

4-2020

The Impact of COVID-19 on Iowa's Corn, Soybean, Ethanol, Pork, and Beef Sectors

Chad Hart

Iowa State University, chart@iastate.edu

Dermot J. Hayes

Iowa State University, dhayes@iastate.edu

Keri L. Jacobs

Iowa State University, kljacobs@iastate.edu

Lee L. Schulz

Iowa State University, lschulz@iastate.edu

John Crespi

jcrespi@iastate.edu

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Recommended Citation

Hart, Chad; Hayes, Dermot J.; Jacobs, Keri L.; Schulz, Lee L.; and Crespi, John, "The Impact of COVID-19 on Iowa's Corn, Soybean, Ethanol, Pork, and Beef Sectors" (2020). *CARD Policy Briefs*. 30.

https://lib.dr.iastate.edu/card_policybriefs/30

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Abstract

In this study, we estimate the COVID-19 outbreak's revenue impacts on some of Iowa's largest agricultural industries. We estimate overall annual damage of roughly \$788 million for corn, \$213 million for soybean, over \$2.5 billion for ethanol and \$347 million in losses due to falling ethanol prices*, \$658 million for fed cattle, \$34 million for calves and feeder cattle, and \$2.1 billion for hogs. As more data become available and as the pandemic evolves, these estimates will certainly change, but for now they represent our best assessment of the impact on these industries.

Disciplines

Agricultural and Resource Economics

April 2020
20-PB 28

The Impact of COVID-19 on Iowa's Corn, Soybean, Ethanol, Pork, and Beef Sectors

Chad E. Hart, Professor, Department of Economics and Center for Agricultural and Rural Development, Iowa State University, chart@iastate.edu

Dermot J. Hayes, Professor, Department of Economics and Center for Agricultural and Rural Development, Iowa State University, dhayes@iastate.edu

Keri L. Jacobs, Associate Professor, Department of Economics and Center for Agricultural and Rural Development, Iowa State University, kljacobs@iastate.edu

Lee L. Schulz, Associate Professor, Department of Economics and Center for Agricultural and Rural Development, Iowa State University, lschulz@iastate.edu

John M. Crespi*, Professor, Department of Economics and Director, Center for Agricultural and Rural Development, Iowa State University, jcrespi@iastate.edu

*Corresponding Author

Published by the Center for Agricultural and Rural Development, 578 Heady Hall, Iowa State University, Ames, Iowa 50011-1070; Phone: (515) 294-1183; Fax: (515) 294-6336; Web site: www.card.iastate.edu.

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Executive Summary

In this study, we estimate the COVID-19 outbreak's revenue impacts on some of Iowa's largest agricultural industries. We estimate overall annual damage of roughly \$788 million for corn, \$213 million for soybean, over \$2.5 billion for ethanol and \$347 million in losses due to falling ethanol prices*, \$658 million for fed cattle, \$34 million for calves and feeder cattle, and \$2.1 billion for hogs. As more data become available and as the pandemic evolves, these estimates will certainly change, but for now they represent our best assessment of the impact on these industries.

*An earlier version of this executive summary did not report the full ethanol losses found in the text of the report.

Introduction

The 2019 COVID-19 outbreak, in terms of the suddenness of onset, the communicability of the disease, and its immediate stress on market and health infrastructure, is the most far-reaching public health crisis the United States has faced. For the first time in U.S. history, governors of all states and four U.S. territories have declared statewide emergencies, and 52 states and territories have deployed the National Guard.¹ The speed and scope of the deadly outbreak is devastating, and not just from a health perspective. As countries around the world have sought to limit the spread and severity of COVID-19 outbreaks, many have set up temporary policies to prevent or slow the transmission of the disease. Most of these policies revolve around social distancing—creating space between individuals to limit transmission. With COVID-19, public health officials have stressed a six-foot buffer zone around non-healthcare, non-household individuals. To enforce social distancing, governments have urged, and in several cases ordered, citizens to stay at home, only allowing trips for basic and necessary supplies and services. State governments have also regulated the shutdown or slowdown of non-essential businesses, for which each state determines its own definition.

These policies appear to work in reducing the rate of infection, but they severely curtail economic output and restrict demand. They also force significant changes in the ways people obtain and use basic goods and services. Agriculture is one of many sectors reshaping itself in order to function in this new economic environment. Iowa's crop industries depend on three major uses: livestock feed, biofuels, and international sales. International sales fulfill other countries' food, feed, and fuel needs; thus, we concentrate on how the COVID-19 outbreak has affected food, feed, and fuel use.

The easiest impact to see is on fuel, and therefore biofuel, use. With the imposition of “stay-at-home” or “shelter-in-place” orders, U.S. fuel usage has plummeted to 50 year lows (per person), and the Energy Information Agency (EIA) is expecting global fuel usage to fall through the second quarter of 2020. The severe cut in fuel demand has led to sizable reductions in fuel prices, ballooning fuel stocks, and the need for dramatic cuts in fuel production.² However, these changes have a ripple effect on other segments of the economy. The idling of some ethanol plants and the slowdown at others not only reduces ethanol production, it also limits the supply of distillers grains, a major livestock feed component. For some livestock producers, this has translated into higher distillers grains prices as supplies are small, and for some producers, no longer available. As distillers grains have disappeared from the feed ration, livestock producers must replace the energy and protein previously provided by distillers grains. Thus, livestock producers are shifting their feed rations to replace distillers grains with other available feed ingredients, typically soybean meal (for protein) and corn (for energy).

¹ National Governors Association, <https://www.nga.org/coronavirus/#states> last accessed 4/13/2020.

² WTI Crude has fallen from an average of \$57/barrel in 2019 to \$29.34/barrel today and U.S. gasoline prices have fallen from an average of \$2.60/gal in 2019 to \$1.86/gal today. Source: US Energy Information Administration <https://www.eia.gov/outlooks/steo/>, last accessed 4/13/2020.

At the same time, the food segments of agricultural markets are transforming to meet food needs, while limiting social interaction. Since 2014, Americans have spent a little over half of their food expenditures on food eaten away from the home.³ On March 17, Governor Reynolds ordered restaurant dining rooms closed. Some restaurants transitioned to carry-out only, while others have been forced to shut down. With the restaurant closures, at-home food consumption has increased significantly, putting the strain on grocery stores, supermarkets, and other food retailers as consumers stock up. With nearly half of food previously being sold outside of the grocery/retail sector, farm supplies cannot simply be sent to a sector that does not have either the space nor refrigeration and transportation capacity to immediately take the products, despite the demand. Consumers see empty shelves in retail stores because prior to the COVID-19 outbreak, about half their food was purchased elsewhere. As people shelter at home and adjust to the limitations of restaurant carry-out, there have been very quick, dramatic shifts in food purchase and consumption patterns. While agricultural supply chains are somewhat nimble, the quick shift has created surpluses in some food products and shortages in others, especially in the repackaging and delivery of items that previously shipped to restaurants. Obviously, the logistics will take time.

One concern is whether food retailers are taking advantage of the pandemic by either raising prices to consumers or lowering prices paid to suppliers. Accordingly, U.S. senators have asked for an investigation into excessive margins.⁴ Researchers know that U.S. Department of Agriculture margins are an inefficient method of determining whether firms in a supply chain exert atypical market power. In fact, the margins themselves can be problematic, especially when compared over long time periods.⁵ Nevertheless, the monthly margins created by USDA can be instructive when measured over short periods of low inflation is low and there are no significant changes to consumption or technological changes to production. Figure 1 shows that the percent of retail value for beef and pork returning to the farmer do not appear to be significantly different in February and March of 2020 than they were in 2018 or 2019. However, we are still early in the pandemic, and as the months pass and data become available, more sophisticated techniques should be used to assess the changes.⁶

³ Saksena, M.J. et al. 2018. *American's Eating Habits: Food Away From Home*. EIB-196. Economic Research Service, USDA, September 2018 https://www.ers.usda.gov/webdocs/publications/90228/eib-196_ch3.pdf?v=8116.5, last accessed 4/13/2020.

⁴ Polansek, T. "U.S. senators scrutinize meat packers' big profits during pandemic." Reuters. 3/30/2020. <https://www.reuters.com/article/us-health-coronavirus-usa-meatpacking/u-s-senators-scrutinize-meat-packers-big-profits-during-pandemic-idUSKBN21H38M>, last accessed 4/1/2020.

⁵ Pouliot, S. and L. Schulz. 2016. "Measuring Price Spreads in Red Meat," *Agricultural Policy Review*: Vol. 2016: Issue 1, Article 5. <https://lib.dr.iastate.edu/agpolicyreview/vol2016/iss1/5>.

⁶ See for example Crespi, J.M. and R.J. Sexton. "A Multinomial Logit Framework to Estimate Bid Shading in Procurement Auctions: Application to Cattle Sales in the Texas Panhandle." *Review of Industrial Organization* 27(2005): 253-278, and Crespi, J.M. and R.J. Sexton. "Bidding for Cattle in the Texas Panhandle." *American Journal of Agricultural Economics* 86(2004): 660-674.

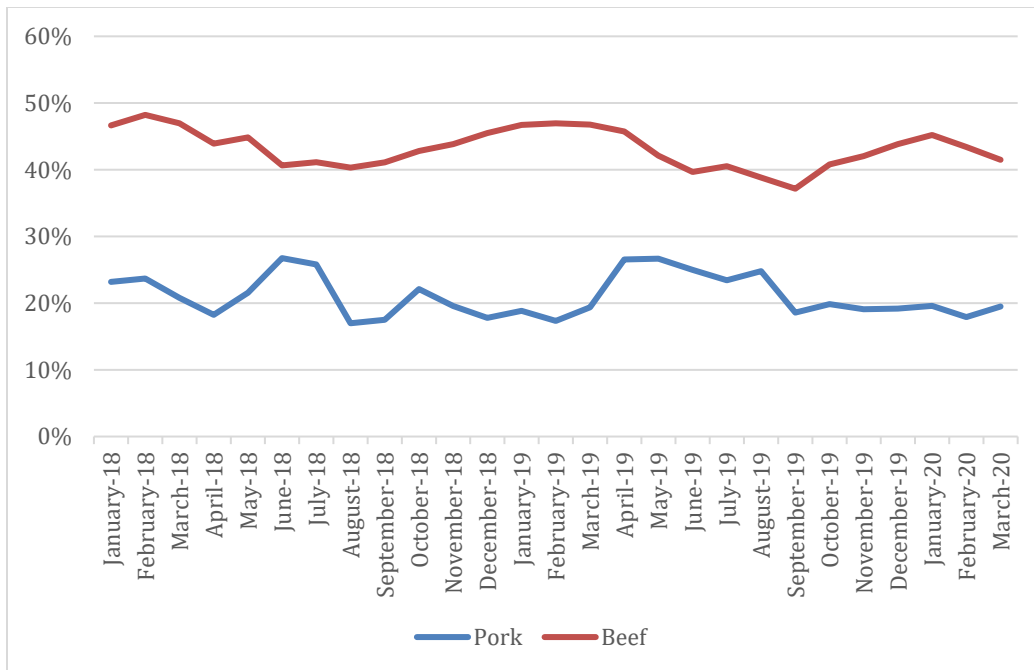


Figure 1. Farm share of retail price.

Source: Economic Research Service, USDA, *Meat Price Spreads* and authors' calculations.⁷

What margins cannot show is how volumes are impacted. As consumer demand becomes more inelastic in a panic, food retailers can decrease their sales, even slightly (increase their prices slightly), and achieve increases in revenue that they cannot achieve when demand is elastic (when substitutes exist and consumers feel free to shop around). Other changes to the supply chain, such as this week's closing of the Smithfield plant in Sioux Falls, SD where nearly 300 employees tested positive for COVID-19, will impact the final marketing of the nation's food supply.⁸

Iowa's agricultural retailers (grain marketing companies and producer input retailers, for example Landus Cooperative and Nutrien Ag Solutions) are not immune to COVID-19's demand and output shocks. To the extent that many of Iowa's agricultural retailers are mixed enterprises with grain marketing businesses, feed mills, energy, and agronomy inputs, they will experience direct and indirect impacts from losses in the crop and livestock spaces and disruptions to their supply chains, including shifting production of commodities. The economic damage we can expect to see will likely be driven by sales reductions and margin upsets in fertilizer usage, crop inputs usage, custom application from shifts in crop production from corn to soybeans, changes in energy demand and pricing, and disruptions in the livestock feed businesses. The immediate concern is employment to maintain operations. Agribusinesses in the Midwest were already

⁷ <https://www.ers.usda.gov/data-products/meat-price-spreads/meat-price-spreads/>, last accessed 4/13/2020.

⁸ Lardieri, A. "Smithfield Foods Closes Plant After Nearly 300 Employees Test Positive for Coronavirus." USA Today. 4/13/2020. <https://www.usnews.com/news/national-news/articles/2020-04-13/smithfield-foods-closes-south-dakota-processing-plant-after-employees-test-positive-for-coronavirus>, last accessed 4/13/2020.

facing shortages of qualified employees for a number of reasons. The emerging challenge is keeping employees on the job and providing safeguards to make them comfortable being at work, particularly as the busy spring planting season approaches.

The economic impacts at the agricultural retail level will be slower to develop and perhaps less obvious to account for in early economic assessments. Looking specifically at farm supply and grain cooperatives, 2019 was a challenging year for agricultural retailers for a number of reasons—trade disputes narrowed commodity margins, a wet spring in 2019 eroded agronomy sales, and a challenging 2019 harvest means a compressed 2020 spring schedule to accomplish applications. The spring challenges are likely to be magnified by a shortage of employees. The good news is that many retail agribusinesses, including cooperatives, come to 2020 in relatively stable financial condition. Preliminary data from the third quarter of 2019 for a subset of cooperatives in Iowa and surrounding states suggests a current ratio of 2.0, local leverage of 0.4 (term debt to total equity is 0.3), and year-end EBITDA of 4.48%. These data, accounts receivables, and enterprise margin metrics will be tracked and analyzed to understand the longer-term effects of COVID-19 on retail agriculture.

We turn now to an assessment of Iowa's five largest agricultural markets to ascertain the COVID-19 revenue impacts on these industries using assumptions about changes to prices and marketings from the outbreak.

A Preliminary Assessment of COVID-19 on Iowa's Corn, Soybean, Ethanol, Pork and Beef Industries

To assess the COVID-19 outbreak's economic impact on Iowa's agriculture, we estimate the economic damage to the corn, soybean, ethanol, pork, and beef markets and the accompanying public health regulatory response. While some of this damage has already been realized, the majority of the impact comes from the continued slowdown of the general economy and the pricing of future commodity sales. To estimate potential losses in agricultural revenues, we examine the price reactions of various agricultural markets during the pandemic and explore the revenue losses indicated by those price movements. For our study, we use the period of January 22, 2020 to April 9, 2020. January 22 was the date the World Health Organization (WHO) issued a statement indicating human-to-human transmission of the virus. Since then, the various markets have reacted to the COVID-19 outbreak and other relevant factors.

Corn, Soybean, and Ethanol

The implementation of the Phase One trade deal between the United States and China and the oil production battle between Saudi Arabia and Russia are both relevant factors for the grain and oilseed markets, as both have major market and price implications. As a conservative estimate, we assume that COVID-19 is driving 70% of the price changes in the corn and soybean markets and 50% of the price changes in the ethanol market. We also include estimates of ethanol production losses as plants idle due to the ongoing restrictions.

For corn, we obtained the futures market prices on January 22 and April 9 and convert those prices to expected Iowa cash prices using average basis levels from the past five years. As columns 2 and 3 of table 1 show, expected cash corn prices have fallen noticeably over the past

two and a half months. While corn is harvested during a relatively small window of time, farmers sell corn all throughout the year. State-level data on sales timing is not available, but USDA does have national-level estimates. We assume that Iowa farmers sell their corn in a pattern similar to the five-year average national percentages (table 1, column 4). Given Iowa's 2019 corn production of 2.58 billion bushels, we can compute the number of bushels destined for sale each month.

Table 1. Corn Prices and Marketings

	Price Estimates, Jan. 22 (\$/bu)	Price Estimates, Apr. 9 (\$/bu)	% of Crop Marketed (%)	# of Bushels Impacted (million bu)
January	3.78	3.78	12.6	326
February	3.73	3.74	7.5	195
March	3.77	3.37	6.9	179
April	3.81	3.18	5.9	152
May	3.77	3.14	6.3	163
June	3.78	3.15	7.8	201
July	3.86	3.26	6.7	174
August	3.91	3.35	6.4	165
September	3.86	3.30	7.0	180
October	3.83	3.30	11.5	296
November	3.82	3.32	12.4	320
December	3.80	3.30	9.0	233

Table 2 outlines COVID-19's economic damage to Iowa's corn market. The price damage began in earnest last month, which is somewhat fortunate, in that corn marketings are relatively low in March and April. However, the loss will expand if prices remain depressed as Iowa farmers head into harvest. Compared to the price expectations from January 22, the current pricing situation leads to a \$788 million loss in revenue for Iowa's corn producers.

Table 2. Corn Economic Damage

	COVID-19 Price Damage	# of Bushels Impacted	Estimated Economic Damage
	(\$/bu)	(million bu)	(\$ million)
January	0.00	326	0.00
February	0.00	195	0.00
March	0.28	179	50.38
April	0.44	152	66.47
May	0.44	163	71.44
June	0.44	201	87.95
July	0.42	174	72.38
August	0.39	165	65.11
September	0.39	180	70.81
October	0.37	296	110.12
November	0.35	320	112.14
December	0.35	233	81.39
Annual 2020		2,584	788.19

For soybean, we follow our same procedure for corn. As the columns 2 and 3 of table 3 show, expected cash soybean prices have fallen over the past two-and-a-half months, with the largest declines occurring later in the year. We assume that Iowa farmers sell their soybeans in a pattern similar to the five-year average national percentages (table 3, column 4). Given Iowa's 2019 soybean production of 502 million bushels, we can compute the number of bushels destined for sale each month.

Table 3. Soybean Prices and Marketings

	Price Estimates, Jan. 22	Price Estimates, Apr. 9	% of Crop Marketed	# of Bushels Impacted
	(\$/bu)	(\$/bu)	(%)	(million bu)
January	8.55	8.55	13.8	69
February	8.76	8.31	7.1	36
March	8.87	8.22	6.0	30
April	8.92	8.28	4.7	23
May	8.95	8.27	3.5	17
June	9.06	8.36	4.3	22
July	9.26	8.53	3.9	20
August	9.41	8.68	3.1	16
September	9.73	8.99	6.7	33
October	9.34	8.59	25.7	129
November	9.16	8.41	11.6	58
December	9.25	8.49	9.7	49

Table 4 outlines COVID-19's economic damage to Iowa's soybean market. The price damage began in February, as the virus spread within China and then to the rest of the world. Soybean was impacted earlier than corn due to its market dependence on exports to China. As with corn,

the timing is somewhat fortunate, in that soybean marketings are relatively low once we pass January. However, the loss will expand if prices remain depressed as the state heads into harvest. Compared to the price expectations from January 22, the current pricing situation leads to a \$213 million loss in revenue for Iowa’s soybean producers.

Table 4. Soybean Economic Damage

	COVID-19 Price Damage	# of Bushels Impacted	Estimated Economic Damage
	(\$/bu)	(million bu)	(\$ million)
January	0.00	69	0.00
February	0.31	36	11.10
March	0.46	30	13.71
April	0.45	23	10.47
May	0.47	17	8.15
June	0.49	22	10.61
July	0.51	20	10.03
August	0.51	16	8.00
September	0.51	33	17.19
October	0.52	129	67.23
November	0.53	58	30.65
December	0.53	49	25.80
Annual 2020		502	212.94

For ethanol, we make no basis adjustments to futures market prices. As the columns 2 and 3 of table 5 show, expected ethanol prices have reached the lowest levels in quite some time. Unlike crops, ethanol is produced continually throughout the year. While state-level data on monthly production is not available, the EIA produces national-level estimates. We assume that Iowa ethanol plants produce in a pattern similar to the 10-year average national percentages (table 5, column 4). Given Iowa’s 2019 ethanol production of 4.23 billion gallons, we can compute the number of gallons impacted each month.

Table 5. Ethanol Prices and Production

	Price Estimates, Jan. 22	Price Estimates, Apr. 9	% of Fuel Produced	# of Gallons Potentially Impacted
	(\$/ga)	(\$/ga)	(%)	(million ga)
January	1.24	1.24	8.3	350
February	1.34	1.23	8.3	350
March	1.37	1.03	8.2	349
April	1.38	0.94	8.1	344
May	1.38	0.97	8.3	351
June	1.38	0.97	8.4	357
July	1.38	0.97	8.4	353
August	1.38	0.97	8.4	353
September	1.38	0.97	8.2	345
October	1.38	0.97	8.3	351
November	1.38	1.01	8.6	362
December	1.38	1.01	8.6	365

Table 6 outlines COVID-19's economic damage to Iowa's ethanol market. There are two distinct impacts—the price damage on produced gallons of ethanol and the loss of gallons (and revenue) when plants are idled. At the time of writing, eight Iowa ethanol plants had been idle over the past two weeks, removing a sizable portion of Iowa's expected ethanol production. Many of the remaining plants have curtailed production. We incorporated those changes into our estimates by explicitly subtracting the production capacity of idled plants and reducing the remaining plants' production by 40%. We base the 40% reduction on EIA's most recent weekly ethanol production report. We compute the economic damage to the ethanol industry from the price drop on produced gallons and the revenue loss from gallons that are no longer being produced. Compared to the expectations for the ethanol industry from January 22, the current pricing and production situation leads to a \$347 million loss in revenue from price declines and a \$2.57 billion loss in revenue from production losses for Iowa's ethanol producers.

Table 6. Ethanol Economic Damage

	COVID-19 Price Damage	# of Gallons Produced	# of Gallons Idled	Estimated Economic Damage from Price Drop	Estimated Economic Damage from Production Loss
	(\$/ga)	(million ga)	(million ga)	(\$ million)	(\$ million)
January	0.00	350	0	0.00	0.00
February	0.06	350	0	19.33	0.00
March	0.17	314	35	53.30	47.62
April	0.22	145	199	32.20	275.10
May	0.21	149	202	30.85	279.10
June	0.21	153	204	31.35	282.35
July	0.21	151	203	30.87	280.22
August	0.21	151	203	30.88	280.27
September	0.21	146	200	29.88	275.74
October	0.21	149	202	30.53	278.66
November	0.19	156	206	28.81	284.94
December	0.19	158	207	29.16	285.88
Annual 2020		2372	1861	347.16	2,569.88

For corn, soybean, and ethanol the projected damages based on current conditions are large, with the ethanol industry facing the biggest financial impacts. As we have seen over the past few weeks though, conditions during this pandemic change quickly. If the social distancing and other restrictions work to slow COVID-19's spread and severity, price and production recovery is possible in the second half of the year. Some industries will recover more quickly than others. For example, the ethanol industry will likely have a more difficult path to recovery, as ethanol stocks now sit at record levels. Those stocks will have to be drawn down before idle plants can profitably return.

Hog and Beef Cattle

COVID-19 has impacted every step in the red meat supply chain. The distribution and transportation system that is in place to take meat from packers to retailers is suffering from a severe lack of labor. Workers are calling in sick, avoiding work due to safety concerns, or staying home to care for school-aged children, which means that the link between retail demand and packer level demand is, in short, broken.

The significant slowdown, and in many cases closure, of the U.S. food service and hospitality sector has caused a major decline in consumption of products such as steak, bacon, ham, and sausage patties. Americans are far more likely to buy these products when eating out or staying at a hotel than they are to purchase them for at-home cooking. These products are now backing up in cold storage.

Packing plants are also suffering from high worker absenteeism, and several have had to suspend operations. The closure of large beef and pork plants, at a time when plants were running near capacity, has broken the link between demand for meat primals and demand for live animals. The short-run limited supply may push wholesale and retail meat prices higher. At

the same time, limited processing capacity will curtail demand for slaughter animals and could push farm-level prices lower. Export markets are weak because of difficulty unloading ships and a worldwide slowdown in economic activity and buying power.

As was the case for corn, soybean, and ethanol, the most accurate way to estimate industry wide damages is to use Iowa's expected monthly output of each species and the change in the basis adjusted futures price for delivery in that month.⁹

Table 7 shows the change in futures prices from January 22 to April 9 as well as the expected Iowa fed-cattle marketings in each month.¹⁰ Table 8 uses the data in table 7 to estimate statewide damage, which sums to \$658 million for fed cattle producers in 2020.

Table 7. Fed Cattle Prices and Marketings

	Price Estimates, Jan. 22	Price Estimates, Apr. 9	# of Head Impacted
	(\$/cwt)	(\$/cwt)	(head)
January	124.45	124.45	170,000
February	125.95	118.79	185,000
March	130.12	112.76	166,997
April	129.82	97.04	235,995
May	126.82	92.74	229,995
June	122.30	88.22	172,997
July	119.18	94.16	198,996
August	118.05	93.03	176,996
September	117.73	95.93	158,997
October	116.62	94.82	150,997
November	118.90	97.77	112,998
December	120.14	99.01	129,997

⁹ We use average basis levels from 2013 to 2019, which are available from the Ag Decision Maker website at <https://www.extension.iastate.edu/agdm/ldmarkets.html>.

¹⁰ Fed cattle marketed from all Iowa feedlots during January and February 2020 were reported in the USDA NASS, in cooperation with the Iowa Department of Agriculture and Land Stewardship, monthly Cattle on Feed report. We estimate March through August 2020 fed-cattle marketings using September through February 2020 placements in all Iowa feedlots. September through December 2020 fed cattle marketings use corresponding 2019 placement data.

Table 8. Fed Cattle Economic Damage

	COVID-19 Price Damage	COVID-19 Price Damage	# of Head Impacted	Estimated Economic Damage
	(\$/cwt)	(\$/head)	(head)	(\$ million)
January	0.00	0.00	170,000	0.00
February	7.16	100.20	185,000	18.54
March	17.36	243.06	166,997	40.59
April	32.78	458.85	235,995	108.29
May	34.08	477.05	229,995	109.72
June	34.08	477.05	172,997	82.53
July	25.03	350.35	198,996	69.72
August	25.03	350.35	176,996	62.01
September	21.80	305.20	158,997	48.53
October	21.80	305.20	150,997	46.08
November	21.13	295.75	112,998	33.42
December	21.13	295.75	129,997	38.45
Annual 2020			2,089,965	657.87

Tables 9 and 10 show similar calculations for calf and feeder cattle producers (cow-calf and backgrounding sector) and show economic damages of \$34 million in 2020.¹¹ The beef cattle industry has some flexibility to adjust cattle flows and timing at the calf and feeder cattle stages of production. The production and marketing windows for finished cattle are much narrower, as finished fed cattle are not readily storable. In a matter of days, market-ready cattle can go from having top market value to being over fed and over finished with a lower value. Maintaining the flow of fed cattle is imperative for not backing up the supply chain.

Damages to Iowa beef cattle producers are projected to total \$692 million in 2020. The Iowa beef cattle industry has already been challenged by cyclically lower prices and weather impacts. The impacts of cold, snow, floods, and fires on cattle producers in 2019 made dramatic headlines. As estimated by the Livestock Marketing Information Center, 2019's cow-calf return above cash costs plus pasture rent was the poorest since 1996. The causes were persistently low cull-cow prices and weak fall calf prices. A major fire at a western Kansas beef packing plant (Tyson Foods plant, Finney County, August 9, 2019) was also a dramatic market disruption. Uncertainty and speculation plagued the industry and cash cattle prices fell. Looking back on 2019, the Iowa State University estimated yearling-to-finish closeouts for the year were negative. Four of the last five years have provided negative estimated annual returns for cattle feeders.

¹¹We estimate Iowa calf and feeder cattle marketings using the USDA-IA Department of Agriculture Market News Iowa Weekly Cattle Auction Summary (LSD_MARS_2167) and the USDA-MO Department of Agriculture Market News National Feed & Stocker Cattle Summary (SJ_LS850). Given the predominance of spring calving, most calves are marketed in the fall; and, if backgrounded, marketed in the winter. Feeder cattle are sold more throughout the year given the array of backgrounding and stocker enterprises that add weight to calves before they are placed into feedlots.

Table 9. Calf and Feeder Cattle Prices and Marketings

	Price Estimates, Jan. 22	Price Estimates, Apr. 9	# of Head Impacted
	(\$/cwt)	(\$/cwt)	(head)
January	157.45	157.45	10,275
February	165.26	158.37	65,699
March	166.50	153.59	25,908
April	170.39	143.89	27,463
May	172.31	143.34	11,794
June	175.28	149.61	7,078
July	174.67	148.99	15,189
August	175.51	149.83	16,877
September	174.71	148.69	15,701
October	170.77	144.87	23,365
November	167.49	141.61	27,555
December	165.67	144.17	31,123

Table 10. Calf and Feeder Cattle Economic Damage

	COVID-19 Price Damage	COVID-19 Price Damage	# of Head Impacted	Estimated Economic Damage
	(\$/cwt)	(\$/head)	(head)	(\$ million)
January	0.00	0.00	10,275	0.00
February	6.89	44.81	65,699	2.94
March	12.92	83.98	25,908	2.18
April	26.50	172.25	27,463	4.73
May	28.98	188.34	11,794	2.22
June	25.68	166.89	7,078	1.18
July	25.68	166.89	15,189	2.53
August	25.68	166.89	16,877	2.82
September	26.03	169.16	15,701	2.66
October	25.90	168.35	23,365	3.93
November	25.88	168.19	27,555	4.63
December	21.50	139.75	31,123	4.35
Annual 2020			278,027	34.18

Tables 11 and 12 show the estimated damage to Iowa's hog industry. Bottlenecks and backlogs in the supply chain are much more acute in the hog industry, which means that the value of feeder pigs can approach zero in a situation like this. There is no place to keep these animals until spaces emerge at finishing facilities.

Total projected annual damages in the Iowa hog industry exceed \$2 billion dollars.¹² The Iowa hog industry had been challenged by two years of trade war retaliation and labor shortages. The industry was already in poor economic shape and cannot handle losses of this magnitude. It is possible that several large integrators will enter bankruptcy and default on rental payments to contract producers. These contract producers are typically heavily leveraged and will default on loans used build the barns. The possible impact of defaults among contract growers is not included in this estimate.

Table 11. Hog Prices and Marketings

	Price Estimates, Jan. 22	Price Estimates, Apr. 9	# of Head Impacted
	(\$/cwt)	(\$/cwt)	(head)
January	62.31	62.31	3,794,502
February	66.31	58.33	3,445,210
March	72.98	61.70	3,702,793
April	74.34	42.62	3,524,341
May	77.59	40.16	3,448,086
June	83.11	44.68	3,328,110
July	84.49	51.26	3,494,254
August	87.92	57.94	3,590,413
September	75.69	52.44	3,518,652
October	74.79	51.54	4,054,415
November	70.63	52.71	3,739,346
December	69.30	51.38	3,755,757

Table 12. Hog Economic Damage

	COVID-19 Price Damage	COVID-19 Price Damage	# of Head Impacted	Estimated Economic Damage
	(\$/cwt)	(\$/head)	(head)	(\$ million)
January	0.00	0.00	3,794,502	0.00
February	7.98	17.16	3,445,210	59.11
March	11.28	24.25	3,702,793	89.79
April	31.73	68.21	3,524,341	240.39
May	37.42	80.46	3,448,086	277.45
June	38.42	82.61	3,328,110	274.95
July	33.22	71.43	3,494,254	249.61
August	29.97	64.45	3,590,413	231.39
September	23.25	49.99	3,518,652	175.89
October	23.25	49.99	4,054,415	202.67
November	17.92	38.54	3,739,346	144.11
December	17.92	38.54	3,755,757	144.74
Annual 2020			43,395,877	2,090.09

¹² We project head marketed using USDA-NASS barrow and gilt slaughter data and the percentage of market hogs in inventory on Iowa farms from USDA's Hogs and Pigs report.

Conclusion

While illness causing pathogens and threats to the economy and the food supply have occurred throughout history, in recent years, they have been mostly contained to specific regions or specific sectors of the food market. The COVID-19 pandemic is something the United States has never experienced in its history. The large scale destruction of farmland and processing facilities in the Southern United States during the Civil War and the dustbowl on the Great Plains in the 1930s may be the closest analogies. At the time of this writing, every state and municipality is mobilized to fight the coronavirus outbreak. Until a vaccine is developed, that mobilization is mostly in the form of social distancing and the curtailment of a majority of the economic sector in which U.S. consumers used to obtain roughly half their food. Both measures have led to marketing problems throughout food supply chains, with immediate and dramatic impacts across the country. Iowa is the United States' second-largest agricultural state, and the impact on Iowa's agricultural producers, especially of soybean, corn, ethanol, pork and beef is expected to be massive. In this study, we provide our best estimate of the revenue impacts on some of Iowa's largest agricultural industries. We estimate overall annual damage of roughly \$788 million for corn, \$213 million for soybean, approximately \$2.9 billion for ethanol, \$658 million for fed cattle, \$34 million for calves and feeder cattle, and \$2.1 billion for hogs. As more data become available and as the pandemic evolves, these estimates will certainly change, but for now they represent our best assessment of the impact on these industries.