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Featured Article

Food Hardship during the COVID-19 Pandemic and Great Recession

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Abstract *I compare the extent of food hardships in the United States among adults and seniors before and during the COVID-19 pandemic. Food insufficiency increased threefold compared to 2019, and more than doubled relative to the Great Recession. Food insufficiency among seniors increased 75% during the COVID period, but more than doubled when including reduced intake of food varieties. Receipt of charitable foods among disadvantaged adults spiked 50% in the COVID period, but the initial response among seniors was a sharp reduction, before rising. These patterns are consistent with strong social distancing measures enacted in response to the pandemic.*

Key words: Aging, Charitable food assistance, Food insecurity, Food insufficiency.

JEL codes: I1, I3.

The fallout stemming from the COVID-19 health pandemic is unprecedented in modern times, with unemployment reaching highs not seen since the Great Depression of the 1930s. Searing images of tens of thousands of cars queuing up for food donations in communities around the nation harken back to the bread lines of the Depression, suggesting the presence of widespread food hardship. This shock comes on the heels of the longest economic expansion on record after the severe downturn from the Great Recession of 2007–2009. One metric of economic distress of the Great Recession was the more than 30% increase in food insecurity, which is a condition in which households lack access to adequate food because of limited resources. Food insecurity remained elevated for several years after the recession, and did not return to pre-Great Recession levels for the population overall until 2018, while rates still remain elevated among seniors (Coleman-Jensen et al. 2020; Ziliak and Gundersen 2020). Prior research suggests that the health of seniors is particularly compromised by food insecurity (Gundersen and Ziliak 2015), and given their vulnerability to the COVID outbreak, understanding how food hardship has changed for this population is especially pressing. In addition, while there was a robust response of both

Unemployment Insurance (UI) and the Supplemental Nutrition Assistance Program (SNAP) to the surge in unemployment in both the Great Recession and early months of the COVID pandemic, seniors are generally not eligible for UI and takeup rates in SNAP are much lower for seniors than younger adults (Vigil 2019; Bitler, Hoynes, and Schanzenbach 2020; Moffitt and Ziliak 2020).

In this paper, I assess how food hardship in the population overall and among seniors compares in the current crisis to the two decades preceding the COVID-19 pandemic. The data for the pre-COVID period come from the 2001 to 2019 December Current Population Survey (CPS), which is the source of official estimates of food insecurity (Coleman-Jensen et al. 2020). Because the CPS supplement on food insecurity spanning the onset of COVID-19 will not be made available until the second half of 2021, for the post-COVID period I rely on data from the Census Bureau's Household Pulse Survey (Pulse).[1] The Pulse is a new survey fielded to provide real time information on a variety of socioeconomic and health outcomes induced by the pandemic (U.S. Census Bureau 2020). The Pulse only asks a couple of the questions found on the CPS, and thus it is not possible to directly compute food insecurity as measured officially by the USDA. Thus, I consider two measures of food hardship, the share of adults who are food insufficient and the share receiving charitable food. Food insufficiency is a broad measure of food distress, and in fact is used as a screener for eligibility for the full food security module in the CPS (Tiehen, Vaughn, and Ziliak 2019). Charitable food is defined as receipt of free groceries or meals from nongovernmental organizations, family, and friends.

I begin the analysis by documenting trends in food insufficiency for all adults and those ages sixty and older. I provide two measures of food insufficiency, one more restrictive whereby the household is food insufficient if they report that they sometimes or often do not have enough food to eat, and the other more inclusive where households reporting that they have enough food to eat but with reduced variety are also classified as being food insufficient. The share of the adult population reporting the more severe form of food insufficiency tripled from 3.4% in 2019 to 10.8% in July 2020. Seniors also reported higher food insufficiency, but a more attenuated increase of 75%, from 2.8 to 4.9%. When including those reporting enough food but reduced variety, the share more than doubles for all adults from 18.6 to 44.2%, as well as seniors sixty and older (14.5 to 32.8%). These sharp increases in food insufficiency during the COVID period are found among the low-income population, as well as across racial groups. Black adults are two to three times more likely than whites to report food insufficiency in a typical year, and with the onset of the Pandemic, one in five Black adults were food insufficient. In contradistinction, overall food insufficiency increased by a more muted 36% over the Great Recession among all adults, and by under 10% among seniors.

I next document trends in the share of adults receiving charitable food. Because of the structure of the CPS questionnaire, I restrict the analysis of free food to those households whose income is less than 185% of the federal

[1]*See Bauer (2020); Bitler, Hoynes, and Schanzenbach (2020); Rachidi (2020); and Schanzenbach and Pitts (2020a,b) for related analyses of food hardship in the COVID-19 pandemic. This study differs in my focus on seniors, the measures of food hardship, and the inclusion of econometric analyses of socioeconomic and business cycle determinants of food hardships.*

poverty line or who report being food insufficient (including those with reduced intake of food variety). The share of disadvantaged adults receiving free food rose steadily from just under 6% at the start of the sample period to just over 9% in December 2019, with no discrete change during the Great Recession. This share leapt to 14.5% by June 2020. The share of low-income or food-insufficient seniors receiving charitable food exceeded that of adults overall in every year, and increased steadily (but more slowly) until 2019. However, with the onset of COVID-19, there was an initial sharp drop in this population of seniors receiving free food, followed by a subsequent rebound. This pattern is consistent with strong shelter-in-place and other social distancing restrictions that were gradually relaxed over time.

I extend the analysis by exploring the determinants of food insufficiency and receipt of charitable food, focusing on both socioeconomic characteristics and the role of state business cycles. Because of the differential trends in food insufficiency and charitable food receipt between younger and older adults, I conduct the analyses separately for adults ages eighteen to fifty-nine years old and those ages sixty and older. The patterns across groups are similar, with risk of food insufficiency higher for those younger in age, members of minority racial or ethnic groups, unmarried, lower educated, lower income, not working, and renters. The more severe form of food insufficiency is unresponsive to state business cycles, though there is evidence of a countercyclical response when including reduced variety in the measure of food insufficiency. These patterns of effects are similar in the models of charitable food receipt, though with the important difference that charitable food receipt rises with age. An auxiliary analysis of the aggregate time effects from the regression models suggests that food insufficiency and charitable food receipt respond countercyclically to the national business cycle, but during the COVID-19 period most of this macroeconomic shock is unexplained by the unemployment rate, pointing instead to other factors such as public health policies.

Data and Measurement of Food Hardship

The CPS is a nationally representative monthly labor-force survey of about 60,000 households conducted by the Census Bureau for the Bureau of Labor Statistics.[2] The survey is a rotating design where households are in sample for four months, out of sample for eight months, and then in sample for another four months. The interviews are conducted primarily in-person during interview months one and five, and by phone in months two to four and six to eight.

Since 1995 the USDA has sponsored the Food Security Supplement (FSS) as part of the CPS, fielding the supplement in December of each year starting in 2001. The CPS FSS contains detailed information on food security and other food-related outcomes such as spending and participation in federal and nonfederal food assistance programs. Supplement weights are provided at both the individual and household level to make the sample nationally representative to estimate the total number of persons residing in food insecure households as well as the total number of food-insecure households.[3] I use the

[2]*The CPS does not include information on individuals living in group quarters, including nursing homes or assisted living facilities.*

[3]*The CPS is representative at the state level as well, though the Census recommends two- or three-year moving averages to smooth out sampling variability, especially among some of the less populous states.*

December 2001 to 2019 supplements that span the 2001 recession, the 2007–2009 Great Recession, and the longest economic expansion on record through 2019. To be consistent with the Pulse survey, I restrict attention to those ages 18 and older, and use person weights so that the estimates of food hardship reflect the share of persons and not households. There are 1,528,484 individuals across the nineteen years.

The Pulse survey was fielded by the U.S. Census Bureau in response to the pandemic to collect information across a host of domains including employment, spending, food hardships, physical and mental health, health insurance and health care access, housing, and education disruptions, along with basic socioeconomic characteristics. Many of the topics are covered in greater detail in separate annual surveys by the numerous federal agencies sponsoring the Pulse, but the advantage of the Pulse is that these topics are being asked of the same respondents on a weekly basis as the health and economic consequences of the Covid-19 Pandemic unfold. The survey is administered on a Web-based platform, and each week weights are provided to make estimates representative of the population ages 18 and older at both the national and state levels, as well as for 15 MSAs.[4] For the analysis here I use data from Week 1 spanning April 23–May 5, 2020; Week 4 spanning May 21–26, 2020; Week 7 spanning June 11–16, 2020; and Week 11 spanning July 9–14, 2020. Estimates are weighted using the person supplement weight for each week, and there are 340,705 persons used in the analysis.

Measuring Food Hardships

The CPS is the source of official food insecurity estimates, the measurement of which entails household responses to a series of eighteen questions in households with children under age eighteen residing, and ten questions if no children reside in the household. Each of the conditions are stipulated to result from financial constraints in order to abstract from dieting, fasting, or other reasons for reduced food intake. Households are classified as food insecure if they respond in the affirmative to at least three of the questions. However, in a bid to reduce respondent burden, not all households are fielded all or any of the food security module. Specifically, CPS households are screened out of the food security questions entirely if they have income above 185% of the federal poverty line (FPL) and show no indication of problems obtaining food for the household in response to the following two questions:

1. "In the last twelve months, since December of last year, did you ever run short of money and try to make your food or your food money go further?" (variable HES9)

1 Yes
2 No
-2 Don't Know
-3 Refused
-9 No Response

and

2."Which of these statements best describes the food eaten in your household—enough of the kinds of food (I/we) want to eat, enough but not always the kinds of food (I/we) want to eat, sometimes not enough to eat,

[4]*Details on the Pulse survey questionnaire and methodology are available at https://www.census.gov/programs-surveys/household-pulse-survey.html*

or often not enough to eat?" (variable HESS1, referred to as the "food sufficiency" question)

1 Enough of the kinds of food we want to eat
2 Enough but not always the kinds of food we want to eat
3 Sometimes not enough to eat
4 Often not enough to eat
-2 Don't Know
-3 Refuse
-9 No Response

If the household's income is below 185% FPL, or they choose options 1 or -2 to question HES9, or they choose options 2, 3, or 4 to the food sufficiency question (HESS1), then they proceed into the food security module (Tiehen et al. 2019).

This screener detail is important because the Pulse does not field the eighteen-item food security module; however, it does ask the same food sufficiency question as in the CPS (HESS1 above), but the reference period is the prior seven days. The food sufficiency question in the CPS has no explicit time horizon, but presumably refers to the time of the interview. This suggests that the CPS and Pulse should line up well on the metric of food sufficiency since there are no screeners on this question for either survey. I consider two variants of food insufficiency, one more restrictive where the household sometimes or often does not have enough food to eat and a second broader measure that also defines the household as food insufficient if they report that they have enough but not always the kinds of food they want to eat. I refer to the former as food insufficiency and the latter as food insufficiency with reduced variety.[5]

The December CPS also asks households a series of questions on whether they received any food assistance from governmental and nongovernmental sources. These include aid from the main federal food program, Supplemental Nutrition Assistance Program (SNAP); school breakfast and lunch programs; as well as from charitable food banks and pantries; religious organizations; soup kitchens; senior centers; and home-delivered meals like Meals On Wheels. The Pulse asks a similar set of questions about receipt and sources of free food from nongovernmental organizations, but they do not ask about SNAP.[6] For charitable food, I use the summary question 26 in the Pulse on whether anyone in the household received free groceries or meals in the prior seven days. In the CPS, I aggregate responses on whether the household received meals delivered (HESC1), ate at a community center or soup kitchen (HESC2 and HESC4M), or went to a food pantry or bank (HESCM3). The reference period for each of these questions in the CPS is the prior thirty days.[7] The CPS questions are only asked of those with incomes below 185% FPL or who report food distress, and thus I restrict the analysis of charitable foods in the CPS and Pulse to the similar subpopulation of low-income and food insufficient with reduced variety.

[5]*In early research on food hardships, food insufficiency was often the focal outcome of interest. See, for example, Gundersen and Oliveira (2001) and Ribar and Hamrick (2003). Subsequent research turned to the more comprehensive food insecurity measure as it became more ubiquitous on social surveys.*
[6]*Phase 2 of the Pulse, which starts with Week 13 (spanning August 19–August 31, 2020), added a question on SNAP receipt. The individual-level data for that week are not available at the time of this writing.*
[7]*The 2001 CPS only asks about food pantry and soup kitchen use in the prior twelve months, and thus to maintain consistency over time I only use survey years 2002 onward for the charitable food analysis.*

Comparing the December CPS to the Pulse

Because the pre-COVID and COVID-period data come from different sources, a brief comparison of the datasets is helpful to understand whether a priori we might expect any differences in food hardships due to survey sample composition.

Appendix Table 1 compares the 2019 December CPS to the pooled waves of the Pulse across a host of socioeconomic characteristics shown to be important determinants of food insecurity, including income, age, race and ethnicity, gender, marital status, education, among others (Gundersen and Ziliak 2018).[8] These summary statistics are presented conditional on income being reported in each survey. Observations with missing incomes are dropped for this comparison because as shown in Appendix Figure 1 missing income data is prevalent, especially in the CPS. That figure shows in the CPS about 15% of unweighted persons ages 18 and older fail to report income, and that percentage is not too different from the Pulse (about 2–3 percentage points higher in the CPS). Among seniors ages sixty and older, unweighted income nonresponse rises to 20% in the CPS, and the gap with the Pulse is more pronounced. That figure also shows weighted percentages of missing income, and here we see a much wider gap between the CPS and Pulse, and indeed as a weighted share of the population missing income in the CPS has been trending upward.[9] This is understood from Appendix Figure 2 that shows the fraction of CPS households refusing to participate in the December food security supplement has doubled from just over 20% in 2001 to over 40% in 2019.[10] This means each responding household is weighted up to account for more of the population, and thus the gap between weighted and unweighted missing income in the CPS has grown over time.

Appendix Table 1 shows that across most demographic characteristics the CPS and Pulse align well. The CPS has slightly more very young and very old persons than the Pulse, and thus on average household size is about one-half person smaller in the CPS. Employment rates are understandably much lower in the Pulse survey because of the Pandemic. The CPS asks about family income in the prior twelve months (*e.g.*, the 2019 survey spans November of 2018 to December 2019), while the Pulse asks about household income in the calendar year 2019.[11] Both surveys only report income in bins, and among those reporting incomes the table shows the income distributions between the 2019 CPS and 2020 Pulse are fairly similar. The table also shows bins of income-to-needs, defined as midpoint of the household's income bin divided by household-size specific weighted poverty thresholds for the

[8]*The appendices are included in the working paper version of the paper available at http://ukcpr.org/sites/ukcpr/files/research-pdfs/DP2020_07.pdf*

[9]*The temporary drop in weighted income nonresponse in 2008 is suggestive that who selects to be a respondent is affected by the business cycle.*

[10]*Bollinger et al. (2019) report a similar rise in supplement nonresponse in the March CPS, which is used for official estimates of poverty, inequality, and health insurance coverage. The December supplement nonresponse rate is about 10% higher than the March rate in a typical year. An important difference is that the Census imputes an entire supplement record to the missing household in the March supplement, but not in December.*

[11]*Family income in the CPS refers to the income of household members ages fifteen and older who are related by birth, adoption, or marriage, and excludes cohabiting partners and other unrelated individuals. It is generally asked in interview months one and five, and then carried forward to intervening months. Household income in the Pulse includes all members of the household, including cohabiting partners and other unrelated individuals.*

corresponding year.[12] Here we see many more people in the Pulse as having incomes below the poverty line than the CPS, and when including persons below twice the poverty line, the CPS has a 28% share compared to 34% in the Pulse. The CPS is likely more accurate because those income bins are in smaller increments, and thus the midpoint of the bin is a better proxy for actual income.

The Census conducts a limited amount of editing to the December CPS to ensure proper skip patterns are followed for each record, and appropriate missing data codes are assigned. There is no replacement of missing data with imputed values from another record. Likewise, there is a limited amount of editing in the Pulse, but also a limited amount of imputation in the Pulse survey on the demographic characteristics, using a pared-down procedure akin to that employed in the March CPS income supplement. Otherwise there is no imputation in the Pulse. Appendix Figure 3 shows trends in missing information on the focal food hardship measures of food insufficiency and charitable food. In the CPS, item nonresponse of food insufficiency is effectively zero, though nonresponse on the free food questions is trending upward, albeit at low levels of under 2% for all adults and about 4% in 2019 for seniors.[13] Nonresponse to the food insufficiency question in the Pulse is about 2–3%, and is about 1–2% for the free food question. There is no difference among seniors and all adults in the Pulse. Because these rates of nonresponse are low, I drop item nonresponders from the analysis of food hardships and rescale the percentages to sum to 100% among respondents.

The takeaway is that the December CPS and Pulse align well across most major socioeconomic characteristics. Rates of missing income are comparable in unweighted data, but because of rising nonresponse to the December CPS supplement there is a wider gap between the CPS and Pulse in weighted estimates of missing income. There is also a difference in income and charitable food nonresponse between all adults and seniors ages 60 and older in the CPS, but this gap is not present in the Pulse. In the ensuing descriptive analyses, I present trends in food hardship including those with missing incomes, and also conditional on low incomes among those with nonmissing income. Low incomes include those with income-to-needs below 185% FPL as that is an important screener in the CPS. Because the heaping of persons into wider bins in the Pulse make income-to-needs less accurate than in the CPS, I also show results for persons with household incomes less than $50,000. The regression models retain the full sample, and include controls for missing income. This permits an estimate of risk of food insufficiency or receipt of charitable food among those with missing incomes, and how they each compare to that risk among those who reported their income.

[12] *Poverty thresholds are obtained from https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html*

[13] *Income nonresponders in the CPS are placed into the category of incomes above 185% FPL and thus are screened out of the food security module that includes the charitable food questions unless they express some food hardship in either of the initial two screeners HES9 and HESS1 (food sufficiency). Bollinger et al. (2019) show that earnings nonresponse in the CPS is U-shaped across the earnings distribution and is highest among low earners. This suggests that the practice of placing income nonresponders in the December CPS in the above 185% FPL category likely results in undercounts of receipt of SNAP and charitable foods, and possibly food insecurity.*

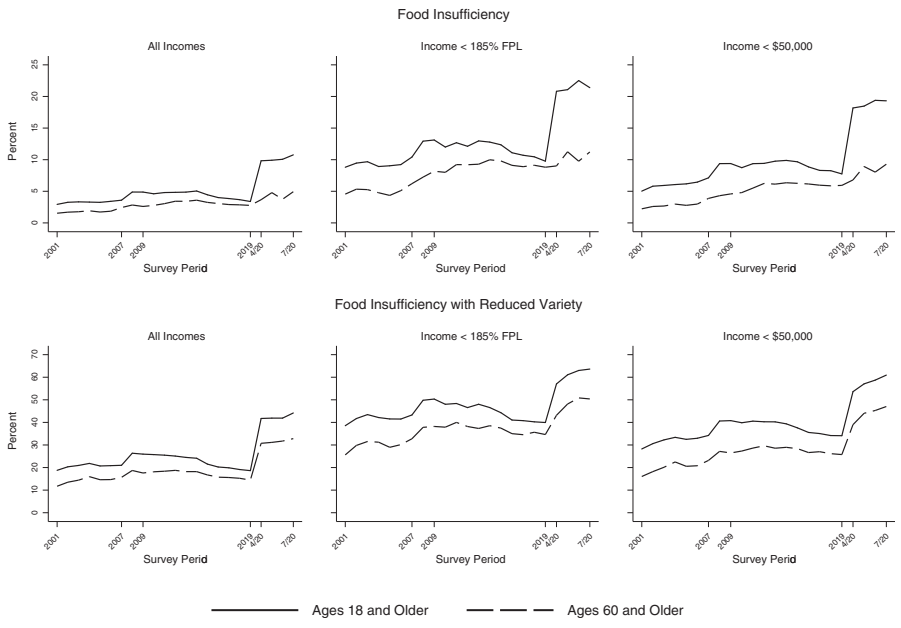
Trends in Food Hardships Before and After Covid-19

In this section I focus on food hardships in the CPS and Pulse, and then turn to the determinants in the subsequent section. I begin with current food insufficiency in Figure 1, which refers to the survey date in the CPS and the prior seven days in the Pulse. The top panel of the figure reports food insufficiency for all adults ages eighteen and older, and separately for seniors ages sixty and older. The bottom panel presents trends in food insufficiency with reduced variety. Within each panel, I show estimates among the full sample, inclusive of those with missing incomes, and for the subsamples of those with household incomes under 185% FPL and under $50,000 annual income.

The upper left panel of Figure 1 shows that across the population of adults eighteen and older there has been a dramatic increase in food insufficiency with the onset of the COVID-19 pandemic. The share of the population reporting food insufficiency in the spring of 2020 is three times higher than seven months earlier. In December 2019, 3.4% of the adult population reported being sometimes or often without enough food to eat. This leapt to 9.8% in April 2020 and continued to climb to 10.8% by the middle of July 2020. This increase swamps the increase during the Great Recession, when food insufficiency rose 36% from 3.6% in 2007 to 4.9% in 2009. Food insufficiency remained elevated for several years after the Great Recession, peaking at 5.1% in 2014, before gradually falling in subsequent years to levels found prior to the Great Recession. A similar pattern is found among seniors, but the increase during the COVID-19 pandemic is attenuated compared to adults overall. Food insufficiency among persons sixty and older stood at 2.8% in December 2019 and rose 75% to 4.9% in July 2020. Unlike adults overall where food insufficiency increased with each survey week of the Pulse,

Figure 1 Trends in Food Insufficiency.

Source: Author's calculations of 2001–2019 December Current Population Survey and Weeks 1, 4, 7, and 11 of the Census Household Pulse Survey. Results weighted using person weights.



there was a temporary reduction among seniors in the month of June before rising again in July. This could be sampling error, but is also consistent with reports of economic reopening in June only to be followed by the summer surge of COVID cases in July. Even though the increase in food insufficiency among seniors during the COVID period is much less compared to adults overall, it still is substantially larger than the 8% increase from 2007 to 2009 over the Great Recession. Similar to the population of adults, senior food insufficiency peaked in 2014 at 3.6% before falling through 2019. Though the levels are much higher as expected, these time-series patterns are also found for the two low-income splits in the upper panel, with a modest increase in the Great Recession and gradual climb until 2014 before abating (all adults) or stabilizing (seniors). There was then a sharp doubling among all low-income adults in the COVID pandemic from April to July 2020, and 45% increase among seniors.

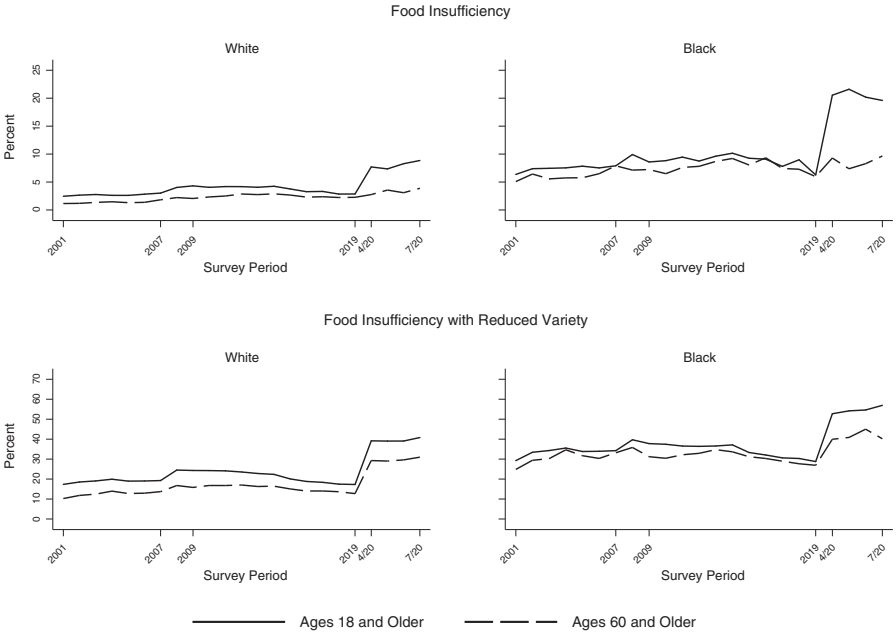
The bottom panel of Figure 1 presents a parallel set of estimates but now for the broader measure of food insufficiency with reduced variety. While the trends are the same, there are two notable features in this panel compared to the top one. First, in every year the level of food hardship when including reduced variety is several orders of magnitude higher than observed for the more restrictive measure food insufficiency. For example, in 2001 18.8% of adults and 11.7% of seniors reported food insufficiency with reduced variety, compared to 2.9 and 1.5%, respectively, reporting food insufficiency. Among the low-income population in 2001, those levels jump to 38.5% for those with incomes under 185% FPL and 28.2% for those with incomes under $50,000. The corresponding figures for those two groups in the top panel in 2001 are 8.8% and 5%, respectively. This suggests that for many families in a typical year, low incomes do not prevent food intake *per se*, but do inhibit the types of foods they can afford. The second notable feature of the bottom panel is the marked increase during the COVID-19 pandemic among seniors. In 2019, 14.5% of all seniors reported food insufficiency with reduced variety, but seven months later nearly 33% reported this hardship. The corresponding estimates for the two low-income samples are 35 and 51% (less than 185% FPL), and 26 and 47% (less than $50,000), respectively. This shift among seniors is consistent with shelter-in-place restrictions that limited mobility, meaning that COVID-19 had a disproportionate effect on seniors' ability to acquire foods of wide variety.

The COVID pandemic has not been neutral with respect rates of infection and mortality across race, with Blacks facing much greater risks of health complications from COVID-19 (Benitez, Courtemanche, and Yelowitz 2020). In addition, the extant food insecurity literature has documented persistent racial differences in risk of food hardships (Gundersen and Ziliak 2018). Figure 2 depicts trends in food insufficiency and food insufficiency with reduced variety separately for whites and Blacks, and within each racial group, among all adults and those ages 60 and older (full sample, including those with missing income).[14] The top panel of the figure makes clear that there is a persistent racial gap in risk of food insufficiency, with Blacks facing rates two to three times higher than whites (about 5% higher in a typical pre-COVID-19 year and 10%–15% higher during COVID). Moreover, the increase in food insufficiency among Black adults was as dramatic as for whites (211%

[14]*The regression models in the next section include nonwhite and non-Black races, as well as Hispanic ethnicity.*

Figure 2 Trends in Food Insufficiency by Race.

Source: Author's calculations of 2001–2019 December Current Population Survey and Weeks 1, 4, 7, and 11 of the Census Household Pulse Survey. Results weighted using person weights.



increase for Blacks from 2019 to July 2020, 206% increase for whites), meaning that one out of five Black adults reported being sometimes or often without enough food to eat compared to one out of eleven whites. The racial gap holds for seniors too, but the increase in food insufficiency during COVID was slightly greater among whites than Blacks (70% versus 62%). Moreover, as seen in the bottom panel, the racial gap also is in evidence with the broader measure of food insufficiency with reduced variety, but that gap is slightly less pronounced than in the top panel. Across both whites and Blacks, all adults and seniors, there was a sharp increase with COVID-19. In July 2020 5.5 out of every ten Black adults reported food insufficiency with reduced variety compared to four out of ten whites (the estimates are 40 and 30%, respectively, among seniors).

Figure 3 depicts trends in receipt of charitable food among the population of adults with incomes under 185% FPL or who report food insufficiency with reduced variety. Much as we saw in Figure 1 with food insufficiency among the low-income population, there was a secular increase in receipt of charitable food among adults ages 18 and older, rising over 70% from 5.7% in 2002 to 9.8% in 2015, and then tapering off slightly to 9.1% in 2019. It then spiked with the onset of COVID-19, reaching a within-sample peak of 14.5% in June before falling to 13.5% in July. This COVID response was substantially larger than the 22% increase over the two years surrounding the Great Recession. In every year leading up to the pandemic, receipt of charitable food among low-income or food insufficient seniors exceeded that of adults by 5-7 percentage points, perhaps because of access to additional congregate and home-delivered meal programs. However, with the onset of COVID-19, there was a sharp drop in seniors receiving free food: from 13.9% in December 2019 to 7.3% in April 2020, falling below adults overall for the first time in the sample

period. Receipt quickly rebounded such that three months later, 11.1% of seniors reported receipt of charitable food, but still below adults overall from similar economic backgrounds. This pattern is wholly consistent with strong social distancing restrictions that have been shown to reduce the spread of COVID-19 (Courtemanche et al. 2020), but then were gradually relaxed in late spring and early summer. These policies likely disproportionately affected the mobility of seniors, which was intended given their vulnerability to the illness.

These descriptive trends point to a sharp increase in food hardships in the United States during the COVID-19 pandemic to levels not seen in the prior two decades, including over the Great Recession. They also point to a substantial racial gap in food insufficiency that if anything was exacerbated during the health crisis. These figures, however, do not control for other factors that may affect the level and trend in food hardships, and thus in the next section I turn to a more systematic exploration of the determinants of food hardships.

Determinants of Food Insufficiency and Charitable Food

I follow the wider food insecurity literature and focus on both socioeconomic characteristics and the role of state business cycles as determinants of food insufficiency and receipt of charitable food (Anderson et al. 2016; Gundersen and Ziliak 2018). Because of the differential trends between younger and older adults, I conduct the analyses separately for adults ages eighteen to fifty-nine years old and those ages sixty and older.

The model for person i residing in state s in time period t in age group j is.

$$y^j_{ist} = \alpha^j + X^j_{ist}\beta^j + Y^j UR^j_{st}\gamma^j + \delta^j_s + \kappa^j_t + \varepsilon^j_{ist}, \quad (1)$$

Figure 3 Trends in Receipt of Charitable Food.

Source: Author's calculations of 2002–2019 December Current Population Survey and Weeks 1, 4, 7, and 11 of the Census Household Pulse Survey. Results weighted using person weights.

where y is the measure of food hardship (=1 if food insufficient or received charitable food; 0 otherwise); X is a vector of socioeconomic characteristics at the individual level that includes controls for age (ages fifty to fifty-nine are omitted for the eighteen-to-fifty-nine models and ages eighty and over are omitted for the 60 and older models), gender (=1 if female), race (white is omitted), ethnicity (=1 if Hispanic), marital status (married is omitted), number of children and household size, education (college is omitted), income (>400% FPL is omitted), and renter (=1 if rent home or apartment)); UR is the state unemployment rate; δ is a control for time-invariant state fixed effects; κ is a control for year-specific fixed effects; and ε is an idiosyncratic error that is assumed standardized normal distributed.[15] This leads to probit maximum likelihood estimation, and I cluster standard errors at the state level for consistent inference of the state unemployment rate variable. Because direct probit coefficients only provide the sign of the relationship and not magnitudes, I focus my discussion on marginal effects evaluated at the means of the regressors, with indicator variables reflecting the difference in the predicted CDF with the indicator set to 1 and 0, respectively. Appendix Table 2 contains weighted summary statistics of the variables used in the regressions, and Appendix Tables 3 and 4 contain the direct probit coefficients.

Table 1 presents the marginal effects from the probit models of food insufficiency and food insufficiency with reduced variety for the combined 2001–2020 survey years. In columns (1) and (2) we see that relative to adults ages fifty to fifty-nine, the risk of food insufficiency initially declines and then rises with age, which is perhaps correlated with the presence of children in the household. Gender has no effect on food insufficiency, but women are at slightly greater risk of food insufficiency with reduced variety. The Black-white racial gap identified in Figure 2 holds once we control for other confounding factors, with Blacks 1.9 percentage points more likely to be food insufficient compared to whites, and 5.5 percentage points more likely to be food insufficient with reduced variety.[16] Hispanics are also at elevated risk of food insufficiency relative to non-Hispanics, but the effect sizes are less than half the Black-white gap. Marriage is quite protective of food insufficiency, with widowed, divorced, or separated persons at substantially greater risk than those never married. Household size leads to slightly greater risk of food insufficiency, but the number of children appear to be protective of the more severe form of food insufficiency.

Higher levels of human capital are particularly protective against food insufficiency, with high school dropouts 5.5 and 15.5 percentage points more likely to be food insufficient and food insufficient with reduced variety, respectively, than college graduates. Consistent with much of the food insecurity literature, higher levels of income are most protective against food hardships. Those adults living in poverty are 15 percentage points more likely to be food insufficient (with reduced variety) compared to adults with household incomes above four times the poverty line, and those living in near poverty are 10 percentage points more likely to be food insufficient (with reduced

[15] *A separate wave dummy variable for the "year effect" is included for the four waves of the Pulse in 2020.*
[16] *Appendix Table 2 reports that the mean rate of food insufficiency among eighteen- to fifty-nine-year-olds is 6% and is 28% when including reduced variety. The corresponding means for ages sixty and over are 3% and 19%.*

Table 1 Marginal Effects from Probit Regression of Food Insufficiency

	(1) Food insufficiency	(2) Food insufficiency with reduced variety	(3) Food insufficiency	(4) Food insufficiency with reduced variety
VARIABLES	Ages 18–59	Ages 18–59	Ages 60+	Ages 60+
Ages 18–29	−0.0036	−0.0061		
	(0.0011)	(0.0036)		
Ages 30–39	0.0020	0.0164		
	(0.0009)	(0.0031)		
Ages 40–49	0.0035	0.0172		
	(0.0011)	(0.0023)		
Ages 60–69			0.0166	0.0963
			(0.0013)	(0.0049)
Ages 70–79			0.0080	0.0489
			(0.0010)	(0.0034)
Female	−0.0006	0.0033	−0.0014	0.0004
	(0.0005)	(0.0017)	(0.0004)	(0.0020)
Black	0.0190	0.0545	0.0147	0.0763
	(0.0011)	(0.0038)	(0.0019)	(0.0051)
Other Race	0.0048	−0.0037	0.0103	0.0250
	(0.0021)	(0.0054)	(0.0021)	(0.0050)
Hispanic	0.0051	0.0250	0.0098	0.0636
	(0.0011)	(0.0055)	(0.0022)	(0.0079)
Widowed, Divorced, or Separated	0.0211	0.0728	0.0091	0.0435
	(0.0010)	(0.0022)	(0.0008)	(0.0030)
Never Married	0.0090	0.0242	0.0061	0.0237
	(0.0006)	(0.0024)	(0.0013)	(0.0059)
Number of Children	−0.0011	0.0051	0.0026	0.0223
	(0.0003)	(0.0016)	(0.0011)	(0.0038)
Household Size	0.0005	0.0047	−0.0000	0.0020
	(0.0003)	(0.0016)	(0.0003)	(0.0020)
Less than High School	0.0545	0.1552	0.0208	0.1126
	(0.0028)	(0.0045)	(0.0026)	(0.0093)
High School	0.0342	0.1096	0.0053	0.0431
	(0.0012)	(0.0034)	(0.0010)	(0.0039)
Some College	0.0238	0.0918	0.0055	0.0508
	(0.0011)	(0.0022)	(0.0010)	(0.0033)
Employed	−0.0164	−0.0476	−0.0046	−0.0226
	(0.0005)	(0.0018)	(0.0012)	(0.0027)
Income <100% FPL	0.1522	0.3383	0.1003	0.2952
	(0.0031)	(0.0044)	(0.0069)	(0.0073)
Income 100–200% FPL	0.1013	0.2925	0.0540	0.2334
	(0.0024)	(0.0043)	(0.0039)	(0.0054)
Income 200–400% FPL	0.0419	0.1654	0.0177	0.1041
	(0.0014)	(0.0031)	(0.0020)	(0.0032)
Missing Income	0.0602	0.1199	0.0297	0.0896
	(0.0023)	(0.0041)	(0.0030)	(0.0029)
Renter	0.0202	0.0690	0.0159	0.0716
	(0.0008)	(0.0044)	(0.0010)	(0.0042)

(Continues)

Table 1 Continued

	(1) Food insufficiency	(2) Food insufficiency with reduced variety	(3) Food insufficiency	(4) Food insufficiency with reduced variety
State Unemployment Rate	−0.0002 (0.0002)	0.0042 (0.0014)	0.0002 (0.0002)	0.0033 (0.0014)
Observations	1,324,266	1,324,266	523,580	523,580

Source: Author's calculations of 2001–2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. Coefficients are marginal effects from weighted probit regression model of food insufficiency. Standard errors are clustered at the state level. Models control for state and year fixed effects.

variety). Beyond income, homeownership is also protective against food insufficiency, reducing the risk by 2 percentage points.

Lastly, the more severe form of food insufficiency is unresponsive to state differences in the business cycle, though the more expansive measure suggests a countercyclical relationship. Holding other factors at their mean values, an unemployment rate of 3% as commonly found in 2019 is associated with a 23% chance of food insufficiency with reduced variety, and a 12% unemployment rate as observed in April 2020 is associated with a 27% risk.[17] These are modest effect sizes in response to large swings in unemployment.

The patterns of effects among those ages sixty and older in columns (3) and (4) of Table 1 are similar to those found on younger adults with a few notable differences. The age gradient in the risk of food insufficiency is much sharper among seniors than younger adults, with a sixty- to sixty-nine-year-old 9.6 percentage points more likely to be food insufficient (with reduced variety) than a senior age eighty and older. This effect size falls by half for seniors age seventy to seventy-nine. A similar age gradient is found in the food insecurity literature, with the young old at substantially elevated risk of food insecurity compared to the oldest old (Gundersen and Ziliak 2018). Table 1 also suggests that seniors who are members of minority groups (Black, other races, Hispanic) are also at greater risk of food insufficiency than found among younger adults in columns (1) and (2). On the other hand, because of their reduced attachment to the labor force, senior food insufficiency is less responsive to state business cycles compared to eighteen- to fifty-nine-year-olds, with a 3% unemployment rate associated with a 15% chance of food insufficiency with reduced variety, and a 12% unemployment rate associated with a 18% risk.

Table 2 contains a parallel set of regressions, but now the dependent variable is receipt of charitable food. Recall that because of the structure of the CPS questionnaire, this analysis is restricted to those adults with household incomes under 185% FPL or who report food insufficiency with reduced variety.[18] In general the marginal effects in Table 2 accord with those found in

[17] *This is found by using the probit coefficients to predict the fitted CDF holding the variables at their mean values but allowing the state unemployment rate to change.*

[18] *In addition, data from the 2001 December CPS is omitted because of inconsistency in recall periods of charitable food compared to all other years.*

Table 1 both within age groups and across age groups.[19] For example, across age groups the racial gap in receipt of charitable food is higher in the senior population than among younger adults. A Black senior is 5.8 percentage points more likely than a white senior to receive charitable food, compared to a 1.5 percentage points gap among eighteen- to fifty-nine-year-olds. The Black senior effect is 32% of the sample mean of charitable food receipt reported in Appendix Table 2, while the effect size for eighteen- to fifty-nine-year-olds is 12% of that group's mean, suggesting that the larger effect size of race for seniors is not driven solely by the larger baseline risk level for receiving charitable food. The one variable whose effect is the opposite in the charitable food models compared to the food insufficiency models is age. Receipt of charitable foods increases monotonically in age, with a eighteen- to twenty-nine-year-old at 3.2 percentage points lower odds of receipt relative to a fifty- to fifty-nine-year-old, compared to only 0.3 percentage points lower relative odds for a forty- to forty-nine-year-old.

Given the dramatic increase in food insufficiency with the onset of COVID-19, coupled with the increase in charitable food receipt among disadvantaged adults and decrease among those ages sixty and older, it is perhaps surprising that the probit models identify such a modest effect of the state business cycle. Notably, the state unemployment rate captures local deviations from national unemployment rates, and thus may understate the total response to the business cycle. To explore this possibility, Figures 4 and 5 plot the marginal effects of the time dummies from the probit models reported in Tables 1 and 2. Those time effects capture all residual factors beyond the socioeconomic characteristics, state unemployment rates, and state fixed effects that are common to households each year. Figure 4 shows that the residual time effects underlying food insufficiency are close to zero in all years through 2019, and then there is a sharp jump in April 2020 among eighteen- to fifty-nine-year-olds, but little change from the models of seniors. This is consistent with the pattern depicted in Figure 1 with the unadjusted data. The figure shows a more marked jump around the Great Recession for the models of food insufficiency with reduced variety, and while socioeconomic factors do a better job of capturing most risk of this measure of food insufficiency from 2009 to 2019, this unexplained year effect persists among those ages sixty and older. For both age groups, the sharp spike in unexplained year effects emerges with the COVID pandemic. Figure 5 shows the year effects from the charitable food regressions, and here we find more of an upward trend in the unexplained time effect after the Great Recession among eighteen- to fifty-nine-year-olds compared to seniors, and then diverging patterns with COVID-19 as seen previously in the raw data of Figure 3.

To test whether the aggregate unemployment rate can account for some of these trends in the aggregate time effects seen in Figures 4 and 5, I run a series of auxiliary time series regressions of the marginal effects of time dummies on the national unemployment rate and a linear trend. In addition, because of the sharp break in the series in 2020, I also run a specification that admits a trend break in the series after 2020, and another that also permits the unemployment rate to differ pre- and post-2020. These regressions are only meant to be suggestive as the time series is short (twenty-two observations for food insufficiency, twenty-one observations for charitable food). Table 3 reports

[19]*Because the sample includes those with incomes below 185% FPL* or *who report food insufficiency with reduced variety, the model identifies the income effects for higher income groups. That is, the food insufficient population draws from a much larger part of the income distribution.*

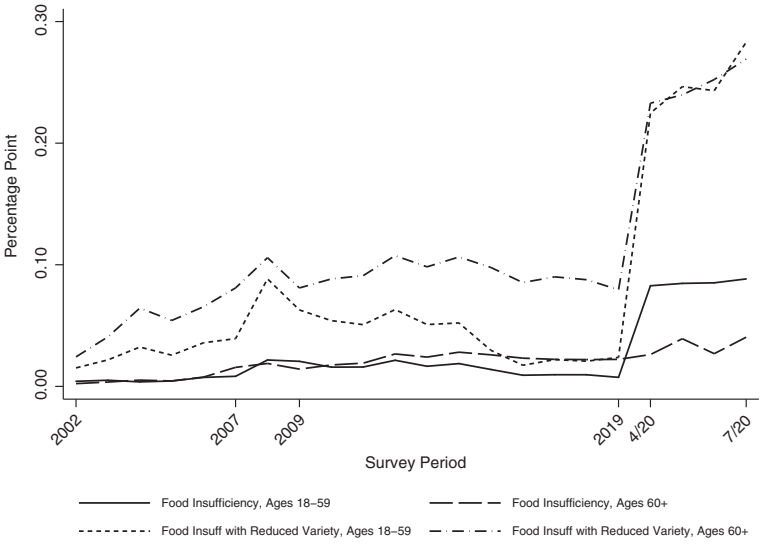
Table 2 Marginal Effects from Probit Regression of Receipt of Charitable Food

	(1)	**(2)**
Variables	Ages 18–59	Ages 60+
Ages 18–29	−0.0320	
	(0.0024)	
Ages 30–39	−0.0138	
	(0.0020)	
Ages 40–49	−0.0031	
	(0.0016)	
Ages 60–69		−0.0281
		(0.0051)
Ages 70–79		−0.0251
		(0.0028)
Female	0.0008	0.0045
	(0.0016)	(0.0032)
Black	0.0154	0.0575
	(0.0027)	(0.0091)
Other Race	0.0056	0.0320
	(0.0029)	(0.0053)
Hispanic	0.0061	0.0086
	(0.0035)	(0.0047)
Widowed, Divorced, or Separated	0.0250	0.0322
	(0.0028)	(0.0048)
Never Married	0.0133	0.0355
	(0.0025)	(0.0068)
Number of Children	0.0038	0.0133
	(0.0009)	(0.0056)
Household Size	0.0040	−0.0036
	(0.0008)	(0.0023)
Less than High School	0.0373	0.0223
	(0.0028)	(0.0032)
High School	0.0286	0.0014
	(0.0024)	(0.0030)
Some College	0.0190	0.0051
	(0.0020)	(0.0038)
Employed	−0.0346	−0.0465
	(0.0023)	(0.0062)
Income <100% FPL	0.0918	0.1104
	(0.0047)	(0.0069)
Income 100–200% FPL	0.0516	0.0706
	(0.0055)	(0.0050)
Income 200–400% FPL	0.0396	0.0578
	(0.0035)	(0.0069)
Missing Income	0.0798	0.0981
	(0.0059)	(0.0078)
Renter	0.0145	0.0681
	(0.0025)	(0.0051)
State Unemployment Rate	0.0022	0.0021
	(0.0015)	(0.0020)
Observations	471,559	160,667

Source: Author's calculations of 2001–2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. Coefficients are marginal effects from weighted probit regression model of receipt of charitable food. Standard errors are clustered at the state level. Models control for state and year fixed effects.

Figure 4 Marginal Effects of Time Dummies from Food Insufficiency Regression Models.

Source: Author's calculations of 2001–2019 December Current Population Survey and Weeks 1, 4, 7, and 11 of the Census Household Pulse Survey. Coefficients are marginal effects from weighted probit regression model of food insufficiency.



the coefficients from the auxiliary regressions, with the estimates for adults ages eighteen to fifty-nine in the top panel, and seniors ages sixty and older in the bottom.

In the upper left of Table 3, among adults ages eighteen to fifty-nine we see that the direct effect of the national unemployment rate on the food

Figure 5 Marginal Effects of Time Dummies from Charitable Food Regression Models.

Source: Author's calculations of 2002–2019 December Current Population Survey and Weeks 1, 4, 7, and 11 of the Census Household Pulse Survey. Coefficients are marginal effects from weighted probit regression model of charitable food receipt.

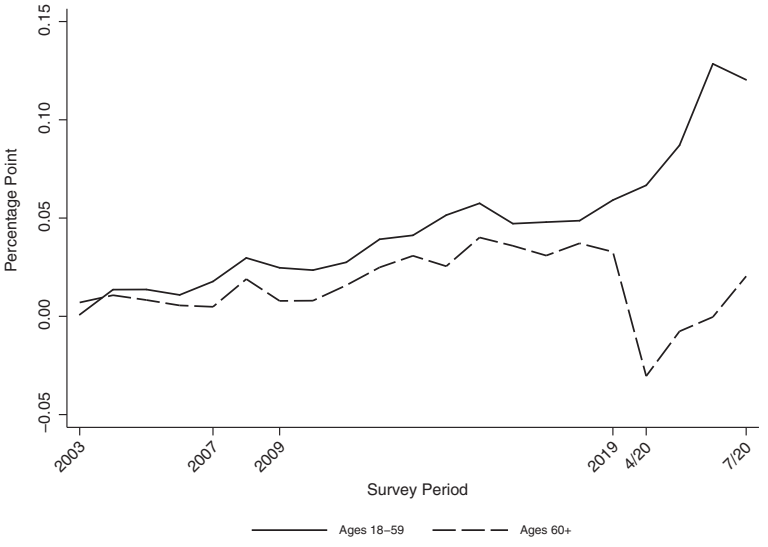


Table 3 Auxiliary Time-Series Regression of Time Effects on Aggregate Unemployment Rate and Trend

	Ages 18–59								
	Food insufficiency			**Food insufficiency with reduced variety**			**Receipt of charitable food**		
Unemployment Rate	0.0064	0.0021	0.0025	0.0187	0.0044	0.0067	0.0029	−0.0006	0.0001
	(0.0007)	(0.0004)	(0.0005)	(0.0025)	(0.0017)	(0.0012)	(0.0012)	(0.0009)	(0.0008)
Trend	0.0018	0.0005	0.0005	0.0046	0.0001	0.0002	0.0043	0.0034	0.0034
	(0.0004)	(0.0002)	(0.0002)	(0.0016)	(0.0007)	(0.0007)	(0.0004)	(0.0003)	(0.0025)
Trend*Post2020		0.0027	0.0032		0.0089	0.0132		0.0023	0.0047
		(0.0002)	(0.0001)		(0.0010)	(0.0013)		(0.0004)	(0.0019)
Unemployment*Post2020			−0.0011			−0.0085			−0.0040
			(0.0004)			(0.0020)			(0.0030)
Constant	−0.0421	−0.0060	−0.0080	−0.1096	0.0116	−0.0034	−0.0230	0.0058	0.0017
	(0.0058)	(0.0033)	(0.0038)	(0.0217)	(0.0161)	(0.0148)	(0.0089)	(0.0062)	(0.0055)
R-Squared	0.851	0.984	0.985	0.782	0.962	0.970	0.889	0.949	0.957
					Ages 60 and Older				
Unemployment Rate	0.0004	0.0008	0.0012	0.0121	0.0031	0.0045	−0.0015	0.0008	0.0020
	(0.0004)	(0.0006)	(0.0005)	(0.0018)	(0.0013)	(0.0015)	(0.0020)	(0.0021)	(0.0024)
Trend	0.0014	0.0015	0.0015	0.0060	0.0032	0.0032	0.0005	0.0011	0.0011
	(0.0002)	(0.0002)	(0.0002)	(0.0011)	(0.0008)	(0.0008)	(0.0009)	(0.0010)	(0.0010)
Trend*Post2020		−0.0002	0.0006		0.0056	0.0081		−0.0015	0.0030
		(0.0003)	(0.0006)		(0.0007)	(0.0013)		(0.0007)	(0.0013)
Unemployment*Post2020			−0.0015			−0.0050			−0.0076
			(0.0010)			(0.0014)			(0.0023)
Constant	0.0011	−0.0019	−0.0046	−0.0444	0.0313	0.0226	0.0209	0.0027	−0.0051
	(0.0030)	(0.0040)	(0.0038)	(0.0147)	(0.0146)	(0.0161)	(0.0086)	(0.0091)	(0.0101)
R-Squared	0.817	0.824	0.842	0.855	0.960	0.964	0.065	0.161	0.265

Source: Author's calculations of 2001–2019 December Current Population Survey and Weeks 1, 4, 7, and 11 of the Census Household Pulse Survey. Coefficients are linear regression model of time effects from Tables 1 and 2. Standard errors are heteroskedasticity robust.

insufficiency time effects is sizable compared to the state unemployment rate presented in Table 1. The third column, which admits both a trend break in the series and a nonlinear effect of the unemployment rate shows that with the more flexible specification the time effects are driven more by the unexplained trend break than the unemployment rate. This is further underscored in same specification for the food insufficiency with reduced variety, as well as the charitable food regression. The explanatory power of these simple models is high, with R-squares in excess of 0.9. The bottom panel for seniors shows that the aggregate unemployment rate accounts for the unexplained macro time effect in the prepandemic period, but not in the COVID-19 era. On the other hand, neither the national unemployment rate nor the trend does much to explain the charitable food time effects for seniors, pointing instead to other factors such as public health policies.

Conclusion

I provide a descriptive portrait of how food hardships facing adults in the United States compare in the two decades leading up to and during the global COVID-19 health pandemic using nationally representative data from the Current Population Survey and the Census Household Pulse Survey. The results point to unprecedented growth in food insufficiency and charitable food receipt among adults overall, with food insufficiency tripling since 2019 and charitable food receipt among the disadvantaged increasing over 50%. Among older adults ages sixty and above, the increase in food insufficiency was more muted, but the robust 75% increase swamped the increase of 10% in the two years surrounding the Great Recession. When expanding the measure of food insufficiency to include those households facing reduced intake of food varieties, senior food insufficiency increased every bit as much as adults overall, suggesting the mobility of seniors was strongly restricted during the early months of the Pandemic. This restricted mobility is underscored by the dramatic drop in receipt of charitable foods among seniors, falling below rates of all adults for the first time since data collection started in 2002. Participation among seniors quickly rebounded, but by July 2020 still fell below that of adults overall and below prepandemic levels. These patterns, which hold in richly specified regression models, are consistent with strong shelter-in-place and other social distancing measures enacted at the state and local levels in response to the pandemic that were gradually relaxed over time.

While the results here are descriptive only, they do point to the value and importance of having access in real-time to key metrics of well-being. The full eighteen-item food security module in the December CPS, along with the other food-related questions, is a crucial part of our nation's data infrastructure on measuring household well-being (Bitler and Mackie 2020). However, the necessary lags in release of the data mean that it is less able to quickly monitor current developments. The Pulse offers a much less comprehensive measurement of food security than the CPS, but with large sample sizes and real-time information on a subset of food hardship indicators and repeated observations, the Pulse is valuable for both monitoring and nonexperimental evaluations. The addition of a question on SNAP participation in Phase 2 of the Pulse offers the opportunity to expand these monitoring evaluations to the nation's major food assistance program as we await release of the full

spectrum of household food security during the COVID-19 pandemic in fall 2021.

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Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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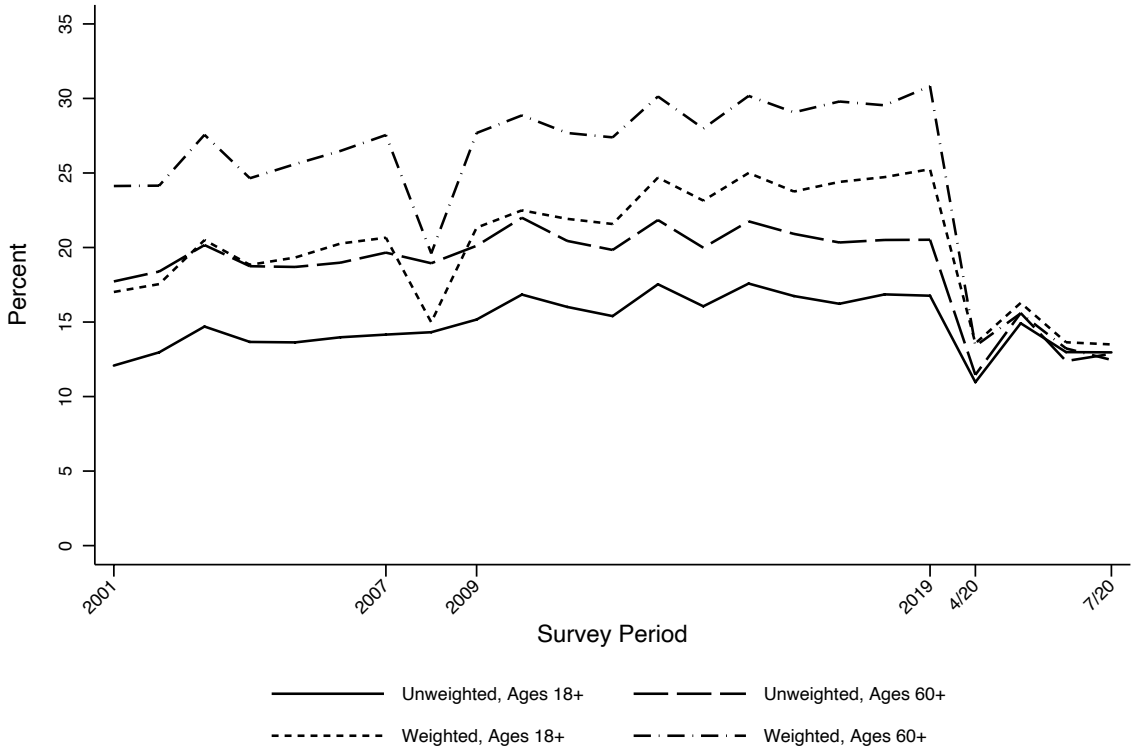
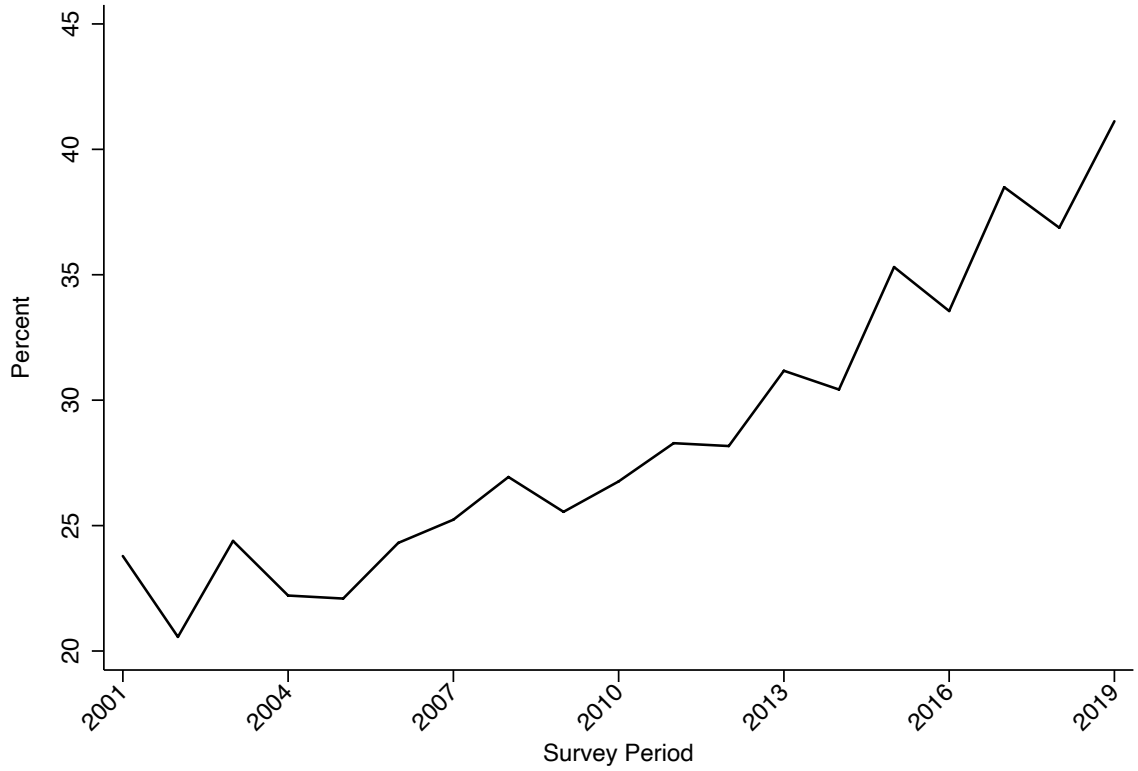
Appendix Figure 1. Trends in Income Nonresponse in December CPS and Household Pulse



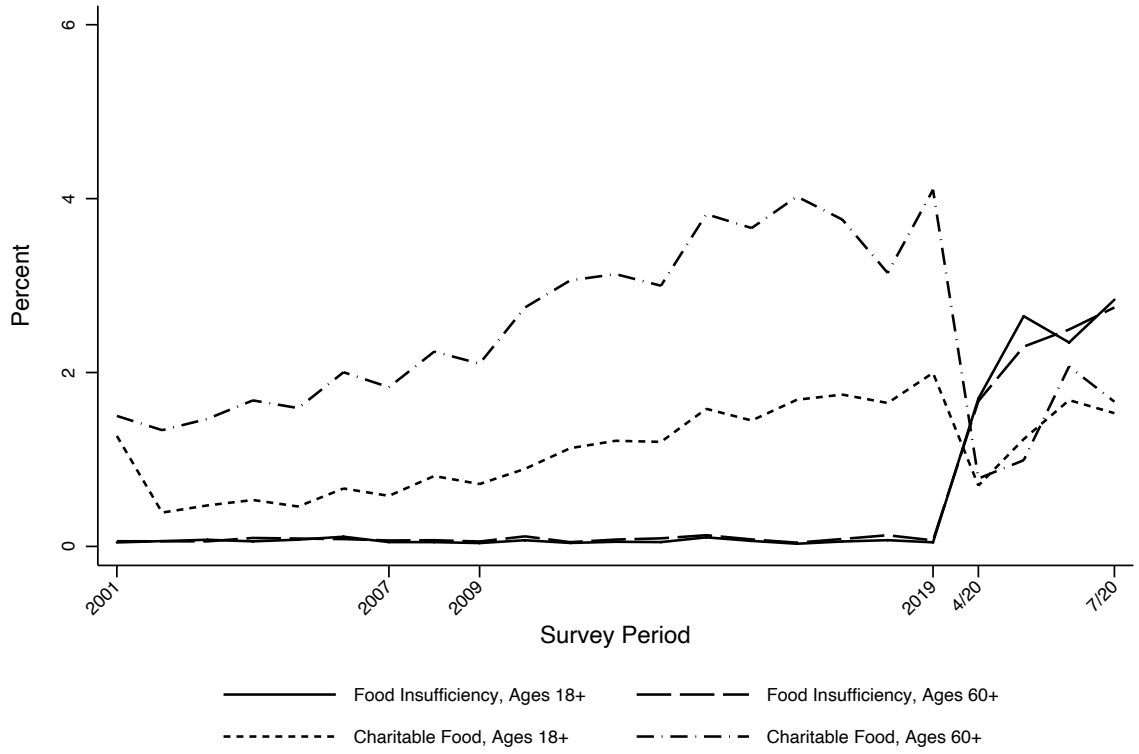
Source: Author's calculations of 2001-2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. Weighted estimates are based on person weights.

Appendix Figure 2. Trends in December CPS Food Security Supplement Noninterviews



Source: Author's calculations of 2001-2019 December Current Population Survey. Numbers are unweighted because weights are not available for noninterview households.

Appendix Figure 3. Trends in Item Nonresponse to Food Insufficiency and Charitable Food Questions in December CPS and Census Pulse



Source: Author's calculations of 2001-2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. The full sample is used for the measures of food insufficiency, and the sample for charitable food is restricted to those persons with incomes below 185% FPL or who report being food insufficient with reduced variety. Results are weighted using person weights.

Appendix Table 1. Comparison of 2019 December CPS and 2020 Household Pulse Survey, Conditional on Non-Missing Income

	2019 December CPS		2020 Pulse	
	Mean	Std. Dev.	Mean	Std. Dev.
Age 18-29	0.21	0.41	0.16	0.37
Age 30-39	0.18	0.39	0.19	0.39
Age 40-49	0.16	0.37	0.17	0.38
Age 50-59	0.17	0.37	0.18	0.38
Age 60-69	0.15	0.36	0.17	0.38
Age 70-79	0.09	0.28	0.10	0.30
Age 80+	0.04	0.19	0.02	0.15
Female	0.51	0.50	0.51	0.50
White	0.78	0.42	0.76	0.42
Black	0.12	0.33	0.12	0.33
Other	0.10	0.30	0.12	0.32
Hispanic	0.17	0.37	0.16	0.37
Married	0.53	0.50	0.56	0.50
Widowed, Divorced, Separated	0.18	0.39	0.19	0.39
Never Married	0.29	0.46	0.25	0.43
Number of Children	0.65	1.08	0.72	1.12
Household Size	2.94	1.55	3.44	1.97
Less than High School	0.09	0.29	0.08	0.26
High School	0.26	0.44	0.30	0.46
Some College	0.28	0.45	0.31	0.46
College	0.36	0.48	0.32	0.47
Employed	0.63	0.48	0.53	0.50
Income < $25,000	0.15	0.35	0.16	0.37
Income $25,000-34,999	0.09	0.29	0.12	0.32
Income $35,000-49,999	0.12	0.33	0.13	0.33
Income $50,000-74,999	0.18	0.39	0.18	0.38
Income $75,000-99,999	0.14	0.34	0.13	0.34
Income $100,000-149,999	0.15	0.36	0.15	0.35
Income >= $150,000	0.17	0.37	0.13	0.34
Income < 100% FPL	0.10	0.30	0.20	0.40
Income 100-200% FPL	0.18	0.38	0.14	0.35
Income 200-400% FPL	0.26	0.44	0.30	0.46
Income >= 400% FPL	0.47	0.50	0.36	0.48
Renter	0.30	0.46	0.33	0.47
Observations	53,257		296,032	

Source: Author's calculations of 2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. Results are weighted using person weights.

Appendix Table 2. Summary Statistics for Variables in Probit Regression Models

	Ages 18-59		Ages 60+	
	Mean	Std. Dev.	Mean	Std. Dev.
Food Insufficiency	0.06	0.24	0.03	0.17
Food Insufficiency, Reduced Variety	0.28	0.45	0.19	0.40
Received Charitable Food	0.13	0.34	0.18	0.38
Age 18-29	0.28	0.45		
Age 30-39	0.24	0.43		
Age 40-49	0.24	0.43		
Age 50-59	0.23	0.42		
Age 60-69			0.53	0.50
Age 70-79			0.32	0.46
Age 80+			0.16	0.36
Female	0.51	0.50	0.55	0.50
White	0.78	0.42	0.85	0.36
Black	0.13	0.34	0.09	0.29
Other	0.09	0.29	0.06	0.24
Hispanic	0.17	0.38	0.08	0.27
Married	0.53	0.50	0.61	0.49
Widowed, Divorced, Separated	0.13	0.34	0.34	0.47
Never Married	0.34	0.47	0.06	0.23
Number of Children	0.89	1.17	0.14	0.54
Household Size	3.33	1.63	2.30	1.52
Less than High School	0.11	0.31	0.15	0.36
High School	0.29	0.45	0.34	0.47
Some College	0.30	0.46	0.24	0.43
College	0.30	0.46	0.27	0.44
Employed	0.71	0.46	0.26	0.44
Income < $25,000	0.12	0.33	0.10	0.30
Income $25,000-34,999	0.14	0.35	0.15	0.36
Income $35,000-49,999	0.24	0.43	0.25	0.43
Income $50,000-74,999	0.31	0.46	0.26	0.44
Income $75,000-99,999	0.19	0.39	0.25	0.43
Income $100,000-149,999	0.33	0.47	0.16	0.37
Income >= $150,000	7.04	3.29	7.18	3.46
Income < 100% FPL	0.51	0.50	0.53	0.50
Income 100-200% FPL	0.78	0.42	0.32	0.46
Income 200-400% FPL	0.13	0.34	0.16	0.36
Income >= 400% FPL	0.09	0.29	0.55	0.50
Renter	0.17	0.38	0.85	0.36
State Unemployment Rate	0.53	0.50	0.09	0.29
Observations	1,334,666		527,707	

Source: Author's calculations of 2001-2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. Results are weighted using person weights.

Appendix Table 3. Probit Regression Coefficients of Food Insufficiency

VARIABLES	Food Insufficiency Ages 18-59	Food Insufficiency with Reduced Variety Ages 18-59	Food Insufficiency Ages 60+	Food Insufficiency with Reduced Variety Ages 60+
Ages 18-29	-0.0558	-0.0192		
	(0.0166)	(0.0113)		
Ages 30-39	0.0299	0.0512		
	(0.0129)	(0.0096)		
Ages 40-49	0.0518	0.0536		
	(0.0164)	(0.0070)		
Ages 60-69			0.4685	0.3964
			(0.0373)	(0.0207)
Ages 70-79			0.2093	0.1924
			(0.0250)	(0.0130)
Female	-0.0095	0.0104	-0.0406	0.0018
	(0.0070)	(0.0054)	(0.0123)	(0.0081)
Black	0.2431	0.1651	0.3137	0.2798
	(0.0118)	(0.0111)	(0.0320)	(0.0171)
Other Race	0.0686	-0.0117	0.2330	0.0979
	(0.0286)	(0.0170)	(0.0401)	(0.0188)
Hispanic	0.0733	0.0775	0.2257	0.2361
	(0.0146)	(0.0167)	(0.0424)	(0.0266)
Widowed, Divorced, or Separated	0.2655	0.2181	0.2371	0.1722
	(0.0108)	(0.0064)	(0.0207)	(0.0118)
Never Married	0.1308	0.0756	0.1492	0.0926
	(0.0085)	(0.0075)	(0.0273)	(0.0221)
Number of Children	-0.0170	0.0160	0.0732	0.0908
	(0.0049)	(0.0051)	(0.0307)	(0.0156)
Household Size	0.0080	0.0148	-0.0012	0.0081
	(0.0050)	(0.0050)	(0.0097)	(0.0081)
Less than High School	0.5503	0.4439	0.4219	0.4036
	(0.0229)	(0.0121)	(0.0406)	(0.0303)
High School	0.4306	0.3307	0.1436	0.1711
	(0.0150)	(0.0098)	(0.0275)	(0.0151)
Some College	0.3169	0.2792	0.1431	0.1972
	(0.0141)	(0.0065)	(0.0242)	(0.0125)
Employed	-0.2262	-0.1468	-0.1396	-0.0942
	(0.0065)	(0.0056)	(0.0387)	(0.0114)
Income < 100% FPL	1.0875	0.9223	1.0894	0.9149
	(0.0148)	(0.0116)	(0.0445)	(0.0198)
Income 100-200% FPL	0.8583	0.8076	0.8045	0.7659
	(0.0136)	(0.0112)	(0.0398)	(0.0153)
Income 200-400% FPL	0.4926	0.4855	0.3975	0.3875
	(0.0138)	(0.0085)	(0.0375)	(0.0111)
Missing Income	0.6208	0.3532	0.5873	0.3366
	(0.0164)	(0.0114)	(0.0458)	(0.0102)
Renter	0.2780	0.2124	0.3474	0.2678
	(0.0095)	(0.0134)	(0.0154)	(0.0143)
State Unemployment Rate	-0.0026	0.0134	0.0043	0.0135
	(0.0030)	(0.0043)	(0.0060)	(0.0059)
Constant	-2.9907	-1.7017	-3.6211	-2.3843
	(0.0427)	(0.0234)	(0.0715)	(0.0465)
Observations	1,324,266	1,324,266	523,580	523,580

Source: Author's calculations of 2001-2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. Coefficients are from weighted probit regression model of food insufficiency. Standard errors are clustered at the state level. Models control for state and year fixed effects.

Appendix Table 4. Probit Regression Coefficients of Receipt of Charitable Food

VARIABLES	Charitable Food Ages 18-59	Charitable Food Ages 60+
Ages 18-29	-0.2642	
	(0.0202)	
Ages 30-39	-0.1115	
	(0.0166)	
Ages 40-49	-0.0244	
	(0.0124)	
Ages 60-69		-0.1541
		(0.0277)
Ages 70-79		-0.1431
		(0.0163)
Female	0.0063	0.0249
	(0.0125)	(0.0179)
Black	0.1131	0.2803
	(0.0194)	(0.0400)
Other Race	0.0426	0.1616
	(0.0213)	(0.0247)
Hispanic	0.0464	0.0463
	(0.0265)	(0.0251)
Widowed, Divorced, or Separated	0.1772	0.1754
	(0.0186)	(0.0257)
Never Married	0.1014	0.1784
	(0.0185)	(0.0312)
Number of Children	0.0292	0.0733
	(0.0065)	(0.0309)
Household Size	0.0310	-0.0199
	(0.0061)	(0.0130)
Less than High School	0.2560	0.1183
	(0.0173)	(0.0167)
High School	0.2107	0.0075
	(0.0175)	(0.0163)
Some College	0.1408	0.0278
	(0.0148)	(0.0204)
Employed	-0.2578	-0.2869
	(0.0158)	(0.0442)
Income < 100% FPL	0.5928	0.5307
	(0.0256)	(0.0302)
Income 100-200% FPL	0.3615	0.3708
	(0.0343)	(0.0255)
Income 200-400% FPL	0.2693	0.2810
	(0.0210)	(0.0304)
Missing Income	0.4724	0.4400
	(0.0282)	(0.0301)
Renter	0.1119	0.3418
	(0.0195)	(0.0229)
State Unemployment Rate	0.0171	0.0114
	(0.0119)	(0.0109)
Constant	-2.6823	-2.0805
	(0.0923)	(0.0733)
Observations	471,559	160,667

Source: Author's calculations of 2001-2019 December Current Population Survey and Weeks 1, 4, 7 and 11 of the Census Household Pulse Survey. Coefficients are from weighted probit regression model of charitable food. Standard errors are clustered at the state level. Models control for state and year fixed effects.