THE PSYCHOLOGICAL TOLL OF FOOD INSECURITY*

M. Alloush† Jeffrey R. Bloem‡

September 28, 2022

Abstract

We investigate the relationship between food insecurity and psychological distress among a sample of poor households in Lebanon. We first document large unconditional differences in various measures of psychological distress based on whether a respondent lives in a household experiencing acute food insecurity. Next we show that these differences persist even when accounting for heterogeneity by interview timing, geography, and other characteristics. Considering results across a variety of regression specifications, we find that experiencing acute food insecurity increases scores on a psychological distress index by at least 0.16 standard deviations. These results carry implications for the literature on the mental health consequences of food insecurity and poverty alleviation policy.

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

JEL Codes: Q18, D91, O12, I15

*We thank Rene Solano, Jumana Al Aref, Jenn Fleming, Haneen El-Sayed, Frank Schilbach, William Masters, Anne Byrne, Jeremy Jelliffe, William Johnson, Matthew Rabbitt, Brandon Restrepo, Saied Toossi, Ramzi Fanous, and participants at both the 2021 North East Universities Development Consortium (NEUDC) conference and the 2022 Pacific Conference for Development Economics (PacDev) for constructive comments on previous drafts of this paper. We are also grateful to two anonymous referees, an anonymous associate editor, and Laura Schechter—our editor—for constructive comments that helped us improve this manuscript. All errors are our own.

†Hamilton College, Department of Economics, 198 College Hill Road Clinton, NY 13323. Corresponding author email: malloush@hamilton.edu.

‡International Food Policy Research Institute, Washington, DC 20005.

1 Introduction

Economic theory and empirical evidence make a strong case for a robust link between economic 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), food insecurity may be a mechanism by which economic well-being influences psychological well-being. Therefore, although food security is an important outcome as an end in itself, food insecurity and hunger can have important consequences beyond first-order calorie or nutrient deficiencies. 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 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, 2022).

In this paper we use unique household survey data from a sample of extremely poor people in Lebanon living in households receiving monthly food vouchers. Using a variety of empirical approaches, we show that experiencing acute food insecurity likely carries important psychological consequences. 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 households that respond affirmatively to this screening question, we ask 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 acute food insecurity—respond affirmatively to the second question.

We first document large unconditional differences in various measures of psychological distress between those experiencing acute food insecurity and those who are not within our sample of poor households which report relatively high levels of psychological distress. In particular, individuals living in households experiencing acute food insecurity score 0.5 standard deviations higher on a scale measuring depressive symptoms, 0.3 standard deviations higher on scale measuring stress, and 0.5 standard deviations higher on a scale measuring pessimism compared to other individuals. Using regression specifications, we show that experiencing acute food insecurity is associated with higher levels of

[1] In 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, 2022; Ridley et al., 2020).

psychological distress even when accounting for a host of confounding variables including town, interview month, and interview day-of-the-week fixed effects. In addition, considering observable heterogeneity as indicative of unobservable heterogeneity, we use the methods of Oster (2019) and show that these regression results are unlikely to be explained entirely by omitted heterogeneity. Furthermore, we show that our measures of food insecurity increase in the number of days since the household received a food voucher, via Lebanon's food E-voucher Program, nearly doubling in the week prior to the monthly distribution of food vouchers. We leverage the variation in interview timing relative to the distribution of food vouchers within an instrumental variables framework.

Across all of our regression specifications, our results indicate that experiencing acute food insecurity likely increases psychological distress. Our most conservative results suggest that reporting acute food insecurity is associated with a 0.16 standard deviation increase in an aggregated measure of psychological distress. More specifically we find that, conditional on a host of potentially confounding factors, experiencing acute food insecurity is associated with a 20 percent increase in the likelihood an individual reports depression symptoms above a critical threshold used in clinical settings to screen for depression.

Our paper is most closely related to existing studies documenting a strong correlation between experiencing food insecurity and psychological distress. This literature includes evidence from the United States (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). Each of these studies are careful to frame their estimates as correlations and not necessarily representing a causal relationship, due to the possibility of a number of relevant confounding factors.

Our study differs from this existing literature in three important ways, which frame the core contributions of this paper. First, we focus our analysis on a carefully defined level of food insecurity—which we call acute food insecurity. This level of food insecurity is important to study because it may carry critical psychological consequences. For instance, insights from the field of evolutionary psychology suggest the presence of a physiological mechanism whereby the experience of hunger coordinates human emotion in the search for food (Al-Shawaf, 2016). Our measure of acute food insecurity, measured in a sample of extremely poor households, allows us to study this possible physiological mechanism in a real-world setting.

Second, we use a variety of estimation methods and regression specifications to in-

vestigate the effect of experiencing acute food insecurity on psychological distress. This is important in the context of research questions—such as ours—where an experimental research design is not feasible for both practical and ethical reasons. Thus, although the presence of unobservable confounding factors prevent us from estimating a single point estimate of the average effect, we show across a variety of regression specifications that experiencing acute food insecurity likely carries psychological consequences. Importantly, even our smallest estimates indicate an important link between acute food insecurity and psychological distress. This allows us to contribute to the literature studying the mental health consequences of experiencing food insecurity (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).

Third, our analysis occurs within the context of Lebanon's food E-voucher program, which resembles the Supplemental Nutrition Assistance Program (SNAP) in the United States and is implemented in partnership with the World Food Programme (WFP). All of the households in our sample are eligible for and receive monthly E-vouchers intended to cover some of their monthly food expenses. Therefore, we contribute to the literature on food voucher programs (Gennetian et al., 2016; Cotti, Gordanier and Ozturk, 2018, 2020; Byrne and Just, 2021; Bond et al., 2021) 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 focuses on the Supplemental Nutrition Assistance Program (SNAP) in the United States, food assistance and other similar programs are exceedingly and increasingly relevant in the lives of many living in low-income countries (Gentilini et al., 2021). Moreover, given the high levels of both poverty and psychological distress measured in our sample, a meaningful relationship between experiencing food insecurity and psychological distress 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).

The remainder of this paper is organized as follows. In the next section we discuss our empirical framework by introducing our data and estimation approach. Section 3 reports our core empirical findings and a variety of robustness checks. Finally, Section 4 concludes.

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 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 and completed in February, March, and April 2019 before the pilot program was officially discontinued in 2020.

The pilot program targeted the ultra-poor and thus we draw our sample from the poorest 10,000 households in Lebanon as determined by the National Poverty Targeting Program (NPTP).[2] 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 to the poorest 10,000 households in the amount of LBP 100,000 per capita for a maximum of six members per household.[3] Similar to the modern implementation of SNAP vouchers in the United States, the food assistance takes the form of an electronic voucher (i.e., debit card) that can only be used to purchase food at participating stores and automatically receives funds on a fixed monthly interval. All of the households in our sample are eligible and receive monthly food vouchers.

2.1 Data

Our baseline survey includes both a household-level and an 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., intended graduation program participants) and collects information on employment, education attainment, health outcomes, and several psychological well-being variables. Of the 1,350 households randomly selected and interviewed, we restrict our sample to 1,409 individuals from 1,124 households who responded to the individual-level survey on the same day as the the household-level survey.[4] Figure A.1 in the Appendix plots histograms of the frequency

[2]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. More information about the NPTP program can be found in this factsheet provided by the World Bank: https://www.worldbank.org/en/news/factsheet/2020/04/21/targeting-poor-households-in-lebanon.

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

[4]The discontinued graduation program specifically prioritized enrolling females, therefore, if a household identified a male participant, they were asked to also identify an eligible female participant. If a household

of successful survey responses per day within each of the three months. The household-level and individual-level questionnaires were mostly answered by different individuals within the same household.[5] This helps us address 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.

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 calculated by the NPTP. Roughly 67 percent of households have at least one member who receives some income from employment mostly through casual labor.[6] The average monthly income per capita in the sample is 79,407 Lebanese Lira (LL) or approximately 53 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 36 years old and roughly four out of five are female. Only 18 percent are employed in any form of work, 47 percent of which is in the form of casual labor.

We use a number of different variables that represent different components of psychological distress. 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 a 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). The CES-D scale is designed to measure relatively variable psychological states (González et al., 2017) and is commonly used to assess the mental health consequences of changes in socio-economic levels (Giuntella et al., 2021).[7]

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,

identified a female first, however, they were not asked to identify an eligible male participant. Thus, the sample includes 1,121 female and 289 male respondents.

[5]The household head answered the household-level questionnaire and the intended graduation program participant answered the individual questionnaire. In only 15 percent of cases, the head of the household was also the intended graduation program participant and therefore answered both the household and individual questionnaires. As we discuss in more detail in Section 2.3, we control for whether the same individual responded to both the household and individual questionnaire to further account for bias associated with a single respondent answering questions about both household-level food security and individual-level psychological well-being.

[6]Table A.1 in the Appendix shows relevant sample summary statistics highlighting the extent of poverty of our sample.

[7]A recent systematic review of the psychiatry literature on depression finds weak evidence for a link between depressive symptoms and psychological chemical (i.e., serotonin) imbalance, and finds that depressive symptoms are more often associated with important life stressors (Moncrieff et al., 2022).

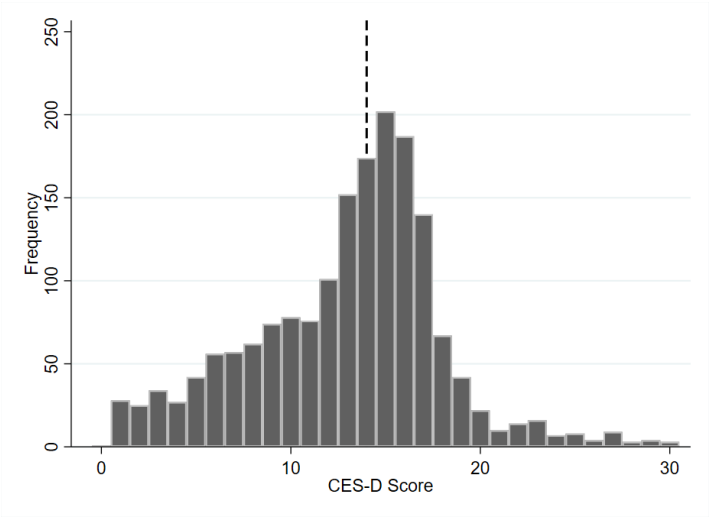
2017; Wood, Taylor and Joseph, 2010). Psychologists use the CES-D scale to screen for depression with scores of 11 through 14 or above indicating a higher probability of experiencing a major depressive episode (Baron, Davies and Lund, 2017). Among this very poor sample, the average CES-D score is very 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 greater than 13 as a binary indicator variable.[8] 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 13 that we use as an indicator of high levels of depression risk in our sample of extremely poor mostly working-age women. Panel B in Figure 1 shows that CES-D scores decline as household income increases. Additionally, in our sample of poor households and across all levels of household income, depressive symptoms are very high relative to previously recorded average CES-D scores for Lebanon and the world.

We also use two additional measures of psychological distress. Our second measure 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.[9] 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 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 with assigned numerical values of zero to four.[10] Lower overall scores on the life orientation test indicate that an individual exhibits more dispositional optimism towards life (Scheier and Carver, 1985), meaning 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

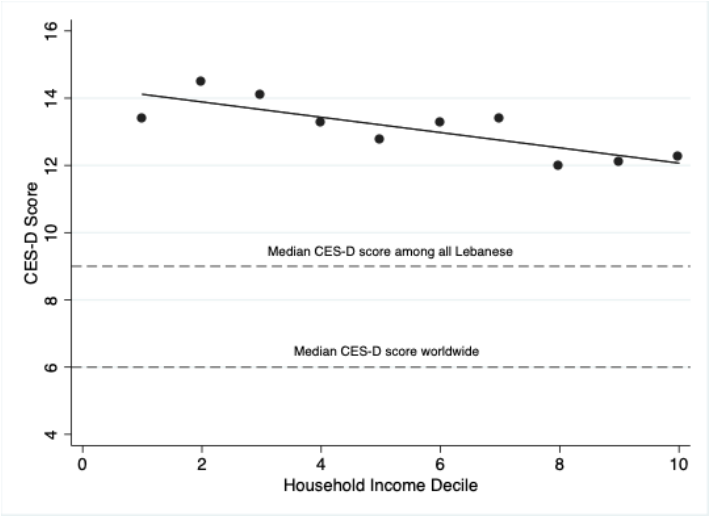
[8]This binary variable uses a relatively high threshold score and while this means it likely has high positive predictive value for depression it may also miss individuals who may have depression and CES-D scores lower than 14. In addition, this binary indicator allows for a robustness test on the cardinal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

[9]Respondents 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.

[10]Answers to questions that are positive are flipped prior to summing the overall score.



(A) Distribution of CES-D Scores



(B) CES-D Scores by Household Income

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

any effort leading to worse outcomes.[11]

We measure food insecurity with 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 A.1,

[11]Optimism is a 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).

TABLE 1: Household and Individual Characteristics by Food Security Status

	Not Acutely Food Insecure	Acutely Food Insecure	Difference (p-value)
Household Income & Expenditure			
Received income from employment	0.68	0.45	0.00
Monthly income per capita	80,842 LL	62,930 LL	0.00
Monthly total expenditure per capita	159,045 LL	160,214 LL	0.89
Monthly food expenditure per capita	81,090 LL	79,184 LL	0.65
Household size	7.81	8.07	0.34
Individual Respondents			
Age	35.9	37.5	0.18
Share Female	0.79	0.76	0.23
Share Married	0.63	0.66	0.53
Some Secondary Education	0.12	0.08	0.13
Employed	0.18	0.12	0.05
CES-D Scale	12.84	15.53	0.00
Share CES-D > 13	0.52	0.80	0.00
Cohen's Perceived Stress Scale	18.08	19.38	0.01
Life Orientation Test Score	25.38	27.52	0.00

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

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 experiencing acute food insecurity.

Despite the fact that our entire sample is poorer and more dependent on food assistance relative to the larger population of Lebanon, there is meaningful variation in economic livelihood indicators in our data. In particular, reporting acute food insecurity is associated with lower levels of economic livelihood indicators at conventional levels of statistical significance. Table 1 shows that households that report acute food insecurity are less likely to receive income from employment and earn less monthly income per capita than households that do not report acute food insecurity. We also find that households reporting acute 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 food insecurity and economic livelihood indicators, such as income, which we address when discussing our estimation approaches in Section 2.2.

Table 1 also shows large unconditional differences in reported levels of our psychological variables. In particular, individuals who live in households experiencing acute food insecurity report CES-D scores that are on average nearly three points higher than individuals who live in households not experiencing acute food insecurity. Similarly, when we create a binary variable based on the CES-D score that is greater than 13, we find that individuals living in households experiencing acute food insecurity are about 30 percentage

points more likely to have CES-D scores above this critical threshold. We observe similar disparities for the perceived stress scale and the life orientation test, with individuals living in households experiencing acute food insecurity reporting levels indicating more psychological distress. Appendix Figure A.2 illustrates these unconditional differences by reporting standardized values of psychological distress. That is, for the full sample, we transform each of the scales measuring psychological distress to have a mean of zero and a standard deviation of one. We find that individuals who live in households experiencing acute food insecurity report levels of depression (Panel A), stress (Panel C), and pessimism (Panel D) that are between 0.2 and 0.5 standard deviations higher than individuals who live in households not experiencing acute food insecurity.[12]

2.2 Estimation Approach

The observed unconditional difference in measures of psychological distress between individuals living in households experiencing acute food insecurity and other individuals in our sample likely does not represent the causal effect of acute food insecurity due to a number of factors. First, the timing of our household survey—due to the effect of holidays, weekends, or the receipt of social support programs—may lead respondents to report both acute food insecurity and psychological distress. Similarly, households may reside in particular geographic locations that lead respondents to both report acute food insecurity and elevated psychological distress. Third, alternative factors that are independent from variation across time and space—such as income, demographic characteristics, or employment—may both lead respondents to report acute food insecurity and psychological distress and, therefore, confound estimates of the effect of food insecurity on psychological well-being. Fourth, and particularly when using survey data, reverse causality may persist whereby higher levels of psychological distress leads to increased food insecurity through, for example, lower labor supply at the intensive and extensive margins (Delaney, Fink and Harmon, 2014; De Quidt and Haushofer, 2016).

We aim to address these challenges 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. Our OLS regression specification, in its least parsimonious form, builds on the following linear regression:

$$PD_{i,h,r,t} = \beta_0 + \beta_1 FI_{h,r,t} + \mathbf{X_{i,h,r,t}}'\Theta + \mathbf{\Gamma_r} + \mathbf{\Pi_t} + u_{i,h,r,t} \quad (1)$$

[12]Panel B in Figure A.2 in the Appendix simple illustrates unconditional differences in the share of respondents with a CES-D score greater than 13.

where, in equation (1), $PD_{i,h,r,t}$ is a measure of psychological distress for individual i in household h in town r as indicated via the individual-level questionnaire administered on interview day t. We show results for four different measures of psychological distress, in addition to an index combining all measures. $FI_{h,r,t}$ is an indicator for living in a household experiencing acute food insecurity as indicated via the household-level questionnaire and β_1 is our coefficient of interest representing an estimate of the effect of experiencing acute food insecurity on psychological distress. $\mathbf{X_{i,h,r,t}}$ is a vector of time-variant individual and household-level characteristics.[13] The vector $\mathbf{\Gamma_r}$ represents town fixed effects and the vector $\mathbf{\Pi_t}$ represents interview month and interview day-of-the-week fixed effects. Finally, $u_{i,h,r,t}$ is the unobserved error term which is clustered at the household level.

We account for direct reverse causality by leveraging the fact that the vast majority of those who are eligible for the individual-level questionnaire were not respondents to the household-level questionnaire which includes the food insecurity survey questions.[14] We also include a control variable in all of our regressions identifying the minority of individuals who do answer questions from both surveys. Still, there may be additional sources of endogeneity that attenuate and bias our OLS estimates, either due to measurement error or other sources of omitted heterogeneity.[15] We address persisting concerns in the following ways. First, we conduct the unobservable selection and coefficient stability test of Oster (2019), which allows for a characterization of the required influence of remaining unobservable heterogeneity—relative to observable heterogeneity—to explain away our core results. Second, as an additional estimation approach and robustness check, we leverage variation in levels of acute food insecurity over time and in the context of Lebanon's food E-voucher Program within an instrumental variable framework. Given that each of these estimation methods require different assumptions, qualitative uniformity of the results provides strong support for the validity of the findings (Currie and Tekin, 2012).

[13]These variables include the following: age of the respondent, age squared, their sex, marital status, education attainment, employment status, household size, household income, the presence of a sick individual, the presence of a newborn child, rural-urban status, and whether the individual is also the household head and therefore responded to the household-level questionnaire.

[14]We use the term "direct reverse causality" here because this does not take into account reverse causality due to a possible intra-household correlation in psychological distress.

[15]One source of bias is worth discussing in more detail. Food insecurity, even at acute levels, is a complex concept that may be measured with error. This error may, in part, be related to how the household head understands the household's level of food needs, which is partially determined by the interviewed participant's food requirements. This individual-level food requirement is unobserved in our data but imperfectly accounted for by variables such as age, sex, and employment which we include in our vector of control variables. Any remaining and unobserved variation in the individual's food requirement will be included in the error terms in our regression specifications leading to bias in our OLS estimators. The validity of the instrumental variable approach (discussed in the next paragraph) requires that these additional factors included in the error term (proxy errors) are also independent of our instrumental variable.

In our instrumental variable estimation approach we leverage the timing of the survey relative to the monthly receipt of food vouchers to instrument for acute food insecurity. The order in which interviews were conducted took place over a three-month period and is plausibly exogenous to psychological distress. Therefore, our identifying assumption is that the timing of an interview relative to receipt of the food voucher only influences psychological distress through 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. Nevertheless, violations of this identifying assumption could take the form of an unobserved shock that happens to be correlated with the distribution of food vouchers and influences both a household's level of food insecurity and the respondent's psychological well-being. Although we cannot fully rule-out confounding variation in the form of a common cyclical shock, we partially account for this source of bias by including town and interview month fixed effects in all of our instrumental variable regressions. We estimate the following two-stage least squares instrumental variable regression specification:

$$FI_{h,r,t} = \gamma_0 + \gamma_1 I_{h,r,t} + \mathbf{X'_{i,h,r,t}}\mathbf{\Psi} + \mathbf{\Lambda_r} + \mathbf{\Xi_t} + \eta_{i,h,r,t} \tag{2}$$

$$PD_{i,h,r,t} = \alpha_0 + \alpha_1 \hat{FI}_{h,r,t} + \mathbf{X'_{i,h,r,t}}\mathbf{\Omega} + \mathbf{Y_r} + \mathbf{\Phi_t} + \epsilon_{i,h,r,t} \tag{3}$$

where in equation (2) $I_{h,r,t}$ is a dummy variable indicating whether the household was surveyed during the seven days before they receive their food voucher. Similar to equation (1), $\mathbf{X_{i,h,r,t}}$ in equations (2) and (3) is a vector of individual and household level characteristics. It is important to note that this vector of controls includes both the individual respondent's employment status and measures of household-level income. 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. While related to food security, variation of this sort represents a different mechanism and could influence the validity of using the instrument for food insecurity. Finally, $\mathbf{\Lambda_r}$ and $\mathbf{Y_r}$ represent a vector of town fixed effects and $\mathbf{\Xi_t}$ and $\mathbf{\Phi_t}$ represent a vector of interview month fixed effects. These fixed effects account for confounding variation occurring at the town level that may influence both responses to both food insecurity indicators and psychological distress variables and confounding cyclical shocks occurring at a monthly interval. The validity of these instrumental variable estimates requires that factors included in the error term (e.g., unobserved heterogeneity, residual variation due to measurement error, etc.) are independent of our instrumental variables.

3 Results

We present three sets of results. First, we discuss a set of graphical results. These results illustrate descriptive findings that motivate and provide context for our OLS and instrumental variable estimation specifications. Second, we present regression results which allow us to (i) estimate the relationship between experiencing acute food insecurity and psychological distress while also accounting for variation in interview timing, geographic location, and other observable characteristics, and (ii) directly leverage variation in the timing of our interviews relative to the monthly distribution of Lebanon's food E-vouchers within an instrumental variables estimation framework. Throughout, we discuss a variety of robustness and sensitivity tests which support our main results.

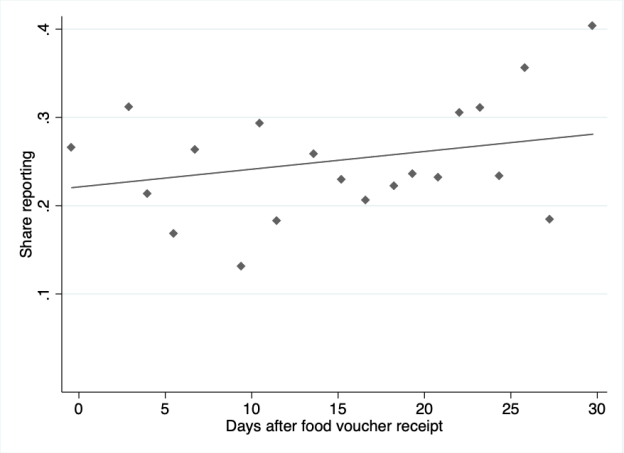
3.1 Graphical Results

We present two graphical results. We first show that the probability of experiencing acute food insecurity increases in the number of days between the monthly distribution of food vouchers and the household survey date. Next, we show that indicators of psychological distress increase in the number of days between the monthly distribution of food vouchers and the household survey date.

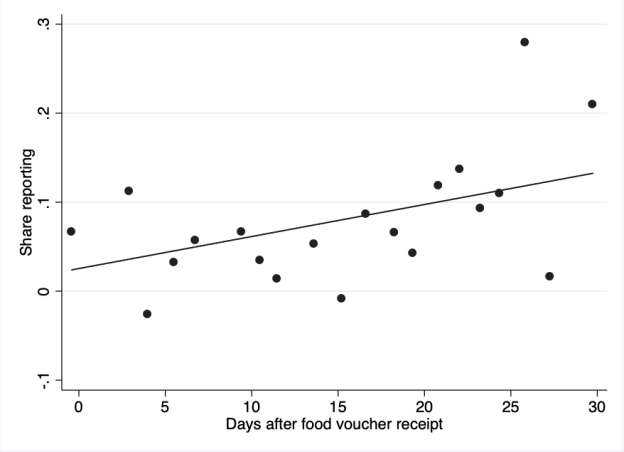
Food Assistance Timing and Food Insecurity—Food assistance provided via monthly food vouchers is a common way to provide financial support to needy households all around the world. Previous work consistently shows that food consumption increases after the monthly receipt of SNAP food vouchers and subsequently declines (Zaki and Todd, 2021). If food consumption declines 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.

Figure 2 presents binned scatter plots of the relationship between the number of days since the household received a food voucher and affirmative responses to our food insecurity questions. These represent conditional means of the share reporting affirmatively to each question while accounting for variation across the household's town, the interview month, and the interview day-of-the-week.[16] 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 increases slightly in the number of days between when households were

[16]These fixed effects allow us to account for the possibility of a spurious relationship based on endogeneity in interview timing or geographic location.



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



(B) *Acute Food Insecurity*: Not enough food for tomorrow

FIGURE 2: Food insecurity by days since the food voucher—Binned scatter plot conditional on town, interview month, and interview day-of-the-week fixed effects.

surveyed and when they received their food voucher. However, as shown in Table A.2 in the Appendix, the slope of this line is not statistically different from zero.[17]

Panel B in Figure 2 shows that the share reporting our measure of acute 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 roughly twice as likely to report experiencing food insecurity as households surveyed at the beginning of the benefit cycle. Table A.2 in the Appendix shows that the slope of this line is statistically significant. In particular, the estimated coefficient indicates that every additional week since the receipt of a food voucher, the household is

[17]This is expected because responses to this question should not vary in relation to the monthly distribution of food vouchers because the screening question uses a reference period of the past 30 days.

about 2.5 percentage points more likely to report experiencing acute food insecurity.

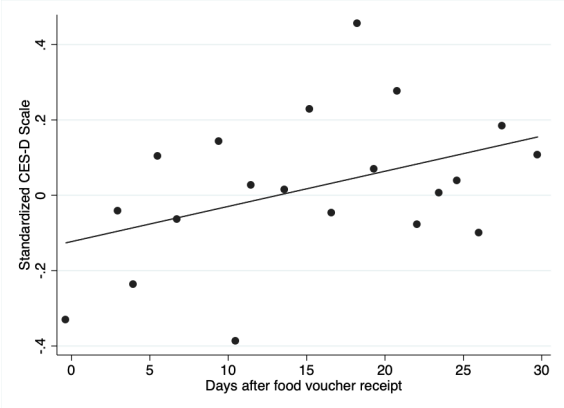
Figure A.3 in the Appendix shows how our measures of food insecurity vary across each of the three months that we collected data (e.g., February, March, and April 2019). We observe a general declining trend of affirmative responses to both the screening question and our measure of acute food insecurity across the data collection period.[18] While this trend may call into question the cyclical nature of the relationship between food voucher distribution and food insecurity, we address this observation in two ways. First, we include month fixed effects in the graphical results shown in Figure 2 and therefore rule out bias due to comparisons across months. Second, in Figure A.4 shown in the Appendix, we replicate Figure 2 but exclude households surveyed during the month of February, which shows that the trend is not solely driven by households surveyed in February. We find qualitatively similar patterns.[19]

Food Assistance Timing and Psychological Well-Being—Figure 3 similarly presents binned scatter plots of the relationship between the number of days since the household received a food voucher and our measures of psychological distress. These binned scatter plots again account for variation across the household's town, the interview month, and the interview day-of-the-week. Panels A and B in Figure 3 show that both the standardized full CES-D scale and the binary indicator of being above the depression risk threshold 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.

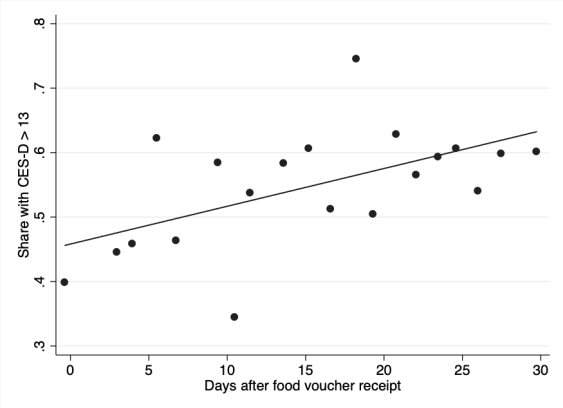
Table A.2 in the Appendix, shows that the slopes of the lines in Figure 3 are statistically significant. For example, Column (4) in Table A.2 in the Appendix, shows that every additional week since the receipt of the food voucher, the individual respondent in the household about 4 percentage points more likely to report a CES-D score above the threshold commonly used to screen for clinical depression. These illustrations highlight that those surveyed at the end of the food assistance benefits cycle experience higher levels of psychological distress. Similar to the previous set of graphical results, we replicate Figure 3 while excluding households surveyed during the month of February in Figure A.5 in the Appendix. We find qualitatively similar findings across each of these four measures

[18]The level of food insecurity in early February, as documented in Figure A.3, is striking. To the best of our knowledge these trends represent true levels of food insecurity, and therefore, we aim to document this heterogenenity across months and perform sensitivity tests on our results to ensure that this trend is not driving our core results.

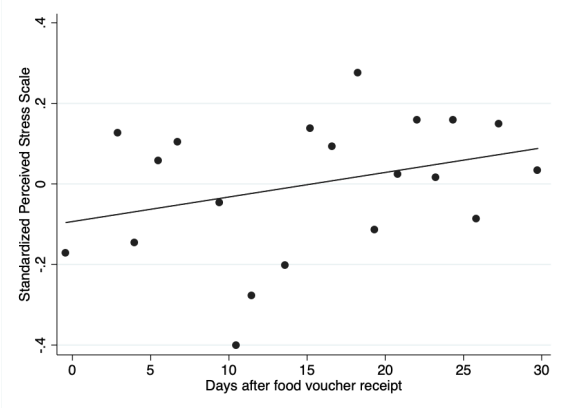
[19]Panel B of Table A.2 in the Appendix also confirm these results using a simple linear regression.



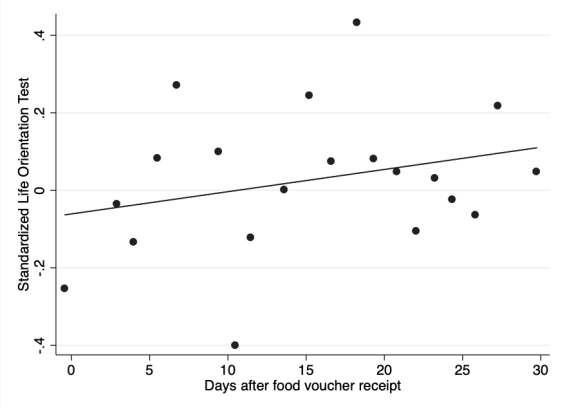
(A) Standardized CES-D Score



(B) CES-D > 13



(C) Standardized Perceived Stress Scale



(D) Standardized Life Orientation Test Score

FIGURE 3: Psychological well-being by days since the food voucher—Binned scatter plot conditional on town, interview month, and interview day-of-the-week fixed effects.

of psychological distress. Taken together with the finding that reported measures of food insecurity also increases at the end of the food assistance benefits cycle, these observations contribute to our core finding that experiencing acute food insecurity carries psychological consequences by motivating more rigorous regression analysis.

3.2 Regression Results

We show two sets of regression results. First, we report OLS regression estimates of the relationship between reported food insecurity and psychological well-being. Next, we show instrumental variable regression results that leverage heterogeneity in levels of food insecurity over time within the context of Lebanon's food voucher program. The results from these two sets of regressions demonstrate an important link between experiencing acute food insecurity and psychological distress.

OLS and Coefficient Stability Results—We first estimate variations of equation (1), moving progressively from its most to least parsimonious form. In Panel A of Table 2 we show simple bivariate OLS regression results. These results directly correspond to Figure A.2 in the Appendix where we illustrate large unconditional differences in our measures of psychological distress based on whether an individual lives in a household experiencing acute food insecurity. In particular the simple bivariate results indicate that individuals living in a household experiencing acute food insecurity report levels of psychological distress that are, as captured by an aggregated psychological distress index, 0.45 standard deviations higher than individuals not living in such households.

We first account for the possibility that factors related to the timing of our household survey or the geographic location of households may lead respondents to report both food insecurity and psychological distress by including town, month, and day-of-the-week fixed effects in our regression specification. In Panel B of Table 2 we find that accounting for both the timing of our household survey and the location households reduces the size of the estimated coefficients. The estimated coefficient on the aggregated psychological distress index, while remaining statistically significant is halved. In particular, we find that individuals living in a household experiencing acute food insecurity report levels of psychological distress that are 0.19 standard deviations higher than individuals not living in such households, as captured by an aggregated psychological distress index.

Next we account for additional factors that may confound estimates of the effect of food insecurity on psychological well-being. In Panel C of Table 2 we present regression results that, in addition to including town, month, and day-of-the-week fixed effects, also control for a host of individual-level and household-level control variables. We find that accounting for these additional control variables reduces the size of our estimated coefficients slightly. In particular, the estimated coefficient on the aggregated psychological distress index, while remaining statistically significant, decreases to 0.16 standard deviations.

Finally, we apply the insights of Altonji, Elder and Taber (2005) and the methods Oster (2019) to formally characterize how much remaining unobservable heterogeneity would need to exist, relative to the observable heterogeneity included in the controls, to explain away results reported in Table 2. This approach considers selection on observable covariates as indicative of the potential selection on unobservable covariates. The method compares the results between a "short regression" with no additional covariates included in the specification (shown in Panel A in Table 2) and a "long regression" with all additional covariates included in the specification (shown in Panel C in Table 2). The core insight being

TABLE 2: OLS Results

	(1) Distress index	(2) CES-D scale	(3) CES-D > 13	(4) Perceived stress scale	(5) Life orientation test
Panel A: Bivariate Regression					
Acute food insecurity	0.446***	0.533***	0.281***	0.280**	0.461***
	(0.0800)	(0.0981)	(0.0428)	(0.110)	(0.0816)
R-squared	0.020	0.021	0.023	0.006	0.016
Fixed Effects	No	No	No	No	No
Controls	No	No	No	No	No
Panel B: Town, Month, and Day-of-the-Week Fixed Effects					
Acute food insecurity	0.194**	0.244**	0.126***	0.208*	0.106
	(0.0909)	(0.105)	(0.0445)	(0.126)	(0.0905)
R-squared	0.125	0.143	0.148	0.048	0.151
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No
Panel C: Additional Controls					
Acute food insecurity	0.160*	0.209*	0.119***	0.157	0.0896
	(0.0926)	(0.109)	(0.0453)	(0.127)	(0.0926)
R-squared	0.193	0.203	0.184	0.101	0.189
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Panel D: Coefficient Stability and Unobservable Selection					
Oster's delta	1.30	1.47	1.62	2.56	0.61
Observations	1,409	1,409	1,409	1,409	1,409

Note: Fixed effects include town, month, and day-of-the-week fixed effects. Controls include age, age squared, sex, marital status, education attainment, employment status, household size, household income, the presence of a sick individual, the presence of a newborn child, rural-urban status, and an indicator for if an individual responded to both the individual and household survey. Columns (1), (2), (4), and (5) use standardized outcome variables. Column (3) uses a binary outcome variable. Oster's delta, in Panel D is calculated by comparing the results between Panels A and C. Standard errors clustered at the household level are reported in the parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

that if the magnitude of the estimated coefficient stays stable relative to the magnitude of the R-squared when additional covariates are added to the regression specification, then these observable covariates can provide information about the potential for unobservable and omitted covariates biasing the coefficient estimates. The specific methods of Oster (2019) calculate the proportional selection coefficient (e.g., Oster's delta) which represents how much more meaningful unobservable and omitted covariates would need to be, relative to the obserevable and included covariates, to explain away the results.

Panel D in Table 2 reports Oster's delta for each of the five outcome variables. In column (1), as discussed above, we see that the coefficient falls from 0.45 in Panel A to 0.16

in Panel C. At the same time, the R-squared increases by nearly a factor of ten. This leads to an Oster's delta value of 1.30, which implies that unobservable and omitted covariates would need to be 30 percent more meaningful than observable covariates to explain away the finding that an individual living in a household experiencing acute food insecurity reports higher levels of psychological distress as measured by our aggregated psychological distress index. Values of Oster's delta are larger in columns (2) through (4), with the largest value in column (4) indicating that unobservable and omitted covariates would need to be over 2.5 times more meaningful than observable covariates to explain away the finding that an individual living in a household experiencing acute food insecurity reports higher levels of stress. Column (5) reports an Oster's delta value of 0.6, which indicates that unobservable and omitted covariates would only need to be 60 percent as influential as observed covariates to explain away the result.

The coefficient stability tests, using the methods of Oster (2019), highlight that most of the estimates are unlikely to become indistinguishable from a null effect even if we could include additional unobserved covariates into the regression specification. Therefore, considering the result on our aggregated psychological distress index, the effect of experiencing acute food insecurity leads to at least a 0.16 standard deviation increase in psychological distress. Considering the binary outcome of a CES-D score above the threshold used to screen for clinical depression, we find that experiencing acute food insecurity leads to about a 12 percentage point increase in the likelihood of being clinically screened for depression. Relative to the mean within our sample, this estimate represents a 20 percent increase in the likelihood of being at risk for depression.

To rule out the possibility that the observed relationship is driven by potentially spurious effects due to the high levels of food insecurity observed during the month of February, we present results in Table A.3 in the Appendix that exclude households surveyed in February. These results show an even stronger relationship than shown in Table 2. In addition, we calculate larger values of Oster's delta than the corresponding estimates reported in Table 2. These results suggest that unobservable and omitted covariates would need to be between five and nine times more important than observable covariates to explain away these results. This sub-sample analysis highlights that our core finding that food insecurity carries psychological consequences is not driven by confounding event within the month of February.

Instrumental Variable Estimates—We now turn to the two-stage regression specified by equations (2) and (3). This instrumental variable approach builds on the graphical results illustrated in Figures 2 and 3, which show that both food insecurity and measures of psy-

TABLE 3: Instrumental Variable Results

	(1) Acute food insecurity	(2) Distress index	(3) CES-D scale	(4) CES-D > 13	(5) Perceived stress scale	(6) Life orientation test
Last week	0.115***					
	(0.0247)					
Acute food insecurity		1.089**	0.729	0.496*	1.214**	1.471**
		(0.510)	(0.562)	(0.287)	(0.610)	(0.629)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,409	1,409	1,409	1,409	1,409	1,409

Note: This table reports instrumental variable results that leverage within-month heterogeneity in food insecurity within the context of Lebanon's food voucher program. Column (1) reports the first-stage estimate of the IV on acute food insecurity. The F-statistic is 15.52. All specifications include town and month fixed effects. Controls include age, age squared, sex, marital status, education attainment, employment status, household size, household income, the presence of a newborn child, rural-urban status, and an indicator for if an individual responded to both the individual and household survey. Columns (2), (3), (5), and (6) use standardized outcome variables. Columns (1) and (4) use a binary outcome variable. Standard errors cluster at the household level are reported in the parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

chological distress increase in the number of days since a household has received a food voucher. In Table 3 we show results using a binary instrumental variable indicating if the individual was, 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. 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 households may not be entirely independent across towns, therefore, we control for town and month fixed effects in all our specifications. The required identifying assumption with this instrument is that the day of the interview does not directly affect our measures of psychological distress through variables we do not control for in our analysis. Importantly, we control for employment status of the respondent, whether anyone in the household brings in any income, and household-level 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 acute food insecurity. Moreover, as shown in column (1) in Table 3, this instrument has a strong first stage.

Instrumental variable estimates reported in Table 3 support our core empirical finding that experiencing acute food insecurity carries psychological consequences. Specifically, in column (2), we find that living in a household reporting acute food insecurity leads to a 1.09 standard deviation increase in psychological our aggregated psychological distress index. In column (3), although not statistically significant at conventional levels, the

estimated coefficient for depressive symptoms indicates that living in a household experiencing acute food insecurity leads to a 0.7 standard deviation increase in the CES-D score on average. In column (4), we find that acute food insecurity leads to a 50 percentage point increase in the likelihood of reporting depressive symptoms that are above the critical threshold used to screen for clinical depression. In addition, we find large and statistically significant coefficients indicating increased stress and pessimism whereby living in a household experiencing acute food insecurity leads to a 1.2 standard deviation increase on the perceived stress scale and 1.5 standard deviation increase on the life orientation test.

Each of the estimates reported in Table 3 are relatively large, and therefore, it is useful to contextualize the potential magnitude. First, it is important to note that if our binary indicator variable of food insecurity is measured with some error, then instrumental variable estimates will be biased upwards (Black, Berger and Scott, 2000); in this case the OLS and instrumental variable estimates can provide lower and upper bounds for the true effect.

Second, the true effect of experiencing acute food insecurity on psychological distress may be relatively large. Other studies also find large differences in measures of psychological distress based on whether an individual is experiencing food insecurity. 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) 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. Therefore, the psychological toll of food insecurity, especially at acute levels, may be relatively large.

Finally, these instrumental results represent estimates for the sub-set of the sample that complies to our instrument. This sub-sample of compliers is likely a particularly vulnerable group. It may not be surprising, therefore, that acute food insecurity can dramatically reduce psychological well-being among this sub-sample of individuals. Although we cannot identify the specific sub-sample of compliers in our data, we can restrict our analysis to the sub-sample who respond affirmatively to our screening question. In Table A.4 in the Appendix, we find OLS estimates that are between two to three times larger than OLS estimates using the full sample conditional on town, interview month, and interview day of the week fixed effects, and additional controls. These results demonstrate that, using a vulnerable sub-sample, there is a strong link between experiencing food insecurity and

psychological distress.

4 Conclusion

Among a very poor population in Lebanon that is heavily dependent on monthly food vouchers, we find that experiencing acute food insecurity likely carries important psychological consequences. In particular, we first document large unconditional differences in various measures of psychological distress based on whether a respondent lives in a household experiencing acute food insecurity. We further show that these differences persist even when accounting for a host of possible confounding variables and town, interview month, and interview day-of-the-week fixed effects. Moreover, applying the methods of Oster (2019) we find that these regression results are unlikely to be explained entirely by omitted heterogeneity. Finally, observing that several measures of psychological distress increase in the number of days since the household received a food voucher, we present instrumental variable estimates that specifically leverage the timing of our household survey. Our results are qualitatively robust to this instrumental variable estimation approach. Considering all of our results across each of these regression specifications, we find that experiencing acute food insecurity increases scores on a psychological distress index by at least 0.16 standard deviations.

Our results point to a psychological mechanism driving persistent poverty (Lybbert and Wydick, 2018; Ridley et al., 2020; Haushofer, 2019; Alloush, 2022). 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 acute food insecurity carries psychological consequences, which may in-turn make escaping poverty even more challenging.

References

Alloush, M. 2022. "Income, Psychological Well-being, and the Dynamics of Poverty." *Working Paper*.

Al-Shawaf, Laith. 2016. "The evolutionary psychology of hunger." *Appetite*, 105: 591–595.

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.

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.

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.

Black, Dan A, Mark C Berger, and Frank A Scott. 2000. "Bounding parameter estimates with nonclassical measurement error." *Journal of the American Statistical Association*, 95(451): 739–748.

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*.

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.

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.

Currie, Janet, and Erdal Tekin. 2012. "Understanding the cycle childhood maltreatment and future crime." *Journal of Human Resources*, 47(2): 509–549.

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.

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).

Gentilini, Ugo, Mohamed Almenfi, John Blomquist, Pamela Dale, Luciana De la Flor Giuffra, Vyjayanti Desai, Maria Belen Fontenez, Guillermo Galicia, Veronica Lopez, Georgina Marin, Ingrid Veronica Mujica, Harish Natarajan, David Newhouse, Robert Palacios, Ana Patricia Quiroz, Claudia Rodriguez Alas, Gayatri Sabharwal, and Michael Weber. 2021. "Social protection and jobs responses to COVID-19."

Giuntella, Osea, Kelly Hyde, Silvia Saccardo, and Sally Sadoff. 2021. "Lifestyle and mental health disruptions during COVID-19." *Proceedings of the National Academy of Sciences*, 118(9).

González, Patricia, Alicia Nuñez, Erin Merz, Carrie Brintz, Orit Weitzman, Elena L. Navas, Alvaro Camacho, Christina Buelna, Frank J. Penedo, Sylvia Wassertheil-Smoller, Krista Perreira, Carmen R. Isasi, James Choca, Gregory A. Talavera, and Linda C. Gallo. 2017. "Measurement properties of the Center for Epidemiologic Studies Depression Scale (CES-D 10): Findings from HCHS/SOL." *Psychological Assessment*, 29(4): 372–381.

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.

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.

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).

Moncrieff, Joanna, Ruth Cooper, Tom Stockmann, Simone Amendola, Michael Hengartner, and Mark Horowitz. 2022. "The serotonin theory of depression: a systematic umbrella review of the evidence." *Molecular Psychiatry*.

Oster, Emily. 2019. "Unobservable selection and coefficient stability: Theory and evidence." *Journal of Business & Economic Statistics*, 37(2): 187–204.

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.

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

This Appendix includes the following material:

- Figure A.1 shows the distribution of survey responses across the three months of our data collection time frame.
- Table A.1 reports descriptive statistics for our sample of households and individuals.
- Figure A.2 shows unconditional differences in our measures of psychological distress by food insecurity status.
- Table A.2 shows regression results corresponding with Figures 2 and 3 in the main manuscript.
- Figure A.3 shows the share reporting affirmatively to each of our questions measuring food insecurity across the three months of our data collection time frame.
- Figure A.4 replicates Figure 2 but with households surveyed during the month of February excluded from the sample.
- Figure A.5 replicates Figure 3 but with households surveyed during the month of February excluded from the sample.
- Table A.3 replicates Table 2 using a sample restricted to individuals living in households interviewed in either March or April, and excluding February.
- Table A.4 shows results using a restricted sample of individuals in households that answer affirmatively to our screening question.

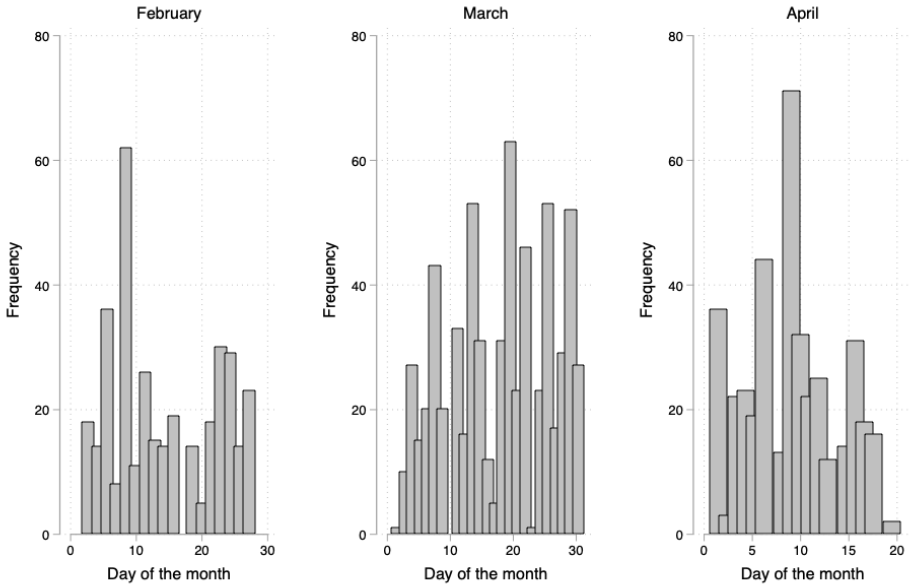


FIGURE A.1: Frequency of survey responses

TABLE A.1: Summary Statistics

	Mean (Std. Dev.)
Household Characteristics	
Head Age	48.1 (10.2)
Head Male	0.86 (0.34)
Head Married	0.84 (0.37)
Head Education: At least Some Secondary	0.17 (0.37)
Household Size	7.83 (2.17)
Presence of newborn	0.17 (0.38)
Presence of sick individual	0.28 (0.45)
Household Income & Expenditure	
Received income from employment	0.67 (0.47)
Monthly employment income per capita	79,407 (47,167) LL
Monthly total expenditure per capita	159,128 (88,534) LL
Monthly food expenditure per capita	80,938 (31,159) LL
Monthly E-Voucher amount (total)	252,242 LL
Monthly E-Voucher amount (Per Capita)	33,805 LL
Household member involuntarily skipped a meal	0.25 (0.43)
Not enough food for next day's meals	0.08 (0.27)
Dwelling Characteristics	
Share who own their dwelling	0.65 (0.47)
Imputed monthly rental value	230,896 (102,973) LL
# of rooms	2.76 (0.92)
Repairs in the last 12 months	0.11 (0.31)
Indoor Plumbing	0.82 (0.38)
Electricity	0.95 (0.22)
Household Assets	
Television	0.95 (0.22)
Computer	0.01 (0.12)
Cellphone	0.85 (0.35)
Stove	0.50 (0.50)
Fridge	0.88 (0.32)
Washing machine	0.90 (0.29)
Motor vehicle	0.28 (0.45)
Individual Respondent	
Age	36 (10)
Share Female	0.79 (0.40)
Share Married	0.63 (0.48)
Education: At Least Some Secondary	0.37 (0.48)
Computer Illiterate	0.87 (0.33)
Employed	0.18 (0.38)
Work for Salary	0.37 (0.48)
Self-Employed	0.22 (0.42)
Casual Labor	0.47 (0.50)

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. Standard deviations are reported in parenthesis.

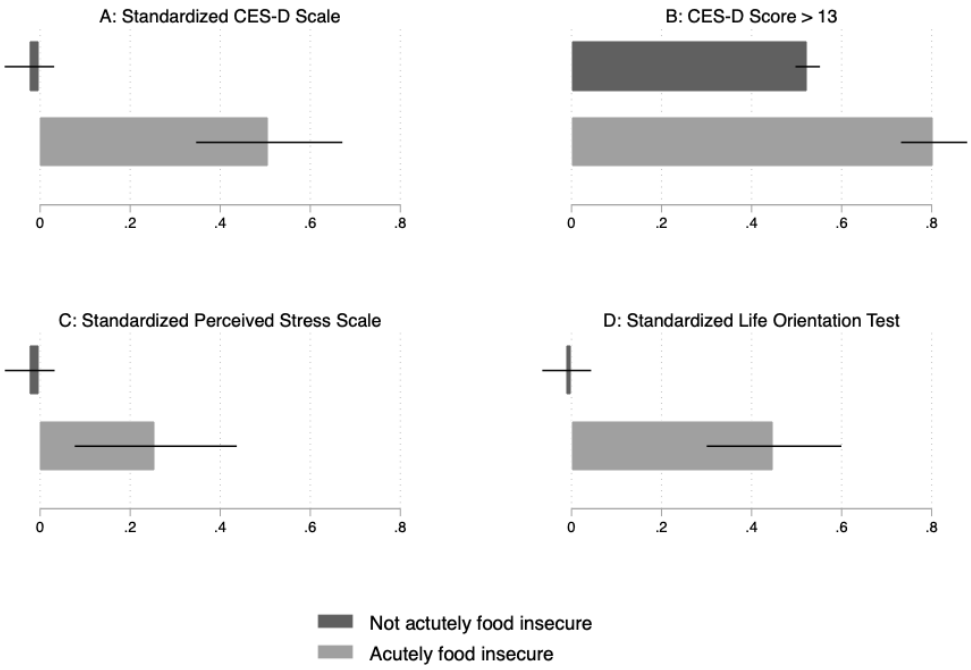
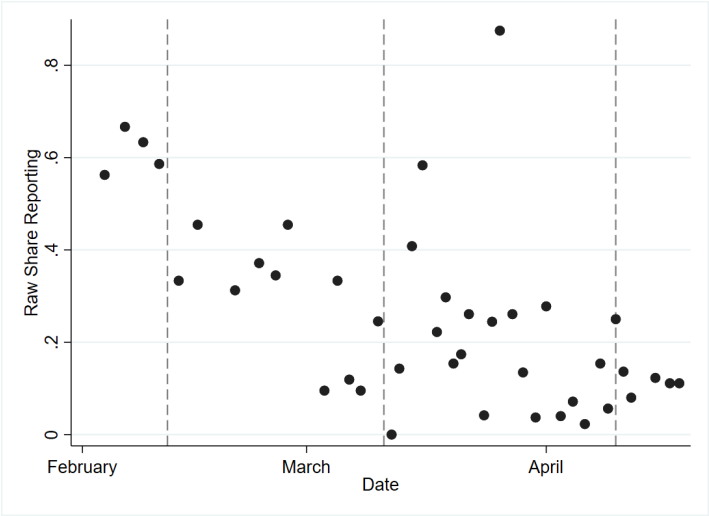


FIGURE A.2: Psychological distress by food security status

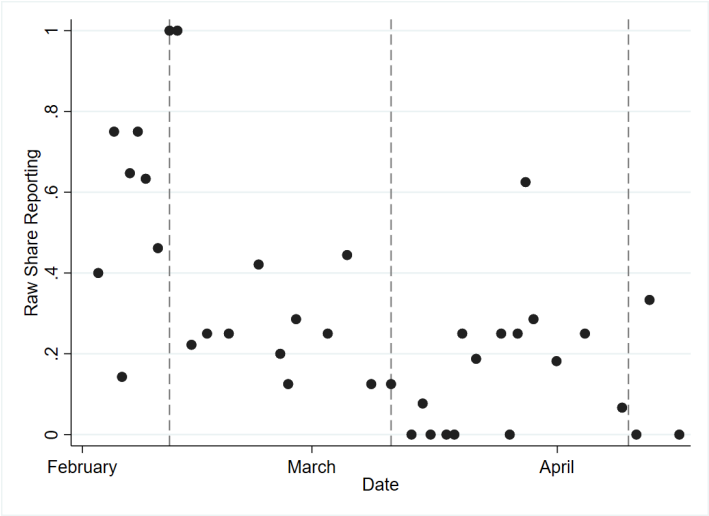
TABLE A.2: Days Since Food Voucher Receipt – Regression Analysis

	(1) Screening question	(2) Acute food insecurity	(3) CES-D scale	(4) CES-D > 13	(5) Perceived stress scale	(6) Life orientation test
Panel A: Full Sample						
Days since voucher	0.00201	0.00360***	0.00934***	0.00586***	0.00610*	0.00574*
	(0.00141)	(0.00103)	(0.00315)	(0.00149)	(0.00315)	(0.00293)
Observations	1,409	1,409	1,409	1,409	1,409	1,409
Panel B: Excluding February						
Days since voucher	-0.00254*	0.00128*	0.0145***	0.00706***	0.00479	0.00813**
	(0.00142)	(0.000718)	(0.00378)	(0.00181)	(0.00385)	(0.00368)
Observations	1,054	1,054	1,053	1,053	1,054	1,054
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No	No

Note: This table reports the coefficient on a linear variable measuring the number of days since the household received a food voucher, corresponding to Figures 2 and 3 in the main manuscript. Fixed effects include town, month, and day-of-the-week fixed effects in Panel A, and include town and day-of-the-week fixed effects in Panels B and C. Columns (3), (5), and (6) use standardized outcome variables. Columns (1), (2), and (4) use a binary outcome variable. Standard errors clustered at the household level are reported in the parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

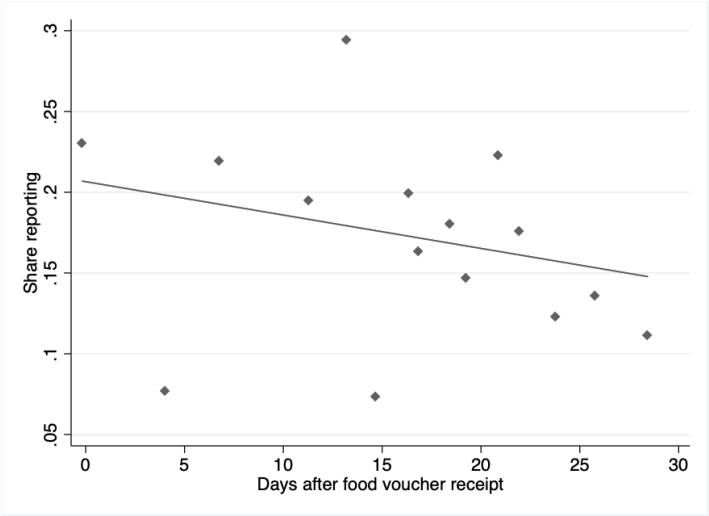


(A) *Screening Question*: Skipped meals in the last 30 days

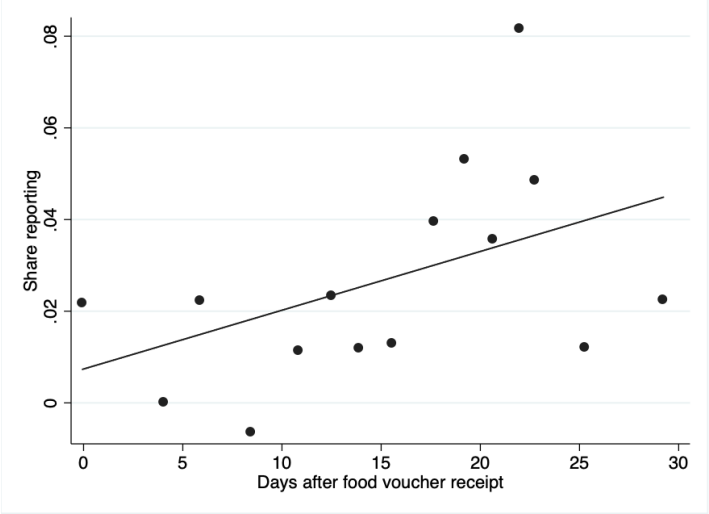


(B) *Acute Food Insecurity*: Not enough food for tomorrow

FIGURE A.3: Food insecurity by day of the month—Binned scatter plot with raw means. Panel B shows acute food insecurity among those who report skipping meals in the last 30 days (the screening question shown in Panel A). The vertical lines represent the day corresponding to distribution of food vouchers.

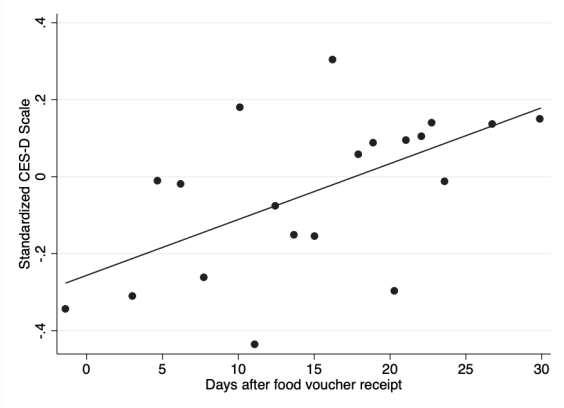


(A) *Screening Question*: Skipped meals in the last 30 days

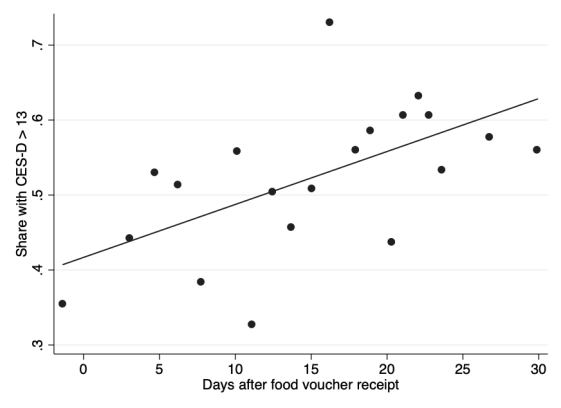


(B) *Acute Food Insecurity*: Not enough food for tomorrow

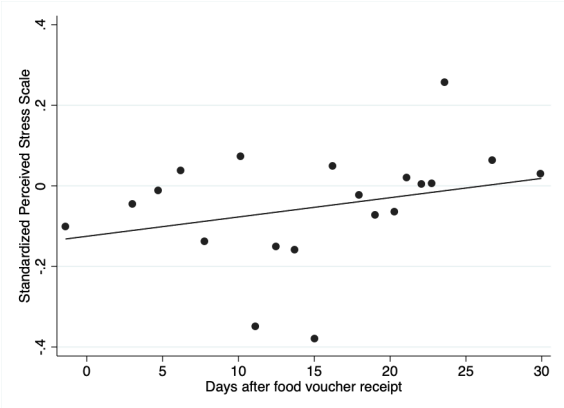
FIGURE A.4: Food insecurity by days since the food voucher excluding February—Binned scatter plot conditional on town, interview month, and interview day-of-the-week fixed effects.



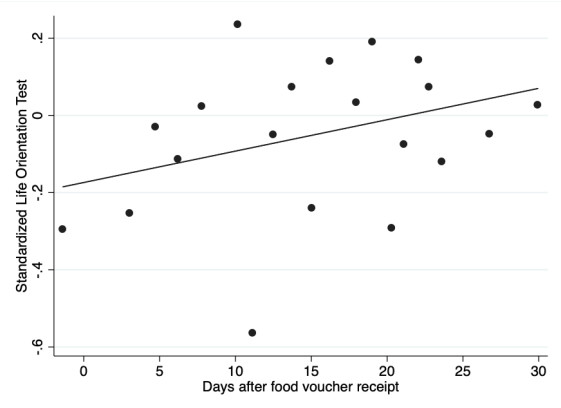
(A) Standardized CES-D Score



(B) CES-D > 13



(C) Standardized Perceived Stress Scale



(D) Standardized Life Orientation Test Score

FIGURE A.5: Psychological well-being by days since the food voucher excluding February—Binned scatter plot conditional on town, interview month, and interview day-of-the-week fixed effects.

TABLE A.3: OLS Results—Excluding February

	(1) Distress index	(2) CES-D scale	(3) CES-D > 13	(4) Perceived stress scale	(5) Life orientation test
Panel A: Bivariate Regression					
Acute food insecurity	0.810***	0.994***	0.454***	0.654**	0.670***
	(0.190)	(0.219)	(0.0393)	(0.301)	(0.166)
R-squared	0.023	0.025	0.021	0.011	0.012
Fixed Effects	No	No	No	No	No
Controls	No	No	No	No	No
Panel B: Fixed Effects Regression					
Acute food insecurity	0.611***	0.689***	0.347***	0.600**	0.500***
	(0.178)	(0.172)	(0.0411)	(0.292)	(0.167)
R-squared	0.128	0.167	0.153	0.040	0.149
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No
Panel C: Additional Controls					
Acute food insecurity	0.584***	0.672***	0.345***	0.541*	0.488***
	(0.179)	(0.170)	(0.0412)	(0.289)	(0.179)
R-squared	0.202	0.233	0.189	0.098	0.195
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Panel D: Coefficient Stability and Unovservable Selection					
Oster's delta	5.87	5.02	6.91	9.42	6.73
Observations	1,053	1,053	1,053	1,053	1,053

Note: Fixed effects include town, month, and day-of-the-week fixed effects. Controls include age, age squared, sex, marital status, education attainment, employment status, household size, household income, the presence of a sick individual, the presence of a newborn child, rural-urban status, and an indicator for if an individual responded to both the individual and household survey. Columns (1), (2), (4), and (5) use standardized outcome variables. Column (3) uses a binary outcome variable. Oster's delta, in Panel D is calculated by comparing the results between Panels A and C. Standard errors clustered at the household level are reported in the parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A.4: OLS Results—Including only screened question==‘yes’

	(1) Distress index	(2) CES-D scale	(3) CES-D > 13	(4) Perceived stress scale	(5) Life orientation test
Panel A: Bivariate Regression					
Acute food insecurity	0.439***	0.563***	0.347***	0.253*	0.420***
	(0.101)	(0.121)	(0.0525)	(0.134)	(0.103)
R-squared	0.048	0.057	0.106	0.011	0.039
Fixed Effects	No	No	No	No	No
Controls	No	No	No	No	No
Panel B: Fixed Effects Regression					
Acute food insecurity	0.341**	0.429**	0.212***	0.298	0.247*
	(0.156)	(0.175)	(0.0729)	(0.236)	(0.147)
R-squared	0.171	0.211	0.193	0.106	0.155
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No
Panel C: Additional Controls					
Acute food insecurity	0.354**	0.416**	0.220***	0.341	0.270*
	(0.153)	(0.178)	(0.0729)	(0.219)	(0.159)
R-squared	0.272	0.293	0.282	0.182	0.250
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Panel D: Coefficient Stability and Unovservable Selection					
Oster’s delta	1.67	1.48	1.09	4.91	1.30
Observations	355	355	355	355	355

Note: Fixed effects include town, month, and day-of-the-week fixed effects. Controls include age, age squared, sex, marital status, education attainment, employment status, household size, household income, the presence of a sick individual, the presence of a newborn child, rural-urban status, and an indicator for if an individual responded to both the individual and household survey. Columns (1), (2), (4), and (5) use standardized outcome variables. Column (3) uses a binary outcome variable. Oster’s delta, in Panel D is calculated by comparing the results between Panels A and C. Standard errors clustered at the household level are reported in the parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.