



Economic Damages to the U.S. Beef Cattle Industry Due to COVID-19

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Introduction

More than 80 million head of the 94.4 million cattle in the U.S. on Jan. 1, 2020 (USDA, 2020) are involved in beef production. The U.S. beef cattle industry had \$77.2 billion in sales in 2017 (USDA, 2019). Cattle are found on 882,692 farms, including 729,046 farms with beef cows (USDA, 2019). The beef cattle industry is complex with multiple production sectors, including cow-calf, stocker/backgrounding and feedlots. Every sector of the beef cattle industry and cattle producers in every state have been significantly impacted by COVID-19.

Results Summary

The total beef cattle industry impact of COVID-19 is an estimated loss of \$13.6 billion in total economic damages, as a result of \$9.2 billion in total revenue loss across 63 million animals. The average economic and revenue loss per head is \$216 and \$146 per head, respectively (Table 1). These impacts include \$8.1 billion loss (\$3.7 billion direct revenue loss; \$4.4 billion breeding herd asset value loss) to the cow-calf sector representing 59.7% of total impact; \$2.5 billion loss to the stocker/backgrounding sector representing 18.2% of total economic loss; and \$3 billion loss to the feedlot sector representing 22.2% of total economic loss.

These estimated losses are based on information available as of April 8, 2020. Given the damage to both cash flows and asset values, and the relationship between the two measures, economic damages and reparations are not necessarily equal or synonymous. Prescribing an exact dollar amount or allocation method for any possible relief was outside the present work. The objective of the work was the timely assessment of the significant economic damages, absent any relief funding to the beef cattle industry given our current understanding of a constantly evolving worldwide health and economic crisis. Additional impacts are likely in the future.

Industry overview

As 2020 began, the U.S. cattle industry included 94.4 million head (Table 2). Beef production in 2020 is forecast at a record 27.5 billion pounds. In 2019, beef production totaled 27.15 billion pounds based on total cattle slaughter of 33.6 million head, including steers and heifers (79.0% of total), dairy cows (9.7%), beef cows (9.6%) and bulls (1.6%).

At this time, COVID-19 does not materially affect the projections for total beef production in 2020. The possible exception could be if there is enough labor disruption in processing facilities to lower total slaughter potential for the year, which

Table 1. Beef Industry Estimated Economic Losses from COVID-19.

Sector	Time Period	Animals (1,000 Head)	Damage/Head (\$)	Total Damage (\$)
Cow-Calf	2020	32,882.5	\$111.91	\$3,679,880,575
	2021+	32,882.5	\$135.24	\$4,446,971,400
	Total	32,882.5	\$247.15	\$8,126,851,975
Stocker/Backgrounding	2020	15,478.1	\$159.98	\$2,476,137,140
Feedlot	2020	14,636.0	\$205.96	\$3,014,429,335
Economic Impact - Industry Total		62,996.6	\$216.16	\$13,617,418,450

could create a backlog of cattle and push some production into 2021. Such impacts remain to be seen, but even a short closure could have significant consequences for market prices and total beef available.

What has happened thus far is tremendous impacts on beef supply chains and the short run timing of beef marketing. Cash fed and feeder cattle prices at all levels have been impacted, along with Live and Feeder futures prices being sharply lower and extremely volatile reflecting expected impacts for the remainder of the year. This report details the methodologies used to formulate the estimated impacts in Table 1.

Damage Estimates Process

Given the urgency of the current situation, the committee moved expeditiously to prepare this report. A series of web meetings were held over a five-day period from April 3 to April 8 with the following outcomes:

- ✓ **April 3:** The initial meeting resulted in a broad-based discussion among committee members regarding what and how impacts should be considered; considerations

Table 2. U.S. Cattle Inventory.

Inventory Class	Jan. 1, 2020 (1,000 Head)
All Cattle and Calves	94,413.3
Beef Cows	31,316.7
Dairy Cows	9,334.6
Beef Replacement Heifers	5,771.9
Dairy Replacement Heifers	4,637.0
Other Heifers	9,705.5
Calves <500 pounds	14,739.0
Steers >500 pounds	16,671.2
Bull >500 pounds	2,237.4
Cattle on Feed	14,667.7
Estimated Feeder Supply*	26,448.0
Calf crop (2019)	36,059.6

*Calculated from inventory
Source: USDA, 2020

of how to prepare estimates that will facilitate USDA interpretation and implementation; and how to proceed with the process. Each committee member contributed to the discussion based on various individual backgrounds and perspectives. Input from a variety of industry groups across the country were shared and considered as the committee formulated an approach.

- ✓ **April 6:** The second meeting resulted in a more focused discussion of the needed estimates and the methodologies to be used to prepare alternative estimates of damages. The committee was divided into three subgroups charged with preparing damage estimates for the cow-calf, stocker and feedlot sectors. Each of the committee members brought not only their knowledge and experience, but also specific tools and procedures that could be employed immediately to prepare damage estimates. Each subgroup submitted initial estimates for a specific sector to the entire committee prior to the subsequent web meeting.
- ✓ **April 8:** The entire committee discussed and refined the estimates in the next meeting, finalizing the range of estimates for each sector. Estimates were summarized and a draft executive summary was prepared.
- ✓ The draft executive summary was distributed among the committee, edited and the executive summary was forwarded to NCBA on April 9.
- ✓ Between April 9 and April 13, the draft full report with details of the estimates was prepared and shared prior to a final committee meeting to edit and finalize the full report. The report was completed on April 14.

General Considerations and Assumptions

Committee discussions included several general considerations and assumptions that provided parameters or boundaries within which the estimates would be made. Some assumptions reflect time constraints and the reality of producing timely estimates. These considerations and assumptions include:

- ✓ Focus of damage estimates would be on price impacts and resulting revenue losses for cow-calf, stocker/backgrounding and feedlot operations. In addition, breeding herd asset value loss would be considered at the cow-calf level.

- ✓ A national perspective would be maintained. Price impacts reflect changes in prices that would apply across the country regardless of differences in regional price levels.
- ✓ Risk management is not considered. The damage estimates should be determined in total regardless of whether there were offsetting factors. While a variety of risk management tools are available and used to varying degrees across all sectors, there is no feasible way to determine or account for the extent to which risk management may have offset some of the cash market damages estimated in this report. Moreover, attempting to reduce damage estimates for risk management penalizes producers who use available risk management tools and may be a disincentive for the use of such tools.
- ✓ Attempts were made to present damage estimates in formats that will facilitate USDA implementation. For example, 2020 cow-calf sector losses are calculated on the basis of calf sales but are presented as an average impact across mature breeding animal inventories, which are easier to document. Likewise, feedlot sector impacts were calculated based on the timing and flow of fed cattle placements but the impacts are stated in terms of the February 1 feedlot inventory for easier documentation.
- ✓ Estimates are made of losses to cattle producers and it is assumed that any relief payments would be made directly to cattle producers/owners.
- ✓ It is likely that USDA will apply similar eligibility criteria similar to other types of farm programs. As with the Market Facilitation Program (MFP) or the Wildfire and Hurricane Indemnity Program Plus (WHIP+), it was presumed that USDA will likely use an eligibility cap of AGI <\$900,000 with a possible exception if more than 75% of income is from the agricultural enterprise. It is further assumed that the reduction in payments due to sequester will be applied prior to payment limits, as implemented in the 2018 Farm Bill programs. While these program implementation issues did not directly influence the damage estimates, the committee elected not to consider any eligibility restrictions on large beef cattle operations in our analysis based on the assumption that programs developed under the CARES Act will follow similar guidelines as other USDA programs.
- ✓ The committee agreed on and ensured that the major assumptions and parameters of the analysis presented in this report were consistent. However, as subgroups were working rapidly, independently and simultaneously, some minor assumptions may differ across estimates for each sector. These inconsistencies do not materially affect the total damages estimates.

COVID-19 Damages to Cow-calf Sector

The impacts of COVID-19 have been felt in every sector of the beef cattle industry and are expected to continue through 2020. Cow-calf producers will market weaned calves in spring 2020 from fall 2019 calf crops and in fall 2020 from spring 2020 calf crops. These calf sales are all expected to experience significant price declines compared to pre-COVID-19 expectations. Further, U.S. cow-calf producers have limited risk management options available to them. There are no beef cattle Title I price safety net programs and beef cattle were not part of the Market Facilitation Program. This leaves

few, if any, aid programs outside of the CARES Act to which cow-calf producers can look for relief in this unprecedented market situation. As a result, cow-calf producers are left highly exposed to the downward spiral of cattle prices in the wake of the expanding COVID-19 health emergency.

The impact of COVID-19 related price declines to the cow-calf sector was estimated using multiple price forecasts and futures contract prices for weaned calves for the period from March 1, 2020 through Dec. 31, 2020. Two price forecasts were obtained from the Livestock Market Information Center (LMIC) and CattleFax. The forecasts published in late March and early April were compared to published forecasts in January 2020, prior to COVID-19 expansion in the US. In addition, Chicago Mercantile Exchange (CME) feeder cattle futures contracts closing prices from April 7 were compared to January 7 closing prices for contracts with expiration dates in 2020. The U.S. mature breeding cattle inventory as of Jan. 1, 2020, normal calving rates and pre-weaning death loss were accounted for to estimate overall value loss to the cow-calf sector in 2020. Total damage estimates were divided by mature cows and bulls (mature breeding animals) as of Jan. 1, 2020. The expected losses for the cow-calf sector in 2020 were estimated at \$1.65 billion (\$50.14 per mature breeding animal) and \$2.75 billion (\$83.65 per mature breeding animal) using LMIC and CattleFax calf price forecasts, respectively. Estimating cow-calf losses using futures prices results in a much higher loss estimate, \$5.16 billion (\$156.92 per mature breeding animal). Due to similarities in the LMIC and CattleFax estimates, and the additional information on price expectations in the CME contracts, a weighted average damage estimate to the cow-calf sector due to COVID-19 could be \$3.7 billion (\$111.91 per mature breeding animal). In addition to the loss in calf sales value, the loss in value of breeding stock is estimated at \$4.45 billion (\$142 per mature breeding female).

Futures prices are more prone to short-term volatility spikes due to the increased uncertainty caused by COVID-19. While CME losses might appear overstated, they are important to include because the few risk management options available to cow-calf producers are tied to futures prices. The 2020 loss estimates are limited to price declines for calves, and the reduced asset value of cows in future periods is presented separately to reflect the longer-term implications of COVID-19 on cow-calf producers. Further, the timeline for market recovery from COVID-19 is unknown, and cow-calf losses could expand into 2021 when the summer and fall 2020 calf crops would be marketed.

Cow-Calf Damages Rationale and Methodology

As with all segments of the beef sector, estimating economic loss to the cow-calf industry associated with COVID-19 has challenges and requires that assumptions on market prices be made. COVID-19 has had drastic impacts on cattle prices across all industries. Although many cow-calf producers have not sold calves since the start of the pandemic, lingering impacts on calf prices are very likely to continue through the balance of 2020 and beyond. For the purposes of this estimation, calendar year 2020 was considered the period of analysis. Given the year-round nature of cow-calf production, this largely affects one calf crop for existing cow-calf operations. However, the impacts of COVID-19 are likely to linger well past December 2020, which is addressed by examining the reduced asset value of the breeding herd extending beyond 2020.

According to USDA-NASS Jan. 1, 2020 inventory estimates (Table 2), there were 31.3167 million beef cows in the U.S. (USDA-NASS, 2020). Assuming a 20:1 cow-to-bull ratio, bull inventory was estimated as 1.5658 million head, bringing the total estimated mature breeding animals to 32.8825 million head. That same report estimated that in 2019, 73.1% of beef cows calved between January 1 and June 30 (loosely referred to as spring calvers) and the remaining 26.9% calved in the second half of the year (loosely referred to as fall calvers). For simplicity, it was assumed that sale of spring-born calves were spread evenly across the third and fourth quarters and sale of fall-born calves were spread evenly across quarters 1 and 2. Further, NAHMS data from 2007-2008 reported that 88.57% of cows weaned a live calf, which was used to convert existing beef cow numbers to an estimated number of calves sold throughout the year (USDA-APHIS).

Finally, it was assumed that there was no real impact on calf prices from COVID-19 in January and February, so the number of impacted calves sold in the first six months of 2020 was reduced by one-third to account for calves sold in the first two months of the year. Based on these assumptions, it was estimated that in 2020, 4,974,317 calves would be sold March through June and 20,276,352 would be sold between July and December.

The next step was estimating a loss in value due to COVID-19 for each calf sold in 2020. Clearly, this is an evolving issue and loss estimation involves forecasting prices for the remainder of the calendar year. In order to incorporate as much information and expertise as possible into an estimate of total loss to the industry and provide some feel for the range of these losses, multiple forecasts were used. These estimates were made using pre-COVID-19 and the most recently published, quarterly price forecasts from the Livestock Marketing Information Center (LMIC) and CattleFax. Similar forecasts from USDA Economic Research Service should also be incorporated into this analysis when they become available on April 15, 2020. We also consider pre-COVID-19, and the most recent, CME® feeder cattle futures contract prices in order to give multiple estimates of loss in value. Both pre-COVID-19 and post-COVID-19 forecasts are shown in Tables 3 and 4. Both LMIC and CattleFax forecast the price for a 550-pound steer, so that was the assumed sale weight of weaned calves

for the analysis. Since CME futures prices are based on an 800-pound steer, this price was multiplied by 1.17. This multiplier is the 2020 relationship between CME futures prices and 550-pound steer prices in Kansas, and it allows for converting CME futures prices into a calf price forecast. The same approach should be used for USDA-ERS forecasts. The changes in price expectation per cwt were multiplied by 5.5 cwt per calf to estimate a loss in value of each 550-pound steer calf that would be sold in 2020. That per-head estimate is multiplied by the number of calves sold in order to estimate total losses to the sector using all three forecasting methods. Losses are shown in Table 5; note they are expressed in total and on a mature breeding animal head basis.

The final question is how to weight each of the damage estimates. Because of the similarities in the approach and data sources used by LMIC and CattleFax, and because of the additional information on expectations reflected in the CME contracts, the individual estimates were weighted as 25% LMIC, 25% CattleFax and 50% CME.

It is worth addressing two factors in the approach employed. First, steer prices and values were used rather than breaking sales out between steers and heifers. This was a simplifying assumption, but also a necessary assumption because forecasts are based on steer prices. Understand the change in value is more critical when estimating losses than breaking out estimates by gender. For example, had heifer price been assumed to be \$10 or \$15 less than the steer price, the change in values would be the same across both genders. Therefore, the total loss estimate is unaffected by this assumption.

Secondly, 2020 cull cow sales value declines were not included in this analysis. This exclusion has both a practical and functional explanation. Cull cow price forecasts are much more limited than calf price forecasts. Multiple pre- and post-COVID-19 forecasts for cows are not available. Further, had cull cow sales been included, heifer sales would need to be reduced to account for heifers that are held to replace those culled cows. Rather than take this approach, we assumed that all steers and heifers are sold at weaning. Had a loss in cull cow values been incorporated into the estimation, it would have been largely offset by reduced losses resulting from fewer heifer calves being sold. Still, it is worth noting that cull cows are likely to sell for less than pre-COVID-19 expectations in

Table 3. Pre COVID-19 Price Forecasts / Futures Prices for Calendar Year 2020 (\$ per cwt).

	March	Quarter 2	Quarter 3	Quarter 4
LMIC (Jan. 7, 2020)	\$166.00	\$169.50	\$172.00	\$171.00
CattleFax (January 2020)	\$175.13	\$173.98	\$168.13	\$162.15
Futures Prices (Jan. 7, 2020)	\$145.13	\$148.50	\$155.04	\$155.23

Note: The price levels are different across forecasts due to the weight of the animal considered. Adjustments to allow for comparison are detailed below.

Table 4. Post COVID-19 Price Forecasts / Futures Prices for Calendar Year 2020 (\$ per cwt).

	March	Quarter 2	Quarter 3	Quarter 4
LMIC (Apr. 3, 2020)	\$161.24	\$149.50	\$157.00	\$164.50
CattleFax (April 2020)	\$156.88	\$152.84	\$147.68	\$143.29
Futures Prices (Apr. 7, 2020)	\$124.54	\$114.37	\$121.75	\$124.51

Table 5. Cow-calf Sector Loss Estimates.

March through June 4,974,317
 July through December 20,276,352

Losses per Calf Sold	LMIC	CattleFax	CME Futures
March through June	\$90.42	\$84.30	\$197.87
July through December	\$59.13	\$90.94	\$205.94
Total Loss of Calf Value	LMIC	CattleFax	CME Futures
March through June	\$449,777,749	\$558,597,153	\$984,259,196
July through December	\$1,198,839,307	\$2,191,924,333	\$4,175,632,583
Total 2020 Loss	\$1,648,617,057	\$2,750,521,486	\$5,159,891,779
Total 2020 Loss per mature breeding animal	\$50.14	\$83.65	\$156.92

2020. As a result, actual breeding stock depreciation is going to be greater on those cows that are culled from the herd this year, which is potentially another source of loss. Depreciation of the cowherd as an asset is a separate issue, which will be discussed later.

Further, a few comments about the unique nature of the cow-calf sector are needed. First, while risk management was not considered in this loss estimation, policy makers should be aware that cow-calf operators have far fewer risk management tools at their disposal compared to other beef cattle sectors. There is no futures market for calf prices and limited forward contracting opportunities exist. The fact that a large number of U.S. cow-calf operations are small only adds to this challenge. Livestock Risk Protection (LRP) Insurance is often touted as a risk management option for cow-calf operations, but it is really based on CME feeder cattle futures prices and option premiums. The steep declines in those prices have limited the ability to use LRP after the impact of COVID-19 on futures prices, which affects spring-calving producers going forward in 2020.

Finally, it should be recognized that cow-calf producers are the only sector in the beef cattle industry that are not “margin” operations. Because of this, the value of calves tends to become the residual of what is left after downstream industries pass losses back upstream. Over time, losses in cattle feeding and backgrounding, are inevitably passed backed to the cow-calf level. The cow-calf sector is the only sector of the beef industry unable to avoid this reality. Therefore, from a derived demand perspective, one could argue that changes in the expected value of fed cattle (forecasts or deferred live cattle futures) may be passed back to the cow-calf level. While this is not the approach utilized in this analysis, it does suggest that these calf prices may have more risk going forward than values in any other sector of the beef system.

Breeding Stock Value Lost

While the approach above looks simply at expected lost calf revenue for 2020, there are deeper impacts on the cow/calf sector due to lost herd value. To approximate the impact on cow-calf herd value it is useful to assess how the net present value (NPV) of breeding stock have changed. Using the KSU-Beef Replacement Excel decision tool (Tonsor and Dhuyvetter) and USDA’s 10-year projected calf prices (USDA-ERS), the base NPV for a female expected to provide seven calves is \$1,013 per cow. If each herd had a one-year decline of \$25

per cwt in sales price for their marketed calves in 2020, and sales in future years were not changed, the NPV declines to \$871 per cow. This implies a decline of \$142 per head in the NPV of each breeding cow. Coupling this with USDA’s January estimate of 31,316,700 million beef cows suggests a total decline of \$4.45 billion in herd value. Including this change in asset value provides a more complete picture of the total damages to the cow-calf sector.

COVID-19 Damages to the Stocker/Backgrounding Sector

Stocker/Backgrounding Summary

The stocker/backgrounding sector includes a wide range of production activities across a wide range of feeder cattle sizes. Various referred to as stocker production or backgrounding, this sector includes growing programs using weaned feeder cattle prior to placement in feedlots. These programs include a variety of grazing programs as well as confinement or semi-confinement programs.

Stocker or backgrounding production varies by location and time of year. Some major stocker activities include winter grazing on cool-season forages, such as wheat pasture in the Southern Plains; summer grazing in the tallgrass prairie regions of the Flint Hills, Kansas and the Osage region, Oklahoma; summer grazing on shortgrass range in the High Plains; and spring/early summer grazing of cool-season annuals in California. A wide variety of other stocker and backgrounding activities occur in other regions (Peel).

Estimated damages for the stocker/backgrounding sector is the average of the four estimates in Table 7 with average damage per head \$159.98 and a sector total of \$2.48 billion. This includes average losses of \$118.40 per head for animals up to 500 pounds and \$184.38 for animals over 500 pounds.

Stocker Impact Rationale and Methodology Inventory Numbers

There is no direct data estimate of stocker inventories or total annual stocker production. Data from the semi-annual cattle inventory reports are typically used to calculate a residual estimate of the number of feeder cattle outside of feedlots on January or July 1 each year. This estimate takes the sum of the inventory of steers over 500 pounds, other (non-replacement) heifers over 500 pounds and calves under 500 pounds from

Table 6. Estimated Stockers, Feb. 1, 2020.

	1,000 Head
1 Steers + Other Heifers	26,376.7
2 Cattle on Feed	14,667.7
3 Jan Placements	1,955.0
4 Stockers over 500 pounds (1, 2 and 3)	9,754.0
5 Calves under 500 pounds	14,739.0
6 Unweaned calves*	9,014.9
7 Stockers under 500 pounds (4 and 5)	5,724.1
8 Estimated Feb 1 Stocker Supply (4+7)	15,478.1

*25% of 2019 calf crop (36059.6 x 0.25 = 9014.9)

which the inventory of cattle in feedlots is subtracted. This residual estimate includes both weaned stockers as well as unweaned suckling calves, which should not be included in stocker production estimates.

In order to determine the number of stockers impacted by COVID-19, the above procedure is modified to produce estimates of stockers over 500 pounds and stockers under 500 pounds. The number of stockers from the January 1 inventory estimates is further adjusted to reflect stocker numbers on February 1, which is the inventory level to which the price impacts of COVID-19 are applied.

Stockers over 500 pounds includes the sum of steers and other heifers over 500 pounds with the January 1 cattle on feed estimate and January feedlot placements subtracted. The January 1 inventory of calves under 500 pounds is adjusted to reflect fall suckling calves with an estimated 25% of the 2019 calf crop born in the fall and thus included in the January 1 estimate of calves. These suckling calves should not be included in stocker estimates as they are covered in the cow-calf sector damage estimates.

Stocker Price Impacts

Four different estimates of stocker price impacts were estimated and ultimately averaged to provide the final estimate of stocker price impacts. The first two estimates were made using different seasonal price forecasts of 2020 feeder cattle prices without COVID-19. Each of these was then compared to post-COVID-19 prices implied by Feeder futures. The third estimates were based on changes in Livestock Marketing Information Center (LMIC) feeder price forecasts from Janu-

ary and March. The fourth estimate was based simply on changes in CME Feeder futures prices between January and March. All estimates produced price impacts per cwt., which were applied to 500-pound and 800-pound feeder animals to represent animals up to 500 pounds and over 500 pounds, respectively.

Method 1 used seasonal price indexes for various feeder cattle weights based on combined Oklahoma auction prices from 2007-2016. Cash prices for January and the first three weeks of February were separately used to project cash prices for the remainder of 2020 for feeder weights ranging from 475 pounds to 875 pounds. These cash price estimates were compared to prices implied by Feeder futures after COVID-19. The post-COVID feeder prices were calculated as the average daily settlement price of feeder futures from March 16 to April 7 for each 2020 contract April, May, August, September, October and November. Basis estimates published by the LMIC were used with the appropriate nearby feeder futures price to calculate price estimates for the same range of weights as the cash price estimates. The average difference in price across all weight groups was quite consistent and averaged \$24.82 per cwt. leading to impacts of \$124.10 per head for 500-pound animals and \$198.56 per head for 800-pound animals (Table 7).

Method 2 used seasonal price indexes based on Oklahoma City auction prices for the period 2016 to 2019. Cash prices for 2020 were projected based on the January pre-COVID-19 price. These were compared to the same futures estimates as method 1 and resulted in estimated impacts of \$15.45 per cwt. This produces estimated impacts of \$77.25 per head for 500-pound animals and \$123.60 per head for 800-pound animals.

Method 3 used the change in LMIC feeder cattle price forecasts from January to March resulting in estimated price impacts of \$26.87 per cwt. for 500 pounds and \$24.34 per cwt. for 800-pound animals. This results in estimated impacts of \$134.35 per head for 500-pound animals and \$194.72 per head for 800-pound animals.

Method 4 calculated the change in feeder futures prices for the April, May, August, September, October and November contracts. The pre-COVID-19 prices was the average daily settlement from January 13 to 31 and the post-COVID-19 price was calculated as the average daily settlement of each contract from March 16 to April 7. The average price change across all contracts was \$27.58 per cwt. leading to impacts of \$137.89 per head for 500-pound animals and \$220.63 per head for 800-pound animals.

Table 7. Estimated Stocker Damages.

Head (Table 6)	1,000	<500 pounds		>500 pounds		Total
		5,724.1	9,754.0	15,478.1		
		\$/head	\$ Total (1,000)	\$/head	\$ Total (1,000)	\$ Total (1,000)
Method 1		124.10	710,360.81	198.56	1,936,754.24	2,6471,15.05
Method 2		77.25	442,186.73	123.60	1,205,594.40	1,647,781.13
Method 3		134.35	769,032.84	194.72	1,899,298.88	2,668,331.72
Method 4		137.89	789,296.15	220.63	2,152,025.02	2,9413,21.17
Average		118.40	677,719.13	184.38	1,798,418.14	2,476,137.14

COVID-19 Damages to the Cattle Feeding Sector

Feedlot Sector Summary

COVID-19 negatively impacted the price of 14.636 million head in U.S. feedlots. The damage totaled \$3.01 billion. The cost per head to the feedlot sector is estimated at \$205.96 of the Feb. 1, 2020, on-feed inventory.

Feedlot Impact Rationale and Methodology

A vital aspect of the U.S. cattle/beef sector is producing high-quality products by finishing animals in feedlots. That is a multi-month process. Cattle feeding enterprises are margin operators; that is, they buy animals to place on-feed and assume the risk of profit or loss on the finished (fed) animal. The unprecedented and unexpected collapse in fed animal prices began in early February 2020.

Independent analysis was conducted by members of the feedlot subgroup and then assumptions and methods were discussed, largely following the earlier full committee conference calls. Calculations and assumptions were then standardized to calculate damages. From a cattle feeding (feedlot sector) perspective, damages began in February 2020 and are expected to reverberate through September 2020. In September 2020, the bulk of animals on-feed as of Feb. 1, 2020, will have been marketed and feeder animals (yearlings and calves) placed on-feed in February and March had lower prices and in September that input price adjustment is expected to have occurred.

Many of the fed animals sold in February had been priced/valued as yearlings (over one year of age) in late summer (e.g., September) or early fall (e.g., October). The same general lags between placement and sale occurred for animals sold in March and April. For fed cattle sold in May, an additional source of placements begins to be incorporated into the marketplace, including fast-growing steer calves that were born early in the prior calendar year and weaned in the early fall.

U.S. Feedlot Sector Damage

The amount of the sector loss has two components: 1) number of head affected and 2) price decline.

Head Impacted

Independently, subgroup members applied approaches and sensitivity analysis to the number of head impacted in

the U.S. Two of the methods built up from monthly placement data back into 2019 reported by USDA's National Agricultural Statistics Service (NASS), which are for U.S. feedlots with a capacity of 1,000 head or more. Those figures were expanded to the national level, including the national inventory percentage as of January 1, 2020, reported by USDA-NASS (81.5% of the national number are in feedlots with a capacity of 1,000 head). The third approach worked back from forecast expected fed cattle marketed during the damage timeframe. Those evaluations, depending on some assumption/method differences, came in line with the reported Feb. 1, 2020 inventory of cattle on feed reported by NASS after adjusting for the proportion of animals outside that survey (11.928 million head divided by .815). The estimate is 14.636 million cattle in U.S. feedlots.

Fed Price Decline

COVID-19 had a total impact per head marketed from the week ending Feb. 7 through the third quarter (i.e., through September 2020). After Sept. 30, 2020, the anticipation is that cattle feeder margins will have adjusted. The breakdown per head is:

- \$ (211.76) closeout date weighted average impact per head marketed
- \$ (205.96) closeout date weighted average impact per head Feb. 1 COF inventory (this is the recommended base).

See Tables 8 through 11 for further details. Total impact on the feedlot sector is estimated at \$3.01 billion (Table 8).

Feedlot Damages Assumptions

- Impact began to develop as of February 7, 2020
- Steers and heifers not differentiated
- Live weight at marketing of 1,380 pounds
- From an economic adjustment standpoint, we discussed but saw no need to explicitly try to segregate beef-type animals in feedlots from dairy-type.

Method

Weighted average of LMIC (25%) and CattleFax (25%) forecasts and implied expected price from Futures plus basis (50%). The futures market price profile has a much more significant decline than do the fundamental cash market analysis of LMIC and CattleFax. That is attributed to substantial supply

Table 8. Total Feedlot Impact.

	<i>Feb 1 – Apr 3</i>	<i>Q2</i>	<i>Q3</i>	<i>Total</i>
Projected Marketings of U.S. Total				
Feb. 1 COF (1,000 head)	4,603	7,370	2,263	14,235
USD Impact per head Marketed	(118.38)	(270.04)	(211.88)	(211.76)
Total Impact (USD)	(544,868,778)	(1,990,162,145)	(479,398,411)	(3,014,429,335)
Feb 1 COF: Feedlots >=1000 head (1,000 hd)	11,928			
U.S. Total Feb. 1 COF* (1,000 hd)	14,636			
USD Impact per US Total Feb. 1 COF	(205.96)			

*Assumes 81.5% of US cattle on feed are in feedlots with 1,000-head or more capacity (USDA-NASS, 2020)

Table 9. Average Fed Cattle Price Impact Forecast.*Average Forecast 25% LMIC, 25% CattleFax, 50% Futures*

	Week Ending		
	Feb. 7-Apr. 3	Q2	Q3
No COVID-19	123.78	120.32	113.39
COVID-19	115.20*	100.75	98.04
COVID-19 Impact	(8.58)	(19.57)	(15.35)

*Actual average weekly price during the period.

Table 10. LMIC Fed Cattle Price Impact Forecast.

LMIC Forecast	Forecast Date	Week Ending		
		Feb. 7-Apr. 3	Q2	Q3
No COVID-19	Jan 7	124.00 [^]	121.50	113.00
COVID-19	Apr 3	115.20*	105.50	104.50
COVID-19 Impact		(8.80)	(16.00)	(8.50)

[^]Assumes constant price across Q1

*Actual average weekly price over the period.

Table 11. CattleFax Fed Cattle Price Impact Forecast. CattleFax Forecast.

	Feb 1- Mar 31			
	Forecast Date	Feb. 7-Apr. 3	Q2	Q3
No COVID-19	Jan 1	124.91	120.87	114.20
COVID-19	Apr 8	115.85*	107.33	103.56
COVID-19 Impact		(9.06)	(13.54)	(10.64)

*Actual average weekly price over the period.

Table 12. Live Futures Fed Cattle Price Impact Forecast Futures Forecast.

	Week Ending			
	Forecast Date	Feb. 7-Apr. 3	Q2	Q3
No COVID-19	Feb. 7	123.10	119.45	113.18
COVID-19	Apr. 3	115.20*	95.09	92.05
COVID-19 Impact		(7.90)	(30.24)	(26.08)

[^]Average LC contract price nearby the projected closeout date plus 3-year average basis

*Actual average weekly price over the period.

disruptions being more prominent in the view of futures market participants.

- Equally account for industry analyst forecasts (LMIC and CattleFax) with market consensus forecasts (Futures).
- Assume that futures are the forecast of the entire marketplace and that the entire price change over the period is from COVID-19 implications. No basis adjustment was made.
- Futures inherently price in the probability of future supply chain issues, which is worth including when accounting for forward-looking damages.
- Feedlot sector impacts were calculated based on the timing and flow of fed cattle placements and estimated marketing dates but the impacts are stated in terms of the Feb. 1 feedlot inventory for easier documentation.

Summary

The U.S. beef cattle industry has been significantly impacted by COVID-19 as illustrated by the damage estimates in this report. Effects of COVID-19 are still manifesting and are likely to continue unfolding in the coming months. Agricultural producers in this industry have significant asset investments, and production occurs over multiple years. Without relief, especially at the primary producer levels, the foundations of the entire U.S. beef supply chain are threatened.

References

- Peel, Derrell S. Beef Cattle Growing and Backgrounding Programs. *Veterinary Clinics Food Animal Practice* Vol. 19 (2003), 365-385.
- Tonsor, Glynn T. and Kevin C. Dhuyvetter. KSU-Beef Replacements. <https://www.agmanager.info/livestock-meat/production-economics/ksu-beef-replacement>
- USDA-ERS. USDA Agricultural Projections to 2029. Office of the Chief Economist, World Agricultural Outlook Board, U.S. Department of Agriculture. Prepared by the Interagency Agricultural Projections Committee. Long-term Projections Report OCE-2020-1, 114 pp. <https://www.ers.usda.gov/webdocs/publications/95912/oce-2020-1.pdf?v=8056.6>
- USDA-APHIS. Beef 2007-08 Part II: Reference of Beef Cow-Calf Management Practices in the United States, 2007-08, USDA-APHIS-VS-CEAH-NAHMS, February, 2010.
- USDA-NASS (2019). 2017 Census of Agriculture United States Summary and State Data, Volume 1, Geographic Area Series, Part 51.AC-17-A-51, National Agricultural Statistics Service, April 2019.
- USDA-NASS (2020). Cattle. National Agricultural Statistics Service, January 31, 2020

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