The effect of COVID-19 on food sales

Eliana Zeballos  |  Xiao Dong

Abstract
Both COVID-19 pandemic-related restrictions and recessionary employment loss severely impacted US food sales during 2020. This article estimates the historical relationship between food expenditures and employment at the county level. Using these estimates, we simulate the impact of the loss of employment on food sales and find that, on average, employment loss increased food-at-home (FAH) sales by 1.3% and decreased food-away-from-home (FAFH) sales by 0.5% in 2020. We argue differences to the actual 4.8% increase in FAH sales and 19.5% decrease in FAFH sales in 2020 likely stem from the more drastic COVID-19 pandemic-related restrictions and behavioral changes.

KEYWORDS
COVID-19, employment, Food Expenditure Series, food-at-home, food-away-from-home

JEL CLASSIFICATION
D12, Q18, E32

US food-at-home (FAH) sales and food-away-from-home (FAFH) sales drastically changed compared to previous years in 2020. The Food Expenditure Series (FES) from the Economic Research Service (ERS) indicates that food purchased at grocery stores, supercenters, and other FAH retailers in 2020 were up 4.8% compared with 2019. Meanwhile, food purchased at FAFH establishments, such as restaurants, cafeterias, and other eating-out places in 2020 were down 19.5% compared with 2019. These 2020 changes in food sales likely stem from both the economic effects and the unique pandemic-related effects of COVID-19.

In the US, the first confirmed case of the novel coronavirus (COVID-19) was confirmed on January 21, 2020.1 By early March, a pandemic was declared by the World Health Organization.2
To slow the spread of COVID-19, the US government announced federal social distancing guidelines in mid-March 2020, and many US jurisdictions followed suit with implementation of stay-at-home orders. Mobility restrictions in the form of lockdowns, stay-at-home orders, and consumers’ fear of infection from a contagious virus altered shopping patterns and associated consumption decisions (Chenarides et al., 2020; Lusk & McFadden, 2021; McFadden et al., 2021). Coupled with supply chain issues, the shifting demand for FAH consumption resulted in stockouts and higher prices (Balagtas & Cooper, 2021; Chenarides et al., 2021). The pandemic-induced anxiety even drove some households to stockpile food (Chenarides et al., 2021).

The economic effects of COVID-19 were severe and resulted in a recession with the unemployment rate peaking at over 14% in the April of 2020 (BLS, 2020). Economic downturns and higher unemployment can significantly reduce household income as 65% of households with children and incomes below $25,000 lost at least some employment income since March 2020 (BLS, 2020). Shocks to household income can affect household consumption decisions (Jappelli & Pistaferri, 2010) and change both the portion of food expenditures of the household budget and the total expenditures on food and beverages (Todd, 2014) per the Engel curves (Lusk & McFadden, 2021). Moreover, the magnitude of impact on food sales will likely be heterogeneous across spatial locations as the effects likely hinge on the severity of the local shock, which can vary across geographic locations partly because of varying industrial compositions.

Previous evidence during the Great Recession between 2006 and 2009 shows that total food spending by US households declined by 5% (Kumcu & Kaufman, 2011). In 2020, Restrepo et al. (2021) show that households with respondents who lost their jobs due to COVID-19 related firm closures spent 15% less on food and were 36% more likely to receive free food. Ultimately, these changes can lead to significant policy implications as Gundersen et al. (2020) projected an increase of 17 million food-insecure Americans in 2020. Furthermore, the change in household income can shift purchasing and consumption patterns within food groups and types of food (Dave & Kelly, 2012; Griffith et al., 2016). Factors related to recessions, such as changing work schedules, financial stress, shifts in physical activity, loss of employer-sponsored health insurance, and the reduction in income itself, can alter household consumption and saving decisions and lead to changes in food purchase patterns (Todd, 2014). Beatty and Senauer (2013) found that households spend 30 min per week more in food preparation and 7.11 min per week more shopping for food in 2010 compared to 2007, after, and before the Great Recession, respectively.

This paper answers three policy-relevant and related questions: (1) How do recessions and changes in employment levels impact FAH and FAFH sales at the local level? (2) What are the economic effects of COVID-19 on food sales in 2020 at the local level? and (3) Can we separate the pandemic-related effects and economic effects of COVID-19 on food sales? We attempt to answer these three questions with the following steps. First, we estimate the historical relationship between FAH and FAFH expenditures and employment levels at the county level. Due to data limitations on food sales at the local level in 2020, we then used the historical estimates to simulate the predicted impact of the employment change in 2020 on food sales. Finally, we aggregate these simulated values and compare them with available national-level data on food sales. We argue that the differences between the simulated economic effects and actual changes are added effects of the pandemic-related restrictions and behavioral changes on food sales.

We report the following results. First, loss of employment leads to larger decreases in FAFH sales compared to FAH sales. Second, during a recessionary year, FAH sales increase while FAFH sales decrease. Third, on average, employment loss is estimated to have increased FAH sales by 1.3% and decreased FAFH sales by 0.5% in 2020. Finally, these numbers are dwarfed by the 4.8% increase in
FAH sales and 19.5% decrease in FAFH sales, respectively, that the United States Department of Agriculture (USDA) ERS's FES reports.

The results of this study make several contributions to the literature and highlight potential economic challenges at the county level. First, we extend the literature on shifts in the overall household food expenditures and FAH and FAFH spending due to recession-driven economic shocks. Second, we focus on the change in food expenditures driven by changes in local economic conditions as we rely on county-level data. Third, we estimate the likely shift in food spending caused by the economic shocks measured by employment rates at the county level in 2020, enabling identification of the counties that potentially experienced the most salient economic effects of COVID-19. Finally, we present evidence that on average and measured by employment levels, the economic effects of COVID-19 on FAH sales, and especially FAFH sales are small compared to the actual changes in food spending at the aggregate level in 2020. From a policy perspective, by isolating the economic effects and pandemic effects on food sales, we can shed light on how food sales will change in response to the potential separate effects from lifting restrictions and economic recovery.

DATA

In this article and building on Dong and Zeballos (2021), we combine and use three different datasets: (1) the National Establishment Time Series (NETS) to examine county-level food spending from 1990 to 2019; (2) employment data at the county level as an indicator of local economic conditions and the severity of the economic shocks in each county from 1990 to 2020; and (3) the FES to measure aggregate changes in FAH and FAFH expenditures from 1990 to 2020.

National Establishment Time Series

To examine county-level food spending across time and among different food establishments, we use sales at FAH and FAFH establishments in each county from the NETS database. NETS is a longitudinal database that records the sales, employment figures, growth, and performance against industry peers for specific business locations across time. Dun and Bradstreet and Walls and Associates created NETS by using Dun and Bradstreet's archival data from surveys of establishments (Walls & Associates, 2013). Each unit of observation in NETS reports the annual sales revenue and the number of employees for each establishment from 1990 to 2019. Due to the detailed and granular level of the data, NETS has been intensively used in recent studies that rely on yearly variations for identification as the database was created to focus on the establishment and firm-level growth and performance across time. As NETS tracks the sales, growth, and number of employees for individual-level establishments, it provides a rich and unique panel dataset that allows us to examine the change in food sales across different food establishment types in varying geographic locations. NETS contains business establishments from a comprehensive list of industries, and the database categorizes establishments using the NAICS and the Standard Industrial Classification numeric codes. To identify food spending at the county level, we use NAICS codes to select only the establishments that sell food, and we base our selection on the methodology used by the USDA, ERS's Food Expenditures Series.

Recent literature has shown NETS captures the food environment relatively well compared to the official Bureau of the Census' Economic Census, and NETS is ideal for researchers
attempting to look at the food environment over time (Cho et al., 2019). Although the number of food establishment employees has similar aggregate trends compared to the County Business Pattern, which is an annual series that provides subnational economic data by industry, aggregate food sales trends do not align with trends observed by the FES and Economic Census. This is likely due to a significant portion of sales data in NETS being imputed based on firm-level employment numbers and in particular with estimated sales based on employment data (Barnatchez et al., 2017; Crane & Decker, 2019). The sales imputation potentially raises concerns about using NETS data for certain research questions surrounding firm and business dynamics (Barnatchez et al., 2017; Crane & Decker, 2019) as a significant portion of sales data in NETS is imputed based on firm-level employment numbers and in particular with estimated sales based on employment data. Therefore, to accurately estimate food sales, we perform a correction by applying a sales per employee ratio, which is calculated using the Economic Census for each North American Industry Classification System (NAICS) code for the most relevant food industries by state and firm size. Our corrected food sales compare well against the aggregate trends observed by the FES.

To further identify FAH and FAFH spending, we use product and services codes (PSCode), which the Bureau of the Census also uses to prepare product line reports that details the percentage of sales by product and contributing industry. We select all the PS codes related to food and nonalcoholic beverages and classified them as FAH if they were sold for off-premise consumption or as FAFH if they were sold for on-premise consumption used by the USDA, ERS’s Food Expenditures Series. Using these percentages, we then calculate the portion of FAH and FAFH sales for each establishment in NETS using its NAICS code.

**Employment data**

We use overall total employment at the county level as an indicator of local economic conditions and the severity of the economic shocks in each county from 1990 to 2020. The Burau of Labor Statistics (BLS) constructs county-level employment and unemployment estimates by combining state-level data from its current population survey with county-level counts of unemployment insurance claimants. Data on annual county-level unemployment and employment start in 1990, similar to the NETS database. To estimate the effect of historical economic conditions and shocks on food expenditure, we use annual county-level employment data from 1990 to 2019, which corresponds to the timespan of the NETS data in our regression analysis. To simulate the change in food sales at the county level due to the COVID-19 recession, we use the most recent 2020 county-level employment figures from BLS (2021). The BLS publishes monthly county-level employment numbers for the latest 18 months, and we use the average employment figures from January 2020 to December 2020.

**Food Expenditure Series**

To measure aggregate changes in FAH and FAFH expenditures from 1990 to 2020, we use the FES from the USDA-Economic Research Service. The ERS FES is a comprehensive data set that measures the US food system by quantifying the value of food acquired in the United States by type of product, outlet, and purchaser. The data series measures the value of food acquired, including food and beverage sales (as well as taxes and tips), and the value of
food produced at home, donated and furnished to employees and institutionalized persons. Figure 1 shows the historical trends in FAH and FAFH spending across time adjusted for inflation. Spending on both FAH and FAFH has been gradually increasing over the last eight decades, except for decreases in food spending during major economic shocks such as the Great Recession. However, FAFH spending is trending upwards more rapidly over time and surpassed FAH expenditures in 2004. FAFH and FAH both comprise about half of the shares of total food expenditures. While both FAFH and FAH decreased during the Great Recession (2008–09), FAFH decreased more, showing the more salient effect that the recession had on FAFH versus FAH.

**METHODOLOGY**

In this article, we first estimate the historical relationship between FAH and FAFH expenditures and changes in employment levels at the county level for the years 1990–2019. Second, as we lack food sales at the local level for 2020, we use the estimates from the historical relationship to simulate the impact of employment loss on food sales during 2020 at the county level.

Finally, we aggregate the simulated values to compare with available national-level food expenditure data.

To econometrically estimate the historical relationship between FAH and FAFH expenditures and changes in employment levels at the county level between 1990 and 2019, we use the following specification.

\[
\log(Sales_{ct}) - \log(Sales_{ct-1}) = \beta_0 + \beta_1 \log(employment_{ct}) - \log(employment_{ct-1}) + \beta_2 \text{Recession}_t + \text{CountyFixedEffects}_c + \epsilon_{ct}
\]

(1)

![Figure 1](https://www.ers.usda.gov/data-products/food-expenditure-series/). Spending on food-at-home and food-away-from-home, 1960–2020. Source: USDA, Economic Research Service (ERS) using data from the ERS 2020 Food Expenditure Series: https://www.ers.usda.gov/data-products/food-expenditure-series/. Constant sales in 1988 dollars and include taxes and tips [Color figure can be viewed at wileyonlinelibrary.com]
We regress the growth rate of food sales on the growth rate of employment at the county level where \( c \) indexes county and \( t \) indexes year. We approximate the growth rate of food sales by differencing the log of food sales and the growth rate of employment by differencing the log of employment. By differencing the log of food sales, we control for potential seasonality and nonstationarity in the data. We estimate the effects of a recession by using the dummy variable \( r \), where \( r \) equals 1 for the years 1990, 1991, 2001, 2008, and 2009 (periods of recession according to the National Bureau of Economic Research [NBER]).\(^9\) The NBER definition for recession is generally presented quarterly. We assume if any of the recession falls into a year for even a quarter (as in 1991), the recession dummy equals 1 for that year.\(^10\) We rely on the local employment rate from 1990 to 2019 to capture the salience of the economic effect of COVID-19, which is likely to be heterogeneous across space. The discrete binary national variable “recession” serves as a “catch-all” for nationwide effects of entering into a recession such as increased federal stimulus, expansion of benefits, and monetary policy changes. Finally, we control for local time-invariant characteristics with county fixed effects.\(^11\) We deflate the dollar value for the sales using the consumer price index for FAH and FAFH sales from BLS.

To simulate the economic effects of COVID-19 on total food sales, FAH sales, and FAFH sales, we apply the resulting estimates of Equation 1 into Equation 2. We multiply \( \beta_1 \), the marginal effect of the growth of county-level employment on the growth of food sales, by the county-level employment growth in 2020. We add \( \beta_3 \), the effect of a recessionary year on the growth of food sales.

\[
\log(Sales_{c2020}) - \log(Sales_{c2019}) = \beta_0 + \beta_1 \left[ \log(employment_{c2020}) - \log(employment_{c2019}) \right] + \beta_2 \text{Recession}
\] (2)

RESULTS

Table 1 shows the results of the regression utilizing Equation 1. In the first column, we use the growth of total food sales as the dependent variable and show that a one percentage point decrease in the growth of a county’s employed population is associated with a 0.08 percentage point decrease in the growth of total food sales. A recessionary year is associated with a 0.86 percentage point decrease. We further run separate regressions in the second column and third columns with the growth of FAH and FAFH sales as the dependent variable, respectively. Results show that the growth of FAH and FAFH sales are associated with 0.08 and 0.13 percentage point decreases in response to a one percentage point decrease in the county growth of the employed population. However, a recessionary year significantly increases the growth of FAH sales by 0.34 percentage points and decreases the growth of FAFH sales by 3.7 percentage points.

Table 2 presents the results of separate regressions with the growth of sales of supermarkets, supercenters, other FAH, limited-service restaurants, full-service restaurants, and other FAFH as the dependent variable. Supermarkets and other grocery (except convenience) stores are establishments primarily engaged in retailing a general line of food. Warehouse, clubs, and supercenters are establishments primarily engaged in retailing a general line of groceries, including a significant amount and variety of fresh fruits, vegetables, dairy products, meats, and other perishable groceries, in combination with a general line of new merchandise, such as apparel, furniture, and appliances. Other FAH includes convenience stores, specialty food stores, all other general merchandise stores, and home delivery and mail orders. Limited-service
restaurants are establishments primarily engaged in providing food services (except snack and nonalcoholic beverage bars) where patrons generally order or select items and pay before eating. Full-service restaurants are establishments primarily engaged in providing food services to patrons who order and are served while seated (i.e., waiter/waitress service) and pay after eating. Other FAFH includes drinking places, food service contractors, and other eating retailers that sell food for on-premise consumption.

Results show that a one percentage point decrease in the growth of a county’s employed population is associated with decreases in the growth of sales in every food establishment, with other FAFH places being affected the most (0.21 percentage point decrease) and supermarkets and other grocery stores being affected the least (0.08 percentage point decrease). While a recessionary year has no significant effect on the growth of supermarkets and other grocery stores sales, it leads to a 0.87 and 0.90 percentage point increase in warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.

Table 3 presents the simulated impacts of the loss of employment on sales of total food, FAH, supermarkets, supercenters, other FAH, FAFH, limited-service restaurants, full-service restaurants, and other FAFH in 2020. On average, total food spending was estimated to increase by 0.8% in 2020 due to the economic effects of COVID-19. FAH sales were estimated to increase by 1.3%, and FAFH sales were estimated to decrease by 0.5%. Food sales at supermarkets and other grocery stores were estimated to decrease by 0.3% while warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.

Table 3 presents the simulated impacts of the loss of employment on sales of total food, FAH, supermarkets, supercenters, other FAH, FAFH, limited-service restaurants, full-service restaurants, and other FAFH in 2020. On average, total food spending was estimated to increase by 0.8% in 2020 due to the economic effects of COVID-19. FAH sales were estimated to increase by 1.3%, and FAFH sales were estimated to decrease by 0.5%. Food sales at supermarkets and other grocery stores were estimated to decrease by 0.3% while warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.

Table 3 presents the simulated impacts of the loss of employment on sales of total food, FAH, supermarkets, supercenters, other FAH, FAFH, limited-service restaurants, full-service restaurants, and other FAFH in 2020. On average, total food spending was estimated to increase by 0.8% in 2020 due to the economic effects of COVID-19. FAH sales were estimated to increase by 1.3%, and FAFH sales were estimated to decrease by 0.5%. Food sales at supermarkets and other grocery stores were estimated to decrease by 0.3% while warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.

Table 3 presents the simulated impacts of the loss of employment on sales of total food, FAH, supermarkets, supercenters, other FAH, FAFH, limited-service restaurants, full-service restaurants, and other FAFH in 2020. On average, total food spending was estimated to increase by 0.8% in 2020 due to the economic effects of COVID-19. FAH sales were estimated to increase by 1.3%, and FAFH sales were estimated to decrease by 0.5%. Food sales at supermarkets and other grocery stores were estimated to decrease by 0.3% while warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.

Table 3 presents the simulated impacts of the loss of employment on sales of total food, FAH, supermarkets, supercenters, other FAH, FAFH, limited-service restaurants, full-service restaurants, and other FAFH in 2020. On average, total food spending was estimated to increase by 0.8% in 2020 due to the economic effects of COVID-19. FAH sales were estimated to increase by 1.3%, and FAFH sales were estimated to decrease by 0.5%. Food sales at supermarkets and other grocery stores were estimated to decrease by 0.3% while warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.

Table 3 presents the simulated impacts of the loss of employment on sales of total food, FAH, supermarkets, supercenters, other FAH, FAFH, limited-service restaurants, full-service restaurants, and other FAFH in 2020. On average, total food spending was estimated to increase by 0.8% in 2020 due to the economic effects of COVID-19. FAH sales were estimated to increase by 1.3%, and FAFH sales were estimated to decrease by 0.5%. Food sales at supermarkets and other grocery stores were estimated to decrease by 0.3% while warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.

Table 3 presents the simulated impacts of the loss of employment on sales of total food, FAH, supermarkets, supercenters, other FAH, FAFH, limited-service restaurants, full-service restaurants, and other FAFH in 2020. On average, total food spending was estimated to increase by 0.8% in 2020 due to the economic effects of COVID-19. FAH sales were estimated to increase by 1.3%, and FAFH sales were estimated to decrease by 0.5%. Food sales at supermarkets and other grocery stores were estimated to decrease by 0.3% while warehouse clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease by 3.4 percentage points and 4.0 percentage points, respectively.
| Growth of sales                      | Supermarkets and other grocery (except convenience) | Warehouses clubs and super centers | Other FAH | Limited-service restaurants | Full-service restaurants | Other FAFH |
|-------------------------------------|----------------------------------------------------|-----------------------------------|-----------|----------------------------|--------------------------|-------------|
| Growth of employed population       | 0.08*** (0.022)                                     | 0.16*** (0.047)                   | 0.10*** (0.025) | 0.16*** (0.028)        | 0.16*** (0.024)        | 0.21*** (0.045) |
| Recession                           | 0.14 (0.195)                                        | 0.87** (0.417)                    | 0.90*** (0.206) | -3.42*** (0.237)     | -3.99*** (0.176)     | -5.22*** (0.438)  |
| Constant                            | -0.09*** (0.032)                                    | 4.95*** (0.069)                   | 2.74*** (0.034) | 5.82*** (0.039)      | 2.83*** (0.030)      | 5.35*** (0.070)   |
| Observations                        | 89,980                                             | 47,032                           | 90,217    | 84,203                   | 90,105                 | 81,895      |
| $R^2$                               | 0.019                                              | 0.028                             | 0.015     | 0.024                    | 0.026                  | 0.020       |

Note: Each column is regressed separately. Other FAH includes convenience stores, specialty food stores, all other general merchandise stores, and home delivery and mail orders. Other FAFH includes drinking places, food service contractors, and other eating retailers that sell food for on-premise consumption. Recession: Dummy variable is equal to 1 if the year is equal to 1990, 1991, 2001, 2008, and 2009, and zero otherwise. The National Bureau of Economic Research definition for recession is generally presented quarterly. We assume if any of the recession falls into a year for even a quarter (as in 1991), the recession dummy equals 1 for that year. Additional controls include county fixed effects. Robust standard errors in parentheses. Abbreviations: FAFH, food-away-from-home; FAH, food-at-home.

**p < 0.05, ***p < 0.01. Source: USDA, Economic Research Service using data from the National Establishment Time Series and the Bureau of Labor Statistics.
TABLE 3  Average simulated growth in food sales in 2020

| Simulated growth sales                          | Mean | SD   | 90% Confidence interval | Obs |
|------------------------------------------------|------|------|-------------------------|-----|
| Total food                                      | 0.77 | 0.437| -0.78                   | 0.75| 3139 |
| Food-at-home                                    | 1.33 | 0.396| -1.34                   | 1.32| 3139 |
| Supermarkets and other (except convenience)     | -0.33| 0.437| 0.31                    | -0.34| 3139 |
| grocery stores                                  | 5.09 | 0.846| -5.11                   | 5.06| 3139 |
| Warehouse clubs and supercenters                | 3.17 | 0.546| -3.19                   | 3.16| 3139 |
| Other food-at-home                              | -0.54| 0.671| 0.52                    | -0.56| 3139 |
| Full-service restaurants                        | -1.86| 0.812| 1.84                    | -1.89| 3139 |
| Limited service restaurants                     | 1.67 | 0.837| -1.69                   | 1.64| 3139 |
| Other food-away-from-home                       | -0.82| 1.102| 0.79                    | -0.86| 3139 |

Note: Other food-at-home includes convenience stores, specialty food stores, all other general merchandise stores, and home delivery and mail orders. Other food away from home includes drinking places, food service contractors, and other eating retailers that sell food for on-premise consumption.

Source: USDA, Economic Research Service using data from the National Establishment Time Series and the Bureau of Labor Statistics.

FIGURE 2  Simulated growth of total food sales in 2020, per county. The first quartile are counties that experienced a decrease in total food sales and an increase up to 0.6%; the second quartile are those counties with an increase in total food sales between 0.6% and 0.8%; the third quartile are those counties with an increase in total food sales between 0.8% and 0.9%; and the fourth quartile are those counties with the largest increase in total food sales (>0.9%). Source: USDA, Economic Research Service (ERS) using data from the National Establishment Time Series and the Bureau of Labor Statistics [Color figure can be viewed at wileyonlinelibrary.com]
and employment rates increase, this map helps provide some insight on the changes in food sales at the county level due solely to these changes. The magnitude of the change varies by location as seen on the broad spectrum of color changes. One notable regional pattern is that most of the Midwest and the northern part of the West are in the fourth quartile, the largest increase, shown in blue.

When comparing the simulated impacts of the loss of employment on the growth of food sales to the actual growth in food sales captured by ERS's FES (Table 3) in 2020, we find that while we estimate an increase of 0.8% in total food sales, on average, FES shows that food sales decreased by 7.8%. Furthermore, results show that, on average, losses of employment are estimated to have increased FAH sales by 1.3% and decreased FAFH sales by 0.5% in 2020. These numbers are dwarfed by the 4.8% increase in FAH sales and 19.5% decrease in FAFH sales, respectively, that the FES reports (Figure 3).

CONCLUSION AND DISCUSSION

The novel coronavirus (COVID-19) was declared a pandemic in early March 2020 and has led to severe economic effects, including loss of employment and a recession. COVID-19 has also significantly altered the entire food supply chain from the agricultural sector (Johansson et al., 2020) to consumer food retail sales (Ellison et al., 2020). In this study, we estimate the historical relationship between food expenditures and employment levels at the county level and simulate the impact of the loss of employment on food sales during 2020. We then aggregate these simulated estimates and compare them with actual food expenditures measured by the USDA ERS’s FES.

Results show that loss of employment leads to larger decreases in FAFH sales compared to FAH sales. Moreover, during a recessionary year, FAH sales increase while FAFH sales
decrease. The increase in FAH sales and decrease in FAFH sales during recessionary years indicates substitution toward FAH sales. This is in line with economic theory as households typically treat FAFH as normal goods. We also see that FAH sales are more elastic than FAH sales to local economic conditions and national economic conditions. Moreover, the shift in food shares, specifically between FAH and FAFH spending, can have implications for diet quality and present another avenue of the impact of economic shocks on health outcomes. A wide literature explores how economic shocks and job loss influence health outcomes in both the United States and other developed countries (Deb et al., 2011; Dehejia & Lleras-Muney, 2004; Economou et al., 2008; Ruhm, 2000, 2003, 2005). Based on the most recent food intake data from the USDA, Agricultural Research Service, and monthly food spending data from the USDA, ERS, FAFH spending per calorie consumed is slightly over twice the per-calorie FAH spending. Other studies have shown that FAFH tends to be of lower nutritional quality than FAH (Lin & Guthrie, 2012). Todd et al. (2010) found that even after controlling for individual tastes and preferences, consumption of FAFH increases total caloric intake and reduces diet quality among adults and children.12

When looking at the relationship between employment and sales at the different types of establishments within FAH and FAFH categories, results show that a one percentage point decrease in the growth of a county’s employed population is associated with a decrease in the growth of sales in every food establishment. While a recessionary year has no significant effect on the growth of supermarkets and other grocery stores sales, it leads to significant increases in warehouses clubs and supercenters, and other FAH sales, respectively. On the contrary, results show that both growth sales of limited and full-service restaurants decrease during a recessionary year. This is in line with Kim and Leigh (2011)’s findings that limited-service restaurants are “normal goods” for lower-income houses but “inferior goods” for higher-income households, whereas full-service restaurants were “normal goods” for all income levels. Limited-service restaurants are probably less sensitive to changes in employment and recessions as limited-service restaurants are often cheaper.

Simulated estimates of the economic effects for 2020 show that, on average, total food spending increased by 0.8% caused by changes in household food spending decisions stemming from the economic impacts of COVID-19. Furthermore, results show that, on average, employment loss is estimated to have increased FAH sales by 1.3% and decreased FAFH sales by 0.5% in 2020. When we looked at traditional supermarkets, supercenters, and other FAH stores, the decrease is higher for supermarkets than for supercenters and other FAH stores, which may be partly due to household substitution toward purchasing groceries at other retailers that primarily sell in bulk and price lower. Similarly, we find that the simulated estimates for 2020 were positive for limited-service restaurants but negative for sit-down restaurants, which may be partly driven by limited-service restaurants being less expensive (the average cost of a meal in a sit-down restaurant is 2.2 times higher than in a limited-service restaurant—FES 2020). One limitation of this project is that we cannot capture seasonal substitution effects as we are estimating from yearly data that only change annually.

Finally, results show that the simulated estimates on FAH sales and FAFH sales are very small compared to the actual 4.8% increase in FAH sales and 19.5% decrease in FAFH sales, respectively. Our results show that the economic effects of COVID-19 were not the likely primary driver of food sales change in 2020, and these differences are added effects of the COVID-19 pandemic-related restrictions and behavioral changes on food sales. This seems especially likely for FAFH sales as the pandemic nature of COVID-19 led to mobility restrictions,
shutdowns of restaurants, business operating limits, and consumer fears typically not seen in other recessions.

The results of this study also provide some insights into heterogeneous effects of local economic conditions on total food, FAH, and FAFH spending and estimates that the economic effects of COVID-19 on food spending vary across counties. These results may help shed light on the potential impacts of the economic recovery at the local level, which will likely be staggered.

ACKNOWLEDGMENTS
The findings and conclusions in this publication are those of the authors and should not be construed to represent any official USDA or the US Government determination or policy. This research was supported by the US Department of Agriculture, Economic Research Service. The analysis, findings, and conclusion expressed in the paper should not be attributed to Walls and Associates.

CONFLICT OF INTEREST
The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS
Eliana Zeballos and Xiao Dong had equal roles in formulating the research question and writing the article. Eliana Zeballos analyzed the data.

ENDNOTES
1 https://www.cdc.gov/media/releases/2020/p0121-novel-coronavirus-travel-case.html.
2 https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020.
3 https://www.defense.gov/Explore/Spotlight/Coronavirus/Timeline/.
4 Decreased food spending does not necessarily indicate less food volume is consumed. Reduced food spending could stem from substitution to lower quality foods, cheaper alternatives, and fewer prepared foods that require more labor hours.
5 The main concern from Crane and Decker (2019) revolves around examining micro-level business dynamics using NETS. However, as we aggregated to the county level and focused on food sales, our results are not relevant to the concerns raised in Crane and Decker (2019). Barnatchez et al. (2017) showed that in correlations of county-level aggregates between NETS and Census data, the official standard is high, indicating county-level aggregates are relatively accurate. In addition, at the spatial location by industry by establishment level, correlations between NETS and official sources are reassuringly strong in appropriately restricted samples. In our study, we focused on both a restricted sample (the food industry) and aggregate to the county level, which meet both criteria suggested in Barnatchez et al. (2017).
6 County-level labor data from BLS can be found on their website: https://www.bls.gov/lau/.
7 For the concern that sales are correlated to unemployment since firm sales are imputed on firm employment, we used overall total employment at the county level across all industries and not at the firm level nor the food sales level. Overall, employment may not be correlated with employment of specific industries during recessions, and business cycles in the food industry (consumption) are typically different than business cycles in other industries.
8 Data from USDA, Economic Research Service (2020) found online on the ERS website Food Expenditure Series.
9 Recessionary periods: July 1990 to March 1991; March 2001 to November 2001; December 2007 to June 2009; February 2020 to April 2020.

10 We perform robust checks using half year in a recession as the definition for the recession variable. This new definition only changes 1 year (1991), and the results are robust.

11 We also perform a robustness by estimating if the effects are similar between metropolitan and non-metropolitan counties, where metro and nonmetro areas are defined by the ERS Rural Urban Continuum Codes: https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/. We see no significant difference between metro and nonmetro counties.

12 This is less clear-cut for children. Those qualifying for reduced-price school meal programs may eat healthier away from home.

REFERENCES

Balagtas, Joseph V, and Joseph Cooper. 2021. “The Impact of COVID-19 on United States Meat and Livestock Markets.” Choices, 36(3):21-2059.

Barnatchez, Keith, Leland D. Crane, and Ryan A. Decker. 2017. “An Assessment of the National Establishment Time Series (NETS) Database.” In Finance and Economics Discussion Series 2017-110. Washington: Board of Governors of the Federal Reserve System.

Beatty, Timothy K.M., and Benjamin Senauer. 2013. “The New Normal? US Food Expenditure Patterns and the Changing Structure of Food Retailing.” American Journal of Agricultural Economics 95(2): 318–24.

Bureau of Labor Statistics. 2020. “Economic News Release.” Accessed from the BLS website.

Bureau of Labor Statistics. 2021. “Local Area Unemployment Statistics.” Accessed from the BLS website. https://www.bls.gov/lau/.

Chenarides, Lauren, Carola Grebitus, Jayson L. Lusk, and Iryna Printezis. 2020. “Food Consumption Behavior During the COVID-19 Pandemic.” Agribusiness 37: 44–81.

Chenarides, Lauren, Mark Manfredo, and Timothy J. Richards. 2021. “COVID-19 and Food Supply Chains.” Applied Economic Perspectives and Policy 43(1): 270–9.

Cho, Clare, Patrick W. McLaughlin, Eliana Zeballos, Jessica Kent, and Chris Dicken. 2019. Capturing the Complete Food Environment With Commercial Data: A Comparison of TDLinx, ReCount, and NETS Databases, TB-1953. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

Crane, Leland D., and Ryan A. Decker. 2019. “Business Dynamics in the National Establishment Time Series (NETS).” In Finance and Economics Discussion Series 2019-034. Washington: Board of Governors of the Federal Reserve System.

Dave, Dhaval M., and Inas Rashad Kelly. 2012. “How Does the Business Cycle Affect Eating Habits.” Social Science & Medicine 74(2): 254–62.

Deb, Partha, William T. Gallo, Padmaja Ayyagari, Jason M. Fletcher, and Jody Sindelar. 2011. “The Effect of Job Loss on Overweight and Drinking.” Journal of Health Economics 30(2): 317–27.

Dehejia, Rajeev, and Aajeed Lleras-Muney. 2004. “Booms, Busts, and Babies’ Health.” The Quarterly Journal of Economics 119(3): 1091–130.

Dong, Xia, and Eliana Zeballos. 2021. COVID-19 Working Paper: The Effects of COVID-19 on Food Sales, AP-088. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

Economou, Athina, Agelike Nikolaou, and Ioannis Theodossiou. 2008. “Are Recessions Harmful to Health After All? Evidence from the European Union.” Journal of Economic Studies 35(5): 368–84.

Ellison, Boannis, Brandon McFadden, Bradley J. Rickard, and Nohot L. Wilson. 2020. “Examining Food Purchase Behavior and Food Values During the COVID-19 Pandemic.” Applied Economic Perspectives and Policy 43(1): 58–72.

Gundersen, Craig, Monica Hake, Adam Dewey, and Emily Engelhard. 2020. “Food Insecurity During COVID-19.” Applied Economic Perspectives and Policy 43(1): 153–61.

Griffith, Rachel, Martin O’Connell, and Kate Smith. 2016. “Shopping Around: How Households Adjusted Food Spending Over the Great Recession.” Economica 83(330): 247–80.

Jappelli, Tullio, and Luigi Pistaferri. 2010. “The Consumption Response to Income Changes.” Annual Review of Economics 2(1): 479–506.
Johansson, Robert, Ashley Hungerford, Mirvat Sewadeh, and Anne Effland. 2020. “Unprecedented Crisis Calls for Unprecedented Policy Responses.” *Applied Economic Perspectives and Policy* 43(1): 120–31.

Kim, DaeHwan, and J. Paul Leigh. 2011. “Are Meals at Full-Service and Fast-Food Restaurants “Normal” or “Inferior”?”, *Population Health Management* 14(6): 307–15.

Kumcu, Aylin, and Phillip R. Kaufman. 2011. *Food Spending Adjustments During Recessionary Times*. Washington, D.C.: U.S. Department of Agriculture, Amber Waves.

Lin, Biing-Hwan, and Joanne Guthrie. 2012. *Nutritional Quality of Food Prepared at Home and Away from Home, 1977–2008*, EIB-105. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

Lusk, Jayson L., and Brandon R. McFadden. 2021. Consumer Food Buying During a Recession. *Choices*, 36(316-2021-1062).

McFadden, Brandon R., Trey Malone, Maik Kecinski, and Kent D. Messer. 2021. “COVID-19 Induced Stigma in US Consumers: Evidence and Implications.” *American Journal of Agricultural Economics* 103(2): 486–97.

Restrepo, Brandon J., Matthew P. Rabbitt, and Christian A. Gregory. 2021. “The Effect of Unemployment on Food Spending and Adequacy: Evidence from Coronavirus-Induced Firm Closures.” *Applied Economic Perspectives and Policy* 43(1): 185–204.

Ruhm, Christopher J. 2000. “Are Recessions Good for your Health?” *The Quarterly Journal of Economics* 115(2): 617–50.

Ruhm, Christopher J. 2003. “Good Times Make you Sick.” *Journal of Health Economics* 22(4): 637–58.

Ruhm, Christopher J. 2005. “Healthy Living in Hard Times.” *Journal of Health Economics* 24(2): 341–63.

Todd, Jessica E., Lisa Mancino, and Biing-Hwan Lin. 2010. *The Impact of Food Away from Home on Adult Diet Quality*, ERR-90. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

Todd, Jessica E. 2014. *Changes in Eating Patterns and Diet Quality Among Working-Age Adults, 2005–2010*, ERR-161. U.S. Department of Agriculture, Economic Research Service.

U.S. Department of Agriculture, Economic Research Service (USDA ERS). 2020. “Food Expenditure Series.” https://www.ers.usda.gov/data-products/food-expenditure-series/.

Walls and Associates. 2013. “National Establishment Time-Series (NETS) Database: 2013 Database Description.” Internal document provided to USDA, Economic Research Service.

**How to cite this article:** Zeballos, Eliana, Xiao Dong. 2021. “The effect of COVID-19 on food sales.” *Applied Economic Perspectives and Policy* 1–14. [https://doi.org/10.1002/aepp.13201](https://doi.org/10.1002/aepp.13201)