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Consumer demand for food at home and food away from home: Understanding economic linkages during the pandemic

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Abstract

Household food expenditure has shifted away from Food at Home (FAH) and towards Food Away from Home (FAFH). Prior to the COVID-19 pandemic, FAFH's share of food expenditure surpassed that of FAH, reaching 55% in 2019. Yet economic research on FAFH and the interaction of FAFH and FAH has been limited. Combining scanner data for meat sales in grocery stores with data for FAFH expenditure, we estimate a model of demand for at-home meat, incorporating FAFH expenditure as a demand shifter. We quantify substitution between FAFH expenditure and FAH meat and quantify the impact of the COVID-19 disruptions to the food service sector on retail prices of FAH meat.

KEYWORDS

COVID-19, food at home, food away from home, meat demand

JEL CLASSIFICATION

Q11, Q18

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Since the onset of the COVID-19 pandemic in Spring 2020, the U.S. economy has witnessed the highest inflation rates since the 1980s, driven in part by higher food prices. In 2022, food prices rose by 9.9% over the previous year, including inflation of 11.4% for Food at Home (FAH), and 7.7% for Food Away from Home (FAFH) (USDA Economic Research Service, n.d.). Potential causes for inflation in general and food inflation, in particular, include the following: changing work and consumption habits in response to the pandemic; change in unemployment and labor force participation; supply chain disruptions created by the pandemic; increased demand for goods and services resulting from government stimulus; food and energy impacts associated with the Russian invasion of Ukraine in February 2022; and loose monetary policy. Policymakers and economists disagree on the relative importance of each of these. In this paper, we attempt to build up the economic evidence to disentangle some of these different causes.

In particular, we focus on retail markets for FAH meat, that is, meat purchased by consumers in grocery stores and supercenters for preparation and consumption in their homes. We focus on FAH meat because of the extraordinary events that occurred in the meat aisle of grocery stores in the early stages of the pandemic in 2020. In March 2020, around the time that the U.S. federal government declared the COVID-19 epidemic a national emergency, economic activity in the food service sector—including restaurants and school and work cafeterias—dramatically decreased, as people and firms sought to avoid perceived risks of illness, and some local governments restricted retail activity to protect public health. Meanwhile, grocery retailers were designated as essential businesses and remained open.

The COVID-19 pandemic also disrupted meat supply chains. In Spring 2020 processors of poultry, pork, and beef were forced to scale back production or temporarily close as COVID-19 spread through the workforce (Balagtas & Cooper, 2021). The daily capacity of cattle and hog facilities fell by as much as 45% in May 2020.

Thus an important question facing the food policy community, the food industry, farmers, and consumers was: how would these dramatic changes to food demand and food supply affect prices, production, and consumption? However, our understanding of U.S. food supply chains has key blind spots, driven largely by a lack of data, that prevent complete answers to these questions. In particular, although FAFH's share of total food expenditure in the United States had gradually grown over time and reached 50% in 2019, we know little about consumer behavior in FAFH markets or the economic linkages between FAFH and FAH. While there is a rich literature exploring many aspects of U.S. meat demand, most of the papers in this literature use national, wholesale data on meat disappearance to estimate aggregate demand (among many others, Chavas, 1983; Eales & Unnevehr, 1993; Holt & Goodwin, 1997; Holt & Balagtas, 2009; Tonsor & Olynk, 2011). Because these papers do not distinguish between demand in different retail settings, they are unable to shed light on the economic linkages between FAH and FAFH.

Another branch of the literature uses experimental methods (e.g., Lusk & Tonsor, 2016; Van Loo et al., 2020) or retail scanner data (e.g., Capps, 1989) to estimate demand for meat attributes in a grocery setting. These studies have contributed to a rich understanding of consumer behavior in FAH markets. But the meat demand literature has largely ignored the FAFH market, or the interaction between FAH and FAFH because there is little data on FAFH purchases of the same granularity and representativeness of FAH data sources. For example, while retail scanner data can provide product-level weekly sales of individual FAH products purchased at outlets of some of the largest retail grocery chains, to the best of our knowledge no equivalent data set exists for FAFH.

A small number of studies estimate demand systems that include FAH products as well as a FAFH composite good (see Okrent & Alston, 2012 for a review). Papers in this literature use data on monthly or annual aggregate spending from the U.S. Bureau of Labor Statistics' Consumer Expenditure Series, including expenditures for FAH products and FAFH reported by surveyed individuals, and Consumer Price Indices. Most relevant for our research, Nayga and Capps (1992) and Piggott (2003) find that composite FAH and FAFH are gross substitutes; the cross-price elasticity of demand for FAH with respect to the price of FAFH is positive. This would suggest that COVID-19 disruptions to the food service sector increased demand for FAH. Okrent and Alston (2012) estimate a model of demand for disaggregated food products and find that FAH meat and eggs and FAFH are gross substitutes.

In this paper, we attempt to extend this literature by estimating the effect of the unprecedented COVID-19 food service disruptions on demand for FAH meat. We do so by positing a model of demand for FAH meat using sales information from scanner data, wherein FAFH expenditure estimates from survey data enter as an exogenous demand shifter. Because of the likely joint determination of FAH and FAFH expenditures, we require an exogenous shock to FAFH expenditure to identify the model. We exploit the COVID-19 pandemic of 2020, arguing that the dramatic drop in FAFH expenditure beginning in March of that year is exogenous. Alternatively, we also explore an instrumental variables approach to identify the model.

The model yields flexibilities of demand for FAH beef, pork, turkey, and poultry (other than turkey) with respect to FAFH expenditures. We combine the FAFH expenditure flexibilities with own-quantity flexibilities to produce estimates of Fdemand elasticities with respect to FAFH. Thus we quantify the vertical and horizontal shifts in FAH meat demand caused by an exogenous shock to FAFH expenditure.

DATA

We combine data from three sources. First, we use IRI retail-based scanner data (InfoScan) on individual store item-level FAH fresh meat sales from 2019 to 2020 to create weekly observations on fresh beef, pork, turkey, and other poultry at the census division level. Specifically, we divide all fresh meat products into these four categories using descriptions from the product dictionary and calculate the corresponding total sales, total volume sold, and expenditure share for each type of meat, in each census division, each week. For each type of meat, we compute weekly average prices per pound by dividing total sales by the weight-equivalent total volume sold.

Second, we merge the IRI scanner data with national monthly slaughter data for each of the four types of meat from the National Agricultural Statistics Service and Agricultural Marketing Service, USDA. The slaughter data provide information on COVID-19 events that directly disrupted meat processing in the spring and summer of 2020.

Third, we use the Consumer Reported Eating Share Trends (CREST) data on FAFH activity from The NPD Group. CREST is derived from a nationally representative consumer panel wherein nearly 70,000 daily survey responses are collected containing information on their FAFH trips including expenditure and where the trip took place. NPD then employs proprietary methodology that uses projection factors for respondents based on demographics to produce monthly estimates of FAFH purchasing behavior that is representative at the U.S. census division level (Marchesi & McLaughlin, 2022). We use estimates of total consumer expenditure and the food service traffic (i.e., the total number of trips) made in the food-service sector from 2019 to 2020 at the census division-month. In Table 1 we report select summary statistics for our data.

TABLE 1 Summary statistics: U.S. retail FAH meat sales and U.S. livestock slaughter, 2019–2020.

Var	Mean	Standard deviation	Min	Max
Retail FAH sales (mil. $/week)				
Beef	91.8	23.1	56.8	169.8
Pork	25.4	6.3	16.3	44.0
Poultry	48.2	8.5	30.9	75.9
Turkey	5.1	10.4	1.4	71.9
Retail FAH volume (mil. lbs./week)				
Beef	17.4	3.6	11.5	34.9
Pork	9.5	2.0	6.0	15.9
Poultry	19.6	2.9	12.5	30.2
Turkey	3.6	10.8	0.4	69.7
Retail FAH price ($/lb.)				
Beef	5.3	0.5	4.3	6.9
Pork	2.7	0.2	2.4	3.3
Poultry	2.5	0.1	2.3	2.7
Turkey	2.7	0.7	0.8	3.9
Slaughter (thous. lbs. of meat)				
Beef	4619	409	3114	5100
Pork	4793	464	3035	5518
Poultry	7158	490	5274	7798
Turkey	937	109	432	1143

Source: Retail sales, volume, and price from IRI InfoScan; Slaughter from USDA National Agricultural Statistics Service and Agricultural Marketing Service.

In Figure 1 we plot the national average retail meat prices computed from the IRI data. Beginning mid-March 2020, and coinciding with President Trump's declaration on March 13, 2020 of a national emergency associated with the COVID-19 pandemic, retail grocery prices of beef began to rise. From the third week of March to the first week of June, FAH beef prices rose 42%. Beef prices then fell over the subsequent 26 weeks, before beginning to rise again in the final weeks of the year. Retail FAH pork prices also rose in the weeks after the emergency declaration but less so than beef prices. Pork prices peaked at $3.19/lb, 14% above prices in early March, and then stabilized near $2.60/lb for much of the rest of the year. In contrast, poultry prices did not change appreciably in 2020.

In Figure 2 we report retail FAH meat quantities for 2019 and 2020. In contrast to the price changes, the quantities for each meat type exhibit an immediate spike in the week of the emergency declaration. This sudden spike in the quantity of meat sold in grocery stores is consistent with increased demand for FAH resulting from broad disruptions to social mobility, including increased perceived risk of exposure to the virus and also mandated closings of schools and businesses, including much of the retail sector (Balagtas & Cooper, 2021). Notably, while much of the food service sector closed, grocery retailers remained open as essential businesses.

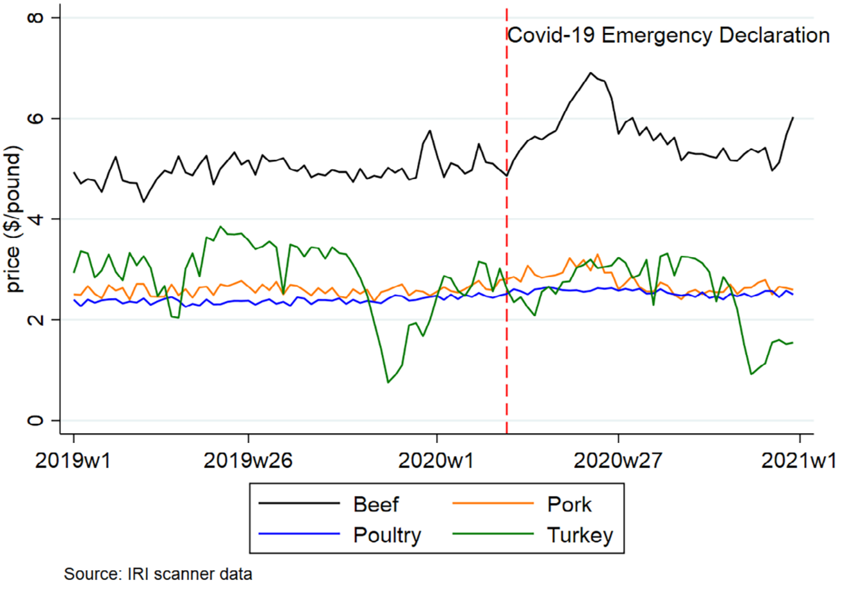

FIGURE 1 U.S. retail food-at-home meat prices, 2019–2020.

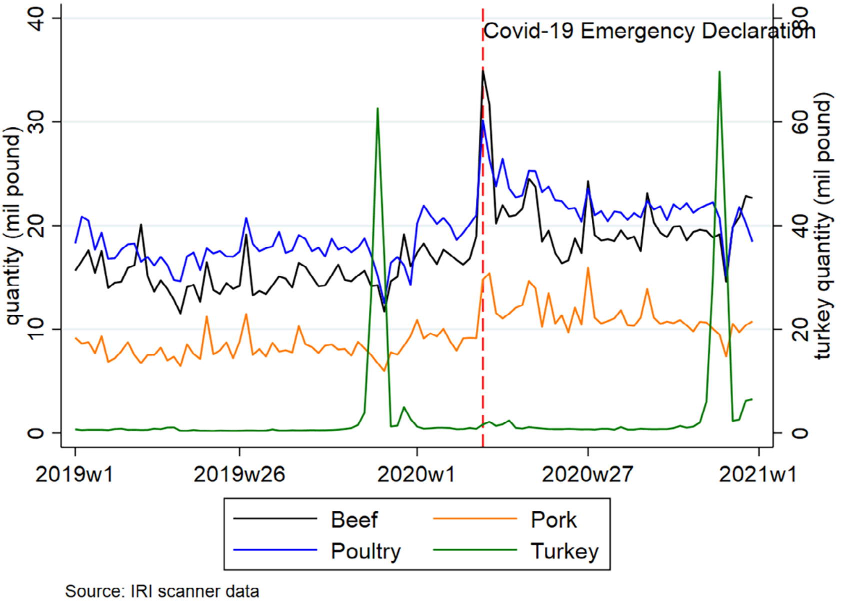

FIGURE 2 U.S. retail food at home meat quantities, 2019–2020.

Similarly, food manufacturers including meat packers were designated as essential businesses, allowing or even requiring them to remain open in the Spring and Summer of 2020. However, the high incidence of COVID-19 infection among meatpacking workers created worker shortages and forced plants to slow or, in some cases, temporarily cease production (CDC, 2020; Krumel & Pender, 2021; Parshina-Kottas et al., 2020). Estimates of lost production capacity because of plant closures ranged up to 25% for beef slaughter, 43% for pork slaughter, and 15% for chicken slaughter (Muth & Read, 2020). In Figure 3 we plot the USDA data on U.S. meat slaughter volumes that are consistent with these estimates, with lost production peaking in May 2020 but largely recovering by Summer.

In Figure 4, we plot the national FAFH data on food service expenditures and food service foot traffic from CREST. Figure 4 shows that food service activity fell by approximately 40% in

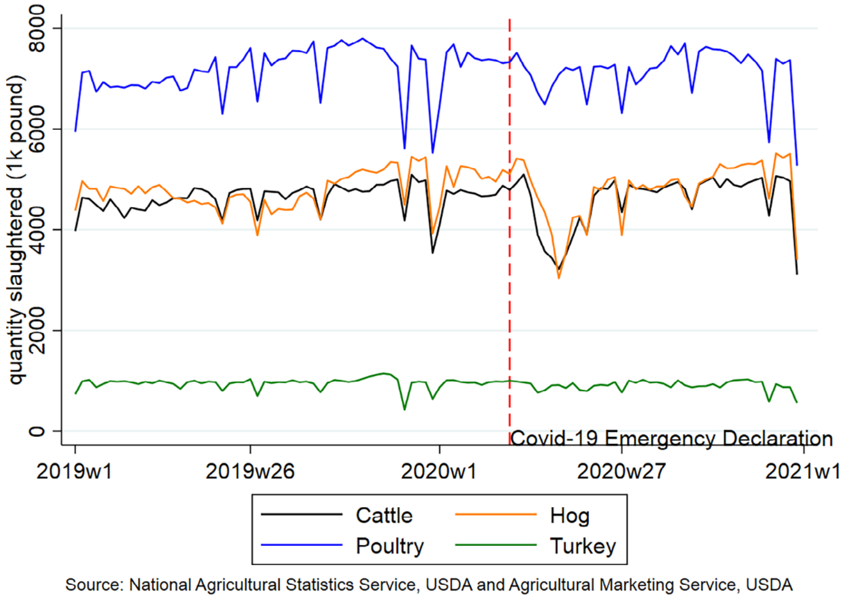

FIGURE 3 U.S. livestock slaughter, 2019–2020.

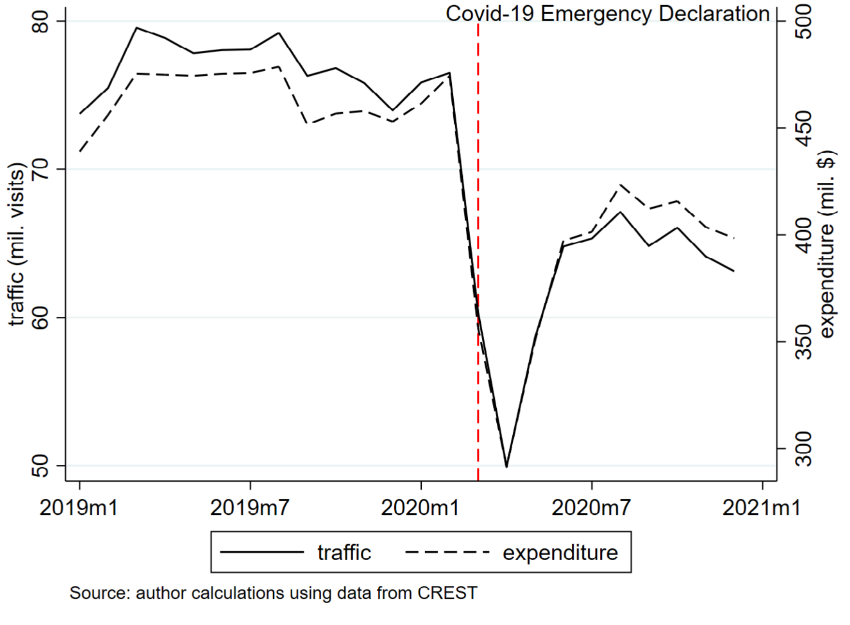

FIGURE 4 U.S. food away from home activity, 2019–2020.

the immediate wake of the national emergency declaration, recovered somewhat by mid-Summer, and then settled at a new level approximately 15% lower than expenditures and traffic in 2019.

MODEL OF FOOD AT HOME MEAT DEMAND

We present a model of FAH meat demand that incorporates FAFH expenditures as a demand shifter and allows us to quantify substitution between FAFH and FAH meat. Among demand system models, the Almost Ideal Demand System (AIDS) has been extensively applied to demand analysis mainly due to its well-defined preference structure and its convenience for welfare analysis (Deaton & Muellbauer, 1980). However, the assumption of the standard AIDS model that products' market-level prices are predetermined is not appropriate for perishable products, such as fresh meat. This is because biological lags exist in meat production, so that the supply may not adjust according to the price shocks immediately. Therefore, it is common to estimate a system of inverse meat demands under the assumption that quantities are predetermined and the market prices adjust according to the quantity of meat supplied to the market (Eales & Unnevehr, 1993; Holt & Goodwin, 1997).

In this study, we apply the Linear Approximate Inverse Almost Ideal Demand System (LA/IAIDS) model to estimate FAH meat demand during Covid-19. We impose adding-up, homogeneity, and symmetry constraints on the demand system. Below we briefly exposit a system of meat equations (beef, pork, and poultry, and turkey). Specifically, demand for meat is specified as

$$w_{ict} = \alpha_i + \sum_{j=1}^{4} \gamma_{ij} lnq_{jct} + \beta_i lnQ_{ct} + \rho_i lnNPD_{ct} + \sum_{c=1}^{8} \varphi_{ic} CD_c + \sum_{r=1}^{3} \tau_{ir} Qt_r + \varepsilon_{ict}, \quad \text{for } i = 1, \ldots, 4, \tag{1}$$

where w_{ict} is the sales share of meat type $i = 1\,(\text{beef}), 2\,(\text{pork}), 3\,(\text{poultry}), 4\,(\text{turkey})$ in census division c in week t; q_{jct} is the quantity of meat sold in grocery stores; $lnQ_{ct} = \sum_{j=1}^{4} w_{jc} \ln\left(q_{jct}\right)$ is the Stone quantity index; NPD_{ct} is FAFH expenditure in census division c, week t[1]; CD_c are the census division indicator variables controlling the time-invariant, division-specific factors that affect meat consumption; Qt_r is a quarter fixed effect which controls for seasonality in meat demand; and ε_{ict} denotes the error term. Parameters α_i, γ_{ij}, β_i, ρ_i, φ_{ic}, and τ_{ir} are to be estimated. We impose the usual restrictions on these parameters so that the budget share equations exhibit the properties of a proper demand system (Eales & Unnevehr, 1993).

While quantities are typically assumed to be predetermined in inverse demand models, we do not rule out the possibility that quantities in Equation (1) are endogenous. We take an instrumental variables (IV) approach to address the potential endogeneity of the meat quantities, q_{jct}, and quantity index, lnQ_{ct}; and FAFH expenditure, $lnNPD_{ct}$. As instruments, we use lags of meat slaughter, plus census division and quarter dummy variables. Thus, first-stage regressions the endogenous variables are:

$$lnq_{ict} = \delta_i + \sum_{j=1}^{4} \sum_{k=1}^{3} \pi_{ijk} lnx_{jt-k} + \sum_{c=1}^{8} \varphi_{ic} CD_c + \sum_{r=1}^{3} \tau_{ir} Qt_r + \mu_{ict} \text{ for } i = 1, \ldots, 4, \tag{2}$$

$$lnQ_{ct} = \delta_Q + \sum_{j=1}^{4}\sum_{k=1}^{3}\pi_{Qjk}lnx_{jt-k} + \sum_{c=1}^{8}\varphi_{Qc}CD_c + \sum_{r=1}^{3}\tau_{Qr}Qt_r + \mu_{Qct} \text{ for } i = 1,...,4, \tag{3}$$

$$ln\text{NPD}_{ct} = \delta_N + \sum_{j=1}^{4}\sum_{k=1}^{3}\pi_{Njk}lnx_{jt-k} + \sum_{c=1}^{8}\varphi_{Nc}CD_c + \sum_{r=1}^{3}\tau_{Nr}Qt_r + \mu_{Nct}, \tag{4}$$

where lnx_{jt-k} is the k-week lag of national slaughter for meat j; NPD_{ct} is the food service expenditure in census division c, week t from the NPD Group; μ_{ict} and μ_{Qct} are error terms, and the δs, πs, φs, and τs are parameters to be estimated.

We estimate the model with the Three Stage Least Square (3SLS) estimator. After obtaining the estimated coefficients from the demand system, we follow Eales and Unnevehr (1993) to compute the Marshallian own-quantity flexibilities, cross-quantity flexibilities, and scale flexibilities. Formulae for quantity flexibilities, scale flexibilities, and FAFH flexibilities are, respectively:

$$f_{ij} = -\delta_{ij} + \left[\gamma_{ij} + \beta_i\left(w_j - \beta_j lnQ\right)\right]/w_i, \tag{5}$$

where δ_{ij} equals 1 if $i = j$, and 0 otherwise;

$$f_{is} = -1 + \beta_i/w_{i,} \text{ and} \tag{6}$$

$$f_{iN} = -1 + \rho_i/w_i. \tag{7}$$

Interpretation of flexibilities is analogous to the interpretation of own-price elasticities, cross-price elasticities, and expenditure elasticities in the standard AIDS model (Eales & Unnevehr, 1993; Holt & Goodwin, 1997). For example, own-quantity flexibility of −0.8 means that a 1% increase in the quantity of a commodity leads to a 0.8% decrease in its price along the demand curve, or marginal valuation.

The flexibilities with respect to FAFH expenditure in Equation (7) quantify the change in marginal valuation for FAH meat caused by an exogenous change in FAFH expenditure (i.e., the vertical shift in demand). Assuming perfectly inelastic retail meat supply, this flexibility is also the change in the equilibrium meat price. Alternatively, we translate that vertical shift in demand to a horizontal shift by dividing by the own-quantity flexibility (Equation 5):

$$\frac{dlnQ_i}{dlnNPD} = -\frac{dlnP_i/dlnNPD}{dlnP_i/dlnQ_i} = -\frac{f_{iN}}{fii}. \tag{8}$$

The elasticity in Equation (8) is a measure of the horizontal shift in demand for meat i caused by an exogenous shock to FAFH expenditure. Also, Equation (8) can be used to evaluate changes to the equilibrium price and quantity of FAH meat when supply is not perfectly inelastic.

RESULTS

We report estimated coefficients from the model in Tables 2–4. In Table 2 we present results from the LA/IAIDS estimating equations (Equation 1) estimated under the assumption individual meat quantities, the quantity index, and FAFH expenditure are exogenous. In Table 3 we present the results of the first-stage regressions from the IV model, and in Table 4 the LA/AIDS estimating equations estimated by IV.

While the parameters of the LA/IAIDS share equations do not have intuitive interpretations, we use these to compute FAH meat demand flexibilities according to Equations (5)–(7). To ease comparison, we report flexibilities for both models in Table 5. Our estimates differ to some extent from those in previous studies, including Eales and Unnevehr (1993), Holt and

TABLE 2 LA/AIDS meat demand estimates, assuming exogenous quantities and FAFH expenditure.

	Beef expenditure share	Pork expenditure share	Poultry expenditure share
Beef quantity	0.16*** (0.005)	−0.05*** (0.002)	−0.08*** (0.003)
Pork quantity	−0.05*** (0.002)	0.12*** (0.001)	−0.06*** (0.001)
Poultry quantity	−0.08*** (0.003)	−0.06*** (0.001)	0.16*** (0.002)
Turkey quantity	−0.03*** (0.001)	−0.01*** (0.0003)	−0.02*** (0.001)
Quantity index	0.03*** (0.001)	0.002*** (0.0004)	0.01*** (0.001)
FAFH expenditure	−0.01* (0.01)	0.03*** (0.002)	0.05*** (0.004)
Quarter FE	Yes	Yes	Yes
Census division FE	Yes	Yes	Yes
R-squared	0.88	0.94	0.95
Number of Obs.	936	936	936

Note: Standard errors in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) levels.

TABLE 3 LA/AIDS meat emand estimates, IV for endogenous quantities and FAFH expenditure.

	Beef expenditure share	Pork expenditure share	Poultry expenditure share
Beef quantity	0.06** (0.03)	−0.01 (0.01)	−0.01 (0.02)
Pork quantity	−0.01 (0.01)	0.11*** (0.01)	−0.09*** (0.01)
Poultry quantity	−0.01 (0.02)	−0.09*** (0.01)	0.12*** (0.01)
Turkey quantity	−0.04*** (0.003)	−0.01*** (0.001)	−0.02*** (0.002)
Quantity index	0.08*** (0.01)	−0.01*** (0.003)	−0.02*** (0.01)
FAFH expenditure	0.18*** (0.04)	−0.03* (0.01)	−0.04* (0.02)
Quarter FE	Yes	Yes	Yes
Census division FE	Yes	Yes	Yes
R-squared	0.64	0.84	0.86
Number of Obs.	909	909	909

Note: Standard errors in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) levels.

TABLE 4 First stage regressions.

	Beef quantity	Pork quantity	Poultry quantity	Turkey quantity	Quantity index	FAFH expenditure
Beef slaughter						
1 week lag	−0.86*** (0.27)	−1.01*** (0.31)	−0.74*** (0.23)	0.51 (0.89)	−1.90** (0.81)	0.80*** (0.14)
2 week lag	−0.72** (0.35)	−0.46 (0.40)	−0.52* (0.29)	−2.59** (1.14)	−1.17 (1.03)	0.40** (0.18)
3 week lag	−0.99*** (0.28)	−1.67*** (0.33)	−1.31*** (0.24)	−6.71*** (0.92)	−5.63*** (0.84)	0.73*** (0.14)
Pork slaughter						
1 week lag	0.92*** (0.20)	1.12*** (0.22)	0.91*** (0.16)	2.98*** (0.64)	3.28*** (0.58)	−0.89*** (0.10)
2 week lag	0.74*** (0.21)	0.71*** (0.24)	0.45*** (0.17)	1.99*** (0.68)	1.83*** (0.62)	−0.42*** (0.11)
3 week lag	1.12*** (0.20)	0.95*** (0.22)	0.96*** (0.16)	5.09*** (0.64)	4.69*** (0.58)	−0.58*** (0.10)
Poultry slaughter						
1 week lag	0.35 (0.25)	0.15 (0.29)	0.36* (0.21)	−5.17*** (0.82)	−0.79 (0.74)	−0.18 (0.13)
2 week lag	0.92*** (0.28)	1.00*** (0.33)	0.92*** (0.24)	−0.70 (0.93)	1.29 (0.84)	−0.49*** (0.14)
3 week lag	0.70*** (0.25)	1.76*** (0.28)	1.14*** (0.21)	2.07*** (0.80)	3.77*** (0.73)	−0.55*** (0.13)
Turkey slaughter						
1 week lag	−0.22** (0.10)	−0.24** (0.11)	−0.31*** (0.08)	1.90*** (0.32)	−0.20 (0.29)	0.16*** (0.05)
2 week lag	−0.46*** (0.10)	−0.62*** (0.12)	−0.44*** (0.08)	1.41*** (0.33)	−0.88*** (0.30)	0.20*** (0.05)
3 week lag	−0.55*** (0.10)	−0.68*** (0.11)	−0.45*** (0.08)	−0.16 (0.33)	−2.08*** (0.29)	0.19*** (0.05)
R-squared	0.95	0.95	0.98	0.85	0.94	0.96
No. obs	909	909	909	909	909	909
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Census Division FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) levels.

TABLE 5 Estimated meat flexibilities.

	With respect to					
	Beef quantity	Pork quantity	Poultry quantity	Turkey quantity	Scale quantity	FAFH expenditure
Assumed exogeneity model						
Beef price	−0.72	−0.08	−0.13	−0.01	−0.95	−1.02
Pork price	−0.32	−0.21	−0.40	−0.05	−0.98	−0.83
Poultry price	−0.29	−0.23	−0.41	−0.04	−0.97	−0.80
Turkey price	1.34	0.52	0.94	−0.05	−2.56	−3.76
Instrumental variables model						
Beef price	−1.08	0.04	0.07	0.11	−0.86	−0.68
Pork price	0.03	−0.34	−0.61	−0.15	−1.07	−1.17
Poultry price	0.03	−0.35	−0.60	−0.14	−1.06	−1.16
Turkey price	1.01	0.65	1.14	−0.95	−2.96	−5.41

Source: Authors calculations based on parameter estimates reported in Tables 2 and 4.

Goodwin (1997). Differences may be attributed to differences in data sources, data periods, data frequencies, and demand models (Alston & Chalfant, 1991). Notably, as discussed previously, our estimates pertain to demand for FAH meat, while previous studies estimate demand for meat aggregated across FAH and FAFH. Those conceptual differences notwithstanding, our results share some common patterns with the previous work. With the exception of beef in the IV model (−1.08) we find that demand for beef, pork, and poultry are own-quantity inflexible (i.e., own-quantity flexibility less than one in absolute value). A one-percent increase in beef quantity reduces marginal valuation for the beef price by between 0.72% and 1.08%, a one-percent increase in pork quantity reduces marginal valuation for pork by between 0.22% and 0.34%, and a one-percent increase in poultry quantity reduces marginal valuation for poultry by between 0.41% and 0.60%. The own-quantity flexibility for turkey ranges between −0.05 and −0.95.

Our estimated quantity scale flexibilities are also similar to previous work by Holt and Goodwin (1997) and Eales and Unnevehr (1993). Scale flexibilities range between −0.86 and −0.95 for beef, between −0.98 and −1.07 for pork, between −0.97 and −1.06 for poultry. Thus for beef, pork, and poultry other than turkey, scale flexibilities are close to −1.0, or near the threshold between luxuries and necessities. Meanwhile, turkey, with scale flexibility between −2.56 and −2.96, is classified as a luxury.

In the last column of Table 5, we report the FAFH expenditure flexibilities. Focusing on the estimates from the IV model, a 10-percent reduction in FAFH expenditure causes a 6.8-percent increase in marginal valuation for FAH beef, an 11.7-percent increase in marginal valuation for FAH pork, an 11.6-percent increase in marginal valuation for poultry, and a 54.1-percent increase in marginal valuation for turkey. Thus, assuming perfectly inelastic meat supply in the short term, the 40% drop in FAFH expenditure in late March 2020 caused prices of FAH meat to rise by 27% for beef and by 47% for pork and poultry. By the end of 2020, FAFH expenditure was down 15% from pre-COVID-19, causing FAH beef prices to rise by 10% and FAFH pork and poultry prices to rise by 17% compared to pre-COVID-19. [Correction added on 31 March 2023, after first online publication: The phrase "elastic meat demand" from this paragraph has been changed to "inelastic meat supply".]

TABLE 6 Elasticity of demand with respect to FAFH expenditure.

	Own-quantity flexibility	FAFH flexibility	FAFH elasticity
Beef	−1.08	−0.68	−0.63
Pork	−0.34	−1.17	−3.44
Poultry	−0.60	−1.16	−1.93
Turkey	−0.95	−5.41	−5.69

Source: authors calculations based on flexibilities from the instrumental variables model reported in Table 5.

Next, we use Equation (8) to convert the FAFH expenditure flexibilities to FAFH expenditure elasticities. We report these (for the IV model) in Table 6. We find that demand for FAH beef is inelastic with respect to FAFH expenditure, meaning beef demand rises less than proportionately as FAFH expenditure (exogenously) falls. Demands for FAH pork and for poultry are elastic with respect to FAFH expenditures, meaning demand increases more than proportionately in response to reductions in FAFH expenditure. Meanwhile, FAH turkey demand is very elastic with respect to FAFH expenditure.

Together, the set of FAH meat flexibilities and elasticities suggest that negative shocks to FAFH expenditure, like the food service disruptions caused by COVID-19, cause demand for FAH meats to increase; FAFH meals are substitutes for FAH, as is expected, albeit not perfect substitutes as the former include services associated with the FAFH experience. Moreover, shocks to FAFH change consumers' relative valuations in FAH meats, as demand for FAH poultry, pork, and turkey rise more than demand for FAH beef. The different effects on poultry, pork, and beef might reflect the demand for convenience, and the large supply of convenience attributes in poultry and pork products relative to beef (e.g., Tonsor et al., 2010).

CONCLUSION AND DISCUSSION

This paper takes a step toward a better understanding of the demand for FAH and FAFH, and the interaction between the two, especially in light of the upheaval experienced broadly in food markets during the pandemic. We posit and estimate a LA/AIDS model of demand for FAH meats, allowing FAFH expenditure to enter as a demand shifter. To identify the model we (i) exploit the plausibly exogenous change in FAFH expenditure in 2020, and alternatively (ii) use an instrumental variable approach with lagged slaughter as instruments. We estimate the model using weekly IRI scanner data during 2019–2020 merged with novel FAFH expenditure data from the NPD Group. The analysis allows us to quantify the effects of COVID-19 disruptions on FAFH spending on prices for FAH meat.

The work presented here may be extended in several interesting directions. The model could be extended to other FAH products or sets of products, including aggregate demand for FAH expenditure. Similarly, expenditures on different types of food service—for example, fast food versus sit-down restaurants—may interact differently with FAH demand (Okrent & Alston, 2012). Also, we leave it for future work to examine the robustness of our results to alternative demand specifications, including those by Holt and Goodwin (1997), and Tonsor et al. (2010).

Finally, we do not address some important questions about how FAH and FAFH demand affect upstream markets for agricultural commodities. Specifically, one important question during Spring and Summer of 2020 was how shifting demand from FAFH to FAH would affect the aggregate demand for meat at wholesale, and thus demand for livestock. Answering such questions requires richer data on the quantity of farm commodities in FAFH and FAH. While quantity data is available for FAH meat, it is not available for FAFH and may be difficult to estimate.

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ENDNOTE

[1] The CREST data on FAFH expenditure are monthly. For each week, we assign the relevant month's value of FAFH expenditure. For example, we assign the January 2019 value of FAFH expenditure to each of the first four weeks of 2019.

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