Assessment of Physical Delivery Mechanisms on the Live Cattle Futures Market

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and

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[1]This project was conducted in response to a *Request for Proposal: Live Cattle Physical Futures Delivery Academic Research* from the NCBA-Live Cattle Marketing Committee. We acknowledge the many industry participants who took time to visit with us in numerous interviews we conducted in completing this project as well as the NCBA Working Group members who provided invaluable feedback on this report. We are also grateful to CME Group for providing live cattle futures delivery data used in this report.

PREFACE

This project was launched to increase understanding of issues surrounding live cattle delivery, how delivery methods might be enhanced, and to assess pros and cons of various physical delivery alternatives. The project involved interviews with live cattle futures market participants as well as affiliated service and regulatory agencies. We pursued ideas and concerns of short hedgers, long hedgers, and speculators to listen to stakeholders from all perspectives on the contract. We visited with market participants who have never delivered or accepted delivery as well as those who have been among the most prominent in making and/or taking delivery in recent years. Discussions were informative, candid, and included sensitive or confidential information. We are indebted to all who took time to visit with us and share their opinions.

We found opinions and perceptions regarding the current live cattle contract delivery process are strongly held. There is consensus on certain issues whereas, on other topics, views are polarized. This report is our attempt to combine what we heard collectively from those interviews with our own data analysis to compare current delivery practices with new alternatives. A better understanding of the trade-offs surrounding delivery alternatives will enhance the risk management role of the live cattle futures contract well into the future.

We thank NCBA for engaging us in this important and interesting project. We look forward to continuing to work with the industry on these and related issues when our assistance can be of value.

INTRODUCTION

The CME Live Cattle Futures Contract has been an important risk management tool available to the cattle and beef industry for more than 50 years. The magnitude of capital at risk in the industry together with elevated market volatility present today makes having a viable live cattle futures market of immense importance in price risk management. The viability of this market hinges on how effectively its use mitigates fed cattle price risk for hedgers.

The performance of the live cattle futures market rests heavily on contract specifications. One debated contract specification in live cattle futures is physical delivery as a way to settle the obligation of a short position in the market. The delivery option is the main way cash and futures prices for delivery settled contracts can be aligned in the delivery period near contract expiration. Convergence of cash and futures in the current contract is conditioned on delivery potential. However, a variety of concerns surround live cattle futures contract delivery. The magnitude of concerns prompted industry and CME Group discussions to consider eliminating delivery in live cattle futures and switch to a cash settled contract.[2] Though certainly not new, as switching the contract to cash settlement was considered in the mid-1990s,[3,4] the debate has elevated again in recent years.

NCBA has an established policy position supporting physical delivery settlement of the live cattle futures contract.[5] However, concerns surrounding delivery need to be carefully assessed and evaluated to potentially improve this component of the live cattle futures contract. This project was designed to identify and document concerns with current delivery and to provide practical guidance to NCBA as they consider alternative physical delivery mechanisms in the live cattle futures market.

The range of sentiments of cattle market participants we interviewed for this study ranged from those who thought the contract worked very well to those who see the contract and physical delivery as outdated and inconsistent with the modern live cattle industry.

[2] Polansek, T. "CME Mulls Cash Settlement for Volatile Cattle Market." Reuters. Available at: https://www.reuters.com/article/us-commodities-summit-cme/cme-mulls-cash-settlement-for-volatile-cattle-market-idUSKCN12D2ZI

[3] Continental Grain Company. "Cash Settlement of the Chicago Mercantile Exchange Live Cattle Futures Contract" Unpublished white paper, November 19, 1996.

[4] Murphy, R. and P. Peterson. "An Examination of an Industry Proposal to Cash Settle the Live Cattle Contract." Unpublished CME Commodity Research Department, January 29, 1997.

[5] Page 97, M 2.7 2016/New in National Cattlemen's Beef Association. *2017 Policy Book*. Updated January 2017. Available at: http://cqrcengage.com/beefusa/file/x5D3pvXpumN/2017NCBAPolicyBook.pdf

Objectives

The purpose of this project was to assess current live cattle futures delivery methods and provide strengths and weaknesses of current as well as possible alternative delivery methods.

The general purposes of this project were to:

1. Summarize and describe current live cattle futures delivery methods and synthesize existing concerns associated with various components of the process
2. Assess strengths and weaknesses of the current delivery system, including logistics, animal handling, and incentives for market participants
3. Assess strengths and weaknesses of alternative delivery systems, including logistics, animal handling, incentives for market participants, and how the systems might impact longs versus shorts

The general purposes were achieved by the following particular objectives:

1. Analyze live and carcass delivery of live cattle, in the context of what is currently done and what could be changed
2. Analyze feedyard delivery of live cattle as a potential delivery option that might complement or replace current methods
3. Based on industry knowledge and options, along with findings from particular objectives 1 and 2, examine variations or combinations of stockyard, feedyard, and/or carcass delivery

Methods

Several sources of information were accessed to complete the objectives of this project. Three major sources of information were utilized most heavily in this study:

1. Live cattle futures market stakeholders, regulators, and service providers
2. USDA AMS data on regional live cattle production, marketing, and price discovery; CFTC data on commitment of traders; and CME Group data on contract deliveries
3. Industry papers, public filings, and unpublished papers focused on live cattle futures contract and delivery

A set of industry and live cattle futures market stakeholder, regulator, and service provider interviews were conducted (via phone and in person) including:

1. Feedyard short hedgers (those who have made deliveries and some who have not)
2. Beef packers
4. USDA AMS live cattle grading service representatives
5. Long position holders that have taken delivery
6. Live cattle futures speculators
7. Industry market consultants/analysts
8. CFTC representatives involved with the contract
9. CME Group directors managing the contract

In our interviews for this study, we visited with some 40 individuals representing about 30 different organizations or firms. Information collected included documenting the specific nature of strengths, weaknesses, and concerns with current delivery methods; exploring how various modifications or alternatives to executing delivery might occur; and assessing the strengths and weaknesses of new alternative delivery methods. Furthermore, because the topic of discussion naturally led to other relevant issues, we leveraged this project to provide information gleaned on related issues. Each group of stakeholders we visited with had a unique perspective because of their role in the industry, the location of their operations, structural character of their business, and how they utilize live cattle futures. Every individual we visited with had considerable experience in some aspect of live cattle contract design, hedging, speculating, making or taking delivery, marketing services, market surveillance and regulation, market consulting, or contract management. The amount of thought and consideration these individuals had given this topic were a testament to its importance to the industry.

Data from USDA AMS, CME Group, and CFTC were collected and utilized to assess issues relative to deliverable supplies, deliverable capacity, pricing systems, deliveries, microstructure of contract trade volume, and basis. Published literature was reviewed and utilized to document the existing body of published works relative to issues associated with the live cattle contract.

ROLE OF LIVE CATTLE FUTURES

This segment of this report summarizes the importance of live cattle futures and composition of traders comprising the contract. This information is central to the major objectives of this project as it documents the growth in the live cattle futures contract; it's importance to short hedgers mitigating price risk; and the relatively small number of natural long hedgers present in the market. We rely on this information in later sections of this report where we synthesize key takeaways.

Purpose and Importance

Futures markets serve major roles of risk transfer, price discovery, and price forecasting. The CME Live Cattle Futures contract has been actively traded since 1964. Today, live cattle futures daily volume typically exceeds 50,000 contracts traded.

Risk Transfer

The most important role of a futures market is providing a tool for risk management. Without hedgers, a commodity futures market will not survive. As a risk management tool, futures provide a market where price risk can be largely alleviated for a hedger by taking a futures position that is opposite the hedger's existing or expected cash market position. Cattle feeders sell live cattle futures to lock in a margin for cattle as feeder cattle are placed in the feedyard or during the feeding period. Once the cattle are ready for harvest, the cattle feeder hedger who is short the futures contract can sell the cattle to a beef packer and buy back the futures position. Assuming the cattle meet contract specifications, the feeder can alternatively opt to deliver the cattle to fulfill the short futures position obligation. Through these transactions, the short cattle hedger has effectively established a future selling price for cattle well in advance of harvest, thereby mitigating price risk. The hedger's remaining fed cattle price risk is basis risk. Establishing a future selling price upon placement of feeder cattle means that feeders also give up positive risk, should prices increase. Many feeders who are less risk averse may place feeder calves and wait to see how market conditions evolve before taking a position in the futures market. In any case, the option to deliver cattle to fulfill futures positions give short hedgers a mechanism by which to make convergence more predictable and reduce basis risk. More discussion related to basis is included later in the discussion of delivery of live cattle to fulfill short futures position.

The CME Live Cattle Futures Contract can be used in an equivalent way by long hedgers who buy live cattle (or beef as a cross-hedge) as inputs to their business. In this case, the buyer of live cattle would establish a long position in the futures market at some point before the cattle are needed. This allows the long hedger to lock in an expected price that would lead to profitable sale of the final product. At the time the long hedger buys cash cattle the futures position is offset by selling futures. In the case of the long, delivery is more nuanced. The long cannot initiate delivery. However, if willing to accept delivery, the long can influence convergence maintaining a long position as contract expiration nears.

Price Discovery and Forecasting

Futures markets are publicly visible and easily accessed markets for both hedgers and speculators. Because of the ease of access, low transaction costs to trade futures, and large numbers of buyers and sellers trading in the market, the futures contract serves as a liquid platform for price discovery. Futures prices are readily available on electronic media any time the market is open and trading. As new information becomes available, traders rapidly impound that information into futures contract prices through bids and offers.

Nearby futures reflect current market supply and demand fundamentals whereas deferred contract prices represent expectations regarding future anticipated supply and demand. As such, deferred contract prices serve a role of being price forecasts. Several studies have compared price forecasting accuracy of futures markets with alternative forecasts such as USDA, university economists, and statistical models.[6,7,8] The general conclusion of research assessing forecasting accuracy of commodity futures markets is, in general, futures are not highly accurate price forecasts, especially for more distant maturity contracts. However, futures are as accurate or more accurate as a forecast of future cash and futures market prices than any other tested alternatives. In other words, futures forecasting accuracy is not great, but it is as good or better than any other alternative forecast source.

Volume and Open Interest in Live Cattle Futures

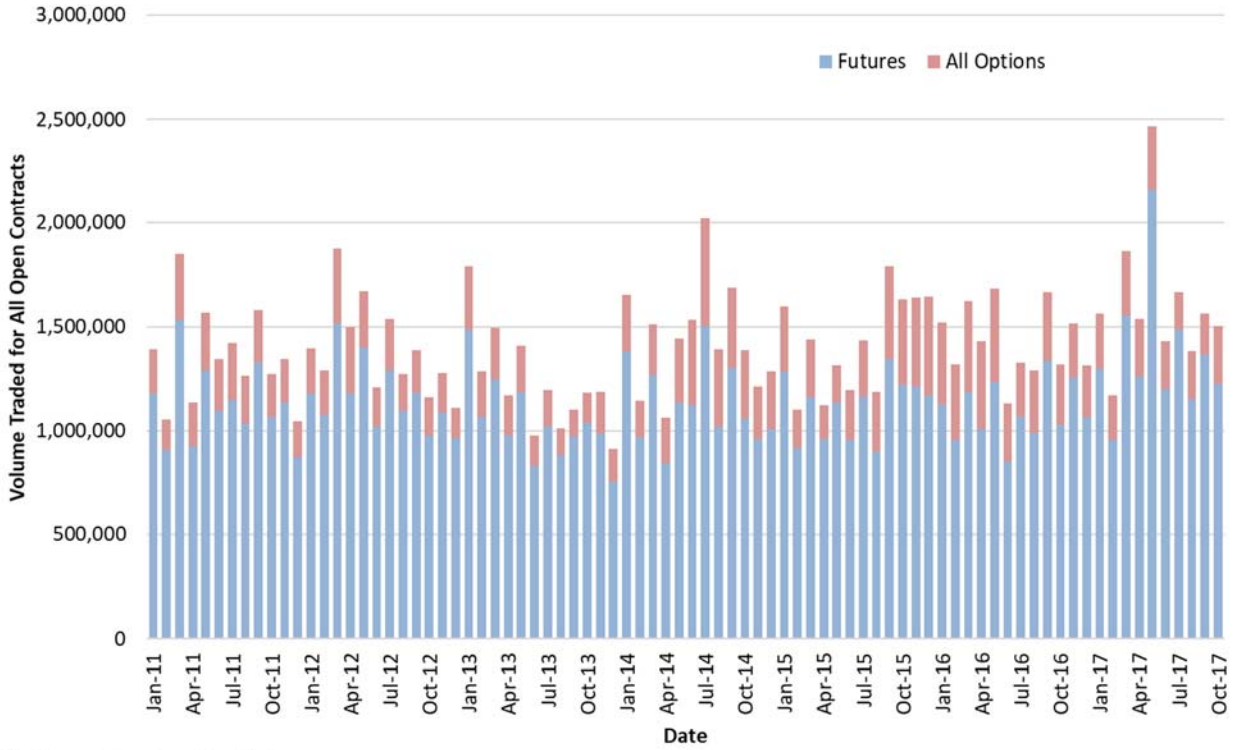
The live cattle contract is actively traded with total monthly volume traded normally ranging between 1.0 million and 1.5 million contracts. Including option trading, monthly volume regularly exceeds 1.5 million contracts. Figure 1 shows aggregate monthly volume for the CME Group Live Cattle Futures Contract from 2011 to 2017. Volume has varied over this time period without a clear trend but saw a spike in April 2017, which was by far a contract record volume.

[6] Carter, C. and S. Mohaparta. "How Reliable Are Hog Price Forecasts." *American Journal of Agricultural Economics* 90(May 2008):367-378.

[7] Tomek, W.G. "Commodity Futures Prices as Forecasts." *Review of Agricultural Economics* 19(March 1997):23-44.

[8] Reeve, T.A. and R. Vigfussion. "Evaluating the Forecasting Performance of Commodity Futures Prices." *FRB International Finance Discussion Paper No. 1025.* August 2011.

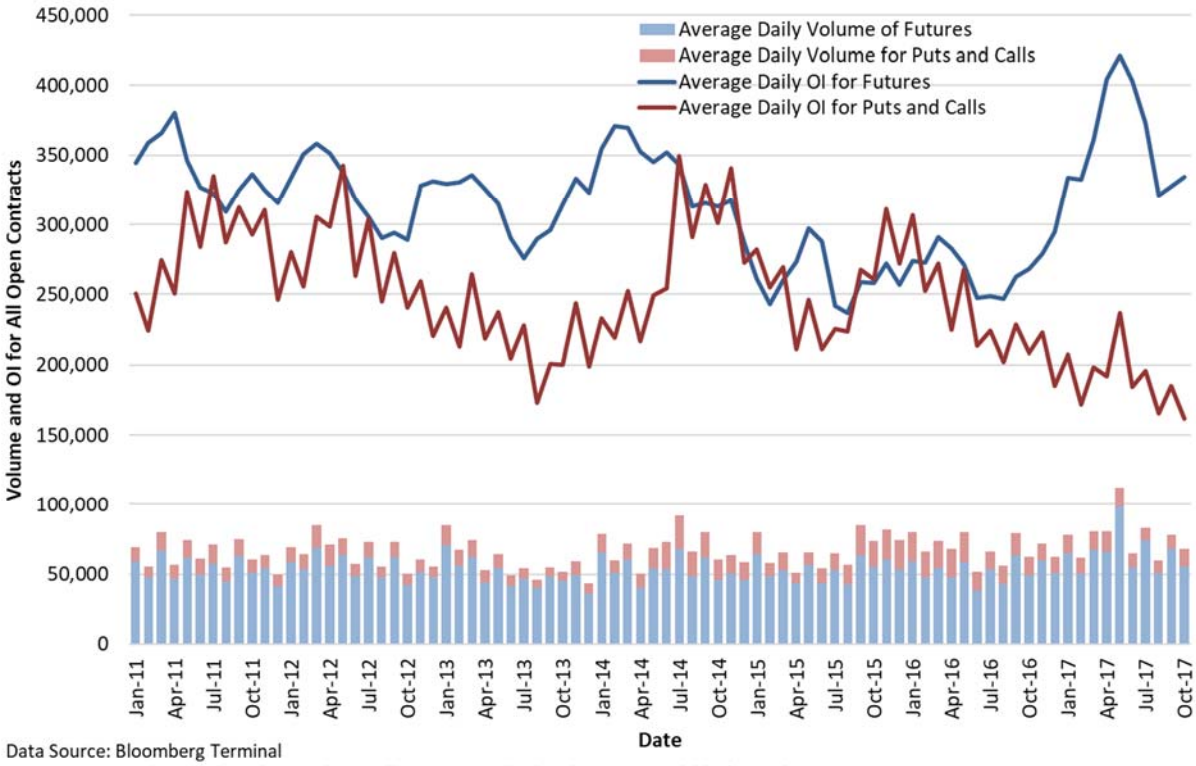
Figure 1. Aggregate Futures and Options Monthly Volume for the CME Live Cattle Futures Contract



Data Source: Bloomberg Terminal
Note: Aggregate volume includes trades on all contracts and related options available for trade at a given time.

Daily trading activity has been relatively consistent over the past few years. Figure 2 shows the average daily volume and open interest for live cattle futures and options. These numbers are the simple average of all end-of-day volume and open interest for all available contracts each month. Average daily volume in futures and options tends to be around 50,000 contracts, approaching 100,000 in more active months. Average daily open interest in futures has been mostly between 250,000 and 350,000 contracts. That level of open interest represents between 7.5 million and 10.5 million head of live cattle, assuming the contract represents 30 head.

Figure 2. Average Daily Volume and Open Interest Futures and Options for the CME Live Cattle Futures Contract



Data Source: Bloomberg Terminal

Note: Average volume is based on trades on all contracts and related options available for trade at a given time.

Commitment of Traders in the CME Live Cattle Futures Contract

The CFTC publishes a Commitment of Traders Report (COT) weekly for several futures contracts, including the CME Live Cattle Contract.[9] COT reports contract open interest and details trading entity long and short positions in the contract. The disaggregated version of COT[10] defines the following categories of traders:

1. Producer/Merchant/Processor/User
2. Swap Dealers
3. Managed Money
4. Other Reportables

Any open interest above and beyond that held by these four categories of traders is attributed to Non-Reportables and assumed to be held by traders whose positions are not large enough to require them to report. The categories are defined by how the CFTC perceives the activity of a certain trader. We offer brief descriptions of each below. Details are available from the CFTC website.[11]

Producer/Merchant/Processor/User: Traders whose business depends on the physical commodity underlying the futures contract. As such, positions held by this group are generally assumed to be hedges and the group is referred to as hedgers or commercial hedgers.

Swap Dealers: Swap dealers are also technically using the futures market to hedge risk. However, their business does not depend on the underlying commodity. Rather, they are hedging the risk of swap transactions made with clients.

Managed Money (or Money Manager): Traders who engage in organized futures trading on behalf of clients. Hedge funds fall into this category.

Other Reportables: This category consists of all traders with positions large enough to require reporting who do not fall into the preceding categories. In general, traders in the Other Reportables category are considered to be large speculative traders.

Non-Reportables: Traders whose holdings do meet the threshold for mandatory reporting. In general, traders in the Non-Reportables category are considered to be small speculative traders.

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[9] Details regarding the Commitment of Traders report, its scheduled release, and links to archived COT data are available at: http://www.cftc.gov/MarketReports/CommitmentsofTraders/index.htm.

[10] CFTC. "Disaggregated Commitment of Traders Report: Explanatory Notes." Available at: http://www.cftc.gov/idc/groups/public/@commitmentsoftraders/documents/file/disaggregatedcotexplanatorynot.pdf.

[11] CFTC. "Disaggregated Commitment of Traders Report: Explanatory Notes." Available at: http://www.cftc.gov/idc/groups/public/@commitmentsoftraders/documents/file/disaggregatedcotexplanatorynot.pdf.

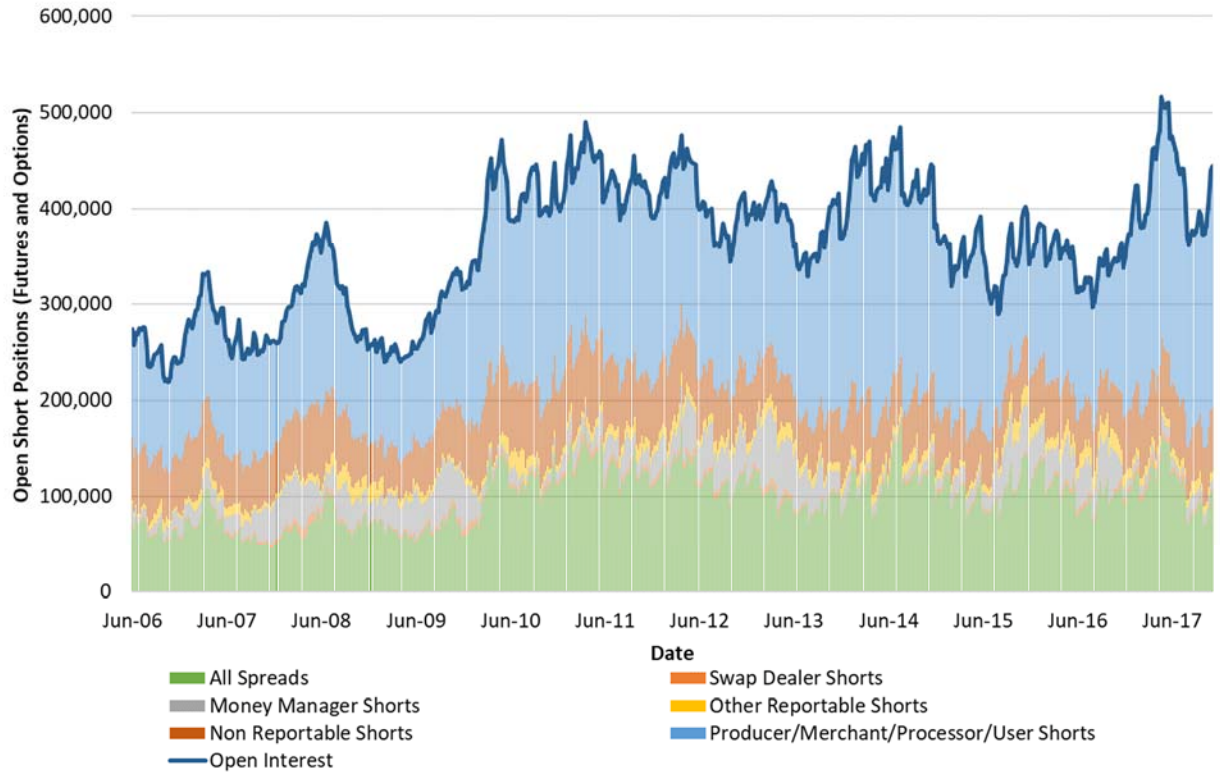
Spreading activity is reported for Swap Dealers, Managed Money, and Other Reportables. A spread is defined as a holding offsetting long and short positions in different contract months (i.e., calendar spreads). For Producer/Merchant/Processor/Users and Non-Reportables, no spread activity is reported.

As CFTC notes, there are limitations to these categories, in that, assumptions must be made by CFTC staff to categorize traders. However, COT data contain a wealth of information and are widely used by market analysts, traders, and hedgers to understand the market.

Short Positions in the CME Live Cattle Futures Contract

Figure 3 shows the breakdown of short positions in the CME Live Cattle Futures Contract. The Producer/Merchant/Processor/Users holding short positions are most likely short hedgers. Short hedgers, who hold more short positions than other groups of traders, generally hold about 40% of open interest. Small speculators (Non-Reportables) hold a substantial portion of short positions but there are historically very few short positions held by large speculators (Other Reportables). Even fewer Swap Dealers are short the contract. Managed Money short positions vary over time but typically account for 10% or less of open interest. In summary, short hedgers are the prominent traders holding short positions in the live cattle contract. This is important because hedgers justify the economic existence of the contract.

Figure 3. Short Positions in the CME Live Cattle Futures Contract

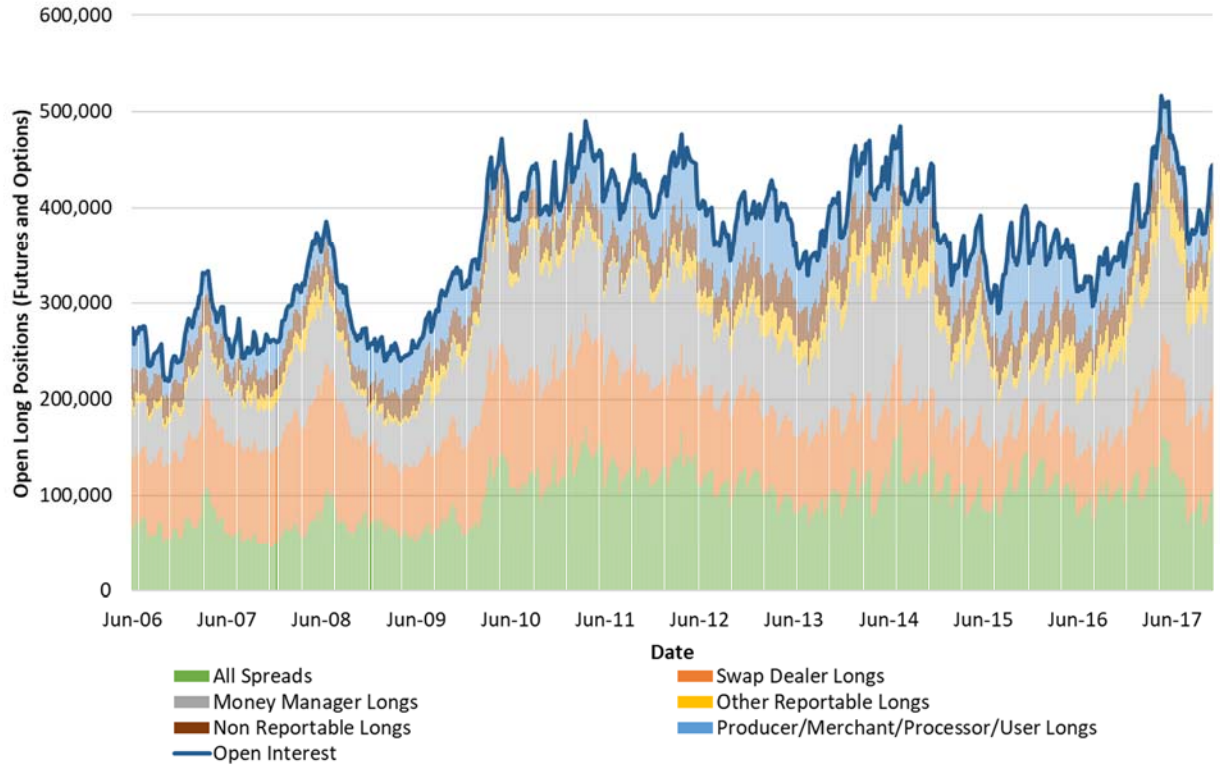


Data Sources: CFTC Commitment of Traders Report via Quandl Futures Data
Note: The chart is based on the Futures and Options version of COT.

Long Positions in the CME Live Cattle Futures Contract

The breakdown of long open interest in the CME Live Cattle Futures Contract is illustrated in Figure 4. The composition of those holding long positions is quite different from the short side. Long hedgers (Producer/Merchant/Processor/Users) typically hold less than 15% of open interest and often less than 10%. Large and small long speculative traders (Other Reportable and Non-Reportables) consistently hold 10% to 15% of open interest. Managed Money long positions have varied between 15% and 35% of open interest between 2006 and 2017. Over the last two years Managed long positions, as a percentage of open interest, have trended upward. The latest peak in percentage of long open interest held by Managed Money coincided with the record open interest in the contract in May and June of 2017. Swap Dealers, who are hedging live cattle swaps with clients, currently hold around 25% of long open interest. The level of involvement by Swap Dealers has been consistent, with long holdings, as a percent of open interest, trending slightly downward over the past few years. The composition of longs in the live cattle contract is almost opposite that of the shorts. Long hedgers have a much less prominent position than short hedgers. Large and small speculative traders hold a smaller percentage of long open interest than shorts. On the long side, Large speculators hold more positions than on the short side. Finally, Managed Money and Swap Dealers hold a substantial portion of long positions but hardly any short positions.

Figure 4. Long Positions in the CME Live Cattle Futures Contract



Data Sources: CFTC Commitment of Traders Report via Quandl Futures Data
Note: The chart is based on the Futures and Options version of COT.

Implications for Live Cattle Contract Trading and De livery

Short hedgers are the prominent players in the short side of the contract. That means a large portion of short open interest is held by commercial entities working with live cattle or products derived from live cattle. This is not true on the long side. The live cattle market has evolved to the point where there are few natural long hedgers. The small volume of long hedgers in the market illustrates this point.

Many of the short positions in the live cattle contract are cattle feeders who are in the business of marketing live cattle and, therefore, delivery is a natural response to a weak basis. However, the same is not true for those long in the contract. Long hedgers are the obvious group to be willing to accept delivery but, they historically hold between 10% and 20% of long open interest.

In certain cases, some speculative traders are willing to accept delivery. Informed speculators who are willing to stand in for delivery understand the industry well, may have relationships with packing plants and can navigate the delivery process when economic incentives exist. The exchange of cattle between short hedgers and speculators, however, does not match normal cash cattle market trade. The speculative trader functions as a third party. He buys live cattle that are ready for slaughter from the issuing short. He must then eventually sell the cattle to a packing plant either directly or after placing the cattle back on feed. If the long accepting delivery cannot find a packing plant willing to offer an acceptable bid, he might place the cattle back on feed until he can find an acceptable outlet. This results in more handling, more animal stress, and a difficult transition to a new feeding ration. These transactions occur but are not consistent with industry cash trade and come with economic, logistical, and animal welfare challenges.

Finally, there are speculative traders who have no desire to own physical cattle and avoid delivery by either getting out of the contract during expiration month or freshening positions in effort to not be the oldest long. Inexperienced speculators who understand neither the industry nor the delivery mechanism may be surprised to get assigned a delivery and lack the expertise or network to successfully accept it. In this case, the retender option is available.

The purpose of this explanation is to highlight the fact that make-up of long and short traders in the live cattle contract is not necessarily consistent with smooth execution of physical delivery. In particular, the make-up of traders ensures few deliveries will be similar to common industry cash market commerce. The differences in holders of long and short positions should be included in discussions regarding the live cattle contract and delivery on the contract.

DESCRIPTION OF DELIVERY AND CURRENT LIVE CATTLE DELIVERY PROCESS

This section of the report describes the current live cattle contract specifications and delivery process. We identify areas where problems can be encountered. The information provided here affects both current and prospective delivery deliberations as the current situation needs to be considered as any type of contract delivery changes are evaluated.

Purpose of Delivery

For a futures contract to function as an effective hedging instrument, futures price must converge with the cash price of the underlying commodity in a predictable way as the contract nears expiration. Settlement procedures, or the method by which contracts are closed out upon expiration, are designed with the intention of ensuring convergence. In the case of the CME Live Cattle Contract, physical delivery is the way convergence is forced. During expiration month, the holder of a short position in the contract may decide to deliver live cattle matching contract specifications, thus fulfilling the contract obligation.

To facilitate understanding the function of delivery, consider two simplified scenarios that explain why physical delivery might occur and how delivery impacts cash and futures markets.

Scenario 1: Cash Price is Less than Futures Price

Consider a cattle feeder who has hedged the cash sale of cattle by taking a short position in the live cattle futures contract. As contract expiration approaches, if the cash price is less than the futures price (basis is weak) then delivery on the futures position might be a reasonable choice. However, delivery comes with additional costs and risk. One added cost is transportation. Most live sales are Free on Board (FOB) at the feedyard, which means buyer pays transportation. In a delivery, the short must pay freight to the chosen stockyard (or equivalent if the long should opt for plant delivery). This cost will vary depending on how far away the stockyard is from the feedyard. There is also a CME delivery fee of $25 per contract and a per-head stockyard fee. The risks are more difficult to quantify.

First the feeder must assess how likely it is that a long will opt for plant delivery. In a plant delivery, adjustments to par are made based on actual carcass performance. Many feeders we spoke with had the strategy of preparing two sets of cattle when issuing a tender—one set for live stockyard delivery and one for plant delivery—to be prepared for either option. In either case, a feeder must have an estimate of how the cattle will grade, whether it is visual grading (live delivery) or carcass grading (plant delivery). In issuing delivery there is a risk of incorrectly estimating cattle grades and, thus, incorrectly estimating the effective price a delivery will result in. There are logistical risks associated with live deliveries. Live delivered cattle must be at the delivery point by 9:00 a.m. There are no exceptions. For example, vehicle problems, traffic, or being held up at a railroad crossing could cause cattle to arrive late at the delivery point. The feeder must consider the probability of these events and plan accordingly to manage for the risk.

One other item that differs in a delivery, compared to live cash sales, is shrink of the animals. Live cash sales generally involved an agreed upon pencil shrink that varies according to region. Cattle are weighed at the feedyard, the pencil shrink is subtracted and the transaction is settled based on the shrunk weight. In a delivery, cattle are weighed at the delivery point. The feeder is subject to actual shrink between the feedyard and delivery point, not a pencil shrink. The feeder must have an estimate of how much delivered cattle will actually shrink. In many cases, the actual shrink may be less than the cash market pencil shrink, benefitting the feeder. However, there is also uncertainty around this estimate of shrink, especially in a live delivery. There is no way to know how long delivered cattle will stand in pens waiting to be graded. This depends on how many deliveries are being processed that day, how many other deliveries arrived earlier, and weather conditions on delivery day.

Taking all these variables into consideration, if the cattle feeder believes basis is weaker than the additional costs associated with delivery and justifies taking the added risk, he can issue delivery, as delivery would be expected to be more profitable than a cash sale. The delivery is assigned to the oldest long in the market. The long holds the obligation to accept delivery at the prevailing futures price, which is higher than cash. For the long this may not be a profitable venture. Issuing delivery causes activity in cash and futures markets. Cattle are diverted out of the cash market, which decreases supply and puts upward pressure on cash prices, though the long still must do something with the cattle so the supply reduction is likely only for a short time until the delivered cattle are sold to a packer. To avoid delivery, outstanding longs sell futures to liquidate positions and the selling pressure depresses futures prices. The net impact is that the difference between cash and futures prices narrows or, in other words, basis strengthens. Once basis strengthens to the point the costs and risks of delivery are no longer covered, delivery issues cease. In this way, delivery encourages convergence of cash and futures prices.

A sufficiently weak basis can also bring investors seeking arbitrage opportunities into the market. An observer of the live cattle market might notice basis is weak enough to make delivery profitable. At that point, he could buy cattle in the cash market, simultaneously establish a short futures position, then deliver on that short position to take advantage of the wide price differential between futures and cash. Buying activity in the cash market would increase cash price and selling activity in futures would decrease futures price. Again, the net impact is that cash and futures prices converge.

Scenario 2: Cash Price is Greater than Futures Price

If cash price is greater than futures price, there is no incentive for delivery. Short hedgers will not deliver and no one will establish a short position for the purpose of issuing delivery. In this case, there could be incentive for long position holders to accept delivery. The decision would be a mirror image of the one described from the short perspective. If basis is strong enough to cover the costs and risk associated with *taking* delivery then the long would benefit from taking delivery and immediately selling in the cash market. However, as is the case with all futures contracts, only the short can initiate delivery. The only way a long can effectively guarantee delivery is to remain in a long position until contract expiration, at which point, existing short

position holders are forced to deliver. Therefore, if the long is convinced delivery is profitable and he is willing to do so, his strategy will be to maintain a long position. Short hedgers have an incentive to avoid delivery and want to offset positions before expiration. Further, if they sell cattle in the cash market during delivery month, they will lift their hedges at the times of those sales. This means shorts have an incentive to buy futures to offset short positions. This buying pressure will increase futures price. If longs maintain their positions and are not anxious to sell, prices will have to increase to the point that they are willing to sell. Specifically, as futures price nears cash prices and the difference between the two no longer makes accepting delivery profitable, longs will be more willing to offset positions as the contract nears expiration. Though the directions of movements are different, the net result is the same as the first scenario—futures and cash prices converge.

Even though the timing of actions make it a challenging proposition, one could imagine establishing a long position late in expiration month as a way to take advantage of arbitrage opportunities. That is, establish a long position with the hope of being assigned delivery then accepting delivery and selling those cattle in the cash market. In this case, as new longs enter the market, buying pressure will increase futures prices. Again, the end result is convergence of futures and cash prices.

Threat of Delivery

There are costs and risks associated with delivery for both shorts and longs. Making or accepting delivery comes at a cost and, therefore, is not generally a desirable strategy but, rather, a strategy executed when the difference in cash and futures reveal arbitrage opportunities. This is by design as the purpose of the futures market is primarily to allow parties to transfer risk. Futures markets are not meant to be a primary supply source for buyers of the commodity or a primary terminal market for producers of the physical commodity. As such, delivery is relatively uncommon. However, *credible threat of delivery* encourages convergence. Threat of delivery encourages longs to sell futures to close positions thereby bringing futures down closer to cash price levels discouraging delivery by short hedgers.

Current Delivery Specifications

Though conceptually straightforward, the process of physical delivery is a complicated procedure which involves regulation, expertise, and participation by numerous parties. A delivery on a live cattle futures contract involves a seller and a buyer, just as a cash sale of live cattle. However, in the case of delivery the buyer (long) and seller (short) could have no relationship and, in fact, most likely neither knows the identity of the other. Further, there is no reason for either to expect them to conduct business transactions with each other in the future. This lack of relationship before the transaction means that the two do not negotiate terms of the exchange. The lack of longer term connection means that neither negative incentives of market discipline nor the advantages that come from strong buyer-seller relationships are present. Given this situation, physical delivery on futures contracts is governed by detailed guidelines that clearly identify the deliverable commodity, the process of delivery, and penalties for noncompliance.

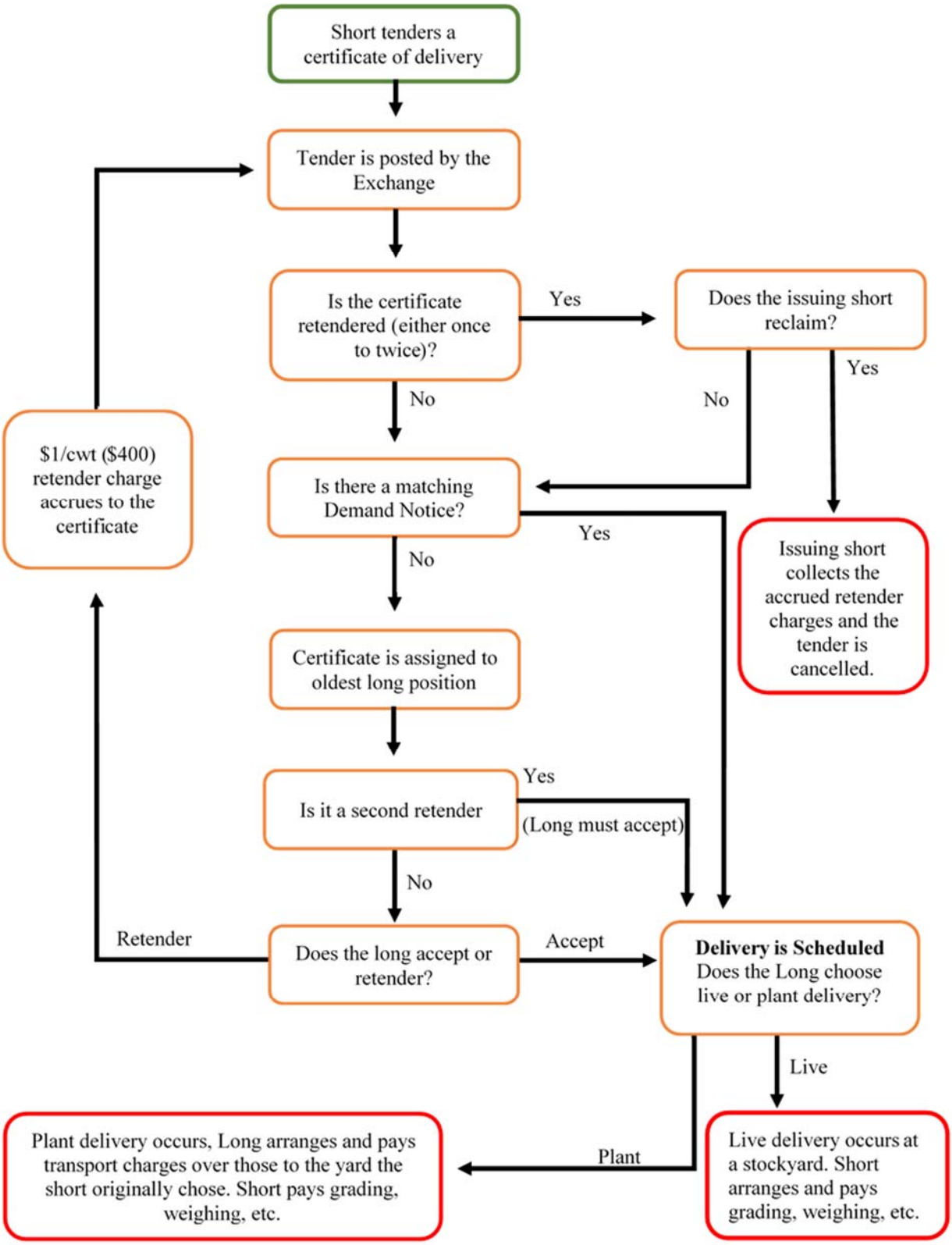
Process of Physical Delivery

The first opportunity to initiate delivery is Monday following the first Friday in the contract expiration month. This is known as *First Notice Day*. Only the holder of a short position can initiate delivery. A short wishing to deliver on a contract (referred to as the issuer) tenders a certificate of delivery. Tendering a certificate of delivery is an official notice that the issuer plans to deliver live cattle to fulfill obligations of a specified number of futures contracts on the eighth business day following issue of the tender. The short chooses a CME-approved live delivery location and specifies whether heifers or steers will be delivered. The issuer is responsible to confirm the delivery location can accept the cattle on the specified day. The issuer must also arrange all sorting, preparation, and transportation details to ensure the appropriate number of live cattle are at the delivery location on delivery day and in a pen by 9:00 a.m. This is an important requirement to note as the issuer will be penalized as defaulting on the delivery for failure to: 1) deliver enough cattle, 2) provide deliverable cattle, or 3) deliver the cattle on time.

Issuing a tender can result in several possible scenarios and delivery is not guaranteed to take place. Figure 5 shows the potential scenarios in the form of a flow chart. The descriptions are concise and meant to show the sequence of events that follow issuing a tender. After a certificate of delivery is tendered, it is matched to a party holding a long position in the contract. On a day that a tender may be issued, longs may issue a demand notice to request that they be given priority when tenders are assigned. A demand specifies a delivery location and whether heifers or steers are preferred. If location and gender of an issued tender and those of a long's demand match, the delivery is assigned to that long. Otherwise, the tender is assigned to the holder of the oldest long position. Depending on how many contracts are issued, tenders may be assigned across one or more longs. However, the criteria are the same—matching demands are assigned first and then oldest open long positions are assigned.

At this point, the long must decide if he wants to accept delivery. If, for whatever reason, he does not, he may issue a retender at the cost of $1/cwt ($400 per contract). A retender provides the long an opportunity to pay a fee rather than receive cattle. The fee paid accrues to the certificate and it is retendered as a delivery notice with the note that it comes with a $1/cwt credit. The first retender can be reclaimed by the issuer. If reclaimed, the retender credit goes to the short and the delivery notice is no longer valid. If not reclaimed, the assignment to a long follows the same procedure as outlined above. Once again, the assigned long has the option to pay the same fee and retender. If retendered a second time, the certificate now has a $2/cwt ($800 per contract) credit attached to it. The short has a final opportunity to reclaim and collect the credit. If not, then delivery must occur, as a certificate of delivery can only be retendered twice. The process of assigning the certificate to a long is repeated.

Figure 5. Process of Physical Delivery on the CME Live Cattle Futures Contract



The assigned long collects any retender credits attached to a certificate when delivery is accepted. The long may opt to take live delivery at the specified location or opt for plant carcass delivery. If the latter option is chosen, the plant must be within 225 miles of the specified live delivery location and be CME-approved. The long has responsibility to arrange delivery at the chosen slaughter plant on a day between four and eight business days following the tender or retender. The long also must pay for any transportation beyond what would have been required to reach the specified live delivery location.

An exception to the above process is when a certificate of delivery is tendered on Last Trading Day. In this case, there is no option to retender or reclaim and delivery will occur. The certificates are assigned to the oldest outstanding long(s) and the long chooses to accept as live or plant delivery.

When a delivery is scheduled, the long purchases a specified number of contracts from the short at the live cattle futures contract settlement price on the day of tender. The short provides cattle that meet contract par specifications. The futures contract defines par specifications and how deviations from par are dealt with.

Deliverable Cattle

The contract specifications are defined in the Live Cattle chapter of the CME Rulebook.[12] The contract allows live or carcass delivery. It is currently for Yield Grade 3 live steers or heifers grading 60% Choice and 40% Select or Yield Grade 3 live steer or heifer carcasses grading 60% and 40% Select. Beginning with the October 2018 contract, the grade will change to 65% Choice and 35% Select. The contract is for live steers *or* live heifers. The two cannot be comingled to fulfill delivery on a single contract.

Only live steers or live heifers born and raised exclusively in the United States are deliverable. The issuing short must sign an exchange affidavit attesting that this is true. If tendering heifers for delivery, the issuing short must provide two additional affidavits: one attesting that the heifers have been given an approved estrus-suppressing progestin additive and another attesting that the heifers have been administered an approved open heifer protocol.

A par deliverable trading unit for live delivery on the contract is 40,000 pounds of live steers *or* heifers grading 60% Choice and 40% Select (after October 2018 this will change to 65% Choice and 35% Select). In the case of steers, par weight is between 1,050 and 1,500 pounds with animals between 1,500 and 1,550 pounds deliverable at a discount. If heifers are delivered, the allowable weight range is 1,050 to 1,350 pounds. The par unit should have an estimated hot yield of 63%. All animals must be healthy, merchantable, and able to withstand being shipped by truck. Animals that appear to be predominantly dairy breeds or having a prominent hump in the forefront of the body are not deliverable. Likewise, heiferettes, cows, and bred heifers are not deliverable.

[12] Chicago Mercantile Exchange. "CME Rulebook Chapter 101 Live Cattle Futures." Accessed November 14, 2017. http://www.cmegroup.com/rulebook/CME/II/100/101/101.pdf.

In carcass delivery, a par unit is also 40,000 pounds of live weight of merchantable, Yield Grade 3 steers or heifers grading 60% Choice and 40% Select. There are differences in the carcass par unit compared to the live par unit. Though a deliverable unit is defined in live weight, all final grading is based on actual carcass performance. This includes the Choice/Select distribution and 63% hot yield. The identification of a prominent hump, which makes an animal undeliverable, is assessed on a carcass basis. Finally, weight limits on individual animals are based on carcass weights. Par weight for carcasses is between 500 and 1,050 pounds. Carcasses are not excluded based on par weights but only discounted.

Deviations from Par

The CME rules specify exceptions made when a delivery does not match par definitions. It is unlikely any group of cattle delivered would exactly match par specifications, so price adjustments are expected in every delivery. Determining whether animals are par is the responsibility of USDA graders. In live deliveries, USDA graders are AMS market reporters. In plant deliveries, USDA federal meat inspectors are responsible for the task. Grader opinions are final and binding on all parties. Total live weight delivered can vary 5% above or below the 40,000-pound contract unit with no penalty. If the issuing short brings more than 42,000 live pounds, he is responsible for the excess animals and they are not part of the CME delivery. If an issuing short brings less than 38,000 pounds of deliverable animals, he is guilty of failing the delivery and subject to a fine. In addition to total live pounds, individual steers (heifers) are undeliverable in live stockyard delivery if they weigh more than 1,550 (1,350) pounds or less than 1,050 pounds. Graders identify and exclude heavy or light animals. Steers delivered live to stockyards are discounted if they weigh between 1,500 and 1,550 pounds.

Quality and Yield Grade Deviations in Live Deliveries

Every individual animal receives a visually determined quality grade. The proportion grading Prime, Choice, Select, and Standard are used to adjust settlement price. The USDA Choice/Select price spread from the afternoon daily boxed beef report from the day of tender is used to distinguish between Choice and Select prices. Adjustments are made for animals grading Prime, Standard, or Sub-standard using the 5-Area Weekly Weighted Average Direct Slaughter Cattle –Premiums and Discounts Report. The report which was most recently issued relative to the day of tender is used. Substandard cattle are penalized by 25% of the settlement price. Cattle assigned Yield Grades of 1, 2 ,4, or 5 receive premiums or discounts from the same report. In the cases of Quality and Yield Grade, premiums and discounts from the USDA report are converted to live weight equivalent using an assumed dressing percentage of 63%. In all cases, adjustments are made on a per pound basis, multiplied by number of adjusted animals, and then multiplied by the average live weight for the group to arrive at total adjustment.

Weight Deviations in Live Deliveries

Animals outside the deliverable weight range are excluded. They become the responsibility of the issuer and are not part of the delivery. Steers weighing between 1,500 and 1,550 pounds receive a discount based on the live weight equivalent of the discount for 900-1,000 pound carcasses in 5-Area Weekly Weighted Average Direct Slaughter Cattle –Premiums and Discounts

Report. The hot yield of the animals is also estimated. If this differs from the par requirement of 63%, settlement price is adjusted accordingly. In all cases, adjustments are made on a per pound basis, multiplied by number of adjusted animals, and multiplied by the average live weight for the group to arrive at total adjustment.

Quality and Yield Grade Deviations in Carcass Deliveries
All Quality Grade and Yield Grade results in carcass deliveries are based on actual carcass results. Premiums and discounts for carcasses outside the par specifications are assigned using the 5-Area Weekly Weighted Average Direct Slaughter Cattle –Premiums and Discounts Report. In all cases, adjustments are made on a per pound basis, multiplied by number of adjusted animals, and then multiplied by the average live weight for the group to arrive at total adjustment.

Weight Deviations in Carcass Deliveries
The par unit for carcass deliveries is defined in terms of 40,000 pounds (plus or minus 5%) of live weight but has the distinction that resulting carcasses should be between 600 and 900 pounds. However, no carcasses are excluded based on weight. They receive discounts based on the reported weight categories in the 5-Area Weekly Weighted Average Direct Slaughter Cattle –Premiums and Discounts Report. The hot yield requirement of 63% is compared to actual hot yield and settlement is adjusted accordingly.

Other Deviations in Carcass Delivery
Carcasses from animals over 30 months old are not deliverable. This is determined after slaughter. The carcass is not included in the delivery and ownership transfers back to the issuer. Likewise, condemned carcasses deemed unfit for fresh marketing channels are removed from the delivery unit. In these cases, it is then up to the issuer to arrange sale of the carcass to the packing plant. The live weight equivalent of removed carcasses is subtracted from the delivered live weight. If subtracting the weight of a condemned carcass causes total live weight to fall below 38,000 pounds the issuer must reimburse the buyer for the animal. The greater of par live value or average carcass value for remaining carcasses is used.

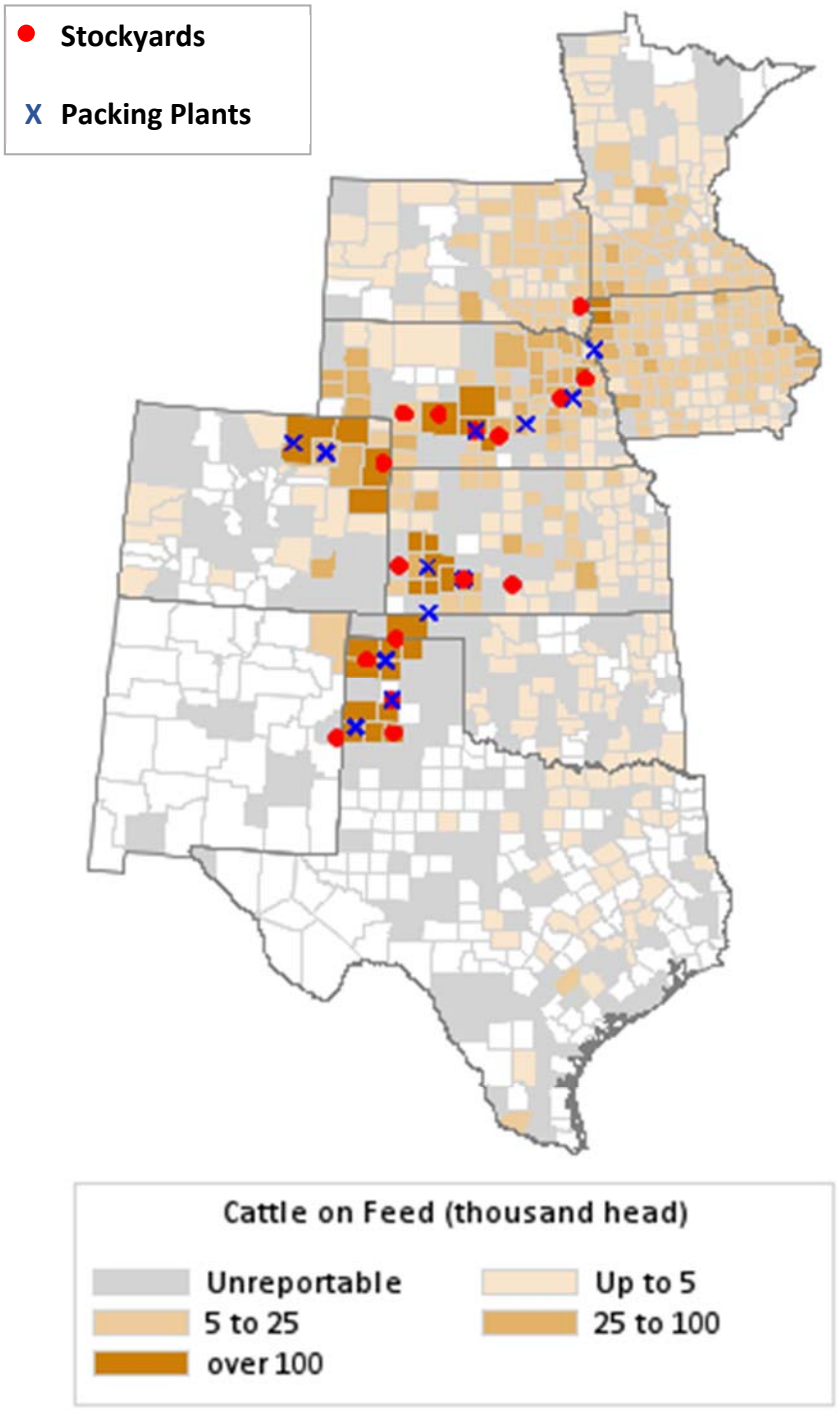
Approved Delivery Locations

The CME determines locations approved to accept live deliveries. These locations are mostly feeder cattle auction stockyards and serve as a neutral site for the issuer and accepting long to finalize the delivery transaction. The list of approved locations has varied over time due to various factors.

Figure 6 illustrates live delivery stockyards and approved carcass delivery packing plants as of December 2017 overlaid with county-level cattle on feed inventory obtained from the 2012 USDA Census of Agriculture. If the number of reporting feedyards in a county enables one to estimate or derive any respondent's individual data, the cattle on feed inventory is not reported in the Census to maintain confidentiality. Counties where this occurs are shaded gray. White-shaded counties had no reported cattle on feed inventory in Census data. Live delivery points and CME-approved packing plants are plotted based on the respective cities in which they are located. Some locations are in the same or nearby cities and, therefore, basically lie on top of each other and are difficult to distinguish on the map. For example, Dodge City, KS has a live delivery point and two CME-approved delivery packing plants.

Live delivery points correlate well with cattle on feed inventory. The more densely populated the cattle on feed inventory, the more delivery points. Two exceptions are northeastern Colorado and the IA/MN region. Northeastern Colorado and southwestern Nebraska have several counties with large numbers of cattle on feed inventories but those counties are relatively longer distances from live delivery points, relative to counties in TX, KS, and the central NE region. The Worthing, SD and West Point, NE delivery points are those most likely suited for deliveries from the IA/MN region. As illustrated on the map, many counties in Iowa and southern Minnesota have cattle on feed but less densely located than in concentrated cattle feeding areas in CO, KS, NE, and TX. We assess delivery point locations and capacity relative to fed cattle marketings in the strengths and weaknesses section later in this report.

Figure 6. Cattle on Feed Inventory and CME Live Cattle Contract Delivery Points



Data Sources: CME Group, USDA AMS 2012 Ag Census

Table 1 summarizes current (December 2017) delivery locations and their respective capacities to accept deliveries. The daily limits are agreed upon by the location and CME Group. Any location might accept fewer loads than their rated capacity on a given day due to staff limitations, unexpected events, etc. Locations also have days each week known as black-out days. These are days when the normal schedule of business makes accepting CME deliveries inconvenient or impossible.

Table 1. CME-Approved Live Delivery Locations with Daily Limits* and Black-Out Days

	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Location Total
Amarillo, TX		60	60	60	60	**240**
Clovis, NM	30	30		30	30	**120**
Columbus, NE	15	15				**30**
Dalhart, TX	15	15	15		15	**60**
Dodge City KS	40	40		40	40	**160**
Kearney, NE	15			15	15	**45**
Lexington, NE	20	20	20			**60**
North Platte NE	20		20	20	20	**80**
Ogallala, NE	25	25			25	**75**
Pratt, KS	10	10	10		10	**40**
Syracuse, KS	25	25	25	25		**100**
Texhoma, OK	30	30		30	30	**120**
Tulia, TX	30	30	30		30	**120**
West Point NE		20	20		20	**60**
Worthing, SD		60		60	60	**180**
Wray, CO	10		10	10	10	**40**
Daily Total	**285**	**380**	**210**	**290**	**365**	**1,530 Weekly Total**

*All limits are in terms of CME Group Live Cattle Futures Contracts

These 16 locations are the only points where a live delivery can take place. The issuer chooses one of these locations when tendering a certificate of delivery. If the accepting long opts for carcass delivery, the long chooses from a list of a CME-approved packing plants associated with the delivery point or any CME-approved plant within 225 miles of the delivery point referenced in the certificate of delivery.

Occurrence of Live Cattle Deliveries

Compared to volume of live cattle futures contracts traded or volume of physical live cattle marketed, the number of contracts that end in delivery is small. Table 2 shows total annual completed deliveries from 2011 to 2017. Data for 2017 does not include the December contract. The deliveries are presented in terms of live cattle futures contracts and, to give some context, as live head equivalent assuming one contract equals 30 head.

Table 2. CME Live Cattle Futures Contracts Settled by Physical Delivery

Year	Contracts			Estimated Head Equivalent**		
	Carcass	Live	Total	Carcass	Live	Total
2011	165	65	**230**	4,950	1,950	**6,900**
2012	316	406	**722**	9,480	12,180	**21,660**
2013	160	284	**444**	4,800	8,520	**13,320**
2014	34	46	**80**	1,020	1,380	**2,400**
2015	151	167	**318**	4,530	5,010	**9,540**
2016	6	62	**68**	180	1,860	**2,040**
2017*	2	49	**51**	60	1,470	**1,530**
Total	**834**	**1,079**	**1,913**	**25,020**	**32,370**	**57,390**

*Does not include the December 2017 contract

**These numbers are estimated assuming 30 head per contract. We did not have access to data regarding actual head of live cattle delivered.

Data Source: CME Group

Deliveries have become rarer in recent years. In addition to total deliveries, it is informative to observe where deliveries occur and if they are live or carcass deliveries. Since 2011, there have been 1,913 completed deliveries. Over one-third of those occurred in 2012. The distribution between carcass and live deliveries has been comparable with 44% of completed deliveries being carcass based and 56% live. Since 2012, relatively more deliveries have been settled on a live basis. Assuming a contract equals 30 head of live cattle, deliveries between 2011 and 2017 totaled approximately 57,390 head. The largest delivery year in the period, 2012, saw an estimated 21,660 head delivered. In 2012, federally inspected slaughter of steers and heifers totaled 25,428,000 head.[13] Deliveries represent less than 0.1% of steer and heifer slaughter. To illustrate how relatively few contracts end in delivery, consider the largest delivery month in the period, December 2012. The December 2012 contract had 382 contracts settled by physical delivery. The total volume traded for the December 2012 contract was 2,387,247.[14] Of all contracts traded, 0.02% were settled via delivery.

[13] USDA AMS Livestock Slaughter: 2012 Summary, April 2013. Available at: http://usda.mannlib.cornell.edu/usda/nass/LiveSlauSu//2010s/2013/LiveSlauSu-04-22-2013.pdf

[14] Authors' calculations using Quandl futures contract data, accessible at: https://www.quandl.com/data/CME/LCZ2012-Live-Cattle-Futures-December-2012-LCZ2012-CME

Table 3 breaks down deliveries by location and type. This table only includes locations that have received deliveries. For example, Dalhart, TX is a more recently added location which has not yet seen its first completed delivery. In general, deliveries have been concentrated in Southwest Kansas and Texas. KS and TX locations represented 41% of total deliveries over the nearly seven-year period. However, Worthing, SD has processed more deliveries over this time than any other single location, representing 40% of total deliveries.

Table 3. CME Live Cattle Futures Contracts Settled by Physical Delivery, 2011-2017*

Delivery Location	Carcass	Live	Total
Pratt, KS	5	11	**16**
Columbus, NE	43	6	**49**
Dodge City, KS	69	251	**320**
Syracuse, KS	9	171	**180**
Tulia, TX	119	44	**163**
Texhoma, OK	0	8	**8**
Wray, CO	10	47	**57**
Worthing, SD	405	369	**774**
North Platte, NE	10	0	**10**
Norfolk, NE	67	64	**131**
Clovis, NM	43	12	**55**
Amarillo, TX	44	63	**107**
Ogallala, NE	10	0	**10**
West Point, NE	0	33	**33**
Total	**834**	**1,079**	**1,913**

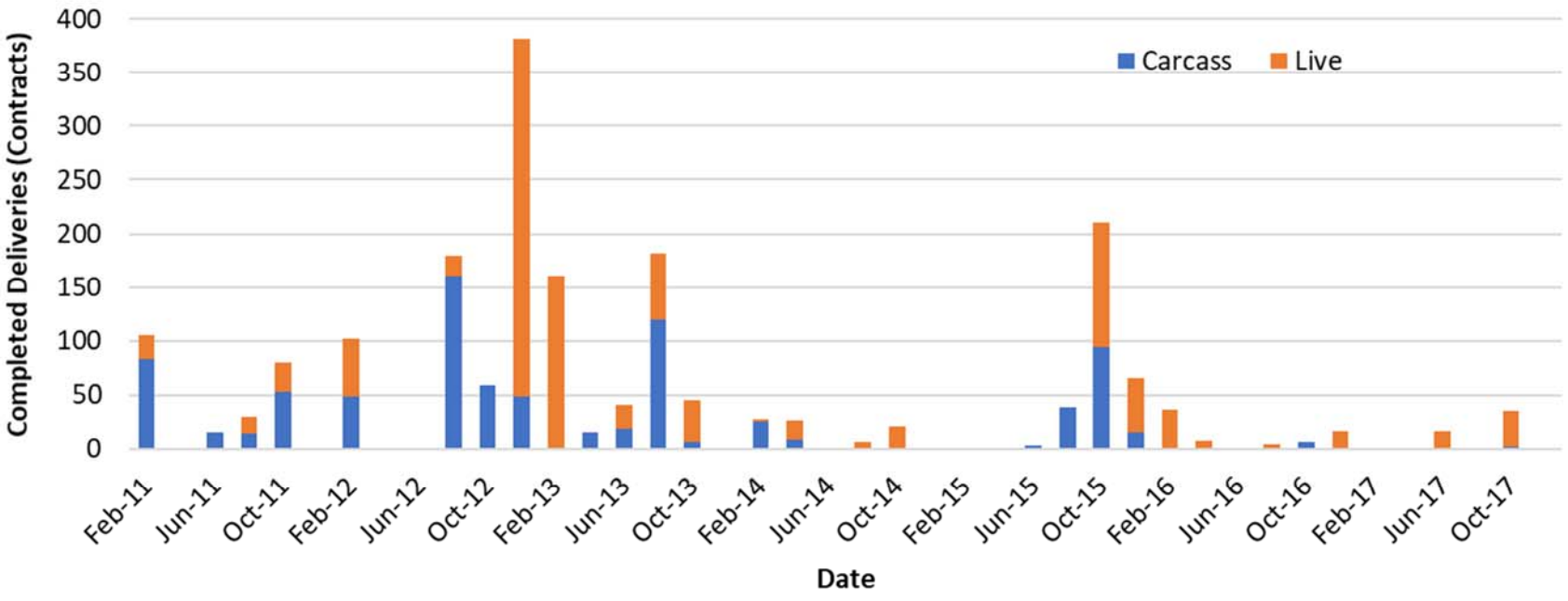
*Numbers do not include the December 2017 contract
Data Source: CME Group

Another component worth noting is seasonality of completed deliveries. Figure 7 shows completed deliveries on each contract between 2011 and 2017. Over this period, October and December are more prone to deliveries. Deliveries on all contracts in 2016 and 2017 have been rare, compared to the previous five years.

Delivery Tenders and Convergence

There is general agreement regarding the conceptual relationship between delivery, threat of delivery, and convergence. Delivery's potential to force convergence is its primary purpose. However, estimating the impact deliveries have on basis is challenging and, to our knowledge, has not been formally conducted. The fact that recent years have experienced few deliveries against live cattle futures makes this estimation even more difficult. Though rigorous quantification of how the quantity of deliveries causes convergence is beyond the scope of this study, we graphically examine convergence trends in two months with relatively large delivery volumes. This case study approach is a starting point for more robust analysis and provides

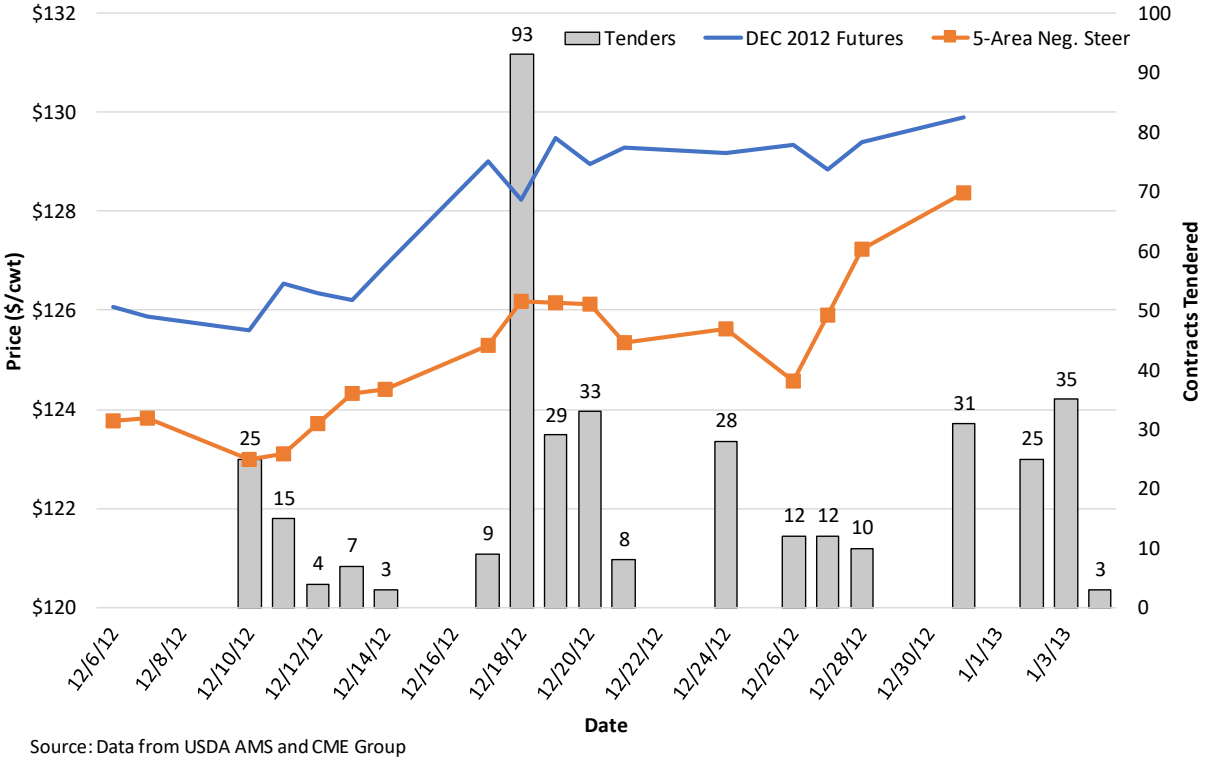
Figure 7. Monthly Completed Deliveries on the CME Live Cattle Futures Contract



anecdotal evidence of the impact of deliveries on basis. Figure 7 showed the largest volume of deliveries in the past four years occurred in October 2015 when 211 contracts were delivered. Prior to that, December 2012 had 382 contracts delivered. These two periods serve as good case studies of how cash and futures converge as deliveries occur.

The daily 5-area weighted-average negotiated steer and daily December 2012 CME Live Cattle Futures Contract prices for the delivery month are plotted in Figure 8. The chart includes tenders through the final tender day of the contract. Included in the chart are the numbers of deliveries tendered each day. We plot tenders as these should impact the market, even if they do not result in completed deliveries. The 5-region basis on December 10th was -$2.60/cwt and 25 contracts were tendered for delivery that day. A few contracts were tendered in subsequent days and basis widened out to -$3.71/cwt by December 17. On December 18th, 93 contracts were tendered and basis strengthened to -$2.05/cwt only to widen back out to -$4.70/cwt by December 26, prompting more tenders. By contract expiration on December 31, basis narrowed to -$1.53/cwt and 63 contracts were tendered after the December contract expired.

Figure 8. Daily December 2012 Live Cattle Futures & 5-Area Weighted-Average Negotiated Steer Prices and DEC Contract Futures Delivery Tenders

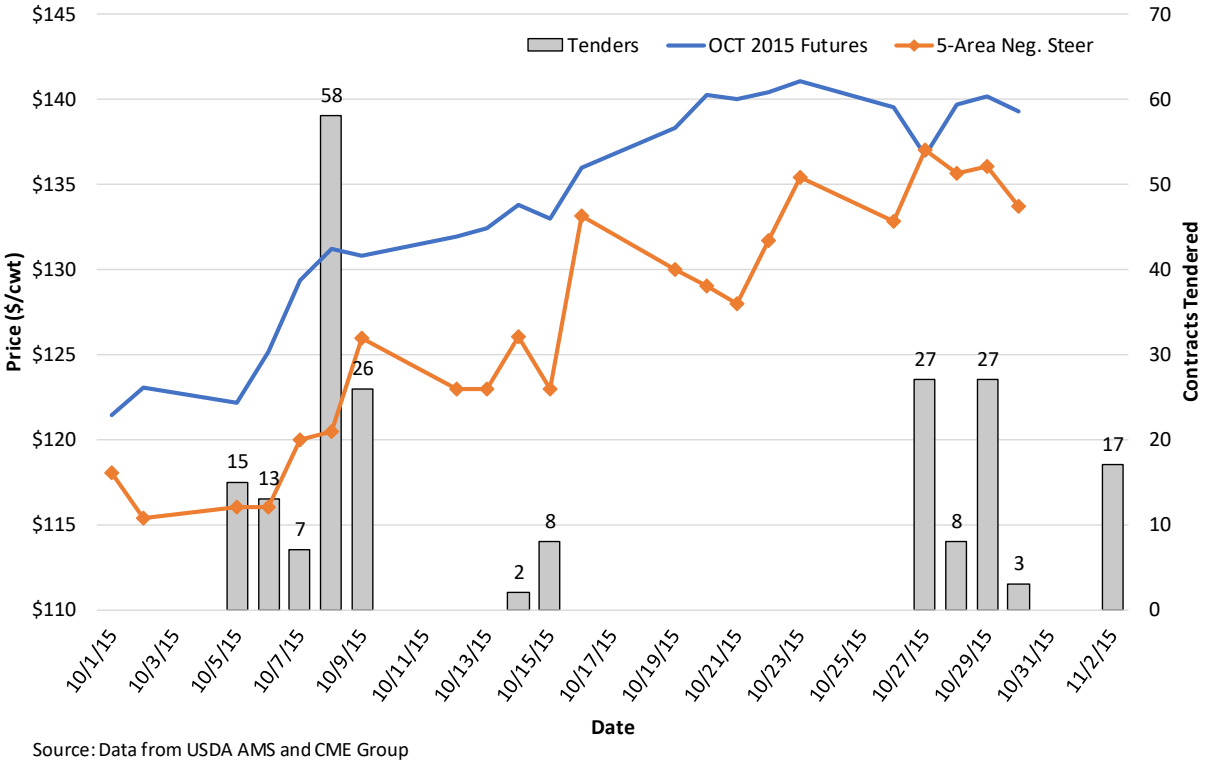


Source: Data from USDA AMS and CME Group

Convergence occurred in the December 2012 contract, but it was not until the last couple of trading days prior to expiration. How much delivery, or the threat of delivery, may have prevented the basis prior to expiration from being even wider than it was is a question we cannot answer without more research. However, realize that even 90 contracts being delivered represents a very small percentage of overall cattle supply and futures market volume which suggests the impact of the observed deliveries is overall relatively modest each day, but more formidable over the entire month.

Similar patterns were observed in the October 2015 contract (Figure 9). The 5-area negotiated fed steer basis was -$6.13/cwt on *First Notice Day* (October 5) and by October 8th widened out to -$10.70/cwt. During October 8 and 9, 84 contracts were tendered. On October 9 basis narrowed to -$4.83/cwt. Basis meandered around during this volatile market period and on October 27 cash prices converged to futures with a basis close to zero. However, basis widened back out the last three days of the contract to wider than -$4/cwt.

Figure 9. Daily October 2015 Live Cattle Futures & 5-Area Weighted-Average Negotiated Steer Prices and DEC Contract Futures Delivery Tenders



Source: Data from USDA AMS and CME Group

One important caveat to keep in mind is interpreting the daily cash market prices during the two time periods illustrated here. Some days have no volume of negotiated cash trade and other days have minimal trade (e.g., less than 100 head) but enough to still report a price for the 5-area market. This reinforces the challenges noted in several places in this report with

basis and market volatility considering thinly traded cash markets and price discovery occurring in regionally disparate markets contributes to basis variation.

Another issue is the direction of causality. We are interested in understanding how deliveries might impact basis. However, it is obvious basis impacts deliveries. That is, when basis is weak, deliveries are more likely. Disentangling these bi-directional impacts is worthy of future research but remains difficult given the small numbers of deliveries.

These case studies illustrate anecdotal evidence that cash and futures did converge for both contracts near expiration. However, the convergence was sporadic. In the 2015 example, basis widened back out the last few trading days after converging to zero. When tenders spike, like the 93 contracts tendered December 10, 2012 or the 58 contracts tendered on October 8, 2015, these case studies did not reveal obvious immediate cash and futures convergence. Indeed, it is likely cumulative tenders impact basis as opposed to tenders on any given day. The threat of additional tenders for delivery also encourages convergence but cannot be directly observed. We do not know how responsive futures are to deliveries at the margin, but we do know the direction of impact. Deliveries contribute to convergence, but they may need to be quite large to be observable.

Practical Implications from the delivery calendar for CME Live Cattle Futures Contract

Live delivery on the CME Live Cattle Futures Contract must occur at specified locations. Each location has an agreed upon maximum number of deliveries for each day of the week and has certain black-out days when no deliveries are accepted. Black-out days generally correspond to events, such as large feeder cattle auctions, which exhaust a delivery point's capacity and make deliveries on that day impractical or impossible. CME-approved delivery locations, daily limits, and black-out days are reported in Table 1.

To have a full understanding of capacity to issue and transact deliveries, one must combine the CME delivery calendar with the above delivery point limits. Short position holders may issue delivery beginning the first Monday following the first Friday of delivery month (*First Notice Day*). We use the October 2017 contract and calendar as an example. First Notice Day for the October 2017 contract was on the ninth of the month. Live deliveries must occur eight business days after issue. The short must arrange all delivery logistics in advance of issuing a tender for delivery. This includes verifying the delivery can be accepted at a delivery point on the appropriate day. Therefore, if a short decides to issue on a given day, he must do so based on the delivery capacity available on the upcoming eighth business day. If a long accepts and opts for plant delivery then the delivery can occur sooner but the issuer must plan for live delivery. Table 4 summarizes the potential to issue and complete deliveries for the month of October 2017. Daily delivery capacities vary. For example, October 9th was First Notice Day. Cattle issued that day (if assigned to a long for live delivery) would be delivered on October 19th. The capacity for deliveries across all locations on October 19th was 290 loads or about 8,700 head.

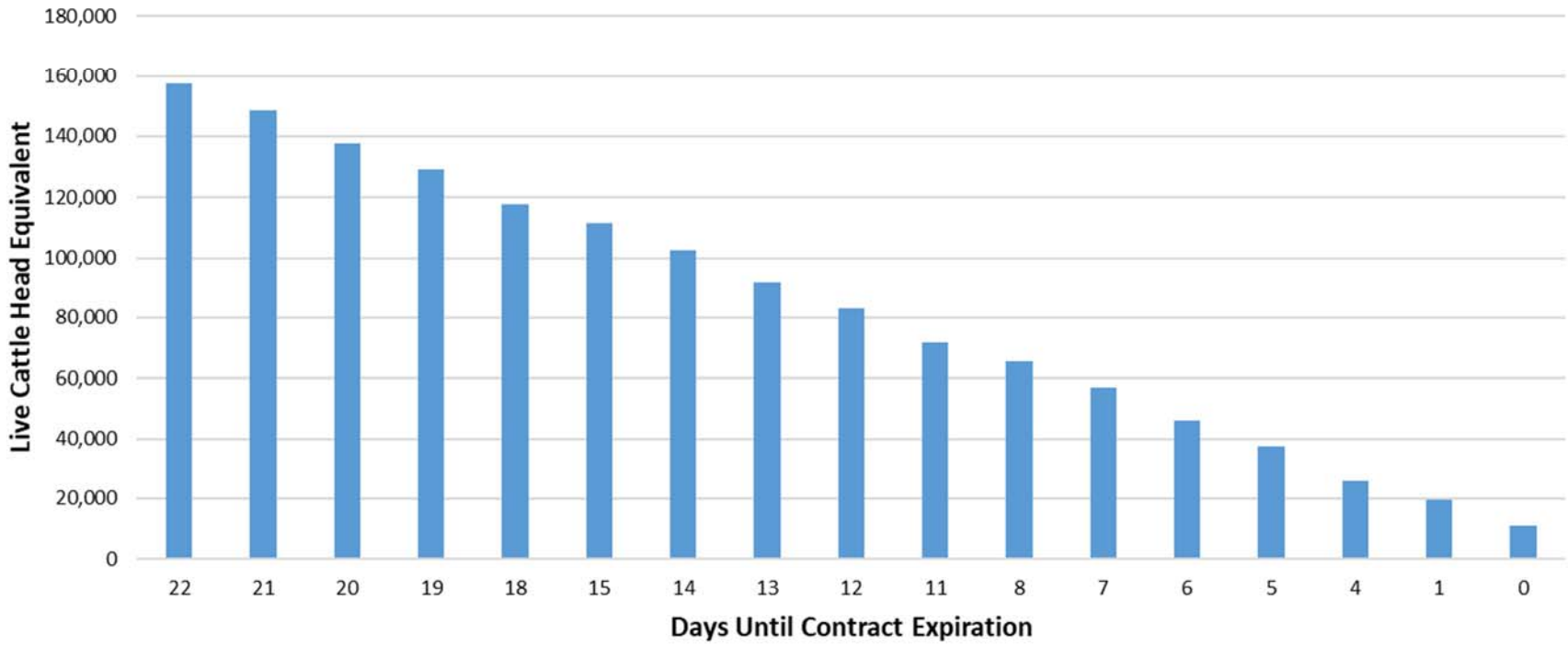
Table 4. Issue/Delivery Potential on the October 2017 CME Live Cattle Futures Contract

		In LC Futures Contracts		In Live Cattle Head Equivalent*	
Issue Date	Delivery Date	Daily Potential Issues/Deliveries	Total Possible Deliveries Remaining in the Month	Potential Issues/Deliveries	Total Possible Deliveries Remaining in the Month
10/9	10/19	290	5,245	8,700	157,350
10/10	10/20	365	4,955	10,950	148,650
10/11	10/23	285	4,590	8,550	137,700
10/12	10/24	380	4,305	11,400	129,150
10/13	10/25	210	3,925	6,300	117,750
10/16	10/26	290	3,715	8,700	111,450
10/17	10/27	365	3,425	10,950	102,750
10/18	10/30	285	3,060	8,550	91,800
10/19	10/31	380	2,775	11,400	83,250
10/20	11/1	210	2,395	6,300	71,850
10/23	11/2	290	2,185	8,700	65,550
10/24	11/3	365	1,895	10,950	56,850
10/25	11/6	285	1,530	8,550	45,900
10/26	11/7	380	1,245	11,400	37,350
10/27	11/8	210	865	6,300	25,950
10/30	11/9	290	655	8,700	19,650
10/31	11/10	365	365	10,950	10,950

*Assuming 1 CME LC Futures Contract = 30 head

Another measure of delivery capacity is the total number of deliveries that could be completed in the month. On any given day, there are a predetermined number of potential live deliveries that can take place in the remainder of the delivery month. For example, if the maximum number of deliveries were issued and completed about 157,350 head of cattle would have been delivered. This assumes that every possible issuing day the maximum number of deliveries for every location was issued. This is not a realistic scenario but meant to show absolute delivery capacity. As contract expiration nears, this number declines. Figure 10 shows the potential deliveries remaining on the October 2017 contract as days to expiration decrease. *First Notice Day* occurred 22 days until contract expiration and remaining delivery capacity was 157,350 head equivalent. With 11 days remaining until expiration capacity decreased to 71,850 head. The salient point is deliverable capacity and, thus, ability to affect basis and force convergence decreases as the contract nears expiration. This characteristic of deliverable capacity is not obvious from casual observation of the current delivery system but deserves attention. For example, with six days (four trading days) remaining until contract expiration a maximum of 45,900 head of live cattle could yet be delivered. The maximum number of cattle that can be delivered decreases as expiration month expires. As this occurs, the ability to influence basis through delivery decreases. If basis was weak in final trading days, even the unlikely event of maximum delivery issues would likely have a small marginal impact on forcing convergence.

Figure 10. Total Potential Issues for Live Deliveries for the Remainder of the October 2017 CME Live Cattle Futures Contract



Deliverable Supply of Live Cattle

Delivery capacity across approved locations and the timing of deliveries as determined by the CME delivery calendar result in relevant constraints on how many live cattle can potentially be delivered. Deliverable supply, the number of live cattle at any point in time which meet contract specifications and can reasonably be delivered, is also an important constraint.

CME, in a recent submission to CFTC regarding position limits, estimated deliverable supply.[15] CME chose to equate monthly deliverable supply with cattle marketed via direct negotiation on a live or dressed basis each month. Though this approach is a reasonable starting point, deliverable supply of live cattle, whether in head or percent of all live cattle, is a complex measure to estimate. For example, weight is not considered in CME's estimate. In February 2016, CME reports the deliverable supply of live steers to be the equivalent of 3,333 futures contracts. However, the average weight for negotiated cash live steers sold that month was 1,455 pounds. With this as the average, some percentage of these animals would have been over the 1,550-pound limit and excluded from delivery. Likewise, the average weight of negotiated live heifers in February 2017 was 1,329 pounds. Heifers weighing more than 1,350 pounds are not deliverable. A substantial percentage of these heifers would have been that weight exclusion. This is just an example from one month. As slaughter weights are seasonal (see figure 10), the percentage of these negotiated steers and heifers which would be excluded due to weight varies across months.

The CME approach also ignores breed and country of origin requirements. Likely, animals not meeting these delivery requirements represent a small percentage of negotiated marketings but do account for some portion. These factors suggest the CME approach overestimated deliverable supply. There are also assumptions that might have underestimated deliverable supply. For example, CME assumed all formula-priced cattle were undeliverable. Their report mentions that industry participants indicated formula agreements sometimes include a clause to allow feeders to pull cattle out of the agreement and deliver on their futures positions if market conditions warrant. As this option seems to be seldom used, CME does not include cattle sold via formula in their calculation. We found similar opinions in our research revealing it is possible to remove cattle from marketing agreements and deliver them against short hedged positions. Whether feeders choose to do this, formula-priced cattle would be deliverable to the extent that they fit contract specifications. Formula priced cattle represent about 60% of overall fed cattle marketings, so this aspect of deliverable supply could be substantial.

[15] CME Group rule filing with CFTC, "Amendments to the Expiring Month Position Limits of the Live Cattle Futures Contract." February 15, 2017. Available at: http://www.cmegroup.com/market-regulation/rule-filings/2017/02/17-054.pdf

The CME filing also estimates delivery capacity. Their report concludes delivery capacity is much more restrictive than deliverable supply. Therefore, they suggested using delivery capacity as the measure of how many cattle can actually be delivered. Though we differ in some details, we concur with this general sentiment. For example, we used October 2017 to form our illustration of the delivery calendar and show that a maximum of 157,350 head equivalent of live cattle could have been delivered. Keep in mind this would require every delivery location across the five regions to receive the maximum allowed deliveries on every day they accept deliveries. In October 2017, according to LMR data, 152,054 steers were sold via negotiation on a live basis. These steers had a weighted average weight of 1,441.5 pounds. In the same month, 82,215 heifers were marketed in the same way and had a weighted average weight of 1,304.3 pounds. Based on an industry paper[16] and proprietary feedyard data shared with us, the weight distribution of a pen of cattle typically has a coefficient of variation (standard deviation/mean) of 0.09 to 0.10. Assuming steer and heifer weights are normally distributed and have coefficient of variation of 0.09, then 21% of steers and 35% of heifers would have exceeded deliverable weight. Assuming graders identified this percentage as non-deliverable, that still leaves a total of about 175,000 head of cattle marketed via direct negotiation on a live basis in October 2017. This number exceeds delivery capacity and fails to take into account negotiated dressed sales and formula-priced cattle. This exercise leads us to conclude that, by any reasonable measure, the deliverable supply of live cattle in the five major reporting regions far exceeds delivery capacity. Delivery capacity is the relevant measure when considering how many cattle can be delivered in a month. We address this issue again in the strengths and weaknesses section presented later in this report.

Position Limits and Spot Month Step-down Limits

Another factor is the regulation of position limits in the spot month. The current CME-imposed position limits are reported in Table 5. The single-month limit is 6,300 contracts. This limit steps down to 450 contracts on the first business day following the first Friday of expiration month. For the last five trading days the limit is reduced to 300 contracts and to 200 contracts for the last two trading days. The first spot-month limit can be waived by applying for a hedge exemption. The applicant must demonstrate to CME that they are engaging in bona fide hedging and that they have the capital and sufficient supply of the underlying commodity to justify holding a hedge position larger than the limit. However, the last two limits (300 contract in last five trading days and 200 last two days) apply to everyone and there are no exceptions.

In our conversations with industry participants, these limits did not seem to generally be controversial. There was some sentiment that the limits are overly restrictive to speculators, as the difference between the non-spot and spot months is large. Along the same line of reasoning, some feared the limits result in a thinly traded contract during spot

[16] Dix, Bob. "Improving the Effectiveness of the Live Cattle Futures Contract." Working Paper. 2003. Available at: http://ageconsearch.umn.edu/record/11841?ln=en

month. At the same time open interest in deferred months increases as speculators roll their positions forward. Some opined that this activity unduly impacts calendar spreads.

Table 5. CME Live Cattle Futures Position Limits

Time Frame	Contracts	Head Equivalent*
Single Month Limit	6,300	189,000
First Notice Day	450	13,500
Last 5 trading days	300	9,000
Last 2 trading days	200	6,000

*Assuming 1 contract = 30 head

It is difficult to determine the net effect of the hedge exemption. It certainly is in the spirit of making sure that futures markets serve their intended risk management role by allowing a hedger to maintain price protection on more than 450 contracts worth of cattle into spot month. The hedge exemption also impacts delivery, indirectly. Since a short hedger can hold the expanded position past first notice day, this affords that hedger the opportunity to influence convergence more than other players, assuming the short has deliverable cattle. Long hedgers could likewise apply for and receive an exemption. Given that longs cannot initiate delivery, they would have less opportunity for direct effect but could hold those larger positions, which could impact convergence. For any hedger holding expanding position limits, there is a risk associated with liquidating positions. Contract volume becomes thin in spot month. As the deadline to step down to 300 contracts approaches, short hedgers may find it difficult in that liquidating large numbers of contracts results in undesirable fills and could noticeably move futures prices. The trade-off between holding out some control over convergence and being willing to trade in a thin spot month market is one that each hedger has to navigate. We hesitate to make any recommendations regarding spot month limits.

CATTLE MARKET STRUCTURAL CHANGE AND LIVE CATTLE CONTRACT IMPLICATIONS

This section of the report provides a succinct summary of changing structure of fed cattle marketing methods. The changes highlighted have important implications on potential pros and cons of modifying live cattle delivery. The importance of a reliable and transparent cash cattle market for futures market performance is multi-dimensional and the industry must continue to contemplate ways to manage this issue going forward, regardless of preferred live cattle delivery methods. These issues will profoundly influence any alternative live cattle delivery pathways.

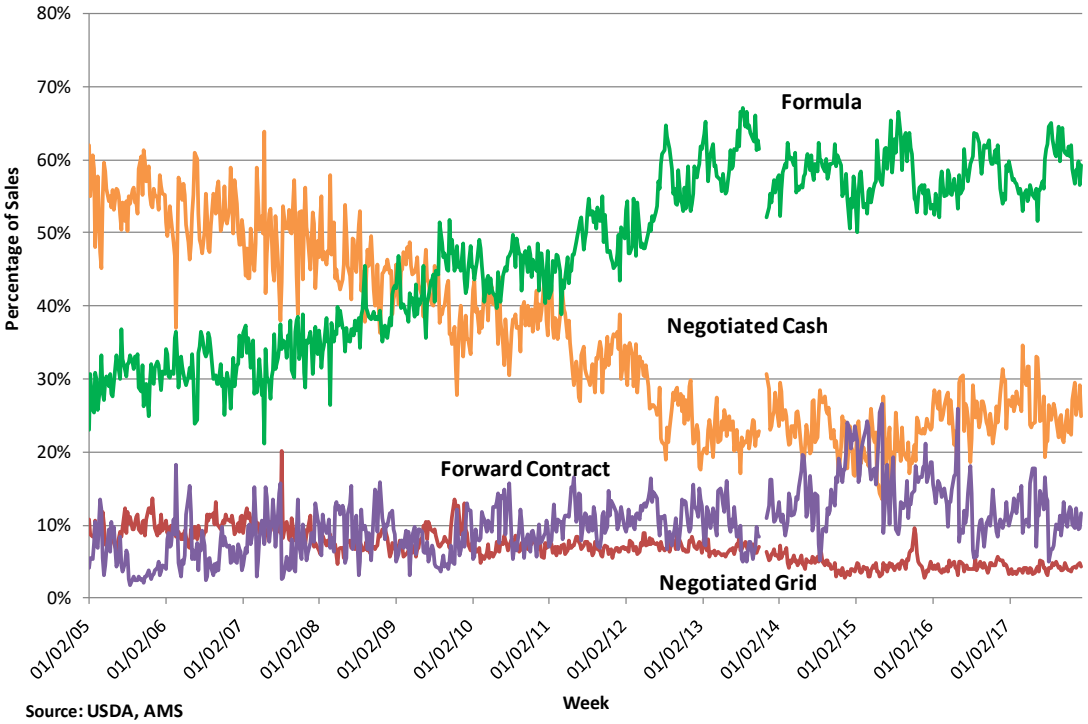
Declining Cash Trade

Over time the negotiated cash fed cattle market has seen declining volume as formula pricing especially has increased in popularity. Figure 11 summarizes weekly fed cattle trade volume shares by packer purchase method since 2005 based upon Livestock Mandatory Price Reporting (LMR) data. Negotiated purchases represented 50% to 60% of typical weekly volume during 2005-06 but declined steadily to around 20% to 30% by 2013. In contrast, formula pricing increased from around 30% in 2005 and 2006 to 50% to 65% in 2013. Formula pricing has become a much more important component of the overall fed cattle market.

One question that arises, given this stark shift in fed cattle marketing from negotiated cash to formula, is whether formula traded cattle are part of deliverable supply for short hedgers. Delivering cattle committed to a packer under a marketing agreement that includes formula pricing requires more planning by the short hedger to remove cattle from the agreement and deliver them. We heard mixed messages from cattle feeders who are involved with marketing agreements about ability or willingness to remove cattle from a marketing agreement to tender delivery on a short hedge. Some suggested packers would not allow this or selectively allow it, others indicated feeders were not willing to remove cattle from formula trade, and some feeders assured us they had done this and could at any time. This mixed sentiment alone suggests increased formula trade reduces practical market-level deliverable supply but by how much is unknown.

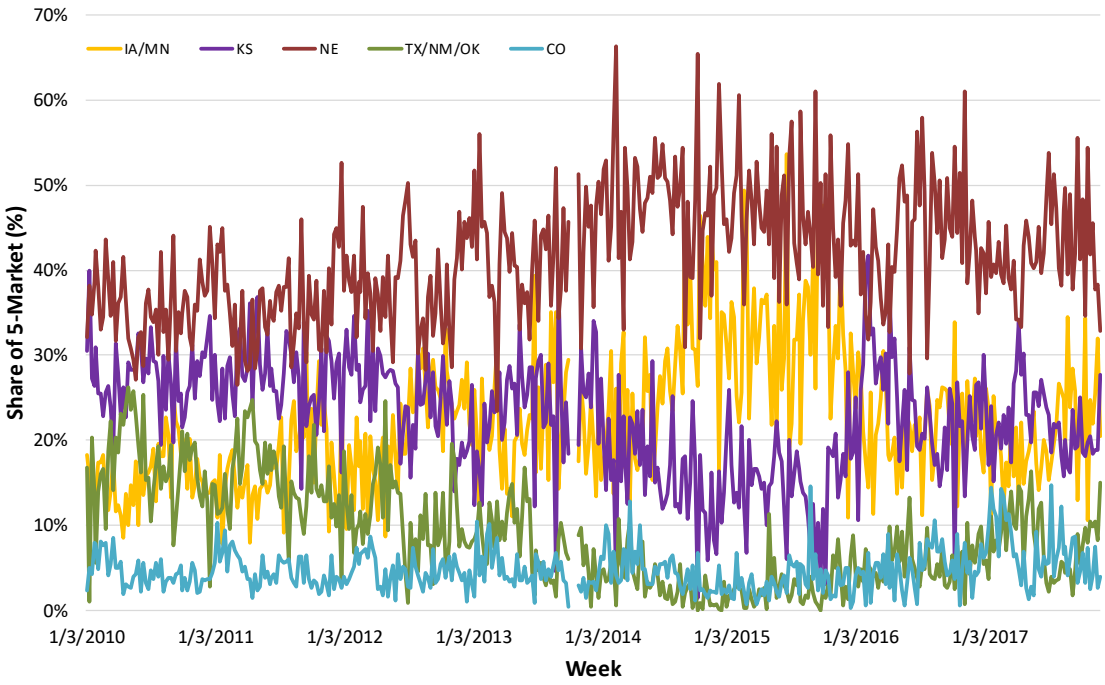
Cash negotiated trade volume in fed cattle has become variable across time, variable across regions, and immensely thin in some regions. As negotiated cash market fed cattle trade volume declined, it declined more rapidly in some market regions than others. Figure 12 illustrates the weekly shares of cash negotiated dressed and live steer and heifer marketings in the five major market regions reported by USDA AMS. Nebraska (NE) has the largest share of cattle negotiated representing about half of negotiated marketings in the 5-area market. Kansas (KS) and Iowa/Minnesota (IA/MN) are each responsible for about 20% to 30% of negotiated transactions. Texas (TX) and Colorado (CO) generally have 10% or less each. The magnitude of variation in negotiated trade shares in each region week-to-week is noteworthy. For example, during 2017 NE has ranged from having 33% to 61% of negotiated sales and, across the same period, TX ranged from 2% to 16%.

Figure 11. Ways Domestic Fed Cattle are Purchased and Priced, Weekly January 2005 - December 8, 2017



Source: USDA, AMS

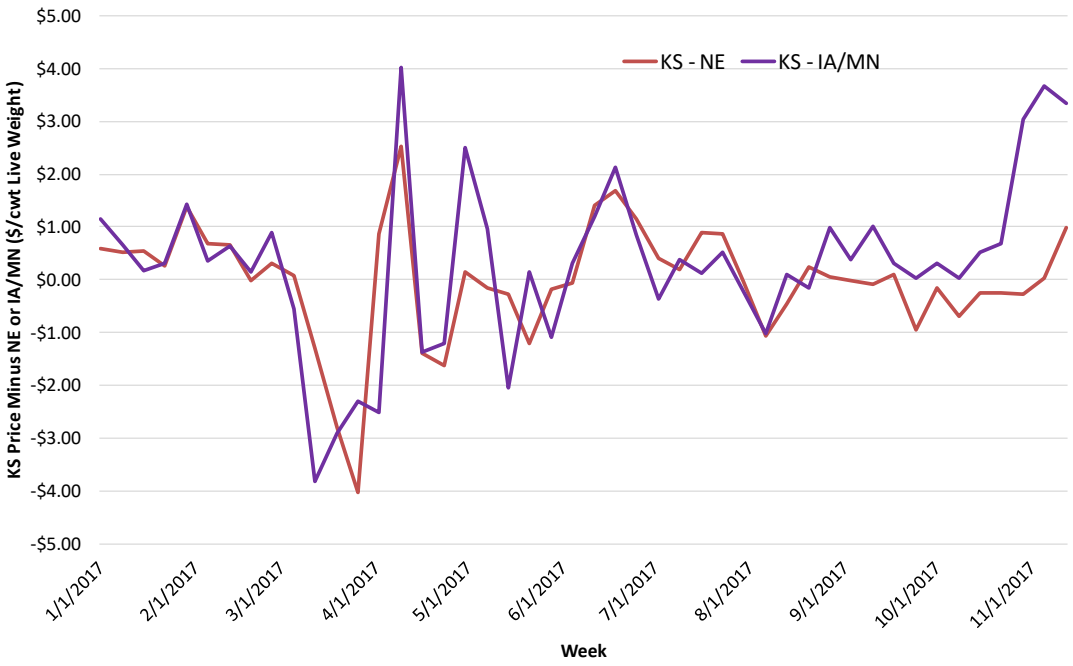
Figure 12. Weekly Shares of Cash Negotiated Dressed and Live Steers and Heifers Marketed from 5-Market Area, 2010-November 2017



Source: USDA, AMS

Variation in market shares of negotiated fed cattle marketings across regions is potentially impactful on live cattle futures market price discovery. Market information flows in both directions from futures to cash and vice versa.[17] As such, when cash market prices change notably, futures markets react to evolving cash market price information. One of the most important indicators of current conditions in the fed cattle market is cash market price discovery. Cash prices across regions vary in economically important ways. Figure 13 illustrates weighted-average negotiated price differences for the KS market region compared to the NE and IA/MN regions during 2017. Variation in fed cattle prices across these market regions is apparent. For example, KS price ranged from a $4/cwt discount to a $4/cwt premium to IA/MN and a $4/cwt discount to a $2.50/cwt premium to NE over just a few weeks. The notable variation in prices across regions directly translates into regional basis variation. The variability in levels of negotiated sales and, at times, divergent reported prices across regions sends mixed signals from cash markets to the live cattle futures market. Further complicating the signals is the fact that much negotiated live cattle trade often takes place during one or two days during a week, resulting in many trading days with no specific cash market price discovery information. Thinly traded cash markets, narrow windows of cash trade, and regional variation over time in relative fed cattle prices, contribute to uncertainty about the value of fed cattle for all cattle market participants including live cattle futures traders.

Figure 13. Weekly Negotiated Weighted-Average Live Steer Price Differences, KS - NE and KS - IA/MN, January - November 2017



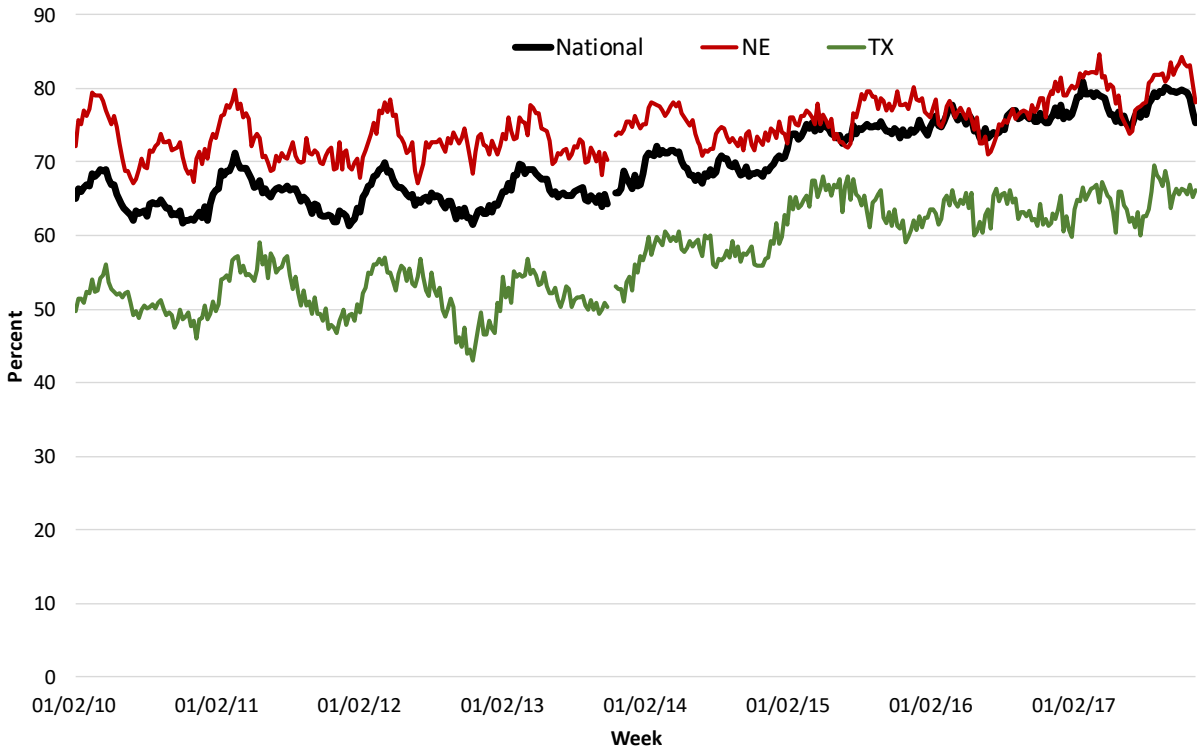
Source: Calculated from USDA, AMS data

[17] Koontz, SR, P Garcia, and MA Hudson. "Dominant-Satellite Relationships between Live Cattle Cash and Futures Markets." *Journal of Futures Markets* 10(April 1990):123-136.

Fed Cattle Quality Grade

An important development in the fed cattle industry over the past decade has been an increase in the proportion of fed cattle grading Choice and higher. Figure 14 illustrates the percentage of fed cattle grading Choice and higher nationally as well as for NE and TX over the 2010-November 2017 time period. Nationally, the percentage grading Choice or higher has increased from around 65% in 2010 to 75% to 80% in 2017. In NE, the percentage grading Choice and higher averaged 80% and 65% in TX in 2017. The live cattle futures contract has been amended to reflect this trend. The contract represented a 55% Choice, 45% Select par load of cattle since 1995. This was updated to a 60% Choice, 40% Select par specification beginning with the October 2017. Contract definition of par quality grade will shift to 65% Choice, 35% Select with the October 2018 contract. Regional differences in quality grades result in regional basis variation. If delivered, NE cattle (assuming they were within the deliverable weight range), which grade higher than contract specifications, would receive a quality grade premium if delivered. TX cattle would receive a quality grade discount. If quality grade of cattle is accurately bid into the market, one would expect differences in TX and NE basis to reflect that.

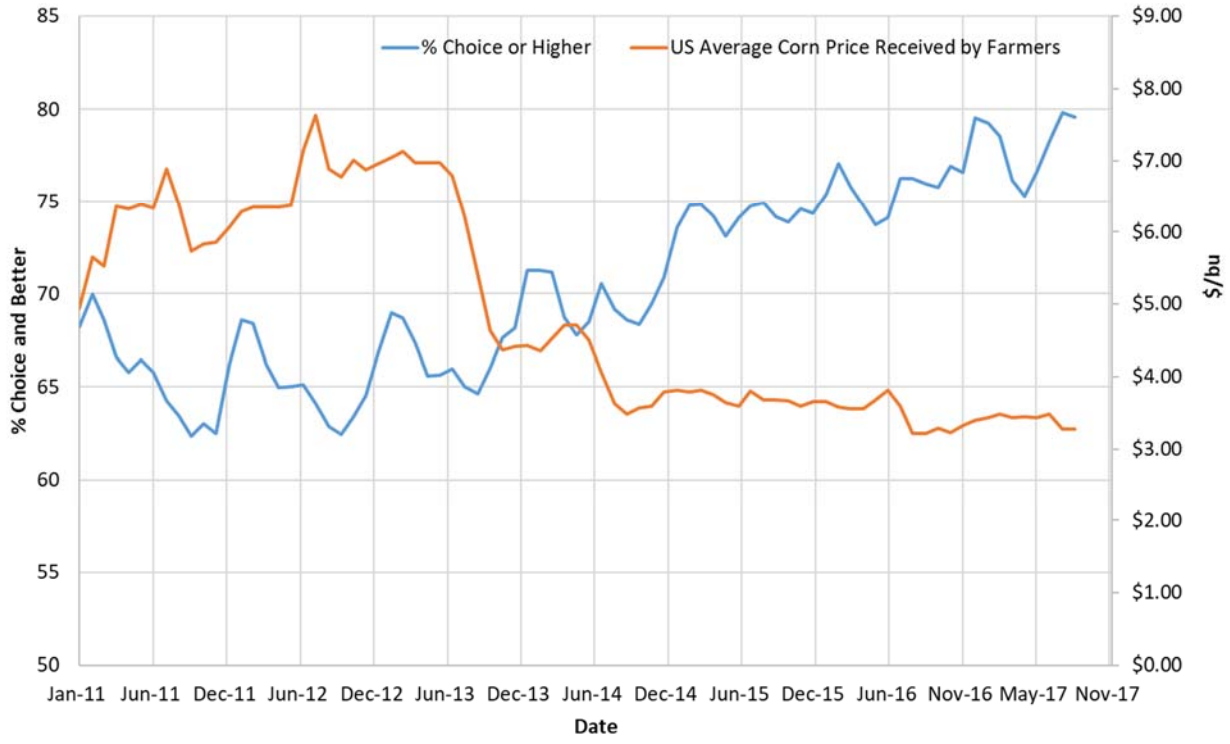
Figure 14. Weekly Fed Cattle Percentages Grading Choice and Prime, National, Nebraska, and Texas, 2010 - November 2017



Source: USDA, AMS

The upward trend in percentage of cattle grading Choice or higher has been driven by several factors. Though difficult to isolate causal relationships, it is important to keep in mind that consumer preferences, market conditions, and input prices affect feeding strategies and, therefore, quality grades of live cattle. As an illustration, Figure 15 shows percentage of live cattle marketed nationally that grade Choice or higher compared to average price for corn received by farmers. The noteworthy point from Figure 15 is the upward trend in percent of live cattle grading Choice or better began after the decrease in corn price in 2012 and 2013. We raise this issue to highlight the complexities of setting static contract specifications based on cash market data. A sustained rally in corn prices would likely influence the trend in quality grades in the cash market but it would be some time before contract specifications could be adjusted.

Figure 15. Percent Live Cattle Grading Choice or Higher and Average US Corn Price Received by Farmers



Data Source: USDA AMS

Fed Cattle Weights

Along with changing quality grades, live cattle weights have changed markedly over the past several years. Since 1990, the 5-area average weight of live negotiated steers has increased by more than 300 pounds. As with quality grade, live cattle weights have seasonal patterns and there are periods when average weights have increased faster than others. However, the upward trend is apparent. Futures contract specifications have adjusted to better match heavier weights. Figure 16 compares the CME Live Cattle Futures Contract weight specifications with 5-area average weights of steers sold via negotiation in the cash market. The light green window is the weight specification of the contract. The dark (light) red areas indicate a discount for heavy (light) animals. Weights outside the green, red, and light red areas are excluded from delivery. As weights of cattle sold in the cash market have trended upward, contract specifications have moved in response.

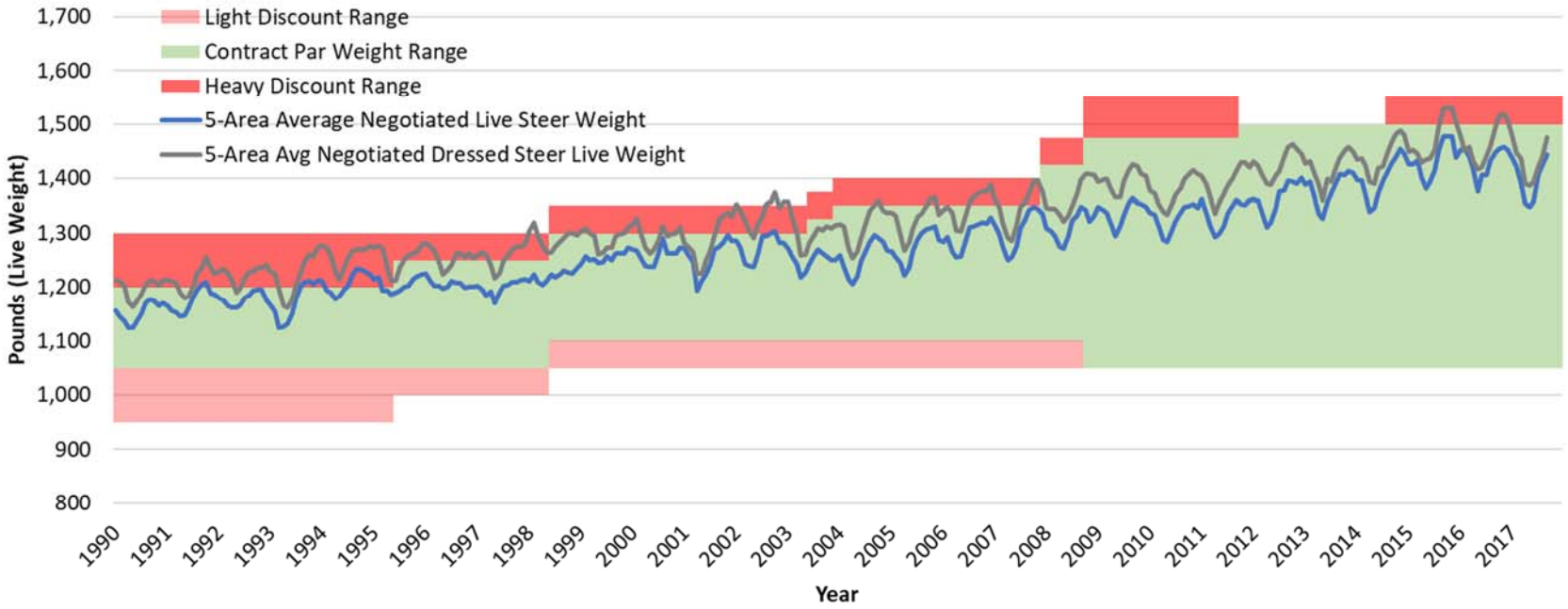
Slaughter Weight and Quality Grade

Comparing average weights of live cattle to contract specifications is helpful but not fully enlightening. Unfortunately, LMR data strictly report weighted averages and no standard deviations. As alluded, we can assume a coefficient of variation and work backwards to build an approximate distribution of weights. Following our approach of illustrating points with specific cases, consider October 2017. Based on the above assumptions, 21% of steers sold on a negotiated live basis in October 2017 would have been excluded from delivery. We have no way to determine if this number is too high or too low. It does indicate that, for most feeders, some substantial sorting for weight will be needed. However, as fall weights are generally high, relative to average, weights may be less of a concern in other months.

Another important concept is that quality grade and weight are correlated and, therefore, should be considered jointly when considering contract specifications. As an illustration, we consider October 2017 formula marketings of steers on a dressed basis. We used dressed basis as actual carcass performance data are not available. Notice that carcass weights increase as the percent of animals grading choice increases (Table 6). Further, the percentage of animals falling into the weight discount and weight exclusion categories also increases with quality grade. This is a rough effort to show these correlations. However, it makes the point that these specifications should be considered jointly. For example, raising the par percent Choice without changing weights makes delivery harder for the short. The short must either deal with the risk of having more animals excluded by bringing extra cattle to deliveries or spending more time sorting and weighing animals. Otherwise, the short must accept that by meeting weight requirements many animals will receive a discount based on the Choice/Select price spread. This is a basis issue and the issuing short can simply plan on these discounts or added costs. However, it adds another layer to an already risky proposition.

This information is by no means definitive research on the topic. However, it shows the connectedness of these traits and suggests future research to understand the economic trade-offs between them would be worthwhile.

Figure 16. CME Live Cattle Futures Contract Live Delivery Weight Specifications for Steers and Average Weight of Negotiated Steers



Source: USDA AMS and interviews with CME Group and CFTC personnel

Table 6. Estimated Percentages of October 2017 Formula Marketed Steers Exceeding CME Live Cattle Futures Contract Deliverable Weight

% Choice	Head Count	Average Carcass Weight	Dressed Percentage	Live Weight Equivalent	Estimated Std Dev	% Heavy Discount	% Heavy Exclusions
> 80	203,002	921	63.6	1448	144.8	11.9%	24.1%
65 – 80	142,916	901	63.8	1412	141.2	10.2%	16.5%
35 – 65	83,699	869	63.8	1362	136.2	7.2%	8.4%
0 - 35	4,336	838	63.6	1318	131.8	4.4%	3.9%

Based on October 2017 5- Area formula marketings of steers. Assumes a coefficient of variation = 0.09 and that weights are normally distributed.

STRENGTHS AND WEAKNESSES OF CURRENT STOCKYARD DELIVERY SYSTEM

This section presents strengths and weaknesses of the current live cattle stockyard delivery system. We also present recommendations to consider as potential ways to reduce weaknesses identified.

STRENGTHS

Enables Active Involvement in Convergence

1. Delivery of live cattle to stockyards provides short hedgers the opportunity to actively tender delivery to influence convergence of cash and futures when local basis is weak enough to incentivize delivery. Delivery drives convergence by encouraging outstanding longs that do not want to take live animal delivery to liquidate long futures positions thereby driving futures down closer to cash cattle prices. Convergence does not imply basis goes to zero even for par delivery animals since costs of delivery are present for short hedgers that include completing necessary affidavits, sorting cattle to meet contract specifications, coordinating with delivery locations, and aligning transportation to get cattle delivered at the appropriate time and place. The uncertainty of accurately assessing how cattle will be graded as well as logistical uncertainties are also built into basis. As such, delivery will not be expected to drive basis to zero in any particular market location. That said, the delivery location with the weakest basis would be the location expected to have the most incentive for making deliveries which could result in basis being near zero is locations that have stronger basis at that time.

Convergence can begin at First Notice Day Early in Contract Expiration Month

2. By providing delivery notice early in the contract expiration month on the first notice day, delivery provides a mechanism to begin to force convergence early in the contract month and not just at expiration.

Process Understood by Experienced Feeders and Risk Managers

3. Cattle feeders we visited who have made deliveries understand how to effectively sort cattle to meet contract delivery specifications, they also have developed reliable rules of thumb or more formal tools to calculate whether delivery is worth the added costs and risks of making delivery (i.e., how weak basis needs to be before they will make delivery). Feeders we visited with quoted differing basis levels that serve as trigger levels at which they at least consider delivery. These values differed due to distance from delivery points, costs associated with sorting, and opinions regarding the delivery process.

Neutral Delivery Site

4. Stockyard markets are neutral sites that favor neither short nor long for delivery. This is an essential component of any physical delivery venue. If a delivery location or method favors either the short or long, it will not be acceptable by the disfavored party. A biased

delivery site can create significant conflict, reduce willingness of one or the other to participate, and ultimately will reduce the ability of delivery to encourage convergence.

Trained USDA Graders Assign Visual Grades

5. USDA AMS market reporters are trained to conduct live graded deliveries at stockyards including determining acceptable lots and individual animals for live delivery. Having this third independent party available for grading cattle and willing to provide this service facilitates live cattle delivery. Third party graders greatly reduce chances for conflict between delivering short and accepting long. One alternative to this could be to have CME hire graders specifically for the task of handling deliveries and charge a fee to cover the costs of graders to those who make delivery. The challenge with this option is that deliveries are not consistent. Several months per year pass with few or no deliveries. As a result, the cost per delivery of maintaining graders for this specific purpose would be prohibitive.

Explicit Delivery Specifications Delineate Delivery Outcomes

6. CME specifications on live cattle delivery are very detailed and delineate exactly how cattle delivery will occur. Specifications include timing, grading, definitions of deliverable cattle, and assignment of premiums and discounts. Having details delineated is essential to reduce disputes because the delivering short and accepting long do not necessarily know each other and do not have an established business relationship. As such, documented details of the delivery and associated valuation must be part of the delivery process.

Delivery Locations Mirror Major Cattle Production Region

7. The locations of physical delivery stockyards are dispersed over the major cattle feeding regions, especially in Nebraska, Kansas, Texas, Oklahoma, and Eastern Colorado where the bulk of cattle are fed. As presented in Figure 6, delivery locations are frequently reviewed by CME Group and occasionally revised.

   Recommendation: More delivery locations could be added to increase potential deliverable supply since delivery volume is constrained physically by the capacity and number of delivery locations today (see Table 4 presented earlier). CME Group's filing to CFTC also confirms the binding constraint on live deliverable supply is stockyard capacity constraints. Certainly, adding more delivery locations enhances opportunity for cattle feeders not located near existing delivery points to consider participating in delivery when economic conditions merit. Delivery locations tend to be near large commercial packing plants, which is reasonable given delivered cattle are ready for slaughter.

   Table 7 provides an estimate of average weekly fed cattle marketings from 1000+ head feedlots over December 2016 – November 2017 in states with delivery points (New Mexico marketings are excluded, even though a delivery stockyard is located in Clovis,

because USDA NASS does not report fed cattle marketings in New Mexico in Cattle on Feed, but Clovis is included in the Texas delivery capacity estimate in the table below). Weekly delivery capacity at current stockyard delivery points is also included in Table 7. Weekly marketings per approximate weekly delivery capacity illustrates how cattle marketing density matches up with delivery locations. The Texas-Oklahoma region has the most stockyard delivery capacity in current live stockyard CME delivery points relative to cattle marketings with 5 cattle marketed weekly per average delivery capacity slot (this can be interpreted as there are 5 times as many cattle marketed in the typical week as there is stockyard delivery capacity in the area) with Iowa-Minnesota-South Dakota similar at 6. On the other extreme, Colorado has the most cattle marketed per current stockyard live delivery capacity slot at 15 cattle per delivery capacity. Kansas and Nebraska are at 11 and 12. Based on this measure, logical regions to consider adding delivery locations to better match up with cattle marketings, one broad measure of deliverable supply, would be in Colorado, Nebraska, and Kansas regions. Each of these regions have at least twice the total fed cattle marketings per delivery slot compared with Texas-Oklahoma and Iowa-Minnesota-South Dakota regions.

Table 7. Estimated Weekly Average Fed Cattle Marketings (1,000 + Head Feedlots) per Delivery Capacity, Major Market Regions, Dec 2016-Nov 2017

Market Region	Weekly Average Dec 2016-Nov 2017 Fed Cattle Marketings (head)	Weekly Delivery Capacity (head)	Weekly Average Fed Marketings per Delivery Capacity (Mkgts/Delivery Slot)
Colorado	35,962	2,325	15
Iowa-Minnesota-S. Dakota	35,365	6,300	6
Kansas	95,481	9,000	11
Nebraska	104,904	8,475	12
Texas-Oklahoma	106,212	19,800	5
Total	377,923	45,900	8

Weekly Delivery Capacity Estimates Calculated as:

Market Region	Delivery Capacity Assigned
Colorado	Wray, 0.5 Ogallala
Iowa-Minnesota-S. Dakota	Worthing, 0.5 West Point
Kansas	Dodge City, Syracuse, Pratt
Nebraska	Columbus, Kearney, Lexington, N. Platte, 0.5 Ogallala, 0.5 W. Point
Texas-Oklahoma	Amarillo, Clovis, Dalhart, Texhoma, Tulia

Sources: Fed cattle marketings calculated using data obtained from USDA NASS Cattle on Feed. Delivery capacity assuming 30 head per contract calculated from data obtained from CME Group.

Delivery Fees Known

8. Commissions and fees for live delivery are known in advance and publicly available.

Comfort in Dealing with Local Stockyards

9. Cattle feeders are used to dealing with stockyards and as such can deal with someone they know to schedule a delivery. This reduces chances for misunderstandings and conflicts.

Premiums and Discounts for Delivered Cattle Quality Mirror an Average Grid

10. Delivered cattle have quality and yield grade premiums that are paid based upon USDA AMS reported weighted average premiums and discounts relative to par. Associated premiums and discounts are publicly reported and easily accessible. However, we note later in this report that the CME delivery grid is somewhat truncated because important gird components are not included. We discuss recommendations associated with that issue further later in this report.

Provides Long Accepting Delivery Optionality

11. Longs when accepting delivery need to find a packer willing to purchase the cattle. However, live delivery also provides the long an option to place delivered cattle back on feed. This gives the receiving long more time to find a terminal buyer for the cattle. Having this optionality provides an incentive for longs to participate in delivery.

WEAKNESSES AND RECOMMENDATIONS

Delivery is Cumbersome

1. Stockyard live delivery is cumbersome and costly. It requires careful cattle sorting, taking cattle off feed (often early), possibly and modifying animal feed additives prior to delivery. Further requirements are shipping cattle to the delivery location, getting all cattle delivered by 9:00 a.m. on the delivery day, handling cattle through grading, and dealing with extra cattle shipped with a delivered load to ensure any rejected cattle do not result in a failed delivery.

   Recommendation: Delivery should not be costless as it is not intended to be a way to market cattle. Instead, it is meant to provide a way for short hedgers to force convergence when basis is weak. However, the logistical challenges and animal stress concerns of the current system are substantial. Some have suggested slotting cattle during the day for delivery over time and not having all cattle required to be at the delivery stockyard by 9:00 a.m. This would be a cumbersome and onerous procedure to manage for the stockyards. They would need to coordinate the delivery slotting with receiving personnel, volume of cattle being delivered by each short, available graders that day, and would increase the USDA graders' needs to

monitor delivery timing while also grading delivered cattle. Given the added complexity of time slotting deliveries to stockyards, we recommend against pursuing that option. We fully recognize there are added issues with animal stress and shrink with cattle delivered by 9:00 a.m. but not processed through the delivery sequence and graded until several hours later, but challenges with trying to manage slotting or scheduling each delivery timing are sizeable. Likely another USDA grader would be required to participate in sequencing delivery and more stockyard personnel would be needed to manage the deliveries. If slotted scheduling were implemented, there would be logistical demands, as well as personnel demands. An impartial method for assigning slots would be needed, which would require careful thought so that the system could not be easily manipulated. Likely, additional penalties for delivery outside a specified time window (both early and late delivery relative to a time slot) would be instituted. It is also possible that cattle might be sitting on trucks longer at the stockyard waiting for their slotted delivery time to unload. The reason being that personnel limits could quickly be exhausted otherwise.

We recommend before this option were introduced that a study be completed measuring added costs relative to potential benefits. Included in such a study would need to be at minimum animal scientists who can assess shrink and animal stress impacts of slotting that include both cattle potentially being at stockyard holding pens for less time, but maybe in trucks longer waiting for scheduled slotting to unload; stockyard management who could determine additional personnel needs; and USDA AMS grading administration to determine additional grader needs. Furthermore, a procedure for how delivery slotting was determined would need to be developed.

Delivery Facility Capability

2. Many stockyard facilities do not normally handle fed cattle and as such are not experienced handling these types of animals. As a result, live cattle deliveries can stress facilities and people and increase chances for injury of cattle or people. This is further complicated by the fact that some facilities are aging. Comments we received indicate that the suitability of delivery points has improved over the past few years but remains a concern.

   Recommendation: We see little that can be done to alleviate this concern. It appears to be a reality of live delivery at stockyards. We suggest industry input regarding problem locations so that CME is well-informed as they evaluate delivery locations in the future.

Long Marketing Delivered Cattle

3. Packers with plants near a delivery point may not be willing to purchase cattle from a physical delivery resulting in significant buyer search costs, freight costs, and at times a need to consider putting animals back on feed. Putting cattle back on feed after physical delivery to auction is difficult and inefficient.

   Recommendation: The long must be aware that they need to collect market information from packers near delivery points prior to accepting delivery to discern delivered bids. The realization is that in many of the market regions where delivery points are located there is often little or no cash cattle market trade on some days (see Figure 11 and ensuing discussion presented earlier in this report). This implies, even if CME Group for example, attempted to collect and report cash bids from carcass eligible delivery facilities, they would often not have any price information to report and if they did, it would breach confidentiality. Further, there is no reasonable mechanism by which to force private packing plants to offer the same bid to different clients. USDA AMS could perhaps calculate some type of rolling average cash bid price for a collection of carcass eligible plants in each region for longs taking delivery. Under Livestock Mandatory Reporting, AMS has packer purchase price by purchase type, by plant in the data they receive twice daily from packers required to report. Such price information, would be useful, though at the margin, it is not clear it would be much more useful than market prices already being reported in the various market regions by USDA AMS. Since cash markets have thinned though, finding a packer who is willing to offer a bid, especially in certain regions, can result in sizeable search costs.

   In addition, it is common for any of the 5 major USDA AMS reporting regions to have no negotiated fed cattle cash trade on a given day. This implies none occurred or what did occur was not publicly reported because of confidentiality. For example, during 2017, the Texas-Oklahoma-New Mexico market region had only 48% of business trading days with any negotiated cash fed steer and heifer price reported by USDA and only 33% of days had more than 500 head transacted. This suggests that a receiving long would have about a 50% chance of being the only cash trade and 66% chance of being a sizeable portion of cash trade in the entire market region any given day when they sold delivered cattle to a beef packer if they took delivery in a Texas market region stockyard delivery location. Thinly traded cash markets make establishing and generating cash market trade a challenge for an assigned long that takes delivery in such a market environment.

Mimic Cash Trade

4. CFTC rules indicate delivery should occur where normal cash market trade occurs. Delivery should mimic cash market. Stockyard delivery does not mimic typical cash fed cattle trade in terms of location or method.

Recommendation: We see little feasible way to make stockyard deliveries better mimic cash fed cattle trade. As we noted earlier, the relationship cash market participants have with each other is important and facilitates trade because it is a repeat game where cattle buyers and feeders must deal with each other in the future so maintaining some level of trust in transactions ensures both are willing to do business together in the future. In such situations for example a visual grade of the pen of cattle, as opposed to sorting out cattle of certain weights in a pen, is rational behavior. However, without such a relationship, delivered cattle must have tighter specifications that will be adhered to and, as a result, sorting to meet tighter contract specifications is reasonable. If there is a better way to try to grade delivered cattle at stockyard facilities that would more closely mimic cash trade while also maintaining the integrity of tight quality specifications in the contract, we do not know what it would be.

Sufficient USDA Graders

5. Live delivery requires USDA graders be available to grade cattle at the delivery point. This is not the primary responsibility of USDA AMS market reporters who typically serve the grading function for live cattle delivery at stockyards. Managing live deliveries requires on-going training and preparation of new AMS market reporters as they become certified for managing live delivery.

   Recommendation: AMS market reporters who grade delivered cattle in small lots of a few head at a time can grade up to about 15 loads at a delivery facility in a day. Two graders can grade about 15-30 loads for a single-alley facility. For 30-60 loads at a multiple-alley facility, AMS typically sends 3-4 graders to work the delivery. The single largest pinch point for deliveries is the size of the scale and number of alleys at the stockyard. AMS graders can grade cattle faster than facilities can typically weigh and stamp cattle. Working on ways to speed up weighing and stamping for a delivery would facilitate grading and overall speed of delivery processing. Accepting live cattle futures deliveries is not the reason these stockyards facilities are designed the way they are and redesign, such as adding alley ways, is a costly endeavor especially for the relatively small proportion of their business this might serve.

   AMS currently has 34 certified graders, but these graders have full time jobs as market reporters and, as such, could not all be deployed simultaneously for grading live cattle deliveries. If deliveries were to become more common, AMS grader capacity under the current structure could be constrained and unable to accommodate grading demands. There are more delivery points and delivery capacities than current USDA AMS graders could accommodate and manage if a large number of deliveries were to occur in a short time period. However, having readily available a large number of graders to meet a possible delivery intensity rate

that has never occurred is not recommended as costs would exceed value. Instead, working with USDA to ensure sufficient graders are available and trained (meaning feedyards might consider volunteering their feedyard as a location for USDA to train inexperienced graders) is highly recommended. At some point if the number of certified graders becomes a binding constraint, fees for grading services should increase to enable AMS to better meet demand for these services. Though unlikely, another item of concern is the USDA AMS budget. If there were to be unexpected cuts in federal funding, live cattle delivery grading could be one of the activities to go away. Again, we see this as unlikely but it remains a risk as long AMS market reporters serve as graders. The alternative to USDA graders is to train private third-party graders for grading cattle deliveries. What these graders would do the rest of the time when not managing futures deliveries is not clear to us. We do not have a simple low-cost solution to what would be an important binding constraint if a lot of deliveries were to occur in a short time frame.

Delivery Constraints

6. Delivery points have capacity constraints that can be a binding limit on number of loads that can be delivered as well as black-out dates where no delivery is feasible at a location. Furthermore, as the contract expiration approaches, deliverable capacity rapidly declines as detailed in Table 4 and associated discussion earlier in this report. This contributes to a small practical delivery capacity as contract expiration occurs lessening ability to affect convergence.

   Recommendation: Possible deliveries that can be made shrink to 25,000 head per day three days prior to contract expiration and to just over 10,000 head on expiration because of delivery point capacity constraints (see Table 4 earlier in this report). This, together with the information presented in Table 5 illustrating delivery point locations relative to cattle feeding density, suggests adding more stockyard delivery points would be advisable. Adding delivery points would ease the constraint on possible deliveries in Table 4 near contract expiration. At the same time, if the delivery points were located in areas where cattle density is greater per delivery location (i.e., Colorado, Nebraska, Kansas) this would lessen the geographic constraints on how many cattle can be delivered. If the live stockyard delivery option is maintained, we recommend adding more delivery points.

   If new candidate delivery points are not capable of handling live cattle deliveries for whatever reasons, they either need to be subsidized to get up to that capability or this remains a binding constraint that we have no solution for other than ideas discussed later relative to expanding carcass delivery or offering feedyard delivery. Relative to adding stockyard delivery points, it is well beyond the scope of this study to inspect and assess capability of each candidate live stockyard delivery point that might be added. We feel this is the responsibility of CME Group and this study did

not have the time or resources to investigate such candidate stockyard live delivery points. We strongly recommend this be explored further if live delivery remains as currently structured. Delivery fees for a short to the delivery stockyard would be expected to increase as more delivery locations are added because likely the delivery points that can least cost and most effectively handle and manage live deliveries are already for the most part certified delivery locations.

Stockyard Delivery Structure

7. Accepting live cattle deliveries is not the primary business of stockyards and, therefore, can be disruptive to normal schedules.

   Recommendation: We see little that can be done to alleviate this issue other than for stockyards to increase fees for delivery if they deem it costly to accommodate. In other words, if stockyards are willing to sign up to accept deliveries, and they can establish their fees, this should not be a binding constraint.

Cattle Grading

8. Cattle grading is somewhat cumbersome at times and does not match well with how industry visually grades live cattle in a pen. Grading in small lots takes time and is more tedious than visual pen grading in feedyards during cash market negotiated pricing.

   Recommendation: First, see point 5 above for additional related discussion around this issue. Second, a few things that can be done to improve this situation are first to educate producers who have not made deliveries before on what the delivery process entails. Specifically, educating feeders on how to sort cattle so that large numbers of undeliverable cattle are not brought to a delivery. A factor that slows grading immensely is unsorted cattle. For example, bringing cattle that are all approaching the maximum allowable delivery weight constraint. In such cases, individual animals are isolated for individual weighing. The CME has empowered graders to reject loads that appear unsorted and refuse to allow them to even begin the delivery process. This issue should be addressed through making sure introducing brokers, FCMs, and cattle feeders contemplating deliveries are well aware of the potential for loads to be rejected. This will likely fix itself quickly as news of a few rejected loads becomes public. However, avoiding these incidents is a way better option. We visited with some FCM personnel who were very experienced in what delivery entails and they were diligent in working with any cattle feeder customer contemplating delivery. This is likely the place where the most impactful change can be made because ultimately there are a small number of FCMs and all tenders go through them.

In our discussion with AMS, they indicated they first certify graders after training. Of the approximately 60 people in the AMS market reporting segment, 34 are certified to grade cattle deliveries. USDA regularly evaluates grader accuracy and often graders collect plant carcass data to compare with live grading results. Though published data were not available for us to review, USDA indicated these results were highly accurate grading. Some question whether grading individual animals, or 3 at a time as is typically done by USDA graders for delivered cattle is more or less accurate than grading larger groups of cattle. There is no published data that we are aware of to assess this. USDA is comfortable with the current grading process used for deliveries, but if one wanted to test the accuracy of small group versus larger group grading, that is a study that would need to be carefully constructed to test. Furthermore, measuring the costs of grading more intensively versus larger group grading, has not been completed. However, recall from discussion above that grading speed is not the constraining issue relative to speed of cattle delivery at delivery stockyards. As discussed above, graders grade faster than stockyards weigh and stamp. Conducting such a study to determine costs and benefits of grading in smaller lots, how this affects speed of commerce and grading accuracy, and whether delivery location speed of stamping and weighing can be increased and at what cost is well outside the scope of this project but would be worth future consideration.

Retender and Reclaim Concerns

9. The current structure of the way retender and reclaim fees accrue and are handled is problematic. NOTE this weakness applies to the entire current contract specification and is not unique to live stockyard delivery only.

   The current policy on retenders is that if the assigned long does not want to accept delivery, the contract can be retendered by the assigned long paying a $1/cwt fee ($400 per contract). The $1/cwt fee is assigned to the certificate. The fee goes to the issuing short if the certificate is reclaimed. If the certificate is not reclaimed, the $1/cwt fee is paid to the next long assigned the contract. This same retender process can occur again with an additional $1/cwt fee paid by the retendering assigned long that accrues to the contract, which would now have $2/cwt associated with it that either the short can reclaim and be paid or the next assigned long receives. This process was described in more detail earlier in this report.

   Our concern is particularly with the fee *being attached to the certificate.* Assigning the fee to the certificate encourages the next assigned long to stay long in the contract instead of liquidating their futures position by selling. That is, the fee increases the long's incentive to stay long and accept delivery rather than offsetting their futures position. If they instead sold futures to close their position, this would drive futures price down and improve convergence. This activity thereby slows and reduces convergence at the margin. Again, the second fee that is paid if the retender

is not wanted by the next assigned long perpetuates this problem. Put briefly, attaching retender fees to the certificate likely slows convergence. Quantifying this impact would be difficult but the intuition is straightforward. If the retender fee remains, it would make more sense for the fee to be used to cover administrative costs of CME for managing deliveries.

Recommendation: Enable one retender of the contract, perhaps at a higher penalty, but do not assign the fee to the certificate. Instead, let the fee accrue to CME for other purposes. According to CME Group data, there were 567 first retenders and 219 second retenders between 2011 and November 2017. The value of those retenders totals $314, 400. Of course, this is spread out over eight years but the amount collected over a few years could be substantial.

We have no opinion on whether to do away entirely with the opportunity to retender or reclaim a delivery that is tendered. We understand the rationale to let a short incur a penalty to get out of a contract, but traders who are long in the delivery period and are unprepared to take delivery should not be trading in live cattle futures. From that standpoint, we see no harm in eliminating this retender activity all together as over time it should not be necessary as ill-informed traders will not last long. On the other hand, ill-formed longs will not understand the delivery process. As a result, any delivery they accept and their subsequent efforts to market the cattle will likely be inefficient. Allowing the retender penalty to avoid taking delivery spares people and animals involved considerable stress.

Delivery Affidavits

10. Currently, issuing shorts must provide various affidavits attesting cattle are eligible for delivery. Consensus is that these are not prohibitive to delivery and completing this can done with minimal effort. One concern with the affidavits is to what degree these requirements differ from cash market transactions. Our one concern is the affidavit attesting that all cattle are US born.

    Recommendation: We recommend that, especially given the country of origin labeling is no longer mandated in retail meat, that this affidavit requirement be removed. It is not a large concern, as the requirements eliminate a small portion of live cattle from being delivered. However, it is one more difference between cash and delivery transactions and its affects differ across marketing regions.

STRENGTHS AND WEAKNESSES OF CURRENT CARCASS DELIVERY SYSTEM OPTION

This section presents strengths and weaknesses of the current carcass option for cattle delivery. This discussion assumes the carcass option is offered in addition to the live stockyard delivery (i.e., the current contract design). We also present recommendations to consider as potential ways to reduce weaknesses identified.

STRENGTHS

Reduces Animal Handling, Stress, and Transportation Costs

1. Compared to live delivery, there is less animal handling and stress for animals delivered directly to packing plants without first going through stockyards. Animals are only loaded and unloaded one time under this option. Furthermore, for the overall industry this reduces transportation costs of a bulky, perishable product that is expensive to haul. In a live delivery, cattle are delivered to a stockyard and then reloaded and transported to a packing plant. In this process, all stress, handing, animal injury risk, and transportation costs are essentially doubled compared to delivering directly to a plant.

   Cattle transport and handling increases animal stress, increases chances for animal and human injury, increases potential for dark cutters, and increases shrink.[18,19,20] Collectively, carcass delivery reduces animal stress, reduces risk of injury to humans and cattle, reduces shrink for both the short and the long, and potentially increases carcass quality. Furthermore, carcass delivery reduces overall transportation costs in the industry – it could increase how far a short needs to go to deliver as often stockyard delivery locations are nearer the feedyard than packing plants, but under current CME contract specifications, the long pays for any extra costs to deliver cattle to a plant instead of the designated delivery stockyard.

   The benefits around reduced animal stress accrue to both shorts and longs, but not in the same way necessarily. The main advantage of carcass delivery by the short is delivered cattle are at the slaughter plant and any that do not fit the delivery (e.g. excess number of animals beyond the delivery range, carcass rejected because of age, etc.) will be slaughtered and do not need to be transported elsewhere. Of course, this has possible disadvantages which we will discuss later.

[18] Voisinet, BD, T Grandin, SF O'Connor, JD Tatum, MJ Deesing. "Bos indicus-cross feedlot cattle with excitable temperaments have tougher meat and a higher incidence of borderline dark cutters." *Meat Science* 46, 4 (1997):367-377.

[19] Ferguson, DM, RD Warner. "Have we underestimated the impact of pre-slaughter stress on meat quality in ruminants?" *Meat Science* 80, 1 (2008):12-19.

[20] Warriss, PD "The handling of cattle pre-slaughter and its effects on carcass and meat quality." *Applied Animal Behavior Science* 28, 1-2 (1990)171-186.

For the long, carcass delivery means the cattle are delivered to the location they are slaughtered and the long does not need to align trucking to the packing plant further incurring additional shrink and potential for animal injury. For the cattle, the stress of hauling and handling is well documented.[21]

Mimics Cash Trade

2. Closely mimics cash trade process of how carcass and grid cattle are currently delivered to packers.

   Carcass delivery is similar in many ways to how carcass and grid cattle are sold today. The main difference is delivered cattle are valued based upon a weighted-average USDA AMS reported grid that may be different from the specific plant's grid. Another possibly important difference, discussed further later, is that yields reportedly can vary across plants. A negative consequence for the packing plants might be if their own grid differs from the USDA weighted-average grid, and it likely will, the grid might not match up well with their end-customer valuation. In such a situation, the price-value signal from that particular packer is not communicated in such transactions. This issue is clearly exemplified in Figure 17 discussed and presented later, that illustrates the wide range in premiums and discounts for carcass attributes across packers.

Meat Graders and Inspectors in Place

3. Federal meat inspectors are already in the plants and as such are prepared for delivered cattle responsibilities.

   Concerns about live grading discussed in the previous section regarding live cattle delivery to stockyards are completely alleviated with carcass delivery. Federal meat graders are already in the plants where cattle are delivered, grading carcasses is one of their primary responsibilities, and they are prepared to handle the volume of cattle the plant slaughters each day.

   Realize that many, if not most, loads of cattle now delivered live to stockyards are graded twice, once at the live delivery and then again carcasses are graded at the plant when the receiving long delivers the cattle. We were informed by packers that we visited with that they often buy futures delivered cattle from longs on a carcass grid basis. As such, grading is happening twice on delivered pens. This increases USDA costs by duplication. If deliveries are made directly to plants on a carcass basis, grading occurs only once and it does not take a concerted effort that is now needed by USDA AMS market reporters to manage and grade a live delivery.

[21] Grandin, T. "Assessment of Stress During Handling and Transport." *Journal of Animal Science* 75, 1 (1997):249-257.

Reduces Live Grading Concerns for Cattle Option to Deliver Carcass is Exercised

4. Concerns about how to physically improve flow of live cattle at stockyard delivery are eliminated for cattle the long opts to have carcass delivered.

   Carcass delivery removes concerns about the rate of cattle flow in stockyards, live animal grading, the rate of cattle grading, and errors inherent in live relative to carcass grading. Furthermore, grading in carcass delivery occurs after animals are slaughtered reducing animal stress associated with the weighing and grading process used at stockyards.

Eliminates Stockyard Delivery Capacity Constraint if Option to Deliver Carcass is Exercised

5. Delivery stockyard capacity is not a concern with carcass delivery for cattle the long opts have carcass delivered. Note, we realize this concern is still present when carcass delivery is an option only as the capacity constraint is still present for live deliveries.

   Constraints associated with stockyard delivery capacity is irrelevant with carcass delivery. The issues illustrated in Table 4 presented earlier in this report about constrained capacity of delivery stockyards are not a concern with carcass delivery as they are eliminated and not binding. But, if live delivery is still in place, and longs do not opt for carcass delivery, this constraint persists.

Provides Long an Option for Carcass Delivery Demand

6. The current carcass option contract specification provides the long the option of carcass delivery. This option is one that benefits the long by them being able to determine whether they want live or carcass delivery increasing the optionality for the long. The carcass delivery option enables longs taking delivery to choose to demand cattle be delivered to a packing plant on a carcass basis which reduces associated costs of the long taking live cattle delivery at designated stockyards and then needing to transport live cattle to a packing plant. These costs include not only transportation, but added risk of cattle injury associated with another haul, increased chances for dark cutters, and increased shrink.

Provides Some Level of Quality Assurance

7. By opting for plant delivery the long ensures that cattle are priced based on carcass performance. This is likely more ensuring to the long than is visual grading. It would seem choosing plant delivery would reduce the uncertainty around the quality of the cattle to be delivered.

WEAKNESSES AND RECOMMENDATIONS

Packer Participation

1. Packers may not be willing to accept deliveries against a futures contract. Deliveries are not normal business for packers and as such the process is disruptive and all involved must go back and review the CME rules and documentation. This can result in increased search costs to find willing packing plants to accept delivery. The result is longs have less incentive to remain in the contract in the delivery month. Further, packers can reject plant delivery requests at any time. While packers may agree to participate in the process, they are under no obligation to interrupt their schedule. In other words, this option is in no way a guarantee to increase delivery capacity.

   Recommendation: This is in our opinion the most important current concern with carcass delivery. We do not see a simple solution to this concern. However, this concern is present whether cattle are delivered live or dressed, except the long has more time to search if they take live delivery at stockyards and place cattle back on feed. As such, this concern likely most adversely directly affects optionality of longs taking delivery. It is especially a problem for inexperienced longs who lack a relationship with packers in the region where delivery was tendered.

   One thing that could be done to try to facilitate packer willingness to participate is provide a succinct document for packers that details what they need to do to accommodate a carcass delivery rather than them having to sort through the entire CME delivery rules. If such a succinct document already exists, we certainly did not hear about it in our conversations with several packers who have taken delivery. Thus, we assume such an easy to translate document specifically designed for packers taking carcass delivery does not exist. Making it easier, less disruptive, and simpler for packers to take carcass delivery will reduce the costs of this activity to them and make them more likely to participate.

Discounts for Undeliverable Cattle

2. Once in the plant, carcasses deemed undeliverable must be sold to the packer regardless of premium/discount structures that may be in place at that plant for that delivered pen. Such delivered carcasses are hanging in the plant but are not part of the delivery unit on the futures contract. The short delivering to a plant is at the mercy of the packer for payment on carcasses that do not meet delivery specifications (e.g., 30+ month carcasses). This can increase risk of the short making plant delivery.

   Recommendation: CME delivery specifications indicate cattle not qualifying for delivery are discounted at 25% of the settlement price. This presumably sets an upper bound on the discount that can be applied for cattle that are slaughtered and not otherwise condemned by a federal inspector but do not meet delivery

requirements. The 25% discount is a lot larger than USDA reported over 30-month grid discount weighted average of $16.43/cwt reported January 15, 2018. The range reported was -$10/cwt to -$40/cwt by USDA AMS. Given that other premiums and discounts in CME Group carcass deliveries are specified and use the weekly USDA AMS 5-area weighted averages we recommend weighted averages from the same report be applied to cattle not deliverable, but already slaughtered. For example, this same USDA report provides weighted-average discounts for non-deliverable cattle (see Figure 17 below). Logical consistency suggests applying these same weighted averages to cattle not meeting delivery specifications for carcass deliveries.

Inconsistency in Deliverable Weights

3. Live delivery weight specifications are not consistent with carcass delivery weights. Par weight range for steer and heifer carcasses is 500 to 1050 pounds. There are no weight exclusions on carcass delivered animals. Those deviating from par weight are discounted. Assuming a 63% dressing percentage the 1,050-pound carcass upper par limit translates into a 1,667-pound live animal, more than 100 pounds greater than the maximum live stockyard deliverable weight for steers. Though greater than a 1,550-pound animal would be completely excluded from a live delivery, it is well within par for carcass delivery. Further, it bears repeating that this is only the weight at which an animal receives a discount. There is no maximum deliverable weight for carcass delivery. Another inconsistency is that heifers have a lower maximum live delivery weight (1350 pounds) than steers but steers and heifers face the same weight specifications when delivered on a carcass basis. A heifer weighing 1360 pounds would be undeliverable on a live basis but that same heifer, as well as one 300 pounds heavier, would be within par limits for a carcass delivery.

   Recommendation: This set of specifications adds confusion to the delivery process and increases the need to have separate sorts or loads of cattle for live stockyard versus carcass delivery. Given that almost half of the completed deliveries between 2011 and 2017 were carcass-based, issuing shorts must be prepared for carcass delivery when issuing. With specifications this far apart, that effectively means needing to have two groups of cattle ready for a tendered delivery — one to meet live specifications and one for carcass specifications. It is difficult to determine exactly how this affects basis but, as it impacts the expected value of delivered cattle and makes specifications more difficult to manage for the short making delivery, it likely deters some from making delivery. We would recommend aligning these weight specifications more closely so that it is clearer as to what the contract represents. At present, one could argue the contract represents two similar but different sorts of live steers and live heifers depending on whether the cattle are delivered to a stockyard or on a carcass basis to a plant.

Figure 17. USDA AMS Weekly Weighted Average Premiums and Discounts Report

LM_CT169
St. Joseph, MO Mon Jan 15, 2018 USDA Market News Service

5-AREA WEEKLY WTD AVERAGE DIRECT SLAUGHTER CATTLE - PREMIUMS AND DISCOUNTS
For the Week of: 1/15/2018
Value Adjustments

	Range	Wtd Avg	Change
Quality:			
Prime	10.00 - 23.00	17.60	0.88
Choice	0.00 - 0.00	0.00	0.00
Select	(12.00)- (5.00)	(6.64)	2.66
Standard	(40.00)- (14.00)	(19.54)	2.91
CAB	3.00 - 8.00	4.90	0.00
All Natural	22.00 - 28.00	23.92	0.00
NHTC	16.00 - 21.00	18.97	0.33
Dairy - Type	(14.00)- 0.00	(4.12)	0.00
Bullock/Stag	(55.00)- (25.00)	(40.93)	0.00
Hardbone	(55.00)- (20.00)	(33.73)	0.66
Dark Cutter	(55.00)- (25.00)	(36.84)	0.10
Over 30 Months of Age	(40.00)- (10.00)	(16.43)	0.10
*Cutability Yield Grade, Fat/Inches			
1.0-2.0 < .10"	4.00 - 8.00	5.71	0.00
2.0-2.5 < .20"	2.00 - 5.00	3.03	0.00
2.5-3.0 < .40"	0.00 - 5.00	2.93	0.00
3.0-3.5 < .60"	0.00 - 0.00	0.00	0.00
3.5-4.0 < .80"	0.00 - 0.00	0.00	0.00
4.0-5.0 < 1.2"	(12.00)- (8.00)	(9.77)	0.00
5.0/up > 1.2"	(20.00)- (10.00)	(14.80)	0.00
Weight:			
400-500 lbs	(40.00)- (15.00)	(25.78)	0.00
500-550 lbs	(40.00)- (12.00)	(23.12)	0.00
550-600 lbs	(15.00)- 0.00	(2.80)	0.00
600-900 lbs	0.00 - 0.00	0.00	0.00
900-1000 lbs	(15.00)- 0.00	(0.19)	0.00
1000-1050 lbs	(15.00)- 0.00	(2.36)	0.00
over 1050 lbs	(35.00)- (10.00)	(22.70)	0.00

Premiums for CAB

3. Current CME guidelines do not have a premium for CAB delivered carcasses.

   Recommendation: Following up on the discounts for cattle that do not fit the grid, to more closely follow a typical grid, adding a premium for CAB consistent with USDA weighted averages is also worth considering. Every packer in the USDA report (Figure 17) paid at least a $3/cwt premium for CAB and the weighted average was $4.90/cwt. Curious why this was omitted in valuation as it significantly influences the delivered value of qualifying cattle.

Yields Vary by Plant

4. Dressing yields reportedly vary notably across plants. The USDA premiums and discount grid makes no consideration of this difference, thus increasing carcass delivery risk. If this is true, it needs to be addressed, but it needs to be scientifically documented before addressing.

   Recommendation: We do not have publicly available empirical evidence of this claim that yields vary by plant that we can share in this report, but we heard this several times in our discussions with credible industry participants. This needs first to be documented scientifically using representative data. If documented and found to exist, then we recommend attempts be made to understand it better and fix it or adjust for it if possible. Documenting the extent of this is certainly beyond the scope of this study as it would take a lot of carefully designed data collection and likely controlled experiments. If found to be present, then the best way to address this is with direct packer engagement. Industry representatives would be advised to meet with the packers and determine why yields are different and whether there is anything that can be done to help them converge (but this is only after documenting they are different first).

STRENGTHS AND WEAKNESSES OF A LIVE STOCKYARD ONLY DELIVERY SYSTEM

This section presents strengths and weaknesses of eliminating the current carcass delivery option and offering only a live delivery option for cattle delivery. We focus here on ***relative*** strengths and weaknesses compared to the current delivery system that enables the long optionality to select live or carcass delivery. We also present recommendations to consider as potential ways to reduce weaknesses identified.

STRENGTHS

Benefits of Current Live Delivery Option Remain in Tact

1. Eliminating the carcass delivery option would retain all benefits we presented previously in the current live stockyard delivery system. Rather than repeat those here, we refer back to the strengths discussed previously.

Some Drawbacks to Carcass Delivery are Eliminated

2. Some weaknesses of the current carcass delivery option are eliminated by having only live delivery without the carcass option. Rather than repeat those he, we refer back to the drawbacks previously discussed.

   We say "some" are eliminated here because some of what we discussed as weaknesses in the carcass delivery option still would be present in live only stockyard delivery such as premiums and discounts not fully mirroring grids (e.g., CAB not explicitly included). Furthermore, the issue raised about yields possibly varying across plants is an issue much broader than futures delivery and as such persists whether there is live stockyard, carcass, or any other cattle delivery system in place.

Simplifies Delivery

3. Dropping the carcass delivery option would essentially cut the CME delivery guidelines by 50%. This would simplify delivery overall as one set of rules, simply for live delivery, would need to be designed, managed, and followed by all industry users.

Eliminates need to Sort Cattle Differently for Live vs. Carcass Delivery

4. Eliminating the carcass delivery option would make it no longer necessary to sort cattle for a live delivery separately from cattle destined for a carcass delivery. This makes managing deliveries for the short easier as they would know at the time of tendering they are delivering cattle live only.

Eliminates needing to Potentially Deliver Cattle to Multiple Destinations

5. With live delivery only, all delivered cattle loads would go to the same destination – the live stockyard location designated in the delivery tender. As such, a given delivery tender would not have the chance of some loads being tendered to the stockyard and

other loads to a packing plant designated by a long demanding delivery. Delivering to different locations can increase delivery costs for the short.

Reduces Risks Associated with Delivery for Issuing Shorts

6. When deciding whether to deliver, the short only has to worry about comparing an expected live delivery price with cash market price. As noted in point 4 the need for sorting is decreased. Many feeders explained that to be comfortable tendering a delivery notice, they wanted to have two groups (or sorts) of cattle—one for live delivery and one for plant delivery. Alleviating this would likely open up delivery participation to smaller feeding operations who do not have enough cattle to prepare in this way.

WEAKNESSES AND RECOMMENDATIONS

Eliminates Strengths of Carcass Option

1. Going to a live only delivery system would eliminate all strengths we already discussed above about the carcass delivery option of the current delivery system. As such, we refer back to those and do not rehash them here.

Decreases Incentive of Long Participation in Spot Month

2. Though uncertain and not without its faults, carcass delivery does offer another option that is attractive to certain longs. Eliminating it could reduce volume and liquidity in the spot month.

STRENGTHS AND WEAKNESSES OF A CARCASS ONLY DELIVERY SYSTEM

This section presents strengths and weaknesses of eliminating the current live stockyard delivery system and offering only a carcass option for cattle delivery. We focus here on ***relative*** strengths and weaknesses compared to the current delivery system that enables the long optionality to select live stockyard or carcass delivery. We also present recommendations to consider as potential ways to reduce weaknesses identified.

STRENGTHS

Eliminates Delivery Concerns

1. Eliminates nearly all concerns associated with live delivery outlined previously, except those specifically noted in the stockyard delivery section that would still apply such as the retender fee discussion.

   Rather than rehash through all of those issues here again, we simply state that eliminating live delivery makes concerns with delivery capacity, grading and graders, animal handling stress disappear, and reduces overall industry transportation costs and animal shrink. Do not take this lightly. Collectively, this is a huge advantage of carcass only delivery. We simply do not take space here to repeat what has already been clearly articulated previously in this report.

Simplifies Delivery

2. This would greatly simplify delivery and CME Rules.
   Eliminating live delivery would essentially cut CME Group delivery specifications documentation in half. This would make it easier for all participants to understand delivery and the rules of delivery would not have multiple alternatives that are not fully aligned perfectly with each other.

Takes Away Dependence on Stockyards and USDA AMS graders

3. In carcass deliveries, meat grades employed at that plant grade the carcasses. These people are already at the plant and do this every day. These graders will be there. Likewise, plants are already operating and already harvesting live cattle. It would no longer be necessary to assume that stockyards and USDA AMS market reporters will continue to participate in deliveries. We have no information to suggest that these entities will stop facilitating deliveries but point out that they are under no obligation to do so.

WEAKNESSES

Reduces Options of Long

1. Reduces optionality of the long accepting delivery.

   Longs value the option of being able to accept live deliveries to provide them the option of then selling cattle directly to a packer or placing cattle back on feed before selling the cattle to a packer. Removing this option will reduce incentives for longs to remain in the contract into the delivery month.

Requires Packers to be Involved Directly in every Delivery

2. Eliminating the live delivery option, results in dependence upon packers to be directly involved in every delivery.

   Of course, packers are now indirectly involved in live delivery in that they eventually purchase cattle delivered by shorts from receiving longs for slaughter. However, that purchase is much like any other cash transaction in that the purchase is similar to any other purchase as far as the packer is concerned. Under carcass only delivery packers would be directly involved meaning every delivery would be only carcass delivery in which packers must agree to comply with CME delivery guidelines.

   On one side, this might be a benefit that packers would be involved in every delivery directly and as such they would become more familiar with the overall process and it would over time become routine for them. With less than half of deliveries over the last 10 years having been carcass deliveries and deliveries themselves having not represented a large volume of cattle, especially the last 2-3 years, carcass delivery to plants by short hedgers is a rarity that takes brining everyone in the plant involved quickly up to speed when such a CME contract delivery occurs. Having more regular CME contract deliveries would increase plant familiarity with the process. This might reduce the nuisance factor of a CME contract carcass delivery to a packer.

   On the other side, nothing requires packers to accept or bid on CME carcass deliveries, whether this was the only delivery method or not. Also, given the highly concentrated packing sector, discussed previously in this report, if carcass delivery were the only option and some packers or some plants were not interested in participating, this could significantly adversely impact the competitiveness of carcass delivery bidding by packers. If this occurred, no long would stay in the contract to accept delivery – longs would largely exit the contract prior expiration and this dis-incentivizes longs to even participate as a long in the contract. We discuss this later in more detail with documents below, but also realize that in some market regions, including those with approved carcass delivery plants, cash negotiated fed cattle trade does not happen daily. As such, on days no cash trade occurs, it is likely going to be more difficult to obtain a base purchase bid price on the delivered load.

FEEDYARD DELIVERY ALTERNATIVE SYSTEM

In this section we assess an option to have a feedyard delivery system. We will briefly define the system we are referring to here as a Feedyard Delivery. Our intent is not to design in detail a feedlot delivery system here and it is certainly well beyond the scope of this project to write a set of prospective rules and guidelines for a feedlot delivery option. We will simply layout a few key items we explore in a feedlot delivery alternative. However, in that vein, the specifications of a feedlot delivery system would obviously have heavy influence on its potential impacts and feasibility.

First, feedlots would need to be certified as delivery points by CME. Not every feedlot would qualify as a delivery location. The feedlot would need to meet certain specifications that would include proximity to packing plants, having available commercial individual animal scales, being accessible by USDA graders, and being capable of reliably sealing pens of cattle destined for delivery. No doubt other conditions would also be present to be an eligible delivery feedyard but this minimum set offers a starting point.

Second, in our discussions with feedyards, most indicated they were simply not at all interested in being certified as a delivery location if it entailed being required to accept and handle futures deliveries from other feeders. That is, feedlots we visited with generally considered it infeasible to manage accepting cattle delivered to their yard for another short hedger making delivery (the feedlots were not interested in performing the role stockyards do currently in live delivery by short hedgers). If this option were to be considered as part of any feedlot delivery alternative, much more work needs to be done understanding the ramifications of having such an option. At this point, it appears to us to be a nonacceptable option to many, if not most, feedyards. But, we only did a limited sampling in our interviews and not a complete survey so please keep this claim in mind. To complete a comprehensive survey of this issue exceeds the time and resources of this study.

Third, in our discussions with industry participants regarding feedlot delivery the sentiment was generally that feedyards did not want to have to deal directly with the long accepting delivery. If delivery to a feedyard was established so the long had to pick up the cattle from the feedyard within some very short time period, say 24-48 hours, this would appear to allay some of this concern. Many feedyards told us without this clause, they would simply not participate in such an option. Again, we must disclaim here that we did not do a full industry survey of this issue, but it was a rather strongly held sentiment from those we did visit with. We concur that without this clause in place, we do not believe feedlot delivery would be feasible as it opens up an enormous set of challenges around feedyards having to deal with suddenly feeding customers that would include longs who accepted delivery and who would now have cattle on feed on a custom basis at the delivery feedyard.

Given these conditions we consider here broadly a feedyard delivery where the feedyard simply defines a pen or pens of cattle as being delivered to fulfill a short-hedged position. The cattle

remain in the yard for up to 24 or 48 hours following the assignment of the delivery to a long. The assigned long must line up transportation of the cattle from the feedyard and pick the cattle up within the determined time window. The cattle would be sealed in a pen or pens until picked up by the long. The cattle would be graded in the same way as they are now at stockyards by a USDA AMS market reporter who does the grading and accepts or rejects cattle. This is the broadly defined feedyard delivery system we evaluate here.

As we consider hybrid systems and associated strengths and weaknesses here of adding a feedyard delivery option pragmatically there are four new combinations that strengths and weaknesses could be assessed, 1) adding feedlot delivery to current options of live stockyard and carcass delivery, 2) adding feedyard delivery and dropping live stockyard delivery but maintaining carcass delivery, 3) adding feedyard delivery and dropping carcass delivery but maintaining live stockyard delivery, 4) adding feedyard delivery and dropping live stockyard and carcass delivery. We will address all four possible combinations for completeness, but we realize some of that will result in considerable potential repetitiveness so we only highlight incremental differences with each. Also, we emphasize that strengths and weaknesses we highlight are conditional on detailed specifications that might be developed in a feedyard delivery system. If specifications deviate from our underlying assumptions, our identified strengths and weaknesses are subject to change.

ADDING FEEDYARD TO CURRENT LIVE STOCKYARD AND CARCASS DELIVERY SYSTEM

In this section we assess strengths and weaknesses of adding a feedyard delivery system to existing live stockyard and carcass option delivery. These strengths and weaknesses discussed here are conditional on the feedyard delivery system defined above and on current specifications in stockyard and carcass delivery being what they are largely today. In addition, we focus on incremental strengths and weaknesses rather than going back through those already addressed previously in stockyard and carcass delivery discussion.

INCREMENTAL STRENGTHS

Reduced Cost for Feedyard that Tenders Delivery in Own Yard

1. Feedlot delivery offers feedyards another delivery option that reduces their costs of making delivery to a stockyard or plant in the case of a long-demanded carcass delivery.

Reduced Animal Handling Stress Relative to Stockyard Delivery

2. Feedyard delivery results in less stress and animal handling relative to the live stockyard delivery option but does not impact animal handling relative to a carcass delivery. That is, under feedyard delivery cattle are obviously not delivered to a stockyard. Instead, assuming the assigned long was selling the cattle direct to a packer, the cattle would go from the feedyard to the plant much like current cattle trade in the market and much like carcass delivered cattle.

Closely Mimics Cash Market Cattle Trade

3. Feedyard delivery would be very similar to current live FOB trade.

Increases Opportunity for Convergence through Delivery

4. At the margin, reducing the costs of delivery for feedyards that would be certified to deliver would increase overall deliveries when market conditions favor delivery. This would create an opportunity to increase convergence of futures to cash price.

Cattle could Remain on Feed Post Delivery Assignment

5. If the feedyard were the delivery point, cattle could remain on feed after delivery is tendered and assigned if the long and short agreed to this. The value of this for the long is the cattle are not put through the challenge of trying to get them back on feed after being taken off feed in a stockyard delivery. CME guidelines have a clause that enable delivering short and assigned long to remove the transaction from CME guidelines and essentially manage it themselves. This clause may not be widely known, but it is in place (See CME Rulebook Chapter 7, 771, “Alternative Notice of Intention to Deliver” for details). This may be a place to execute such an exception. However, we doubt this option would be used very often as it requires a strong relationship and trust between the delivering short and assigned long.

Feedyard Delivery Better Enables Assigned Long to Feed Cattle Further

6. Having feedlot delivery enables a long that wants to feed the cattle longer to transfer the cattle to another feeding facility, if they cannot feed them at the delivering feedyard, without the cattle being off feed as long as if they were presented at a stockyard facility. This makes putting the cattle back on feed easier with lower cost potentially making the contract more attractive for the long.

INCREMENTAL WEAKNESSES AND RECOMMENDATIONS

A Feedyard is not Considered a Neutral Site

1. Delivery at feedyards is not considered a neutral delivery location as are stockyards and packing plants. This is very important and must be addressed before feedyard delivery could be adopted.

   Recommendation: We heard this concern about feedyard delivery not being a neutral site several times from both shorts and longs in the live cattle market. This is simply unacceptable to several longs we visited with as they were concerned about potential game playing that could occur. Those we visited with were highly skeptical of this option to the point some said they would no longer participate as a long in the market with this option added to the contract. This is based on our interviews and doing a comprehensive survey of potential longs in the live cattle futures market was beyond the scope of this study. We are summarizing here what we heard, but it was consistently and it was rather strongly held, so take that for what it is worth. Addressing this concern will be essential if the industry elects to move forward with adding feedyard delivery. We recommend you start by having dialogue with longs that take delivery to hear their concerns and see how you could best address them. Our concern is they may not be highly receptive of this alternative unless you offer them some clear and tangible benefits to support this.

   CFTC made it especially clear that feedyard delivery would need very detailed documentation to not enable manipulation. CFTC would heavily scrutinize any feedyard delivery proposal and associated documentation we expect could become burdensome for certified feedyards. Please note, we are <u>not</u> representing CFTC here, but simply stating <u>our interpretation</u> of what we would expect the burden would be on a feedyard becoming certified if feedyard delivery were adopted.

Increases Complexity in Already Complex Delivery System

2. Adding feedyard delivery to existing delivery options would increase complexity of delivery specifications even more than the current system.

   Recommendation: We have no recommendation here if feedyard delivery is added to existing options this seems like a given reality that would simply need to be recognized.

Increases the Need for Regulation

3. Many issues will require ongoing policing by CME or some other regulatory group. A few of these include reliably sealing pens, the long and short settling yardage costs for the time delivered cattle are at the yard, feedyards being up to date on requirements, and calibration of scales. Especially given the attitudes we encountered regarding the non-neutrality of feedyards as delivery points, these issues will require regulation. We are not sure who will absorb the cost of this activity or even who will perform it.

Increases Demands on USDA Market Reporter Graders

4. Feedyard delivery requires having USDA AMS graders (or some reputable third party) assess deliverability, grade cattle, and seal delivered pens of cattle at the delivery feedyard. USDA AMS indicated to us they are willing to accommodate this if requested, but it could quickly challenge their capacity to conduct grading with existing market reporting staff. Details of this constraint are discussed previously in this report and are not repeated here.

   Recommendation: If delivery became more common, this would stretch USDA AMS grading capacity under current conditions. It may be that considering hiring a grader dedicated to feedyard delivery would be worth considering. We did not assess this specifically as how such a grader might get paid and what they would do when no deliveries are being made is not apparent to us.

Feedyard Delivery would only be Available to Certified Feedyards

5. Feedyard delivery being an option only for certified feedyards creates an advantage for feedyards that can become certified to make delivery. In particular, it seems larger operations are more likely to meet certification standards. Many people we visited with saw feedyard delivery as excluding smaller operations. Arguably delivery to force convergence of cash and futures helps all short hedgers, so this might not be a major problem. However, we heard concern from some in our discussions that this would be a problem in gaining support for such an option.

   Recommendation: If feedyard delivery is pursued, demonstrating how those who are not able to access feedyard delivery would still benefit from increased convergence will be necessary to gain support. We are not sure of likelihood of success of such an effort, but it will be necessary our opinion and would take dedicated time to accomplish.

ADDING FEEDYARD DELIVERY, RETAINING CARCASS DELIVERY, AND DROPPING STOCKYARD DELIVERY SYSTEM

In this section we assess strengths and weaknesses of adding a feedyard delivery and retaining existing carcass delivery while dropping live stockyard delivery. This would imply two delivery alternatives of feedyard or plant. In such a delivery system, we presume here the long would still have the option of demanding carcass delivery instead of feedyard delivery which would be the default delivery. Again, we consider here incremental strengths and weaknesses relative to the current system of combined stockyard and carcass delivery option.

All strengths and weaknesses associated with adding feedyard delivery to the current system discussed previously still apply here as well with the few noted incremental adjustments presented here.

INCREMENTAL STRENGTHS

Maintains Delivery Complexity

1. Relative to simply adding feedyard delivery to current stockyard and carcass delivery system, adding feedyard delivery to replace stockyard delivery essentially keeps delivery complexity unchanged though a learning curve would be essential for such a large change.

Eliminates many Weaknesses of Stockyard Delivery

2. Many weaknesses of stockyard delivery previously discussed are eliminated with this option including costs of animal transportation and animal handling stress; constraints associated with stockyard delivery capacity; and cumbersome aspects of delivery.

Maintains Long Flexibility

3. Feedyard delivery without stockyard delivery does not change enabling long flexibility to put cattle back on feed. However, we heard strong sentiments from several feedyards that we visited with that keeping cattle on feed for an assigned long that they would normally not do business with is highly undesirable and for many unacceptable. So, the long would in all likelihood have to transport the cattle to another feedyard if the long wanted to continue to feed the cattle after delivery by a short hedger.

INCREMENTAL WEAKNESSES AND RECOMMENDATIONS

Short Hedgers that are not Certified Delivery Feedyard can only Deliver Carcass Basis

1. Assuming feedyard delivery only allows a feeder to deliver its own cattle at his own yard, short hedgers in uncertified feedyards that wanted to deliver cattle against their hedge would have no other option than to deliver on a carcass basis. This would require a complete modification to carcass delivery as being an option of the long as it would become the only option for feedyards that are not certified for delivery. All the weaknesses of carcass delivery without feedyard delivery described previously would

now apply, but they would only apply to cattle delivered from feedyards that are not certified delivery points and whose only option to deliver was carcass. We do not see how this option would be feasible, given that now the short trying to make delivery from a non-certified feedyard would need to find the packer buyer willing to purchase the cattle and agreeable to the long.

Recommendation: The only way feedyard delivery, without live stockyard delivery options for a short hedger will work will require a substantial overhaul to how delivery occurs, especially for non-certified feedyards. We do not have a viable fix for this weakness and we believe it likely renders it infeasible.

ADDING FEEDYARD DELIVERY, RETAINING STOCKYARD DELIVERY, AND DROPPING CARCASS DELIVERY SYSTEM

In this section we assess strengths and weaknesses of adding a feedyard delivery and retaining existing live stockyard delivery while dropping carcass delivery. This would imply two delivery alternatives: feedyard or stockyard. In such a delivery system, we presume the long would not have the option of demanding feedyard or stockyard delivery but the short would have the option of these two. Again, we consider here incremental strengths and weaknesses relative to the current system of combined stockyard and carcass delivery option.

All strengths and weaknesses associated with adding feedyard delivery to the current system discussed previously still apply here as well with the few noted incremental adjustments presented here.

INCREMENTAL STRENGTHS

Maintains Delivery Complexity

1. Relative to simply adding feedyard delivery to current stockyard and carcass delivery system, adding feedyard delivery and dropping carcass delivery essentially keeps delivery complexity unchanged though a learning curve would be essential for such a large change.

Eliminates many Weaknesses of Carcass Delivery

2. Many weaknesses of the carcass delivery option previously discussed are eliminated with this option.

Short Hedgers not Certified as Delivery Feedyards can Deliver to Stockyards

3. If feedyard delivery were developed, it would be essential in our opinion to have stockyard delivery available for non-certified feedyards. Without this, we do not believe this option would be feasible.

INCREMENTAL WEAKNESS AND RECOMMENDATION

Further Stretches USDA AMS Graders

1. If all deliveries were either feedyard or stockyard, and none were carcass, this would mean all deliveries made by short hedgers would need to be graded either by a USDA AMS or other not yet identified grader. If about half of deliveries have been on a carcass basis, you would essentially be doubling the current need for USDA AMS grader needs at minimum. Likely this option would more than double the needs because every certified feedyard is also now another delivery point and this would mean potentially needing graders at several feedyards in addition to stockyards during deliveries.

   Recommendation: Because of the added grader demands this option would entail, this would need to be addressed directly before this option were introduced. Notice, the grader demands with this option exceed those with simply adding feedyard delivery to

the existing delivery system because with the existing delivery system some of the burden of grading is only with federal meat graders at packing plants for carcass delivery and this option would remove them from the grading process. As such, if feedyard delivery were instituted, it might make sense to have the grading occur at the packing plant when the cattle are slaughtered, and thusly have this feedyard delivery option start to resemble more of a carcass delivery. However, to accomplish this would require that the long deliver the feedyard delivered cattle directly to a packer and take away their option to place the cattle back on feed. In this manner, the feedyard delivery option would be like a carcass option only dictated by the short and not the long. This is likely to face resistance from the long on this basis alone, but we expect stronger resistance from the long relative to the non-neutral delivery location of any feedyard delivery option will occur regardless.

ADDING FEEDYARD DELIVERY, DROPPING STOCKYARD AND CARCASS DELIVERY SYSTEM

In this section we assess strengths and weaknesses of adding a feedyard delivery and dropping both live stockyard and carcass delivery. This would imply one short hedger delivery method, that being feedyard delivery.

Again, we consider here incremental strengths and weaknesses relative to the current system of combined stockyard and carcass delivery option.

All strengths and weaknesses associated with adding feedyard delivery to the current system discussed previously still apply here as well with the few noted incremental adjustments presented here.

INCREMENTAL STRENGTHS

Reduces Complexity of Delivery

1. Reduces complexity relative to having two or three delivery mechanisms in place.

INCREMENTAL WEAKNESS

Limits Access to Delivery and Would Not Adequately Encourage Convergence

1. Having only feedyard delivery would greatly limit access to non-certified feedyards in the delivery process and as such would greatly reduce deliverable supply and would not enable convergence. We see little way around this. Some other form of delivery would need to complement feedyard delivery if it were to be launched to enable access to non-certified short hedgers to deliver.

CONCLUDING COMMENTS

Given the goal to maintain delivery as a way to settle live cattle futures, this study assessed strengths and weaknesses of alternative delivery structures and procedures. We offered numerous suggestions and recommendations to consider as alternatives and modifications to delivery are considered. Every alternative has tradeoffs and no single option clearly dominates all others in our mind, but some alternatives are not feasible.

There are several areas we noted where improvements can be made at the margin to encourage convergence, but which of these might be pursued and to what extent depend on the mixture of delivery methods that participants decide are most preferred given the tradeoffs. Weighing and prioritizing the tradeoffs is a committee decision and we leave that to those with vested interest. Given the range of vested interests and opinions, we recommend this group be broadly representative of affected parties to any contract design or changes made will likely meet with considerable resistance. We also suggest that future initiatives to alter contract specifications or delivery mechanisms take a careful approach to simplify, and not add complexity to, the existing structures. That said, opportunities to improve convergence of the contract through modifying existing contract specifications or delivery options appear to exist.

APPENDIX: LITERATURE REVIEW

This section provides a brief literature review of published research relevant specifically to the live cattle delivery discussion presented in this report. A wide breadth of topics could be included in such a literature review, but we focus here on those we felt were most germane to the specific questions related to this proposal. We also note that scattered throughout the report are additional references to those presented here that document specific points in the report.

We primarily reference here just published work. There are a host of working and position papers drafted having various degrees of scientific rigor that have been circulated from numerous sources over the years related to the live cattle futures delivery issue. Because of the variability in levels of rigor, at times confidentiality, and general lack of peer review generally characterizing these documents, we limit our review to published research.

Factors Affecting Delivery of Cattle on Futures

Abstract:

"Deliveries on the CME live cattle contract respond to the delivery month basis, discounts for yield grade 4 carcasses, and limited seasonal influences. Modification of the contract to tighten quality standards resulted in a decline in the response of deliveries to the yield grade 4 carcass discounts. The certificate delivery system appears to have had no significant effect on the total number of deliveries. Analysis of spatial combinations of delivery points suggests that markets east of the Mississippi River respond to different factors than the western markets."

Reference:

Hudson, MA, TA Hieronymus, and SR Koontz. "Deliveries on the CME Live Cattle Contract: An Economic Assessment." *North Central Journal of Agricultural Economics* 10, 2(1988):155-164.

Summary:

"Under the provisions of the live cattle futures contract, the decision on whether to deliver and on the location of delivery have always rested with the trader holding a short position. Packers have been the group most interested in participating in the market as long hedgers. Under the physical delivery system, the packer faced the possibility that cattle would be delivered at points some distance from their slaughter facilities. Cattle redelivered one or more time are not a desirable product, and the packers have been reluctant to risk being assigned delivery regardless of the location….A certificate system was eventually approved and became effective with the December 1983 live cattle contract."

Reference:

Purcell, WD and MA Hudson. "Delivery in Live Cattle: Conceptual Issues and Measures of Performance." *Journal of Futures Markets* 6, 3 (1986):461-475.

Basis Determinants

Abstract:

"Basis prediction errors for live cattle in the five major LMR reporting areas are analyzed to determine how shifts in the live cattle market and contemporaneous market conditions, including price momentum, impact ability to hedge. Results reveal that thinness of the negotiated market, weight of cattle marketed, and contemporaneous factors statistically impact basis prediction errors. Impacts vary across region. Volatility in cost of gain and delivery costs have greater effects on basis prediction error than do market trends. Results offer guidance for future research on ability of producers to use the CME Live Cattle contract to hedge."

Reference:

Coffey, B, G Tonsor, T Schroeder. "Impacts of Market Changes and Price Momentum on Hedging Live Cattle." *Journal of Agricultural and Resource Economics* 43 (2018): in press.

Abstract:

"Unanticipated basis changes can reduce the ability of futures markets to transfer risk and can affect income levels of producers and market participants. This study examines short-term basis risk, defined as the variance of the random component of the basis over time, for several Midwest livestock markets. Basis risk is related to several factors influencing the long-term pattern in the time series and unexpected changes in price. Little evidence is found that basis risk changed as maturity approached or that risk varied across markets except for the Interior Iowa hog market."

Reference:

Garcia, P, R.M. Leuthold, and M.E. Sarhan. 1984. "Basis Risk: Measurement and Analysis of Basis Fluctuations for Selected Livestock Markets." *American Journal of Agricultural Economics*. 66, 4 (1984):499-504.

Summary:

"In-sample tests show that the lagged spread and lagged basis both have considerable ability to explain movements in nearby live cattle basis. The lagged spread may be more generally applicable because, unlike the lagged basis, it is not tied to a specific geographic location. Non-nested hypothesis tests suggest a joint model which contains both variables has greater explanatory power than models without both variables. Thus, lagged spread and lagged basis each contain unique information."

Reference:

Liu, S.M., B.W. Brorsen, C.M. Oellermann, and P.L. Farris. 1994. "Forecasting the Nearby Basis of Live Cattle." *The Journal of Futures Markets*. 14(3):259.

Abstract:
"Empirical analysis examines the presence of basis risk, speculative component, and expected maturity basis component in basis relationships for nonstorable commodities. The results indicate that all three above components exist in both cattle and hog markets. The basis risk and speculative components vary across contracts. Hog markets showed seasonality, which helps explain the hog basis more accurately. Flexibility in making the marketing decision strengthens the explanation of intertemporal price relationships for both cattle and hogs beyond that previously attributed to only feed prices."
Reference:
Naik, G. and R.M. Leuthold. 1988. "Cash and Futures Price Relationships for Nonstorable Commodities: An Empirical Analysis Using a General Theory." *Western Journal of Agricultural Economics*. 13(2):327-338.

Abstract:
"The purpose of this study was to assess the basis behavior of the Live Cattle Futures contract at the Chicago Mercantile Exchange (CME) before and after the 1995 contract changes. Additionally, an alternative method of basis calculation utilizing weighted mean futures prices versus settlement futures prices was compared to determine which method provides a better representation of the basis level. Within a regression model with heteroskedasticity error framework, we found that the level of nearby basis in the period after June 1995 has shifted lower and the average monthly open interest of net commercial long positions has substantially increased after the contract modifications. These empirical results are consistent with the notion that more long activity entered the market in response to the contract modifications. Additionally, an alternative (new) measure of basis calculation (cash price minus weighted mean futures price) produced similar results to two other commonly used measures. In conclusion, the 1995 contract changes have neither increased nor decreased the volatility of live cattle basis."
Reference:
Newsome, J.E., G.H.K. Wang, M.E. Boyd, and M.J. Fuller. 2004. "Contract Modifications and the Basis Behavior of Live Cattle Futures." *Journal of Futures Markets*. 24(6):557-590.

Abstract:
"Cattle producers and beef packers need to understand basis determinants as they develop price expectations and make pricing, hedging, and forward contracting decisions. This study empirically estimated factors explaining variability in monthly fed cattle basis. The five main results regarding live cattle basis are 1) corn price is an important determinant, 2) a change in the value of the Choice-to-Select spread positively affects basis, 3) changes in the levels of captive supplies have no significant statistical or economic impact on basis, 4) the June 1995 live cattle futures contract did not impact basis, and 5) both market fundamentals and seasonal components are important basis determinants."
Reference:
Parcell, J.L., T.C. Schroeder, and K.C. Dhuyvetter. 2000. "Factors Affecting Live Cattle Basis." *Journal of Agricultural and Applied Economics*, 32(3): 531-541.

Abstract:
"Successful risk management strategies for agribusiness firms based on futures and options contracts are contingent on their ability to accurately forecast basis. This research addresses three primary questions as they relate to basis forecasting accuracy: (a) What is the impact of adopting a time-to-expiration approach, as compared to the more common calendar-date approach? (b) What is the optimal number of years to include in calculations when forecasting livestock basis using historical averages? and (c) What is the effect of incorporating current basis information into a historical-average-based forecast? Results indicate that use of the time-to-expiration approach has little impact on forecast accuracy compared to using a simple calendar approach, but forecast accuracy is improved by incorporating at least a portion of current basis information into basis forecasts."
Reference:
Tonsor, G.T., K.C. Dhuyvetter, and J.R. Mintert. 2004. "Improving Cattle Basis Forecasting." *Journal of Agricultural and Resource Economics*. 29(2):228-241.

Abstract:
"The futures-cash price spread for live beef cattle is hypothesized as reflecting the expected change in cash price over time, caused by shifts in supply. An empirical test supports this hypothesis for all basis except the nearby. Important supply variables for explaining the cattle basis are slaughter, cattle on feed, prices of corn, feeder steers, and fat cattle, and seasonal shift variables."
Reference:
Leuthold, RM. "Analysis of the Futures-Cash Price Basis for Live Beef Cattle." *North Central Journal of Agricultural Economics* 1, 1 (1979):47-52.

Impacts of Non-par Delivery Points

Abstract:

"With variable intermarket price relationships between Omaha and the outlying market areas, the use of a single adjustment factor for non-par delivery points will not significantly improve hedging opportunities. Using the Guymon (Oklahoma) point to illustrate, the need for more sophisticated adjustment procedures or consideration of separate contracts is demonstrated."

Reference:

Crow, JR, JB Riley, and WD Purcell. "Economic Implications of Nonpar Delivery Points for the Live Cattle Futures Contract." *American Journal of Agricultural Economics* 54, 1 (1972):111-115.

Industry Analysis of Delivery Points

Summary: Report prepared for CME Group to analyze the $1.50/cwt discount at the Worthing, SD delivery point. Though the specific purpose was to evaluate the Worthing discount, the report also summarized live cattle pricing and price differences across regions. Also of interest is the summary of deliveries from 2009 to 2015 and discussions around regional basis.

Reference:

Informa Economics. 2016. "Regional Cattle Price Differences and Their Impact on CME Live Cattle Delivery Points." Report prepared for CME Group, June 2016.

Animal Stress, Shrink, and Meat Quality Impacts from Added Transport and Handling

Summary:

There is a vast literature addressing the issues related to how transportation and handling of cattle influences animal stress and how this stress affects meat quality after slaughter. General conclusions are that animal handling and transport increases animal stress and added animal stress (physical as well as environmental) can adversely impact meat quality post slaughter. Rather than reviewing details of this vast literature we refer to key papers and books in the area and especially note this topic is the focus of the entire career of noted scientists, perhaps among the most noteworthy, Dr. Temple Grandin, Professor of Livestock Handling and Behavior, Colorado State University. We recommend if this is an area where more comprehensive information is desired, Dr. Grandin would be an ideal contact to launch such an effort.

Noteworthy References:

Ferguson, DM and RD Warner. "Have we underestimated the impact of pre-slaughter stress on meat quality in ruminants?" *Meat Science* 80, 1 (2008):12-19.

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