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The Impact of Coronavirus COVID-19 on U.S. Meat and Livestock Markets

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This preliminary working paper is being released to stimulate discussion of the impacts of COVID-19 on agriculture. The preliminary findings and conclusions in this working paper are subject to change and do not necessarily represent any final position or policy of the USDA or the U.S. Government.

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Abstract

This working paper assesses the COVID-19-related disruptions to meat and livestock markets in the United States. We provide a data-based description of the COVID-19 impact, including the shutdown of the food service sector, costs associated with packing plants' efforts to move product across supply chains, and meatpacking plant closings.

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Outlook for U.S. Livestock and Meat Markets Prior to the Pandemic

After a run of low prices for livestock and meat dating back to 2014, the year 2020 was shaping up to be a bull market for U.S. livestock interests. African swine fever continued to decimate China's pig population. As a result, China, the world's leading meat importer, was poised to increase purchases dramatically through 2020. Moreover, in January 2020, the U.S. Government signed the Phase One trade agreement with China, which promised to end a 2-year trade war and dramatically expand China's imports of U.S. agricultural products, including pork and beef. At the consumer end of U.S. meat markets, a strong economy and record-low unemployment pointed to increased demand for meat (Badau, 2020). The net result was that, early in 2020, analysts were forecasting increased U.S. exports of beef and pork as well as high prices for livestock and meat.[12]

Effects of the COVID-19 Pandemic on U.S. Livestock Markets

The first known cases of COVID-19 in the United States appeared in Seattle, WA, in January 2020, and cases were dispersed throughout the country by March 2020. The U.S. Government declared a Federal Emergency on March 13, 2020. The pandemic disrupted U.S. livestock and meat markets in several ways. First, global merchandise trade fell 14 percent in the second quarter of 2020 compared to the same time last year (WTO, 2020), and we can surmise that much of this is associated with the economic response to COVID-19. As a net exporter of meat, reduced global trade amounted to a reduction in demand for U.S. meat exports, and downward pressure on prices of U.S. meat and livestock. Second, although U.S. pork exports rose in the first half of 2020 compared to 2019, driven by a huge spike in Chinese demand associated with the African swine fever in that country, exports likely would have been even larger if China had not been affected by COVID-19. Through July 2020, year-to-date U.S. exports of beef were down 8 percent compared to 2019 (USDA-ERS, 2020a).

The spread of the virus throughout the United States caused additional, more acute disruptions to livestock and beef markets. Starting in March 2020, private precautions taken by people and firms to protect themselves from the virus, together with mandated closings of schools, businesses, and much of the retail sector, led to a sudden and dramatic reduction in demand for food service meals and an increase in demand for food in grocery stores (see Figure 1). With children staying home from school and workers staying home from work or losing their jobs, fewer people were eating meals at school and work. State and local governments took emergency measures to close retail businesses, including full-service restaurants and bars (fast food restaurants were not permitted to open dine-in facilities, but were allowed to continue drive-thru

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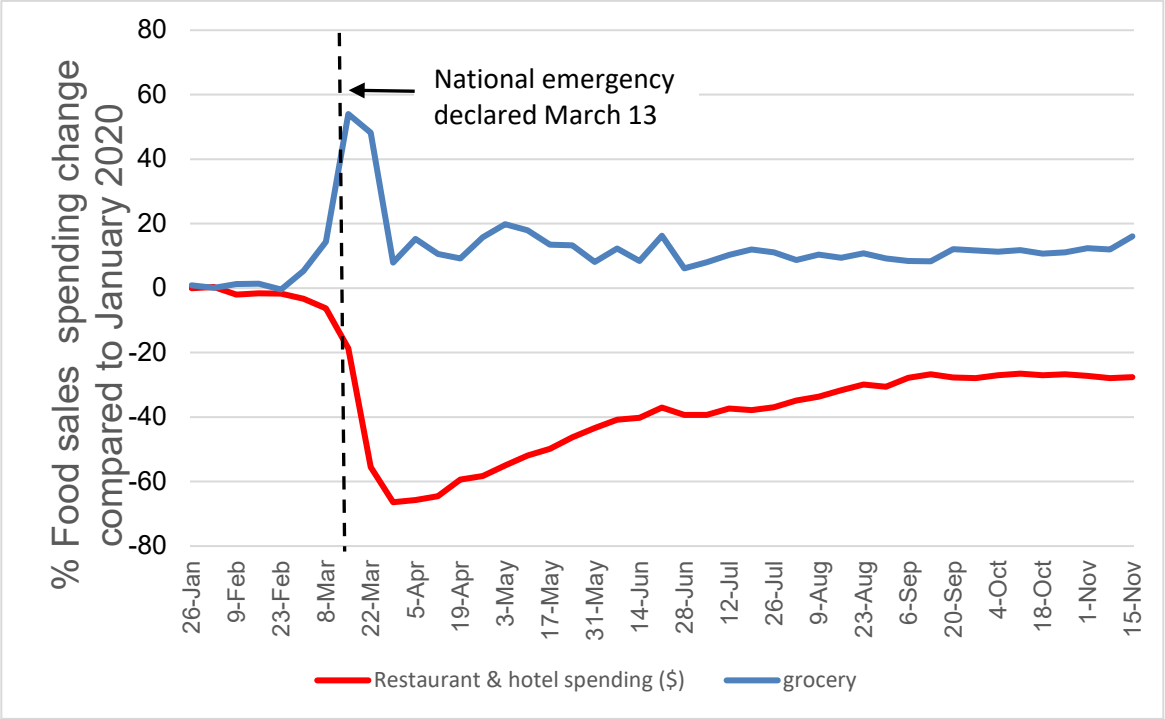
and delivery service). In contrast, grocery stores were designated as essential businesses and remained open through the pandemic.

The combined effect of these events was to dramatically and suddenly alter retail demand for food, reducing demand for food served by commercial food service institutions, known as food away from home (FAFH); and increasing demand for food purchased in grocery stores, known as food at home (FAH). Figure 1 shows that spending in restaurants and hotels fell by more than 60 percent in March, while grocery spending spiked by more than 50 percent, as people prepared more meals at home.

Figure 1. Spending changes have moderated after the initial March 2020 shock, but grocery spending remains above pre-COVID levels and restaurant sales below.



Source: Opportunity Insights (2020)

The pandemic also affected U.S. meat supply chains. Starting in early March 2020, meatpacking plants and processors of poultry, pork, and beef were forced to scale back production or temporarily close as COVID-19 spread through the workforce (Bunge, 2020). According to Douglas (2021), as of February 1, 2021, 53,000 workers at 569 meatpacking plants in the United States have tested positive for the coronavirus, and at least 277 have died. The resulting illness, or fear of illness, contributed to absenteeism among plant workers (Polansek and Sullivan, 2020). Some plants were forced to temporarily close to prevent spread of the pandemic virus. Plants remaining open slowed production lines in in order to comply with public health guidelines for reducing COVID-19 spread (Parshina et al., 2020; CDC, 2020). As plants were idled or forced to limit operations, daily capacity at U.S. cattle and hog facilities declined as much as 45 percent in May 2020 (Cowley, 2020), with others (Muth and Read, 2020; Haley, 2020) citing similarly

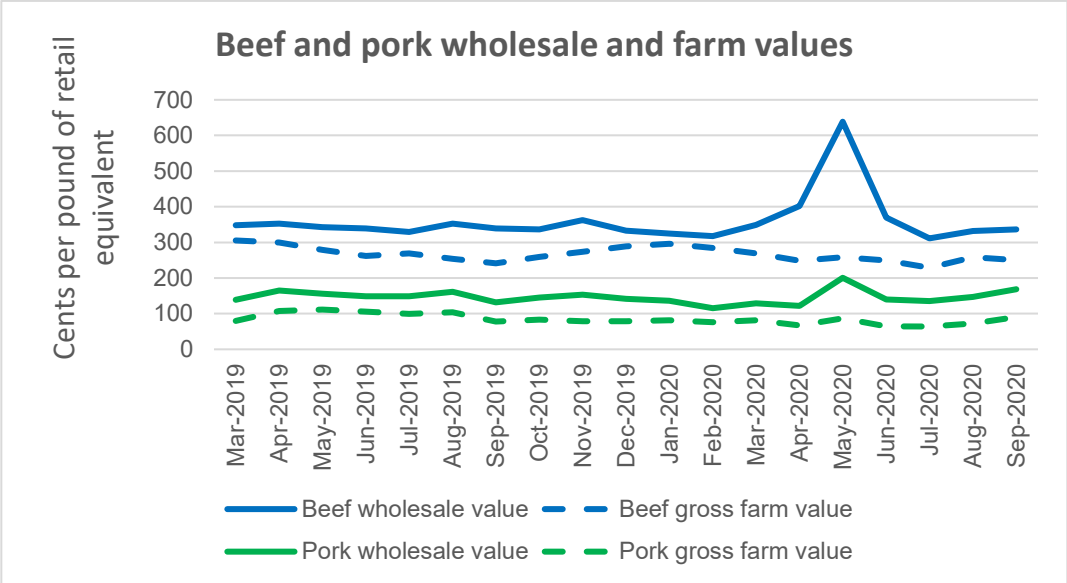
dramatic declines. Muth and Read (2020) cite estimates of the loss of production capacity because of plant closures ranging up to 25 percent for beef slaughter plants, 43 percent for pork slaughter plants, and 15 percent for chicken slaughter plants. The disruption of meatpacking plants reduced production of meat destined for retail outlets and created a backlog of livestock destined for the closed plants.

On April 28, 2020, President Donald Trump issued an Executive Order invoking the Defense Production Act to keep meatpacking plants open (USDA, 2020). The Executive Order exempted plants from State and local orders to close nonessential businesses but did not solve plants' problems with sick workers. COVID-19 outbreaks among the workforce continued to force plants to close and slow down even after the Executive Order.

Meat supply chains also faced barriers to immediately transitioning their production lines and distribution networks in response to the pandemic events in the retail sector that reduced demand from food service and increased demand in groceries. Meat served in FAFH is differentiated from meat served in FAH, and specialized production processes and distribution networks serve these separate marketing channels (Bittle, 2020). The rapid shift of demand from FAFH to FAH, combined with a costly transition of supply chains, contributed to higher prices and at times stockouts for some meat products in grocery stores in the spring of 2020 (Riley, 2020).

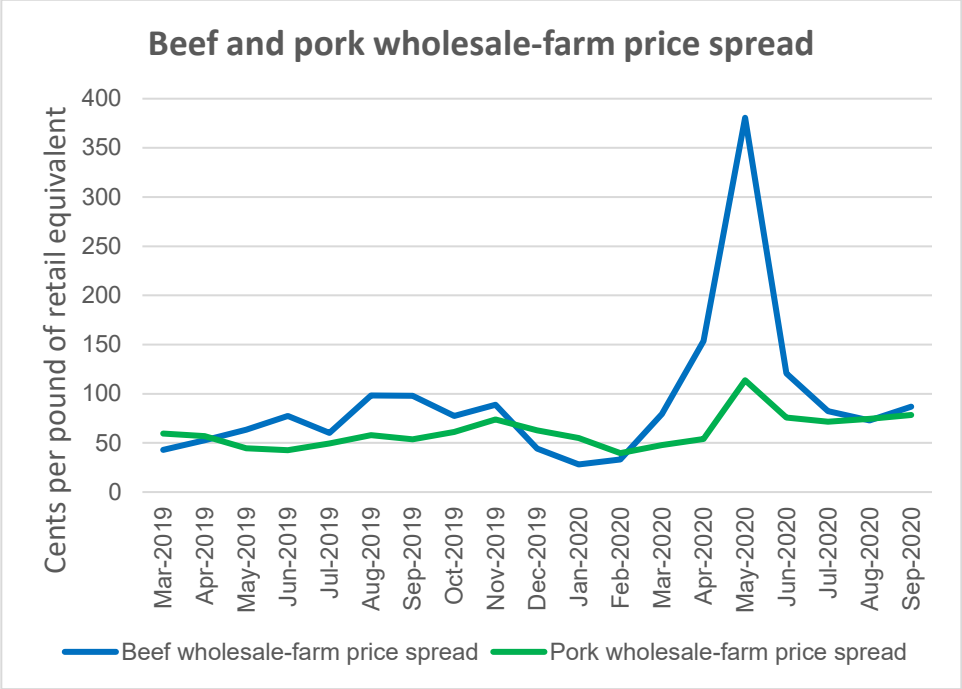
As will be discussed in more detail below, from approximately early April to early June 2020, capacity utilization fell significantly at pork and beef packing plants due to shutdowns or downs related to COVID-19. This meant decreased supplies of prepared meats entering wholesale and retail markets. At the same time, this packing disruption represented a lower demand by packing plants for live animals. The net effect of these COVID-19 impacts was to increase wholesale and retail meat prices, decrease upstream prices of livestock, and thus increase the price spread between meat and livestock (Figures 2a and 2b).

Figure 2a. In first half of 2020, wholesale values for beef and pork increased sharply and farm prices fell



Source: USDA, Economic Research Service (2020b).

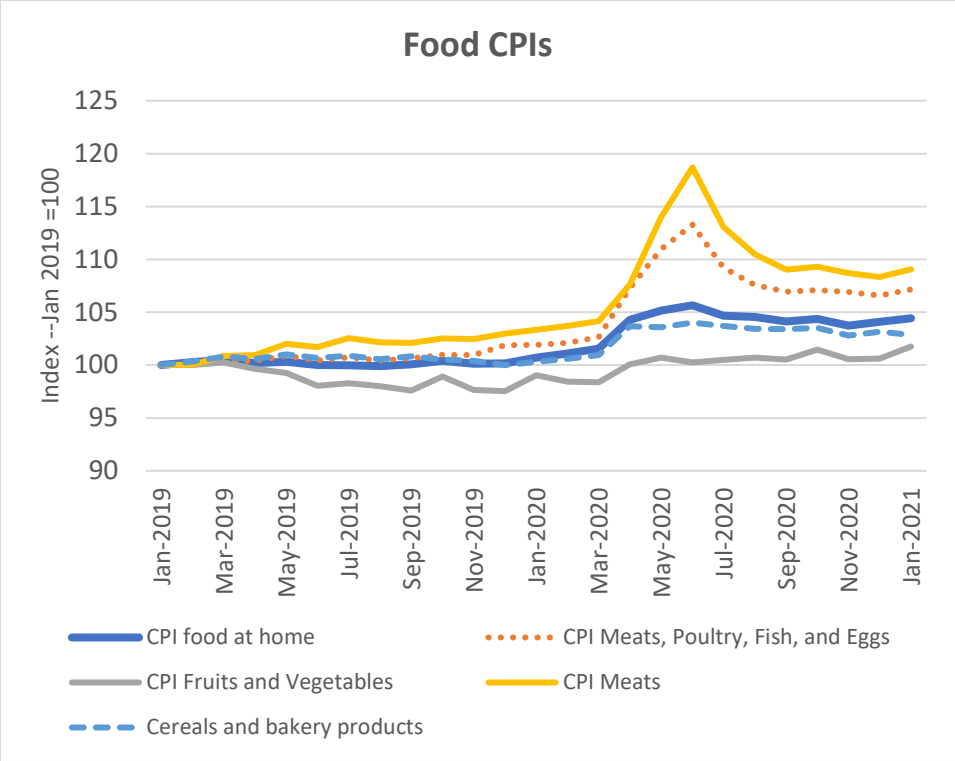
Figure 2b. … causing a spike in the wholesale-farm price margin



Source: https://www.ers.usda.gov/data-products/meat-price-spreads/

The market disruptions starting in March 2020 are evident in the food Consumer Price Indices (CPIs) (Figure 3). Between February and June 2020, the food at home CPI increased 3.5 percent. While CPIs for all food categories in the chart increased over this period, by far the largest increase was the meat CPI at 9 percent. The CPI started to fall around June 2020, with the meat CPI falling almost 5 percent between June and July. Reductions in meat processing capacity associated with COVID outbreaks were a likely cause of the increase in the meat CPI. For example, on April 29, 2020, pork packing plant capacity utilization bottomed out at 54 percent, compared to 100 percent in early April (Haley, 2020). By mid-June, capacity utilization in pork processing plants rebounded to near 95 percent; consumer prices for pork were falling. Other disruptions in the food chain were due to the precipitous drop in FAFH and the associated increase in FAH, given differences between product types and production and distribution processes targeted at FAFH versus for FAH, and the efforts needed to re-channel goods. Overall, even after the decrease in the CPI for food consumed at home from its peak in June, in July it was still 3.5 percent higher compared to February 2020. In contrast, the headline CPI for all goods – the CPI-U – actually fell from February to May 2020, and as of July was 0.1 percent lower than in February 2020. The gasoline CPI fell 23 percent from February to May 2020, likely driving much of that decrease in overall CPI.

Figure 3. Food CPIs up sharply from March to June 2020, but slowing or decreasing thereafter



CPI=Consumer Price Index

Data Source: Bureau of Labor Statistics (2020).

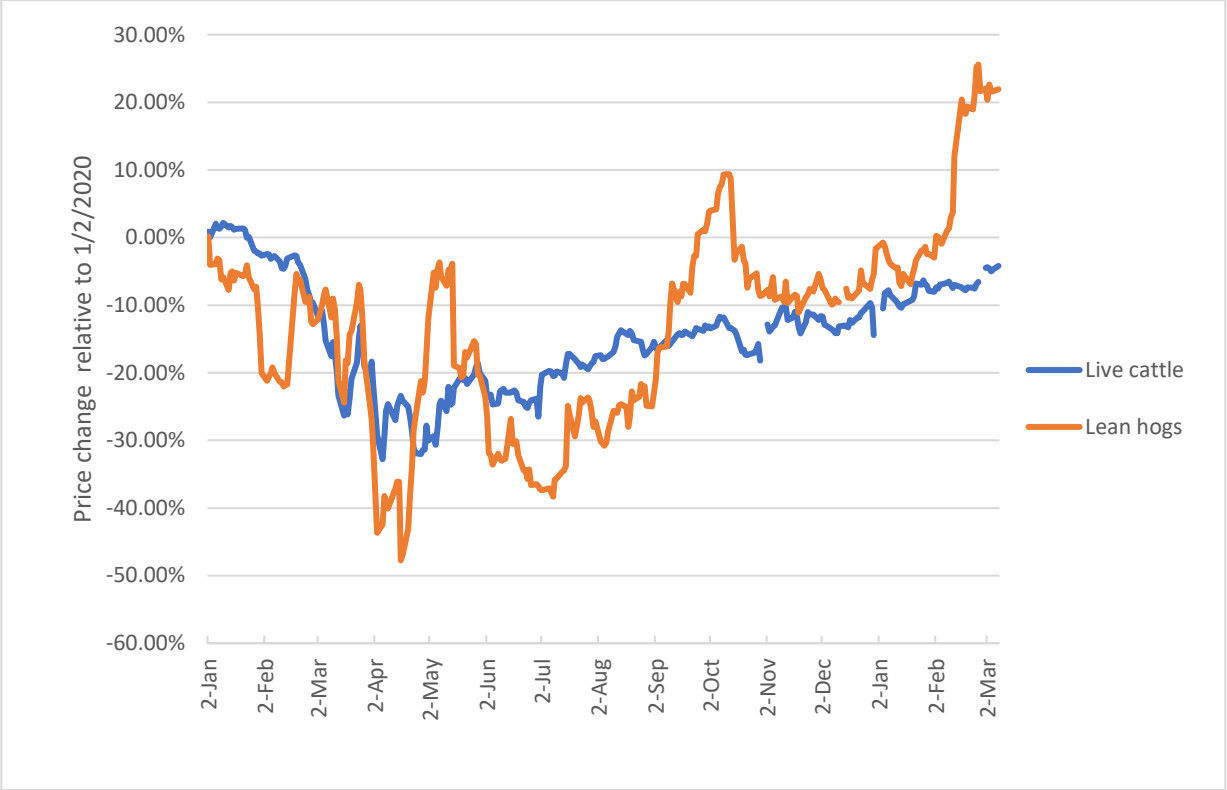
Table 1 reports USDA's projections for 2020 average annual livestock prices, as produced in the January, May, and September World Agricultural Supply and Demand Estimates (WAOB, 2020) reports. Between January and May 2020, USDA's projected prices fell by 11.4 percent for steers and 20.9 percent for barrows and gilts. Between May and October 2020, prices for steers had recovered somewhat, while prices for barrows and gilts were relatively flat. Figure 4 shows a similar pattern in futures contracts for cattle but considerably more fluctuation in hog futures, and with the latter rallying in February 2021 to levels over 20 percent higher than at the end of 2019.

Table 1. Comparison of January, May, September, and October projections for annual 2020 prices

	Jan. Proj.	May Proj.	Sept. Proj.	Oct. Proj.	Percent change Jan vs. May	Percent change Jan vs. Sept	Percent change Jan vs. Oct.
Steers ($/cwt)	117.50	104.10	107.30	108.71	-11.40%	-8.68%	-7.48%
Barrows and Gilts ($/cwt)	54.50	43.10	39.40	43.25	-20.92%	-27.71%	-20.64%
Broilers (Cents/lb.)	86.50	71.40	70.90	70.80	-17.46%	-18.03%	-18.15%
Turkeys (Cents/lb.)	92.50	104.60	105.80	106.10	13.08%	14.38%	14.70%
Eggs (Cents/doz.)	95.50	129.50	114.90	116.70	35.60%	20.31%	22.20%
Milk ($/cwt)	19.25	14.55	17.75	18.00	-24.42%	-7.79%	-6.49%

Source: January and September 2020 World Agricultural Supply and Demand Estimates (USDA,World Agricultural Outlook Board, 2020)

Figure 4. Hog and cattle futures prices (% change 1/1/20 to 03/02/21)

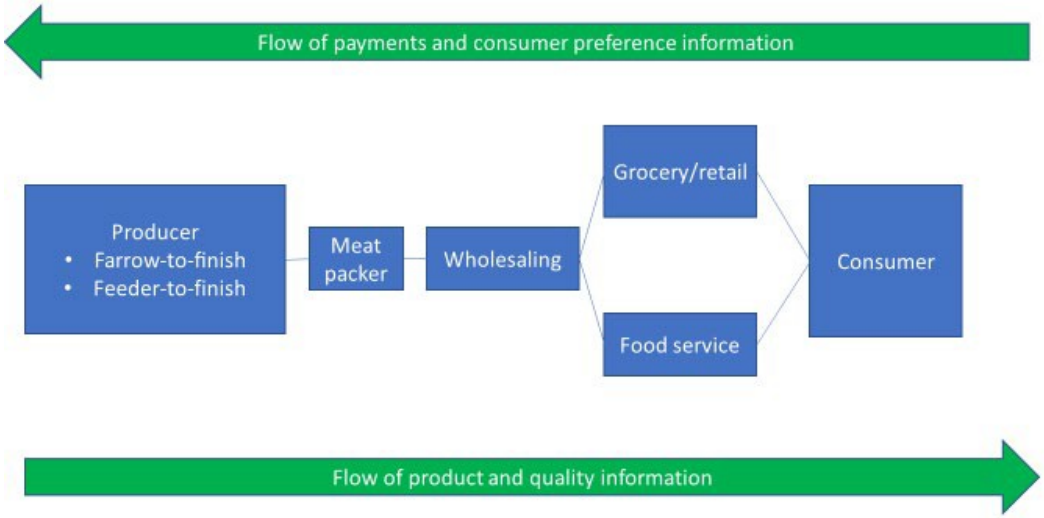


Source: Generic 1st cattle and lean hogs (live) futures contract, Bloomberg. Note: missing data represent nontrading dates or dates with data not otherwise provided by the source. For hogs, missing prices for 10/14/20 and 02/12/21 were fitted with the average of the prior and subsequent trading days' prices to avoid discontinuities in the chart.

A Simple Model to Understand U.S. Livestock and Meat Prices in 2020

Figure 6 contains a flowchart of a meat marketing channel, using the example of hogs. Payment and consumer preference information move upstream from the consumer, and product and quality information move downstream from the producer.

Figure 5. Stages of the Hog Marketing Channel



Adapted from: Rhodes, J. , J. Dauve, and J. Parcel, 2015. The Agricultural Marketing System,7th ed. University of Missouri Publishing, page 7; and Marchant, M. 2020. "Marketing of Agricultural Commodities". Lecture, Virginia Tech University, Fall.

Lusk, Tonsor, and Schultz (2020) posit a simple theoretical model of a meat supply chain to help illustrate the impact of COVID-19 on meat and livestock markets. In the model, the retail market for meat (e.g., beef) is linked to the market for livestock (e.g., fed cattle) by a "marketing" sector that includes meat processing, wholesale services, and retail services. Under some simplifying assumptions, the demand for livestock is obtained by subtracting the costs of these marketing inputs from the retail demand for meat. Similarly, the retail supply of meat is obtained from adding the costs of marketing inputs to the marginal cost (or supply) of livestock.

The model produces an intuitive equilibrium relationship between meat prices and livestock prices and:

$$P_{meat} = P_{livestock} + M$$

where P_{meat} is the retail price of meat (e.g., \$/lb of beef), $P_{livestock}$ is the price of livestock (in meat-equivalent units), and M is the marketing margin. The simple interpretation of this relationship is that retail meat prices are comprised of two components: the packing plants' cost of the livestock that yielded the meat, $P_{livestock}$, and the cost of the marketing input, M. The marketing costs drive a wedge between the price of meat on the animal and the price of the meat at retail.

COVID-19 affects meatpacking plants by raising their costs of production, initially by making the workforce sick and thus less productive, and eventually by forcing processors to incur costs to protect workers from the virus. The effects of higher processing costs are distilled in the equilibrium pricing relationship displayed above, in the form of higher M. Higher processing costs increase the wedge between meat prices and livestock prices, so that meat prices must rise or livestock prices must fall. Higher processing costs cause a decrease in the meatpackers' demand for livestock and a decrease in the retail supply of meat. As a result, downstream meat prices rise and upstream livestock prices fall.

The magnitudes of these price changes depend on the responsiveness (elasticities) of livestock supply and retail demand. Because both meat demand and livestock supply are quite inelastic in the short term, we expect to see relatively large changes in prices and relatively small reductions in quantity.

Implications for Policy

While the COVID-19 pandemic continues to play out, livestock and meat markets have begun to recover (Figure 5). But the events of the past 10 months have raised questions about the performance of U.S. food supply chains generally, and of U.S. meat supply chains, in particular. While these questions deserve more careful consideration, we provide some initial reactions based on the data and simple model presented above.

Meatpacker Market Power

News media and other observers of agricultural markets have speculated that meatpackers took advantage of COVID-19 to increase margins (e.g., Fassler and Brown, 2020; Hagemann, 2020). At issue is meatpacking plants' ability to exercise market power to earn super-competitive profits. The question arises in part because of the high degree of concentration in meatpacking. The CR4—a common measure of industry concentration of the four largest firms in the industry—was 85 percent for livestock/beef, and 64 percent for hogs/pork in 2012 (Saitone and Sexton, 2017), up from 36 and 56 percent, respectively, in 1980 (Crespi, Saitone, and Sexton, 2012). In addition, the industry is characterized by large capital investment that prevents new firms from entering, at least in the short term. Indeed, a large body of empirical work by agricultural economists has investigated the question over the past decades and has tended to find that meatpacking plants do not exercise market power to harm livestock suppliers or consumers. We do not specifically assess market power here, and thus cannot rule it out. But, we do note that the observed price patterns—high retail prices and low livestock prices—are not themselves evidence of market power, as they are consistent with the model described above, which assumes a perfectly competitive meatpacking sector. Also, capacity constraints may reduce the incentives for plants to reduce production; Lusk, Tonsor, and Schulz (2020) found that plants are better off trying to run near full capacity than voluntarily restricting output. They also found that, in general, changes in the stock prices of companies with significant packing operations do not suggest substantial windfalls corresponding to COVID-19.

Resilient Meat Supply Chains

Another question related to the industrial organization of meatpacking plants is whether concentration makes the sector less resilient to the pandemic, and speculation that *localized supply chains have been more resilient to COVID.* Resiliency to a particular risk depends on susceptibility to the risk, and ability to manage the risk if it is realized (Johansson, 2020). On the question of susceptibility, it is not clear that smaller, more localized meatpacking plants would have been less susceptible to the pandemic. If smaller plants are less susceptible, then more resiliency via smaller and more localized packing plants comes at cost of efficiency, as larger plants capture economies of scale that result in lower meat prices and higher livestock prices. It is possible there is a trade-off between efficiency in meat packing and ability to quickly pivot to operating under a pandemic and/or more quickly changing marketing channels. For instance, at least initially, business was reportedly brisk at some small packing plants in the initial days of the COVID outbreak (Huffsturrer and Nickel, 2020; NPR, 2020).

Trade

In early summer 2020, as the COVID-19 pandemic caused high prices and stockouts in the meat section of grocery stores, U.S. pork producers were expanding exports to China (Braun, 2020), causing some observers to wonder if trade exacerbated U.S. domestic supply shortages caused by COVID-19 in livestock and meat markets. Some countries restricted agricultural exports in order to protect domestic consumers (Reuters, 2020). Similar policies were implemented by some countries during the global commodity price spike of 2008-2011. While such policies may appear to help domestic consumers in the short term, the restriction of trade can actually exacerbate the local shortages that they are intended to prevent (Hendrix, 2020). First, export restrictions reduce domestic prices of restricted goods, and thus create a disincentive to increase production and economize on consumption. Moreover, export restrictions disrupt the ability of markets to move product to places most in need. Currently, the United States does not restrict exports of meat or other agricultural commodities.

Conclusion

In this paper, we provide an overview of the ways in which the COVID-19 pandemic upset U.S. markets for meat and livestock. Around the time that the U.S. Government announced a national emergency in mid-March 2020 and State and local officials began to close schools and some businesses, demand for meat and other foods shifted dramatically away from food service and towards retail grocery. This demand shock, combined with some difficulties in reorienting meat supply chains, resulted in a spike in retail meat prices in the spring and occasional grocery store stockouts of some meat products. The pandemic also disrupted U.S. meat supply chains as the virus spread through the workforce in meatpacking plants, causing some to temporarily close and all plants to slow production to inhibit the spread of the virus. The resulting reduction in demand for livestock and supply of beef and pork caused lower livestock prices and higher meat prices in the spring and summer of 2020.

By late summer, perhaps due to public health precautions taken by meatpacking plants, the number of COVID-19 cases at meatpacking plants from August through September was considerably lower than in May through July (Douglas, 2020) and steer and hog futures prices

have returned to pre-pandemic levels. Food demand patterns have moved towards normalcy, but demand for FAFH remains more than 20 percent below pre-pandemic levels and demand for FAH approximately 10 percent higher than pre-pandemic levels. By late August, the CPI for meat was declining but remained 10 percent above pre-pandemic levels.

The COVID-19 pandemic raises several questions and issues related to meat supply chains that warrant further research. We see a need for economic research into the incentives of meatpacking plants to run at full capacity, and the tradeoff that they face between profits and costly measures to manage the public health risk. More generally we see resiliency, and in particular potential tradeoffs between resiliency and efficiency, as a fruitful area for further research. For example, research could examine how might increasing supply resiliency to large unexpected shocks impacts consumer prices.

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