyze people's decision to enter or exit the labor force, but whether or not those who are in the labor force are employed or unemployed.

We also created samples based on household composition, to see if different groups respond differently to food insecurity. We built samples for people under 185% FPG and based on household composition: dual vs. single head households, and households with or without children, and all their combinations[3] (e.g. dual head with children, single head without children, etc.). These samples are primarily for robustness checks.

3.3 Summary Statistics

Table A.2 contains descriptive statistics on the demographics of the Employment Sample, and Table A.1 for the Labor Force Sample. Both samples have relativley similar demographics, the proportion of female and Black individuals increases as food security decreases. In the Employment Sample 57% of all people reporting VLFS are women, compared to the entire sample which is 46% female. 19% of people who report VLFS are Black, almost twice as high as the percentage of Black people in the HFS group (10%). The proportion of single and divorced people increases as food security decreases: 55% of HFS respondents were married, compared to 50% of MFS, 45% of LFS and 33% of VLFS respondents. This means people experiencing food security are more likely to be in a household with one income.

Other broad demographic trends associated with lower FSS include: a higher proportion of individuals without a high school diploma, lower incomes, increased SNAP participation,

[3]Household composition was determined using CPS questions on household type: husband/wife or unmarried man/woman; and information on the number of couples in each household. We did not use the "nchild" variable provided by the CPS, because it includes adult children living at home. Instead we created a variable based on the ages and relation of household members.

and having children present in the household[4]. All of these trends are seen in both the Labor Force and Employment Sample. The main difference between the two samples is average age and income, Labor Force sample has a higher average age because it includes retired individuals and a lower income because it includes people who are not working.

In order to prove that food insecure households have a demonstrated need for more money we included FSM responses broken down by food security status, in Table A.4. Among all households experiencing marginal food security 27% said they needed more money for food (averaging at $16.12 per week), and 56% said they had worried food would run out before they had money to buy more in the last year. Only 19% of households with LFS said they had enough quantity and kinds of food, and 44% said they needed more money to meet weekly food needs (average $27.67). VLFS households reported the most need, 61% of people with VLFS said they needed more money to meet their weekly food needs (averaging at $38.84), and 75% of VLFS households said they could not afford to eat balanced meals in the last 30 days. At any level of food insecurity there is some level of financial need, with the greatest being among VLFS households.

Table A.6 breaks down the labor force status for individuals in the Labor Force Sample. Consistent with other literature, we see labor force participation decreases with FSS. Most of the people not in the labor force in the HFS group are retired, compared to the LFS and VLFS individuals who are more likely to be unable to work. While there are lower rates of participation in the labor force among food insecure households, there is also more movement into and out of the labor force. Table A.7 reports the proportion of respondents who entered or exited the labor force in a given month. On average across all years 1.7% of HFS respondents entered the labor force in January, compared to 2.7% of LFS resopndents. However, food insecure households were also more likely to leave the labor force, perhaps

[4]The proportion of households with children for MFS and LFS households is 10 percentage points higher than HFS households, but VLFS households have the same proportion as HFS households.

because they are discouraged and don't believe they will find work. This makes sense given what we know about the association between food insecurity and employment volatility.

When looking at the employment status of people who were in the labor force (Table A.8) we see unemployment rises as food security decreases, 11% of VFLS respondents are unemployed compared to 3% of HFS respondents. This is a motivation for examining the relationship between employment and food security status. On average, food insecure respondents were less likely to work full-time, but were more likely to have multiple jobs. Existing literature has shows that food insecure households are known to take multiple jobs to fill income gaps (Coleman-Jensen 2010).

Table A.9 looks at the changes in labor supply at the intensive margin (hours worked and employment status). The first two sections of Table A.9 show whether the usual/actual hours worked by the head of household increased or decreased in a given month. Actual hours worked is what the respondent said they worked the previous week, while usual hours worked is what the respondent says they usually work in an average week. We expect to see more variation in the actual hours worked since it is more salient and reflects immdeiate circumstances. As FSS decreases we see higher rates of change in hours worked across all months and measurements (actual and usual hours).

The bottom part of Table A.9 reports the proportion of respondents who gained or lost employment in a given month. In January, February and March VLFS respondents were more than twice as likely to gain or lose employment than HFS respondents, with rates of change steadily increasing as FSS decreased. In January 2.1% of VLFS gained employment, compared to .07% of HFS households, and 2.8% of VLFS households lost employment in January compared to 1.2% of HFS households. This is in line with existing literature on employment volatility in food insecure households (Hofferth 2004; Nord 2002).

Of the 1,552 individuals who gained employment in January, 527 of them were also surveyed in February. Of those 527 individuals, 83.9% were still employed in February. 188

of these people were also in the March survey, of those 188 people who gained a job in January and kept it in February, 88.3% were employed in March. Of the 235 people who gained a job in February and were surveyed again in March, 83.8% were still employed in March. This shows that the majority of people who get a job, keep their job during these months, and that it is not the same people cycling in and out of employment each month.

Chapter 4

Methods

We will report results from OLS linear probability models with and without fixed effects. We have chosen to employ a linear probability model (LPM) for several reasons. We knew our primary model would have a binary outcome (employment status 0 or 1) and include a fixed effects parameter. Since probit models cannot include fixed effects, we were chosing between a logit or linear probability model. Logit models with fixed effects require variation within groups, meaning all individuals who had the same work status in both periods were thrown out (80% of the sample). This was not ideal, and since none of our predicted probabilities from the LPM were outside 0-1, we chose to use a linear probability model.

The model without fixed effects estimates the mean effects of FSS on employment status. We expect food insecurity to have a negative impact on employment status when looking at sample averages without taking individual heterogeneity into account. The purpose of these models is to show how the fixed effects parameter α_i changes interpretation and meaning. Below is the model we will run without fixed effects:

$$Jan.Employment_{it} = \beta_0 + X'_{it}\beta_1 + \delta Dec.Emp._{it} + FSS'_{it}\eta + FSS \times Dec.Emp.'_{it}\gamma + \epsilon_{it} \quad (4.1)$$

X'_{it} represents a vector of time-variant household characteristics: December income (and income^2), dummy variables for current SNAP participation and if they indicated they needed more money to meet food needs, and a categorical variable for the year. In Equation 4.1 the dependent variable is January employment status, 0 if unemployed and 1 if employed. $Dec.Emp._{it}$ is a binary variable representing December employment status, 0 if unemployed and 1 if employed, allowing us to control for the impact of previous employment on current employment. FSS'_{it} is a vector of three dummy variables for food security status, one for MFS, LFS and VLFS (HFS is the omitted category). We include an interaction term for December employment status and FSS is $FSS \times Dec.Employment'_{it}$, it is a vector that consists of three dummy variables, one for MFS, LFS and VLFS, each interacted with a dummy for December employment. This will allow us to compare the effects of FSS on the probability of *gaining* and *keeping* employment. And ϵ_{it} is the error term. While the dependent variable in Equation 4.1 is January employment, we report the impact FSS has on February and March employment in the appendix.

Since our dependent variable is binary, the predicted value of Y_{it} is the probability that someone is employed. To determine the effect of food insecurity on employment we will look at the marginal effect of FSS on the probability of employment. The coefficient η can be interpreted as the marginal effect of FSS on the probability of *gaining* employment (e.g. having VLFS in December increases the probability of gaining employment in January by X% compared to HFS). The coefficient γ is interpreted as the marginal effect of FSS on the probability of *remaining* employed in January.

To measure the marginal effect of FSS on the probability of *being* employed in January, regardless of December employment status, we take the partial derivative of Equation 4.1 with respect to FSS. The linear combination, defined as $\eta + \gamma \times Dec.Employment$ where $Dec.Employment$ is the sample employment average, can be interpreted as the marginal effect of FSS on the probability a person is employed in January. This allows us to compare

the way food insecurity impacts people's probabilities of gaining, keeping or being employed. We expect our model without fixed effects to show people experiencing any level of food insecurity are more likely to gain or lose employment, due to higher employment volatility, and less likely to be employed, due to higher unemployment rates for these groups.

In the above equation we assume the error term ϵ_{it} is correlated with our dependent and independent variables due to omitted factors. In order to account for unobserved individual heterogeneity, we use a linear probability model with fixed effects to see how FSS impacts the probability of gaining or keeping employment in future months. The error term is now defined as a linear function of time-invariant inividual characteristics α_i and an ideosyncratic error term υ_{it}. Below is our linear probability model with fixed effects:

$$Jan.Employment_{it} = X'_{it}\beta_1 + Dec.Emp._{it}\delta + FSS'_{it}\eta + FSS \times Dec.Emp.'_{it}\gamma + \alpha_i + \upsilon_{it} \quad (4.2)$$

X_{it} represents the same time-variant characteristics as in Equation 4.1. $Dec.Emp._{it}$ and FSS'_{it} are the same as in Equation 4.1. α_i is the individual indicator variable. α_i controls for unobserved time-invariant individual heterogenity, allowing identification to stem from within household responses to FSS.

υ_{it} is a zero-mean error term, uncorrelated with all independent variables. In linear probability models the residual is not normally distributed, but with a large sample size the central limit theorem ensures normally distributed coefficient estimates and predicted values. Since we have a large sample we assume coefficient estimates and predicted valus are normally distributed. Another weakness of the linear probability model is that it can deliver a predicted value of less than 0 or greater than 1. This is a problem, since we interpret the predicted value as the probability of employment, and probabilities are by definition between 0 and 1. All of our predicted values fall in between 0 and 1 so there are no mathematically impossible results.

The third and final concern with linear probability models is that the residuals are heteroskedastic, causing biased standard error estimates. To correct for heteroskedasticity we calculate robust standard errors using Stata's robust option. Robust standard errors provide more trustworthy standard errors and significance tests, without changing the value of any coefficient estimates.

To ensure our results are robust we will run Equation 4.1 and Equation 4.2 on the entire sample, and then broken down into groups based on December employment status. When the models are run on people who were unemployed(employed) in December, the coefficients represent the marginal effect of FSS on the probability of gaining(keeping) employment when compared to HFS individuals who are also unemployed(employed). We will report the results along side the coefficients from the entire sample. If the hypothesis that food stress motivates employment is correct, we expect to see food insecure groups have higher probabilities of gaining or being employed, and lower probabilities of losing employment when to compared to HFS people.

Chapter 5

Results

5.1 OLS Without Fixed Effects

First we will report results from OLS model without fixed effects, to see the conditional mean effects of food insecurity on labor supply. Table 5.1 displays results from Equation 4.1, column (1) reports results when the model was run on the entire sample, column (2) on people who were unemployed in December, and column (3) for people who were employed in December[5].

The middle part of Table 5.1 displays the linear combination of coefficients η and γ. η is the coefficient on the FSS_{it} and γ is the coefficient on $FSS \times Dec.Emp.'_{it}$. Their linear combination, $\gamma + \eta \times \overline{Dec.Emp}$, where $\overline{Dec.Emp}$ is the sample average of December employment, reveals the impact of a specific FSS on the probability of *being* employed, regardless of December employment status. Respondents from households that reported MFS, LFS and VLFS in December have a decreased probability of being employed in January compared to HFS individuals, -.57% (p-value=.034), -.94% (p-value=.001) and -1.44% (p-value=.001), respectively.

[5]The dependent variable in Table 5.1 is January employment, the impact of December FSS on Feburary and March employment can be found in Table A.10 and Table A.11 respectivley.

Table 5.1: Effect of Food Security Status on January Employment (OLS Model)

	All Individuals	Unemployed in Dec.	Employed in Dec.
Employed in Dec.	76.56***		
	(1.43)		
Marginal FS	0.31	2.28	
	(2.70)	(2.82)	
Low FS	-2.19	1.16	
	(2.64)	(2.92)	
Very Low FS	-4.99*	-0.20	
	(2.75)	(3.14)	
MFS x Dec. Emp.	-0.91		-0.72***
	(2.71)		(0.24)
LFS x Dec. Emp.	1.31		-1.06***
	(2.65)		(0.26)
VLFS x Dec. Emp.	3.71		-1.53***
	(2.78)		(0.43)
Effect of FSS on January employment regardless of December employment[a]			
Marginal FS.	-0.57**		
	(0.27)		
Low FS	-0.94***		
	(0.29)		
Very Low FS	-1.44***		
	(0.44)		
Effect of December employment on January employment by FSS			
Marginal FS.	75.17***		
	(3.59)		
Low FS	78.56***		
	(3.49)		
Very Low FS	82.23***		
	(3.72)		
Observations	50580	2304	48276

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were in the labor force in all eight survey periods. Results reported in percentages. Each column represents a different regression.

[a] Linear combination of both food security status coefficients reported above.

While individuals experiencing food insecurity are more likely to *be* unemployed in January, people from MFS, LFS and VLFS households also have an increased probability of *gaining* or *losing* employment from December to January when compared to people in HFS households. In column (2), coefficients represent the marginal effect of FSS on the probability of gaining employment in January. The coefficients on MFS and LFS are positive, however no meaningful interpretation can be drawn due to insignificance. Column (3) reports the impact of December FSS on the probability someone keeps their employment from December to January. All coefficients are negative, meaning food insecurity decreases the probability of keeping employment. People experiencing MFS, LFS or VLFS had a -.72% (p-value=.003), -1.06% (p-value=.000) or -1.53% (p-value=.000) *decreased* probability of keeping employment from December to January respectively, when compared to people in fully food secure households. In other words, as food insecurity becomes more severe, the probability of losing employment increases.

These results from Table 5.1 reflect what literature has agreed upon, that food insecure households have decreased probabilities of employment and increased probability of employment volatility compared to HFS households. This model is limiting because it does not account for unobservable fixed characteristics that are associated with food insecurity, like region, economic opportunities, ability, mental health or self-efficacy, in order to do that we must include a fixed effects parameter.

5.2 OLS With Fixed Effects

Now we will report the results from our linear probability model with fixed effects in order to account for the unobservale fixed characteristics mentioned above. Each column in Table 5.2 reports the results from a different regression. Column (1) reports results from Equation 4.2 when run on the entire sample, column (2) reports results from Equation 4.2 when run only

Table 5.2: Effect of Food Security Status on January Employment (Fixed Effects Model)

	All Individuals	Unemployed in Dec.	Employed in Dec.
Employed in Dec.	61.42***		
	(2.12)		
Marginal FS	-1.13	3.04	
	(3.32)	(8.07)	
Low FS	0.63	0.34	
	(3.57)	(8.29)	
Very Low FS	-1.81	4.07	
	(3.88)	(9.94)	
MFS x Dec. Emp.	1.57		0.15
	(3.34)		(0.34)
LFS x Dec. Emp.	-0.66		-0.25
	(3.60)		(0.41)
VLFS x Dec. Emp.	3.49		1.38**
	(3.93)		(0.69)
Effect of FSS on January employment regardless of December employment[a]			
Marginal FS.	0.37		
	(0.40)		
Low FS	-0.00		
	(0.47)		
Very Low FS	1.52**		
	(0.76)		
Effect of December employment on January employment by FSS			
Marginal FS.	63.81***		
	(4.46)		
Low FS	60.41***		
	(4.90)		
Very Low FS	66.74***		
	(5.36)		
Observations	50580	2304	48276

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were in the labor force all eight survey periods. Results reported in percentages. Each column reports results from a different regression. [a] Linear combination of both food security status coefficients reported above.

on people who were unemployed in December, and column (3) from Equation 4.2 only on people who were employed in December[6]. The first notable difference between Table 5.1 and Table 5.2 is that many of the coefficient estimates have switched signs. In the OLS model, VLFS had a negative and significant impact on January employment, but when we include a fixed effects parameter VLFS has a positive and significant impact on the probability of January employment (+1.52%). In the fixed effect models VLFS is the only food security category with significant coefficients, and all are in the direction that suggests VLFS is a motivating factor for employment.

We interpret the first three FSS dummy variables in Table 5.2 columns (1-2) as the marginal effect of each FSS category on the probability of going from unemployed to employed when compared to HFS people who were also unemployed and in the labor force. While these coefficients are positive, no conculsions can be drawn due to insignificance. Coefficients in column (3) represent the impact of FSS on the probability someone keeps their job. In the model without fixed effects these estimates were all negative and significant, but when we account for individual heterogeneity coefficients on MFS and VLFS become positive. People with VLFS had a 1.38% (p-value=.043) increased probability of keeping employment from December to January compared to people with HFS who were also employed in December.

The middle section of Table 5.2 reports the linear combination of coefficients η and γ, η is the coefficient on the FSS_{it} and γ is the coefficient on $FSS \times Dec.Emp._{it}'$, reported in column (1). These estimates can be interpreted as the marginal effect of FSS on the probability of being employed in January, regardless of December employment status, when compared to HFS households. People who reported VLFS in December had a 1.52% (p-value=.045) increased probability of *being* employed in January when compared to people

[6]For all regressions the dependent variable is January employment status, impacts of FSS on February and March employment are reported in Table A.12 and Table A.13.

experiencing HFS. In the OLS model without effects, VLFS decreased the probability of employment by a significant -1.42%.

For all FSS categories and months, December employment is the variable with the most explanatory power on January employment. In order to correctly interpret the effect of $Dec.Emp._{it}$ on $Jan.Emp._{it}$, we take the derivative of $Jan.Employment_{it}$ with respect to December Employment, leaving $\delta + \gamma \times \overline{FSS}$, where $\overline{FSS}$ is the sample average, these results are reported in the bottom part of Table 5.2. People employed in December with VLFS have a 66.74% (p-value=.000) increased probability of January employment compared to HFS people who are unemployed in December, but only a 34.65% (p-value=.000) increased probability of March employment[7]. It makes sense that last month's employment status would have the greatest impact on current employment status, and we see that as time continues December employment status has a smaller effect on current employment.

While most of the coefficients on FSS are insignificant, the fact that all significant coefficients are positive and on people with VLFS suggests that very low food security might be a motivating factor for employment, especially when compared to the OLS estimates without fixed effects, which are all negative and significant. Next we will break our sample down into sub-populations based on household composition, to see if different groups respond differently to food insecurity.

5.3 Robustness Check

We wanted to break our sample down by household characteristics and income level below 185% FPG to see if our results would hold. Below we will provide a brief overview of our robustness checks, Table 5.3 contains key significant findings (for all results see appendix Table A.14 - Table A.16). First we broke the sample down into categories based on household

[7]These estimates are reported in Table A.13

composition: dual-head households (all, without children and with children), single-head households(all, without children, with children and single mothers), households with children and households without children. Then we further isolated groups based on income to see if people with incomes below 185% FPG would respond to food insecurity differently than the 300% FPG group[8]

On each group we ran Equation 4.2 with the January employment status as the dependent variable. Overall the results were similar to the findings presented above, VLFS households had increased probabilities of being employed and decreased probabilities of losing employment across household compositions. Single-head VLFS households without children who were employed in December had a 2.34% (p-value=.024) increased probability of keeping employment in January compared to HFS households with similar composition. This same group also had a 2.87% (p-value=.029) increased probability of being employed in January, regardless of December employment, when compared to HFS households. VLFS households without children had a 3.19% (p-value=.007) increased probability of being employed and a 2.58% (p-value=.021) decreased probability of losing employment in January compared to HFS households without children.

However, there was one notable deviation, in dual-headed households without children, people with LFS had significantly lower probabilities of employment. LFS dual-head households without children have 3.74% (p-value=.014) decreased probability of being employed and a 3.16% (p-value=.02) increased probability of losing employment in January, when compared to HFS households with the same composition. We also see LFS increase the probability of losing employment in single households with children, 1.08% (p-value=.064) when compared to HFS households with the same composition[9]. These three coefficients are

[8]The results for people under 185% FPG were very similar to the 300% FPG, the same subpopulations had significant coefficients as in the 300% FPG group. All results refrenced in the robustness section are from regressions run on the 300% FPG sample.

[9]Results displayed in Table A.15

Table 5.3: January Employment for Dual Headed Households(Fixed Effects Model)

	No Kids	Dual (No Kids)	Dual (Kids)	Single (Without Kids)
Effect of FSS on January employment for people unemployed in December[a]				
Marginal FS	-3.86	-8.27	10.38	3.24
	(11.81)	(23.72)	(16.88)	(12.06)
Low FS	1.46	-3.59	-2.25	4.93
	(9.64)	(20.63)	(18.08)	(10.01)
Very Low FS	9.85	-12.43	-9.47	14.87
	(12.35)	(27.07)	(23.36)	(12.20)
Observations	1293	434	578	748
Effect of FSS on January employment for people employed in December[b]				
Marginal FS	-0.10	-1.06	1.23**	0.19
	(0.56)	(0.88)	(0.56)	(0.75)
Low FS	-0.90	-3.16**	0.63	-0.03
	(0.79)	(1.38)	(0.67)	(0.99)
Very Low FS	2.58**	2.18	0.43	2.34**
	(1.12)	(2.87)	(1.33)	(1.17)
Observations	23858	9032	16248	12872
Effect of FSS on January employment regardless of December employment[c]				
Marginal FS.	0.38	-0.58	1.21*	0.67
	(0.64)	(1.11)	(0.65)	(0.83)
Low FS	-0.90	-3.74**	0.80	0.23
	(0.82)	(1.52)	(0.79)	(1.02)
Very Low FS	3.19***	2.77	-0.01	2.87**
	(1.18)	(2.79)	(1.48)	(1.31)
Observations	24418	9466	16826	13620

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were employed in all eight survey periods. Results have been scaled by 100 for interpretation as "percetage points". [a]Regressions run on only people who were unemployed in December. Reflect the probability of gaining employment in January. [b]Only includes individuals who were employed in December, coefficients represent marginal effect of FSS on the probability of keeping employment in January. [c]These results are a linear combination of the coefficients from Eq.4.4 when run on the entire sample. Coefficients reflect the marginal effect of FSS on probability of January employment regardless of December employment status.

the only significant results that would point to food insecurity being a limiting factor for employment, and in these models we still see people with VLFS having increased probabilities of employment.

There seem to be differences in the way labor supply responds to food insecurity based on household composition and the level of food security. The results suggest that LFS dual-headed households without children might find anxiety over food acquisitions as a limiting factor for employment. This could be explained by the fact that dual-headed households without children have less expenses and less pressure to provide for their family[27]. However, our analysis is limited because we do not include the labor supply of the other household head.

Chapter 6

Conclusions

Current literature states that people experiencing food insecurity are more likely to be employed. However by failing to include individual fixed effects they fail to account for unobservable heterogeneity (e.g. region, ability and prefrence to work). When we ran OLS models without fixed effects our results supported the idea that people with VLFS were less likely to work, but by including fixed effects we find VLFS households actually have higher probabilities of employment than HFS households.

Across all regressions, previous employment status had the largest and most significant effect on current employment status. However, we consistently saw positive and significant beta coefficients on the very low food security group. Based on these results we can conclude that very low food security could be a motivating factor for employment. Overall people reporting VLFS had an increased probability of employment in January and March by 1.52% and 2.94% respectivley, and a 1.38% increased probability of keeping employment in January, when compared to highly food secure households who were also employed in December. These results were larger in absolute value and significance for households without children. When looking at all households without children VLFS increased the probability of January employment by 3.13% compared to HFS individuals, and by 2.87% for single-head households

without children.

These results are statistically and economically significant. To provide a sense of the magnitude of 1.52% of very low food secure households, in 2017 there were an estimated 9.7 million adults living in households with VLFS, roughly half of whom were in the labor force (Coleman-Jensen et al., 2018). Of those 4.9 million people, 1.52% translates to 73,780 people.

Our research is the first time anyone has attempted to quantify labor supply's response to food insecurity. Until now it was not known if food insecurity would increase labor due to more demand for income, or decrease labor supply because of increases in unearned income or depression. Our findings can help inform the current debate over the relationship between food insecurity and labor supply, as well as SNAP's effect on labor supply. While our analysis did not focus directly on SNAP recipients, our sample did have disproportionatley high SNAP participation compared to the population at large. These findings shed light on how labor supply in groups with high SNAP participation responds to anxiety overfood acquisition.

6.1 Limitations and Future Research

These results are limited by the fact that CPS data is self-reported, so there is the possibility respondents mis-remembered their employment status or food security. However, 30-day FSS and employment status (0 or 1) are likely more accurate than the 12-month FSS or other employment measurements since less time has passed and there is less detail to recount (people are more likely to remember if they were employed than how many hours they worked). Our results are also limited because they do not include the labor supply of other household members. If the CPS respondent is a stay at home parent, we won't see their labor supply increase, but there might be changes in the labor supply of a spouse. This

could be why we saw decreased employment probabilities for LFS dual-headed households with children.

Future research should examine other labor force measurements and household structures. Intensive measures, like actual hours worked, could show how the intensity of labor changes in response to food insecurity. It would also be benneficial to look at the labor supply of all household members, not just the survey respondent, to see if other people in the household are increasing their labor supply. This would also allow for better control and understand of the way different household structures make labor decisions, (e.g. joint labor decisions made between husband and wife). Future research should also examine the difference in labor supply decisions among households who do and do not recieve welfare benefits.

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Appendix A

Additional Tables

Table A.1: Labor Force Sample Demographics

	Entire Sample mean	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
Demographics					
Female	0.54	0.52	0.58	0.61	0.61
Age	54.02	55.92	50.30	48.29	50.28
Race					
White	0.80	0.83	0.75	0.72	0.73
Black	0.14	0.11	0.19	0.22	0.21
Asian	0.03	0.04	0.02	0.02	0.01
Native	0.01	0.01	0.01	0.01	0.02
Mixed Race	0.01	0.01	0.02	0.02	0.02
Marital Status					
Married	0.47	0.50	0.44	0.40	0.30
Divorced	0.17	0.15	0.18	0.21	0.28
Single	0.18	0.16	0.21	0.24	0.24
Widowed	0.15	0.16	0.12	0.10	0.11
Education					
No HS Diploma	0.17	0.14	0.23	0.25	0.24
HS Diploma	0.35	0.35	0.35	0.34	0.34
Some College	0.20	0.19	0.20	0.20	0.21
2 Year Degree	0.10	0.10	0.10	0.10	0.10
4 Year Degree	0.13	0.15	0.10	0.08	0.08
Post Bachelors Degree	0.05	0.06	0.03	0.02	0.02
Household Structure					
Family Size	2.52	2.42	2.78	2.92	2.38
Has Children	0.41	0.37	0.51	0.57	0.42
Number of Children[a]	1.93	1.89	1.98	2.03	1.97
U.S. Citizen	0.93	0.94	0.91	0.88	0.92
Household Finances					
Poor	0.46	0.36	0.66	0.69	0.75
On SNAP Now	0.11	0.04	0.21	0.30	0.37
On SNAP in Last Year	0.13	0.05	0.24	0.35	0.42
Observations	124034	87678	14585	13486	8285

Source: Current Population Survey 2005-2018

Notes: Labor Force Sample consists of individuals whose labor force status was known for all eight survey periods. Analytic weight: fssuppwth. [a] Average number of children in households with children present.

Table A.2: Employment Sample Demographics

	Entire Sample mean	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
Demographics					
Female	0.47	0.43	0.50	0.55	0.58
Age	44.58	45.39	42.66	42.08	44.07
Race					
White	0.80	0.83	0.77	0.74	0.75
Black	0.13	0.11	0.17	0.19	0.19
Asian	0.04	0.05	0.03	0.03	0.02
Native	0.01	0.01	0.01	0.01	0.02
Mixed Race	0.01	0.01	0.02	0.02	0.02
Marital Status					
Married	0.51	0.54	0.48	0.44	0.31
Divorced	0.18	0.17	0.18	0.20	0.29
Single	0.23	0.22	0.25	0.27	0.29
Widowed	0.04	0.04	0.03	0.04	0.05
Education					
No HS Diploma	0.11	0.09	0.15	0.17	0.14
HS Diploma	0.33	0.33	0.34	0.35	0.35
Some College	0.21	0.20	0.22	0.21	0.24
2 Year Degree	0.12	0.12	0.12	0.12	0.12
4 Year Degree	0.17	0.19	0.12	0.11	0.11
Post Bachelors Degree	0.06	0.07	0.04	0.03	0.03
Household Structure					
Family Size	2.92	2.86	3.14	3.21	2.66
Has Children	0.57	0.54	0.65	0.69	0.54
Number of Children[a]	1.99	1.96	2.05	2.09	2.04
U.S. Citizen	0.91	0.92	0.89	0.86	0.90
Household Finances					
Poor	0.42	0.32	0.60	0.64	0.68
On SNAP Now	0.07	0.03	0.15	0.19	0.20
On SNAP in Last Year	0.09	0.04	0.18	0.24	0.26
Observations	50580	35497	6495	5720	2868

Source: Current Population Survey 2005-2018

Notes: Employment Sample consists of individuals who were in the labor force for all eight survey periods. Analytic weight: fssuppwth. [a] Average number of children in households with children present.

Table A.3: Food Security Over Sample Years (Employment Sample)

	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
2005	0.734	0.113	0.111	0.042
2006	0.708	0.138	0.108	0.046
2007	0.699	0.144	0.107	0.049
2008	0.641	0.152	0.126	0.081
2009	0.633	0.147	0.133	0.086
2010	0.681	0.125	0.130	0.063
2011	0.694	0.135	0.115	0.056
2012	0.700	0.128	0.116	0.057
2013	0.713	0.114	0.115	0.057
2014	0.716	0.115	0.116	0.053
2015	0.718	0.128	0.098	0.056
2016	0.735	0.113	0.101	0.050
2017	0.734	0.124	0.100	0.042
Observations	50580	50580	50580	50580

Source: Current Population Survey 2005-2018.

Notes:Employment Sample consists of individuals who were in the labor force for all eight survey periods. Analytic weight: fssuppwth.

Table A.4: Food Spending (Employment Sample)

	Entire Sample mean	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
Run Short[a]	0.32	0.13	0.64	0.83	0.94
Need More Money for Food	0.17	0.07	0.27	0.43	0.61
Value of Additional Need[b]	10.04	3.69	16.12	27.40	38.84
Weekly Food Expenditures					
Usual Spent	120.25	122.75	118.40	116.02	103.38
Total Spent	130.96	133.28	132.89	126.28	107.81
Spent at Restaurants	28.88	31.71	25.66	20.99	18.22
Food Stamp Value	23.34	9.37	46.41	63.67	62.41
Less Needed[c]	9.78	11.46	7.48	5.24	3.70
Observations	50580	35497	6495	5720	2868

Source: Current Population Survey 2005-2018.

Notes: Employment Sample consists of individuals who were in the labor force all eight survey periods. Analytic weight: fssuppwth. [a] Ever run short on money for food in past year. [b] Per Week.

[c] Amount less money required to still meet food needs.

Table A.5: Food Security Module Responses (EMP Sample)

	Entire Sample mean	Marginal FS mean	Low FS mean	Very Low FS mean
Enough and Kinds of Foods				
Enough Food	0.69	0.41	0.19	0.07
Enough, Not Kinds	0.26	0.56	0.66	0.47
Not Enough	0.05	0.03	0.15	0.46
Worried Food Would Run Out				
During Last 30 Days	0.11	0.15	0.42	0.72
Sometimes (Over Last Year)	0.19	0.56	0.73	0.55
Often (Over Last Year)	0.05	0.05	0.16	0.44
Ran Out, Couldn't Afford More				
During Last 30 Days	0.13	0.15	0.54	0.78
Sometimes (Over Last Year)	0.15	0.29	0.69	0.63
Often (Over Last Year)	0.03	0.02	0.09	0.33
Couldn't Afford Balanced Meals				
During Last 30 Days	0.10	0.10	0.38	0.75
Sometimes (Over Last Year)	0.13	0.26	0.60	0.56
Often (Over Last Year)	0.04	0.03	0.12	0.37
Observations	50580	6495	5720	2868

Source: Current Population Survey 2005-2018.

Notes: Employment Sample consists of individuals who were in the labor force all eight survey periods. Analytic weight: fssuppwth.

Table A.6: Labor Force Statistics (Labor Force Sample)

	Entire Sample mean	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
Not in the Labor Force	0.48	0.48	0.43	0.44	0.52
Retired	0.29	0.35	0.20	0.14	0.13
Unable to Work	0.09	0.06	0.12	0.17	0.28
Other	0.09	0.08	0.10	0.13	0.11
In the Labor Force	0.52	0.52	0.57	0.56	0.48
Employed	0.48	0.48	0.51	0.48	0.38
Full Time	0.34	0.35	0.34	0.31	0.23
Part Time	0.14	0.13	0.17	0.16	0.14
Unemployed	0.05	0.03	0.07	0.08	0.10
Observations	124034	87678	14585	13486	8285

Source: Current Population Survey 2005-2018.

Notes: Labor Force Sample consists of individuals whose labor force status was known for all eight survey periods. Analytic weight: fssuppwth.

Table A.7: Changes in Labor Force Participation

	Entire Sample mean	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
Enter/Exit Labor Force					
Enter Labor Force in Jan	0.019	0.017	0.022	0.027	0.022
Exit Labor Force in Jan	0.022	0.019	0.026	0.028	0.032
Enter Labor Force in Feb	0.019	0.016	0.020	0.026	0.027
Exit Labor Force in Feb	0.019	0.016	0.023	0.027	0.027
Enter Labor Force in Mar	0.019	0.016	0.025	0.024	0.026
Exit Labor Force in Mar	0.018	0.016	0.020	0.025	0.022
Observations	124034	87677	14586	13486	8285

Source: Current Population Survey 2005-2018.

Notes: Labor Force Sample consists of individuals whose labor force status was known for all eight survey periods. Analytic weight: fssuppwth.

Table A.8: Employment Statistics (Employment Sample)

	Entire Sample mean	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
Employed	0.95	0.97	0.93	0.92	0.88
Full Time	0.71	0.74	0.65	0.64	0.58
Part Time	0.24	0.22	0.27	0.28	0.30
Usual Hours Worked	39.35	39.79	38.42	38.28	37.88
Actual Hours Worked	38.60	39.19	37.51	37.02	36.55
Number of Jobs[a]	1.08	1.07	1.08	1.09	1.10
Unemployed	0.05	0.03	0.07	0.08	0.12
Observations	50580	35497	6495	5720	2868

Source: Current Population Survey 2005-2018

Notes: Employment Sample consists of individuals who were in the labor force for all eight survey periods. Analytic weight: fssuppwth. [a] Average number of jobs if employed.

Table A.9: Changes in Labor at the Intensive Margin (Employment Sample)

	Entire Sample mean	High FS mean	Marginal FS mean	Low FS mean	Very Low FS mean
Change in Actual Hours Worked					
Increased in Jan	0.226	0.221	0.232	0.240	0.244
Decreased in Jan	0.273	0.270	0.280	0.273	0.291
Increased in Feb	0.267	0.259	0.280	0.288	0.302
Decreased in Feb	0.267	0.260	0.278	0.282	0.304
Increased in Mar	0.277	0.269	0.305	0.287	0.298
Decreased in Mar	0.247	0.240	0.255	0.272	0.270
Change in Usual Hours Worked					
Increased in Jan	0.152	0.148	0.158	0.161	0.175
Decreased in Jan	0.175	0.172	0.174	0.183	0.205
Increased in Feb	0.157	0.153	0.155	0.174	0.191
Decreased in Feb	0.155	0.152	0.158	0.167	0.171
Increased in Mar	0.156	0.150	0.168	0.176	0.164
Decreased in Mar	0.146	0.145	0.138	0.154	0.163
Gain/Lose Employment					
Gain Employment in Jan	0.010	0.007	0.017	0.017	0.021
Lose Employment in Jan	0.015	0.012	0.020	0.023	0.028
Gain Employment in Feb	0.013	0.010	0.018	0.019	0.032
Lose Employment in Feb	0.011	0.009	0.013	0.018	0.020
Gain Employment in Mar	0.013	0.011	0.015	0.018	0.029
Lose Employment in Mar	0.013	0.010	0.021	0.017	0.018
Observations	50580	35497	6495	5720	2868

Source: Current Population Survey 2005-2018.

Notes: Employment Sample consists of individuals who were in the labor force for all eight survey periods. Analytic weight: fssuppwth.

Table A.10: Effect of Food Security Status on February Employment (OLS Model)

	All Individuals	Unemployed in Dec.	Employed in Dec.
Employed in Dec.	68.06***		
	(1.90)		
Marginal FS	6.03	7.68**	-0.49*
	(3.80)	(3.91)	(0.29)
Low FS	-5.09	-2.49	-1.34***
	(3.55)	(3.81)	(0.36)
Very Low FS	2.31	5.00	-1.48***
	(4.12)	(4.57)	(0.54)
MFS x Dec. Emp.	-6.46*		
	(3.81)		
LFS x Dec. Emp.	3.86		
	(3.56)		
VLFS x Dec. Emp.	-3.61		
	(4.15)		
Effect of FSS on February employment, regardless of December employment[a]			
Marginal FS.	-0.12		
	(0.33)		
Low FS	-1.41***		
	(0.39)		
Very Low FS	-1.14**		
	(0.56)		
Effect of December employment on February employment by FSS			
Marginal FS.	58.24***		
	(5.12)		
Low FS	73.92***		
	(4.69)		
Very Low FS	62.56***		
	(5.71)		
Observations	33928	1582	32346

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018. Analytic Weight: fssuppwth

Notes: Results reported in percentages. Employment Sample consists of people who were in the labor force in all eight survey periods.

Table A.11: Effect of Food Security Status on March Employment (OLS Model)

	All Individuals	Unemployed in Dec.	Employed in Dec.
Employed in Dec.	59.16***		
	(2.66)		
Marginal FS	2.84	4.57	-1.02*
	(5.47)	(5.67)	(0.54)
Low FS	-3.71	-0.83	-1.05*
	(5.50)	(5.78)	(0.57)
Very Low FS	3.59	5.96	-1.13
	(5.93)	(6.68)	(0.86)
MFS x Dec. Emp.	-3.80		
	(5.48)		
LFS x Dec. Emp.	2.78		
	(5.52)		
VLFS x Dec. Emp.	-4.47		
	(5.99)		
Effect of FSS on March employment, regardless of December employment[a]			
Marginal FS.	-0.76		
	(0.59)		
Low FS	-1.07*		
	(0.63)		
Very Low FS	-0.65		
	(0.89)		
Effect of December employment on March employment by FSS			
Marginal FS.	53.39***		
	(7.42)		
Low FS	63.38***		
	(7.48)		
Very Low FS	52.37***		
	(8.27)		
Observations	16332	844	15488

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018. Analytic Weight: fssuppwth

Notes: Results reported in percentages. Employment Sample consists of people who were in the labor force in all eight survey periods.

Table A.12: Effect of Food Security Status on February Employment (Fixed Effects Model)

	All Individuals	Unemployed in Dec.	Employed in Dec.
Employed in Dec.	51.71***		
	(2.60)		
Marginal FS	4.18	3.95	
	(4.26)	(10.59)	
Low FS	2.73	-2.59	
	(4.83)	(10.86)	
Very Low FS	10.03*	15.60	
	(5.59)	(18.48)	
MFS x Dec. Emp.	-4.22		-0.26
	(4.27)		(0.39)
LFS x Dec. Emp.	-2.91		-0.06
	(4.90)		(0.52)
VLFS x Dec. Emp.	-9.20		1.38
	(5.61)		(0.86)
Effect of FSS on February employment regardless of December employment[a]			
Marginal FS.	0.15		
	(0.48)		
Low FS	-0.05		
	(0.61)		
Very Low FS	1.26		
	(0.97)		
Effect of December employment on March employment by FSS			
Marginal FS.	45.30***		
	(5.79)		
Low FS	47.28***		
	(6.84)		
Very Low FS	37.72***		
	(7.82)		
Observations	33928	1582	32346

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were in the labor force all eight survey periods. Results reported in percentages.

[a] Linear combination of both food security status coefficients reported above.

Table A.13: Effect of Food Security Status on March Employment (Fixed Effects Model)

	All Individuals	Unemployed in Dec.	Employed in Dec.
Employed in Dec.	39.62***		
	(3.38)		
Marginal FS	0.10	0.49	
	(6.11)	(16.54)	
Low FS	1.26	1.45	
	(6.81)	(15.76)	
Very Low FS	6.05	18.23	
	(7.06)	(19.06)	
MFS x Dec. Emp.	-0.43		-0.51
	(6.17)		(0.68)
LFS x Dec. Emp.	-0.04		1.01
	(6.90)		(0.90)
VLFS x Dec. Emp.	-3.28		2.43*
	(7.09)		(1.39)
Effect of FSS on March employment regardless of December employment[a]			
Marginal FS.	-0.31		
	(0.78)		
Low FS	1.22		
	(0.97)		
Very Low FS	2.94**		
	(01.48)		
Effect of December employment on March employment by FSS			
Marginal FS.	38.97***		
	(8.50)		
Low FS	39.56***		
	(9.72)		
Very Low FS	34.65***		
	(9.82)		
Observations	16332	844	15488

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were in the labor force all eight survey periods. Results reported in percentages.

[a] Linear combination of both food security status coefficients reported above.

Table A.14: Impact of Food Security Status on January Employment for Dual Headed Households (Fixed Effects Model)

	Dual Head	No Children Present	Children Present
Effect of FSS on January employment for people unemployed in December			
Marginal FS	5.61	-7.16	11.34
	(11.42)	(22.91)	(16.31)
Low FS	-1.61	-1.72	-1.92
	(13.64)	(20.62)	(17.76)
Very Low FS	-7.58	-11.15	-10.30
	(19.17)	(26.69)	(26.36)
Observations	1051	434	578
Effect of FSS on January employment for people employed in December			
Marginal FS	0.57	-1.06	1.27**
	(0.45)	(0.88)	(0.55)
Low FS	-0.28	-3.16**	0.66
	(0.59)	(1.37)	(0.67)
Very Low FS	1.21	2.18	0.45
	(1.27)	(2.87)	(1.34)
Observations	26243	9032	16248
Effect of FSS on January employment, regardless of December employment			
Marginal FS.	0.07	-0.59	1.26*
	(0.54)	(1.11)	(0.64)
Low FS	0.06	-3.75**	0.85
	(0.69)	(1.52)	(0.79)
Very Low FS	1.26	2.76	0.04
	(1.33)	(2.79)	(1.49)
Observations	27294	9466	16826

Standard errors in parentheses

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were emeployed in all eight survey periods. Results reported in percentages.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.15: January Employment for Single Headed Households(Fixed Effects Model)

	Single Head	No Children Present	Children Present	Single Mother
Effect of FSS on January employment for people unemployed in December				
Marginal FS	8.05	3.24	37.40	16.13
	(10.42)	(12.06)	(26.93)	(29.83)
Low FS	4.83	4.93	26.03	27.99
	(9.51)	(10.01)	(21.90)	(28.55)
Very Low FS	12.01	14.87	-10.71	-32.64
	(10.85)	(12.20)	(33.79)	(39.91)
Observations	1102	748	323	260
Effect of FSS on January employment for people employed in December				
Marginal FS	-0.05	0.19	-1.06	-1.23
	(0.53)	(0.75)	(0.70)	(0.79)
Low FS	-0.23	-0.03	-1.08*	-1.03
	(0.61)	(0.99)	(0.60)	(0.66)
Very Low FS	1.09	2.34**	-0.96	-1.06
	(0.81)	(1.17)	(1.01)	(1.11)
Effect of FSS on January employment, regardless of December employment				
Marginal FS	0.24	0.66	-0.76	-0.71
	(0.61)	(0.83)	(0.94)	(1.00)
Low FS	-0.12	0.23	-0.98	-0.87
	(0.70)	(1.02)	(0.97)	(1.05)
Very Low FS	1.20	2.87**	-1.38	-1.32
	(0.95)	(1.31)	(1.38)	(1.50)
Observations	19958	13620	5824	4920

Standard errors in parentheses

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were emeployed in all eight survey periods. Results reported in percentages.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.16: January Employment for Households With or Without Children (Fixed Effects Model)

	No Children Present	Children Present
Effect of FSS on January employment for people unemployed in December		
Marginal FS	-4.06	5.45
	(11.42)	(13.24)
Low FS	1.11	0.21
	(9.21)	(14.85)
Very Low FS	9.55	-11.15
	(11.72)	(22.09)
Observations	1247	962
Effect of FSS on January employment for people employed in December		
Marginal FS	-0.12	0.26
	(0.55)	(0.47)
Low FS	-0.94	0.08
	(0.78)	(0.48)
Very Low FS	2.51**	0.11
	(1.11)	(0.89)
Observations	23171	23184
Effect of FSS on January employment, regardless of December employment		
Marginal FS	0.37	0.32
	(0.64)	(0.53)
Low FS	-0.93	0.21
	(0.82)	(0.59)
Very Low FS	3.13***	-0.33
	(1.18)	(1.01)
Observations	24418	16262

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were emeployed in all eight survey periods. Results reported in percentages.

Table A.17: January Employment for Dual Headed Households(Fixed Effects Model)

	Dual Head	No Children Present
Employed in Dec.	0.00	0.00
	(.)	(.)
Marginal FS	-0.12	0.26
	(0.55)	(0.47)
Low FS	-0.94	0.08
	(0.78)	(0.48)
Very Low FS	2.51**	0.11
	(1.11)	(0.89)
MFS x Dec. Emp.	0.00	0.00
	(.)	(.)
LFS x Dec. Emp.	0.00	0.00
	(.)	(.)
VLFS x Dec. Emp.	0.00	0.00
	(.)	(.)
Observations	23171	23184

Standard errors in parentheses

Source: Current Population Survey 2005-2018.

Notes: Analytic Weight: fssuppwth. Employment Sample consists of people who were emeployed in all eight survey periods. Results reported in percentages.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B

Definitions

USDA Food Security Status Definitions

High Food Security: The USDA defines high food security having no problems, or anxiety about, consistently accessing adequate food.

Marginal Food Security: Marginal food security is when households had problems at times, or anxiety about, accessing adequate food, but the quality, variety, and quantity of their food intake were not substantially reduced.

Low Food Security: The USDA defines low food security, also called food insecurity without hunger, as households that reduced the quality, variety, and desirability of their diets, but the quantity of food intake and normal eating patterns were not substantially disrupted.

Very Low Food Security: Very low food security, also called food insecurity without hunger is defined as: during certain times the year, eating patterns of one or more household members were disrupted and food intake reduced because the household lacked money and other resources for food.

USDA Food Security Module

Optional USDA Food Sufficiency Question/Screener: Question HH1 (This question is optional. It is not used to calculate any of the food security scales. It may be used in conjunction with income as a preliminary screener to reduce respondent burden for high income households).

HH1. Which of these statements best describes the food eaten in your household in the last (12 months/30 days): —enough of the kinds of food (I/we) want to eat; —enough, but not always the kinds of food (I/we) want; —sometimes not enough to eat; or, —often not enough to eat?

Household 12 Month Questions: For the following statements, please say whether the statement was often true, sometimes true, or never true for (you/your household) in the last 12 months.

1. (I/We) worried whether (my/our) food would run out before (I/we) got money to buy more.
2. The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more.
3. (I/we) couldn't afford to eat balanced meals.
4. In the last 12 months, since last (name of current month), did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?
5. If answered yes above, how often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
6. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?

7. In the last 12 months, were you every hungry but didn't eat because there wasn't enough money for food?

8. In the last 12 months, did you lose weight because there wasn't enough money for food?

9. In the last 12 months, did (you/you or other adults in your household) ever not eat for a whole day because there wasn't enough money for food?

10. If answered yes above, how often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?