

Restaurant food consumption in the time of the pandemic. Channel Changes, Social Vulnerability, and Food Logistics Implications

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The COVID-19 pandemic has changed many facets of our lives, including the way we procure and consume prepared meals because of social distancing, forced closures of restaurants with only on-site dining, and lockdowns. Approximately a third of California restaurants closed permanently, and two-thirds of restaurant employees lost their jobs, at least temporarily (Thompson, 2021). Nationwide, 90% of dine-in restaurant saw substantial revenue drops in patronage during the early days of the pandemic (Lucas, 2020). In addition to policy restrictions, health concerns kept some patrons away from on-site dining and prompted them to seek a safer food experience in more controlled environments, such as their homes (Gavilan et al., 2021; Truong and Truong, 2022).

While dine-in restaurant sales plunged, takeout and delivery sales soared. This success was not limited to restaurants that mainly offered takeout or deliver orders: according to the National Restaurant Association, more than half of registered full-service restaurateurs devoted more resources to delivery and takeout during the pandemic, a shift that was well-received by customers (Klein, 2021). Despite these substantial changes, research on prepared meal purchased in the U.S. is still limited. Although some studies have addressed restaurant food consumption during COVID-19 (Ali et al., 2021; Ben Hassen et al., 2021, 2020; Gavilan et al., 2021; Mehroliia et al., 2021), they investigated relatively short period of time (one or two months), and typically focused on deliveries. Moreover, most papers in this strand of the literature analyzed non-probability samples obtained via online surveys, which precludes safely generalizing findings to a target population.

This study starts to fill these gaps by analyzing answers to a May 2021 random survey of California members of KnowledgePanel®, the largest and oldest panel representative of the U.S. population, to understand the impact of the pandemic on the frequency that Californians consume restaurant meals, and how this may change when the pandemic is over. To test our conjecture that Californians who reside in areas more susceptible to disasters had more difficulties shopping for prepared meals during the pandemic, we added to the explanatory variables of our ordered and generalized structural equation models the four components of the social vulnerability index (SVI) (Flanagan et al., 2011). Using this novel approach, we answered the following questions: 1) what explains the frequency of

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meal purchases (dine in, online with home delivery, online with pickup, or other) in California and how is it likely to change after the pandemic is over? and 2) did social vulnerability play a role in observed changes in these frequencies?

Data for this paper were collected through a survey conducted for us by Ipsos in late May 2021 to understand how COVID-19 impacted the way Californians commute, travel using different modes, and buy food. Our survey was administered to a random sample of the California members of KnowledgePanel® (KP), which is the largest and oldest probability-based online U.S. panel. KP is large enough (~60,000 members) that its California members are representative of the state's population. For surveys such as ours, Ipsos relies on a patented method to ensure that samples behave as if they had been generated using the equal probability selection method, which enables us to simply generalize our results to Californians 18 and over (our target population). As shown in Cornesse et al. (2020), numerous studies have reported that internet surveys of probability samples yield more accurate estimates than internet surveys of non-probability samples, even after poststratification weighting.

We first wrote our questionnaire in English and tested it on graduate students. It has two parts. In the first part, we inquire about commuting, telework, and travel before, during, and potentially after COVID-19. In the second part, we explore how Californians shopped for groceries and prepared meals before and during the pandemic, and what they may do after it is over.

To test our survey instrument, we fielded a pilot study in mid-May 2021 with 25 KP members from California. We then modified our survey instrument based on their feedback. To include Californians who prefer communicating in Spanish, we asked a native speaker to translate our survey and pre-tested it with native speakers. Both versions of the survey were administered starting May 22, 2021. By the end of May 2021, we stopped collecting data after getting responses from 1,026 respondents.

In our survey, we asked our respondents how frequently they shopped for restaurant meals (dine-in, takeout, and delivery) before the March 2020 stay-at-home Executive Order, during the pandemic, and how they intend to shop for prepared meals after the pandemic, by selecting one of six options ("Never", "Less than once a month", "1-3 times a month", "1-2 times a week", "3 or more times a week", and "I don't know"). Our explanatory variables include socio-economic characteristics, census characteristics of the restaurant access area for each respondent (i.e., the isochrone from driving 20-minutes at 6 pm on a usual weekday, starting from the centroid of a respondent's ZIP Code Tabulation Area), a county-level variable about COVID-19 severity, and a technology savviness index based on twelve questions designed to gauge attitudes towards communication technology.

To model shopping frequency for restaurant meals, we relied on ordinal generalized linear models, which were proposed by Williams (2010) to capture heterogeneity in ordinal regression models. We also used exploratory factor analysis to model tech savviness and relied on Sankey diagrams to visualize changes in the frequencies at which Californians 18 and over dine-in at restaurants, order takeout, or have restaurant food delivered (see Figure 1).

Starting with the generation of our respondents, we found that while age has almost no impact on the frequency of dining-in, it is important for both takeout and delivery, which are less likely to be used by older generations (Baby Boomers and older).

Race also matters. Before the pandemic, African Americans were less likely to dine-in than Whites, a difference likely to reappear after the pandemic. However, during the pandemic, they were more likely to dine-in and rely on takeout. In general, they are also much more likely to order restaurant food online and have it delivered. Differences in results between the Hispanic and Spanish survey coefficients illustrates the heterogeneity of Hispanics in California.

Education plays a limited role in our results. For dine-in, Californians with a graduate education intend to frequent restaurants more after the pandemic while relying less on deliveries. They used takeout less before, just like Californians with at most a high school education.

As expected, income impacts restaurants meal consumption. People at the bottom of the income range eat out less frequently, and use takeout less, while more affluent Californians dine-in more and are much more likely to get meals delivered.

Likewise, more tech savvy Californians relied more on deliveries both during and before COVID, and intend to continue doing so after the pandemic. They were also more likely to use takeout during the pandemic.

Characteristics of restaurant access areas have little impact on the frequency of use of various channels for restaurant food consumption.

However, various facets of the social vulnerability index play a significant role for takeout and deliveries. Starting with takeout, our results show that before the pandemic, Californians with lower economic standing, and minority status/language barriers were more likely to use takeout, while the reverse was true for those limited by transportation barriers and housing type. These differences continued during the pandemic only for lower economic standing, and intentions suggest that after the pandemic those with housing and transportation barriers would like to use takeout more. Results are different for deliveries, as households limited by household composition and disability status (surprisingly) used meal deliveries less before and during the pandemic.

Finally, in areas that were more affected by the pandemic, Californians intend to use takeout and meal deliveries more post-pandemic.

Our results also show substantial heterogeneity, which varies by time period (before, during, or after COVID), and by channel (dine-in, takeout, or delivery).

Understanding changes in how restaurant food is consumed is important to policymakers concerned with public health and equity. According to U.S. Centers for Disease Control and Prevention (CDC), poor diets lead to chronic illnesses such as heart disease, type 2 diabetes, and obesity, which account for 70% of deaths in the U.S. (CDC, 2020). Purchased prepared food is often considered less healthy than food prepared at home because the former tends to contain more calories, more fat, and more sodium (Saksena et al., 2018). Moreover, the CDC points out that low-income and minority communities tend to lack easily accessible places that offer affordable and healthy food (CDC, 2020).

Understanding changes in the way restaurant food is consumed is also critically important to food delivery logistics managers, at a time when the online food delivery industry is experiencing an annual growth of close to 11% (from \$126.9 billion in 2021 to a forecast value of \$192.2 billion in 2025). Challenges that need to be overcome include managing delivery loads in a fiercely competitive environment, maintaining delivery standards as delivery windows shrink, offering secure multi-payment options, and providing reliable real-time communications between restaurants, delivery drivers, and customers.

Parole Chiave: food deliveries; takeout food; ordinal generalized linear models; COVID-19; food logistics; California

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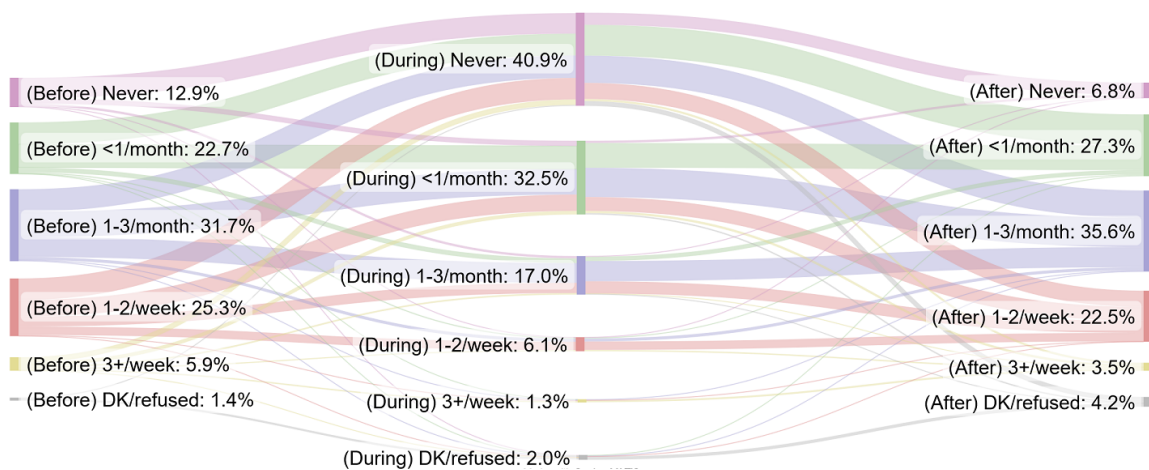
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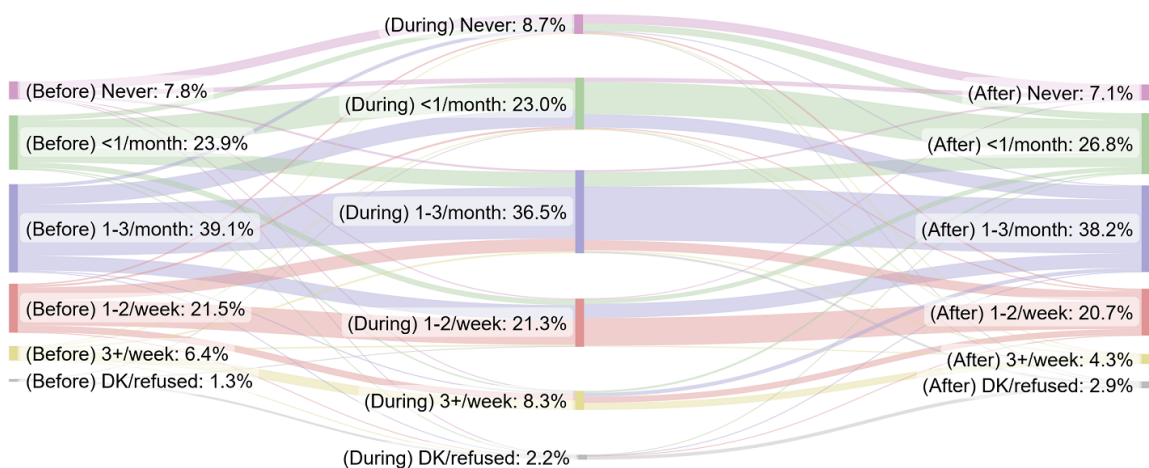
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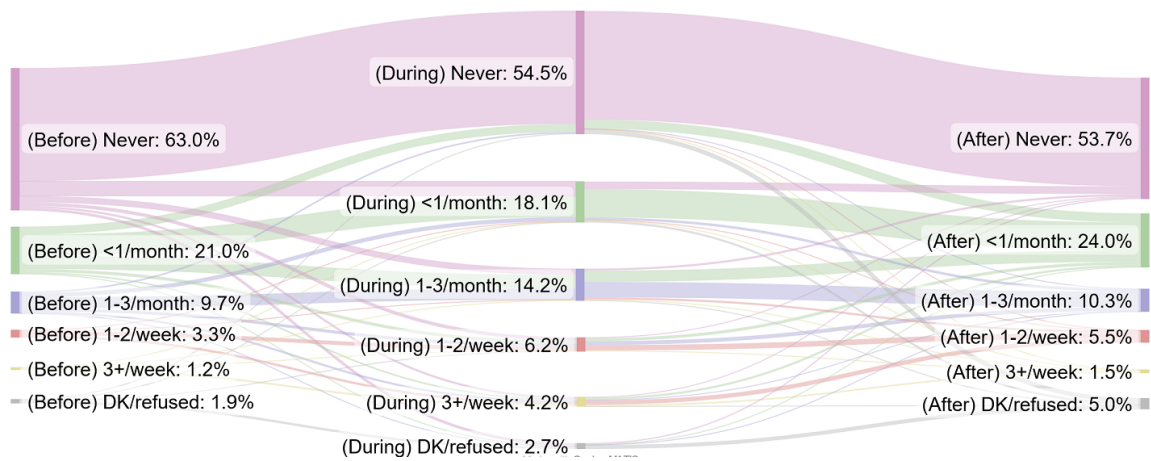
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Panel A. Dining-in



Panel B. Takeout



Panel C. Delivery