

The Psychological Toll of Food Insecurity*

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Abstract

We investigate the relationship between experiencing food insecurity and psychological well-being among a sample of poor households in Lebanon. Leveraging the plausibly exogenous timing of the household survey relative to a monthly distribution of food vouchers, we observe that indicators of food insecurity increase in the week prior to receiving a food voucher. We also find that those who live in a household experiencing food insecurity report lower levels of psychological well-being. These results carry implications for the literature on the health consequences of food insecurity and, given the poverty level of our sample, poverty alleviation policy—such as the timing and frequency of food voucher distribution.

Keywords: Food Insecurity, Psychological Well-being, Depression, Mental Health, Stress, Food Vouchers, Poverty, Lebanon.

JEL Codes: Q18, D91, O12, I15

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1 Introduction

Economic theory and empirical evidence makes a strong case for a robust link between economic well-being and psychological well-being.¹ Given that food insecurity is generally more common among low-income households (Schanzenbach, Bauer and Nantz, 2016; Coleman-Jensen et al., 2020), experiencing food insecurity may be a mechanism by which economic well-being influences psychological well-being. Therefore, although food insecurity is an important outcome as an end in itself, experiencing food insecurity can have important consequences beyond first-order calorie or nutrient deficiencies.² For example, experiencing food insecurity can lead to a nutrition-based poverty trap (Dasgupta and Ray, 1986; Behrman and Deolalikar, 1987; Deaton and Dreze, 2009; Banerjee and Duflo, 2011; Schofield, 2014). If experiencing food insecurity directly leads to lower-levels of psychological well-being, this may illuminate an additional mechanism through which persistent poverty can be reinforced via a *psychological* poverty trap (Lybbert and Wydick, 2018; Ridley et al., 2020; Haushofer, 2019; Alloush, 2020).

In this paper we use unique household survey data from a sample of extremely poor people in Lebanon who all live in households receiving monthly food vouchers. We leverage the plausibly exogenous timing of the survey relative to the monthly distribution of food vouchers to study the relationship between experiencing food insecurity on various components of psychological well-being. We measure food insecurity with two survey questions. First, we ask a screening question that indicates if a member of the household involuntarily skipped at least one meal over the past 30 days. Second, for those households that respond affirmatively to this screening question, we ask a question that indicates if the household does not have enough food for the next day's meals. In our data, 25 percent of households respond affirmatively to our screening question and eight percent of households—who we categorize as experiencing food insecurity—respond affirmatively to the second question. We find that the probability a household reports food insecurity in our data roughly doubles in the week prior to the monthly distribution of food vouchers.

We also find that several measures of psychological well-being deteriorate as the num-

¹In microeconomic theory, the indirect utility function is increasing in wealth. Moreover, recent empirical studies show that increased income leads to increased psychological well-being (Haushofer and Shapiro, 2016; Alloush, 2020; Ridley et al., 2020).

²Large multinational, national, and research organizations—such as the United Nations, the US Government, and the International Food Policy Research Institute (IFPRI)—track global food security via ongoing annual reports. See the Annual State of Food Insecurity and Nutrition in the World from the United Nations' Food and Agriculture Organization, the International Food Security Assessment from the United States Department of Agriculture's Economic Research Service, and IFPRI's Global Food Security Report.

ber of days between the monthly distribution of vouchers and the survey date increases. In our cross-sectional data, simple ordinary least squares (OLS) regressions show that living in a household reporting not enough food for the next day's meals is associated with lower levels of psychological well-being conditional on demographic characteristics, education attainment, and other economic livelihood controls. This relationship, however, may be spurious due to the presence of reverse causality and various forms of persistent omitted heterogeneity. We therefore leverage the plausibly exogenous timing of our household survey relative to the monthly distribution of food vouchers within an instrumental variables framework to rule out measurement error and bias driven by omitted heterogeneity. Our instrumental variable estimates suggest that the OLS approach *underestimates* the psychological toll of experiencing food insecurity and further supports the finding that food insecurity carries psychological consequences.

Our work in this paper is most closely related to two lines of research. First, existing studies find a strong correlation between experiencing food insecurity and lower levels of psychological well-being among survey respondents in the US (Casey et al., 2004; Heflin, Siefert and Williams, 2005; Whitaker, Phillips and Orzol, 2006; McLaughlin et al., 2012; Burke et al., 2016; Fang, Thomsen and Nayga, 2021), Canada (Melchior et al., 2012), Spain (Shankar-Krishnan, Deu and Sanchez-Carracedo, 2021), Ghana (Gyasi, Obeng and Yeboah, 2020), and in an analysis of survey data from 149 countries around the world (Jones, 2017). Second, existing studies show that the timing of food voucher receipt matters when considering outcomes such as test scores (Cotti, Gordanier and Ozturk, 2018), college-entrance exams and the probability of attending college (Bond et al., 2021), disciplinary infractions at school (Gennetian et al., 2016), emergency room visits (Cotti, Gordanier and Ozturk, 2020), and food pantry visits (Byrne and Just, 2021). Similar to Bazzi, Sumarto and Suryahadi (2015), who study the timing of cash transfers on food consumption in Indonesia, we build on these existing findings and pull these two lines of research together by exploiting the timing of our survey relative to the monthly distribution of food vouchers to study the relationship between experiencing food insecurity and psychological well-being.

We make three main contributions: First, we add to the literature on the health consequences of food insecurity (Eicher-Miller et al., 2009; Kirkpatrick and McIntyre, 2010; Park and Eicher-Miller, 2014; Chi et al., 2015; Gundersen and Ziliak, 2015) by specifically considering mental health or psychological distress (Casey et al., 2004; Heflin, Siefert and Williams, 2005; Whitaker, Phillips and Orzol, 2006; Melchior et al., 2012; McLaughlin et al., 2012; Burke et al., 2016; Jones, 2017; Shankar-Krishnan, Deu and Sanchez-Carracedo, 2021; Fang, Thomsen and Nayga, 2021). This literature is careful to point out that previous es-

timates may be biased estimates of any causal effect. We contribute to this literature by leveraging the timing of our household survey relative to the monthly distribution of food vouchers to better estimate the psychological toll of experiencing food insecurity.

Second, we contribute to the literature investigating the effect of the timing of food voucher receipt on food security and other important outcomes (Gennetian et al., 2016; Cotti, Gordanier and Ozturk, 2018, 2020; Byrne and Just, 2021; Bond et al., 2021). We show that affirmative responses to our survey questions measuring food insecurity increase in the number of days between when a household received their monthly food voucher and when they were surveyed. We further contribute to this literature by extending the existing knowledge base to an important and understudied context of an extremely poor population in a non-Western country. This extension is important because although much of the literature on the effect of food assistance timing focuses on the Supplemental Nutrition Assistance Program (SNAP) in the United States, food assistance and other programs—such as the distribution of pension funds, child support, and cash transfers—often follow set distribution schedules and are exceedingly relevant in the lives of many living in low-income countries. Moreover, a meaningful relationship between experiencing food insecurity and psychological well-being may have downstream consequences such as the formation of fatalistic beliefs about socioeconomic mobility and higher dis-utility of labor which could reinforce the persistence of poverty (Lybbert and Wydick, 2018; Ridley et al., 2020).

Third, we add to the literature on the quantitative measurement of food insecurity (Carletto, Zezza and Banerjee, 2013; Cafiero et al., 2014; Cafiero, Viviani and Nord, 2018; Abay et al., 2021; Lee, Barrett and Hoddinott, 2021) and demonstrate the possibility of non-classical measurement error (Abay et al., 2019; Millimet and Parmeter, 2021). Our food insecurity screening question, which indicates if a member of the household has involuntarily skipped at least one meal over the past 30 days, should not vary based on the timing of the survey relative to the monthly distribution of food vouchers because it uses a 30 day reference period. Yet, we find that the probability of affirmative responses to this question increases in the number of days between the monthly distribution of food vouchers and the household survey date. This finding has implications for more sophisticated measurements of food insecurity that use the same type of recall elicitation method, such as the Food Insecurity Experience Scale developed by the United Nations Food and Agriculture Organization (Ballard, Kepple and Cafiero, 2013; Smith, Rabbitt and Coleman-Jensen, 2017).

The remainder of this paper is organized as follows. In the next section we discuss our

empirical framework by introducing our unique set of data and our identification strategy. Section 3 first reports descriptive results and then presents regression results from our OLS and instrumental variable regression specifications. Finally, Section 4 concludes with a brief discussion.

2 Study Setting and Empirical Framework

We use data from the baseline survey of an impact evaluation of a poverty graduation pilot program in Lebanon. This pilot program and its randomized evaluation were ultimately not implemented by the government due to political and economic challenges stemming from an abrupt change in government and the COVID-19 pandemic. However, a complete baseline survey was conducted in March, April, and May 2019 before the pilot program was officially discontinued in 2020.

We draw our sample from the poorest 10,000 households in Lebanon as determined by the National Poverty Targeting Program (NPTP). The Government of Lebanon launched the NPTP in 2011 to identify, via a proxy means test, poor Lebanese households and provide targeted social assistance that includes both health and education subsidies. Since its launch, and in response to rising levels of poverty among Lebanese households associated with the neighboring Syrian war, the Government of Lebanon expanded the NPTP to provide monthly food assistance via an electronic voucher to the poorest 10,000 households identified in the NPTP in the amount of LBP 100,000 per capita for a maximum of six members per household.³ Our sample includes 1,350 randomly selected households from the 10,000 poorest households identified in the NPTP. All households in our sample receive food vouchers and reside in the North and Bekaa Governorates in Lebanon.⁴

2.1 Data

Our baseline survey includes both a household- and individual-level questionnaire. The household-level questionnaire includes questions for the household head and collects information on various household-level socioeconomic outcomes including income, expenditures, assets, and food insecurity. The individual level questionnaire includes questions for working age and able-bodied individuals (i.e., potential graduation program participants) and collects information on employment, education attainment, health outcomes,

³In 2019, this was approximately 66 USD per household member.

⁴These are the two governorates with the highest levels of poverty in the country. Over 70 percent of the poorest 10,000 households reside in these two regions.

and several psychological well-being variables. Our full individual-level sample include 1,726 individuals from 1,350 households.⁵ We describe specific variables included in these data below, which are unique for such a sample of households in Lebanon. The household-level and individual-level questionnaire were mostly answered by different individuals within the same household.⁶ As we discuss in more detail in Section 2.2, we rule out concerns relating to recall-bias and reverse causality that may persist if a single individual answers survey questions about both household-level food security and their own individual-level psychological well-being by controlling for whether the same individual responded to both the household and individual questionnaire.

Our sample includes individuals living in extremely poor households in Lebanon—randomly selected from roughly the poorest three to four percent of households as measured by the poverty means score. Table 1 describes the level of poverty experienced by those in our sample by showing household- and individual-level summary statistics. Roughly 64 percent of households have at least one member who receives some income from employment, mostly through casual labor. The average monthly income per capita in the sample is 78,650 Lebanese Lira (LL) or approximately 52.4 USD, and is slightly lower than average monthly food expenditure per capita and the value of the food voucher. The individuals in our sample are on average 35 years old and nearly four out of five are female. Only 17 percent are employed in any form of work most commonly in casual labor. Only about seven percent of the individuals in our sample are formally employed in a job registered with the Lebanese Government.

We measure food insecurity by asking two survey questions. First, we ask a screening question to the respondent of the household-level questionnaire if anyone in their household involuntarily skipped meals over the last 30 days. In our data, 25 percent of households report that someone in the household involuntarily skipped meals in the last 30 days. Second, if a respondent answered affirmatively to this screening question, we ask if their household has enough food for the next day's meals. In our data, as shown in Table 1, eight percent of the full sample, and 33 percent of the sub-set of households who answer affirmatively to the screening question, report not having enough food for the next day's meals and, therefore, are food insecure.

⁵With a specific intention to target females, if a household identified a male participant, they were asked to also identify an eligible female participant. If a household identified a female, however, they were not asked to identify an eligible male participant. Thus, the sample includes 1,726 individuals with 1,349 female and 377 male participants.

⁶The head of the household was also the intended graduation program participant, and therefore answered both the household and individual questionnaires, in only 15 percent of cases.

TABLE 1: Summary Statistics

Household Respondent	
<i>Age</i>	48.5
<i>Share Female</i>	15%
<i>Share Married</i>	89%
<i>Education: At least Some Secondary</i>	17%
Household Income & Expenditure	
<i>Received income from employment</i>	64%
<i>Monthly income per capita</i>	78,650 LL
<i>Monthly total expenditure per capita</i>	153,731 LL
<i>Monthly food expenditure per capita</i>	79,722 LL
<i>HH member involuntarily skipped a meal</i>	25%
<i>Not enough food for next day's meals</i>	8%
Dwelling Characteristics	
<i>Share who own their dwelling</i>	65%
<i>Imputed monthly rental value</i>	225,000 LL
<i># of rooms</i>	2.73
<i>Repairs in the last 12 months</i>	10%
<i>Indoor Plumbing</i>	82%
<i>Electricity</i>	95%
Household Assets	
<i>Television</i>	94%
<i>Computer</i>	1.50%
<i>Cellphone</i>	97%
<i>Stove</i>	52%
<i>Fridge</i>	86%
<i>Washing machine</i>	90%
<i>Motor vehicle</i>	26%
Individual Respondent	
<i>Age</i>	34.9
<i>Share Female</i>	79%
<i>Share Married</i>	63%
<i>Education: At Least Some Secondary</i>	41%
<i>Computer Illiterate</i>	87%
Employed	17%
<i>Work for Salary</i>	36%
<i>Formally Employed</i>	7%
<i>Self-Employed</i>	21%
<i>Casual Labor</i>	43%

Note: This table includes the authors' tabulations of household- and individual-level summary statistics. The top panel includes summary statistics from the household-level questionnaire and the bottom panel includes summary statistics from the individual-level questionnaire.

Despite the fact that our entire sample is poorer and more dependent on food vouchers relative to the larger population of Lebanon, there is meaningful variation in economic livelihood indicators in our data. In particular, reporting food insecurity is associated with lower levels of economic livelihood indicators at conventional levels of statistical significance. Table 2 shows that households that report food insecurity are less likely to receive income from employment, earn less monthly income per capita, and have less wealth than households that do not report food insecurity. We also find that households reporting

TABLE 2: Household and Individual Characteristics by Food Security Status

	Not Food Insecure	Food Insecure	Difference (p-value)
Household Income & Expenditure			
<i>Received income from employment</i>	65%	45%	0.00
<i>Monthly income per capita</i>	79,216 LL	62,544 LL	0.00
<i>Monthly total expenditure per capita</i>	153,369 LL	157,471 LL	0.59
<i>Monthly food expenditure per capita</i>	79,348 LL	78,372 LL	0.73
<i>Wealth Index</i>	0.051	-0.325	0.00
Individual Respondents			
<i>Age</i>	36.11	37.5	0.15
<i>Share Female</i>	0.79	0.71	0.05
<i>Share Married</i>	0.64	0.68	0.34
<i>Some Secondary Education</i>	0.12	0.08	0.13
<i>Employed</i>	0.18	0.14	0.19
<i>CES-D Scale</i>	12.77	15.35	0.00
<i>Share CES-D \geq 14</i>	0.70	0.91	0.00
<i>Cohen's Perceived Stress Scale</i>	18.12	19.00	0.04
<i>Life Orientation Test Score</i>	25.28	27.33	0.00

Note: This table includes the authors' tabulations of household- and individual-level summary statistics by food security status. P-values are based on robust standard errors are in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

food insecurity are no different than the other households in terms of monthly total or food expenditures per capita. These findings demonstrate the complex relationship between reporting food insecurity and economic livelihood indicators such as income and wealth, which we address when discussing our identification strategy in Section 2.2.

We measure a variety of different variables that represent components of psychological well-being with a unique survey among a sample of very poor households in Lebanon. First, we use the Center for Epidemiologic Studies of Depression (CES-D) scale to measure depressive symptoms. The CES-D scale is a widely used measure to screen for depression in the population and has been validated for use in different languages and countries around the world, including recently in Arabic and in Lebanon (Radloff, 1977; Baron, Davies and Lund, 2017; Kazarian and Taher, 2010). We represent the CES-D scale in two ways. Our first measure is the full CES-D scale with lower scores indicating fewer depressive symptoms (Siddaway, Wood and Taylor, 2017; Wood, Taylor and Joseph, 2010). Psychologists use the CES-D scale to screen for depression with scores of 11 through 14 or above indicating a higher probability of experiencing a major depressive episode (Baron, Davies and Lund, 2017). Among this very poor sample, the average CES-D score is very high compared to the average in Lebanon and other countries around the world (Kazarian and Taher, 2010; Baron, Davies and Lund, 2017). Our second measure, therefore, uses a

CES-D scale score of 14 or above as a critical threshold.⁷ As shown in Table 2, about 70 percent of households not reporting food insecurity, and 90 percent of households reporting food insecurity, have CES-D scores greater than or equal to 14 indicating high levels of depression risk in our sample of extremely poor mostly working-age women. Panel A in Figure 1 illustrates the distribution of scores on the CES-D scale and shows that a large share of our sample have CES-D scores above the threshold value of 14 that is commonly used to screen for depression. Panel B in Figure 1 shows that CES-D scores decline as wealth increases and our sample of poor households express levels of depressive symptoms that are very high relative to Lebanon and the world.

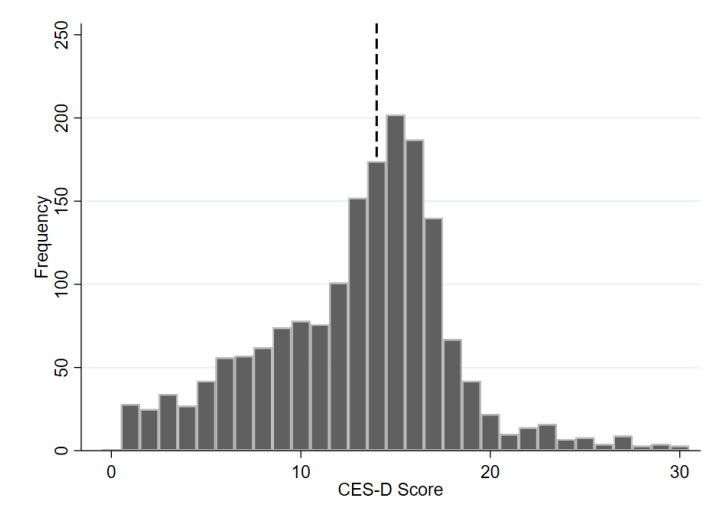
We also use two additional measures of psychological well-being. Our second measure of psychological well-being is Cohen's perceived stress scale, which measures an individual's evaluation of their life events as stressful (Cohen, Kamarck and Mermelstein, 1983). Our individual level questionnaire includes 14 questions asking the respondent about their feelings and thoughts within the last month regarding various potentially stressful situations.⁸ Unlike the CES-D scale, the perceived stress scale is not a diagnostic tool with validated threshold scores on the scale (Cohen and Janicki-Deverts, 2012). The higher someone scores on this stress scale, the more stressful they perceived their life to be relative to others within the same sample (Cohen, Kamarck and Mermelstein, 1983; Cohen and Janicki-Deverts, 2012). Our final measure of psychological well-being is the life orientation test which consists of 12 questions designed to evaluate the individual's optimism about life (Scheier, Carver and Bridges, 1994). The respondent answers questions on an ordinal scale from with assigned numerical values of zero to four.⁹ Lower overall scores on the life orientation test indicate that an individual exhibits more dispositional optimism towards life (Scheier and Carver, 1985)—they are more likely to think that good outcomes can be achieved through one's own effort. Those with less dispositional optimism are more likely to think that external forces will always thwart any effort leading to worse outcomes.¹⁰

⁷This binary variable uses a relatively high threshold score and while this means it likely has high positive predictive value for depression it may also miss individuals who may have depression and CES-D scores lower than 14. In addition, this binary indicator allows for a robustness test on the cardinal treatment of ordinal variables (Bond and Lang, 2019; Bloem, 2021) akin to that discussed by Bloem and Oswald (2021).

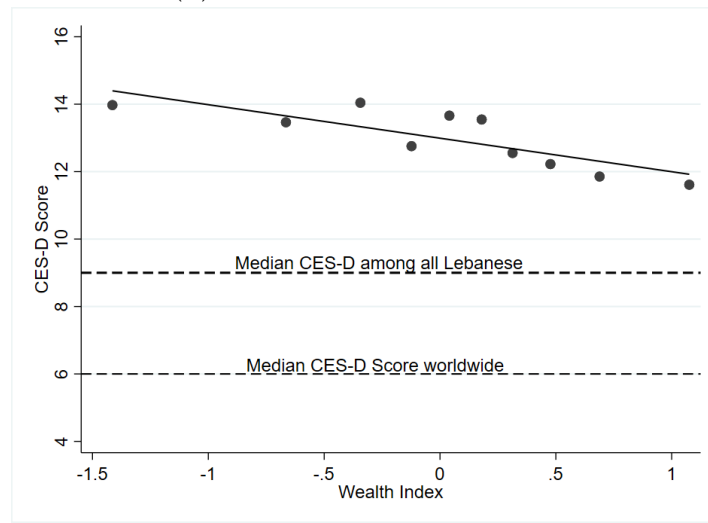
⁸Respondents use a zero through four ordinal scale to answer these questions. Answers on positive questions are reversed and then the score is summed across all questions.

⁹Answers to questions that are positive are flipped prior to summing the overall score.

¹⁰Optimism is seen as a family of related constructs that include self-efficacy, hope, and attributional styles (Snyder, 1994; Bandura, Freeman and Lightsey, 1999; Seligman, 2006). Optimism as measured by the life orientation test is linked to positive social, health, and coping outcomes Carver and Scheier (2014).



(A) Distribution of CES-D Scores



(B) CES-D Scores and Wealth

FIGURE 1: CES-D Scores in our sample of poor households

2.2 Identification Strategy

The observed correlation between experienced food insecurity and psychological well-being may be biased due to a number of factors. First, alternative factors—such as income, wealth, regional variation, employment status, or seasonal fluctuations—may both lead to changes in food insecurity and psychological well-being and confound estimates of the effect of food insecurity on psychological well-being. Second, particularly when using survey data reverse causality may persist, whereby lower levels of psychological well-being lead to increased food insecurity through lower labor supply at the intensive and exten-

sive margins (Delaney, Fink and Harmon, 2014; De Quidt and Haushofer, 2016). Finally, food security is a complicated and multidimensional concept to quantitatively measure and therefore may be measured with error. As previously discussed, this error can be non-classical when the data are collected via a household survey.

We aim to address each of these challenges with our unique set of data by controlling for key observable factors and by leveraging the plausibly exogenous timing of the household survey relative to the monthly distribution of food vouchers. As a transparent and simple baseline specification, we start by estimating the following linear regression:

$$PW_{i,h,r} = \beta_0 + \beta_1 FI_{h,r} + X'_{i,h,r} \Theta + \delta_r + u_{i,h,r} \quad (1)$$

where in equation (1) $PW_{i,h,r}$ is a measure of psychological well-being for individual i in household h in district r as indicated via the individual-level questionnaire. We show results for four different measures of psychological in addition to an index combining all available measures. $FI_{h,r}$ is an indicator for living in a household experiencing food insecurity as indicated via the household-level questionnaire and β_1 is our coefficient of interest. $X_{i,h,r}$ is a vector of individual and household-level characteristics—including age of the respondent, their sex, employment status, their level of education, and whether the individual is also the household head and therefore responded to the household-level questionnaire. Household level controls include wealth quintiles, household income per capita, household size, and characteristics of the household head—and δ_r is a district fixed effect. Finally, $u_{i,h,r}$ is the unobserved error term.¹¹

We show results estimated with an OLS regression specified in equation (1). We rule out direct reverse causality by leveraging the fact that the majority of those who are eligible for the individual-level questionnaire were not respondents to the household-level food insecurity survey questions. In all of our results we control for those who do answer questions from both surveys. Still, there may be sources of endogeneity—either due to measurement error or omitted heterogeneity—that bias our OLS estimates. We therefore leverage the plausibly exogenous timing of the survey compared to the food voucher monthly payment to instrument for food insecurity. The order in which interviews were conducted took place over a three-month period and is plausibly exogenous to food security status and psychological well-being. Therefore, our identifying assumption is that the

¹¹We do not cluster our standard errors because our "treatment" variable (e.g., experiencing food insecurity), varies at the household level and the majority of households in our sample include one individual observation in our data. In addition, we do not aim to estimate representative estimates for a given geographical area. Therefore, as discussed by Abadie et al. (2019), we report robust standard errors.

timing of an interview relative to receipt of the food voucher only influences psychological well-being because it influences food insecurity. This assumption is supported by the reality that these households are among the poorest of poor in Lebanon and depend heavily on the food voucher for food consumption.

We estimate the following two-stage least squares instrumental variable regression specification:

$$FI_{h,r} = \gamma_0 + \gamma_1 I_{j,h} + X'_{i,j,r} \Psi + \pi_r + \eta_{hi} \quad (2)$$

$$PW_{i,h,r} = \alpha_0 + \alpha_1 \hat{F}I_{h,r} + X'_{i,h,r} \Omega + \tau_r + \epsilon_{i,h,r} \quad (3)$$

where in equation (2) $I_{j,h}$ is a dummy variable indicating whether the household was surveyed during the seven days before they receive their food voucher.¹² Similar to equation (1), $X_{i,h,r}$ in equations (2) and (3) is a vector of individual and household level characteristics including age of the respondent, their sex, employment status, their level of education, and whether the individual is also the household head and therefore responded to the household-level questionnaire. Household level controls include wealth quintiles, household income per capita, household size, and characteristics of the household head. Additionally, π_r and τ_r are district fixed effects. One avenue through which the date of the interview could affect psychological well-being is how it is related to the timing of income incoming into the household. Therefore, it is important that we control for employment status of the individual, employment of other members of the household, and household income and wealth in our regression specifications. While related to food security, this is a different mechanism and could influence the validity of using the instrument for food insecurity.

3 Results

We present three sets of results. First, we discuss a set of descriptive results. These descriptive results illustrate important findings in and of themselves and complement our OLS and instrumental variable estimation results. Second, we show our regression results. These regression results more rigorously estimate the relationship between experiencing food insecurity and psychological well-being by addressing the identification challenges discussed above. Finally, we present robustness and sensitivity checks, which support the validity of our core empirical finding that experiencing food insecurity carries psycholog-

¹²As a robustness check, we also show results for a flexible day of the month instrument, week fixed effects, and including the month of the interview as an additional instrument.

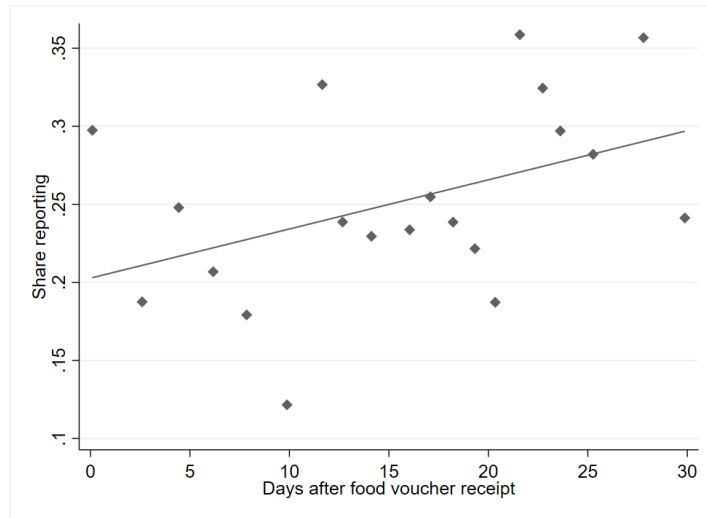
ical consequences.

3.1 Descriptive Results

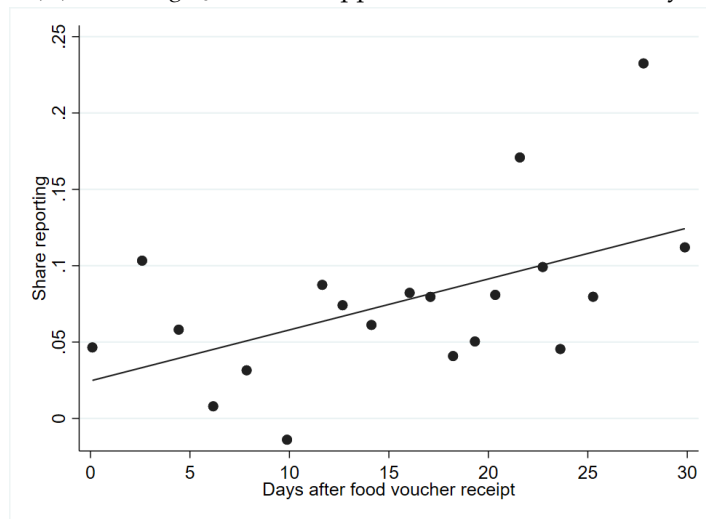
We present three descriptive results. We first document evidence of possible non-classical error in the measurement of food insecurity using household surveys. Next we show that the probability of experiencing food insecurity increases in the number of days between the monthly distribution of food vouchers and the household survey date. Finally, we show declining levels of psychological well-being as the number of days between the monthly distribution of food vouchers and the household survey date increases.

Non-Classical Measurement Error—Panel A in Figure 2 shows the relationship between responses to the screening question and the number of days since the household received the food voucher. We find that the share of households answering affirmatively to this question is increasing in the number of days between when households were surveyed and when they received their food voucher. This is notable because responses to this question should not vary within a month. That is, despite the fact that the screening question uses a reference period of the past 30 days, the probability of answering affirmatively is increasing in time since the household last received their monthly food voucher. This result is possibly due to recency bias when answering survey questions (Hogarth and Einhorn, 1992).

The observation of possible non-classical measurement error is relevant to the use of more sophisticated approaches used to measure food insecurity with household surveys using recall methods, such as the FIES (Ballard, Kepple and Cafiero, 2013; Smith, Rabbitt and Coleman-Jensen, 2017). Developed by the FAO as a "gold standard" for measuring hunger globally, the FIES measures experienced food insecurity by asking eight questions about a household's experience accessing adequate and nutritious food over some references period (e.g., a month or a week). The FIES is included in household surveys conducted by large multinational organizations, such as the World Bank and IFPRI, and is used in hundreds of academic research papers to date. This possible non-classical measurement error is particularly problematic when food insecurity is an outcome of interest and the treatment is correlated with this within-month recall error. For example, consider a study that aims to measure the effect of earned income or pension income on food insecurity. If the distribution of this income follows a monthly pattern, then the observed relationship between income and food insecurity could be affected by the timing of the survey.



(A) *Screening Question: Skipped meals in the last 30 days*



(B) *Food Insecurity: Not enough food for tomorrow's meals*

FIGURE 2: Food insecurity by days since the food voucher—Binned scatter plot

The possible non-classical measurement error discussed here is not a problem in the present study for at least two reasons. First, our measure of food insecurity (e.g., answering affirmatively to both a screening question and a follow-up question) can plausibly vary based on the amount of time between the monthly distribution of food vouchers and the survey date. Second, we directly exploit the variation in experienced food insecurity within the survey month as part of our estimation approach, which rules out bias driven by omitting this information.

Food Assistance Timing and Food Insecurity—Food assistance provided via monthly food

vouchers are a popular way to provide financial support to needy households all around the world. For example, the food assistance program we study in Lebanon is roughly modeled after the Supplementary Nutrition Assistance Program (SNAP) implemented in the United States. Previous work consistently shows that food consumption increases after the monthly receipt of food vouchers and subsequently declines (Zaki and Todd, 2021). If food consumption decreases enough and if this pattern persists for relatively low-income households, then food insecurity itself may increase at the end of the food assistance benefits cycle.

Panel B in Figure 2 shows that the share reporting our measure of food insecurity increases in the number of days between the monthly distribution of food vouchers and the household survey date. We find that households surveyed at the end of the food assistance benefit cycle are over twice as likely to report experiencing food insecurity as households surveyed at the beginning of the benefit cycle. This figure represents an important finding in and of itself. It shows that the relatively poor households in our sample are unable to effectively smooth consumption between the monthly distribution of food vouchers. Given the poverty level of the households in our sample, this finding informs poverty alleviation policies, such as the timing and frequency of food voucher distribution programs. This figure also illustrates the first-stage relationship in our instrumental variable estimation approach (discussed in Section 2.2 above) where we leverage the plausibly exogenous timing of the survey in reference to the food voucher distribution date as an instrument for reporting food insecurity.

Food Assistance Timing and Psychological Well-Being—Finally, we show the reduced form relationship between the number of days since receiving the food voucher and various measures of psychological well-being. Panels A and B in Figure 3 show that both the standardized full CES-D scale and a binary indicator of being above the depression risk threshold (e.g., greater than a CES-D score of 14) are increasing in the number of days between when households were surveyed and when they received their food voucher. Panel C in Figure 3 shows this same pattern with the standardized perceived stress scale scores. Finally, Panel D in Figure 3 again shows this same pattern with the standardized life orientation test score. Moreover, Table 2 shows that those who live in households reporting food insecurity have higher average CES-D scores, are more likely to have a CES-D score above 14, have higher perceived stress scale scores, and have higher life orientation test scores. All of these differences are statistically significant at conventional levels. This highlights that those surveyed at the end of the food assistance benefits cycle experience lower levels of psychological well-being as measured by the CES-D scale, a binary indica-

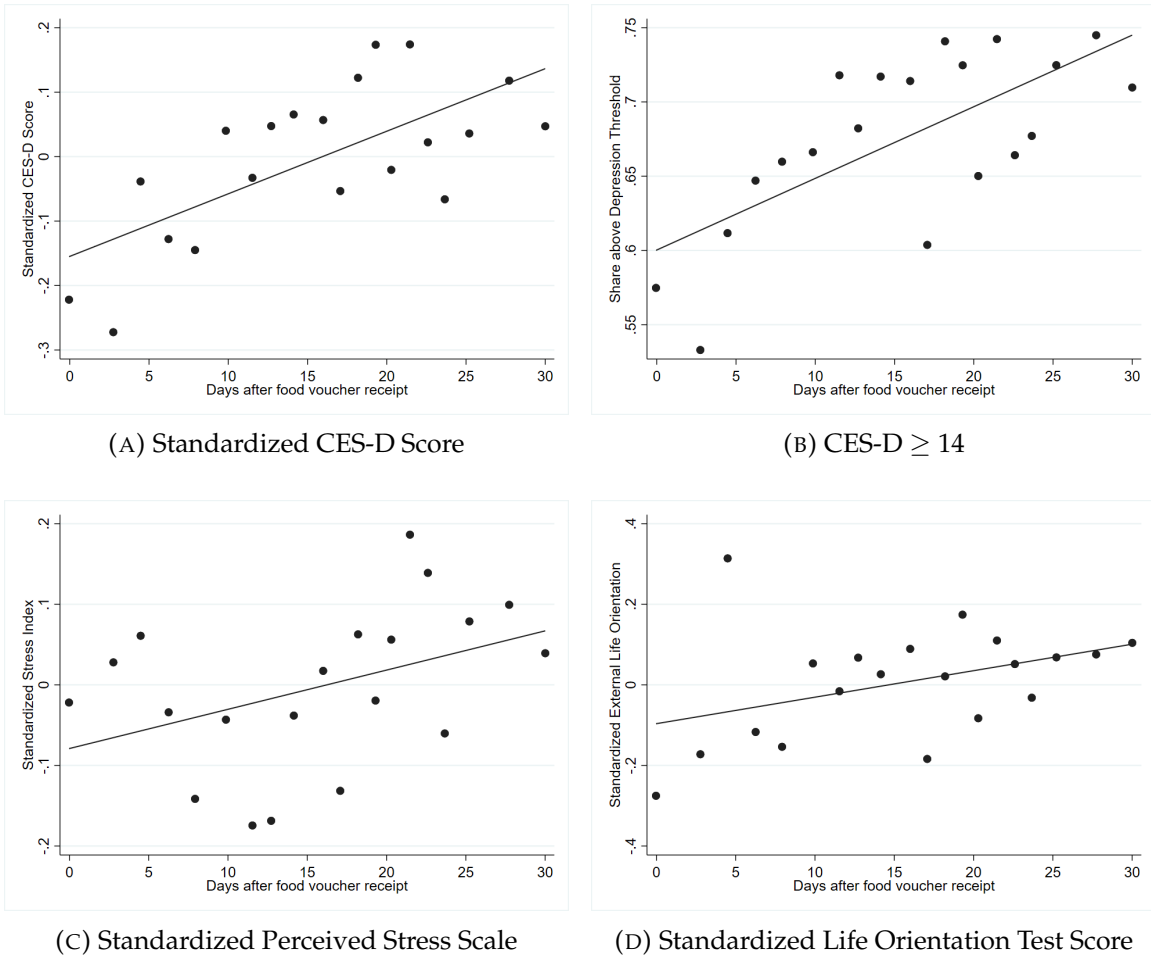


FIGURE 3: Psychological well-being by days since the food voucher—Binned scatter plot

tor of depression risk, Cohen’s perceived stress scale, and the life orientation test. Taken together with the finding that reported food insecurity also increases at the end of the food assistance benefits cycle, these observations support our core finding that food insecurity carries psychological consequences.

3.2 Regression Results

We show three sets of regression results. First, we present OLS regression results for the timing of the interview and reported food insecurity. Second, we report OLS regression estimates of the relationship between reported food insecurity and psychological well-being. Finally, we show instrumental variable estimates that exploit the plausibly exogenous variation in the number of days between the monthly distribution of food vouchers and the household survey date.

TABLE 3: OLS Results—Food Assistance Timing and Food Insecurity

<i>Dep Var</i>	Screening Question			Food Insecurity		
	(1)	(2)	(3)	(4)	(5)	(6)
Interview in last week before voucher	0.040 (0.026)	0.044* (0.026)	0.087*** (0.027)	0.071*** (0.019)	0.069*** (0.019)	0.102*** (0.019)
Female		-0.028 (0.032)	-0.046 (0.028)		-0.045** (0.019)	-0.026 (0.019)
Age		-0.007 (0.007)	-0.002 (0.006)		0.003 (0.004)	0.004 (0.004)
Age ²		0.000 (0.000)	0.000 (0.000)		-0.000 (0.000)	-0.000 (0.000)
Married		0.044 (0.029)	0.021 (0.028)		-0.006 (0.017)	-0.011 (0.017)
Education: Primary		0.042 (0.029)	0.024 (0.027)		0.016 (0.018)	0.029 (0.018)
Education: Intermediate		-0.007 (0.032)	0.034 (0.029)		-0.020 (0.019)	0.007 (0.020)
Education: Secondary or More		-0.026 (0.041)	0.019 (0.039)		-0.024 (0.025)	0.010 (0.026)
Employed		0.074** (0.033)	0.008 (0.030)		-0.046*** (0.018)	-0.016 (0.018)
Same Respondent		-0.021 (0.035)	-0.001 (0.032)			-0.000 (0.020)
Wealth Quintile=2			0.009 (0.030)			-0.027 (0.024)
Wealth Quintile=3			-0.141*** (0.031)			-0.101*** (0.025)
Wealth Quintile=4			-0.165*** (0.034)			-0.138*** (0.026)
Wealth Quintile=5			-0.142*** (0.035)			-0.132*** (0.025)
Household: Size			-0.000 (0.005)			0.007* (0.004)
Household: Income from work			-0.068*** (0.022)			-0.078*** (0.016)
Household: Log of Income Per Capita			-0.014 (0.017)			-0.012 (0.011)
Household: Someone Ill			0.120*** (0.026)			0.040** (0.016)
Household: Newborn			-0.086*** (0.026)			-0.026 (0.016)
Urban			0.086** (0.040)			0.033 (0.023)
Constant	0.240*** (0.012)	0.337*** (0.122)	0.554** (0.231)	0.062*** (0.007)	0.053 (0.072)	0.272* (0.150)
Town Fixed Effects	No	Yes	Yes	No	Yes	Yes
N	1,726	1,726	1,726	1,726	1,726	1,726

Note: The results in this table estimate the first-stage relationship between interview timing and food insecurity. In columns (1) through (3) the dependent variable is a binary variable representing affirmative responses to our screening question. In columns (4) through (6) the dependent variable is a binary variable representing affirmative response to our follow-up food insecurity question. P-values based on robust standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Food Assistance Timing and Food Insecurity—In Table 3 we show results using an OLS estimation approach where we control for host of household and individual level charac-

teristics and include district fixed effects. We find that interviewing individuals later in the monthly food voucher cycle is associated with higher reported food insecurity. Even when controlling for observable variables, households interviewed late in the monthly food voucher cycle are nearly nine percentage points more likely to report someone going hungry in the last month and 10 percentage points more likely to report not having enough food for the next day's meals—our measure of food insecurity. In fact, including additional control variables to the regression specification—i.e., comparing columns (1) to (3) and (4) to (6) in Table 3—we find that the estimated coefficient increases in magnitude and statistical significance. According to Oster (2019), this suggests robustness of these results to potential unobservable heterogeneity.

The results reported in columns (1) through (3) in Table 3 lend credence to the descriptive results reported in Panel A of Figure 2. That is, despite the fact that the screening question uses a 30 day recall period, and thus affirmative answers should not systematically vary within a month, we find that being interviewed in the week before food voucher distribution is leads to more affirmative responses. As previously discussed, this is evidence of potential non-classical measurement error in the quantitative measurement of food insecurity using household survey data.

The results reported in columns (4) through (6) in Table 3 support the descriptive results illustrated in Panel B of Figure 2. That is, being interviewed in the week before food voucher distribution leads to an increase in the likelihood the respondent indicates that their household does not have enough food for the next day's meals. With an overall incidence of food insecurity of eight percent, the estimated effect, representing over an 100 percent change, is relatively large and meaningful in magnitude. As illustrated in Figure 2, households surveyed at the end of the food assistance benefit cycle are over twice as likely to experience food insecurity compared to households surveyed at the beginning of the benefit cycle. These results also represent the first-stage relationship in our instrumental variables estimation approach. The results in columns (4) through (6) in Table 3 show a strong first-stage even when conditioning on a host of control variables.

Food Insecurity and Psychological Well-Being—In Table 4 we show results using an OLS estimation approach where we control for a host of household and individual level characteristics and include district fixed effects. We find that individuals in households experiencing food insecurity have higher levels of depressive symptoms, a higher likelihood of depression, and have less dispositional optimism at statistically significant levels. In addition, we construct an index aggregating each of the three measures of psychological well-being (e.g., CES-D scale, the perceived stress scale, and life orientation test) us-

ing factor analysis and find higher levels, indicating diminished psychological well-being, among individuals in food insecure households. However, as we add additional control variables—i.e., comparing columns (1) to (3) in Table 4—we find that the estimated coefficient decreases in magnitude and statistical significance. According to the methods of Altonji, Elder and Taber (2005) and the methods of Oster (2019), this suggests that these results may be biased due to unobservable heterogeneity.

The magnitude of these estimated coefficients on the relationship between experiencing food insecurity and various components of psychological well-being are relatively large. In columns (1) through (3) we find that living in a household that does not have enough food for the next day's meals is associated with between an 0.17 and 0.4 standard deviations higher score on our overall psychological well-being index, indicating diminished psychological well-being. Columns (4) and (6) show that the observed change in the standardized index is mostly driven by higher levels of depression and life orientation test (e.g., less dispositional optimism) among individuals who live in households that report not having enough food for the next day's meals.

While all of the households in the sample are poor, those in relatively wealthier households express lower levels of depressive symptoms, stress, and lower levels of dispositional optimism. Those who are unemployed report statistically significantly higher stress levels compared to those not in the labor force or those who work. Other statistically significant predictors of the different measures of psychological well-being are living in an urban area, having a newborn in the household (perhaps a reflection of post-partum depression), and education-levels of the individual.

Instrumental Variable Estimates—In Table 5 we show results using a binary indicator for the being interviewed in the week before food voucher distribution. This binary variable identifies those who were, due to the nature of the survey implementation process, interviewed on dates that happened to be in the seven days before their household received a food voucher and are thus late in the voucher monthly cycle. The order in which households were interviewed both across and within towns is unrelated to the local distribution of food vouchers. Nevertheless, the enumeration of towns did follow an specified order, therefore, we control for town-fixed effects in all our specifications. Our coding choice of dummy variable for the last week is based on finding the strongest first stage. We show results for different instrumental variable coding specifications in the Appendix and find similar point estimates. Our identifying assumption with this instrument is that the day of the interview does not directly affect our measures of psychological well-being through variables we do not control for in our analysis. Importantly, we control for employment

TABLE 4: OLS Results—Food Insecurity and Psychological Well-being

<i>Dep Var</i>	Overall Index			CES-D	PSS	LOT
	(1)	(2)	(3)	(4)	(5)	(6)
Food Insecure	0.408*** (0.068)	0.378*** (0.069)	0.175** (0.073)	0.220** (0.085)	0.088 (0.104)	0.185** (0.083)
Female		-0.117** (0.048)	-0.063 (0.052)	-0.042 (0.062)	-0.102 (0.067)	-0.058 (0.063)
Age		0.021 (0.013)	0.021* (0.012)	0.031** (0.015)	0.022 (0.015)	0.007 (0.016)
Age ²		-0.000 (0.000)	-0.000 (0.000)	-0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)
Married		0.168*** (0.059)	0.113* (0.059)	0.091 (0.069)	0.120* (0.070)	0.135* (0.071)
Education: Primary		-0.211*** (0.048)	-0.147*** (0.048)	-0.176*** (0.059)	-0.119** (0.059)	-0.128** (0.056)
Education: Intermediate		-0.187*** (0.057)	-0.061 (0.057)	-0.082 (0.068)	-0.054 (0.068)	-0.035 (0.066)
Education: Secondary or More		-0.391*** (0.081)	-0.230*** (0.081)	-0.255*** (0.093)	-0.246** (0.099)	-0.178* (0.098)
Employed		0.003 (0.056)	0.032 (0.056)	0.068 (0.068)	-0.017 (0.073)	0.024 (0.067)
Same Respondent			0.037 (0.060)	0.020 (0.072)	0.004 (0.073)	0.089 (0.070)
Wealth Quintile=2			-0.161*** (0.062)	-0.157** (0.072)	-0.111 (0.076)	-0.207*** (0.078)
Wealth Quintile=3			-0.148** (0.061)	-0.145** (0.073)	-0.082 (0.079)	-0.207*** (0.078)
Wealth Quintile=4			-0.200*** (0.065)	-0.210*** (0.077)	-0.193** (0.084)	-0.188** (0.079)
Wealth Quintile=5			-0.397*** (0.073)	-0.400*** (0.085)	-0.388*** (0.093)	-0.394*** (0.085)
Household: Size			-0.012 (0.010)	-0.017 (0.012)	-0.009 (0.013)	-0.006 (0.012)
Household: Income from work			-0.089* (0.048)	-0.076 (0.057)	-0.132** (0.057)	-0.069 (0.057)
Household: Log of Income Per Capita			-0.055 (0.039)	-0.109** (0.047)	-0.010 (0.047)	-0.016 (0.048)
Household: Someone Ill			0.060 (0.053)	0.107* (0.062)	0.024 (0.068)	0.022 (0.062)
Household: Newborn			0.139*** (0.050)	0.186*** (0.059)	0.100 (0.065)	0.106* (0.059)
Urban			-0.267*** (0.091)	-0.298*** (0.103)	-0.349*** (0.109)	-0.147 (0.109)
Constant	-0.031 (0.021)	-0.321 (0.232)	0.654 (0.503)	1.159* (0.598)	-0.093 (0.598)	0.580 (0.631)
Town Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1,726	1,726	1,726	1,726	1,726	1,726

Note: The results in this table estimate the relationship between food insecurity and psychological well-being. In columns (1) through (3) the dependent variable is an index representing the aggregation of our three psychological well-being variables. In columns (4) through (6) the dependent variables are each of the three variables measuring depression (e.g., CES-D), stress (e.g., PSS), and dispositional optimism (e.g., LOT). P-values based on robust standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE 5: Instrumental Variable Results—Food Insecurity and Psychological Well-Being

<i>Dep Var</i>	(1) Overall Index	(2) CES-D	(3) PSS	(4) LOT
Food Insecure	1.242** (0.508)	0.904 (0.564)	1.606** (0.628)	1.377** (0.600)
	First Stage F-stat = 30.48			
Controls	Yes	Yes	Yes	Yes
Town Fixed Effects	Yes	Yes	Yes	Yes
N	1,726	1,726	1,726	1,726

Note: The results in this table estimate the relationship between food insecurity and psychological well-being by leveraging the plausibly exogenous timing of our household survey relative to the monthly distribution of food vouchers. In column (1) the dependent variable is an index representing the aggregation of our three psychological well-being variables. In columns (3) through (4) the dependent variables are each of the three variables measuring depression (e.g., CES-D), stress (e.g., PSS), and dispositional optimism (e.g., LOT). P-values based on robust standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

status of the respondent, whether anyone in the household brings in any income, and household-level wealth and income per capita. Finally, as shown in Figure 2, the number of days between food voucher receipt and the interview date is a strong predictor of higher levels of food insecurity.

Instrumental variable estimates support our core empirical finding that food insecurity carries psychological consequences. Table 5 shows that living in a household reporting food insecurity has a large detrimental effect on psychological well-being. In particular, not having enough food for the next day results in a 1.2 standard deviation decrease in psychological well-being as captured by the index of our three measures. Although not statistically significant, the estimated coefficient for depressive symptoms shows a 0.9 standard deviation increase in the CES-D score. In addition, we find large and statistically significant coefficients indicating increased stress and decreased dispositional optimism whereby living in a household experiencing food insecurity leads to a 1.6 standard deviation increase in the perceived stress scale and 1.4 increase on the life orientation test.

As we will discuss in more detail below, these effect estimates are relatively large. Other studies, it should be noted, also find evidence of a dramatic influence of experiencing insecurity on mental health and psychological well-being. For example, studying a sample of low-income households in the United States, Fang, Thomsen and Nayga (2021)

find that experiencing food insecurity is associated with a 257 percent increased risk of anxiety and a 253 percent increased risk of depression. In comparison, losing a job is associated with a 32 percent increase in risk for anxiety and a 27 percent increase in risk for depression. Noting that Fang, Thomsen and Nayga (2021) clearly frame their estimates as associations and not necessarily causal estimates, they find that the psychological toll associated with food insecurity is roughly nine times higher than the psychological toll of job loss.

3.3 Robustness Tests

We now present three sets of results that support the credibility of our core empirical finding that food insecurity carries psychological consequences. First, we show graphical results showing the lack of systematic variation between the number of days between food voucher distribution and the interview and variables other than our measures of food insecurity and psychological well-being. Second, we discuss and defend the plausibility of the instrumental variable estimates being larger than the OLS estimates. Finally, we report results using alternative iterations of our instrument leveraging the plausibly exogenous timing of the household survey relative to the monthly distribution of food vouchers.

Falsification—Given the graphical results in Figures 2 and 3, one may wonder if other variables systematically vary by the number of days between the survey date and food voucher distribution. In Figure A.1 in the Supplemental Appendix, we show the relationship between six alternative variables that each should have no systematic relationship with our key source of variation. Panels A and B of A.1 show that important economic variables—the log of household income per capita and employment—do not systematically increase or decrease in the number of days between the survey date and food voucher distribution. Panels C through F show that important demographic variables—household size, respondent age, education attainment, and marital status—also are not systematically related to the number of days between the survey date and food voucher distribution. Taken together, these falsification results support the validity of our core empirical finding that food insecurity carries psychological consequences. Despite these falsification tests, we are careful to note that there may well be unobservable factors influencing psychological well-being that are correlated with day of the month.

The Complier Sub-Sample—These instrumental variable estimates are large, and notably, larger than the corresponding OLS estimates. This requires a brief discussion. Two details are important to keep in mind. First, our measure of food insecurity (i.e., not having

enough food for tomorrow's meals) is a strong treatment that can be particularly psychologically difficult. Second, these instrumental variable approach estimates the local average treatment effect on the sub-sample of individuals who comply to our instrument. Therefore, taking these two details together, the instrumental variable estimates report the effect of experiencing food insecurity on psychological well-being for those who are more likely to not have enough food for the next day's meals at the end of the food benefits cycle. This sub-sample group of compliers is a particularly vulnerable group and may be unable to effectively smooth their consumption for a variety of reasons relating to their vulnerability. Therefore, it is not particularly surprising that food insecurity in the severity we measure in our data can dramatically reduce psychological well-being among this sub-sample of individuals who comply to our instrument.

Although we cannot specifically identify the sub-sample of compliers in our data, we can restrict our analysis to the sub-sample who respond affirmatively to our screening question (i.e., those who indicating a household member has involuntarily skipped a meal in the last 30 days). In Panel A of Table A.1 we find OLS estimates that are between two to three times larger than OLS estimates using the full sample. In Panel B of Table A.1 we find instrumental variable estimates that are roughly the same size, if not slightly smaller, than the instrumental estimates using the full sample. These results, using a sample restricted to a vulnerable sub-sample, highlight the stronger psychological toll of experiencing food insecurity among a more vulnerable sub-sample of our data and partially explain why the instrumental variable estimates are large relative to the OLS estimates.

Additional Instruments—Our choice of instrument, a dummy variable for the last week before receipt of the food voucher, is a choice we made to increase the strength of the instrument. As with the now classic quarter-of-birth instrument used in Angrist and Krueger (1991), our timing instrumental variable can be used differently. The source of variation is the same, but other ways for us to use the variable is continuously, dummy variables for every week, or even day of the month dummies, among others. We are also able to add the month of the interview as an additional instrumental variable. These specifications lead to weaker first stages. However, we show results with these flexible instrumental variable specifications in Table A.2 in the Appendix. Results show estimates that are largely the same as in Table 5, albeit with lower first stage F-statistic values. In most these cases, overidentification tests do not reject the validity of the instrument. However, in the specification with day of the month dummy variables, while the first stage is weak, the overidentification tests suggest that the instrument is not valid.

4 Conclusion

In this paper we show that among a very poor population in Lebanon that is heavily dependent on monthly food vouchers, not everyone is able to smooth consumption and food insecurity increases in the latter parts of the monthly voucher cycle. We find that several measures of psychological well-being also decline later in the voucher cycle. We present regression evidence that observable controls do not account for this differences and that food insecurity is highly correlated with lower measures of psychological well-being.

Using a unique sample of ultra-poor individuals in Lebanon and a detailed dataset, we make three contributions: We add to the literature on the consequences of food insecurity that may extend beyond just calorie-deficits. We show that timing of food vouchers matter in a non-western context where transfer programs are becoming more important. Finally we show that traditional measures of food insecurity may suffer from non-classical measurement error possibly driven by recency bias.

Our results point a psychological mechanism driving persistent poverty (Lybbert and Wydick, 2018; Ridley et al., 2020; Haushofer, 2019; Alloush, 2020). A classic literature defines and examines a nutrition-based poverty trap, whereby an individual is unable to consume a sufficient number of calories to earn a large enough wage to purchase a sufficient number of calories (Dasgupta and Ray, 1986; Behrman and Wolfe, 1987; Deaton et al., 2009; Banerjee and Duflo, 2011; Schofield, 2014). Our core finding is that experiencing food insecurity carries psychological consequences, which may in-tern make escaping poverty even more challenging.

References

- Abadie, Alberto, Susan Athey, Guido W Imbens, and Jeffrey Wooldridge.** 2019. "When should you adjust standard errors for clustering?" National Bureau of Economic Research.
- Abay, Kibrom A, Gashaw T Abate, Christopher B Barrett, and Tanguy Bernard.** 2019. "Correlated non-classical measurement errors, 'Second best' policy inference, and the inverse size-productivity relationship in agriculture." *Journal of Development Economics*, 139: 171–184.
- Abay, Kibrom A, Guush Berhane, John F Hoddinott, and Kibrom Tafere.** 2021. "Assessing response fatigue in phone surveys: Experimental evidence on dietary diversity in Ethiopia." *World Bank Policy Research Working Paper, No. 9636*.
- Alloush, M.** 2020. "Income, Psychological Well-being, and the Dynamics of Poverty." *Working Paper*.
- Altonji, Joseph G, Todd E Elder, and Christopher R Taber.** 2005. "Selection on observed and unobserved variables: Assessing the effectiveness of Catholic schools." *Journal of political economy*, 113: 151–184.
- Angrist, Joshua D, and Alan B Keueger.** 1991. "Does compulsory school attendance affect schooling and earnings?" *The Quarterly Journal of Economics*, 106(4): 979–1014.
- Ballard, Terri, Anne Kepple, and Carlo Cafiero.** 2013. "The Food Insecurity Experience Scale: Development of a Global Standard for Monitoring Hunger Worldwide." *FAO Technical Paper Version 1.1*.
- Bandura, Albert, WH Freeman, and Richard Lightsey.** 1999. *Self-efficacy: The exercise of control*. Worth Publishers.
- Banerjee, A., and E. Duflo.** 2011. *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*. Public Affairs.
- Baron, Emily Claire, Thandi Davies, and Crick Lund.** 2017. "Validation of the 10-item Centre for Epidemiological Studies Depression Scale (CES-D-10) in Zulu, Xhosa and Afrikaans populations in South Africa." *BMC Psychiatry*, 17(1): 6.
- Bazzi, Samuel, Sudarno Sumarto, and Asep Suryahadi.** 2015. "It's all in the timing: Cash transfers and consumption smoothing in a developing country." *Journal of Economic Behavior & Organization*, 119: 267–288.
- Behrman, Jere R, and Barbara L Wolfe.** 1987. "HOW DOES MOTHER ' S SCHOOLING AFFECT FAMILY HEALTH , NUTRITION , MEDICAL CARE USAGE , AND HOUSEHOLD SANITATION ?* Analysts of the economics of the family often have stressed the role played by the mother in household productivity [Becker (1981) Leibowi." 36: 185–204.
- Behrman, J.R., and A.B. Deolalikar.** 1987. "Will Developing Country Nutrition Improve with Income? A Case Study for Rural South India." *Journal of Political Economy*, 95(3): 492–507.
- Bloem, Jeffrey R.** 2021. "How Much Does the Cardinal Treatment of Ordinal Variables Matter? An Empirical Investigation." *Political Analysis*, 1–17.

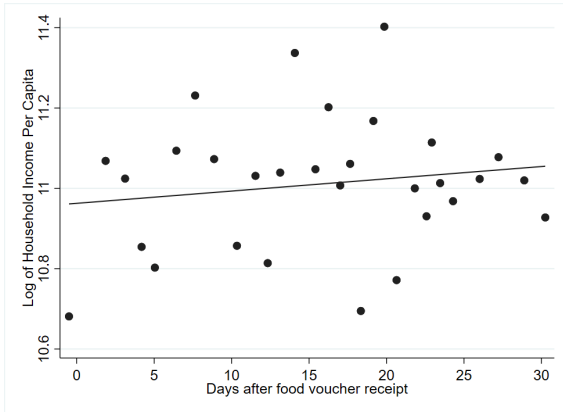
- Bloem, Jeffrey R, and Andrew J Oswald.** 2021. "The Analysis of Human Feelings: A Practical Suggestion for a Robustness Test." *Review of Income and Wealth*.
- Bond, Timothy N, and Kevin Lang.** 2019. "The sad truth about happiness scales." *Journal of Political Economy*, 127(4): 1629–1640.
- Bond, T.N., J.B. Carr, A. Packham, and J. Smith.** 2021. "Hungry for Success? SNAP Timing, High-Stakes Exam Performance, and College Attendance." *NBER Working Paper*, no. 28386.
- Burke, M.P., L.H. Martini, E. Cayir, H.L. Hartline-Grafton, and R.L. Meade.** 2016. "Severity of Household Food Insecurity Is Positively Associated with Mental Disorders among Children and Adolescents in the United States." *The Journal of Nutrition*, 146: 2019–2026.
- Byrne, A.T., and D.R. Just.** 2021. "The Other Half: An Examination of Monthly Food Pantry Cycles in the Context of SNAP Benefits." *Applied Economic Perspectives and Policy*.
- Cafiero, Carlo, Hugo R Melgar-Quinonez, Terri J Ballard, and Anne W Kepple.** 2014. "Validity and reliability of food security measures." *Annals of the New York Academy of Sciences*, 1331(1): 230–248.
- Cafiero, Carlo, Sara Viviani, and Mark Nord.** 2018. "Food security measurement in a global context: The food insecurity experience scale." *Measurement*, 116: 146–152.
- Carletto, Calogero, Alberto Zezza, and Raka Banerjee.** 2013. "Towards better measurement of household food security: Harmonizing indicators and the role of household surveys." *Global food security*, 2(1): 30–40.
- Carver, Charles S, and Michael F Scheier.** 2014. "Dispositional optimism." *Trends in cognitive sciences*, 18(6): 293–299.
- Casey, P., S. Goolsby, C. Berkowitz, D. Frank, J. Cook, D. Cutts, M.M. Black, N. Zaldivar, S. Levenson, T. Heeren, A. Meyers, and the Children's Sentinel Nutritional Assessment Program Study Group.** 2004. "Maternal Depression, Changing Public Assistance, Food Security, and Child Health Status." *Pediatrics*, 113(2): 298–304.
- Chi, D.L., E.E. Masterson, A.C. Carle, L.A. Mancl, and S.E. Coldwell.** 2015. "Socioeconomic status, food security, and dental caries in US children: mediation analyses of data from the National Health and Nutrition Examination Survey, 2007–2008." *American Journal of Public Health*, 104(5).
- Cohen, Sheldon, and DENISE Janicki-Deverts.** 2012. "Who's stressed? Distributions of psychological stress in the United States in probability samples from 1983, 2006, and 2009 1." *Journal of applied social psychology*, 42(6): 1320–1334.
- Cohen, Sheldon, Tom Kamarck, and Robin Mermelstein.** 1983. "A global measure of perceived stress." *Journal of health and social behavior*, 24: 385–396.
- Coleman-Jensen, Alisha, Matt Rabbitt, Christian Gregory, and Anita Singh.** 2020. "Household food security in the United States in 2013." *USDA-ERS Economic Research Report*, 175.
- Cotti, C.D., J.M. Gordanier, and O.D. Ozturk.** 2020. "Hunger pains? SNAP timing and emergency room visits." *Journal of Health Economics*, 71.

- Cotti, C., J. Gordanier, and O. Ozturk.** 2018. "When does it count? The timing of food stamp receipt and educational performance." *Economics of Education Review*, 66: 40–50.
- Dasgupta, P., and D. Ray.** 1986. "Inequality as a Determinant of Malnutrition and Unemployment." *The Economic Journal*, 6(2): 1011–1034.
- Deaton, A., and J. Dreze.** 2009. "Inequality and Nutrition in India: Facts and Interpretations." *Economic and Political Weekly*, XLIV(7): 42–65.
- Deaton, Angus S, Anne Case, Hank Farber, Bill Easterly, Bo Honoré, Michael Kremer, David Lee, and Chris Paxson.** 2009. "No Title."
- Delaney, Liam, Günther Fink, and Colm P Harmon.** 2014. "Effects of stress on economic decision-making: Evidence from laboratory experiments." *IZA Discussion paper, No. 8060*.
- De Quidt, Jonathan, and Johannes Haushofer.** 2016. "Depression for Economists." *NBER Working Paper Series No. 22973*, 1–33.
- Eicher-Miller, H.A., A.C. Mason, C.M. Weaver, G.P. McCabe, and C.J. Boushey.** 2009. "Food Insecurity is Associated with Iron Deficiency Anemia in US Adolescents." *The American Journal of Clinical Nutrition*, 90: 1358–1371.
- Fang, Di, Michael R Thomsen, and Rodolfo M Nayga.** 2021. "The association between food insecurity and mental health during the COVID-19 pandemic." *BMC public health*, 21(1): 1–8.
- Gennetian, L.A., R. Seshardi, N.D. Hess, A.N. Winn, and R.M. George.** 2016. "Supplemental Nutrition Assistance Program (SNAP) Benefit Cycles and Student Disciplinary Infractions." *Social Service Review*, 90(3).
- Gundersen, C., and J.P. Ziliak.** 2015. "Food Insecurity and Health Outcomes." *Health Affairs*, 34(11): 1830–1839.
- Gyasi, Razak M, Bernard Obeng, and Joseph Y Yeboah.** 2020. "Impact of food insecurity with hunger on mental distress among community-dwelling older adults." *PloS one*, 15(3): e0229840.
- Haushofer, Johannes.** 2019. "Is there a Psychological Poverty Trap?" *Working Paper*.
- Haushofer, Johannes, and Jeremy Shapiro.** 2016. "The short-term impact of unconditional cash transfers to the poor: Experimental evidence from kenya." *Quarterly Journal of Economics*, 131(4): 1973–2042.
- Heflin, C.M., K. Siefert, and D.R. Williams.** 2005. "Food insufficiency and women's mental health: Findings from a 3-year panel of welfare recipients." *Social Science and Medicine*, 61: 1971–1982.
- Hogarth, Robin M, and Hillel J Einhorn.** 1992. "Order effects in belief updating: The belief-adjustment model." *Cognitive psychology*, 24(1): 1–55.
- Jones, A.D.** 2017. "Food Insecurity and Mental Health Status: A Global Analysis of 149 Countries." *American Journal of Preventative Medicine*, 53: 264–273.
- Kazarian, Shahe S, and Dana Taher.** 2010. "Validation of the Arabic Center for Epidemiological Studies Depression (CES-D) scale in a Lebanese community sample." *European Journal of Psychological Assessment*, 26.

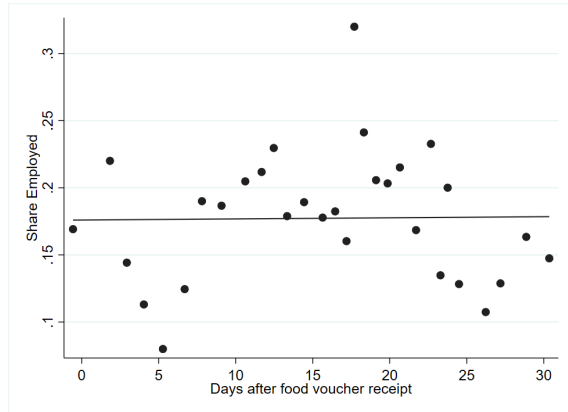
- Kirkpatrick, S.I., and M.L. McIntyre, L. Potestio.** 2010. "Child Hunger and Long-term Adverse Consequences for Health." *Archives of Pediatrics and Adolescent Medicine*, 164(8): 754–762.
- Lee, Seungmin, Chris B. Barrett, and John F. Hoddinott.** 2021. "Food Security Dynamics in the United States, 2001-2017." *Working Paper*.
- Lybbert, Travis J., and Bruce Wydick.** 2018. "Poverty, Aspirations, and the Economics of Hope." *Economic Development and Cultural Change*, 66(4).
- McLaughlin, K.A., J.G. Green, M. Alegria, E.J. Costello, M.J. Gruber, N.A. Sampson, and R.C. Kessler.** 2012. "Food Insecurity and Mental Disorders in a National Sample of U.S. Adolescents." *Journal of the American Academy of Child and Adolescent Psychiatry*, 51(12): 1293–1303.
- Melchior, M., J.F. Chastang, B. Falissard, R.E. Tremblay, S.M. Cote, and M. Boivin.** 2012. "Food Insecurity and Children's Mental Health: A Prospective Birth Cohort Study." *PLOS One*, 7(12).
- Millimet, Daniel, and Christopher Parmeter.** 2021. "Accounting for skewed or one-sided measurement error in the dependent variable." *Political Analysis*.
- Oster, Emily.** 2019. "Unobservable selection and coefficient stability: Theory and evidence." *Journal of Business & Economic Statistics*, 37(2): 187–204.
- Park, C.Y., and H.A. Eicher-Miller.** 2014. "Iron Deficiency Is Associated with Food Insecurity in Pregnant Females in the United States: National Health and Nutrition Examination Survey 1999-2010." *Journal of the Academy of Nutrition and Dietetics*, 114: 1967–1973.
- Radloff, Lenore Sawyer.** 1977. "The CES-D Scale: A Self-Report Depression Scale for Research in the General Population." *Applied Psychological Measurement*, 1(3): 385–401.
- Ridley, Matthew W., Gautam Rao, Frank Schilbach, and Vikram H. Patel.** 2020. "Poverty, Depression, and Anxiety: Causal Evidence and Mechanisms." *Science*, 370: 1–12.
- Schanzenbach, Diane Whitmore, Lauren Bauer, and Greg Nantz.** 2016. *Twelve facts about food insecurity and SNAP*. Brookings Institution Washington DC.
- Scheier, Michael F, and Charles S Carver.** 1985. "Optimism, coping, and health: assessment and implications of generalized outcome expectancies." *Health psychology*, 4(3): 219.
- Scheier, Michael F, Charles S Carver, and Michael W Bridges.** 1994. "Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test." *Journal of personality and social psychology*, 67(6): 1063.
- Schofield, H.** 2014. "The Economic Costs of Low Caloric Intake: Evidence from India." *Working Paper*.
- Seligman, Martin EP.** 2006. *Learned optimism: How to change your mind and your life*. Vintage.
- Shankar-Krishnan, N., A.F. Deu, and D. Sanchez-Carracedo.** 2021. "Associations Between Food Insecurity And Psychological Wellbeing, Body Image, Disordered Eating And Dietary Habits: Evidence From Spanish Adolescents." *Child Indicators Research*, 14: 163–183.

- Siddaway, Andy P., Alex M. Wood, and Peter J. Taylor.** 2017. "The Center for Epidemiologic Studies-Depression (CES-D) scale measures a continuum from well-being to depression: Testing two key predictions of positive clinical psychology." *Journal of Affective Disorders*, 213: 180–186.
- Smith, Michael D, Matthew P Rabbitt, and Alisha Coleman-Jensen.** 2017. "Who are the world's food insecure? New evidence from the Food and Agriculture Organization's food insecurity experience scale." *World Development*, 93: 402–412.
- Snyder, Charles Richard.** 1994. *The psychology of hope: You can get there from here.* Simon and Schuster.
- Whitaker, R.C., S.M. Phillips, and S.M. Orzol.** 2006. "Food Insecurity and the Risks of Depression and Anxiety in Mothers and Behavior Problems in their Preschool-Aged Children." *Pediatrics*, 118(3).
- Wood, Alex M., Peter J. Taylor, and Stephen Joseph.** 2010. "Does the CES-D measure a continuum from depression to happiness? Comparing substantive and artifactual models." *Psychiatry Research*, 177(1-2): 120–123.
- Zaki, Mary, and Jessica E Todd.** 2021. "Price Consciousness at the Peak of "Impatience"." *Journal of Human Resources*, 0121–11411.

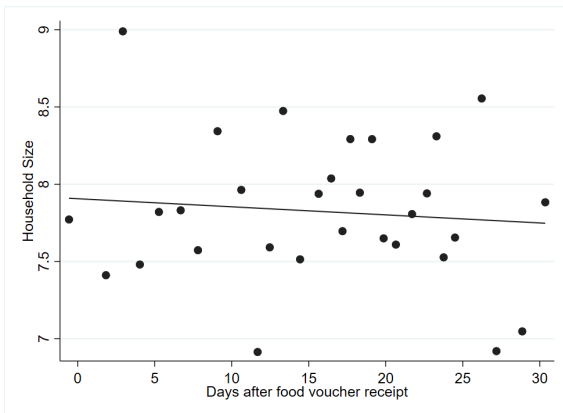
A Appendix



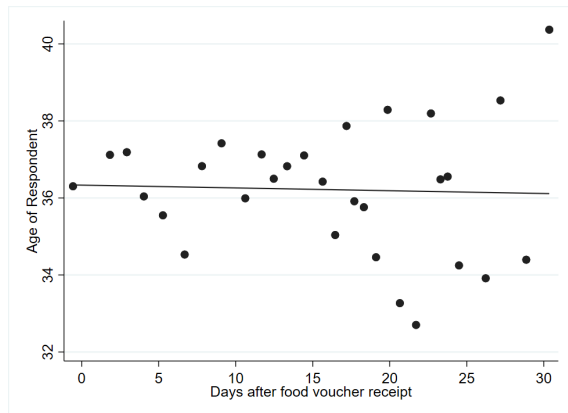
(A) Log of Household Income Per Capita



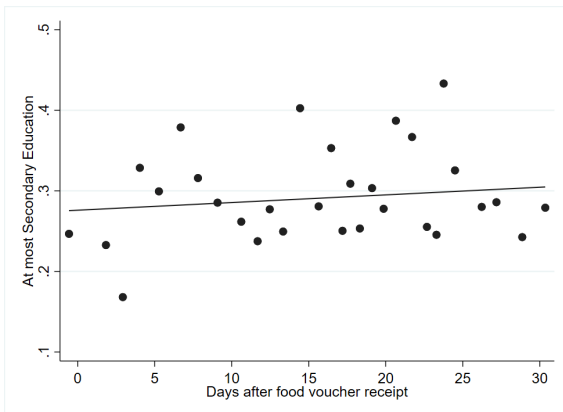
(B) Share Employed



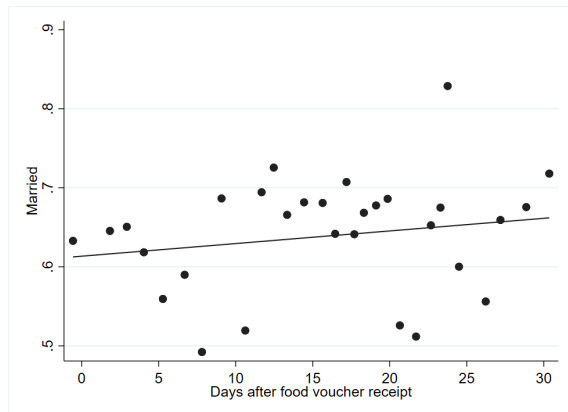
(C) Household Size



(D) Age of Respondent



(E) At most Secondary Education



(F) Married

FIGURE A.1: Observable covariates do not seem to vary much with our instrument. This gives us confidence that the unobservables do vary greatly with our instrument.

TABLE A.1: Results for Screened Sample

Dep Var	(1) Overall Index	(2) CES-D	(3) Stress	(4) LI
Panel A: OLS				
Food Insecure	0.329*** (0.111)	0.407*** (0.128)	0.217 (0.157)	0.310** (0.121)
Panel B: IV				
Food Insecure	0.791** (0.316)	0.641 (0.609)	0.884* (0.529)	0.909 (0.599)
First Stage F-stat = 7.52				
Controls	Yes	Yes	Yes	Yes
N	429	429	429	429

Note: The results in this table estimate the relationship between food insecurity and psychological well-being among the sub-sample of respondents who respond affirmatively to our screening question. Panel A shows OLS estimates. Panel B shows instrumental variable estimates. P-values based on robust standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A.2: Instrumental Variable Results: Additional Instruments

<i>Dep Var</i>	(1) Overall Index	(2) CES-D	(3) Stress	(4) LI
Panel A: Last Week Dummy & Month Dummies				
Food Insecure	1.045*** (0.281)	0.748* (0.447)	0.968* (0.506)	1.514*** (0.381)
<i>Hansen J-Test p-value</i>	0.84	0.95	0.47	0.97
First Stage F-stat = 11.87				
Panel B: Days Since Receipt & Month Dummies				
Food Insecure	1.125*** (0.277)	0.962* (0.501)	0.834** (0.394)	1.588*** (0.359)
<i>Hansen J-Test p-value</i>	0.67	0.58	0.77	0.97
First Stage F-stat = 12.67				
Panel C: Week Since Receipt Dummies				
Food Insecure	1.590*** (0.520)	1.561*** (0.342)	1.490** (0.760)	1.687** (0.691)
<i>Hansen J-Test p-value</i>	0.72	0.33	0.74	0.67
First Stage F-stat = 5.05				
Panel D: Day of the month Dummies				
Food Insecure	1.079*** (0.337)	0.851** (0.381)	1.008** (0.417)	1.448*** (0.411)
<i>Hansen J-Test p-value</i>	0.03	0.00	0.15	0.03
First Stage F-stat = 3.15				

Note: P-values based on robust standard errors are reported in the parentheses.*
 $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.