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COVID-19 risk perception and restaurant utilization after easing in-person restrictions

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ABSTRACT

This article investigated the influence of risk aversion and the perception of risk associated with dining inside a restaurant on restaurant utilization and expenditures in the initial re-opening phase of the COVID-19 pandemic. Consistent with economic theory, risk aversion and perception decreased the use of in-person restaurant services and increased the probability of using take-out and delivery, but had no influence on total restaurant expenditures. Risk perception had a larger effect on indoor dining compared to outdoor dining, suggesting risk averting behavior within the utilization of in-person restaurant services. These findings suggest COVID-19 concerns may influence restaurant use even after states relax their policies restricting restaurant operations. Our results also highlight the importance of developing policies to support the restaurant industry as consumers adjust to the re-opening phase of the pandemic.

1. Introduction

Restaurant operations are of particular concern during the COVID-19 pandemic because the virus that causes COVID-19 spreads through respiratory droplets produced while breathing, talking, coughing, and sneezing (CDC, 2020a). Thus, close contact indoor activities, like dining inside a restaurant, present a risk of spreading and contracting the virus. Recognizing the potential role that restaurants play in the pandemic, state, and local governments in the United States (U.S.) began prohibiting in-person services at restaurants in March of 2020, and by April 1st 49 states had implemented such a policy (Gupta et al., 2020a). In-person services include dining at a restaurant, either inside or outside, but do not include take-out and delivery. Given that restaurant and food away from home (FAFH) expenditures accounted for 55% of all food expenditures in 2019, these restrictions represented a significant shock to household purchasing behavior and resulted in a dramatic decline in FAFH expenditures (Dong and Zeballos, 2021; Ellison et al., 2020; Goolsbee and Syverson, 2021; USDA, 2020). However, it is unclear how consumers responded to the re-opening of restaurants to in-person services in the U.S. in late spring of 2020, especially given the on-going risk of contracting COVID-19.

By late April, states began easing their restaurant restrictions in an effort to stimulate the economy. The potential influence of ending these restrictions is evidenced in the trends in FAFH expenditures, which declined from $68 billion in February to a low of $35 billion in April and then began climbing again through July although never reaching pre-COVID levels (USDA ERS, 2021). However, aggregate statistics do not reveal where FAFH dollars were spent, and in particular, if consumers utilized newly reopened in-person services. Given that the pandemic continued through the summer of 2020, the decision of if and how to utilize newly re-opened restaurants was likely influenced by the risk of contracting COVID-19.

The purpose of this study was to investigate the influence of risk on restaurant utilization and expenditures in the U.S. in June 2020, which was shortly after state governments began easing restrictions on in-person restaurant services. Guided by the expected utility theory, we included both a measure of restaurant specific risk perception and a measure of underlying preferences for risk, known as risk aversion. Theory predicts that increasing risk aversion and risk perception independently, or simultaneously decreases the likelihood a person will engage in the risky behavior. The expected utility theory has previously been utilized to study the decision to purchase or consume risky foods prior to the pandemic (Lusk and Coble, 2005; Pennings et al., 2002; Petrolia, 2016).

Based on the expected utility theory we investigated two primary hypotheses in this study. First, higher levels of restaurant risk perception or higher levels of risk aversion will decrease the likelihood of using in-person restaurant services, and the number of times in-person restaurant services are utilized will be lower. Second, after states relax their COVID-19 restrictions, people who are more risk averse or perceive greater risk will utilize newly re-opened restaurants less than those who are less risk averse or perceive lower risk. Therefore, in person restaurant expenditures will be lower for those more risk averse or perceiving greater risk.
services are used conditionally on any use. In-person restaurant services include both outdoor and indoor dining. Second, higher levels of risk aversion and restaurant risk perception, captured by the interaction between aversion and risk perception, will decrease the likelihood and conditional use of in-person restaurant services. We also hypothesized that restaurant risk perception will have the greatest influence on in-person indoor dining decisions and the smallest influence on take-out and delivery decisions. However, this final hypothesis was also informed by more recent research that has found consumers perceive the greatest level of COVID-19 related risk from indoor dining (McFadden et al., 2020).

This study combined results from an original COVID-19 state restaurant policy dataset with an online survey that assessed restaurant utilization, restaurant expenditures, risk perception, and risk aversion in June 2020. A Cragg model was used to estimate the relationship between risk and the decision to utilize restaurants and the number of times a restaurant was used conditional on any use (Cragg, 1971). The influence of risk on different methods of restaurant utilization, including take-out and delivery, outdoor dining, and indoor dining, which represent different levels of risk exposure, and total restaurant expenditures were also estimated.

June 2020 represents a unique opportunity to study the influence of risk on consumer’s decision to utilize restaurants because June was the first month in which all states had some level of in-person restaurant services available, and by early July some states had begun reimposing restrictions on in-person services (Andrews, 2020). However, since not all areas were opened to in-person services for the entire month of June, we also controlled for the availability of in-person services in a county allowed by state policy.

This research adds to a growing body of literature seeking to understand the influence of risk in food behaviors during the COVID-19 pandemic. Several studies have investigated the existence and nature of consumer concerns related to COVID-19 while engaging in food behaviors (McFadden et al., 2020; Byrd et al., 2021). Other studies have sought to understand the influence of COVID-19 concerns or risk perceptions on food related behaviors (Chenardies et al., 2020; Kim and Lee, 2020; Dedeoglu and Bogan, 2021; Foroudi et al., 2021; Wang et al., 2020; Hesham et al., 2021; Bender et al., 2021).

Studies related to restaurant behaviors during the pandemic have investigated the relationship between COVID-19 risk perception and intention to use restaurants, or preferences for attributes of dining facilities but we are unaware of any prior studies that consider the influence of COVID-19 risk on restaurant utilization (Kim and Lee, 2020; Dedeoglu and Bogan, 2021; Foroudi et al., 2021). Our study adds to this literature by studying the influence of restaurant risk perception and risk aversion on restaurant utilization shortly after most states eased restrictions on in-person dining. Understanding this relationship is important for developing future policies to support the restaurant industry as consumers adjust to the ongoing pandemic.

We also add to the COVID-19 literature by developing a policy dataset that tracks county level changes in restaurant policies issued by state governments. County level data is important for understanding consumer food behavior during the initial re-opening because several states took an incremental county by county approach. While there are other publicly available COVID-19 policy datasets covering the re-opening, they only record policy changes at the state level and most do not differentiate between restaurant re-opening policies that allowed for outdoor dining only or allowed for both indoor and outdoor dining (Fullman et al., 2020; Raifman et al., 2020; CDC, 2020b).

1.1. Background: Impacts of COVID-19 on consumer food purchasing behavior

Consumer expenditures on FAFH have been increasing steadily in the United States (U.S.) since the 1980s and overtook food at home (FAH) (i.e., supermarket and groceries) expenditures in the early 2000s (Dong and Zeballos, 2021). By 2019, FAFH expenditures accounted for approximately 55% of all food expenditures, while food services, along with other agriculture and food industries, accounted for 5.4% of the U.S. gross domestic product (GDP) and 11% of employment (USDA, 2020; Dong and Zeballos, 2021). Thus, prohibiting in-person restaurant services likely influenced consumer food behaviors and expenditures (Gupta et al., 2020b; Ellison et al., 2020; Dong and Zeballos, 2021). Dong and Zeballos (2021) found that FAFH expenditures, which included restaurants, were 29% lower and FAH expenditures were 19% higher in March 2020 as compared to March 2019 after adjusting for inflation. Ellison et al. (2020) also found a significant decline in expenditures on dining at restaurants between early March and late April that was only partially offset by an increase in expenditures on take-out.

Throughout the pandemic, consumer food purchasing behavior has not only been influenced by policies restricting restaurant operations but also the risk of contracting COVID-19 while purchasing food or from consuming food. Although the Centers for Disease Control and Prevention (CDC) has concluded there is no evidence to suggest that COVID-19 can be spread during the handling or consumption of food, continued concerns with food consumption may come from the association between COVID-19 and the Wuhan wet market or disruptions in U.S. food production (CDC, 2021; McFadden et al., 2020). On the other hand, CDC researchers found that individuals who tested positive for the virus that causes COVID-19, were approximately twice as likely to have utilized in-person restaurant services in the prior two weeks compared to those with negative test results (Fishbe, 2020).

Although not a direct study of food purchasing behavior, several studies have evaluated the implementation of shelter-in-place (SIP), also referred to as stay-at-home (SAH), orders and found that they can only account for between 5 and 10 percent of overall declines in consumer food traffic, suggesting voluntary changes related to COVID-19 concerns had a greater impact on consumer behavior early in the pandemic (Gupta et al., 2020b, Goolsbee and Syverson, 2021).

When considering the influence of policies prohibiting in-person restaurant services, Goolsbee and Syverson (2021) found the main effect was to shift consumer foot traffic from restaurants to grocery stores. They also found that using a county level policy measure better captured the influence of SIP policies as compared to a state level measure, suggesting the need for future research to focus on documenting policies at the county level (Goolsbee and Syverson 2021).

Further, Goolsbee and Syverson (2021) found that in states ending their SIP policies in early May, the repeal only increased foot traffic by 6.4%, which suggests COVID-19 fears continued to influence consumer behavior. Thus, it is likely that even after policies restricting restaurant operations have ended, the risk of contracting COVID-19 will continue to influence consumer food purchasing behavior during the pandemic.

When considering consumer perceptions of COVID-19 risk while engaging in different food behaviors, several studies have found that consumers were more concerned about eating inside restaurants than shopping at grocery stores, or contracting COVID-19 from consuming food (Byrd et al., 2021; McFadden et al., 2020; Bender et al., 2021). Specifically, McFadden et al. (2020) found that consumers ranked sit-down restaurants as the most concerning retailer for COVID-19 transmission in May, June, and July surveys (McFadden et al., 2020).

Individuals with greater levels of concern or perceptions of COVID-19 risk related to food behaviors tended to be women, older, African American, or at higher risk for contracting COVID-19 (Byrd et al., 2021; McFadden et al., 2020; Hesham et al., 2021). The study also found that trust in the government moderated COVID-19 concerns related to restaurant use intentions (Dedeoglu and Bogan, 2021). Research from previous pandemics and research related to food safety concerns also suggests that trust in different sources of information may influence risk perceptions (Majid et al., 2020; Tonsor et al., 2009).

Finally, several studies have found that increasing levels of COVID-19 risk perception decreased intentions for restaurant utilization and increased preferences for private dining options (Kim and Lee, 2020;
Table 1
Restaurant and grocery store risk perception.

| Restaurant risk perception                                | Mean (SD) | Grocery store risk perception | Mean (SD) |
|-----------------------------------------------------------|-----------|-------------------------------|-----------|
| Question 1: Eating inside a restaurant during the COVID-19 pandemic will NOT pose a risk to my family and me* | 6.49 (2.70) | Question 1: Shopping in a grocery store during the COVID-19 pandemic will NOT pose a risk to me or my family* | 6.03 (2.62) |
| Question 2: I could be exposed to great risk from eating inside a crowded restaurant during the COVID-19 pandemic | 7.21 (2.25) | Question 2: I could be exposed to great risk from shopping in a crowded grocery store during the COVID-19 pandemic | 6.85 (2.25) |
| Question 3: The dangers of catching COVID-19 from eating food prepared in a restaurant are largely unknown | 5.72 (2.44) | Question 3: The dangers of catching COVID-19 from food in grocery stores is largely unknown | 5.79 (2.32) |
| Restaurant Index                                          | 19.42 (4.90) | Grocery Index                 | 18.66 (4.68) |

*Responses reverse coded for analysis.

Respondents were asked to rate their level of agreement with each statement on a 5-point Likert scale, with higher levels of agreement coded to indicate higher levels of risk perception. Indices created by summing responses across statements.

Dedeoglu and Bogan, 2021; Foroudi et al., 2021). However, we are unaware of any studies that have assessed the relationship between risk perceptions and utilization of food services during the COVID-19 pandemic.

2.1. Background: Expected utility theory for risk and food purchasing behaviors

In economic theory, individuals face risk when they have to make choices with uncertain outcomes. For example, dining inside a restaurant during the COVID-19 pandemic is risky because individuals do not know, with certainty, if dining inside a restaurant will result in contracting COVID-19 prior to making their decision. The expected utility theory is used in economics as a theoretical framework to model consumer decisions under uncertainty (Pratt, 1964). Two important components of the risky decision-making process in the expected utility model are risk aversion, which captures an individual’s underlying preference for any risk, and risk perception, which captures the uncertainty of the specific outcome (Pratt, 1964). Increasing risk aversion and risk perception independently, or simultaneously decreases the likelihood a person will engage in the risky behavior (Pratt, 1964). Thus, in empirical studies it is important to control for risk aversion, risk perception, and the interaction between risk aversion and perception (Lusk and Coble, 2005; Pennings et al., 2002; Petrolia, 2016).

Risk perception is commonly measured using self-assessment methods that ask respondents to rate their level of agreement with different statements related to the risk associated with a specific outcome (Lusk and Coble, 2005; Pennings et al., 2002; Petrolia, 2016). Risk aversion has been measured using either self-assessment or experimental methods, such as the Holt and Laury method (Lusk and Coble, 2005; Pennings et al., 2002; Petrolia, 2016). Petrolia (2016) compared the performance of several methods, including the standard Holt and Laury method, a variant of the Holt and Laury method that uses health outcomes rather than money, and a single question self-assessment measurement that asked individuals if they tend not to take risk in everyday life. In Petrolia’s (2016) research the explanatory power (i.e., the sign, magnitude, and significance of the estimated coefficient) was very similar across all three methods. This suggests that using a single question self-assessment method may be sufficient to capture the influence of risk aversion on consumer behavior.

Prior studies estimating the influence of risk on consumer food behaviors have focused on the decision to consume risky foods, such as beef after the outbreak of mad cow disease, genetically modified foods, and oysters (Lusk and Coble, 2005; Pennings et al., 2002; Petrolia, 2016). These studies have found that both risk preference and perception decrease consumer’s intentions to consume risky foods, with risk perception generally having a larger impact on consumer behavior.

2. Methodology

2.1. Data sources

The data for this study came from two sources. The first data source is an original restaurant policy dataset that captures state government policies directed at restaurant operations between March 1st and June 30th, 2020. Since state policies could be county-specific, the dataset records policies at the county level.

Second, Qualtrics was used to collect a national convenience sample with quotas in July 2020 to assess food purchasing behaviors in June 2020. The survey also collected information on respondent’s risk aversion, risk perception, and additional respondent characteristics. Joining these two datasets based on the respondent’s state and county produced the final dataset utilized in the analysis.

2.1.1. Policy data

The state policy dataset captures the date, duration, and types of restrictions imposed on restaurant operations by state governments through executive orders and public health orders. Multiple sources were utilized to collect the documents used in the construction of the policy dataset. These sources included state websites, news organizations, and the Council of State Governments (CSG) COVID-19 website (CSG, 2020).

Once the source materials were gathered, they were coded to capture the date policies began, ended, and the type of restrictions they imposed on restaurant operations. Policies that prohibited in-person services (i.e., dining at the restaurant) but still allowed take-out and delivery, are referred to as take-out and delivery policies. Policies that allowed for in-person service but only in outdoor settings are referred to as outdoor policies. Policies that allowed for in-person service in either outdoor or indoor settings are referred to as indoor policies.

After initial coding was finished, the COVID-19 State Policy Database was used to partially corroborate the resulting policy timeline (Fullman et al, 2020). Results could only be partially compared because the COVID-19 State Policy Database, as of January 1st, 2021, did not record policies at the county level but instead indicated when state policies did not apply to the entire state. Nonetheless, the COVID-19 State Policy Database provided an important resource to compare timelines when state policies cover the entire state or corroborate the earliest date of a change in policy in states that implemented changes county-by-county.

2.1.2. Survey data

The survey dataset included 2,000 respondents and was collected using an online survey administered by Qualtrics in July 2020. The panel consisted of individuals living in the U.S. who were the primary household food shopper, at least 18 years of age, and lived in the same state since February 1st, 2020. The sample panel was drawn by Qualtrics to reflect the distribution of U.S. households according to the American Community Survey (ACS) based on their 2019 income (<$25,000, $25,000 to $49,999, $50,000 to $74,999, $100,000 plus), age (18–34 years, 35–54 years, 55 years and older) and geographical region (i.e., Northeast, Midwest, West, and South). The survey was pre-tested using 50 respondents before being released for broader distribution. Appropriate human subjects’ protocols were followed, and institutional review board approvals were obtained (UTK-IIR-20-05882-XM).

The survey instrument included sections on restaurant utilization...
and expenditures in June 2020, household demographics, socioeconomic status, and COVID-19 experiences and attitudes. Appendix Table A1 contains variable definitions and the corresponding survey questions for variables created from the consumer survey and used in this analysis. Respondents were asked how many times in June they used take-out and delivery, dined in-person in an outdoor setting, or dined in-person in an indoor setting. Risk aversion was assessed using a single question, which asked respondents to rate their level of agreement with the statement “I tend to take many risks in everyday life” on a 9-point Likert scale. Responses were reverse coded, so higher levels of agreement indicated higher levels of risk aversion.

Risk perception questions were asked about restaurant and grocery store utilization (see Table 1). The results from the grocery store risk perception questions were used to investigate the specificity of the restaurant risk perception results. Respondents were asked to rate their level of agreement with several statements related to COVID-19 risk at restaurants and grocery stores on a 9-point Likert scale, and higher levels of agreement were coded to indicate higher levels of risk perception. Responses to three statements were designed to capture the two elements of COVID-19 food-related risk: the risk associated with being physically inside the restaurant or grocery store and the risk associated with food consumption. Two risk perception indexes were created by summing responses to the restaurant and grocery store questions.

After excluding observations with missing values for restaurant utilization, restaurant risk perception, risk aversion, and additional covariates in the Cragg model the final sample utilized in the analysis included 1,661 observations.

3. Empirical application

The analysis for this study occurred in two stages. The first stage assessed the ability of the restaurant risk perception index to detect restaurant specific risk associated with COVID-19. The second stage used a Cragg model to estimate the influence of risk aversion and risk perception on the utilization of restaurants while controlling for the number of days an indoor or outdoor policy was in effect in the respondent’s county in June.

In the first stage of the analysis, linear regression was used to investigate the determinants of the restaurant risk perception index. The determinants included age, sex, income, self-reported health conditions, tobacco use, trust in scientists, and trust in government. Demographic and self-reported health status variables were included to control individual-level factors associated with a higher risk of contracting COVID-19 or experiencing more severe cases of COVID-19, which may independently influence risk perception (CDC COVID-19 Response Team, 2020; Popkin et al., 2020).

The last two covariates, trust in scientists or government, were measured using responses to the questions “How much do you trust information scientists (the government) provide(s) to you?” These responses were elicited using a nine-point Likert scale where one indicated ‘not at all’ and nine was ‘fully trust’. Both the government and scientists are important sources of public health information and trusting them may influence an individual’s perception of risk. Understanding this relationship is important for developing and implementing future public health information campaigns.

Based on prior research showing both that the risk of contracting COVID-19 is higher at restaurants than grocery stores and that consumers perceive greater risk at restaurants it was anticipated that the value of the restaurant risk perception index should be larger than the grocery risk perception index (CDC, 2021; Fisher et al., 2020; Byrd et al., 2021; McFadden et al., 2020). To determine if our risk perception indexes were sensitive to this difference in retailer-specific concerns, the within respondent difference between the grocery store and restaurant risk perception index was calculated. Then, a one-sided t-test was used to determine if the difference between the risk perception indexes was statistically greater than zero, which would suggest a greater perception of risks at restaurants.

In the second stage of the analysis, we investigated the relationship between risk and restaurant utilization using a Cragg model, which is used to study consumer behavior when the outcome of interest has a large number of zeros (Cragg, 1971). The zeros represent “corner solutions,” a utility maximizing outcome in which consumers choose not to use restaurants (Cragg, 1971). The advantage of the Cragg model relative to the Tobit, is that the Cragg model allows the estimated relationship between risk and restaurant utilization to differ, in either sign or magnitude, between the choice to use restaurants at all and choice of the number of uses conditional on any use. Since the most effective way to avoid restaurant-related risks is not to utilize restaurants, we believed the influence of risk could differ between the two decisions.

To be consistent with the expected utility model it is necessary to include the restaurant risk perception index, risk aversion, and their interaction. However, the inclusion of the interaction term introduces significant multicollinearity and to reduce the multicollinearity, we utilized standardized (i.e., mean zero and standard deviation equal to one) versions of the restaurant risk perception and restaurant aversion variables. We refer to the standardized version of our risk variables as the standardized restaurant risk perception index (SRRP) and the standardized risk aversion (SRA). Standardization also assists with the interpretation of the results as both variables were ordinal and measured on different scales.

A Cragg model includes two equations. Eq. (1) captures the decision to use restaurants, which has binary outcome (i.e., 1 or 0) and was estimated using a probit model.

\[ \Pr(\text{RestaurantUse} > 0 | x_{i}) = \Phi(x_{i}\gamma) \]  

\( x_{i} \) is a vector of respondent characteristics, SRA, SRRP, and their interaction (SRA × SRRP) for the ith shopper and \( \gamma \) is a vector of parameters to be estimated and \( \Phi \) is the standard normal probability distribution.

Eq. (2) captures the decision of how many times to use a restaurant conditional on any use and was estimated using a truncated normal regression.

\[ E(\text{RestaurantUse} | \text{RestaurantUse} > 0, x_{i}) = x_{i}\beta + \sigma + x_{i}\gamma \]  

\( x_{i} \) is a vector of respondent characteristics, SRA, SRRP, and their interaction (SRA × SRRP) for the ith shopper,\( \beta \) is a vector of parameters to be estimated, and \( \lambda \) is the inverse Mills ratio where \( \lambda = \phi(x_{i}\gamma/\sigma) / \Phi(x_{i}\gamma/\sigma) \).

Additional respondent characteristics in both equations included age, self-identified gender, race, ethnicity, income, presence of children in the home, education, the number of days an outdoor policy was in effect in June, the number of days an indoor policy was in effect in June, living in a metropolitan county, and fixed effects for U.S. region (i.e., Midwest, Northeast, South, and West). Individuals were categorized as living in a metropolitan county if their residence fell within the United States Department of Agriculture, Economic Research Service (USDA ERS) Rural Urban Continuum Code categories of one through three.

The full analytical sample was used to estimate the relationship between risk and overall restaurant use. To evaluate the influence of risk on the type of restaurant service used (take-out and delivery, in-person dining outdoors, and in-person dining indoors), a subset sample of those who had used a restaurant at least once during June was used. We hypothesized that the influence of risk should increase as the level of exposure to risk increases. Take-out and delivery likely represented the

\( ^{1} \) Without standardization, the correlation between the interaction term and the restaurant risk perception index was 0.57 and the correlation between the interaction term and risk aversion was 0.86. With standardization the correlation between the interaction term and the standardized restaurant risk perception index was 0.09 and the correlation between the interaction term and standardized risk aversion was 0.08
Table 2  
Respondent characteristics and American Community Survey (ACS) comparison.

| Characteristic                  | Analytical Sample N = 1,661 | ACS 1 |
|--------------------------------|------------------------------|-------|
| Age                            | 42                           | 38.10 |
| Household size                 | 2.80                         | 2.62  |
| Female (%)                     | 67.73                        | 50.80 |
| Presence of child (%)          | 39.49                        | 29.40 |
| Metropolitan county (%) 2      | 86.27                        | –     |
| Self-identified race and ethnicity |                            |       |
| White (%)                      | 75.14                        | 60.70 |
| Black (%)                      | 7.65                         | 12.31 |
| Other and multiple races (%)   | 9.51                         | 8.97  |
| Hispanic (%)                   | 7.65                         | 18.01 |
| Highest level of education     |                              |       |
| Highschool or less (%)         | 21.07                        | 39.00 |
| Completed technical, two-year degree or some college (%) | 34.80 | 28.90 |
| Completed college or graduate school (%) | 44.13 | 32.20 |
| 2019 Income                    |                              |       |
| Less than $25,000 (%)          | 17.10                        | 19.20 |
| Between $25,000 and $74,999 (%)| 44.01                        | 38.40 |
| Between $75,000 and $99,999 (%)| 14.99                        | 12.70 |
| At least $100,000 (%)          | 23.90                        | 29.60 |
| U.S. Region                    |                              |       |
| Northeast (%)                  | 17.04                        | 21.06 |
| Midwest (%)                    | 21.73                        | 17.36 |
| South (%)                      | 39.55                        | 37.66 |
| West (%)                       | 21.67                        | 23.03 |

1 2015 to 2019 5-year ACS estimates are reported for all variables except U.S. region which are compared to 2014 to 2018 5-year ACS estimates.
2 Median age and mean household size are reported to compare to ACS estimates.
3 No comparison is made for metropolitan status because metropolitan is determined using the ERS rural urban continuum codes not the Census definition of rural urban status.

Table 3  
Respondent health outcomes and COVID-19 experiences.

| Self-reported health conditions | Mean (SD) |
|--------------------------------|-----------|
| N = 1,661                      |           |
| Diabetes (%)                   | 14.98 (25.70) |
| Any cardiovascular condition (%)| 20.69 (40.52) |
| Asthma (%)                     | 17.11 (37.67) |
| Current tobacco use (%)        | 30.27 (45.96) |
| Obese (%)                      | 29.84 (45.77) |
| COVID-19 attitudes and experiences |               |
| Essential worker (%)           | 28.51 (45.16) |
| Had COVID-19 (%)               | 3.98 (19.55) |
| Knows someone who had COVID-19 (%)| 28.67 (45.24) |
| At least moderately concerned with contracting COVID-19 (%) | 79.75 (40.20) |
| Risk perception, risk preference and trust |             |
| Risk aversion 2                | 5.94 (2.48) |
| Restaurant risk perception index 3 | 19.42 (4.90) |
| Grocery risk perception index 3 | 18.66 (4.68) |
| Trust information from scientists 4 | 6.72 (1.95) |
| Trust information from the government 4 | 4.76 (2.32) |

1 At least moderately concerned indicates a response of at least a 5 on a 9-point Likert scale
2 Measured using agreement with ‘I tend to take many risks in life’ on a 9-point Likert scale
3 The restaurant and grocery risk perception indexes were created by summing across the responses to three questions (Table 1) related to COVID-19 risk at restaurants or grocery stores and can range in value from 3 to 27
4 Measured using response to 9-point Likert scale where 1 indicated ‘not at all’ and 9 indicated ‘fully trust’

lowest exposure to risk because individuals do not consume food on the premises. In contrast, indoor dining likely represented the highest level of exposure to risk because individuals consume food indoors around other individuals not from their households. We also estimated a model using total restaurant expenditures to determine if risk influenced how much was spent in June.

Descriptive statistics were calculated in R. Regression models and marginal effects were estimated in Stata Version 16.0.

4. Results

4.1. Descriptive statistics

Respondents’ demographics and comparison to American Community Survey (ACS) 2015–2019 5-year estimates are reported in Table 2. Our analytical sample was slightly older, more likely to be female, more likely to be white, and more educated than the national average. This may be due in part to the primary food shopper inclusion criteria for our survey.

Table 3 shows that when asked about their current health status, 30.27% reported current tobacco use, 20.69% any cardiovascular disease, 17.11% asthma, 14.95% diabetes, and 29.84% were classified as obese based on self-reported height and weight. When asked about their experiences with COVID-19, 28.51% reported they were considered essential workers, 3.98% indicated they previously had COVID-19, and 28.67% indicated they knew someone who previously had COVID-19. Finally, 79.75% indicated they were at least moderately concerned with contracting COVID-19.

Table 3 reports descriptive statistics for risk and trust questions. The average risk aversion was 5.94. The restaurant and grocery risk perception indexes were created by summing across the responses to three questions (Table 1) related to COVID-19 risk at restaurants or grocery stores. Each risk perception index could range in value from 3 to 27 and the average value for the restaurant risk perception index was 19.42 and the average value for the grocery risk perception index was 18.66. To provide some context for these values consider that if an individual rated their level of agreement to each question as a 5, the median response value for each question, their index score would be 15. The average response for trusting information from scientists was 6.72, and the average response for trusting information from the government was 4.76.

Descriptive statistics for restaurant utilization and expenditures are reported in Table 4. A large majority, 87.96%, of respondents used restaurants in some form in June 2020. The most common method of utilizing restaurants was take-out and delivery, 83.99%, followed by in-person services in an indoor setting, 35.16%, and in-person services in an outdoor setting 28.48%. On average, and conditional on any use, respondents used restaurants 7.19 times overall, take-out and delivery 5.54 times, in-person services inside 2.72 times, and in-person services outside 2.52 times.

Respondents were asked to compare their restaurant utilization in June 2020 to a typical month prior to the pandemic. Fig. 1 shows that the majority, 72.74%, indicated they were using in-person services less. Only 6.72% responded that they were using in-person services more,
and 20.53% responded that they were using them about the same. In
contrast, 34.99% indicated they were using take-out and delivery more,
25.97% respondent they were using it less, and 39.04% indicated they
were using it about the same.

Finally, respondents were asked about their food expenditures in
June. On average, respondents spent $119.92 at restaurants, which
accounted for 22.38% of overall food expenditures and was below the
pre-pandemic proportion of 55% (USDA, 2020). When asked to compare
their restaurant expenditures in June 2020 to a typical month before the
pandemic, Fig. 1 shows 40.40% responded they were spending less,
25.50% were spending more, and 34.10% were spending about the
same.

State policies restricting restaurant operations may have influenced
consumer decisions related to restaurant utilization. Fig. 2 shows the
results of general findings from the full policy dataset for all 50 states
and the District of Columbia (D.C.). Each row represents the policy
timeline for a specific state, and policies were color coded based on the
policy type. Patterns indicate multiple policies were in effect in a state

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Fig. 1. Self-reported changes in restaurant utilization and expenditures in June as compared to typical month before the pandemic.

Fig. 2. Timeline of state policies restricting restaurant operations.
Table 5

Respondent’s exposure to state policies restricting restaurant operations.

| Policy Type                        | Mean (SD)  
|------------------------------------|------------
| Presence of take-out and delivery policy in June (%) | 21.07 (40.79) |
| Only take-out and delivery policy in June (%) | 1.57 (12.42) |
| Number of days of take-out and delivery policy in June | 2.37 (5.80) |
| Outdoor policies                   |            |
| Presence of outdoor policy in June (%) | 26.85 (44.33) |
| Only outdoor policy June (%)        | 5.84 (23.46) |
| Number of days of outdoor policy in June | 3.80 (7.10) |
| Indoor policies                    |            |
| Presence of indoor policy in June (%) | 92.59 (26.19) |
| Only indoor policy June (%)         | 71.58 (45.12) |
| Number of days of indoor policy in June | 22.84 (10.05) |
| Percentage of days of indoor policy in June | 82.29 (32.73) |

1. Take-out and delivery policies prohibited in-person services at restaurants.
2. Outdoor policies allowed in-person services at restaurants but only in outdoor settings.
3. Indoor policies allowed in-person services at restaurants in either outdoor or indoor settings.

Table 6

Regression results for the determinants of restaurant risk perception.

| Variable                        | Estimated Coef (SE) |
|---------------------------------|---------------------|
| Age                             | 0.05 (0.01) ***     |
| Female                          | 1.24 (0.27) ***     |
| White                           | −0.98 (0.41) *      |
| Black                           | −0.33 (0.58)        |
| Hispanic                        | −0.65 (0.57)        |
| Income of at least $75,000      | −0.07 (0.27)        |
| Essential worker                | −0.31 (0.28)        |
| At least college graduate       | −0.03 (0.27)        |
| Diabetes                        | −0.29 (0.36)        |
| Cardiovascular disease          | 0.30 (0.31)         |
| Asthma                          | 0.36 (0.32)         |
| Tobacco Use                     | 0.24 (0.26)         |
| Obese                           | −0.09 (0.27)        |
| Respondent had COVID-19         | −0.76 (0.64)        |
| Respondent knows someone who had COVID-19 | 0.70 (0.26) |
| Level of trust in information from scientists | 0.75 (0.06) *** |
| Level of trust in information from government | −0.23 (0.05) *** |
| Metropolitan County             | −0.07 (0.35)        |

AIC = Akaike’s Information Criteria, BIC = Bayesian Information Criteria.

The results of the regression investigating the determinants of the restaurant risk perception index are reported in Table 6. Being older, identifying as female, knowing someone who had COVID-19, and trusting information from scientists increased the restaurant risk perception index. On the other hand, being white and higher levels of trusting information from the government were associated with a statistically significant decrease in the restaurant risk perception index.

Given previous research suggesting that the risk and perception of risk of contracting COVID-19 was greater at restaurants than grocery stores, we wanted to determine if our restaurant risk perception index was sensitive to these retailer specific concerns (CDC, 2021; Fisher et al., 2020; Byrd et al., 2021; McFadden et al., 2020). To do so, we calculated the within respondent difference between the restaurant and grocery store risk perception index. The average of the within respondent difference between the restaurant and grocery risk perception index was 0.68, indicating that respondents perceived greater risk at restaurants. A one-sided paired t-test found that the difference was statistically greater than zero (p-value < 0.001).
relationship between risk and restaurant utilization. Full results for the Cragg models are available in Appendix Table A2. Columns contain the results for overall restaurant use and columns two through four contain results for the influence of risk on specific methods of restaurant utilization amongst individuals who used a restaurant at least once in June. Results from the probit model for the decision to utilize a restaurant are reported in Table 7. Standardized risk aversion (SRA) and standardized restaurant risk perception index (SRRP) are included in these models. The first column contains results for the decision to utilize a restaurant, followed by the results from the truncated negative binomial regression for the second stage of the Cragg model.

Since the SRRP measures the perceived COVID-19 risk associated with dining inside a restaurant, these results suggest the possibility of risk avoidance behavior in which individuals with a higher SRRP are more likely to use take-out and delivery possibly to avoid in-person dining risks.

When considering the influence of risk on the conditional number of uses, SRRP and SRA not only decreased the conditional number of restaurant uses overall, but also for specific methods of using restaurants. For overall restaurant use, increasing SRA by one standard deviation decreased the conditional number of uses overall by 0.39 uses, while increasing SRRP by one standard deviation decreased the conditional number of trips by approximately 0.52 uses. SRA again had a negative influence on either outdoor or indoor dining, but SRRP only influenced the conditional number of uses of indoor dining, where increasing SRRP by one standard deviation decreased the conditional number of indoor dining uses by 0.42. This suggests that SRRPs influence on overall conditional restaurant use was driven by its influence on indoor dining. The interaction between SRA and SRRP also had a statistically significant and negative relationship with the conditional use of indoor dining, suggesting an additional influence of risk perception amongst more risk-averse individuals.

Finally, the sixth column of Table 7 shows that SRRP and SRA had no statistically significant effect on either the decision to spend money at a restaurant, or on the amount of money spent at restaurants conditional on any use. This finding suggests the primary mechanism through which COVID-19 risk influenced restaurant utilization was through the decision of how to use restaurants and not how much to spend. Increases in the number of restaurants offering take-out and delivery during the pandemic, which allowed for greater expenditures at a wider variety of restaurants, may have partially driven this result (Grindy, 2020). However, analysis to further investigate this hypothesis is beyond the scope of this study.

### Table 7

Cragg model regression marginal effects of risk on restaurant utilization and expenditures in June 2020.

| Marginal effect and Delta-method (SE) | All restaurant use | Take-out delivery | In-person service outside | In-person service inside | All restaurant expenditures |
|--------------------------------------|--------------------|-------------------|--------------------------|-------------------------|----------------------------|
|                                      | Any restaurant use (Any expenditures) |                     |                          |                         |                            |
|                                      | N = 1,461          | N = 1,461         | N = 1,461                | N = 1,461               | N = 1,461                 |
|                                      | –2.97E-03          | –8.05E-04         | 3.20E-03                 | 1.39E-04                | –2.28E-03                 |
|                                      | (1.94E-03)         | (3.13E-03)       | (3.00E-03)               | (3.15E-03)              | (2.00E-03)                |
|                                      | 1.98E-03           | 1.13E-03          | –1.23E-03                | 3.48E-03                | 4.96E-04                  |
|                                      | (1.57E-03)         | (1.09E-03)       | (2.38E-03)               | (2.48E-03)              | (2.15E-03)                |
| Standardized restaurant risk perception index (SRP) | –0.01 | 0.01 | –0.07*** | –0.13*** | –0.01 |
|                                      | (0.01)            | (0.01)           | (0.01)                   | (0.01)                  | (0.01)                    |
| Standardized risk aversion (SRA)     | –0.01             | –4.35E-03        | –0.05***                 | –0.05***                | –4.24E-03                 |
|                                      | (0.01)            | (0.01)           | (0.01)                   | (0.01)                  | (0.01)                    |
| SRRP × SRA                           | –5.87E-04         | –1.01E-03        | 0.02                     | –0.01                   | 1.59E-03                  |
|                                      | (0.01)            | (0.01)           | (0.01)                   | (0.01)                  | (0.01)                    |

Number of times restaurant is used, conditional on any use (Amount of expenditures, conditional on any expenditures)

|                                      | Any restaurant use (Any expenditures) |                     |                          |                         |                            |
|                                      | N = 1,461          | N = 1,395         | N = 473                  | N = 584                 | N = 1,459                 |
|                                      | –4.85E-03          | 0.02             | 4.70E-03                 | –0.05*                  | –1.78*                    |
|                                      | (0.04)            | (0.03)           | (0.02)                   | (0.02)                  | (0.08)                    |
|                                      | 0.03              | 0.03             | –0.01                    | –0.01                   | –1.04                     |
|                                      | (0.03)            | (0.02)           | (0.01)                   | (0.02)                  | (0.68)                    |
| Standardized restaurant risk perception index (SRP) | –0.52*** | 0.09 | –0.19 | –0.42*** | –3.36 |
|                                      | (0.13)            | (0.11)           | (0.10)                   | (0.09)                  | (3.53)                    |
| Standardized risk aversion (SRA)     | –0.39*            | 0.11             | –0.35***                 | –0.39***                | –3.90                     |
|                                      | (0.15)            | (0.12)           | (0.10)                   | (0.10)                  | (4.14)                    |
| SRRP × SRA                           | –0.09             | –0.06            | –0.09                    | –0.26**                 | –1.83                     |
|                                      | (0.14)            | (0.13)           | (0.09)                   | (0.09)                  | (4.14)                    |
| % Correctly Classified               | 87.96             | 95.48            | 70.57                    | 68.17                   | 88.16                     |
|                                      | 9,566.22          | 7,944.33         | 3,480.99                 | 4,041.00                | 18,246.15                 |
| AIC                                   | 9,764.14          | 8,139.06         | 3,655.18                 | 4,219.19                | 18,443.97                 |

\[ p < 0.05 \quad \text{**} p < 0.01 \quad *** p < 0.001 \]

Variables included in both the any restaurant use and conditional restaurant use regression models but not reported: age, female, white, black, Hispanic, income, presence of children, education, metropolitan county, and US region fixed effects. Full results reported in appendix table A2. AIC = Akaike’s Information Criteria, BIC = Bayesian Information Criteria.

\(^1\) Reports the percent correctly identified in the probit regression for any restaurant use or expenditures.

\(^2\) For the restaurant use count variables (overall restaurant use, take-out and delivery, outdoor dining, and indoor dining the results were similar when using a truncated negative binomial regression for the second stage of the Cragg model.
The two policy variables, the number of days an outdoor or indoor policy was in effect, had little influence on restaurant utilization. Only the conditional number of uses of indoor dining and conditional expenditures had a statistically significant and negative relationship with the number of days an outdoor policy was in effect, however, in both cases the magnitude of the effect was small.

The previous discussion of the results from the Cragg model used the significance values associated with the marginal effects. When considering the significance values associated with the raw regression results, the conclusions were largely robust with the exception of several variables in the second stage of the restaurant expenditures model. The effects of the number of outdoor policy days and two unreported variables (age and black) were not significant when using the significance levels from the raw regression results. Raw regression results are available by request.

5. Policy implications

There has been substantial debate regarding the influence of COVID-19 business restrictions on consumer behavior during the pandemic. Much of the current literature has focused on the shut-down period of the pandemic that occurred in spring 2020 and has generally found that stay-at-home orders can only explain between 5 and 10 percent of the overall decline in consumer foot traffic, suggesting that voluntary changes, likely due to COVID-19 concerns, played a larger role (Gupta et al., 2020b, Goolsbee and Syverson, 2021). Similarly, research found that delaying SAH orders in May only increased foot traffic by 6.4%, which suggests COVID-19 concerns continued to influence consumer behavior even after restrictions ended (Goolsbee and Syverson, 2021).

Our study adds to this policy debate by documenting the easing of restrictions on in-person restaurant services and investigating the influence of COVID-19 risk on restaurant utilization in June 2020. Since consumers’ risk aversion and perception of risk in restaurants will continue to influence their utilization of restaurants even in the absence of state policies, this investigation adds to our understanding of how consumers are adjusting their restaurant utilization to the re-opening phase of the pandemic. The study findings suggest that COVID-19 risks associated with indoor dining influenced how consumers utilized restaurants even after states eased in-person dining restrictions.

Our policy dataset showed that during the initial restaurant re-opening phase some states chose to re-open incrementally by either moving from take-out and delivery only to outdoor dining and then indoor dining, or re-opening on a county-by-county basis. Nine states, including California, New York, Pennsylvania, and Michigan, utilized county specific policies in June, highlighting the importance of tracking county level variations in COVID-19 policies.

Most important for this study, our policy dataset showed that in June 2020, 45 states and D.C. had or implemented policies that allowed for in-person dining at restaurants in indoor or outdoor settings. In our sample, respondents lived in a county that, on average, had an indoor policy in effect for 23 days in June, which allows for both forms of in-person services: indoor and outdoor dining. However, 73% of our sample reported dining in-person less in June than prior to the COVID-19 pandemic, suggesting the continued influence of the pandemic on restaurant utilization even after in-person restaurant restrictions were eased.

Similar to previous studies, we found that consumers had a higher perception of COVID-19 risk in restaurants, as compared to grocery stores (Byrd et al., 2021; McMadden et al., 2020). Consistent with our hypotheses based on the expected utility model, increasing SRRP decreased the probability of dining in-person, either indoors or outdoors. Furthermore, the magnitude of the effect was twice as large for outdoor dining as compared to outdoor dining, which is consistent with the relatively larger exposure to risk when dining indoors. SRRP also decreased the number of times a person dined indoors, conditional on any indoor dining. Similarly, SRA had a consistent negative effect on both the probability of and the number of times a person dined indoors or outdoors conditional on any use. The interaction between SRA and SRRP also had a statistically significant and negative relationship with the conditional use of indoor dining, suggesting an additional influence of risk perception amongst more risk-averse individuals.

One unanticipated finding was that increasing SRRP increased the probability of using take-out and delivery. However, this finding is still consistent with the expected utility theory because the SRRP measures the perceived COVID-19 risk associated with dining inside a restaurant. Thus, the increased likelihood of utilizing take-out and delivery services amongst individuals with higher SRRP is consistent with risk avoidance behavior.

The number of days available for indoor dining in a county based on state policy had no influence on restaurant utilization, and while more days of an outdoor policy decreased the number of times a person dined inside and restaurant expenditures, conditional on any indoor dining or expenditures respectively, the magnitude of the effect was very small. Our analysis of the determinants of restaurant risk perception may provide some additional insights for policymakers and future researchers seeking to understand restaurant utilization behavior during the pandemic. Similar to previous research we found that being female or older was associated with higher levels of perception of COVID-19 risk at restaurants (Byrd et al., 2021; McMadden et al., 2020).

Our research also found that trusting information from scientists increased restaurant risk perception, but trusting the government decreased risk perception. Prior research has shown that trust in different information sources (i.e., the government or scientists) plays an important role in how individuals perceive communications during public health emergencies and their perceptions of risk (Quinn et al., 2013; Savoia et al., 2015; Sopory et al., 2021). Thus, the conflicting messages regarding the severity of the coronavirus from government officials in the U.S. and scientific experts may have resulted in the conflicting relationship between trust and the perception of risk at restaurants observed in our study (Kyun et al., 2020).

Although we did not specify in our survey question if the government was local, state, or federal all three are involved in public health information campaigns and there were instances of conflicting messages from both state and federal elected government officials regarding both the severity of the coronavirus and the ongoing risk from the pandemic going into the summer of 2020 (Kyun et al., 2020; Cathey and Haslett, 2020; Bump, 2020; Cohen, 2020). Additionally, since the federal government has changed administrations since our data collection, it is possible these results would change if the survey was repeated. Nonetheless, future policies designed to influence consumer’s perceptions of risky foods may need to consider who delivers public health messages in addition to the content of those messages.

Finally, although risk aversion and restaurant risk perception had no influence on restaurant expenditures, our findings may also have important implications for the restaurant industry. Not only did SRRP increase the probability of using take-out and delivery, but 39% of our respondents reported using take-out and delivery more in June as compared to pre-pandemic. Increased use of take-out and delivery may translate into higher costs for some restaurant owners, thereby impeding their ability to recover financially even after in-person restrictions are lifted (Harris, 2021). Thus, policymakers may need to consider additional policies and programs to support the restaurant industry.

Our findings are subject to several limitations. Because we utilized cross-sectional data, we cannot determine how changes in restaurant policy influenced restaurant utilization. Additionally, our analysis did not address variations in the use of capacity constraints and social distancing guidelines states used to regulate indoor dining. We only had a measure of total restaurant expenditures and were unable to determine restaurant expenditures for different methods of restaurant utilization. Finally, we used a single question to assess risk aversion and while prior research suggests this method is sufficient for capturing risk aversion, future research should further investigate the appropriateness of the use
of a single question (Petrolia, 2016). Although the primary purpose of this paper was to investigate the influence of restaurant risk perception and risk aversion on the utilization of different restaurant services, our findings suggest the potential for future research to investigate how risk influenced shopping behavior across restaurants and grocery stores. Although most respondents in our sample had access to most forms of restaurant services in June, 40.40% still reported that their monthly expenditures at restaurants were less than a similar month before the pandemic. While our analysis did not find that restaurant risk perceptions could meaningfully explain variations within restaurant expenditures not within restaurant services, but between restaurant services and grocery store utilization.

Future research related to restaurant utilization during the pandemic may also want to consider the influence of vaccinations. Vaccinations may also play an important role in increasing the utilization of in-person restaurant services by decreasing the risk of contracting COVID-19. However, it is unclear what role vaccinations play in changing the perception of risk in restaurants. Thus, future research may investigate the relationship between vaccination, risk perception, and restaurant utilization further.

Appendix Table A1-A2.
Table A1 (continued)

| Variable Name                  | Survey Question                                                                 | Variable Definition                                                                 | Survey Question Responses |
|--------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------|
| Metropolitan county            | Based on responses to ‘In what state do you live?’ and ‘In what county do you live?’ and joined with the 2013 ERS Urban Rural Continuing Codes (RUCC) | If the RUCC indicated respondent’s county was in a metropolitan area (RUCC code equal to 1 through 3) | Metropolitan Counties 1 – Counties in metro areas of 1 million population or more; 2 – Counties in metro areas of 250,000 to 1 million population; 3 – Counties in metro areas of less than 250,000 population; Nonmetropolitan Counties; 4 – Urban population of 20,000 or more, adjacent to a metro area; 5 – Urban population of 20,000 or more, not adjacent to a metro area; 6 – Urban population of 2,500 to 19,999, adjacent to a metro area; 7 – Urban population of 2,500 to 19,999, not adjacent to a metro area; 8 – Completely rural or less than 2,500 urban population, adjacent to a metro area; 9 – Completely rural or less than 2,500 urban population, not adjacent to a metro area |
| Less than $25,000              | In 2019, what was your total household income before taxes?                      | If response was 1                                                                  | 1 – Less than $25,000; 2 – $25,000-$34,999; 3 – $35,000-$44,999; 4 – $45,000-$54,999; 5 – $55,000-$64,999; 6 – $65,000-$74,999; 7 – $75,000-$89,999; 8 – $100,000-$124,999; 9 – $125,000-$149,999; 10 – $150,000 or greater; 11 – Prefer not to answer |
| Between $25,000 and $74,999    | In 2019, what was your total household income before taxes?                      | If response was 2, 3, 4, 5, or 6                                                   | 1 – Less than $25,000; 2 – $25,000-$34,999; 3 – $35,000-$44,999; 4 – $45,000-$54,999; 5 – $55,000-$64,999; 6 – $65,000-$74,999; 7 – $75,000-$89,999; 8 – $100,000-$124,999; 9 – $125,000-$149,999; 10 – $150,000 or greater; 11 – Prefer not to answer |
| Between $75,000 and $99,999    | In 2019, what was your total household income before taxes?                      | If response was 7                                                                  | 1 – Less than $25,000; 2 – $25,000-$34,999; 3 – $35,000-$44,999; 4 – $45,000-$54,999; 5 – $55,000-$64,999; 6 – $65,000-$74,999; 7 – $75,000-$89,999; 8 – $100,000-$124,999; 9 – $125,000-$149,999; 10 – $150,000 or greater; 11 – Prefer not to answer |
| At least $100,000              | In 2019, what was your total household income before taxes?                      | If response was 8, 9, or 10                                                        | 1 – Less than $25,000; 2 – $25,000-$34,999; 3 – $35,000-$44,999; 4 – $45,000-$54,999; 5 – $55,000-$64,999; 6 – $65,000-$74,999; 7 – $75,000-$89,999; 8 – $100,000-$124,999; 9 – $125,000-$149,999; 10 – $150,000 or greater; 11 – Prefer not to answer |
| Use of in-person restaurant services inside | Approximately how many times in June 2020 did you eat at a restaurant and sit inside the restaurant? Include eating at a fast-food restaurant but exclude the times you ate at a restaurant but sat outside, such as on a patio. (Answer 0 if none) | Continuous form used | Open response |
| Use of in-person restaurant services outside | Approximately how many times in June 2020 did you eat at a restaurant and sit outside, such as on a patio. Include eating at fast-food restaurants. (Answer 0 if none) | Continuous form used | Open response |
| Used in-person dining less     | How does this compare to the number of times in a month you would typically eat at a restaurant (sitting either inside or outside) before the pandemic? | If response was 3                                                                  | 1 – More times than I normally would; 2 – About the same number of times I normally would; 3 – Less times than I normally would; 4 – Prefer not to answer |
| Used in-person dining about the same | How does this compare to the number of times in a month you would typically eat at a restaurant (sitting either inside or outside) before the pandemic? | If response was 2                                                                  | 1 – More times than I normally would; 2 – About the same number of times I normally would; 3 – Less times than I normally would; 4 – Prefer not to answer |
| Used in-person dining more     | How does this compare to the number of times in a month you would typically eat at a restaurant (sitting either inside or outside) before the pandemic? | If response was 1                                                                  | 1 – More times than I normally would; 2 – About the same number of times I normally would; 3 – Less times than I normally would; 4 – Prefer not to answer |
| Use of take-out or delivery    | Approximately how many times in June 2020 did you use drive-through, pick-up, or delivery from a restaurant or fast-food restaurant? (Answer 0 if none) | Continuous form used | Open response |
| Used take-out and delivery about the same | How does this compare to the number of times in a month you would typically use drive-through, pick-up, or delivery from a restaurant, including fast-food restaurants, before the pandemic? | If response was 3                                                                  | 1 – More times than I normally would; 2 – About the same number of times I normally would; 3 – Less times than I normally would; 4 – Prefer not to answer |
| Used take-out and delivery more | How does this compare to the number of times in a month you would typically use drive- | If response was 2                                                                  | 1 – More times than I normally would; 2 – About the same number of times I normally would; 3 – |

(continued on next page)
| Variable Name | Survey Question | Variable Definition | Survey Question Responses |
|---------------|-----------------|---------------------|--------------------------|
| Used take-out or delivery less | How does this compare to the number of times in a month you would typically use drive-through, pick-up, or delivery from a restaurant, including fast-food restaurants, before the pandemic? | If response was 1 | 1 – More times than I normally would; 2 – About the same number of times I normally would; 3 – Less times than I normally would; 4 – Prefer not to answer |
| Total restaurant expenditures | Approximately, how much did you spend on food from restaurants in June 2020 (include in-person dining, drive-through, pick-up, and delivery)? (Answer 0 if none) | Continuous form used | Open response |
| Total grocery expenditures | Approximately, how much did you spend on groceries in June 2020 (include both in-store and online purchases)? (Answer 0 if none) | Used in total food expenditures | Open response |
| Spent more on restaurant expenditures | How does this compare to the amount you would typically spend in a month on food from restaurants before the pandemic? | If response was 4 or 5 | 1 – A lot less than I normally would spend; 2 – Slightly less than I normally would spend; 3 – About the same amount as I would normally spend; 4 – Slightly more than I normally would spend; 5 – A lot more than I normally would spend; 6 – Prefer not to answer |
| Spent about the same on restaurant expenditures | How does this compare to the amount you would typically spend in a month on food from restaurants before the pandemic? | If response was 3 | 1 – A lot less than I normally would spend; 2 – Slightly less than I normally would spend; 3 – About the same amount as I would normally spend; 4 – Slightly more than I normally would spend; 5 – A lot more than I normally would spend; 6 – Prefer not to answer |
| Spent less on restaurant expenditures | How does this compare to the amount you would typically spend in a month on food from restaurants before the pandemic? | If response was 1 or 2 | 1 – A lot less than I normally would spend; 2 – Slightly less than I normally would spend; 3 – About the same amount as I would normally spend; 4 – Slightly more than I normally would spend; 5 – A lot more than I normally would spend; 6 – Prefer not to answer |
| Had COVID-19 | Have you had COVID-19? | If response was Yes | 1 – Yes; 2 – Maybe; 3 – No; 4 – Prefer not to answer |
| Household member had COVID-19 | Has anyone in your household (excluding yourself), had COVID-19? | Used in know someone who had COVID-19 variable | 1 – Yes; 2 – Maybe; 3 – No; 4 – Prefer not to answer |
| Knew someone outside the household that had COVID-19 | Do you have any friends, or family members who have had COVID-19 but do not live in your home? | Used in know someone who had COVID-19 variable | 1 – Yes; 2 – Maybe; 3 – No; 4 – Prefer not to answer |
| Know someone who had COVID-19 | Used response to household member of knew someone outside the household that had COVID-19 | If response was 1 or yes | 1 – Yes; 2 – Maybe; 3 – No; 4 – Prefer not to answer |
| At least moderately concerned with contracting COVID-19 | How concerned are you about becoming ill with COVID-19? | If response was at least 5 | (1–9) – None, not concerned; 5 – Moderately Concerned; 9 – Extremely Concerned; 10 – Prefer not to answer |
| Essential Worker | Since the pandemic started, has your employer ever told you are an “essential worker”? | If response worker was Yes | 1 – Yes; 2 – No; 3 – Maybe; 4 – Unsure; 5 – Prefer not to answer |
| Current tobacco use | Do you currently - Smoke, use tobacco, or electronic cigarettes? | If response was Yes | 1 – Yes; 2 – No; 3 – Prefer not to answer |
| Risk Aversion | Rate your level of agreement with the following statement about taking risks. "I tend to take many risks in everyday life." | Continuous form used | (1–9) – Strongly Disagree; 5 – Neither agree or disagree; 9 – Strongly agree; 10 – Prefer not to answer |
| Self-reported height | Please provide your height without shoes and your weight. Height: - and inches | Used in obese variable | Open response |
| Self-reported weight | Please provide your weight. - Weight in pounds | Used in obese variable | Open response |
| Obese | Uses self-reported height and weight questions | If 703*weight/(height in inches squared) is at least 30 | Open response |
| Household Size | Including yourself, how many people live in your household? (Don’t forget to include babies, small children, and non-relatives who live with you and share food. Do not include people who are living away, for example at school). | Continuous form used | Open response |
| Presence of child | How many children (aged 18 years or younger) currently live in your household? (Answer 0 if none) | If number of children was greater than 0 | Open response |
| Female | With which of the following genders do you most identify? - Selected Choice | If response was 2 | 1 – Male; 2 – Female; 3 – Not listed (TEXT see below); 4 – Prefer not to answer |
| Highschool or less | What is your highest level of education? | If response was 1 or 2 | 1 – Less than HS; 2 – HS Graduate; 3 – Some college or technical school; 4 – 2-year degree; 5 – (continued on next page) |
Table A1 (continued)

| Variable Name                                      | Survey Question                                                                 | Variable Definition                                                                 | Survey Question Responses                                                                 |
|----------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Completed technical, two year degree or some college| What is your highest level of education?                                        | If response was 3 or 4                                                              | 4 year degree; 6 – Graduate or professional degree; 7 – Prefer not to answer              |
| Completed college or graduate school                | What is your highest level of education?                                        | If response was 5 or 6                                                              | 1 – Less than HS; 2 – HS Graduate; 3 – Some college or technical school; 4 – 2-year degree; 5 – 4 year degree; 6 – Graduate or professional degree; 7 – Prefer not to answer |
| Diabetes                                           | Has a doctor, nurse, or other health professional told you that you currently have any of the following? - Diabetes | If response was Yes                                                                | 1 – Yes; 2 – No; 3 – Prefer not to answer                                                  |
| Any cardiovascular disease                         | Has a doctor, nurse, or other health professional told you that you currently have any of the following? - Cardiovascular disease, including hypertension | If response was Yes                                                                | 1 – Yes; 2 – No; 3 – Prefer not to answer                                                  |
| Asthma                                             | Has a doctor, nurse, or other health professional told you that you currently have any of the following? - Asthma | If response was Yes                                                                | 1 – Yes; 2 – No; 3 – Prefer not to answer                                                  |
| White                                              | How would you describe your race or ethnicity? (Select all that you identify with) | If response was only 1                                                              | 1 – White; 2 – Asian; 3 – Hispanic or Latino; 4 – Black or African American; 5 – American Indian or Alaska Native; 6 – Native Hawaiian or Pacific Islander; 7 – Other; 8 – Prefer not to answer |
| Black                                              | How would you describe your race or ethnicity? (Select all that you identify with) | If response was only 4                                                              | 1 – White; 2 – Asian; 3 – Hispanic or Latino; 4 – Black or African American; 5 – American Indian or Alaska Native; 6 – Native Hawaiian or Pacific Islander; 7 – Other; 8 – Prefer not to answer |
| Other and multiple races                            | How would you describe your race or ethnicity? (Select all that you identify with) | If there were multiple responses, but did not include 3                            | 1 – White; 2 – Asian; 3 – Hispanic or Latino; 4 – Black or African American; 5 – American Indian or Alaska Native; 6 – Native Hawaiian or Pacific Islander; 7 – Other; 8 – Prefer not to answer |
| Hispanic                                           | How would you describe your race or ethnicity? (Select all that you identify with) | If response was only 3 or multiple responses including 3                            | 1 – White; 2 – Asian; 3 – Hispanic or Latino; 4 – Black or African American; 5 – American Indian or Alaska Native; 6 – Native Hawaiian or Pacific Islander; 7 – Other; 8 – Prefer not to answer |
| Trust information from scientists                  | How much do you trust information scientists provide to you?                   | Continuous form used                                                                | (1–9) – Not at all; 9 – Fully trust; 10 – Prefer not to answer                           |
| Trust information from government                  | How much do you trust information the government provides to you?              | Continuous form used                                                                | (1–9) – Not at all; 9 – Fully trust; 10 – Prefer not to answer                           |

### Table A2

Cragg model regression marginal effects of risk on restaurant utilization and expenditures in June 2020.

| Marginal effect (Delta-method std. error) | All restaurant use | Take-out delivery | In-person service outside | In-person service inside | All restaurant expenditures |
|-------------------------------------------|--------------------|-------------------|--------------------------|-------------------------|----------------------------|
| Marginal effect                           | Any restaurant use (Any expenditures) | N = 1661 | N = 1461 | N = 1461 | N = 1461 | N = 1655 |
| Num. outdoor policy days in June          | 2.97E-03           | -8.05E-04         | 3.20E-03                 | 1.39E-04                | 2.28E-03                  |
|                                          | (1.94E-03)         | (1.31E-03)        | (3.00E-03)               | (3.15E-03)              | (2.08E-03)                |
| Num. indoor policy days in June           | 1.98E-04           | 1.13E-03          | -1.23E-03                | 3.48E-03                | 4.96E-04                  |
|                                          | (1.57E-03)         | (1.09E-03)        | (2.38E-03)               | (2.48E-03)              | (1.58E-03)                |
| Standardized restaurant risk perception index (SRP) | -0.01              | 0.01              | -0.07***                 | -0.13***                | -0.01                     |
|                                          | (0.01)             | (0.01)            | (0.01)                   | (0.01)                  | (0.01)                    |
| Standardized risk aversion (SRA)          | -0.01              | -4.35E-03         | -0.05***                 | -0.05***                | -4.24E-03                 |
|                                          | (0.01)             | (0.01)            | (0.01)                   | (0.01)                  | (0.01)                    |
| SRRP X SRA                               | -5.87E-04          | -1.01E-03         | 0.02                     | -0.01                   | 1.59E-03                  |
|                                          | (0.01)             | (0.01)            | (0.01)                   | (0.01)                  | (0.01)                    |
| Age                                      | -3.13E-02***       | -8.24E-04*        | -3.37E-02***             | -2.30E-02**             | -3.40E-02***              |
|                                          | (5.17E-04)         | (3.69E-04)        | (8.12E-04)               | (8.26E-04)              | (5.37E-04)                |
| Female                                   | 0.02               | -0.01             | -0.09***                 | -0.06*                  | 0.01                      |
|                                          | (0.02)             | (0.01)            | (0.03)                   | (0.03)                  | (0.02)                    |
| White                                    | 0.05*              | -0.02             | 1.76E-05                 | 0.07                    | 0.04                      |
|                                          | (0.03)             | (0.02)            | (0.04)                   | (0.04)                  | (0.03)                    |
| Black                                    | 0.09*              | -0.04             | -0.03                    | -0.04                   | 0.08                      |
|                                          | (0.04)             | (0.03)            | (0.06)                   | (0.06)                  | (0.04)                    |
| Hispanic                                 | 0.11*              | 0.01              | -0.02                    | 0.04                    | 0.09*                     |
|                                          | (0.04)             | (0.03)            | (0.05)                   | (0.06)                  | (0.04)                    |
| Income of at least $75,000               | 0.07***            | 1.00E-03          | 0.08**                   | 0.07*                   | 0.06**                    |
|                                          | (0.02)             | (0.01)            | (0.03)                   | (0.03)                  | (0.02)                    |
| Presence of children                     | 0.04*              | 0.02              | -0.01                    | 0.03                    | 0.02                      |
|                                          | (0.020)            | (0.01)            | (0.03)                   | (0.03)                  | (0.02)                    |
| At least college graduate                |                    |                   |                          |                         |                           |

(continued on next page)
Table A2 (continued)

| Marginal effect | All restaurant use | Take-out delivery | In-person service outside | In-person service inside | All restaurant expenditures |
|-----------------|--------------------|-------------------|--------------------------|-------------------------|----------------------------|
|                  | N = 1461           | N = 1395          | N = 473                  | N = 584                 | N = 1459                   |
| (Delta-method std. error) |                   |                   |                          |                         |                            |
| Num. outdoor policy days in June | –4.85E-03         | 0.02              | 4.70E-03                 | –0.05*                  | –1.78*                     |
| (0.04)           | (0.03)             | (0.02)            | (0.02)                   | (0.02)                  | (0.08)                     |
| Num. indoor policy days in June | 0.03              | 0.03              | –0.01                    | –0.01                   | –1.04                      |
| (0.03)           | (0.02)             | (0.01)            | (0.02)                   | (0.02)                  | (0.68)                     |
| Standardized restaurant risk perception index (SRP) | –0.52***          | 0.09              | –0.19                    | –0.42***                | –3.36                      |
| (0.13)           | (0.11)             | (0.10)            | (0.09)                   | (0.09)                  | (3.35)                     |
| Standardized risk aversion (SRA) | –0.39*            | 0.11              | –0.35***                 | –0.38***                | –6.40                      |
| (0.15)           | (0.12)             | (0.10)            | (0.10)                   | (0.10)                  | (4.14)                     |
| SRP X SRA | –0.09              | –0.06             | –0.09                    | –0.26**                 | –1.83                      |
| (0.14)           | (0.13)             | (0.09)            | (0.09)                   | (0.09)                  | (4.14)                     |
| Age | –0.06***           | –0.04***          | –0.02**                  | –0.01                   | –0.69***                   |
| (0.01)           | (0.01)             | (0.01)            | (0.01)                   | (0.01)                  | (0.26)                     |
| Female | –0.61*             | 0.13              | –0.24                    | –0.30                   | 6.39                       |
| (0.30)           | (0.24)             | (0.18)            | (0.18)                   | (0.18)                  | (8.14)                     |
| White | 0.27               | 0.08              | 0.08                     | 0.15                    | 0.81                       |
| (0.45)           | (0.35)             | (0.28)            | (0.32)                   | (0.32)                  | (12.77)                    |
| Black | –0.39              | –0.18             | 0.09                     | 0.12                   | –5.46*                     |
| (0.65)           | (0.51)             | (0.39)            | (0.43)                   | (0.43)                  | (23.19)                    |
| Hispanic | –0.16              | –0.33             | –0.10                    | 0.29                    | –2.48                      |
| (0.57)           | (0.47)             | (0.39)            | (0.39)                   | (0.39)                  | (16.14)                    |
| Income of at least $75,000 | 0.57               | 0.12              | 0.05                     | 0.40*                   | 59.75***                   |
| (0.32)           | (0.26)             | (0.20)            | (0.20)                   | (0.21)                  | (9.41)                     |
| Presence of children | 1.05**             | 0.83***           | 0.05                     | 0.06                   | 38.67***                   |
| (0.30)           | (0.25)             | (0.18)            | (0.18)                   | (0.18)                  | (8.64)                     |
| At least college graduate | –0.31              | –0.43             | 0.01                     | 0.02                   | 14.79                      |
| (0.32)           | (0.26)             | (0.19)            | (0.19)                   | (0.19)                  | (8.93)                     |
| Metropolitan county | 0.80               | 1.01**            | –0.40                    | –0.12                  | 7.49                       |
| (0.41)           | (0.32)             | (0.27)            | (0.23)                   | (0.23)                  | (12.22)                    |
| Midwest | 0.65               | 0.45              | –0.17                    | 0.48                    | –5.41                      |
| (0.43)           | (0.36)             | (0.31)            | (0.28)                   | (0.28)                  | (11.97)                    |
| Northeast | 1.03               | 0.57              | 0.16                     | 0.49                   | –3.12                      |
| (0.52)           | (0.50)             | (0.33)            | (0.32)                   | (0.32)                  | (14.82)                    |
| South | 0.74*              | 0.52              | 0.10                     | 0.25                   | –0.97                      |
| (0.38)           | (0.30)             | (0.24)            | (0.24)                   | (0.24)                  | (9.82)                     |

*p < 0.05 **p < 0.01 ***p < 0.001.

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