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THE PRICE IS NOT RIGHT:

GROCERY TAXATION, RACE, AND FOOD SECURITY

DURING COVID-19

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THE PRICE IS NOT RIGHT:
GROCERY TAXATION, RACE, AND FOOD SECURITY
DURING COVID-19

A THESIS APPROVED FOR THE
DEPARTMENT OF SOCIOLOGY

BY THE COMMITTEE CONSISTING OF

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I dedicate this work to Team Bonner.

Kahlil Gibran wrote that “Work is love made visible”.
Our meaningful, intentional work—for each other, joined together—is making love visible.

I am grateful.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Using recent data from a national sample of 2.8 million households surveyed by the Household Pulse Survey (HPS) (U.S. Census Bureau 2022), this research examines the relationships across food insecurity, grocery taxes, and race during the COVID-19 pandemic. This research asks: How does a respondent's household food insecurity differ in states that impose grocery taxes compared to states without grocery taxes? How does a respondent's food insecurity differ by their race? How do these trends reflect government COVID-19 relief policy during this time? This analysis provides a baseline reporting of factors associated with food insecurity during the Covid-19 pandemic using the most recent HPS data. Overall, 35% of respondents report being food insecure at some point during the pandemic. Using survey-weighted logistic regressions and controlling for background demographic and socio-economic variables, this research finds that food insecurity is higher for respondents living in states with grocery taxes compared to those in states without grocery taxes. As the pandemic progresses, a substantial gap in food insecurity is observed; respondents in states with grocery taxes reported higher food insecurity compared to respondents in states without grocery taxes, net of other effects. This research also finds that food insecurity is a more salient issue for Black respondents; Black households in states with grocery taxes have a 43% predicted probability of reporting current food insecurity compared to 34% for white respondents in states without grocery taxes, net of the other covariates. Grocery taxes and being Black negatively affect food security during the Covid-19 pandemic.

INTRODUCTION

Using data from a national sample of 2.8 million households surveyed by the U.S. Census Bureau's Household Pulse Survey, this research examines the relationship across grocery taxes, food insecurity, and race during the COVID-19 pandemic.

The onset of the COVID-19 pandemic in early 2020 created an external shock to our society. Our society experienced the impact of navigating a serious new sickness in tandem with the impact of navigating the many drastic changes to daily life. Prior to the COVID-19 pandemic an estimated 1 in 8 households were food insecure and by April of 2020, rates of food insecurity had risen dramatically to 1 in 5 households (Bauer 2020; USDA ERS 2020). Households affected by food insecurity are most often found in marginalized communities separated from the white, middle-class majority by race, ethnicity, and socioeconomic status (Diez-Roux 2003). For those households already at risk of food insecurity, the challenges of COVID-19 infections, quarantines, school and business closures, and dramatic increases in unemployment have exacerbated the issue of food insecurity (Murdoch, Marsden, and Banks 2000; NCSL 2022). Of course, these increases in unemployment for many Americans led to a loss of income which has been shown to increase food insecurity (Loopstra and Tarasuk 2013). In addition to this, external shocks to our society, such as a global pandemic, have been shown to magnify patterned inequities already in place that are connected to increases in food insecurity (Bowen, Elliott, and Hardison-Moody 2021).

The goal of this study is to map the trends in food insecurity in relationship to two of the factors that are known to contribute to food insecurity issues—grocery taxation and race—while considering national-level and state-level policy responses of the past two

years (Bowen, Elliott, and Hardison-Moody 2021; Zheng et al. 2021). The challenge of the pandemic has been met by several governmental measures at the national level that have attempted to alleviate the strain on American households, including the Coronavirus Aid, Relief and Economic Security (CARES) Act of 2020, the Consolidated Appropriations Act of 2021, the American Rescue Plan of 2021 and the substantial increase in Child Tax Credit provided as part of the American Rescue Plan in 2021 (U.S. Department of the Treasury 2023; U.S. Government 2022)[1].

This statistical analysis focuses on this link between race and grocery taxes and the household-level food insecurity trends observed throughout the pandemic[2]. The research addresses the following questions: How does household food insecurity differ in states that impose grocery taxes as compared to household food insecurity in states that do not impose grocery taxes? How do these trends reflect government COVID relief policy during this time? What trends in current food insecurity are evident by race during the COVID-19 pandemic?

This research expects that food insecurity will have increased during the pandemic for those in states with grocery taxes, and that this will disproportionately

[1] The Coronavirus Aid, Relief and Economic Security (CARES) Act was signed into law on March 27, 2020 and provided economic assistance for American households and businesses. This support was continued and expanded through the Consolidated Appropriations Act (2021), which was signed into law on December 27, 2020. The Consolidated Appropriations Act (2021) provided $900 billion in stimulus relief for Americans and included funds to prevent a government shutdown. The American Rescue Plan Act of 2021 was signed into law on March 11, 2021, and included a $1400 payout per individual, based on total income. The American Rescue Plan also increased the Child Tax Credit, among other measures meant to provide support for COVID-19 recovery at the state and local levels.

[2] It is important to make a note on language here. Much of the research surrounding this issue uses the term "food insecurity". The USDA ERS uses this term in reference to their survey results; this research also uses the term "food insecurity" for the general purposes of this analysis. The HPS question operationalized as the dependent variable measures the reported food sufficiency for the current week in the household being surveyed, rather than the measured food security of the household overall. Current food sufficiency is one of several widely used measures of overall food security for households in the United States (Poblacion, Ettinger de Cuba, and Cook 2021).

affect marginalized households. This research expects that food insecurity will have decreased in response to COVID-19 relief measures, as households that struggle with food insecurity received cash payouts that could be used to address their lack of food. This research expects that this analysis will help explain any patterned food inequity trends during the pandemic and will help point toward policy implications as society continues to move towards recovery from the pandemic.

The analysis of these data reveals that those in states with a grocery tax have significantly higher reported food insecurity than those in states without a grocery tax. This research finds that Black, Hispanic, Asian, and "Other race" respondents have higher probabilities of reporting food insecurity than their white counterparts. The results of this analysis also suggest that governmental policy response decreased reported food insecurity for most households, although the long-term positive effects of these policy responses on food insecurity have now worn off. Households in the United States have not yet returned to pre-pandemic food insecurity levels.

Food Insecurity as a Health Concern

Food insecurity is one of the primary health concerns in our nation today as many Americans find the physical and economic access to food to be elusive (Coleman-Jensen 2021). Food security is the ability for all people, always, to have physical and economic access to sufficient food to meet their needs (USDA ERS 2021). It is known that both a lack of nutritious food—physical access—and a lack of sufficient food—economic access—can precipitate nutritional deficiencies and health problems. The first issue stems from the disparities in food availability based on neighborhood, or geographical access

(Leroy et al. 2015; Shannon 2014). This second issue stems from household socioeconomic status and the inability to afford the nutritious food needed by all members of the household, including both adults and children (Coleman-Jensen 2021). Both scenarios lead to food insecurity and health disparities by neighborhood and race (Caspi et al. 2016). Link and Phelan (1995) explain in their theory of fundamental causes that the association of socio-economic status—a factor that has varied widely during the pandemic for families living precariously—to decreases in health and mortality rates suggests that we focus our research on addressing the meso-level policy issues that perpetuate these differences. As our society moves towards recovery from the global pandemic, this research will analyze other factors that may contribute to the inequity in food insecurity in the United States.

To understand how grocery taxation and race may be affecting food insecurity in the United States, it is important to begin with an overview of the structural and systemic conditions that contribute to inequality in income and access (Sullivan 2014). This research finds that food insecurity affects households that are also struggling under the weight of systemic oppression that converges and magnifies this issue (Bowen, Elliott, and Hardison-Moody 2021; Cooksey Stowers et al. 2020; Corcoran 2018; Reese 2019). Households in marginalized communities are at greater risk of food insecurity, especially households with lower educational attainment and lower socioeconomic status (Coleman-Jensen 2021; Zajacova and Lawrence 2018). Households with lower socioeconomic status tend to eat less nutritionally dense food because it is often less expensive than the fresh, nutritious food recommended by the USDA Dietary Guidelines. In addition to this, nutritious food is also less available in neighborhoods with high levels of poverty.

Scholarship shows that the disparity in healthy dietary habits between socioeconomic status levels and race/ethnicities has expanded over time (Rehm et al. 2016). Low-income households have more limited food-acquisition options than high-income households, putting them at greater risk of food insecurity in times of stress (Kaiser and Hermsen 2015). Local food environments vary substantially by neighborhood racial/ethnic and socioeconomic composition and may contribute to food insecurity, which has been shown to influence disparities in health (Moore and Diez Roux 2006).

The COVID-19 pandemic highlights and exacerbates these systemic vulnerabilities. If one's household was non-white, in poverty, and struggling to access nutritious food prior to the pandemic, it is likely that this same household has just undergone a magnification of the issue of food insecurity. There has been an overall increase in global and local food insecurity due to general supply chain issues, disruptions to food supply chains, and the loss of income and livelihood for so many households due to the global economic recession sparked by the pandemic (Clapp and Moseley 2020; Anderson, Ivanic, and Martin 2013). These powerful pandemic realities continue to increase the burden for surviving and thriving on households who are struggling under these systems of oppression.

In addition to the weight of addressing food insecurity for one's family, the lack of food security at a general community level is also connected to multiple negative health outcomes over time for the affected households (Diez-Roux et al. 1999; Frohlick, Corin, and Potvin 2001). These negative health outcomes include the exacerbation of chronic conditions like diabetes, heart disease, and mental health disorders (National Institute on Minority Health and Health Disparities 2023). Food is a necessity without

which adults and children are not able to function in health, as food insecurity has been shown to affect school and work attendance even before the additional effects of the COVID-19 pandemic. The diminished health outcomes that are related to food insecurity issues have also been shown to magnify the effect of COVID-19 infections and recovery over time (Clapp and Mosely 2020). Altogether, scholarship indicates that food insecurity is a health concern which may be felt unevenly by factors such as income, racial-ethnic background, and economic and racial makeup of the neighborhood of residence.

Food Insecurity and Grocery Taxation

One of the most salient public policies surrounding the issue of food insecurity that has been under debate, especially in the last two years, involves state-level grocery tax. Thirteen states have state-level grocery taxes at an average grocery tax rate of 4.3%[3]. Of these thirteen states, seven states tax groceries at the same rate as their state's sales tax[4]. This research finds that residents of states that have historically imposed grocery taxes experience a significant increase in the annual cost of groceries[5]. Zheng et al. (2021) estimate that a one percentage point increase in grocery tax rates is associated with a 0.84% increase in the probability of being food insecure for low-income households. This association is evident in Figure 1, which shows that states with a relatively high grocery tax of four percent or higher are experiencing food insecurity at rates of 27 percent and higher.

[Insert Figure 1]

[3] These thirteen states are: Alabama, Arkansas, Hawaii, Idaho, Illinois, Kansas, Mississippi, Missouri, Oklahoma, South Dakota, Tennessee, Utah, and Virginia.
[4] These seven states are: Alabama, Hawaii, Idaho, Kansas, Mississippi, Oklahoma, and South Dakota.
[5] Oklahoma currently taxes at 4.5% with exceptions for local increases. For example, in Cleveland County, Oklahoma, residents pay an additional 4.25% local grocery sales tax for a total of 8.75% grocery tax.

Grocery tax is a flat tax, meaning that all grocery shoppers pay the same tax, no matter what their socioeconomic status may be. The lower the household income, the greater the percentage of income the household is spending on grocery tax (Gundersen and Ziliak 2018; Thomhave et al. 2022). In 2020, the highest income quintile spent 7% of their income on groceries, as compared to the more than 25% spent on groceries by households in the lowest income quintile. To make this more concrete, a family with an annual grocery bill of $7200 (approximately $150/week) living in Norman, Oklahoma will pay $630 in taxes. This is equivalent to more than a month's worth of groceries! This clearly represents a significant portion of the household income for those at or near the poverty level, which is linked to food insecurity. Based on this generalized calculation, this research expects there to be a difference in patterned food insecurity shaped by whether a respondent lives in a state with substantial grocery taxes or not (Wilson et al. 2016). This pattern may be exacerbated by the context of the pandemic.

Food Insecurity and Racial-Ethnic Group

Recent work highlights the difference in food insecurity rates between minority and non-Hispanic white households. Food insecurity rates in the United States are consistently higher than other comparable wealthy democratic countries. Indeed, there has been minimal improvement in food insecurity since the United States Department of Agriculture (USDA) Economic Research Service (ERS) began tracking food insecurity in the 1990s. Factors that historically contribute to the presence of food insecurity challenges include the racial-ethnic composition of the community, food environments,

socioeconomic status, and household demographics (See Thibodeaux 2016; Oswin and Ramirez 2015; Powell, et al., 2007; Moore and Diez-Roux 2006).

Access to food is related to the racial-ethnic composition of the geographical location of the household. Access is associated with the number of grocery stores and supermarkets in a neighborhood as well as with the racial-ethnic composition of the neighborhood and city (Powell et al. 2007). It is evident that there is greater access to healthy, nutritious foods in neighborhoods that are white and wealthy and that this access is limited in neighborhoods that are non-white and of lower socioeconomic status (Powell et al. 2007; Thibodeaux 2016). Kimbro et al. (2012:22) report that "there may be something about living in a disadvantaged neighborhood that increases the risk of food insecurity beyond a family's level of disadvantage." This connection between racial and ethnic disparity in access to food and levels of food insecurity stands as a crucial societal challenge that has been magnified during the pandemic.

Bowen et al. (2021:1) find that racism is a "fundamental cause of food insecurity," while controlling for socioeconomic status or poverty level, and that racism is linked to underlying disparities in income, employment, property ownership, wealth accumulation, and life expectancy. Black and Hispanic households experience food insecurity at double the rate of white households, a trend which continues to this day (Coleman-Jensen 2021). Black communities have been associated with higher rates of food insecurity and related negative health outcomes over time (Cooksey Stowers et al. 2020). Countering both food insecurity and negative health outcomes patterned by race, there is a food justice movement on the rise which seeks to address the structural inequities in the access and distribution of food. This movement is calling for the

resolution of the longstanding racial and class inequities underlying food insecurity here in the United States. To date, attempts to address these inequities in food insecurity have not to this point resulted in significant improvements in household food insecurity in the United States (Coleman-Jensen 2021; Holt-Giménez and Wang 2011). There remains a need to document and understand food insecurity by racial-ethnic background in the U.S. context and across states with and without grocery tax. This research aims to do just that within the larger context of the COVID-19 pandemic.

RESEARCH IMPERATIVE

Given the history of food insecurity in the United States related to grocery taxation and race and based on our synthesis of the extensive scholarly research on food insecurity, this study addresses the need to analyze the current trends in food insecurity during the pandemic for households in states with grocery taxes. This research also analyzes trends in food insecurity for households that are non-white; Black and Hispanic households have historically experienced food insecurity at double the rate of white households (Coleman-Jensen 2021).

Using a nationally representative sample of households from across the United States, this statistical analysis first predicts changes in food insecurity based on the grocery tax status of the state of residence. Second, this research analyzes household food insecurity by race during the pandemic. Third, this research also maps food insecurity onto a timeline of government COVID-19 relief policies enacted during the pandemic to understand the effectiveness of these policies and identify factors that may be affecting food insecurity for Americans.

In addition to the focal variables—food insecurity, grocery tax status, and race—prior research makes it clear that thorough empirical study needs to consider individual-level socioeconomic and demographic background factors as possible predictors of food insecurity. This research considers the possible underlying interrelationships across these factors by using a multivariate model. This research includes controls in each model that prior research has shown to contribute to food insecurity. This includes the demographic variables of gender, marital status, the total number in the household, and whether children are present in the household, as well as the socioeconomic variables of educational attainment, income, whether the household members had a change in employment in the past week, and the housing status of the household. This research expects that households with female heads of household, more members and those with children will experience greater food insecurity. Conversely, this research expects that households with married partners, greater income, and higher educational attainment will experience less food insecurity during the pandemic. Owning your home is reflective of a more stable financial status than those who rent their homes, suggesting that the households who own their home may experience less food insecurity. In addition to the controls stated above, this research control for changes in employment to reflect the possible loss of income as a strong contributing factor to food insecurity. These sociodemographic and socioeconomic variables are included to control for any interrelationships across these factors[6].

[6] There may be other factors that are particular to high grocery tax states like Oklahoma that shape whether there are grocery taxes and food insecurity.

DATA AND METHODS

Data

This study utilizes the Household Pulse Survey (HPS) Data to analyze the factors that are associated with food insecurity during the COVID-19 pandemic (U.S. Census Bureau 2022; Hermann and Cornelissen 2020). The HPS was created by the U.S. Census Bureau to gauge the effects of the pandemic on a wide range of outcomes as the pandemic progressed. These include basic social and demographic variables as well as variables related to food access and food insecurity, government assistance, childcare, vaccination rates, housing, anxiety, self-reported health, and health insurance[7]. The HPS also captures information about many of the stressors that have been linked to food insecurity issues such as poverty level and employment status (Pickett and Pearl 2001; Morton et al. 2005; Dixon and Richards 2016). These stressors have been exacerbated during the pandemic and have increased the state of persistent insecurity of households in ways that interact (Niles et al. 2020).

The HPS is a 20-minute online instrument that has been collected in Phases starting with Phase 1 on April 23, 2020, through Phase 3.6, which was released on October 17, 2022. Data collection will continue through October 31, 2023. The first

[7] The U.S. Census Bureau partnered with 12 federal agencies to disseminate this survey to measure the effects of COVID-19 quickly and consistently throughout the United States at the national level, the state level, and in 15 large metropolitan areas. These partnerships allow for more rapid and relevant data collection during the COVID-19 pandemic. The survey is called the "Interagency Federal Statistical Rapid Response Survey to Measure Household Experiences during the Coronavirus (COVID-19) Pandemic" (U.S. Census Bureau n.d., 2022), which reflects the collaboration between agencies that was undertaken for the design, content, and data collection strategies for the HPS. The survey is part of the Census Bureau's Experimental Data Products group that "may not meet all the requirements" of the typical U.S. Census Data collection (U.S. Census Bureau n.d., 2022). The U.S. Census Bureau typically has a rigorous, time-intensive process for creating and testing surveys, but the concession to speed-approve this survey was made for the benefit of getting real-time data that can be analyzed as the pandemic progressed. The benefit of the timely and consistent nature with which these data have been collected far outweighs any concerns about the design and nature of the data collection (Clapp and Mosely 2020). Full approval from the Office of Personnel Management (OPM) was received following Week 17 of data collection (August 31, 2020).

phase was collected as panel data but due to low response rates, the second phase and all subsequent phases followed a cross-sectional sampling frame. This could also be considered a longitudinal trend study which follows changes in specific characteristics measured over time. At the outset, data were collected weekly, but after Phase 1, the collection interval was increased to a two-week period. For consistency in the dataset, the HPS continues to reference these collection periods as "weeks". See Appendix Table 1 for exact dates of collection.

The mode of the Qualtrics survey included email and text, as it was expected that response rates to in-person or mail surveys would be too low. Email and text-administered surveys also support the timely collection of data for the HPS. Response rates for the weeks of the survey through October of 2022 range between 4.00% and 10.65%, with an average of a 7.10% response rate. Benefits to the electronic collection plan were implementation efficiency, cost, and timeliness of responses. Households were cross-referenced with addresses and available phone numbers and email addresses to ensure that data was connected correctly to one household per survey response. In the later survey collection phases, SMS texting was utilized and resulted in an improved response rate.

The sample design is a systematic sample of all eligible households in a defined sampling area as determined by the Census Bureau Master Address File (MAF). Sample sizes were chosen based on a 3% coefficient of variation so that the survey would be representative of at least 40% of each sampling area. The first sample was separated into three panels and each panel received up to three interviews before being phased out for a

new panel. This sampling design continued through all of Phase 1. Following Phase 1, independent samples were selected, and each household unit was interviewed only once.

To address the research questions, the HPS Public Use File (PUF) is used for weeks 13 through 50 of the survey collection corresponding to the date range of August 2020 to October 2022. This decision was made based on the shift in collection strategy from panel to cross-sectional after week 12 as well as the addition of new indicator variables at week 13 that are key for this analysis. Census data include stratification weights so that the data can be nationally representative at each survey administration date[8]. To utilize this weighting procedure for results with improved standard error, the dataset was merged for each week with the corresponding dataset provided that includes the weights found in the PUF on the HPS website. Following this, weekly datasets were compiled into one complete dataset including the merged data for each week, for a total of 38 weeks of data[9].

After accounting for missing data, the analytical sample from this cross-sectional survey contains N = 2,113,382 responses, with a corresponding representative sample size of n = 179,475,871[10]. To organize these data, this research creates a sub-population for the survey data including only those households who are not part of the Supplemental Nutritional Assistance Program, or SNAP. Participants in SNAP are exempt from paying grocery tax, so they are not included in this analysis. Following the weighting and

[8] Special thanks to David Hornick, Lead Scientist for National Crime and Victimization Survey and Current Population Survey Supplements in the Demographic Statistical Methods Division, Sample Design and Estimation at the U.S. Census Bureau for his patient and insightful help in applying the weighting procedure for this dataset.
[9] See Appendix Notes for STATA code and weighting explanation.
[10] This representative sample size is calculated with the weighting procedure for this dataset created by the U.S. Census Bureau's office of Demographic Statistical Methods Division.

creation of the sub-population, the data set contains N = 1,932,967 household responses, with a corresponding representative sample size of n = 153,966,800.

[INSERT TABLE 1]

Table 1 shows that overall, 35% of households report food insecurity. This table also provides the mean and standard deviation for all variables of interest in this study.

Using these data, this research analyzes the trends in food insecurity over time during the pandemic for racial/ethnic groups and considers how food insecurity may be patterned and shaped by tax policies. In addition, this research analyzes whether respondents living in states with grocery taxes experience a higher level of food insecurity compared with respondents in states without substantive grocery tax.

Dependent Variable

To address the effects of race and socioeconomic status on current food insecurity, the HPS asks, "Getting enough food can also be a problem for some people. In the last 7 days, which of these statements best describes the food eaten in your household? Select only one answer." The options are: (1) Enough of the kinds of food (I/we) wanted to eat, (2) Enough, but not always the kinds of food (I/we) wanted to eat, (3) Sometimes not enough to eat, (4) Often not enough to eat. For these analyses, responses are dichotomized based on supporting research that distinguishes between food secure (Option 1, reflecting enough food = 0) and food insecure (Options 2 through 4, reflecting not enough access to or quantity of food = 1) (Chilton et al. 2009; Niles et al. 2020). This coding design captures the insecurity – both the physical and economic access – to food. This measure for food insecurity which measures households that do not

have enough food as compared to those who do have enough food has been validated by previous research to appropriately reflect household food insecurity (Migotto et al. 2007; Tanaka, Engelhard, and Rabbitt 2020). This is the dependent, or outcome, variable as it measures changes in food insecurity in response to factors present during the COVID-19 pandemic in the United States. Current food insecurity may also have relationships with other variables that inform current policy issues.

Key Independent Variables

There are likely many factors that contribute to food insecurity and this study is a first step in understanding the sociological factors that contribute to changes in food insecurity during the pandemic (Clapp and Moseley 2020; Morton et al. 2005; Niles et al. 2020). With the focal issues of grocery taxation and race in mind, the primary indicators in this analysis are whether the state of residence has a grocery tax, the "week" the survey was taken, and the race of the respondent[11].

To model food insecurity by state of residence during the pandemic, the variable for state of residence (i.e., numbered alphabetically in a drop-down menu with all state options, including Washington, D.C.) is recoded as a binary variable. States are coded as 1, having a grocery tax, if the grocery tax equals the regular sales tax rate. States are coded as 0, not having a grocery tax, if the state does not levee grocery taxes or have a grocery tax that is adjusted substantially below the regular sales tax rate[12]. This

[11] The race variable in this dataset is problematic in that it refers to the race of the respondent, although the questions are meant to gather information about the entire household. Therefore, since households are not always monoracial, this is not a precise measurement.

[12] A sensitivity analysis was performed to confirm the choice to use the seven states that have grocery tax equal to their state sales tax, as opposed to any other combination of states (Kim 1984). See appendix Figure A1 and Figure A2 for sensitivity analysis results.

operationalization draws upon the conceptualizations of Guler (2019) and Zheng et al. (2021). Figure 1 provides more detailed information on grocery tax rates by state. States with grocery tax are Alabama, Hawaii, Idaho, Kansas, Mississippi, Oklahoma, and South Dakota[13].

To create a variable for time that corresponds to the calendar dates of data collection, the week variable, representing weeks 13 through 50, was recoded with exact date-stamps that correspond to the date of collection to make the analysis clearer. This results in a collection span of 131 total calendar weeks, with 38 collection points over the period of August 19, 2020, to October 17, 2022[14].

Race is captured in this dataset by the question "What is your race? Please select all that apply", and the options include "White, Alone" (1), "Black, Alone" (2), "Asian, Alone" (3), "Any other race alone, or race in combination" (4). Ethnicity is partially captured by the survey question, "Are you of Hispanic, Latino, or Spanish origin?", with the option of "No, not of Hispanic, Latino, or Spanish origin" (1) or "Yes, of Hispanic, Latino, or Spanish origin" (2). Race is a social construct with powerful contextual effects (Bowen, Elliott, and Hardison-Moody 2021). Greater specificity within this variable to include Hispanic ethnicity in addition to the race categories may offer insight into current food insecurity. To utilize this demographic information, the race and Hispanic variables are recoded to combine them into the following categories: "White, non-Hispanic" (1), "Black, non-Hispanic" (2), "Hispanic" (3), "Asian, non-Hispanic" (4), and "Other, non-Hispanic" (5), with White, non-Hispanic as the comparison group (Harnois 2017; Liebler and Halpern-Manners 2008; Wolfson and Leung 2020).

[13] See Figure 1 for further state and tax rate information.
[14] See Appendix Table 1 for specific dates.

Control Variables

In all models, factors that have been shown to contribute to food insecurity in the United States are included as control variables (Burchi and De Muro 2016). Tenure is used as a proxy for household wealth (Zavisca and Gerber 2016). Tenure, the conditions in which the household members hold or occupy their place of residence, is captured in the dataset by the question "Is your house or apartment…? Select only one answer.". The options include "Owned by you or someone in this household free and clear?" (1), "Owned by you or someone in this household with a mortgage or loan (including home equity loans)?" (2), "Rented?" (3), "Occupied without payment of rent?" (4). I dichotomized this variable into "Owned" (coded 1 2 = 0), and "Rented" (coded 3 4 = 1) (Zavisca and Gerber 2016).

The categorical variable for income is included to control for socioeconomic differences because prior research has found a relationship between income and food insecurity (Morton et al. 2005). The survey asks: In 2019[15] what was your total household income before taxes? Select only one answer." The options are "Less than $25,000" (1), "$25,000 - $34,999" (2), "$35,000 - $49,999" (3), "$50,000 - $74,999" (4), "$75,000 - $99,999" (5), "$100,000 - $149,999" (6), "$150,000 - $199,999" (7), and "$200,000 and above" (8).

Drawing on the literature that shows that greater educational attainment results in greater socioeconomic status and lower food insecurity (Zajacova and Lawrence 2018), an indicator for educational attainment is included. The survey asks, "What is the highest

[15] Wording for the survey question about income changes during the survey administration to refer to the household income for the year prior to the survey date. For example, the survey questionnaire in October of 2022 asks for the 2021 total household income.

degree or level of school you have completed? Select only one answer." Options include "Less than high school" (1), "Some high school" (2), "High school graduate or equivalent (for example GED)" (3), "Some college, but degree not received or is in progress" (4), "Associate's degree (for example AA, AS)" (5), "Bachelor's degree (for example BA, BS, AB)" (6), and "Graduate degree (for example master's, professional, doctorate)" (7). This variable is recoded to: "Less than high school" (1), "Some high school" (2), and "High school graduate or equivalent (for example GED)" (3) into "High School or less" (1 2 3 = 1). This variable is also recoded to: Associate's Degree (for example AA, AS)" (5) and "Bachelor's Degree (for example BA, BS, AB)" into Some College/Associate's Degree (4 5 = 2), followed by Bachelor's Degree (6 = 3) and Graduate Degree (7 = 4).

To account for the documented connection between employment status and food insecurity, an indicator is included for current employment status that denotes whether the respondent has had a change in work status in the last four weeks (Bowen, Elliott, and Hardison-Moody 2021). This is captured by the HPS question which asks, "Now we are going to ask about your employment. In the last 7 days, did you do ANY work for either pay or profit? Select only one answer." The options are yes (1) and no (2), which were recoded to create a comparison group of respondents who worked in the last seven days (coded 0) and those who did not work (coded 1).

Family structure, including the number of children in the household as well as the total number in the household have been shown to influence food insecurity (Coleman-Jensen et al. 2021). For this reason, an indicator for total number of people in the household and whether children are present in the household has been included. The HPS asks respondents the total number of people in their household by asking "How many

total people – adults and children– currently live in your household, including yourself? Please enter a number." The options collected are whole numbers one through ten. This variable is recoded into household numbers up to six, while household numbers seven through ten are collapsed into one category based on the number of respondents in those categories with one as the comparison group. Total number of children in the household is captured by asking "How many people under 18-years old currently live in your household? Please enter a number." The options are whole numbers from one through five or more, with zero as the comparison group. This variable is recoded as a binary variable to indicate whether there are children present in the household (0 = 0, else = 1).

Marital status is included as another demographic control because prior research finds that there is a relationship between marital status and food insecurity (Lee, Shin, and Kim 2020). Marital status options are presented as "Now married" (1), "Widowed" (2), "Divorced" (3), "Separated" (4), and "Never married" (5) and the question asked is "What is your marital

status? Select only one answer." Marital status is recoded as: Married (1 = 1), Previously Married (2 3 4 = 2), and Never Married/Single (5 =3), with married as the comparison group.

This study includes these demographic and socioeconomic variables discussed above, because they have been included in other analyses and have been shown to have powerful and important effects on household functioning. Using these control variables in the logistic regression models will allow us to control for underlying relationships across the demographic and socioeconomic variables included in this analysis.

Analytical Strategy

To model the Household Pulse Survey Data, logistic regression models are used in which a positive coefficient of a key independent variable can be interpreted as being associated with a higher probability of current food insecurity:

$$log\left(\begin{matrix} y \\ 1-y \end{matrix}\right) = \alpha + \beta 1_{state} + \beta 2_{week} + \beta 3_{race} + \beta 4_{interactions} + \beta 5_{controls}$$

Drawing upon the methodology of Long and Freese (2014) the logistic regression equation shows y as the indicator for food insecurity. State is a variable for the tax status in the state of residence, captured in the $\beta 1$ vector. Week is a variable for the date of data collection and the $\beta 2$ coefficient captures trends in outcomes over time. Race is a vector that contains the race indicators with the corresponding regression coefficients captured in the $\beta 3$ vector. To see if the relationships between grocery tax status in the state of residence and other variables change over time, models with interactions between the key independent variables are included. These trends are captured in the $\beta 4$ vector of coefficients. The $\beta 5$ vector of coefficients shows the effect of the control variables on current food insecurity. Finally, α is intercept for these models.

For the primary research question modeling the effects of racial-ethnic group over time on current food insecurity, Model 1 includes the multivariate relationship between current food insecurity predicted by states with grocery tax, week of survey, and race, while controlling for background demographic and socioeconomic variables. Model 2 includes the multivariate relationships in Model 1 in addition to the relationship between current food insecurity and an interaction between the state of residence and the week of the survey. Model 3 includes the multivariate relationships in Model 1 in addition to the

relationship between current food insecurity and an interaction term between the state of residence and the race of the respondent. All controls are included in all models.

RESULTS

Table 2 presents results from the logistic regression models predicting current food insecurity. In Model 1, the analysis shows that, as compared to white respondents, Black respondents have 0.399 higher log odds of reporting food insecurity. Hispanic respondents have 0.369 higher log odds, Asian respondents have 0.164 higher log odds, and respondents of "Other" race have 0.487 higher log odds of reporting food insecurity. This reveals that all racial-ethnic categories report higher log odds of food insecurity than their white counterparts. In addition to this, respondents in states with grocery taxes report 0.110 higher log odds of food insecurity.

[INSERT TABLE 2]

From the predicted probabilities for these main line effects (results not shown), those in states with grocery taxes report 37% food insecurity as compared to 35% food insecurity for those in states without grocery taxes. White respondents report 32% food insecurity as compared to the significantly higher predicted probabilities reported for Black respondents (40%), Hispanic respondents (39%), Asian respondents (35%), and Other respondents (41%).

Model 2 includes the interaction between the state and week of the survey; this is unwieldy to report here in the main regression table, because the week variable is treated as a categorical variable rather than a continuous variable[16]. To make these changes in

[16] See Table 2 for complete regression results.

food insecurity during the pandemic clearer, Figure 2 shows the trend in respondents' food insecurity by week of the survey during the COVID-19 pandemic separately for states with and without grocery taxation.

[INSERT FIGURE 2]

Figure 2 shows this interaction between states with grocery taxes and the week of the survey; respondents in states with grocery tax report higher food insecurity than those in states with no grocery tax. At Week 34, which corresponds to December of 2020, food insecurity was lowest during the pandemic for all respondents and then began a somewhat steady increase. It is important to note here that in December of 2020 the Consolidated Appropriations Act of 2021 was approved as a response to the financial needs of Americans at that time. This was one of the largest and longest spending bills ever to be passed to benefit the American people during the pandemic era. It prevented a government shutdown at the time, and far surpassed the original CARES Act of 2020 in total amount of money allocated for relief. The lowest food insecurity is reported near April of 2021. Building on the Consolidated Appropriations Act, the American government created the American Rescue Plan Act of 2021 on March 11, 2021. This measure sought to address the economic recession that was unfolding, as well as to speed up the COVID-19 recovery of Americans in many ways. Following the survey date in April of 2021, a relatively steady increase in food insecurity is observed for all respondents, although those in states with grocery tax consistently report higher levels of food insecurity. It is interesting to note that relative food insecurity shifts for all Americans were similar until early 2021, when a gap appears between those in states with grocery taxes and those without (Figure 2). This gap becomes evident around the time

that the American Rescue Plan payments issued by the IRS were being received by American households[17], and this gap remains through October of 2022, the final week for which data were available for this analysis.

Overall, Figure 2 provides evidence that the increase in food insecurity continues while the gap between those in states with grocery taxes and those in states without taxes is maintained over the period from January 2021 through October 2022[18]. These results support this research's supposition that the race of the respondent and whether the respondent pays grocery tax affects food insecurity for Americans during the COVID-19 pandemic era.

To examine this relationship, Model 3 of Table 2 tests for the interaction between the race of the respondent and whether the respondent pays a state grocery tax. The interaction in Model 3 shows that Black respondents in states with grocery taxes have 0.075 higher log odds of reporting food insecurity as compared to white respondents in states without grocery taxes. Hispanic respondents in states with grocery taxes have 0.121 lower log odds and Asian respondents in states with grocery tax have 0.125 lower log odds of reporting food insecurity compared to white respondents living in states with grocery taxes.

[INSERT FIGURE 3]

Figure 3 shows the comparison between the predicted probabilities for those in states with grocery tax and those in states without grocery tax by race. For those in states

[17] March 12, 2021.
[18] The CARES ACT included payments of up to $1200 per adult and $500 per child (based on adj. gross income) in March of 2020. The Consolidated Relief Act of 2021 included payments of up to $600 per adult and $600 per child in December of 2020. The American Rescue Plan Act of 2021 included payments of $1400 for individuals and $2800 for married couples filing jointly, plus $1400 for each qualifying dependent, including adult dependents in March of 2021.

with grocery tax, the predicted probability of reporting food insecurity is highest for white, Black and Other race respondents, while Hispanic and Asian respondents in states with grocery tax have lower predicted probabilities of food insecurity than those in states with grocery tax; this is a positive difference in the predicted probability of reporting food insecurity. This is surprising, given the results of our previous models interacting race and state grocery tax status. This may be related to the region of the country in which the states that have grocery taxes are located and warrants further analysis.

[INSERT FIGURE 4]

Figure 4 presents the difference in the predicted probabilities across race for those with taxes minus those without taxes, calculated using the marginal results presented in Figure 3. White respondents have a significant 2.2% difference in the predicted probability of reporting food insecurity, while Black respondents have a significant 3.8% difference in the predicted probability of reporting food insecurity. This provides evidence to show that being a Black or white resident of a state with grocery tax translates into a higher propensity for reporting food insecurity. The difference in the predicted probability of reporting food insecurity is insignificant for Hispanic, Asian, and Other respondents. For these respondents, living in a state with grocery tax does not necessarily translate into greater food insecurity.

Further interpreting Model 3, the full model, women are less food secure than men, and the previously married and/or single are less food secure than those who are married. In addition to this, an increase in the number living in a household results in an increase in the predicted probability of food insecurity, and those with children in the home are less food secure during the pandemic. Turning to socioeconomic status, those

with more education, higher income, employment, and home ownership are more food secure during the pandemic, all else being equal.

DISCUSSION AND CONCLUSIONS

The goal of this research was to determine the effects of grocery taxation and race on food insecurity during the pandemic, and to analyze these trends considering government economic actions that were meant to provide relief for Americans. This statistical analysis finds higher levels of food insecurity are found in states that charge grocery tax, and that these effects are significantly different for Black and White respondents. On the other hand, Hispanic, Asian, and Other respondents do not reflect significant differences in food insecurity in states with grocery taxes as compared to those in states without grocery taxes. This research also finds that, despite legislation meant to mitigate hardship for Americans, the gap in food insecurity between those who pay grocery tax and those who do not pay grocery tax remains.

Although this novel dataset is profoundly helpful in modeling food insecurity in real time, it does present some challenges. Changes to data collection and variables included in the dataset limit the scope of the research questions that can be addressed quantitatively. The early weeks of the COVID-19 quarantine period are not included, and it is during these weeks that Bauer (2020) reports that food insecurity was at its height for households across the United States, and food insecurity was dramatically higher for households with children.

The race and ethnicity questions in this survey have changed over the course of the survey to reflect the appropriate need for finer detail in this category, but these

changes took quite some time to implement. To include as much of the pandemic in this analysis as possible, this research uses the original race/ethnicity variables. It would be helpful to re-analyze this dataset using a racial-ethnicity category that includes Indigenous peoples, for example. Research shows that there are higher rates of food insecurity for Indigenous populations than the national average, and several of the states used in this analysis have substantial Indigenous populations (Pindus and Hafford 2019). Oklahoma and South Dakota rank second and fourth, respectively, on the highest state-level number of Native Americans. Idaho ranks eleventh out of all fifty states. The levels of current food insecurity may be captured in the "Other" race/ethnicity category in this analysis, but further specificity in this variable could change the way food insecurity is understood during the pandemic, and the effects of COVID-relief measures across racial categories.

The shifts in food insecurity seem to relate to the COVID-relief and stimulus packages that have been passed throughout the past two years. Future research should analyze the change in food insecurity in greater detail during the pandemic considering these documented COVID-relief policy measures.

Overall, the shifts in food insecurity that are observed during the COVID-19 pandemic support further consideration of abolishing or shifting the policies surrounding grocery tax for those states that still depend on a grocery tax for local and state-level funding. The findings from this research reveal that food insecurity is higher for those who are non-white, and that this trend is unchanged from reports prior to the COVID-19 pandemic. Previous research has also shown that an increasing number of Hispanic members of the population is associated with more regressive tax systems, and that the

racial composition of communities may be associated with preferences for taxation (O'Brien 2017). This suggests that racial composition may be a determinant of decision-making surrounding grocery taxation and prompts a call for further research in this area.

Grocery taxes are affecting the food insecurity of Americans. An historical perspective on food crises and the policies that have attempted to address the issue leaves us with the same food insecurity trends in states with grocery taxes and by race that have been seen in the past (Zheng et al. 2021). This disappointing legacy of poor policy responses inspires continued work to analyze and report the effects of policies on food insecurity as quickly as possible to divert policy efforts into more effective channels (Clapp and Moseley 2020). Despite the reality of policies that seem to perpetuate patterned oppression, many local neighborhoods and communities have responded to the needs of their people with resiliency, creativity, grit, and determination (Oswin and Ramirez 2015; Reese 2019; White 2011).

Returning to Figure 1, several of the states that still have grocery tax are currently considering ways to address the regressive nature of this type of tax. Some policymakers believe that the regressive nature of grocery taxation can be offset by a grocery tax credit for those in the lowest income quintile, which is one of the ways Idaho has attempted to address this issue (Konish 2022). Kansas is phasing the grocery tax out over several years, although the details of this process continue to be debated (Wallington 2022; Phillips and Wallington 2023). Oklahoma and Mississippi have unsuccessfully proposed the removal of the grocery sales tax, while the proposal for a complete removal of the grocery tax is still on the docket in South Dakota. Local governments depend on these

taxes for funding programs that may benefit those in the lowest earning quintile and so removal of the tax is a complex and challenging proposition.

Abolishing this tax is not an easy answer. Still, this research provides evidence that the *price of food is not right* for those in poverty. Food insecurity is felt disproportionately by those who live in states with grocery taxes and by Black households, all else being equal. This research therefore provides evidence to affirm that eliminating a tax on groceries is a step in the right direction to ameliorate economic and racial inequities in the larger context of food insecurity.

REFERENCES

Anderson, Kym, Maros Ivanic, and Will Martin. 2013. *Food Price Spikes, Price Insulation, and Poverty*. Washington, DC: World Bank. doi: 10.1596/1813-9450-6535.

Bauer, Lauren. 2020. "The COVID-19 Crisis Has Already Left Too Many Children Hungry in America." *Brookings*. Retrieved October 21, 2022 (https://www.brookings.edu/blog/up-front/2020/05/06/the-covid-19-crisis-has-already-left-too-many-children-hungry-in-america/).

Birkenmaier, Julie, Jin Huang, and Youngmi Kim. 2016. "Food Insecurity and Financial Access during an Economic Recession: Evidence from the 2008 SIPP." *Journal of Poverty* 20(2):194–213. doi: 10.1080/10875549.2015.1094767.

Bowen, Sarah, Sinikka Elliott, and Annie Hardison-Moody. 2021. "The Structural Roots of Food Insecurity: How Racism Is a Fundamental Cause of Food Insecurity." *Sociology Compass* 15(7):e12846. doi: 10.1111/soc4.12846.

Burchi, Francesco, and Pasquale De Muro. 2016. "From Food Availability to Nutritional Capabilities: Advancing Food Security Analysis." *Food Policy* 60:10–19. doi: 10.1016/j.foodpol.2015.03.008.

Caspi, Caitlin Eicher, Jennifer E. Pelletier, Lisa Harnack, Darin J. Erickson, and Melissa N. Laska. 2016. "Differences in Healthy Food Supply and Stocking Practices between Small Grocery Stores, Gas-Marts, Pharmacies and Dollar Stores." *Public Health Nutrition* 19(3):540–47. doi: 10.1017/S1368980015002724.

Chilton, Mariana, Maureen M. Black, Carol Berkowitz, Patrick H. Casey, John Cook, Diana Cutts, Ruth Rose Jacobs, Timothy Heeren, Stephanie Ettinger de Cuba, Sharon Coleman, Alan Meyers, and Deborah A. Frank. 2009. "Food Insecurity and Risk of Poor Health Among US-Born Children of Immigrants." *American Journal of Public Health* 99(3):556–62. doi: 10.2105/AJPH.2008.144394.

Clapp, Jennifer, and William G. Moseley. 2020. "This Food Crisis Is Different: COVID-19 and the Fragility of the Neoliberal Food Security Order." *The Journal of Peasant Studies* 47(7):1393–1417. doi: 10.1080/03066150.2020.1823838.

Coleman-Jensen, Alisha, Matthew P. Rabbitt, Christian A. Gregory, and Anita Singh. 2021. "Household Food Security in the United States in 2021." 51.

Cooksey Stowers, Kristen, Qianxia Jiang, Abiodun T. Atoloye, Sean Lucan, and Kim Gans. 2020. "Racial Differences in Perceived Food Swamp and Food Desert Exposure and Disparities in Self-Reported Dietary Habits." *International Journal of Environmental Research and Public Health* 17(19):7143. doi: 10.3390/ijerph17197143.

Corcoran, Mary P. 2021. "Beyond 'Food Apartheid': Civil Society and the Politicization of Hunger in New Haven, Connecticut." *Urban Agriculture & Regional Food Systems* 6(1):e20013. doi: 10.1002/uar2.20013.

Diez Roux, Ana V. 2003. "Residential Environments and Cardiovascular Risk." *Journal of Urban Health* 80(4):569–89. doi: 10.1093/jurban/jtg065.

Diez-Roux, Ana V., F. Javier Nieto, Laura Caulfield, Hermann A. Tyroler, Robert L. Watson, and Moyses Szklo. 1999. "Neighbourhood Differences in Diet: The Atherosclerosis Risk in Communities (ARIC) Study." *Journal of Epidemiology and Community Health (1979-)* 53(1):55–63.

Dixon, Jane, and Carol Richards. 2016. "On Food Security and Alternative Food Networks: Understanding and Performing Food Security in the Context of Urban Bias." *Agriculture and Human Values* 33(1):191–202. doi: 10.1007/s10460-015-9630-y.

Frohlich, Katherine L., Ellen Corin, and Louise Potvin. 2001. "A Theoretical Proposal for the Relationship between Context and Disease." *Sociology of Health & Illness* 23(6):776–97. doi: 10.1111/1467-9566.00275.

Gelman, Andrew. 2007. "Struggles with Survey Weighting and Regression Modeling." *Statistical Science* 22(2). doi: 10.1214/088342306000000691.

Guler, Selen. 2019. "The Good, the Bad, and the Taxed: How Taxes Shape Morals in Markets." Master's, University of Washington, United States -- Washington. https://soc.washington.edu/research/graduate/good-bad-and-taxed-how-taxes-shape-morals-markets.

Gundersen, Craig, and James P. Ziliak. 2018. "Food Insecurity Research in the United States: Where We Have Been and Where We Need to Go." *Applied Economic Perspectives and Policy* 40(1):119–35. doi: 10.1093/aepp/ppx058.

Harnois, Catherine E. 2017. *Analyzing Inequalities: An Introduction to Race, Class, Gender, and Sexuality Using the General Social Survey*. 1st edition. Los Angeles: Sage Publications, Inc.

Hermann, Alexander, Cornelissen, Sharon. 2020. "Using the Census Bureau's Household Pulse Survey to Assess the Economic Impacts of COVID-19 on America's Households." *Joint Study for Housing Studies of Harvard University*.

Holt-Giménez, Eric, and Yi Wang. 2011. "Reform or Transformation? The Pivotal Role of Food Justice in the U.S. Food Movement." *Race/Ethnicity: Multidisciplinary Global Contexts* 5(1):83–102. doi: 10.2979/racethmulglocon.5.1.83.

IRS.gov. "Coronavirus Tax Relief and Economic Impact Payments | Internal Revenue Service." Retrieved December 8, 2022 (https://www.irs.gov/coronavirus-tax-relief-and-economic-impact-payments).

Jann, Ben. 2021. "MGOF: Stata Module to Perform Goodness-of-Fit Tests for Multinomial Data." *Statistical Software Components*.

Judkins, David R. 1990. "Fay's Method for Variance Estimation." *Journal of Official Statistics* 6(3):223.

Kaiser, Michelle L., and Joan Hermsen. 2015. "Food Acquisition Strategies, Food Security, and Health Status among Families with Children Using Food Pantries." *Families in Society* 96(2):83–90. doi: 10.1606/1044-3894.2015.96.16.

Kim, Jae-On. 1984. "An Approach to Sensitivity Analysis in Sociological Research." *American Sociological Review* 49(2):272–82. doi: 10.2307/2095576.

Kimbro, Rachel T., Justin T. Denney, and Sarita Panchang. 2012. "Individual, Family, and Neighborhood Characteristics and Children's Food Insecurity." 3.

Lavallée, Pierre, and Jean-François Beaumont. 2015. "Why We Should Put Some Weight on Weights." *Survey Methods: Insights from the Field (SMIF)*. doi: 10.13094/SMIF-2015-00001.

Lee, Jung Woo, Woo-Kyoung Shin, and Yookyung Kim. 2020. "Impact of Sex and Marital Status on the Prevalence of Perceived Depression in Association with Food Insecurity." *PLOS ONE* 15(6):e0234105. doi: 10.1371/journal.pone.0234105.

Leroy, Jef L., Marie Ruel, Edward A. Frongillo, Jody Harris, and Terri J. Ballard. 2015. "Measuring the Food Access Dimension of Food Security: A Critical Review and Mapping of Indicators." *Food and Nutrition Bulletin* 36(2):167–95. doi: 10.1177/0379572115587274.

Liebler, Carolyn A., and Andrew Halpern-Manners. 2008. "A Practical Approach to Using Multiple-Race Response Data: A Bridging Method for Public-Use Microdata." *Demography* 45(1):143–55.

Lisic, Jonathan J., and Omolola E. Ojo. n.d. "Application of Fay's Method for Variance Estimation in the National Compensation Survey Benefits Products October 2008." 6.

Long, J. Scott, and Jeremy Freese. 2014. *Regression Models for Categorical Dependent Variables Using Stata*. College Station, TX, US: Stata Press.

Long, J. Scott, and Sarah A. Mustillo. 2021. "Using Predictions and Marginal Effects to Compare Groups in Regression Models for Binary Outcomes." *Sociological Methods & Research* 50(3):1284–1320. doi: 10.1177/0049124118799374.

Loopstra, Rachel, and Valerie Tarasuk. 2013. "Severity of Household Food Insecurity Is Sensitive to Change in Household Income and Employment Status among Low-Income Families." *The Journal of Nutrition* 143(8):1316–23. doi: 10.3945/jn.113.175414.

Pindus, Nancy, and Carol Hafford. 2019. "Food Security and Access to Healthy Foods in Indian Country: Learning from the Food Distribution Program on Indian Reservations." *Journal of Public Affairs (14723891)* 19(3). doi: 10.1002/pa.1876.

Migotto, Mauro, Benjamin Davis, Calogero Carletto, and Kathleen Beegle. 2007. "2 Measuring Food Security Using Respondents' Perception of Food Consumption Adequacy." P. 0 in *Food Security: Indicators, Measurement, and the Impact of Trade Openness*, edited by B. Guha-Khasnobis, S. S. Acharya, and B. Davis. Oxford University Press.

Moore, Latetia V., and Ana V. Diez Roux. 2006. "Associations of Neighborhood Characteristics with the Location and Type of Food Stores." *American Journal of Public Health* 96(2):325–31. doi: 10.2105/AJPH.2004.058040.

Morton, Lois Wright, Ella Annette Bitto, Mary Jane Oakland, and Mary Sand. 2005. "Solving the Problems of Iowa Food Deserts: Food Insecurity and Civic Structure*." *Rural Sociology* 70(1):94–112. doi: 10.1526/0036011053294628.

Murdoch, Jonathan, Terry Marsden, and Jo Banks. 2000. "Quality, Nature, and Embeddedness: Some Theoretical Considerations in the Context of the Food Sector." *Economic Geography* 76(2):107–25. doi: 10.2307/144549.

NCSL.org. "National Employment Monthly Update." Retrieved March 10, 2022 (https://www.ncsl.org/research/labor-and-employment/national-employment-monthly-update.aspx).

Niles, Meredith T., Farryl Bertmann, Emily H. Belarmino, Thomas Wentworth, Erin Biehl, and Roni Neff. 2020. "The Early Food Insecurity Impacts of COVID-19." *Nutrients* 12(7):2096. doi: 10.3390/nu12072096.

National Institute on Minority Health and Health Disparities. nih.gov. 2023. "Food Accessibility, Insecurity and Health Outcomes." *NIMHD*. Retrieved March 1, 2023 (https://www.nimhd.nih.gov/resources/understanding-health-disparities/food-accessibility-insecurity-and-health-outcomes.html).

O'Brien, Rourke L. 2017. "Redistribution and the New Fiscal Sociology: Race and the Progressivity of State and Local Taxes." *American Journal of Sociology* 122(4):1015–49. doi: 10.1086/690118.

Oswin, Natalie, and Margaret Marietta Ramirez. 2015. "The Elusive Inclusive: Black Food Geographies and Racialized Food Spaces." *Antipode* 47(3):748–69. doi: 10.1111/anti.12131.

Phelan, Jo C., Bruce G. Link, and Parisa Tehranifar. 2010. "Social Conditions as Fundamental Causes of Health Inequalities: Theory, Evidence, and Policy Implications." *Journal of Health and Social Behavior* 51 Suppl:S28-40. doi: 10.1177/0022146510383498.

Pickett, K. E., and M. Pearl. 2001. "Multilevel Analyses of Neighbourhood Socioeconomic Context and Health Outcomes: A Critical Review." *Journal of Epidemiology and Community Health* 55(2):111. doi: 10.1136/jech.55.2.111.

Powell, Lisa M., Sandy Slater, Donka Mirtcheva, Yanjun Bao, and Frank J. Chaloupka. 2007. "Food Store Availability and Neighborhood Characteristics in the United States." *Preventive Medicine* 44(3):189–95. doi: 10.1016/j.ypmed.2006.08.008.

Poblacion, Ana, Stephanie Ettinger de Cuba, and John T. Cook. 2021. "Comparing Food Security Before and During the COVID-19 Pandemic: Considerations When Choosing Measures." *Journal of the Academy of Nutrition and Dietetics* 121(10):1945–47. doi: 10.1016/j.jand.2021.06.004.

Reese, Ashanté M. "Black Food Geographies" *University of North Carolina Press*. Retrieved November 30, 2021 (https://uncpress.org/book/9781469651507/black-food-geographies/).

Rehm, Colin D., José L. Peñalvo, Ashkan Afshin, and Dariush Mozaffarian. 2016. "Dietary Intake Among US Adults, 1999-2012." *JAMA* 315(23):2542–53. doi: 10.1001/jama.2016.7491.

Shannon, Jerry. 2014. "Food Deserts: Governing Obesity in the Neoliberal City." *Progress in Human Geography* 38(2):248–66. doi: http://dx.doi.org/10.1177/0309132513484378.

Sullivan, Daniel Monroe. 2014. "From Food Desert to Food Mirage: Race, Social Class, and Food Shopping in a Gentrifying Neighborhood." *Advances in Applied Sociology* 04(01):30–35. doi: 10.4236/aasoci.2014.41006.

Sun, Alexander, Paul A. Parker, and Scott H. Holan. 2022. "Analysis of Household Pulse Survey Public-Use Microdata via Unit-Level Models for Informative Sampling." *Stats* 5(1):139–53. doi: 10.3390/stats5010010.

Tanaka, Victoria T., George Engelhard, and Matthew P. Rabbitt. 2020. "Using a Bifactor Model to Measure Food Insecurity in Households with Children." *Journal of Family and Economic Issues* 41(3):492–504. doi: 10.1007/s10834-020-09686-9.

The White House. n.d. "American Rescue Plan." *The White House*. Retrieved February 9, 2023 (https://www.whitehouse.gov/american-rescue-plan/).

Thibodeaux, Jarrett. 2016. "City Racial Composition as a Predictor of African American Food Deserts." *Urban Studies* 53(11):2238–52. doi: 10.1177/0042098015587848.

Thomhave, Kalena, Natalie Shure, Natalie Shure, Siva Vaidhyanathan, Moustafa Bayoumi, and Mallory McMorrow. 2022. "How Red States Use Regressive Grocery Taxes to Feed the Rich." *The New Republic*, August 23.

US Census Bureau. n.d. "Household Pulse Survey: Measuring Social and Economic Impacts during the Coronavirus Pandemic." *Census.Gov*. Retrieved March 10, 2022 (https://www.census.gov/householdpulse).

USDA ERS. "USDA ERS - Food Security and Nutrition Assistance." Retrieved April 7, 2022 (https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-security-and-nutrition-assistance/).

Wallington, Natalie. 2022. "What to Know about Kansas' Food Tax Elimination Plan | The Kansas City Star." Retrieved December 10, 2022 (https://www.kansascity.com/news/politics-government/article260904887.html).

Wallington, Natalie, and Kynala Phillips. 2023. "New Year, Lower Food Tax in Kansas. Here's What the Cut Means for Your Grocery Bill." *The Kansas City Star*. Retrieved February 15, 2023 (https://www.kansascity.com/news/state/kansas/article270709117.html).

White, Monica M. 2011. "Sisters of the Soil: Urban Gardening as Resistance in Detroit." *Race/Ethnicity: Multidisciplinary Global Contexts* 5(1):13–28. doi: 10.2979/racethmulglocon.5.1.13.

Wilson, Norbert L. W., Yuqing Zheng, Shaheer Burney, and Harry M. Kaiser, eds. 2016. *Do Grocery Food Sales Taxes Cause Food Insecurity?*

Wolfson, Julia A., and Cindy W. Leung. 2020. "Food Insecurity and COVID-19: Disparities in Early Effects for US Adults." *Nutrients* 12(6):1648. doi: 10.3390/nu12061648.

Zajacova, Anna, and Elizabeth M. Lawrence. 2018. "The Relationship between Education and Health: Reducing Disparities through a Contextual Approach." *Annual Review of Public Health* 39:273–89. doi: 10.1146/annurev-publhealth-031816-044628.

Zavisca, Jane R., and Theodore P. Gerber. 2016. “The Socioeconomic, Demographic, and Political Effects of Housing in Comparative Perspective.” *Annual Review of Sociology* 42:347–67. doi: 10.1146/annurev-soc-081715-074333.

Zheng, Yuqing, Jianqiang (Jason) Zhao, Steven Buck, Shaheer Burney, Harry M. Kaiser, and Norbert L. Wilson. 2021. “Putting Grocery Food Taxes on the Table: Evidence for Food Security Policy-Makers.” *Food Policy* 101:102098. doi: 10.1016/j.foodpol.2021.102098.

Tables and Figures

Table 1. Summary Statistics of Variables of Interest

	Mean	*SD*
Current Food Insecurity		
Enough of All Kinds of Food	0.650	0.477
Not Enough of All Kinds of Food	0.350	0.477
State of Residence		
No Grocery Taxation	0.948	0.223
With Grocery Taxation	0.052	0.223
Week of Survey	√	√
Race/Ethnicity		
White Alone	0.657	0.475
Black Alone	0.102	0.302
Hispanic Alone	0.153	0.360
Asian Alone	0.050	0.219
Other	0.037	0.190
Gender		
Male	0.482	0.450
Female	0.518	0.450
Marital Status		
Married	0.574	0.495
Previously Married	0.187	0.390
Never Married/Single	0.240	0.427
Total Number in Household		
1	0.089	0.284
2	0.341	0.474
3	0.199	0.399
4	0.182	0.386
5	0.097	0.297
6	0.046	0.210
7	0.046	0.209
Children Present in Household		
No Children Present	0.664	0.472
1 or more Children Present	0.336	0.472
Educational Attainment		
High School or Some Equivalent	0.354	0.478
Some College or Associate's Degree	0.305	0.460
Bachelor's Degree	0.187	0.390
Graduate Degree	0.155	0.361
Household Income		
Income less than $25,000	0.145	0.352
Income $25,000-$34,999	0.113	0.316
Income $35,000-$49,999	0.125	0.331
Income $50,000-$74,999	0.177	0.381
Income $75,000-$99,999	0.133	0.340
Income $100,000- $149,000	0.155	0.362
Income $150,000- $199,999	0.072	0.258
Income $200,000 and above	0.081	0.272
Change in Work Status in the Last Four Weeks		

Yes work for pay or profit	0.591	0.492
No work for pay or profit	0.409	0.492
Tenure		
Housing Owned	0.702	0.458
Housing Rented	0.298	0.458
Total Number of Observations (N)	2,113,382	
Population Size Represented by Weighting	179,475,871	

Source: Household Pulse Survey Data: U.S. Census Bureau (2022)
√ : This analysis includes 38 weeks of administration, which tells us that each week makes up ≈2.63% of the total weighted sample, on average.
To be clear, these descriptive statistics were created following the weighting procedure for the dataset, as explained in the STATA manual and in accordance with the HPS data dictionary.

Table 2. Logistic Regression Predicting Food Insecurity by States with Grocery Tax, Week of Survey, and Race

	Model 1		Model 2		Model 3	
	β	*(SE)*	*β*	*(SE)*	*β*	*(SE)*
Indicator Variables						
States With Grocery Tax at Regular Sales Tax Rate	0.110***	0.01	0.053	0.04	0.120***	0.01
Week of Survey *(Ref. Week 18)*	√	√	√	√	√	√
Race/Ethnicity *(Ref. White, non-Hispanic)*						
Black, non-Hispanic	0.399***	0.01	0.399***	0.01	0.394***	0.01
Hispanic	0.369***	0.01	0.369***	0.01	0.372***	0.01
Asian, non-Hispanic	0.164***	0.02	0.164***	0.02	0.171***	0.02
Other, non-Hispanic	0.487***	0.02	0.487***	0.02	0.494***	0.02
Interactions						
States with Grocery Tax at Regular Sales Tax Rate x Week of Survey			√	√		
States With Grocery Tax at Regular Sales Tax Rate x Race *(Ref. States With No Tax x White)*						
x Black					0.075*	0.04
x Hispanic					-0.121**	0.04
x Asian					-0.125*	0.06
x Other					-0.055	0.04
Demographic and Socioeconomic Control Variables						
Gender *(Ref. Male)*						
Female	0.058***	0.01	0.058***	0.01	0.058***	0.01
Marital Status *(Ref. Married)*						
Previously Married	0.114***	0.01	0.114***	0.01	0.114***	0.01
Never Married/Single	0.049***	0.01	0.049***	0.01	0.049***	0.01
Total Number in Household *(Ref. 1)*						
2	0.206***	0.01	0.206***	0.01	0.206***	0.01
3	0.543***	0.01	0.543***	0.01	0.543***	0.01
4	0.655***	0.02	0.655***	0.02	0.654***	0.02
5	0.809***	0.02	0.809***	0.02	0.809***	0.02
6	0.876***	0.02	0.876***	0.02	0.876***	0.02
7 or more	0.881***	0.03	0.881***	0.03	0.881***	0.03
Children Present in Household *(Ref. None)*						
1 or more Children Present	0.158***	0.01	0.158***	0.01	0.158***	0.01
Educational Attainment *(Ref. High School or Equivalent)*						
Some College	0.006	0.01	0.006	0.01	0.006	0.01
College Degree	-0.403***	0.01	-0.403***	0.01	-0.403***	0.01
Graduate Degree	-0.517***	0.01	-0.517***	0.01	-0.518***	0.01
Income *(Ref: Less than $25,000)*						
$25,000-$34,999	-0.275***	0.02	-0.275***	0.02	-0.275***	0.02
$35,000-$49,999	-0.526***	0.02	-0.526***	0.02	-0.526***	0.02
$50,000-$74,999	-0.874***	0.02	-0.874***	0.02	-0.873***	0.02
$75,000-$99,999	-1.240***	0.02	-1.240***	0.02	-1.240***	0.02
$100,000-$149,999	-1.606***	0.01	-1.606***	0.01	-1.606***	0.01

$150,000-$199,999	-2.015***	0.02	-2.015***	0.02	-2.014***	0.02
$200,000 or more	-2.509***	0.02	-2.510***	0.02	-2.509***	0.02
Change in Work Status in Last Four Weeks	0.077***	0.01	0.077***	0.01	0.077***	0.01
Tenure *(Ref. Housing Owned)*						
Housing Rented	0.475***	0.01	0.475***	0.01	0.475***	0.01
Constant	-0.057*	0.02	-0.054*	0.02	-0.058*	0.02
Observations	2,113,382		2,113,382		2,113,382	
Population Size Represented By Weighting			179,475,871			
Sub-population Observations			1,932,967			
Sub-population Size Represented By Weighting			153,966,800			

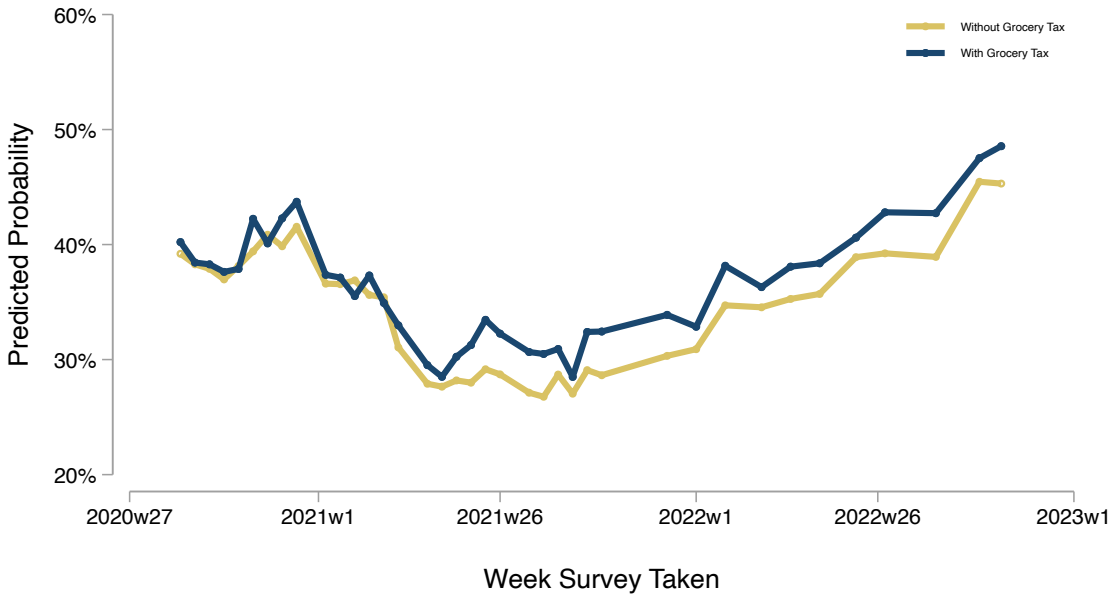
The β coefficient results of the logistic regression are in logged odds.
Standard errors in second column.
√ : Please refer to Appendix Table 2A for complete regression results for the week variable, which are unwieldy to report here.
AIC, *BIC*, and Likelihood Ratio tests are not appropriate for weighted survey data. I utilized a multinomial goodness of fit test using mgof, a command written by Ben Jann, to compute goodness of fit tests for categorical variable analysis with large survey-weighted data sets. Results of the mgof test for all variables are significant at p<0.001.
Source: Household Pulse Survey: U.S. Census Bureau, 2022
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 1. Current Policy Status of States with Grocery Tax

State	Sales/Grocery Tax	Food Insecurity Reported*	Considerations
Alabama	4%	33.9%	Revenues go into the Education Trust Fund
Hawaii	4%	32.5%	Hawaii has an excise tax, as opposed to state sales tax, but this tax is also leveed on groceries
Idaho	6%	27.2%	Grocery Sales Tax Credit was approved in early 2022
Kansas	6.5%	27.7%	Grocery Tax being reduced until complete removal by January 2025
Missisippi	7%	40.3%	Grocery tax cut considered but all proposals have failed
Oklahoma	4.5%	35.7%	Grocery tax cut considered but all proposals have failed (SB 1495, 2022)
South Dakota	4.5%	27.0%	Permanent sales tax removal proposed in September 2022

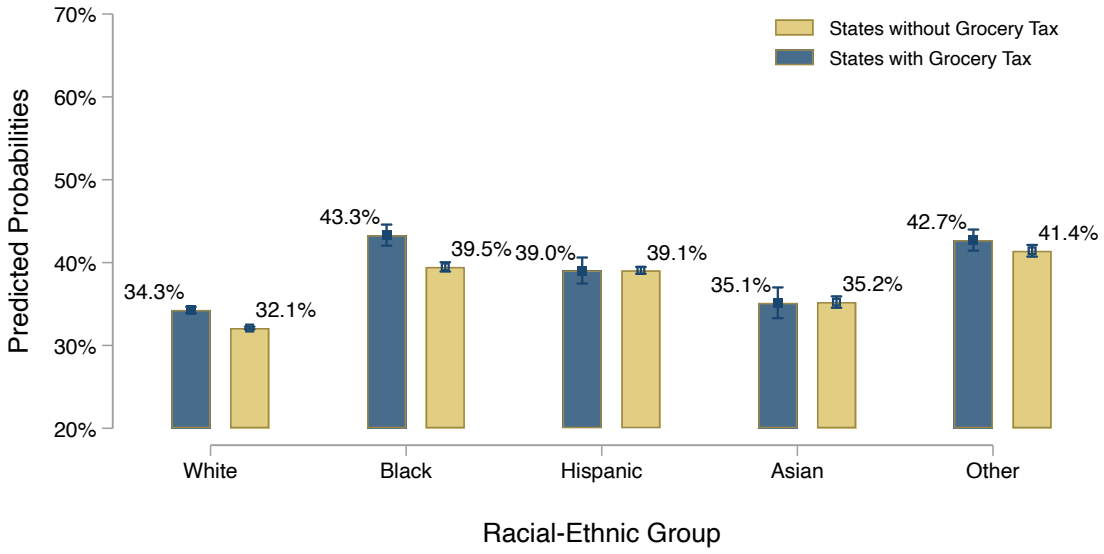
*Table created by the author using calculations performed with tabulations of reported food insecurity from the Household Pulse Survey (2022).
See https://taxfoundation.org/grocery-tax-candy-tax-soda-tax-2019/ for more information

Figure 2. Effect of Grocery Taxation on Current Food Insecurity by Week of Survey



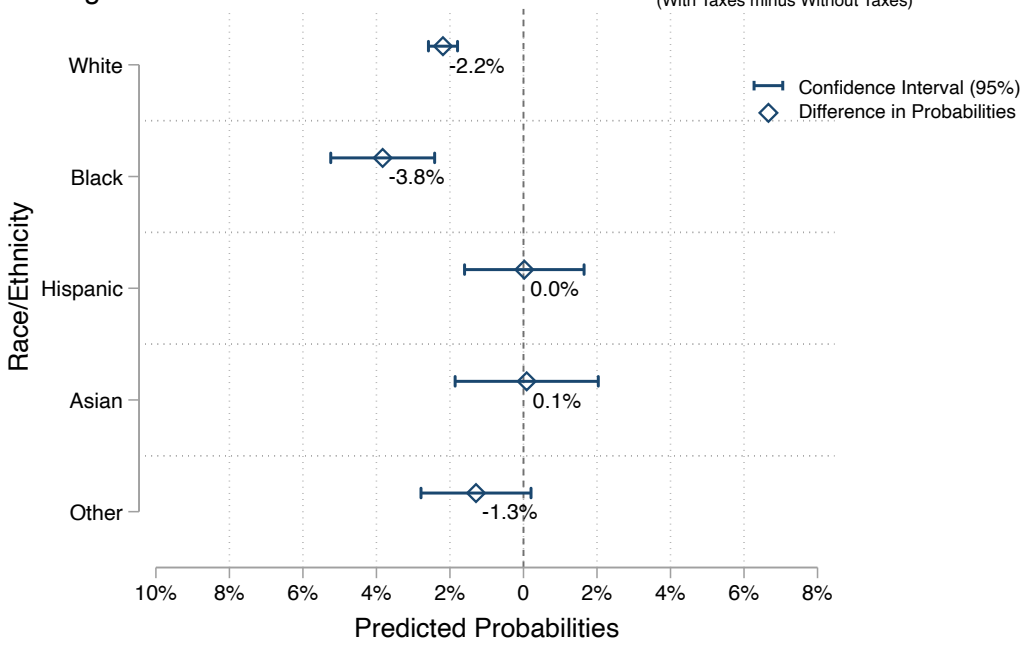
Source: Household Pulse Survey 2022 (U.S. Census Bureau)
N = 2,113,382

Figure 3. Predicted Probabilities of Current Food Insufficiency by State Grocery Tax Status and Racial-Ethnic Group



Source: Household Pulse Survey 2022: U.S. Census Bureau
N = 2,113,382

Figure 4: Difference in Predicted Probabilities (With Taxes minus Without Taxes)



Source: Household Pulse Survey, U.S. Census Bureau 2022
N=2,113,382

Appendix

Table A1. Dates of Household Pulse Survey (HPS) Data Collection

WEEK OF HPS SURVEY	CORRESPONDING DATE OF COLLECTION	WEEK FROM OUTSET OF SURVEY
	2020	
1	May 5	1
2	May 12	3
3	May 19	4
4	May 26	5
5	June 2	6
6	June 9	7
7	June 16	8
8	June 23	9
9	June 30	10
10	July 7	11
11	July 14	12
12	July 21	13
DATA ANALYSIS BEGINS		
13	August 31	18
14	September 14	20
15	September 28	22
16	October 12	24
17	October 26	26
18	November 9	28
19	November 23	30
20	December 7	32
21	December 21	34
	2021	
22	January 18	38
23	February 1	40
24	February 15	42
25	March 1	44
26	March 15	46
27	March 29	48
28	April 26	52
29	May 10	54
30	May 24	56
31	June 7	58
32	June 21	60
33	July 5	62
34	August 2	66
35	August 16	68
36	August 30	70
37	September 13	72
38	September 27	74
39	October 11	76
40	December 12	85
	2022	
41	January 10	89
42	February 7	93
43	March 14	98
44	April 11	102
45	May 9	106
46	June 13	111
47	July 11	115
48	August 8	121
49	September 26	128
50	October 17	131

Table A2. Logistic Regressions Predicting Current Food Insecurity by Survey Week, Including Week x State Interaction

Week of Survey	Model 1: Week Alone		Model 2: Week Alone		Model 3: Week Alone		Model 3: Week x State with Grocery Tax	
20	-0.043*	0.02	-0.039	0.02	-0.043*	0.02	-0.056	0.06
22	-0.052*	0.02	-0.049*	0.02	-0.052*	0.02	-0.054	0.05
24	-0.084**	0.03	-0.082**	0.03	-0.084**	0.03	-0.037	0.07
26	-0.035	0.03	-0.031	0.03	-0.035	0.03	-0.071	0.07
28	0.034	0.03	0.027	0.03	0.034	0.03	0.112	0.07
30	0.089***	0.02	0.094***	0.02	0.089***	0.02	-0.094	0.07
32	0.062**	0.02	0.060**	0.02	0.062**	0.02	0.026	0.07
34	0.154***	0.02	0.152***	0.02	0.154***	0.02	0.022	0.07
38	-0.116***	0.02	-0.115***	0.03	-0.116***	0.02	-0.012	0.07
40	-0.138***	0.02	-0.136***	0.02	-0.138***	0.02	-0.035	0.08
42	-0.120***	0.02	-0.113***	0.02	-0.120***	0.02	-0.118	0.07
44	-0.167***	0.02	-0.168***	0.02	-0.167***	0.02	0.015	0.07
46	-0.211***	0.02	-0.207***	0.03	-0.211***	0.02	-0.055	0.08
48	-0.414***	0.03	-0.413***	0.03	-0.414***	0.03	-0.022	0.08
52	-0.618***	0.03	-0.619***	0.03	-0.618***	0.03	0.023	0.08
54	-0.615***	0.02	-0.614***	0.02	-0.615***	0.02	-0.012	0.07
56	-0.574***	0.02	-0.578***	0.02	-0.574***	0.02	0.069	0.08
58	-0.581***	0.03	-0.589***	0.03	-0.581***	0.03	0.121	0.08
60	-0.505***	0.03	-0.518***	0.03	-0.505***	0.03	0.193*	0.08
62	-0.539***	0.03	-0.550***	0.03	-0.539***	0.03	0.163*	0.08
66	-0.645***	0.03	-0.654***	0.03	-0.645***	0.03	0.145*	0.07
68	-0.653***	0.02	-0.661***	0.02	-0.653***	0.02	0.125	0.08
70	-0.562***	0.02	-0.568***	0.03	-0.562***	0.02	0.098	0.08
72	-0.641***	0.02	-0.643***	0.02	-0.641***	0.02	0.031	0.07
74	-0.526***	0.03	-0.534***	0.03	-0.527***	0.03	0.118	0.07
76	-0.554***	0.03	-0.563***	0.03	-0.554***	0.03	0.146*	0.07
85	-0.458***	0.03	-0.465***	0.03	-0.458***	0.03	0.116	0.08
89	-0.440***	0.02	-0.440***	0.02	-0.440***	0.02	0.000	0.08
93	-0.242***	0.02	-0.248***	0.02	-0.242***	0.02	0.103	0.06
98	-0.250***	0.02	-0.252***	0.02	-0.250***	0.02	0.030	0.07
102	-0.201***	0.02	-0.207***	0.03	-0.201***	0.02	0.097	0.07
106	-0.158***	0.03	-0.164***	0.03	-0.158***	0.03	0.096	0.08
111	0.007	0.02	0.004	0.02	0.007	0.02	0.043	0.07
115	0.037	0.02	0.029	0.03	0.037	0.02	0.123	0.08
Constant	-0.057*	0.02	-0.054*	0.02	-0.058*	0.02	-0.057*	0.02
Observations	2,113,382		2,113,382		2,113,382		2,113,382	

The β coefficient results of the logistic regression are in logged odds.
Standard errors in second column.

These results are in reference to the √ cells in Table 2.
AIC, *BIC*, and Likelihood Ratio tests are not appropriate for weighted survey data. I utilized a multinomial goodness of fit test using mgof, a command written by Ben Jann, to compute goodness of fit tests for categorical variable analysis with large survey-weighted data sets. Results of the mgof test for all variables are significant at p<0.001.
Source: Household Pulse Survey: U.S. Census Bureau, 2022
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A3. Notes on Survey Weighting:

This survey dataset required the creation of a new variable for each sampling weight (80 are provided) divided by the number of weeks included in the dataset (38), as well as a new variable for the pweight for the dataset, also divided by the number of

weeks (38). The data were then set with these weights using the survey set (svyset) command in STATA, including the Fay's adjustment (0.05) provided by the Household Pulse Survey's Data Source and Accuracy Statement (Judkins 1990; Lavallée and Beaumont 2015; Lisic and Ojo 2008), to run a balanced repeated replication (brr) estimation for the logistic regressions. The mean standard estimation (mse) option was specified so that the survey balanced repeated replication (svy brr) estimation computes the variance using deviations of the replicates rather than using deviations of the replicates from their mean, which is the default for the svy brr command in STATA. The default method for variance estimation which is vce(brr), is used (Gelman 2007; Sun, Parker, and Holan 2022).

STATA code for weighting procedure:

```
gen rpweight =(pweight/38)

foreach x of varlist pweight1-pweight80 { gen r2`x'=`x'/38 }

svyset [iw=rpweight], brrweight(r2pweight*) fay(0.5) vce(brr) mse
```

Following this weighting procedure, all further analyses were run with the following code:

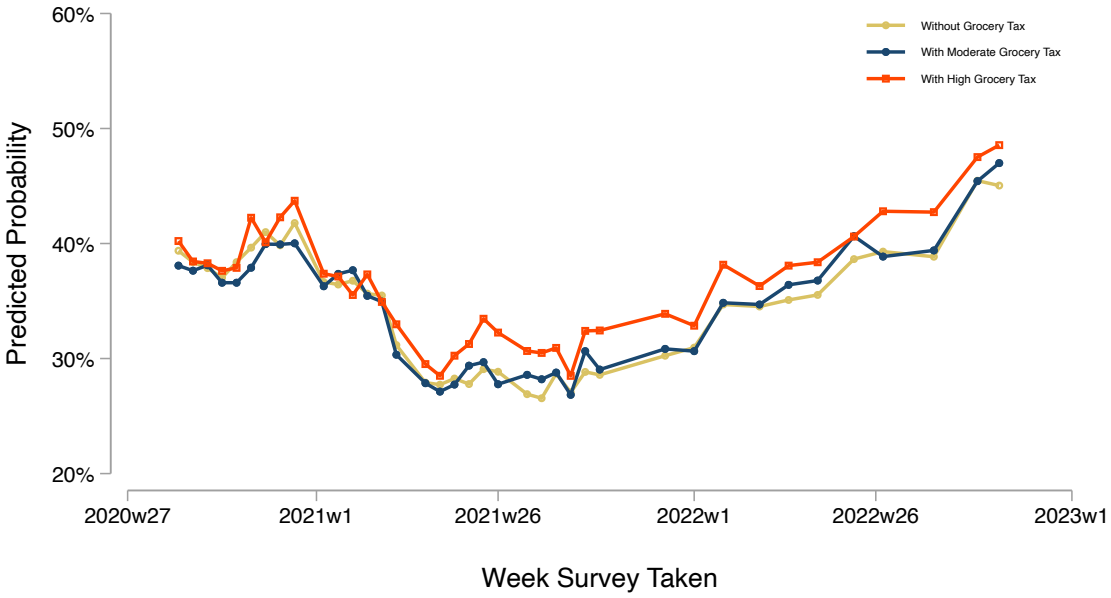
```
svy brr: logit [variable list]
```

A4. Sensitivity Analysis results:

Figure A1. (below) displays the marginal results of the logistic regression using a state variable that is coded into states with no grocery tax, “Without Grocery Tax”, states with moderate grocery tax that does not equal their state sales tax, “With Moderate Grocery Tax”, and states with high grocery tax that equals their state sales tax, “With High Grocery Tax”. The first two state variables explained above have similar predicted probabilities (see Figure A1), which suggested that these two categories could be collapsed together.

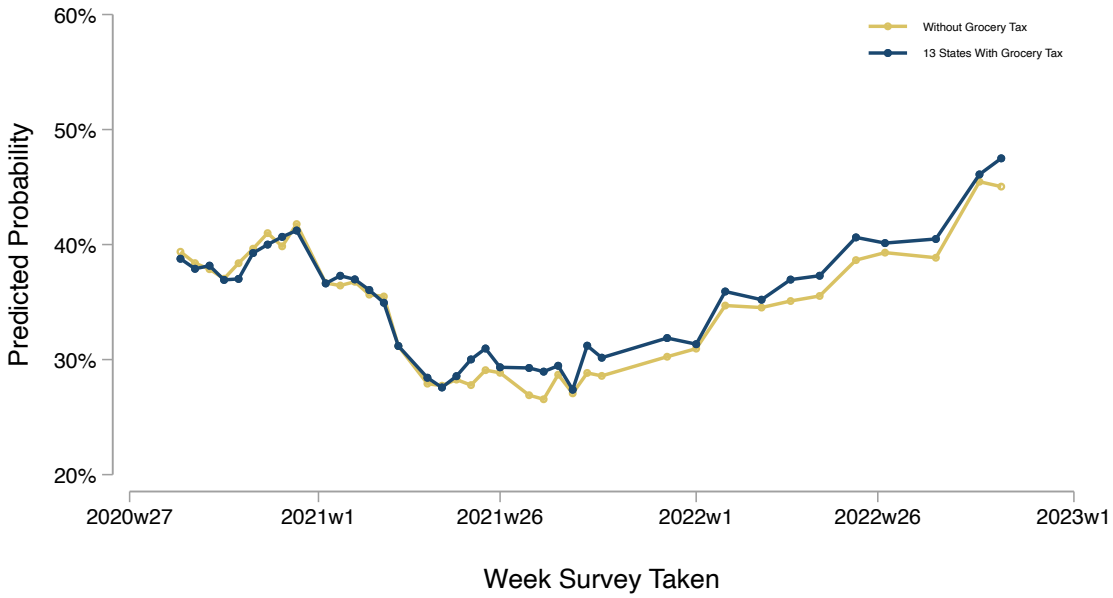
Figure A2., below, displays the marginal results of the logistic regression using a state variable that is coded into states with no grocery tax, “Without Grocery Tax”, and states that have any grocery tax at all,”13 States with Grocery Tax”. This also suggests that pulling out the 7 states with high grocery tax and comparing them to all other states is a valid statistical tool.

Figure A1. Effect of Grocery Taxation on Current Food Insecurity by Week of Survey



Source: Household Pulse Survey 2022 (U.S. Census Bureau)
N = 2084693

Figure A2. Effect of Grocery Taxation on Current Food Insecurity by Week of Survey



Source: Household Pulse Survey 2022 (U.S. Census Bureau)
N = 2084693