

The U.S. Beef Supply Chain: Issues and Challenges

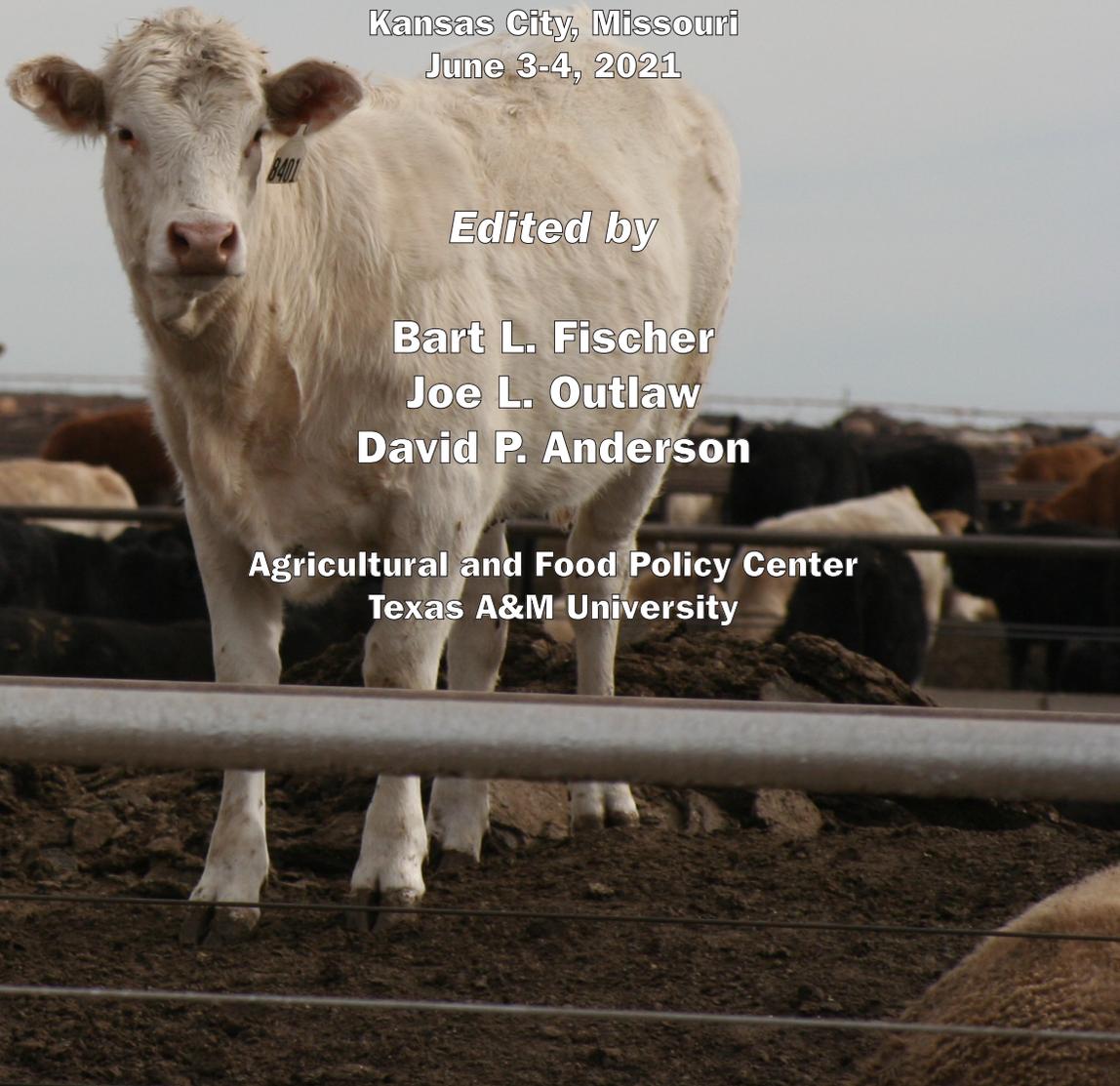
Proceedings of a Workshop on Cattle Markets

Kansas City, Missouri
June 3-4, 2021

Edited by

**Bart L. Fischer
Joe L. Outlaw
David P. Anderson**

**Agricultural and Food Policy Center
Texas A&M University**



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Introduction

Bart L. Fischer and Joe L. Outlaw¹

On the evening of August 9, 2019, a fire swept through the nation's second-largest beef packing plant in Holcomb, Kansas, taking it offline for four months. A few months later, the COVID-19 pandemic struck, halting production at many of the nation's packing plants and significantly disrupting beef supply chains. While these were significantly different events, the economic impacts were much the same: processing disruptions (coupled with a rapid change in retail demand in the case of COVID-19 as consumers shifted to eating at home and away from restaurants) sent wholesale and retail prices sharply higher. In contrast, disruptions in the processing sector resulted in less demand for fed cattle, which put downward pressure on fed and feeder cattle prices.

While economists offer explanations rooted in fundamental supply and demand relationships, many others view these events as evidence that the system is broken, particularly as it relates to fed cattle pricing. These events have led to renewed concerns about packer concentration, lack of transparency in fed cattle pricing, and insufficient packing capacity. These same events have also resulted in a litany of legislative proposals as policymakers have sought to respond to the concerns of their constituents.

While some of these issues are relatively new, many have been around for a very long time. For example, as long as ranchers have been raising cattle in the United States, there have been concerns about competition in the packing sector. In fact, as we write this, the *Packers and Stockyards Act*, which was designed "to assure fair competition and fair trade practices, to safeguard farmers and ranchers...to protect consumers...and to protect members of the livestock, meat, and poultry industries from unfair, deceptive, unjustly discriminatory and monopolistic practices..." turned 100 years old. While competition is a near-constant concern of many in the industry, it is an issue that has been thoroughly studied. As such, it is addressed in this volume for context, but the primary work on concentration is being done by others who focus more on enforcement – for example, the U.S. Department of Justice.

Following passage of the *Agricultural Marketing Act of 1946*, USDA's Agricultural Marketing Service (USDA-AMS) began collecting livestock pricing information from meat packers on a voluntary basis. Following concentration in the packing sector and an expansion of the use of alternative marketing arrangements (AMAs) beyond the traditional negotiated (or cash) sales, Congress passed

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The Honorable Sonny Perdue
Secretary of Agriculture
U.S. Department of Agriculture
1400 Independence Ave. SW
Washington, DC 20250

Dear Secretary Perdue:

As you are aware, the U.S. beef sector has experienced unprecedented stress due to the COVID-19 pandemic. Labor disruptions in the meatpacking industry have resulted in fluctuating cattle and beef prices. At the same time that some industry segments have experienced meat shortages, others have experienced high prices at the consumer level and demand disruptions at the restaurant level. Meanwhile, prices received by ranchers have declined. This situation has led to questions arising regarding the vulnerability of the beef supply chain and the level of concentration in the industry.

Under the authority granted in 7 U.S.C. 3155, the Secretary can utilize policy research centers to conduct research and education activities. In light of these recent and ongoing events, we are writing to request that the Office of the Chief Economist engage the policy research centers to address the following:

- Current issues and trends in cattle markets, including structure of the industry, price discovery and methods to address deficiencies, price reporting, purchasing mandates, and barriers to entry in the packing sector. As appropriate, the policy research centers could commission work from national experts and initiate regional/national workshops.
- Beyond addressing the general topics above, we also request that the policy research centers provide an in-depth description of today's beef packing sector. This research would address a series of questions:
 - How did the sector get to its current structure and what are its advantages and disadvantages for producers as well as consumers?
 - Is the current capacity sufficient for the industry to thrive and grow?
 - What are the impediments to expansion for both new and existing firms of varied sizes?
 - Are there policy options to expand capacity or increase price discovery regionally or nationally, and would those options address current concentration and supply chain vulnerability concerns?
 - What common success factors for small to medium packing plants, including producer-owned processing can be documented, and is there a set of generalizable strategies for success?

agriculture.house.gov

the *Livestock Mandatory Reporting Act of 1999* (LMR) which went into effect in April 2001. With respect to cattle, the act required price reporting for live cattle and boxed beef.

Growth in the use of AMAs has led to less use of negotiated cash pricing. Fewer cattle traded in a negotiated cash framework has led to worries about price discovery. As many (or most) AMAs are based on negotiated trades happening in the market, some argue that the lack of negotiated trades would result in a lack of adequate price discovery, affecting all cattle prices. The assumption of many is that more discovery (i.e. negotiated trades) would lead to higher producer prices. That assumption is not necessarily true.

We would request that the policy research centers engage other experts from across the country, including critical private industry members and industry associations, to ensure this research has appropriate regional representation.

We also request that the policy centers provide quarterly briefings for the Committee staff to provide timely updates on findings and progress.

From a legislative perspective, we see this as an opportunity to fully examine and bolster the beef sector, ameliorating current concerns and ensuring food security for America's future.

Sincerely,



Collin C. Peterson
Chairman



K. Michael Conaway
Ranking Member

With LMR set to expire on September 30, 2020, many saw an opportunity to address a number of lingering concerns with fed cattle pricing. Instead, Congress chose to extend LMR authority through September 30, 2021, and the bipartisan leadership of the Committee on Agriculture in the U.S. House of Representatives asked USDA to commission a study to look into the issues surrounding fed cattle pricing (see pages *vi-vii*). Ultimately, USDA partnered with the Agricultural and Food Policy Center (AFPC) at Texas A&M University, and this book is a culmination of that request.²

² The findings and conclusions in this book are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy. This research was supported in part by the U.S. Department of Agriculture, Office of the Chief Economist.

While this book focused primarily on fed cattle pricing, Congress also asked us to weigh in on packing capacity issues as well. In many ways, packing capacity and fed cattle pricing are inextricably linked. As a result, capacity is addressed in a number of places throughout the book. With that said, on July 9, 2021, the Biden Administration announced that it was investing \$500 million “to expand meat and poultry processing capacity” along with “\$150 million for existing small and very small processing facilities to help them weather COVID, compete in the marketplace and get the support they need to reach more customers.”³ As a result, some of the concern about packing capacity may dissipate as loans and grants are made available to bring additional capacity online.

In carrying out our work, we commissioned papers from noted experts around the country on a variety of topics, ranging from a history of how the industry arrived at this point to an initial evaluation of voluntary proposals introduced by industry to address some of these pressing challenges. AFPC hosted a workshop in Kansas City, MO, on June 3-4, 2021, where the authors of the respective papers presented their findings. Four discussants – representing a diverse cross-section of the industry – were invited to offer a formal response. The workshop was open to the public, and participants offered a number of helpful comments.

In Chapter 1, Derrell Peel provides a historical overview of how the cattle and beef markets have evolved over time. In Chapter 2, John Anderson, Andrew McKenzie, and James Mitchell distinguish between price discovery and price determination while addressing concerns about market thinness and undertaking an empirical evaluation of market efficiency. In Chapter 3, Christopher Bastian, Chian Jones Ritten, and Amy Nagler provide an overview of risks and agent incentives, and they tie those to fed cattle market implications. In Chapter 4, Ted Schroeder, Brian Coffey, and Glynn Tonsor closely examine the incentives and tradeoffs of marketing agreements and cash negotiated trade. In Chapter 5, Stephen Koontz revisits the RTI Livestock and Meat Marketing Study (LMMS) and uses those findings to provide an initial evaluation of various proposals to mandate minimum levels of negotiated (or cash) trade. In Chapter 6, Joshua Mables and Kenneth Burdine examine market reporting and transparency, with a particular focus on the role that contract libraries play in providing transparency. In Chapter 7, Scott Brown highlights lessons learned from other agricultural markets. In Chapter 8, David Anderson, Charley Martinez, and Justin Benavidez examine the implications of fed cattle pricing changes on the cow-calf sector. In Chapter 9, Justin Benavidez and David Anderson examine negotiated cash trade targets – specifically, the 75% Plan developed by the National Cattlemen’s Beef Association (NCBA). Finally, in Chapter 10, David Anderson provides a summary of the comments made by the discussants and participants at the workshop in Kansas City, MO. The box on pages *x-xi* provides a summary of the key findings from our work.

While we offer these findings – which can largely be characterized as urging caution before changing a system that has resulted in cattle producers capturing

³ <https://www.usda.gov/media/press-releases/2021/07/09/usda-announces-500-million-expand-ed-meat-poultry-processing>

significant value over the last three decades – we acknowledge the palpable frustration of many producers throughout the country. In many cases, their frustration seemingly stems from feeling like they aren't receiving the prices they think they should and the fact that economists often simply urge caution instead of offering finite answers. For example, as noted in the findings, economists are generally quite comfortable saying that price discovery is still quite robust, but we can't pinpoint the point at which that would cease to be the case. Unfortunately, we are limited to what we know, and that is what we've endeavored to outline in this book. Further, finite answers may not exist (and may never exist) because they are situation specific, and circumstances in the market are constantly changing.

With that said, if Congress and/or USDA wish to make even more informed decisions, then additional research is in order. While Congress could certainly revisit confidentiality requirements in the context of reauthorizing LMR – for example, making more data publicly available for analysis – there are legitimate reasons for making sure confidential business data is protected. On the other hand, USDA has collected enormous volumes of data via LMR over the last two decades, much of which has never been independently analyzed. As such, in lieu of relaxing confidentiality requirements, Congress may wish to consider requiring USDA to contract for additional analysis but in a manner that protects business-sensitive information. There are a number of analytical tools that could be brought to bear, but so far, independent analysis is limited to a small subset of data that is made publicly available. As John Anderson, one of our chapter authors, recently quipped:

Why do we keep studying the moon through binoculars when we have the Hubble Space Telescope sitting right there?

In the meantime, we would urge extreme caution in making changes to a system that has grown organically over time to reward high-quality beef production in a way that acknowledges regional differences throughout the country.

Finally, a housekeeping note: this book is admittedly very technical and assumes a working knowledge of the industry. Where possible, we've tried to define terms, but we undoubtedly missed some. Further, many of these chapters are looking at varying angles on a common issue – principally, fed cattle pricing. Consequently, there is overlap between various chapters. Rather than forcing the reader to constantly refer to earlier chapters (for similar charts and definitions in particular), they are left in place throughout the book.

Key Findings from AFPC's Evaluation of Cattle Markets

General

1. The beef cattle industry is one of the most – if not the most – complicated markets in agriculture, and stakeholders throughout the supply chain have a number of varied viewpoints.
2. Our capacity to answer questions is limited to the data that is collected, the timeframe over which it is collected, and the extent to which it is made publicly available.

Concentration

3. While not the central focus of the study, one can't discuss fed cattle pricing and capacity without acknowledging concerns over packer concentration. However, with respect to fed cattle pricing, research shows that alternative marketing arrangements (AMAs) do not create market power, because they do not change underlying supply and demand fundamentals.
4. While not necessarily a popular position, most economic research confirms that the benefits to cattle producers due to economies of size in packing largely offset the costs associated with any market power exerted by packers. Research indicates that there is market power, but its effect has been small.

Fed Cattle Pricing

5. Innovation via AMAs originated with feeders who were attempting to capture value associated with improved quality. There has been tremendous variability in the adoption of AMAs, with the Texas-Oklahoma-New Mexico region by far being the largest users of AMAs.
6. Reliance on formula pricing significantly reduced transaction costs associated with negotiation and induced predictability in the supply chain.
7. Among the cattle market economists consulted, there was general agreement that price discovery in fed cattle markets is still robust despite the fact that less than 30% of the transactions are negotiated (or cash).

Key Findings from AFPC's Evaluation of Cattle Markets

8. While some argue that imposing mandatory minimums on negotiated (or cash) transactions would improve price discovery in the fed cattle markets – accruing benefits to the cow/calf producer in the process – authors in this book argue it could have the opposite effect, potentially imposing huge costs that are passed down to cattle producers in the form of lower prices.
9. While the costs associated with imposing mandatory minimums could be huge, that is predicated on the statute being drafted in a way that is enforceable by USDA. The transaction types are so loosely defined that satisfying a mandate may simply be done by reporting a different transaction type – for example, even if the transaction was formula based, a buyer could make a phone call and subsequently report it as a “negotiation.” The rules of what constitutes a negotiation would have to be carefully defined for mandatory minimums to have the intended effect.
10. While the economists consulted argued that fed cattle price discovery was still robust, they also noted that additional transparency in general would be good because it could help build confidence in the market. They also noted that a contract library could be a good option (or at least wouldn't hurt).

Capacity

11. The experts consulted in this study repeatedly stressed the cyclical nature of the cattle business. While cattle supplies have outpaced available packing capacity, that will not always be the case. As a result, anyone who decides to build additional capacity must understand those market dynamics and be aware that packer margins can plummet with that cycle. The decline in packing capacity has occurred over several decades; it is not just a recent event.
12. As a result, expansion of small and regional packing capacity needs to be done in a way that is sustainable and economically viable. While the program is still being implemented, the funding recently made available by the Biden Administration may help meet that demand for additional capacity.

Contributors

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Acknowledgments

Bart L. Fischer and Joe L. Outlaw

This book is the product of a partnership between the Agricultural and Food Policy Center (AFPC) at Texas A&M University and the Office of the Chief Economist at the United States Department of Agriculture (USDA-OCE). The work originated from a request by the bipartisan leadership of the Committee on Agriculture in the U.S. House of Representatives during the 116th Congress.

The project was partly funded via a cooperative agreement with USDA-OCE. Seth Meyer, Chief Economist, and Callie McAdams, Senior Economist, managed the project within USDA. We thank them both for their support and insightful comments throughout the project. We also thank the bipartisan staff on the House Agriculture Committee for their help and feedback throughout the project.

The core of this project is a series of papers commissioned from experts across the country. The authors were exceptionally diligent in meeting very stringent deadlines and in presenting the results of their work at a workshop in Kansas City, MO, on June 3-4, 2021. They were joined by four discussants who offered a diversity of perspectives at the workshop, as did many others who simply came to attend. This topic attracts a lot of interest and a variety of opinions, and that was on full display at the workshop.

Finally, this book would not be possible were it not for the exceptional team at AFPC that is frequently called on to analyze a wide array of policy issues related to agriculture. Brian Herbst coordinated the project within AFPC. David Ernestes served as technical editor for the book and formatted the final product. Sandra Norman managed conference registration and travel. Allison Wilton provided an initial review of each chapter. Finally, this was an all-hands-on deck project, with each member of our team playing a role in making sure the project was successfully completed on time.

Chapter 1

How We Got Here: A Historical Perspective on Cattle and Beef Markets

Derrell S. Peel

Introduction

“The beef cattle industry is caught up in difficult times.

As economic pressures intensify, reactions tend to move away from the objective and toward the emotional. Calls for solutions are becoming more strident and many are taking the form of proposed legislative remedies. Increased regulation of how buyers and sellers do business, legislative or world court actions to stop imports of live cattle, laws to mandate the reporting of price information and terms of trade, country of origin labeling, and a host of other “solutions” to low prices and to producer-level losses are being proposed.

There is a danger in all this, and the biggest danger is not in the long history of, at best, mixed results in efforts by the government to legislate solutions to economic problems. The big danger is that all the attention on short-run and highly visible issues will block recognition of the problems that are long run and structural in nature and, in the process, prevent efforts to move to programs and policies that have a legitimate chance of helping.”

The quote above is an apt assessment of the current situation in the U.S. cattle and beef industry. However, the passage is not new; it was written by Dr. Wayne Purcell in 1999 (Purcell, 1999). The issues facing the beef cattle industry today are not new; indeed, they have changed little in the past 30 years, and some have roots that extend back over a century. It is perhaps reassuring that the industry has, for the most part, avoided embarking on policies targeting issues “that are more nearly peripheral in nature and often deal with the symptoms of economic problems rather than the causes” (Purcell, 1999). Mandatory Country of Origin

Labeling (mCOOL) is a notable exception to that, but the United States did back away from the detrimental policy. However, like many other issues, mCOOL has not gone away. Indeed, the emotions, anger and frustration accompanying recent events such as the Holcomb packing plant fire in 2019, the ongoing COVID-19 pandemic beginning in 2020, and the winter storm of February 2021 have fueled demands for an array of potential legislative actions that attempt to jump to a solution without addressing the complex structural and behavioral issues that brought the industry to the current situation. The risk is that these overly simplistic solutions will have long term detrimental impacts on cattle producers, the industry, and consumers, and jeopardize the ability of the industry to compete in dynamic global protein markets for a successful future.

The issues facing the beef cattle industry today are not new; indeed, they have changed little in the past 30 years, and some have roots that extend back over a century.

The risk is that these overly simplistic solutions will have long term detrimental impacts on cattle producers, the industry, and consumers, and jeopardize the ability of the industry to compete in dynamic global protein markets for a successful future.

The more pressing need, as identified by Dr. Purcell, is to understand and address issues “that would help the long run and structural issues that are prompting the price pressures” (Purcell, 1999). There is critical need to understand why the industry has evolved to have the structure that exists today and to function the way that it does. Individual firms and producers respond to the economic incentives that influence their actions. Collectively, these actions sometimes produce an industry structure and market outcomes that may not be desirable, in some respects, to the broader industry. If the industry desires to change or modify those outcomes, it is imperative that proposed solutions carefully evaluate new or changed incentives and the likelihood that desired outcomes are feasible or sustainable and, most critically, to understand potential unintended consequences and undesirable outcomes that may accompany proposed solutions.

The objective of this chapter is to provide a brief history of the beef cattle industry and a historical perspective on structural changes and the evolution of industry characteristics and practices that determine the current structure and status of the industry. Profound changes in the beef cattle industry began in the 1960s and 1970s with the introduction of boxed beef technology fundamentally changing beef merchandising, the arrival of European continental genetics, and the development of commercial cattle feeding in the Plains. Arguably the most profound changes occurred in the 1980s and 1990s with dramatic increases in packer concentration, growth in cattle feeding, increased beef grading and dramatic changes in beef marketing, development of value-based cattle marketing, growth in international beef and cattle trade, and growing captive supply con-

cerns. The 2000 to 2010 period saw recovery in beef demand from the late 1990s low, increasing use of alternative fed cattle marketing arrangements, dramatic growth in the ethanol industry leading to profound changes in crop agriculture and feed markets, and more development of branded and specialized beef markets. The period from 2010 to today has been characterized by several events – a historic drought in 2011 to 2013 resulting in unprecedented cattle prices in 2014 to 2015, reductions in packing capacity, the first significant cyclical expansion in cattle numbers in 25 years, unprecedented growth and expansion in global beef trade, and most recently, a barrage of black swan events since 2019 dominated by the COVID-19 pandemic.

The Most Complex Set of Markets Anywhere

It is reasonable to ask why the beef cattle industry should be plagued with so many contentious issues that have persisted for so long. Much of the reason is attributable to the fact that the U.S. cattle and beef industry may well be the most complex set of markets in existence. In its entirety, the cattle and beef industry represents an extraordinarily complicated set of cattle production and marketing activities which provide the source of a massive set of beef products marketed through a diverse set of final markets and all coordinated by a multitude of inter-related market transactions.

No single graphic can represent the tremendous complexity of the beef cattle industry, but Figure 1.1 provides a representation of some of the many factors

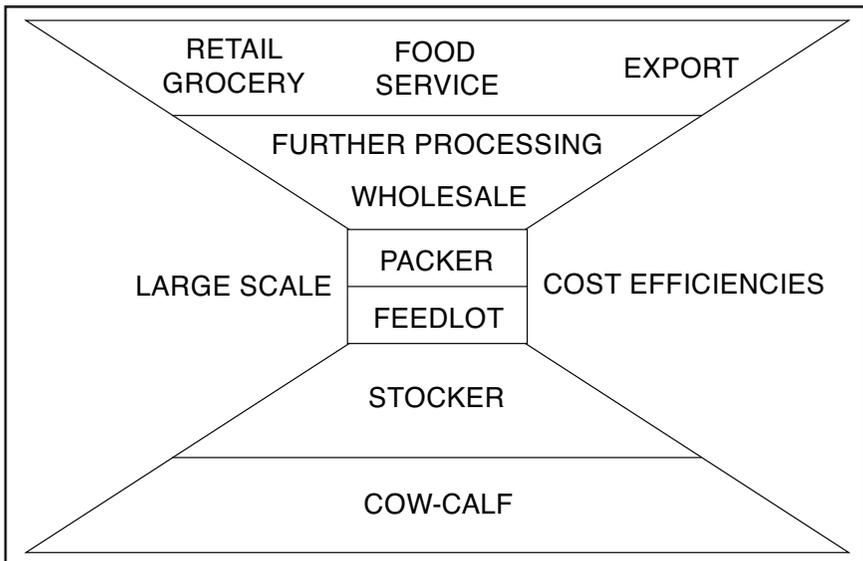


Figure 1.1. Beef Industry Structure.

that comprise the cattle and beef industry. Figure 1.1 shows that cattle originate in a dispersed and diverse cow-calf production sector, which are assembled and aggregated through multiple production and marketing activities before being marketed from a relatively concentrated feedlot sector into a highly concentrated packing sector. Many beef products originating from beef packers are transformed into thousands of different beef products by further processors and food distributors before being marketed through a diverse set of supply chains that support retail grocery, food service and export markets. The list of factors that contribute to the vast complexity of the cattle and beef industry includes:

It is reasonable to ask why the beef cattle industry should be plagued with so many contentious issues that have persisted for so long. Much of the reason is attributable to the fact that the U.S. cattle and beef industry may well be the most complex set of markets in existence.

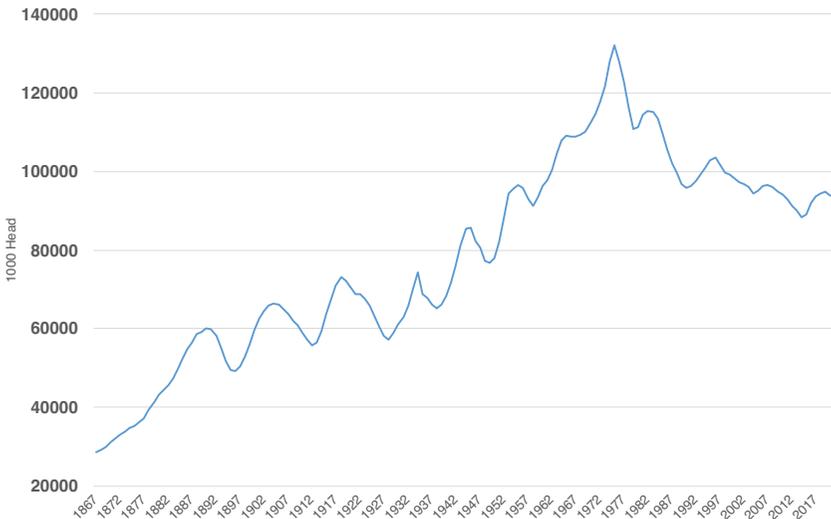
- Multiple distinct and separate production sectors (cow-calf, stocker, and feedlot),
- Geographically dispersed primary production with many small producers,
- Tendency for multi-year cycles of production/prices,
- Ruminant biology impacts, such as,
 - Long production lags,
 - Single offspring/interaction between breeding and production, and
 - Ability to use a wide variety of feed resources,
- Interaction between production and marketing due to
 - Variable production systems,
- Seasonality of the many production and product markets,
- Assembly of animals regionally into larger marketing groups,
- Joint production/disassembly of carcasses into a vast array of products,
- Product perishability,
- Multiple product marketing sectors,
- Many diverse final markets, and
- Dairy sector interaction with beef industry.

The complicated industry described above and illustrated in Figure 1.1 involve many different economic decision-makers and these factors all contribute to an intricate set of markets over time and space needed to provide a steady flow of perishable products. The difficulty for market participants at all levels to recognize and appreciate the enormous complexity of this massive set of markets and relationships is understandable.

A Brief Early History of the North American Cattle Industry

Christopher Columbus brought cattle to the New World on his second voyage in 1493. In 1521, Hernán Cortés brought cattle to present day Mexico. The same year, Ponce de León brought cattle to present day Florida, though it likely was subsequent introductions that established cattle in the southeast United States. Cattle proliferated in central Mexico and moved north in the 16th century following the mining industry. By the early 17th century, cattle reached the Rio Grande and moved into present-day Texas, brought by the Spanish missions established in the region. Through the 17th and 18th centuries, Spanish cattle, escaped from or released by the missions and perhaps reflecting a touch of oxen breeding, became established and evolved into the iconic Texas Longhorn, running wild over a huge territory in present-day Texas.

The cattle industry that we recognize today really began in the post-Civil War period as returning soldiers established or reclaimed ranches abandoned before the war. Burgeoning beef demand in population centers in the eastern United States led to the roundup of millions of Longhorn cattle and resulted in the signature cattle drives in the late 19th century. It was also during this period that one of the most salient characteristics of the cattle industry emerged...the cattle cycle. Figure 1.2 shows the inventory of cattle and calves since 1867 and the pronounced tendency of the industry to experience multi-year cycles of inventory expansion



Source: USDA-NASS, compiled by LMIC.

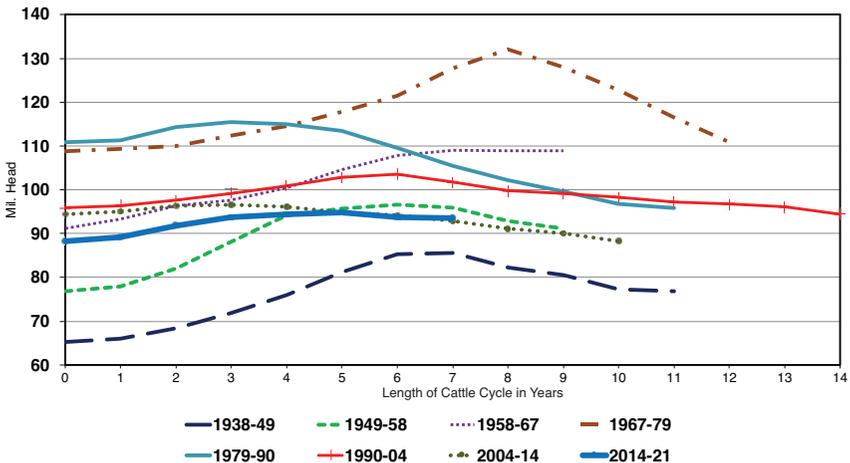
Figure 1.2. All Cattle and Calves, 1867 - 2021.

and liquidation. The cyclical tendency has persisted regardless of whether the industry was trending higher or lower in overall inventory and is still a characteristic feature of the industry today.

The era of open range and cattle drives was short lived as barbed wire fenced the range and westward expansion of railroads increased access to railheads. By the late 19th century, major stockyards developed next to packing companies in Chicago, Omaha, Kansas City, Fort Worth, and Oklahoma City. Cattle shipped to these terminal markets, mostly by rail, were traded by private treaty through stockyard commission companies. As the trucking industry developed, the influence of the railroads declined, and the role of the central stockyards declined. In the 1950s, packing companies began to relocate closer to cattle feeding and the large urban stockyards like Chicago, Kansas City, and Fort Worth declined and ultimately closed. Some of these terminal markets converted to auctions and continued as feeder cattle markets. The Oklahoma City stockyards, for example, changed to the auction format in 1961 and still conducts all sales through commission companies, a remnant of the terminal market structure. The St. Joseph stockyards recently announced that the auction would close in May 2021 after 134 years in business as stockyards and later an auction.

Inventory Trends and Cattle Cycles

Figure 1.2 highlights the long-term trends in the cattle industry. Cattle numbers grew, with cyclical variation, in a steady trend upwards to a sharp peak of 132 million head in 1975. After the peak, cattle numbers declined, with continued



Source: USDA-NASS, compiled by LMIC.

Figure 1.3. Total Cattle Inventory by Cycle, United States, January 1.

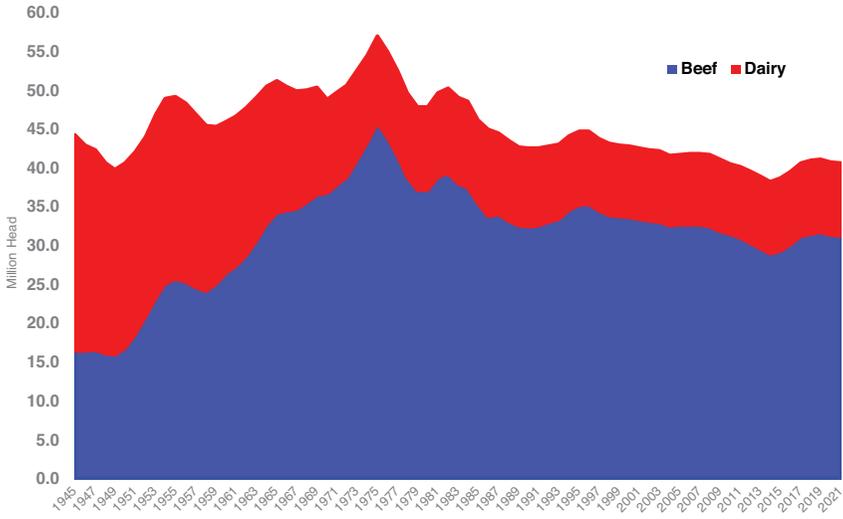
Table 1.1. Beef Cow Inventory, Top 15 States and United States, 1950, 1975 and 2021.

Rank	1950		1975		2021			
	State	1,000 Head	State	1,000 Head	State	1,000 Head	Percent of 1950	Percent of 1975
1	TX	3,302	TX	6,895	TX	4,685	141.9	67.9
2	NE	1,051	MO	2,759	OK	2,189	285.4	80.7
3	KS	928	OK	2,713	MO	2,035	342.6	73.8
4	SD	810	NE	2,374	NE	1,900	180.8	80.0
5	OK	767	SD	2,116	SD	1,799	222.1	85.0
6	MT	754	KS	1,978	KS	1,477	159.2	74.7
7	CA	622	IA	1,835	MT	1,419	188.2	83.9
8	NM	619	MT	1,692	KY	983	525.7	68.8
9	CO	615	FL	1,468	ND	975	293.7	78.5
10	MO	594	MS	1,458	FL	929	166.8	63.3
11	IA	588	KY	1,429	AR	925	451.2	73.5
12	FL	557	TN	1,349	TN	900	491.8	66.7
13	LA	475	AR	1,259	IA	890	151.4	48.5
14	WY	431	ND	1,242	WY	702	162.9	87.1
15	AZ	393	AL	1,238	AL	697	224.8	56.3
U.S.	---	16,743	---	45,712	---	31,158	186.1	68.2

cyclical variation, to under 110 million head a decade later in 1985, then to less than 103 million head by 1995; By 2005, cattle numbered 95 million head. In the past 10 years, all cattle and calves’ inventory has averaged 92.1 million head, ranging from a recent low of 88.2 million head in 2014 to a recent cyclical peak of 94.8 million head in 2019. The January 1, 2021, inventory total was 93.6 million head. The inventory cycles apparent in Figure 1.2, when plotted from low to low as repeating patterns in Figure 1.3, give rise to the so-called “Ten Year Cattle Cycle.” In spite of this title, the figure shows that the last seven complete cycles have ranged from 9 years to 14 years, with only one cycle (2004 to 2014) being exactly ten years in length.

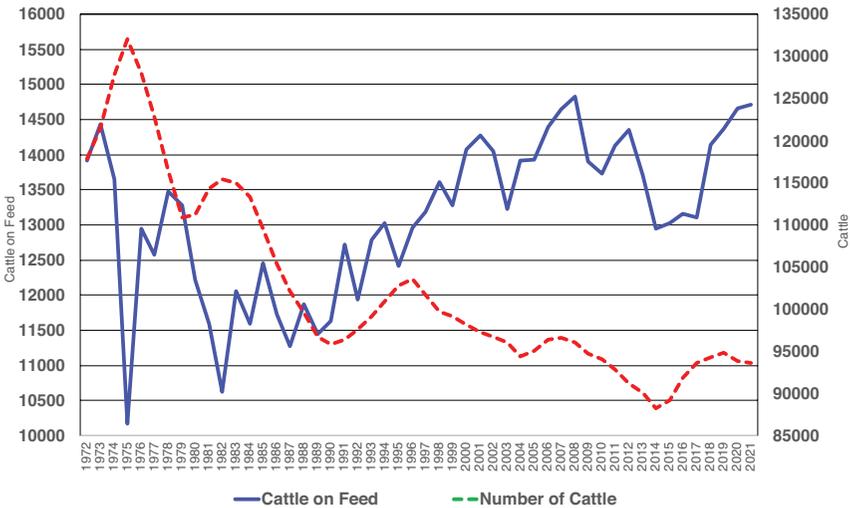
The U.S. cow herd, consisting of beef and dairy cows, is the source of calf production and thus the ultimate supply of cattle for the beef industry. Figure 1.4 shows the inventories of beef and dairy cows since 1945 and the changing roles of the two cattle sectors over time. Beef cows made up just 37 percent of the total cow numbers in 1945. Beef cow numbers grew rapidly and by the peak in 1975, beef cows represented a peak level of just over 80 percent of all cows. Beef cows have represented roughly 77 percent of the total cow inventory for the past 40 years with a recent low of 75.9 percent in 2014. On January 1, 2021, beef cows represented 76.7 percent of all cows.

Table 1.1 shows the fifteen largest beef cow states at various points in time and regional changes in cow-calf production over time. In 1950, the beef cattle industry was concentrated even more in the West than today. For example, Califor-



Source: USDA-NASS, compiled by LMIC.

Figure 1.4. United States Cow Inventory, 1945 - 2021.



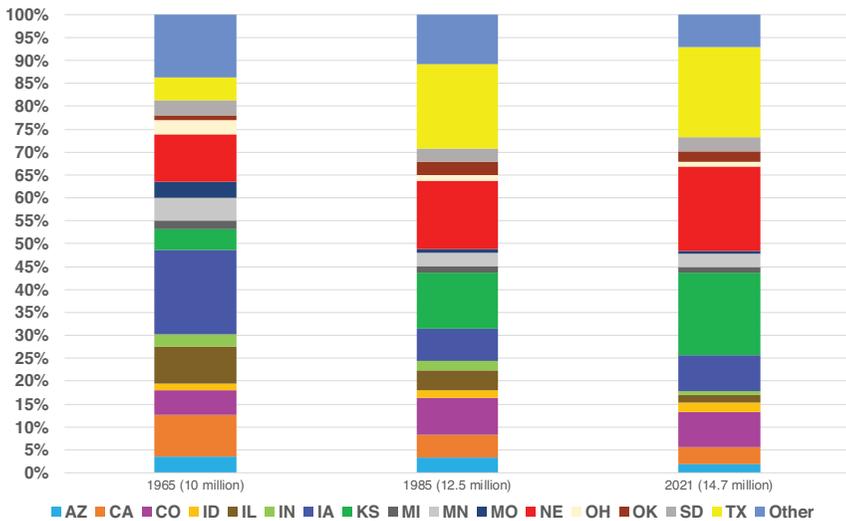
Source: USDA-NASS, compiled by LMIC.

Figure 1.5. Cattle on Feed and All Cattle and Calves Inventory, 1,000 head, January 1.

nia, Colorado, New Mexico, and Arizona were all in the top fifteen states in 1950, but fail to make the list currently. Table 1.1 shows that some states increased faster from 1950 to 1975, with some states having declined more from peak 1975 levels. Several states increased proportionately more than others over time. Most dramatic are the increases in beef cows since 1950 in Kentucky, Tennessee, and Arkansas, none of which made the list in 1950. North Dakota made the top fifteen by 1975 and increased to number nine currently. Several traditionally large beef cow states increased in rank from 1950 including Oklahoma and Missouri, while others remained highly ranked including Florida, Kansas, Montana, Nebraska and South Dakota. Iowa increased in rank from 1950 to 1975 then dropped significantly to 2021, at only 48.5 percent of the 1975 level.

Dairy Sector Impacts

The dairy industry operates under economic forces that drive milk production. While these are quite separate from the beef industry, the animals used in dairy production ultimately become part of the beef supply. Slaughtered animals include male dairy calves, culled dairy replacement heifers, and culled dairy cows. The dairy sector is generally more stable and not, for example, subject to the cyclical variation typical of the beef cattle industry. However, normal dairy industry dynamics can sometimes serve to compound and exaggerate beef industry dynamics and at other times offset and mute beef industry dynamics. On occasion,



Source: USDA-NASS, compiled by LMIC.

Figure 1.6. Cattle on Feed Share, Selected States, 1,000 head, January 1.

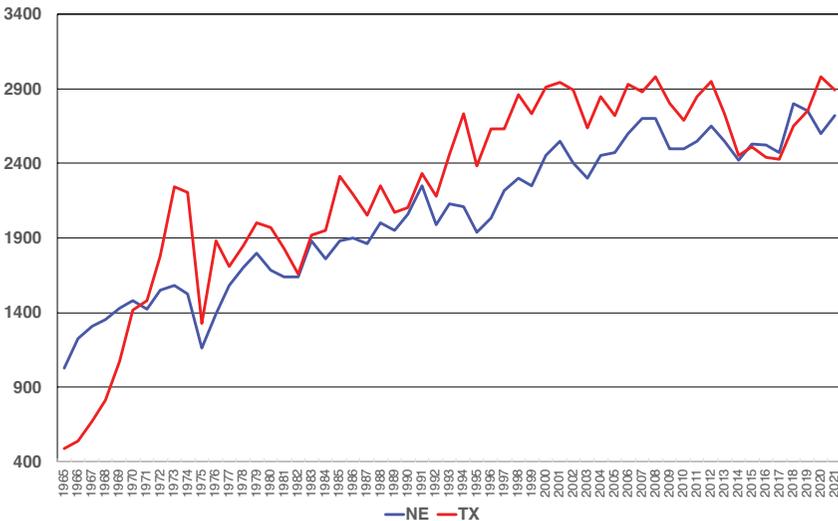
the dairy industry has been the source of dramatic shocks to cattle markets, most notably the infamous (from a beef perspective) dairy herd buyout in 1986. On average, the dairy sector contributes 15 to 20 percent of total beef supplies.

Dairy animals are discounted for their poorer productivity (gains, feed efficiency, etc.) as well as carcass yield and muscle conformation. Dairy steers are typically placed on feed at light weights and fed in feedlots for roughly a year. Because dairy genetics are very uniform, dairy steers finish very predictably and consistently produce high levels of Choice and Prime carcasses.

The previously described dairy production practices are changing rapidly at the current time. The availability of sexed semen is allowing the dairy industry to focus artificial insemination on the highest quality cows for producing replacement heifers while breeding the remaining cows (sometimes using semen sexed for male animals) to beef breeds to produce beef-dairy crossbred calves that will perform and be valued more closely to beef calves. The sharp distinction between beef and dairy calves in beef production will become much more blurry in the coming years.

Cattle Feeding

Cattle feeding developed rapidly in the post-World-War II period in the Corn Belt as farmer-feeders used cattle and hog feeding to market corn production. During this period, interest in carcass grading increased as consumer preferences for mar-



Source: USDA-NASS, compiled by LMIC.

Figure 1.7. Cattle on Feed Inventory, 1,000 head, January 1.

bled beef developed. After limited beginnings in the 1950s, large commercial feedlots developed in the Plains in the 1960s and cattle feeding expanded rapidly. The feedlot inventory was just under 10 million head in 1965, increased to 12.5 million head in 1985, and was 14.7 million head in 2021 (Figure 1.5). Figure 1.6 shows the shares of cattle on feed total by state and changes at these three points in time. The decrease in Midwest cattle feeding, including Iowa, Illinois, Indiana, and Ohio, is apparent in Figure 1.6. Just as obvious is the increase in cattle feeding in Texas, Kansas, Colorado, and additional growth in Nebraska. Cattle feeding in the Plains increased rapidly in the 1960s and early 70s with the development of irrigated crop agriculture that increased feedgrain supplies in the region and the use of steam flaked corn, which reduced the feed cost disadvantage of the plains compared to the Midwest. A smaller feed cost disadvantage combined with weather advantages to make the Plains region competitive with the Midwest. Figure 1.7 shows annual cattle on feed inventories for Texas and Nebraska (the two largest cattle feeding states since 1977). The figure shows the rapid rise of cattle on feed in Texas in the late 1960s, passing Nebraska in 1971. January 1 feedlot inventories in Texas exceeded Nebraska from 1971 to 2015.

Figure 1.5 shows that feedlot production has generally increased since the 1980s. This is despite declining cattle numbers, also shown in Figure 1.5. Figure 1.8 confirms that cattle on feed inventories have increased as a percent of total cattle inventories over the past 40+ years. Figure 1.9 shows cattle on feed inventories as a percent of calf crop, as a percent of estimated feeder supply, and as a percent of total steer and heifer slaughter, all of which have trended up since the



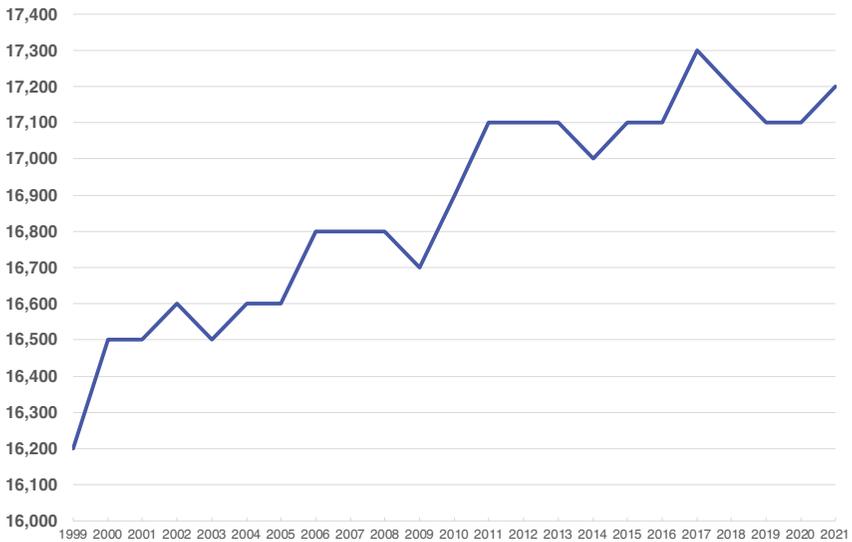
Source: Calculations by Peel from USDA-NASS data.

Figure 1.8. Cattle on Feed Inventory as Percent of All Cattle and Calves, January 1.



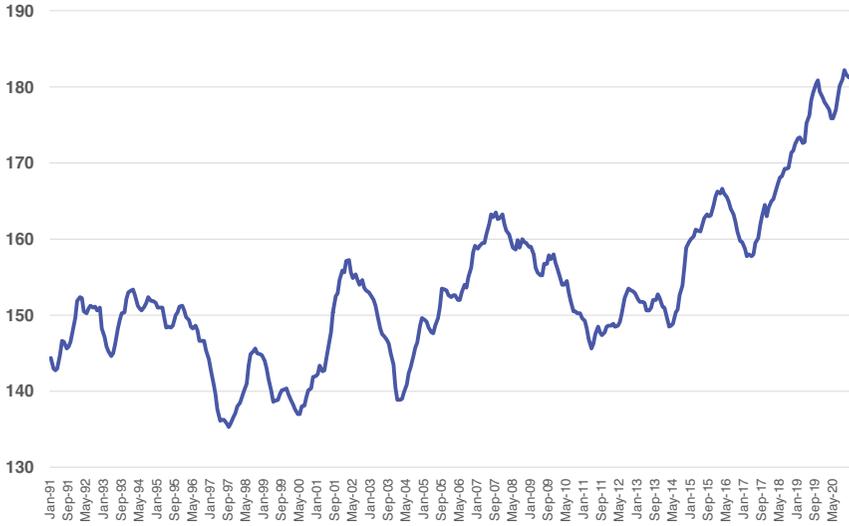
Source: Calculations by Peel from USDA-NASS data.

Figure 1.9. Cattle on Feed Inventory Increasing Relative to Industry, January 1.



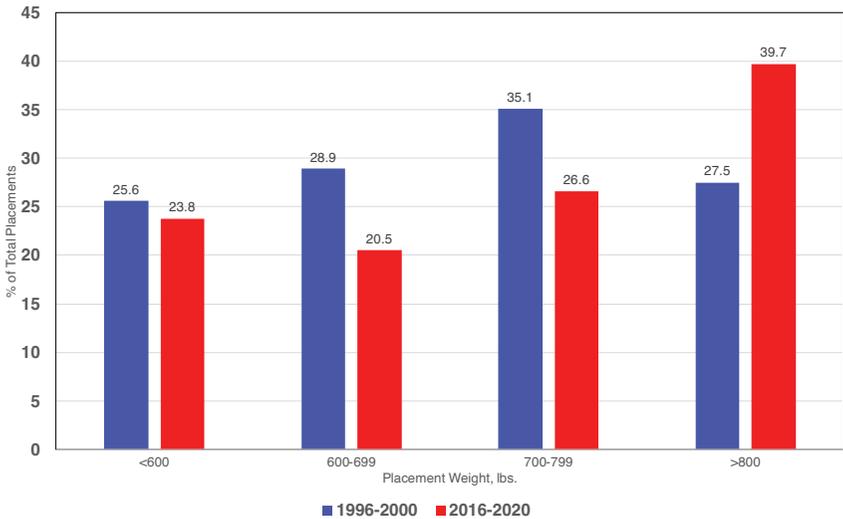
Source: USDA-NASS, compiled by LMIC.

Figure 1.10. Feedlot Capacity, January 1, 1,000 head, 1999 - 2021.



Source: Focus on Feedlots, compiled by LMIC.

Figure 1.11. Days on Feed, 12 month moving average, Kansas Focus on Feedlots.



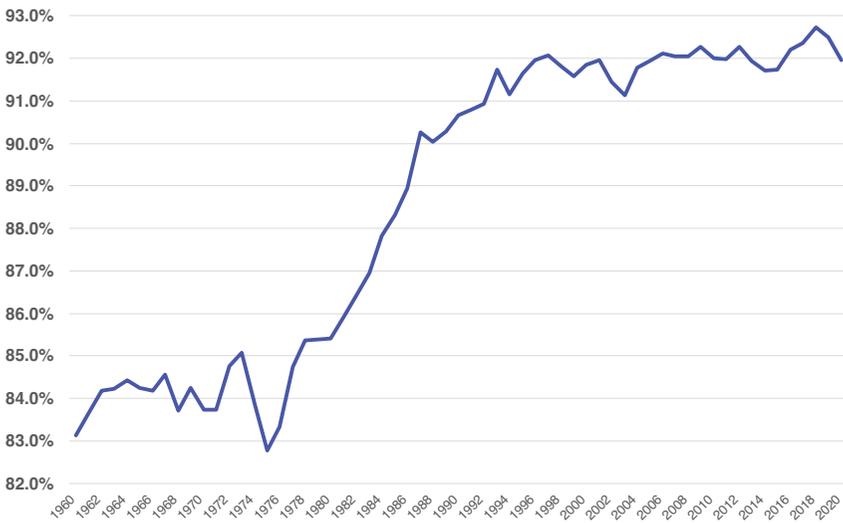
Source: Calculations by Peel from USDA-NASS data.

Figure 1.12. Distribution of Feedlot Placements by Weight.

1980s. Figure 1.10 shows that total feedlot capacity, as reported by USDA, has increased by roughly a million head in the past 20 years. Feedlots have been able to maintain inventories despite declining cattle numbers by reducing the turnover rate, i.e. by increasing days on feed (Figure 1.11). This results from feeding cattle to bigger weights and by feeding significant numbers of lightweight placements, which need additional days on feed. Figure 1.12 shows that feedlot placements have shifted in the past twenty years to include a larger percentage of heavy weight placements while maintaining the percentage of lightweight placements and reducing the proportions of traditional placements from 600 to 800 pounds. This has resulted in a more bimodal placement distribution in recent years.

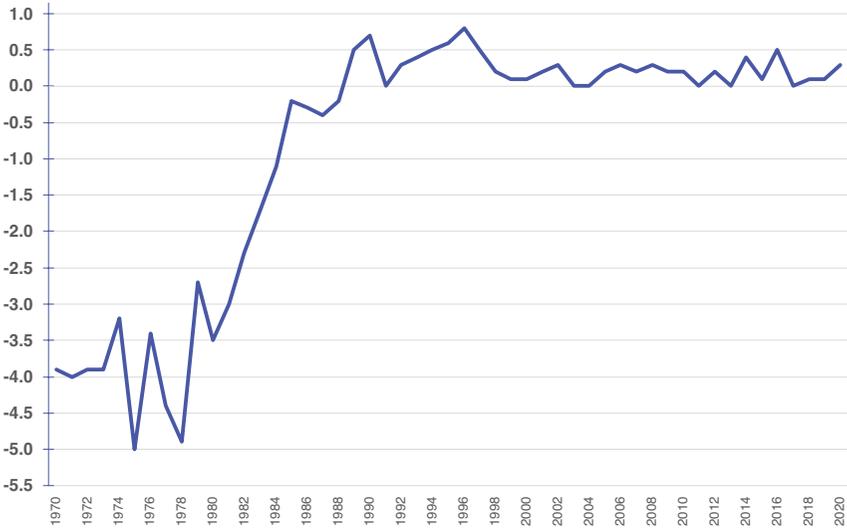
Heifer Feeding

Beginning about 1980, heifer feeding received much more attention and improved rapidly and dramatically. Prior to that time, heifer feeding was treated as a residual – necessary, but not worthy of much management. Figure 1.13 shows that prior to about 1980, heifer carcass weights averaged about 15 percent less than steer carcass weights. In a matter of about a decade, heifer carcass weights increased relative to steers and have averaged 91 to 92 percent of steer carcass weights for the past 30 years. At the same time, the fed heifer price improved from a roughly four percent discount to fed steer prices to a par level with fed steer prices (Figure 1.14). Of course, there are productivity differences in heifer gains and feed efficiency that are still reflected in the typical discount of feeder heifer to feeder steer prices.



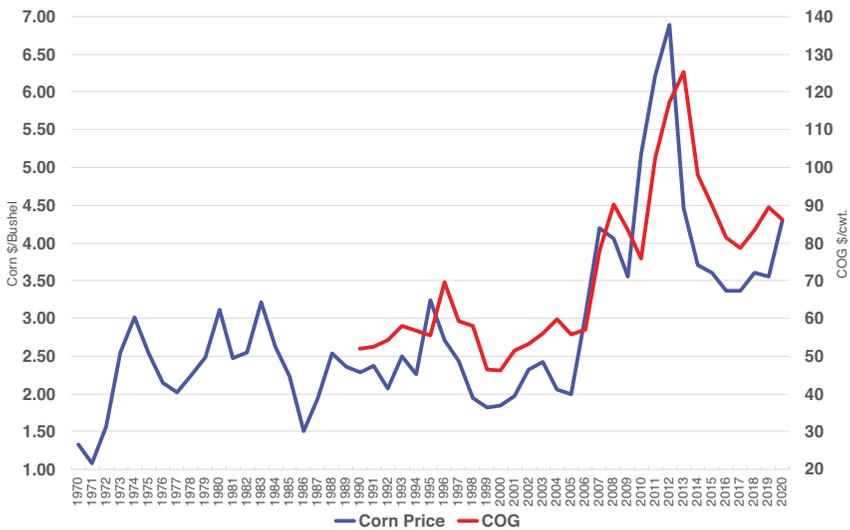
Source: Calculations by Peel from USDA-NASS data.

Figure 1.13. Heifer Carcass Weight as Percent of Steer Carcass Weight, 1960 - 2020.



Source: Calculations by Peel from USDA-NASS data.

Figure 1.14. Percent Difference in Fed Heifer and Fed Steer Live Price, 1970 - 2020.



Source: USDA-NASS and Focus on Feedlots, compiled by LMIC.

Figure 1.15. Corn Price and Feedlot Steer Cost of Gain (COG), 1970 - 2020.

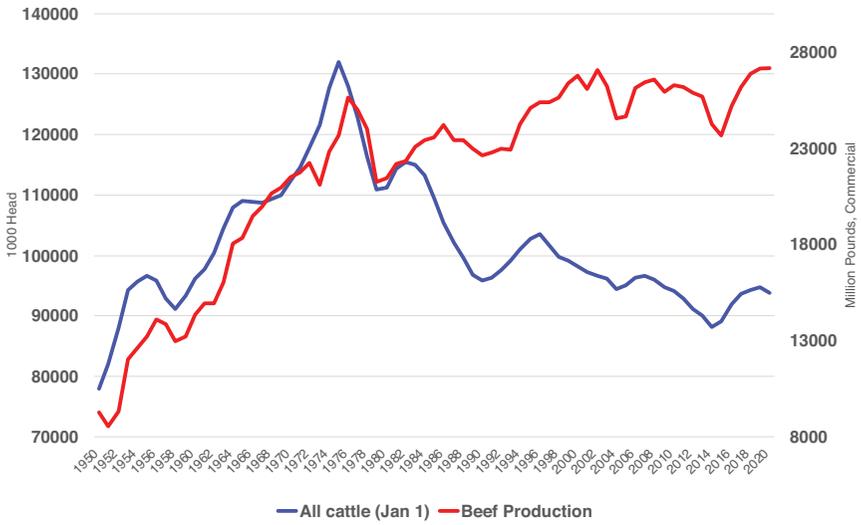
Ethanol Impacts

A fundamental change in cattle feeding occurred with the rapid expansion of the ethanol industry in 2006 to 2007. Corn used for food, seed and industrial purposes increased from an average of 2.4 billion bushels annually from 1997 to 2006 to an annual average of 6.2 billion bushels since 2007. National average corn prices averaged \$2.27/bushel from 1970 to 2005 and have averaged \$4.20/bushel in the period from 2006 to 2019 (Figure 1.15). Increased corn prices are reflected in higher feedlot cost of gain. Figure 1.15 shows how feedlot cost of gain (COG) has increased similarly to the increase in corn prices. Ethanol production is heavily concentrated in the Corn Belt and the availability of distiller's grain feeds favors feed costs in the Corn Belt compared to the Plains. This was especially true in the initial years of the ethanol mandate. Economists predicted that the change in crop demand and use would have regional implications for cattle production with the competitive advantage shifting back to the Midwest (Peel, 2007). Figure 1.7 shows that the gap between Texas and Nebraska cattle on feed inventories began to narrow after 2006 and by 2015, the combination of cost disadvantages and limited cattle supplies allowed Nebraska on-feed inventories to equal or exceed Texas from 2015 to 2019. In 2020 to 2021, increased cattle numbers and more time for market adjustments have allowed Texas to again regain the inventory advantage. However, a relative change in regional competitiveness remains.

The dramatic change in crop production due to ethanol production had other implications for cattle markets as well. Ethanol demand boosted corn acreage significantly. From 1997 to 2006, average annual corn planted acreage was 79.1 million acres which increased to 91.1 million acres from 2007 to 2016. Because of price relationships between corn and soybeans – and the fact that the two crops are often grown in fixed rotations – soybean acreage also increased after 2006. The increased crop acreage came from many places, but in the heart of the Corn Belt, more corn and soybeans meant less pasture. Total pastureland in Illinois, Indiana and Iowa decreased by 1.4 million acres, nearly 25 percent, between the 2007 and 2017 Census of Agriculture (USDA-NASS, 2009 and 2019). The number of beef cows in those three states also declined. The combined 5-year average inventory of beef cows in Illinois, Indiana, and Iowa decreased by 11.8 percent, nearly 200,000 head. This explains part of the decrease in Iowa's rank among major beef cattle states (Table 1.1).

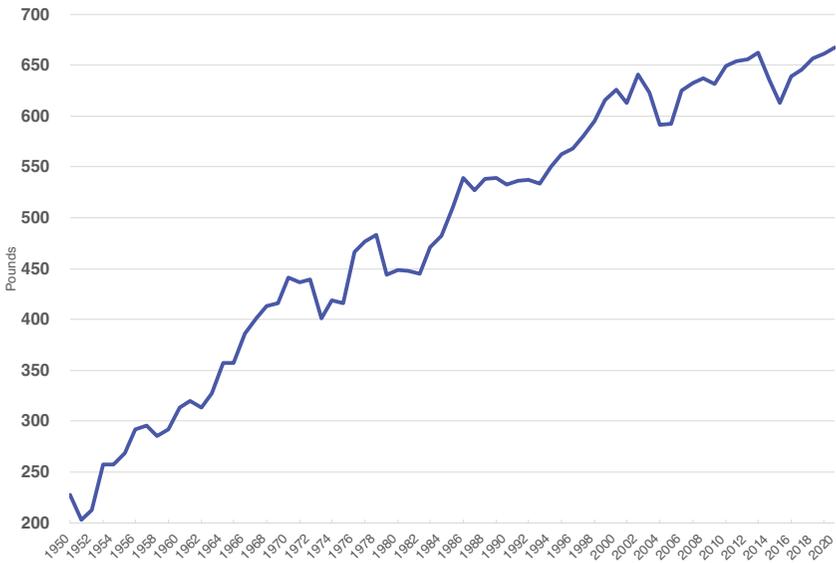
Beef Production

Following the peak cattle numbers in the mid-1970s, increased productivity in the beef industry helped maintain the level of beef production despite falling cattle numbers. Several factors contribute to this. In the short run, beef production and inventory adjustments are correlated. Thus, during liquidation phases of the cattle cycle, beef production increases as animals are removed from the breeding herd. In short, the industry must make beef production larger before it can get smaller.



Source: USDA-NASS, compiled by LMIC.

Figure 1.16. All Cattle and Calves Inventory and Annual Beef Production, 1950 - 2020.



Source: Calculations by Peel from USDA-NASS data.

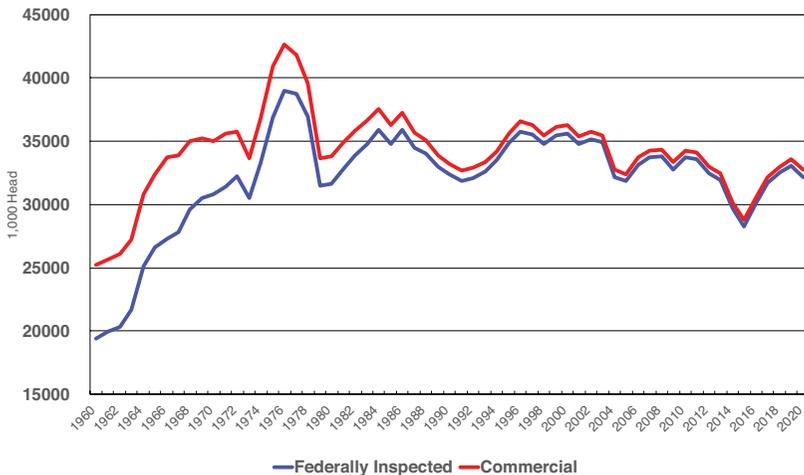
Figure 1.17. Beef Production per Cow, 1950 - 2020.

(Conversely, attempts to increase beef production require making a tight beef supply even tighter initially to save more females for breeding and invest in future production.) The inventory adjustments to beef production are temporary. Eventually, an ever-decreasing cattle inventory must necessarily lead to decreasing beef production.

Figure 1.16 shows the relative change in beef production relative to cattle numbers since 1950. Beef production increased as cattle numbers increased until 1975 and has increased more slowly since then. It could be said that beef production has continued to grow despite the decrease in cattle numbers since 1975. It could also be said that increasing productivity since 1975 is the reason for declining cattle numbers since 1975. Beef production per cow is a broad aggregate measure of industry productivity that includes the inventory adjustments discussed previously, but also numerous other increases in productivity including larger carcass weights (discussed below), other improvements in management, and production efficiency. Figure 1.17 shows that beef production per cow has generally increased since 1950 from less than 250 pounds per cow to over 660 pounds per cow currently.

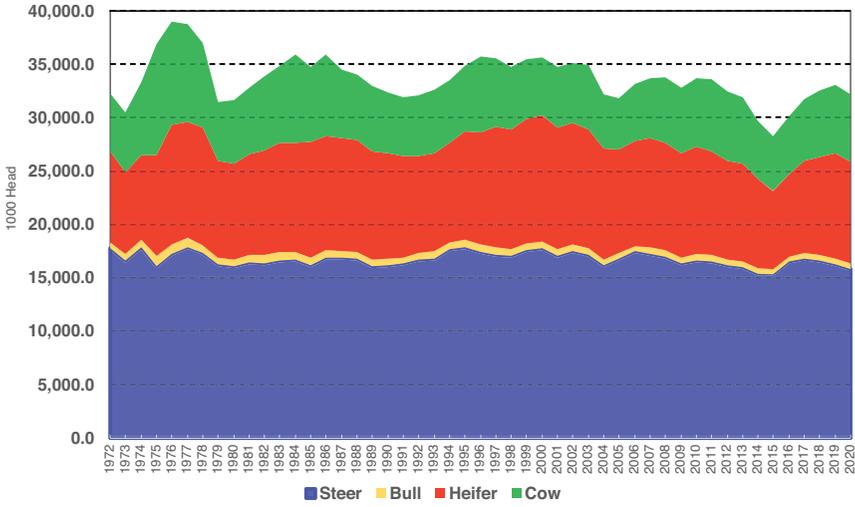
Cattle Slaughter

Cattle slaughter increased from 1960 as cattle numbers increased and reached a peak in 1976, one year after cattle inventories peaked and began a sharp liquidation (Figure 1.18 and Figure 1.2). Total commercial cattle slaughter in 2020 was 32.8 million head, down 23 percent from the 1976 peak of 42.7 million head. Today, the vast majority of cattle slaughter is federally inspected resulting in the



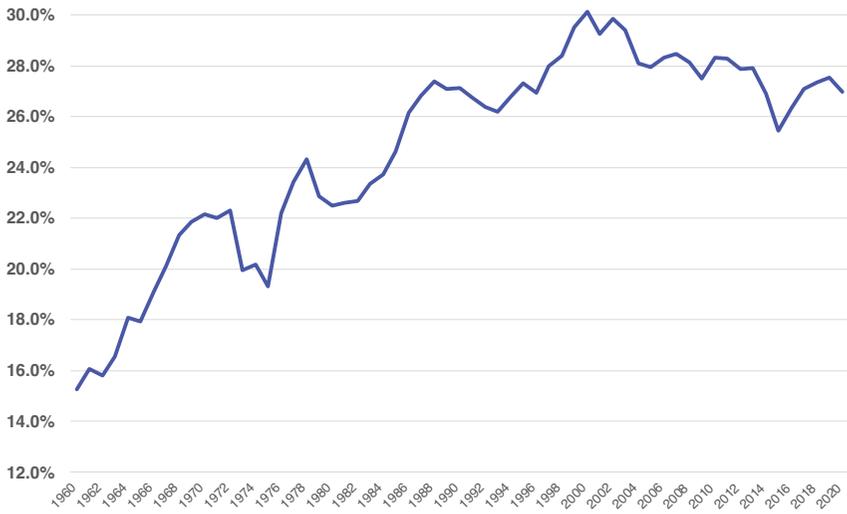
Source: USDA-NASS, compiled by LMIC.

Figure 1.18. Cattle Slaughter, 1960 - 2020.



Source: USDA-NASS, compiled by LMIC.

Figure 1.19. Cattle Slaughter, Federal Inspection, 1972 - 2020.



Source: Calculations by Peel from USDA-NASS data.

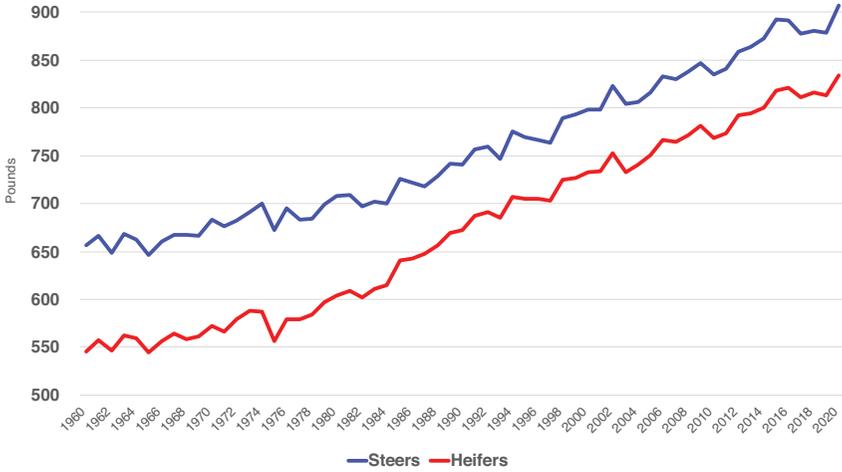
Figure 1.20. Steer and Heifer Slaughter as Percent of All Cattle and Calves, 1960 - 2020.

difference in commercial and federally inspected slaughter nearly disappearing in the past three decades (Figure 1.18). Total cattle inventories decreased 29 percent from the 1975 peak to current levels. Figure 1.19 shows the breakdown of cattle slaughter by steers, heifers, cows, and bulls and highlights that steer slaughter averages 50 percent of total cattle slaughter and is quite stable over time. Female slaughter (heifers plus cows) makes up about 48 percent of total slaughter and are 3 to 5 times more variable compared to steers. This highlights the fact that the dynamics of heifer retention and cow culling that are the core components of the cattle cycle also produce variation in heifer and cow slaughter. It is this interaction between breeding and production and the corresponding female dynamics that drive most of the variation in cattle slaughter and beef production over time. One broad measure of productivity in the cattle industry is the production of steers and heifers for slaughter. This can be thought of as the industry extraction rate and is shown in Figure 1.20. Steer plus heifer slaughter as a percent of the total cattle inventory increased from 15 percent in 1960 to a peak of 30 percent in 2000 and declined to 27 percent in 2020.

Carcass Weights

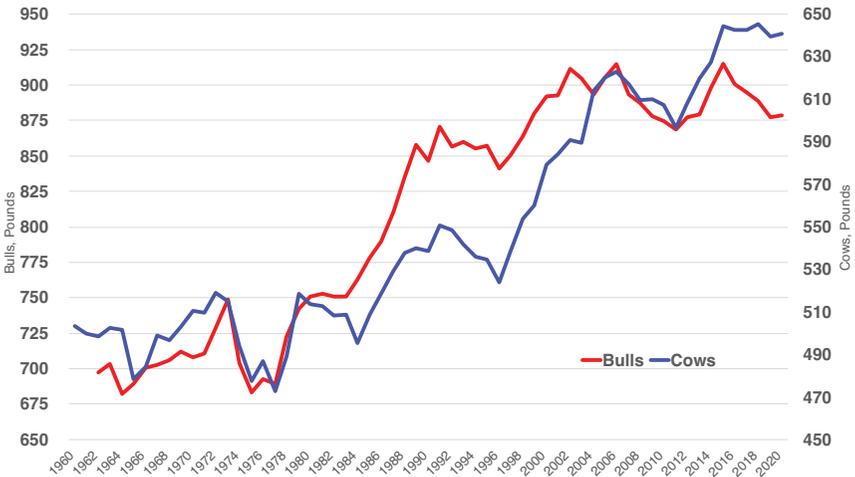
Carcass weights have increased on average since 1960. Steer carcass weights increased from 656 pounds in 1960 to 907 pounds in 2020, an average increase of 4.2 pounds per year (Figure 1.21). Heifer carcasses have increased from 546 pounds in 1960 to 834 pounds in 2020, increasing an average of 4.8 pounds per year (Figure 1.21). Increased attention to heifer feeding increased heifer carcass weight faster in the 1980s (Figure 1.13). Increased steer and heifer carcass weights are the result of genetics that have increased cattle size combined with feeding technology such as growth implants, ionophores, and beta agonists that push cattle weights. Feedlot production economics provide continued incentive for larger carcass weights, and it is not clear at what point a biological limit will be reached. However, there are moves at the cow-calf level to moderate cattle size to improve cow efficiency. Additionally, there are demand implications of larger and larger beef cuts (Maples, Lusk and Peel, 2017).

Bulls and cows are bigger as well with bull carcass weights increasing from 698 pounds in 1962 to 879 pounds in 2020, an average increase of 3.1 pounds per year (Figure 1.22). Cow carcass weights have increased from 499 pounds in 1962 to 641 pounds in 2020, increasing an average of 2.5 pounds per year (Figure 1.22). The difference in average cow size between dairy and beef cows means that the average cow carcass weight reflects the proportion of dairy and beef cows slaughtered. Separate data on beef and dairy cow slaughter has been available since 1986 and shows that beef cows have averaged 52 percent of total cow slaughter. Because of beef cow herd cyclical dynamics, the proportion of beef cows in the cow slaughter total has varied from 43 to 58 percent. The higher rate of increase of fed steer and heifer carcass weights compared to cow and bull carcass weights likely reflects the impact of the aforementioned feeding technologies. As a result,



Source: USDA-NASS, compiled by LMIC.

Figure 1.21. Steer and Heifer Carcass Weights, Average Annual, 1960 - 2020.



Source: USDA-NASS, compiled by LMIC.

Figure 1.22. Cow and Bull Carcass Weight, Annual Average, 1960 - 2020.

the gap between steer and bull carcass weights has been narrowing in recent years and annual average steer carcass weights in 2019 and 2020 exceeded the average bull carcass weight¹.

Bull carcass weights increased more rapidly compared to cows in the 1980s. As a result, cow carcass weights declined relative to bull carcass weights from 1960 until the mid-1990s then increased (Figure 1.23). This may reflect the adoption of continental genetics and an industry push to increase frame size that accelerated in 1970s. Bulls reflected this size increase initially, increasing relative to cows until the mid-1990s before cow size began to catch up. Cow carcasses dropped from about 71 percent of bull carcass weights in the 1960s to a low near 62 percent in 1996 before increasing to 73 percent by 2020.

Beef Fabrication

The introduction of boxed beef fabrication technology in 1967 by Iowa Beef Processors (later IBP and later still Tyson) may well be the most significant factor impacting the beef industry in the past century. Boxed beef rapidly became the dominant wholesale beef technology in the 1970s and profoundly changed

¹ The fact that steer carcass weights exceeded bull carcass weights recently is a long term structural trend that has been developing in the industry. In 1976, steer carcass weights exceeded bull carcass weights for a single year. This likely reflects industry adjustments to the spike peak in cattle numbers in 1975. The likelihood is that many young bulls were slaughtered as a result of the sharp decline in cow numbers in 1976 resulting in unusually low bull carcass weights for one year.



Source: Calculations by Peel from USDA-NASS data.

Figure 1.23. Cow Carcass Weight as Percent of Bull Carcass Weight, 1960 - 2020.

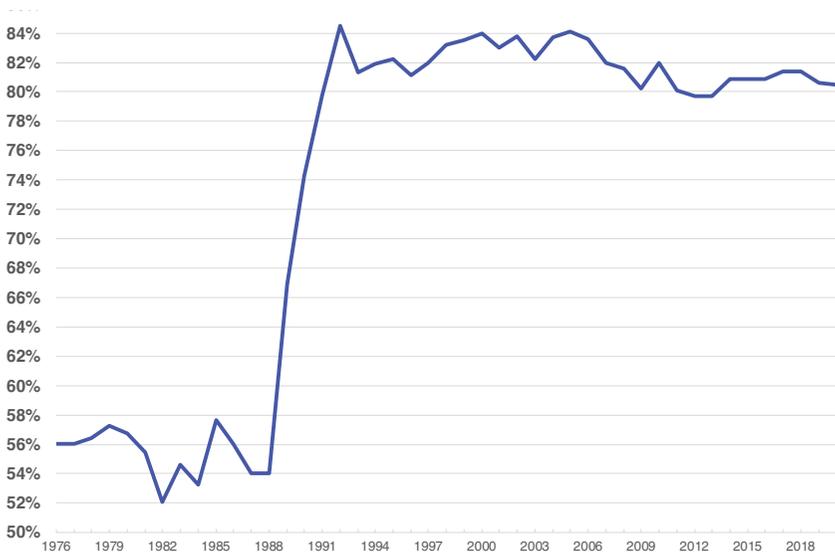
wholesale and retail beef markets because of the increased value and cost savings that accompany boxed beef. Prior to boxed beef, carcasses were shipped to retailers or further processors for final fabrication. Swinging carcasses are very inefficient to ship compared to boxes that stack and utilize refrigerated shipping capacity much more efficiently. Moreover, fabricating carcasses into primals and subprimals at the point of slaughter removes bone, fat and trim that is costly to ship. Prior to boxed beef, most grocery stores had in-store butchers that fabricated retail cuts on-site. Some larger grocery chains had centralized facilities to provide partial fabrication of carcasses prior to shipping to store butchers. Restaurants likewise either utilized in-house butchers or relied on local further processors to source beef products. Boxed beef technology facilitated significant increases in total carcass value by allowing specific beef products to be directed efficiently to specific markets to meet product demand. Beef packers integrating boxed beef fabrication into the slaughter operations represented the first of many subsequent shifts of beef product development further upstream into increasingly centralized operations.

Declining beef demand in the 1980s (discussed below) led to a series of product changes and innovations that continue today. Growing consumer preferences for “lean” beef led to early interest in grass-fed beef in the 1980s and 1990s that was not, for the most part, very successful. However, this interest led to changes in wholesale beef product standards from traditional “commodity” trim of 1 inch of fat cover to “close-trim” produced by physically removing fat during fabrication. It turned out that consumers mostly wanted closely trimmed fed beef rather than grass-fed beef that generally (at that time) had little marbling. Trimming fat at the packer level was additionally efficient by further reducing shipping costs and facilitating markets for edible and inedible tallow rather than simply being waste trim for downstream customers. Over time, more and more fabrication has shifted to the packer level moving from primals to subprimals to a growing set of specific beef products including more boneless and peeled (denuded of fat) products and ultimately to case-ready products. Packers increasingly have additional fabrication facilities producing value-added products including marinated and cooked products and, importantly, case-ready fresh beef for retail grocery. With a few notable exceptions, major grocery chains do not maintain butcher shops in stores and have little ability for in-store fabrication. Some small/independent grocers continue to utilize in-store butcher shops but now can source exactly the set of wholesale beef products desired for the grocery case. Previously grocery stores had to find a way to merchandise all the products that resulted from in-store carcass fabrication. Packers fabricate to specific product specifications for various retail grocery customers, further processing and food service customers, and a variety of export markets. As a result, the major packers produce several thousand different products from a basic fabrication process that begins with several hundred carcass products and by-products of slaughter and fabrication. Some packing facilities in certain locations have some or all packing capacity dedicated to value-added programs that operate as sole-source for upstream suppliers and downstream markets.

Beef Further Processing and Distribution

The food service sector consists of a wide range of restaurants, schools, and institutions such as hospitals and other service facilities and was previously referred to as HRI (hotels, restaurants, and institutions). The end users in this sector rely on further processing and food distribution companies to provide specific beef products. Further processors amplify the set of packer-sourced wholesale boxed beef products into an even larger array of fresh and frozen beef products including portion-control cuts and products that are tenderized, marinated, seasoned, breaded, and partially/fully cooked. This sector provides a variety of services for food service customers in addition to product processing, including product aging (wet or dry), cold storage (refrigerated, deep chill (suspended fresh) or frozen), and packaging for back-of-house restaurant convenience and efficiency.

The COVID-19 pandemic revealed, somewhat to the shock and surprise of both consumers and producers, that the supply chains for retail grocery and food service are largely separate, very specialized, and quite complex. Not only are various beef cuts often used in different supply chains or used differently, but products like ground beef for retail grocery and for food service originate in very different supply chains (Peel, 2021). These specialized supply chains have developed over time to be efficient and reduce costs but are now revealed to be somewhat rigid and lack flexibility that could become more important in uncertain environments.



Source: Calculations by Peel from USDA-NASS and USDA-AMS data, compiled by LMIC.

Figure 1.24. Percent of Beef Graded, Federally Inspected, 1976 - 2020.

Beef Grading

USDA commodity beef grades were developed in the first half of the 20th century and have been revised and adapted numerous times. The current set of carcass grades were established in 1941 and continue to be the basis for the majority of beef marketing. Grading is voluntary and the use of beef grades has changed considerably over time. In the era of carcass beef, many grocery stores did not rely heavily on grades. Much of the Choice and virtually all of the Prime beef was directed to the food service (HRI) trade. Instead of merchandising Select beef, retail groceries often purchased ungraded or “no-roll” beef. This changed dramatically in the 1980s as retail grocery switched to graded beef and actively marketed Select and Choice beef. Figure 1.24 shows that in the four-year period from 1989 to 1992, the percent of beef graded jumped from roughly 55 percent to about 82 percent. Recognizing that cull cow and bull carcasses are rarely graded, this means that nearly 100 percent of steer and heifer carcasses were then graded. Figure 1.25 shows the percent beef graded that is Choice. It appears that Choice grading declined sharply in the late 1980s and early 1990s, but this reflects the change in grading percentage from Figure 1.24. In other words, 94 percent Choice of 56 percent of beef graded in 1988 is roughly the same as 56 percent Choice of, say, 95 percent of steer and heifer beef graded in 1992. A similar explanation applies to Figure 1.26 that shows the change in Prime grading over time. The important story for both Choice and Prime has been the increase in high quality beef



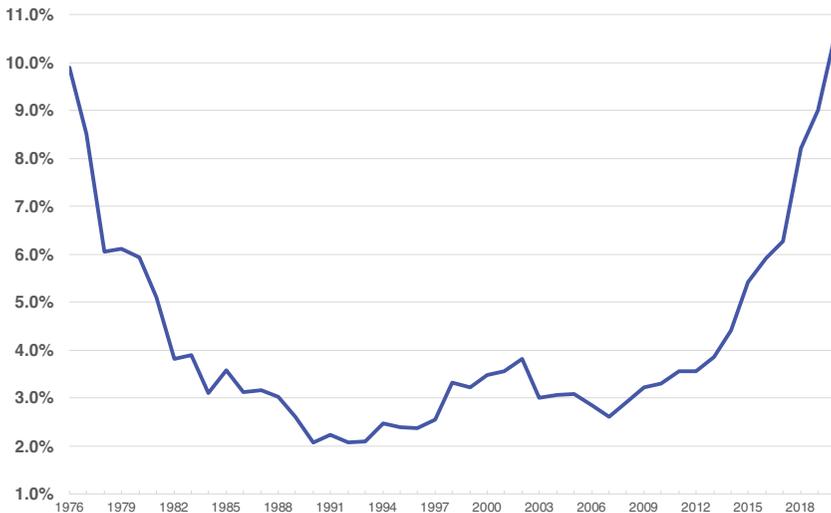
Source: USDA-AMS, compiled by LMIC.

Figure 1.25. Percent of Beef Graded Choice, Federally Inspected, 1976 - 2020.

grading in recent years. Choice beef grading percentage increased from roughly 56 percent in 2006 to over 74 percent currently. The increase in Prime grading has occurred more recently with percent of Prime beef less than four percent as recently as 2013 but increasing to nearly 11 percent in less than a decade. Figure 1.24 indicates a slight decrease in percent of beef graded in recent years. This may be the result of growth in branded beef marketing programs that do not rely on commodity grades. Historically, commodity grades were developed to provide quality information to consumers in situations where products were marketed in commodity form rather than differentiated products. However, most branded beef programs continue to use USDA grades as a component of the brand specifications.

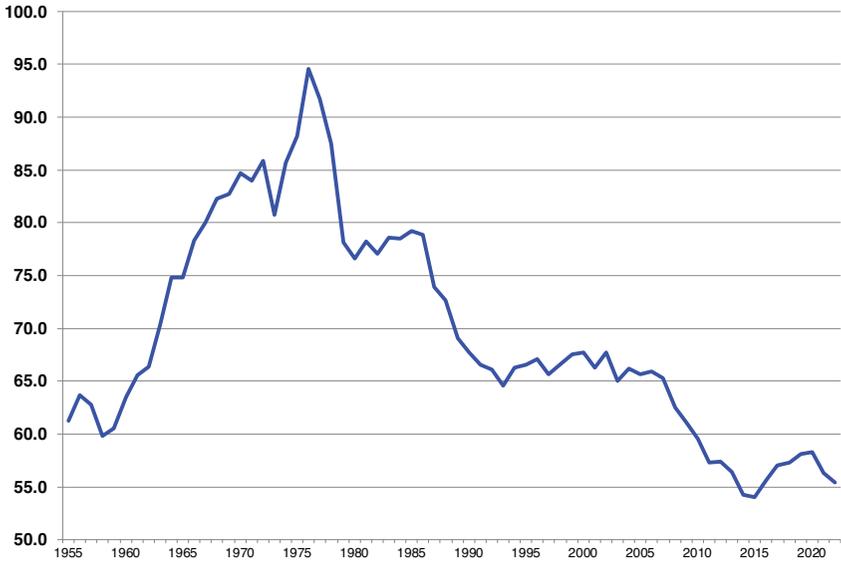
Beef Demand

Economists define demand for beef (or indeed any product) as the consumers' willingness to purchase a given quantity of the product at a given price. If we know the range of quantities purchased over a range of prices, holding other factors that affect demand constant, we can draw a demand curve for the product. Figure 1.27 shows per capita beef consumption since 1955. Beginning at about 61 pounds, per capita beef consumption increased to a 1976 peak of 95 pounds and has generally decreased, with periods of stable consumption to current levels of 55 pounds/capita. Figure 1.27 is not a measure of beef demand but rather is better viewed as a measure of beef supply. Beef is a perishable product and will be consumed if produced and Figure 1.27 reveals the available per capita domestic



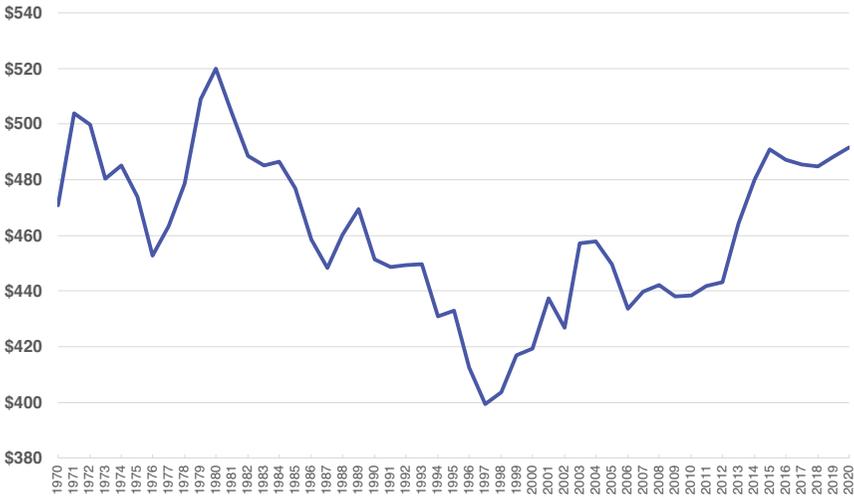
Source: USDA-AMS, compiled by LMIC.

Figure 1.26. Percent of Beef Graded Prime, Federally Inspected, 1976 - 2020.



Source: Compiled and analysis by LMIC from USDA data.

Figure 1.27. Beef Consumption, Pounds per Capita, Retail Weight, 1955-2020.



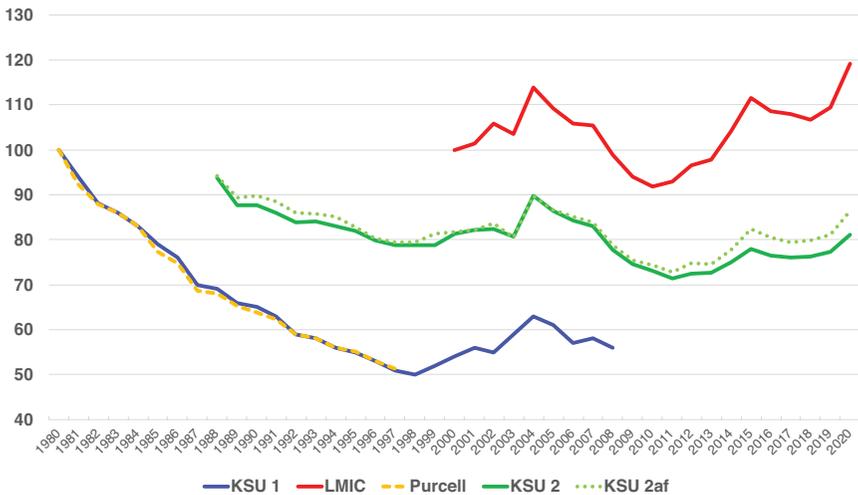
Source: Calculations by Peel from USDA-ERS data, compiled by LMIC.

Figure 1.28. Retail Beef Price, Dollars per Hundredweight Deflated (2010 = 100), 1970 - 2020.

supply of beef, adjusted for population changes and net trade flows. However, Figure 1.27 does show the central fact that beef consumption per person declined significantly starting in the late 1970s.

The other principal component of beef demand is price. Figure 1.28 shows inflation-adjusted retail beef prices since 1970. Real retail beef prices decreased from a peak in 1980 to a low in 1997 before generally increasing to current levels. Economists combine this quantity and price data into models that also account for other demand factors to create demand indices that show relative changes in beef demand over time. Figure 1.29 is a plot of several beef demand indices from various researchers. These demand indices use different models, different base years and different price series (some are based on the Choice retail beef price and others on the broader All-Fresh retail beef price). Comparisons across indices are not valid, but each index over time and the relative pattern of changes across indices are revealing. The indices consistently show that beef demand decreased from 1980 to about 1998 then increased with another drop in 2010 to 2011 followed by general increases in the last decade.

While useful as a general indication of beef demand, there are numerous limitations to the aggregate demand analyses in Figure 1.29. The retail price series are imperfect measures of retail beef product prices. More importantly, retail grocery is only one consumer market channel and we do not have prices for beef in food service and export channels. Moreover, reducing beef consumption to a single aggregate measure glosses over the fact that beef is actually consumed as a broad set of specific products, each of which is a separate market and a separate demand, usually interrelated with many other beef product demands as well as other demand factors (Clark, 2019).



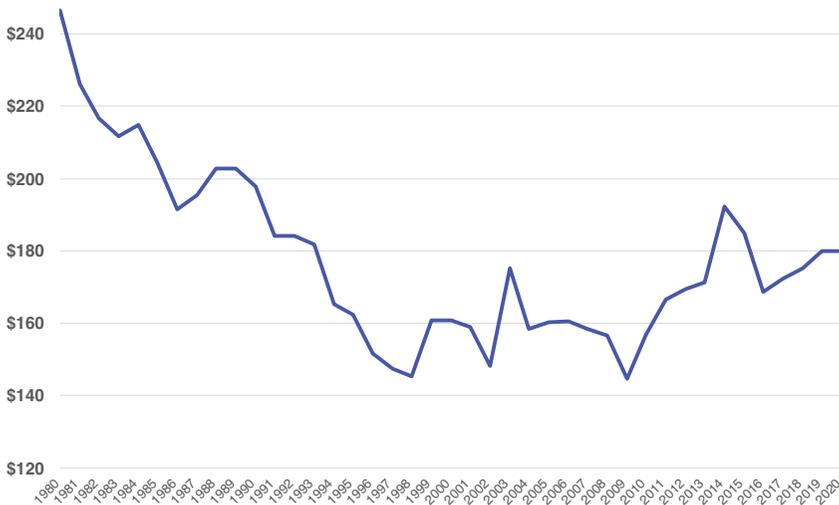
Source: Purcell, KSU and LMIC.

Figure 1.29. Beef Demand Indexes, Choice (KSU 1, KSU 2, Purcell) and All Fresh (LMIC, KSU 2af), 1980 - 2020.

Choice and Select boxed beef prices are, in some ways, a better measure of the value of the entire set of beef products, but these also have many limitations. Boxed beef prices attempt to capture the wholesale value of beef products and convert them to a rough carcass equivalent. Boxed beef prices are calculated from a set of roughly 50 reported wholesale cut prices. The set of products included in boxed beef prices changes over time to reflect changing fabrication styles and product mixes. This makes the reported boxed beef price more closely reflect the value at a point in time, but more difficult to compare over time. Today's boxed beef prices reflect products with substantially higher levels of fabrication than earlier. For example, in recent years, wholesale prices are reported for the Top Blade (used to make Flat Iron steaks) and the Chuck Tender, both derived from the Chuck Clod subprimal. These products offer higher value potential, but they also represent additional fabrication and labor cost. Figure 1.30 shows inflation-adjusted Choice boxed beef prices since 1980. The figure indicates that wholesale beef values have generally increased since the late 1990s. Exactly what this means (especially for things like packer profitability) is not easily understood. The set of beef products originating at the packing level has expanded considerably but so has the amount of further processing requiring additional fabrication (and cost).

Packing Capacity and Industry Concentration

Suspicion and animosity between cattle producers and beef packers is nearly as old as the industry itself. Ward (2002) includes a quote from Senator John B.

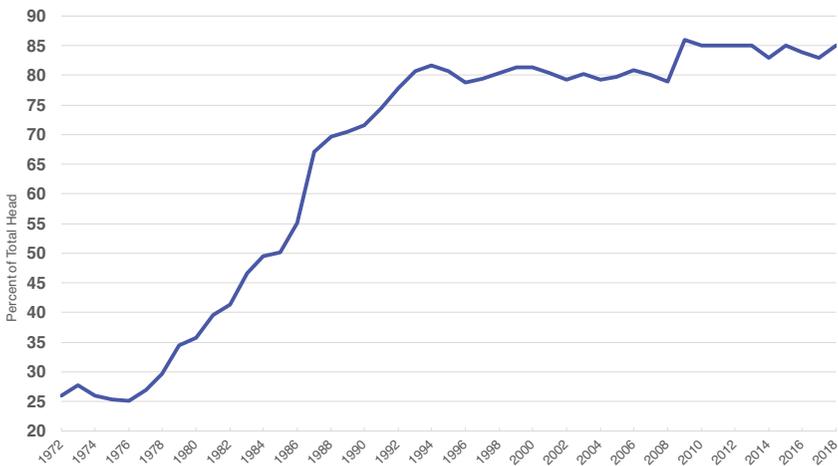


Source: Calculations by Peel from USDA-AMS data, compiled by LMIC.

Figure 1.30. Choice Boxed Beef Price, Dollars per Hundredweight Deflated (2010 = 100), 1980 - 2020.

Kendrick, Wyoming in 1919: “This squall between the packers and producers in this country ought to have blown over forty years ago, but we still have it on our hands ...” The “Big Four” meat packers at the turn of the 20th century were Armour, Swift, Cudahy, and Wilson. These companies and their descendants gave rise 80 years later to a new “Big Four,” known today as Tyson, JBS, Cargill and National. The cost efficiencies associated with beef packing and fabrication (known as economies of size) are very strong economic drivers and, on the heels of the boxed beef revolution and continued fabrication and product innovations previously discussed, led to rapid concentration of beef packing in the 1980s (Figure 1.31). The four-firm concentration ratio is the percent of the market controlled by the four largest firms. The four-firm concentration ratio increased from less than 30 percent in the late 1970s to over 80 percent in just about a decade through a series of mergers and acquisitions by the largest firms (Ward, 2002). The four-firm concentration ratio has been relatively stable since the early 1990s, averaging 80.2 percent from 1993 to 2008, then stepping up in 2009, and averaging 84.6 percent the past decade (Figure 1.31).

Economies of size in beef packing is well documented and significant (e.g., McDonald *et al.*, 2000). The largest packing plants have considerable cost advantages over smaller (but still large) packing plants even half that size. However, increased concentration means that large firms have market power, thus raising the potential for anti-competitive behavior. Research shows that small but significant negative price impacts of market power are outweighed by several magnitudes in cost efficiencies that benefit producers and consumers (Peel *et al.*, 2020).

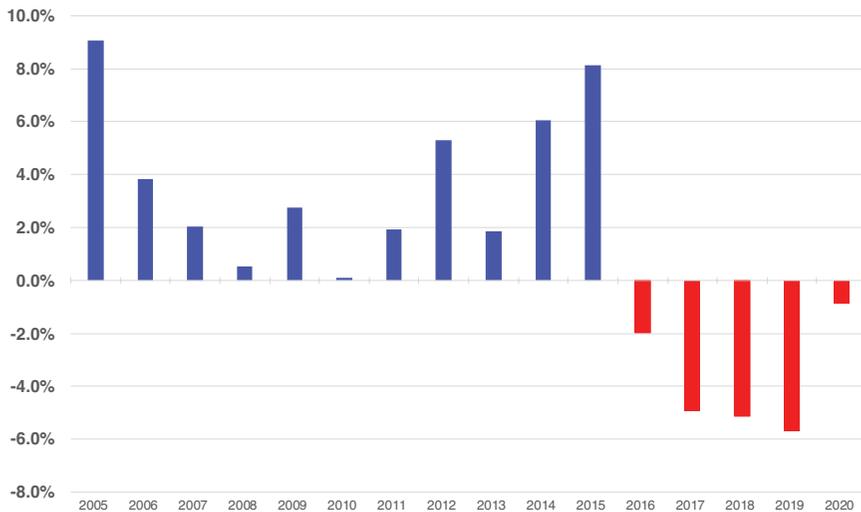


Source: Ward and USDA-GIPSA.

Figure 1.31. Four-Firm Concentration Ratio, Steer/Heifer Packing, 1972 - 2018.

Much of the beef packing infrastructure in the United States was built in the 1980s when cattle inventories were 15 to 20 percent larger than today. In the intervening time, the cattle industry has operated with excess packing capacity as cattle numbers declined (Figure 1.18). Slowly, packing capacity declined with several permanent plant closures including the ConAgra plant in Garden City, Kansas in 2000 (the plant burned and was not rebuilt); the Tyson plant in Emporia, Kansas in 2008; and the Cargill plant in Plainview, Texas in 2013. The reduction in packing capacity – combined with the cyclical herd expansion from 2014 to 2019 – resulted, for the first time in more than 35 years, in a shortage of cattle packing capacity (Figure 1.32). Estimated steer plus heifer slaughter capacity has been less than slaughter demands by increasing Saturday slaughter and stretching normal operating schedules. This fundamental change in fed cattle supply and demand balance is impacting fed cattle markets in ways not seen for many years.

The reduction in packing capacity – combined with the cyclical herd expansion from 2014 to 2019 – resulted, for the first time in more than 35 years, in a shortage of cattle packing capacity.



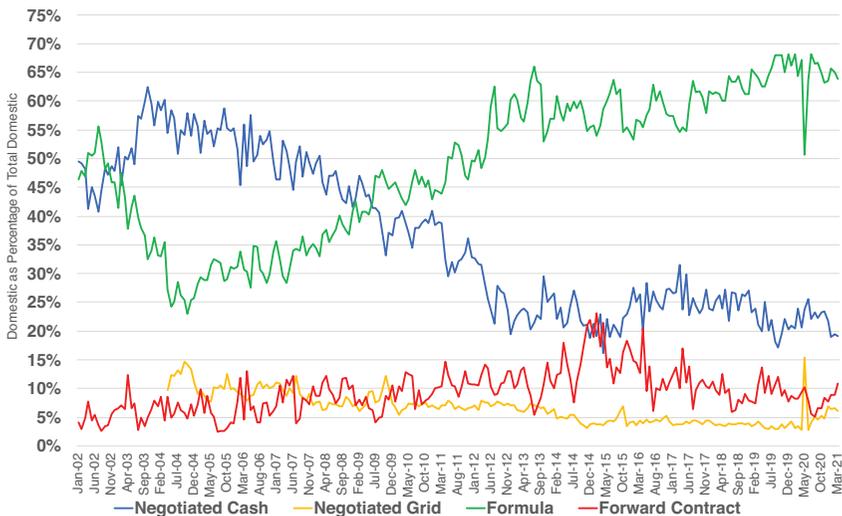
Source: Calculated by Peel from USDA-NASS and Cattle-Fax estimates.

Figure 1.32. Estimated Excess Steer and Heifer Packing Capacity, 2005 - 2020.

Fed Cattle Pricing and Alternative Marketing Arrangements

Until the 1990s most fed cattle were priced on averages, at the pen level and even entire showlists. Very little quality differentiation meant that high quality cattle were undervalued, and low-quality cattle usually received the average price. Packers had little incentive to differentiate cattle quality since they had to process all the cattle anyway. All that was important to packers was to get the average correct. The lack of quality signals meant that producers had little incentive to improve cattle. The problem was apparent; quality grading was low and beef demand was declining. This led to a major push in the industry for “value-based marketing,” which aimed to differentiate and value cattle according to quality differences. The result was the development of grid pricing in which a matrix of quality characteristics was applied to a base price to determine fed cattle premiums and discounts. Both buyers and sellers of fed cattle recognized the transaction costs of continually negotiating these grid sales. This quickly led to the use of formulas which incorporated the grid matrix and utilized a base price from an external source, most commonly a publicly reported cash price. In other cases, cattle were forward contracted. There were also concerns about packer-owned cattle, which diminished later as Cargill divested Caprock Cattle Feeders and JBS divested Five Rivers Cattle Feeding in the late-2010s.

By the late 1990s, these various pricing and ownership arrangements led to concerns about “captive supplies” (later referred to as Alternative Marketing



Source: USDA-AMS, compiled by LMIC.

Figure 1.33. Fed Cattle Pricing, 2002 - 2021.

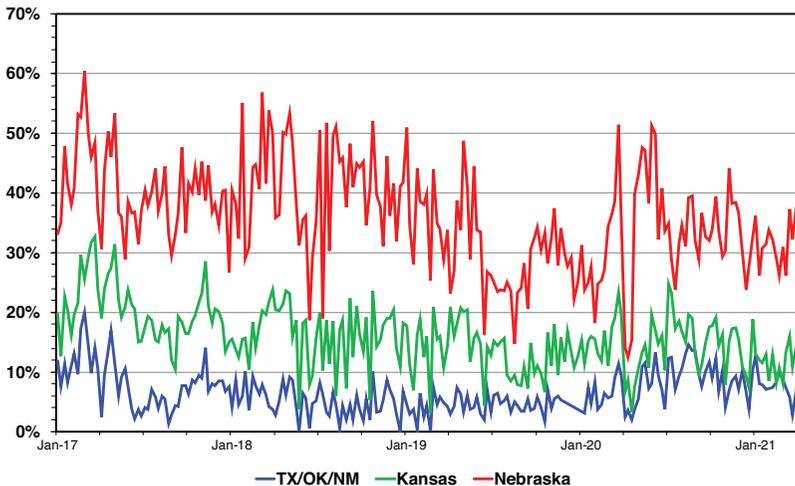
Arrangements or AMAs) and thinning cash markets.² One outcome was Livestock Mandatory Reporting (LMR) legislation requiring mandatory price reporting of fed cattle. The act was implemented in 2001. Figure 1.33 plots LMR data showing the percentage of fed cattle pricing by various categories. The figure confirms that negotiated cash trades declined in the 2000s from roughly 55 percent to a level ranging from 20 to 25 percent. Negotiated cash trades have remained at this level for the last decade. Concerns about thin markets and price discovery in fed cattle markets have persisted and grown sharper recently. Several current proposals would mandate a fixed percentage of negotiated cash trade for fed cattle. Many of the issues and concerns about thin markets and price discovery are summarized in Peel *et al.*, 2020.

Part of the complexity of the cattle industry is the significant regional variation in production and marketing practices and attendant diversity of cattle industry culture in various parts of the country.

Regional Fed Cattle Pricing Issues

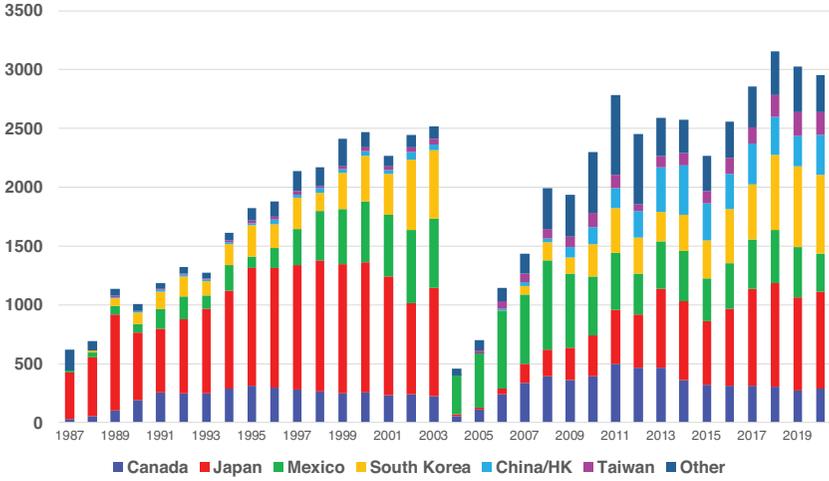
Part of the complexity of the cattle industry is the significant regional variation in production and marketing practices and attendant diversity of cattle industry

² As discussed in detail in Chapter 5, AMAs commit cattle to packers in a formula relationship. While this has been referred to as “captive supplies,” the inventory of fed cattle is not captive or under the control of the packer.



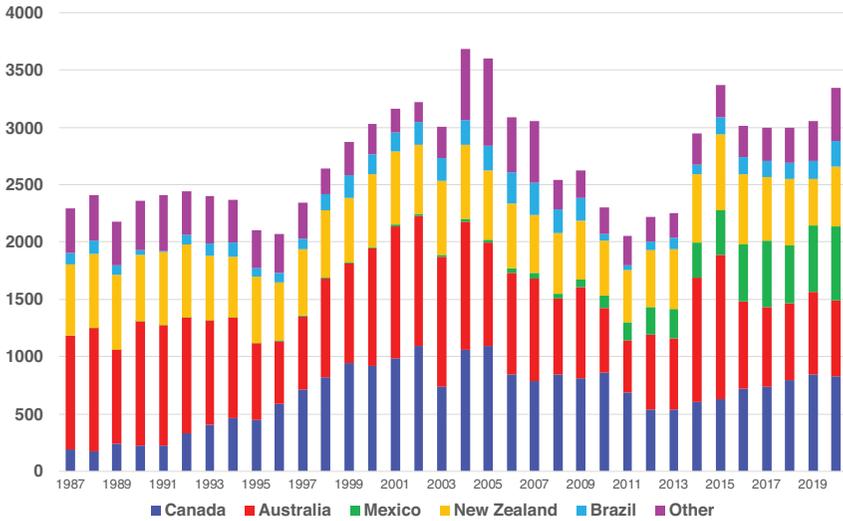
Source: USDA-AMS, compiled by LMIC.

Figure 1.34. Negotiated Cash Steers/Heifers as Percent of Sales by Region, Weekly, 2009 - 2021.



Source: USDA-ERS, compiled by LMIC.

Figure 1.35. U.S. Beef Exports, 1,000 Tons, 1987 - 2020.



Source: USDA-ERS, compiled by LMIC.

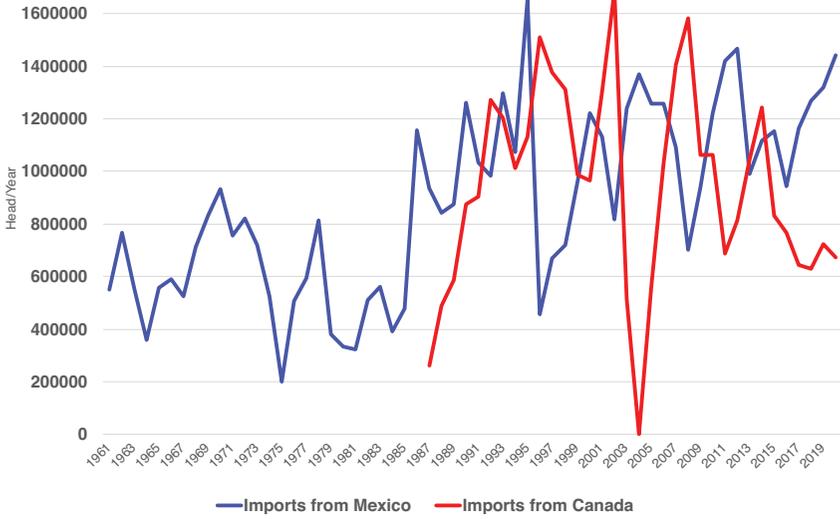
Figure 1.36. U.S. Beef Imports, 1,000 Tons, 1987 - 2020.

culture in various parts of the country. The feedlot industry reflects this with characteristic differences in structure, business practices, and attitudes in different regions. The Midwest has a traditional history that evolved from farmer-feeders to smaller, independent feedlots. The southern and central plains include a higher proportion of large multi-feedlot operations and most of the largest cattle feeding firms are based in this region. These regional differences have led to marked differences in fed cattle pricing in different areas. Figure 1.34 shows the average negotiated cash percentage for the three largest cattle feeding areas of Kansas, Nebraska, and Texas/Oklahoma/New Mexico. The cash trading percent is the lowest in the TX/OK/NM area and the highest in Nebraska. Regional variation in feedlot marketing practices is a significant contributor to the diverse concerns and variable perspectives about the nature of price discovery issues and proposed solutions that are currently evident in the cattle industry. Many concerns are couched in the context of price discovery (discussed in detail in Chapter 2) but really extend beyond price discovery per se into the long-standing suspicions related to concentration and market power.

International Trade of Beef and Cattle

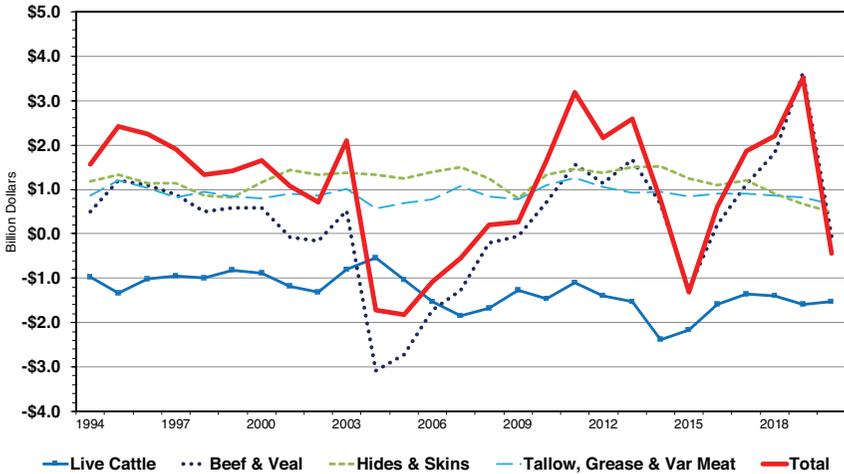
International trade of beef and cattle continues to grow in importance to the beef cattle industry. The United States is both a major exporter and importer of beef, and is currently projected to be the number two global beef exporter and the number two global beef importer (USDA-FAS 2021). Figure 1.35 shows U.S. beef exports to major destinations since 1987. Beef exports have grown significantly since the late 1980s with a major setback and long recovery after the first U.S. BSE (Bovine Spongiform Encephalopathy) case in late 2003. Recent growth in beef exports to China/Hong Kong represent potential to significantly expand beef exports beyond the current dominant markets of Japan and South Korea. U.S. beef imports from major sources are shown in Figure 1.36. The United States has long imported significant amounts of beef, primarily processing beef to support the food service ground beef market in the United States. An exception is beef imports from Mexico, which have grown sharply since 2013 and consists largely of cuts that are marketed to retail grocery.

The increasingly integrated North American cattle and beef industry includes trade in live cattle between the United States, Mexico, and Canada. The United States imports a mix of feeder cattle, fed cattle and cull cows/bulls from Canada along with feeder cattle from Mexico (Figure 1.37). Cattle imports from Mexico have averaged 1.2 million head annually for the past decade. Imports of Canadian cattle have averaged about 800,000 head per year for the past decade. The United States does export some cattle to Mexico and Canada. These cattle exports are relatively small compared to cattle imports from Mexico. The number of cattle exported to Canada has increased since 2017 and the volume of cattle exported to Canada in 2020 was 40 percent of the volume of cattle imports from Canada. U.S. cattle trade with Mexico has a long and somewhat colorful history that includes trade during the Mexican Revolution (1910 to 1920) when the northern haciendas



Source: USDA-ERS, compiled by LMIC.

Figure 1.37. U.S. Imports of Mexican and Canadian Cattle, 1961 - 2020.



Source: USDA-FAS, compiled and analysis by LMIC.

Figure 1.38. U.S. Beef Industry Net Export Values, Annual, 1994 - 2020.

sold cattle to the United States to finance the Mexican government, and Pancho Villa sold cattle stolen from the haciendas to the United States to finance the revolutionaries.

The fact that the United States is both an exporter and importer of beef leads to many questions. The answer is a recognition that beef is not a single product but consists of many different products with varying demands and uses. The United States exports beef products that have higher value in foreign markets and imports products demanded in the United States that can be obtained more economically in foreign markets. As noted previously, beef imports are driven by the need for lean processing beef to support the enormous U.S. appetite for hamburgers. Though the volume of U.S. beef exports and imports is roughly equal, the value of products exported is typically higher than the value of beef products imported (Figure 1.38). Figure 1.38 also shows that the total trade picture involves not only beef but live cattle, hides, variety meats and tallow. The net value of trade for all these markets has been about \$1.5 billion annually for the last decade.

The value of international beef and cattle trade goes beyond the value reported in Figure 1.38. The disassembly of cattle into thousands of beef products inevitably leads to a mix of products that does not match consumer preferences in the United States, so some will have low demand. Some products, such as variety meats, would have little or no value without exports and would be redirected to the pet food industry or to rendering. Other products would be consumed in the United States in the absence of exports, but at the expense of higher value demand for more preferred products. In other words, exporting less desired products boosts domestic beef demand by allowing consumers to focus their beef spending to their highest value. Beef is a perishable product which will be consumed by someone, and if all products must be consumed in the domestic market, it will happen only with lower total value. The value and importance of international beef and cattle trade to the U.S. beef cattle industry continues to grow.

Country of Origin Labeling

The 2002 Farm Bill included legislation to require country of origin labeling on beef and ground beef. While imported meats have been labeled since 1930, this law required meat from imported animals, along with ground beef, to carry detailed labels listing all origins for beef sold in retail grocery (Peel, 2009). The law did not apply to food service or highly processed products. The law specifically forbade USDA from implementing an animal identification system in order to verify the origin of domestically produced cattle. After several modifications and delays, mandatory country of origin labeling (mCOOL) was implemented in 2008. The United States lost a WTO case challenging the rule and ultimately removed the law in 2015 when faced with expensive tariffs from trading partners. Despite the lack of research that shows any demand increase or net value to the industry from mCOOL, along with numerous studies that verify the increased costs associated with mCOOL, the idea retains strong support among some cattle producers. It should be noted that there have never been any restrictions on the

use of voluntary origin labels to the extent that such efforts provide value in beef product markets.

Where We Are Now

In many ways, the cattle and beef industry has evolved significantly over time. A growing set of beef products are marketed through a vast array of retail grocery, food service, and export markets. An expanding set of specialized beef markets is capturing additional product value for branded programs based on grass-fed, natural (defined variably), non-hormone treated, or other attributes or consumer-desired production practices. The importance and value of international beef and cattle trade continues to grow and offers the greatest potential for sustained growth in the industry. Beef exports and imports help to optimize the mix of beef products in domestic markets and increase value directly and indirectly. Value-based marketing has provided incentives for cattle producers to increase beef quality over time as indicated by sharply higher Choice and Prime grading percentages and strong beef demand in recent years.

On the other hand, little has changed. As indicated by the Purcell quote that began this chapter, the concerns, issues, and proposed solutions have changed little from cattle producers' perspectives. The adversarial relationship between producers and packers has not improved and is arguably worse than ever. Regional and sectoral differences among cattle producers are sharper and more bitter than ever. Producers have cycled through a veritable list of perceived villains over time including packer concentration/market power, price discovery, beef and cattle imports, and futures markets. Historically, periods of high cattle prices have significantly diminished producer concerns only to see them revived during typical industry dynamics. The turmoil of the past two years has revived all these concerns simultaneously and added a couple of new ones in the form of supply chains and cold storage. There are numerous, very real issues and concerns in cattle and beef markets now and going forward. These deserve serious attention and consideration, based on careful evaluation developed from past and needed future research. There are also many distractions. To conclude, it is worth repeating the words of Dr. Wayne Purcell:

“The big danger is that all the attention on short-run and highly visible issues will block recognition of the problems that are long run and structural in nature and, in the process, prevent efforts to move to programs and policies that have a legitimate chance of helping.”

Summary

This chapter had two principal objectives: 1) to highlight the extraordinary complexity of the beef and cattle industry and 2) to provide a historical perspective to understand how the industry has evolved over time to have the characteris-

tics, structure, and practices that make up the industry today. Both are critical in the face of many varied legislative solutions being proposed at the current time. Whether we are considering proposals such as mandated cash trading levels, mCOOL, or others, it is essential that producers, industry leaders, and policy-makers understand the difficulty of successfully intervening in complex market systems without producing numerous and detrimental unintended consequences. Overly simplistic, one-size-fits-all legislative solutions to complex problems are almost certain to impede and interrupt the complicated, dynamic market signals and adjustments that coordinate a vast array of cattle and beef markets. The cattle industry has historically strongly embraced market systems. Many current proposals represent a significant departure from that market-oriented tradition and producers and policymakers are advised to proceed with great caution and deliberation before invoking simplistic solutions with great potential for long-term harm to the industry and to consumers.

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Chapter 2

Price Determination and Price Discovery in the Fed Cattle Market: A Review of Economic Concepts and Empirical Work

John D. Anderson, Andrew M. McKenzie, and James L. Mitchell

Introduction

Price discovery and price determination are closely related but distinct economic concepts related to the efficient and effective performance of markets. In discussions regarding the performance of prices in the fed cattle market, these two concepts are frequently not adequately distinguished. This leads to confusion regarding the perceived problems in the market, and consequently, potentially effective solutions. This chapter will describe both price discovery and price determination, focusing on the factors that influence the price discovery process in the fed cattle market. To assess the state of price discovery in regional fed cattle markets, an event study is performed using the reaction of regional cash fed cattle prices to unanticipated information in monthly *Cattle on Feed* reports. Results suggest that, while the information content of negotiated prices by region has changed in recent years, all regions continue to contribute to price discovery in the overall market. This result calls into question the need for proposed policy interventions to improve price discovery, as does the potential for such interventions to impede the ongoing market-driven evolution of pricing institutions in the sector. Few issues in the agricultural economy have attracted as much attention for as long a time as the behavior of prices in the fed cattle market. Questions about the accuracy and volatility of livestock prices – and particularly about the relationship of market structure to those issues – have been thoroughly investigated and hotly contested for well over a century now – with, it seems, little prospect for resolution even now.

A brief example from history should suffice to illustrate the impressive continuity between past and present controversies in the livestock and meat sector. In summarizing the results of a major congressionally-mandated investigation

into meat-packer business practices by USDA and the Federal Trade Commission (FTC) in the early twentieth century, Virtue (1920) notes that:

One of the most general and persistent complaints of the feeders is that prices of livestock so frequently have no relation to cost of production, and, taken for short periods, no relation to natural market conditions; that these fluctuations introduce so great an element of risk as to make feeding one of the most hazardous of industries, resulting in disastrous losses to the feeders and in the end throwing a great burden on consumers as well. Well-informed stock men are convinced that these erratic price movements can be explained only on the theory of “manipulation” by packers, whom they regard as the beneficiaries of the changes. (p. 652)

The issues that concerned Virtue’s “well-informed stock men” related to whether or not livestock prices accurately reflected underlying supply and demand conditions, how quickly those prices adjusted to new information, and whether or not the concentration of market power at the processing level led to intentional, strategic manipulation of these processes. This would be a pretty fair summary of the concerns of today’s cattle market participants as well. In slightly more technical jargon, these are issues that touch on the distinct but related concepts of price determination and price discovery.

Price determination refers to how the forces of supply and demand for a particular product or commodity interact to produce an equilibrium price.

In contrast to price determination, price discovery refers to the means by which a particular buyer and seller arrive at a price on a specific transaction.

Definition of Terms

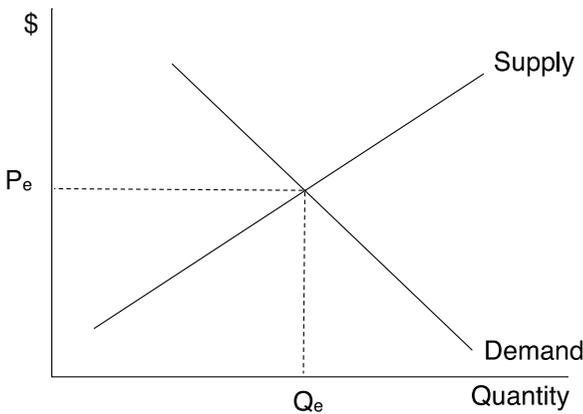
The terms “price determination” and “price discovery” are used virtually interchangeably in a great deal of non-technical communication about markets. However, among agricultural economists, these are terms of art with specific meaning, referring to different but related concepts relevant to any discussion of commodity pricing. In order to productively assess the impacts of changing institutional arrangements in the fed cattle market on price behavior, it is helpful to clearly distinguish between these concepts.

Price determination refers to how the forces of supply and demand for a particular product or commodity interact to produce an equilibrium price. It is concerned not with the outcome of any particular transaction but rather with the general price level that prevails based on fundamental conditions in the broader market. Price determination is well-represented graphically by the classic,

“Marshallian scissors” supply and demand graph, as depicted in Figure 2.1.¹ The interaction of market supply and market demand – reflecting the summation of individual participants on each side of the market – results in an equilibrium price and quantity.

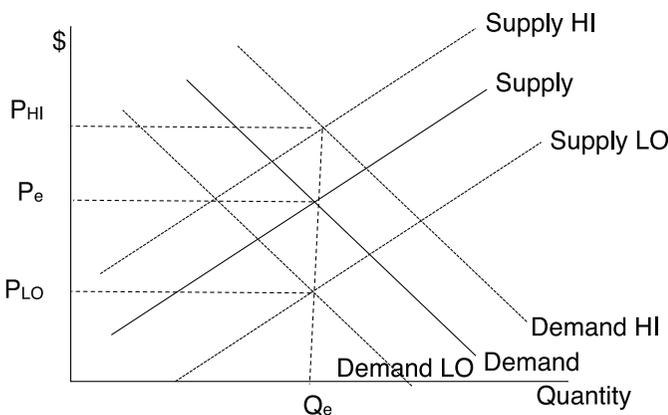
In contrast to price determination, price discovery refers to the means by which a particular buyer and seller arrive at a price on a specific transaction. In reality, market supply and demand are not directly observable. Buyers and sellers lack perfect information, so the equilibrium price and quantity are not as readily

¹ The graphical representations of price discovery and price determination in Figures 2.1 and 2.2 are common depictions of a market. In the context of specifically illustrating price determination and price discovery, though, these graphs borrow directly from Ward and Schroeder (2004).



Notes: P_e and Q_e denote equilibrium price and quantity, respectively.

Figure 2.1. Price Determination in a Hypothetical Market.



Notes: P_e and Q_e denote equilibrium price and quantity, respectively.

Figure 2.2. Price Discovery in a Hypothetical Market.

transparent as Figure 2.1 might imply. Thus bid (buyer) and ask (seller) prices will vary around the equilibrium price in the process of price discovery. This process is illustrated in Figure 2.2, in which the “true” supply and demand are bracketed by the upper and lower estimates of market participants. Bid and ask prices would be expected to fall between the high and low prices implied by the intersection of these supply and demand estimates, centering around the true equilibrium price.

Improving price discovery cannot be expected to improve the overall level of prices if prevailing supply and demand fundamentals are consistent with low prices.

Price discovery is concerned directly with the mechanics by which individual transaction prices (and other terms of trade) are established rather than with broader, and generally more theoretical, issues of how supply and demand fundamentals affect the general price level (Tomek and Kaiser 2014). In effect, then, price determination represents a macro-level perspective on the equilibrium price while price discovery represents a micro-level perspective on the variability of prices around that equilibrium.

With these distinctions in mind, it is worth noting clearly what improving price discovery can and cannot do. Most importantly, improving price discovery cannot be expected to improve the overall level of prices if prevailing supply and demand fundamentals are consistent with low prices. That is, if supply and demand conditions in the market are consistent with low prices (price determination), then the interactions of buyers and sellers in specific transactions should produce a low average price (price discovery). Realistically, what improving price discovery can accomplish is to make prices more efficient.

Efficiency is another term that has a specific meaning among economists. A market is efficient if prices in that market reflect all available information (Fama, 1970). Janzen and Adjemian (2017) note that effective price discovery accomplishes the task of reflecting underlying information in a timely manner and does so via “bona fide transactions or standing bids and offers whose prices are known to all market participants” (p. 1192). This understanding of price discovery offers a useful perspective in that it allows potential price discovery issues to be separated from mere discontent over price determination at a low price point. For example, are market transactions truly bona fide? In a heavily concentrated market where power between buyers and sellers is dramatically asymmetrical, are transactions a reliable reflection of underlying fundamental conditions or are they distorted by the impact of that power asymmetry on the negotiation process? Further, as the volume of transactions declines, are there sufficient transactions or open bids to inform the broader market? In other words, how many negotiated transactions are needed to adequately reflect underlying fundamental information? These and similar issues complicate the conceptually simple relationship between price discovery and price determination.

Complicating Factors: Market Concentration

The meatpacking sector is, and has long been, highly concentrated. The most recent annual report from USDA's Agricultural Marketing Service, Packers and Stockyards Division (2020) puts the four-firm concentration ratio for the steer and heifer processing sector at 85%, consistent with the level of concentration since the 1980s. Concentration ratios in regionally-defined markets are generally even higher (Ward, 1988). This high degree of market concentration has long fostered concern that prices are manipulated through non-competitive behavior (e.g., see the earlier citation from Virtue, 1920). A great deal of work over many years has sought evidence of such behavior in the fed cattle market, but such work has consistently found little support for significant negative price effects of concentration (Ward, 1997; Ward, 1999; Crespi, Saitone, and Sexton, 2012).

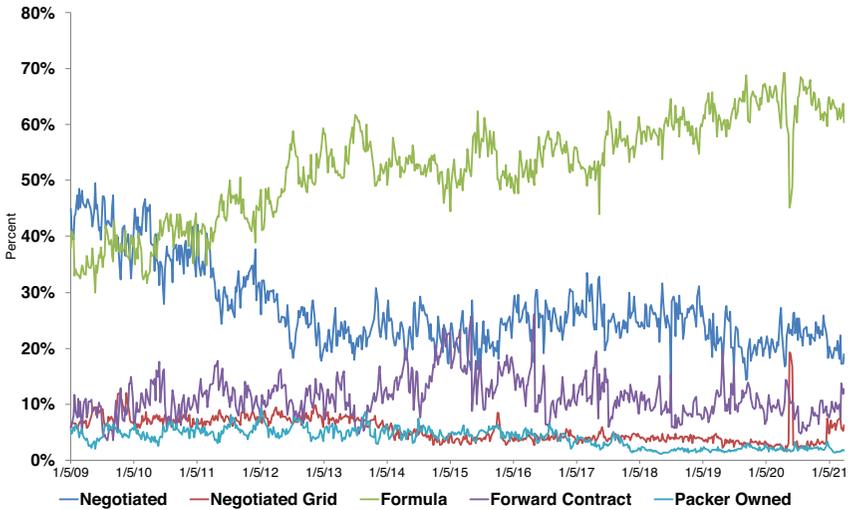
Even aside from the intentional exercise of market power, concentration could have more subtle effects on price discovery. Concentration in the meatpacking industry has largely been driven by the significant economies of size associated with meatpacking operations (Ward, 1988). Bailey and Brorsen (1987) note that economies of size could directly influence price discovery. Larger firms have more total information (public plus private) simply by virtue of the volume of transactions to which they are party. If this combination of information is more accurate than public information alone, price discovery may be affected. Price adjustments to new information in concentrated markets may also be affected if one or two major firms play a price leadership role (Goodwin and Holt, 1999).

This high degree of market concentration has long fostered concern that prices are manipulated through non-competitive behavior. A great deal of work over many years has sought evidence of such behavior in the fed cattle market, but such work has consistently found little support for significant negative price effects of concentration.

Complicating Factors: Thin Market Issues

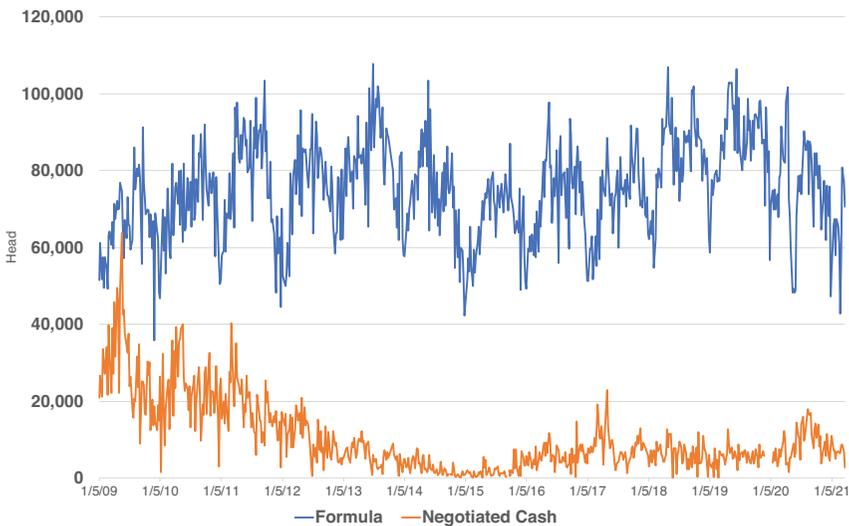
A market in which negotiated transactions over a given period of time are not sufficient to support efficient price discovery is a thin market (Anderson *et al.*, 2007). In a thin market, prices may become a less reliable guide to actual value as supported by market fundamentals and, in so doing, contribute to resource misallocation (Adjemian, Saitone, and Sexton 2016). In a practical sense, in such a market, we would expect to see increasing variability of prices around the equilibrium price; and evaluations of price discovery on thin markets often involve some means of quantifying this phenomenon (Tomek 1980).

There is no doubt that pricing behavior in the fed cattle market has changed dramatically, particularly within the past decade, in ways that raise concerns about



Source: USDA Agricultural Marketing Service, Livestock, Poultry & Grain.

Figure 2.3. Weekly Live Cattle Transactions by Type: Percent of Total Weekly Transactions.



Source: USDA Agricultural Marketing Service, Livestock, Poultry & Grain.

Figure 2.4. Weekly Live Cattle Transactions by Formula and Negotiated Cash Sales: Texas/Oklahoma Reporting Region.

effective price discovery. While the total number of cattle traded each week remains quite large, negotiated transactions as a percentage of all transactions have fallen sharply. This is illustrated in Figure 2.3, which shows the percentage of total weekly fed cattle transactions accounted for by each transaction type reported by USDA's Agricultural Marketing Service from January 2009 through March 2021. The change in the proportion of negotiated cash transactions is significant. For example, in 2010, 45 percent of all fed cattle transactions were negotiated (either negotiated cash or negotiated grid); 39 percent were formula-based transactions. In 2020, just 26 percent of fed cattle transactions were negotiated while 63 percent were formula-based.

The decline in negotiated transactions is more pronounced at the regional level. For example, in the southern Plains feeding region, the volume of negotiated transactions has become quite small in recent years. This is confirmed by Figure 2.4, which shows negotiated cash and formula-based fed cattle transactions in Texas/Oklahoma from January 2009 through March 2021. For the whole of 2020, negotiated cash transactions in this region amounted to just 12% of all fed cattle transactions.

To a large extent, formula-based transactions rely on some previous negotiated price as a key component of the pricing formula (Coffey, Pendell, and Tonsor, 2019). Thus, more and more formula transactions are dependent on negotiated prices that reflect fewer and fewer underlying sales. As Adjemian *et al.* (2016) point out, this has the potential to propagate any pricing inefficiencies more broadly, thus magnifying any pricing problems that already exist. This is not a new concern. Schroeder *et al.* (1998) report results of a survey of both feeders and packers regarding fed cattle pricing practices. Those survey respondents note the potential for quality differences between negotiated and formula sales to result in pricing inaccuracies. Livestock Mandatory Price Reporting (LMR) was intended to alleviate at least some of these concerns. For example, LMR made it impossible for packers to manipulate the base price in formulas by only reporting some of their negotiated prices (Matthews *et al.*, 2015). However, as the negotiated side of the market has thinned further, concerns over pricing accuracy related to formula pricing have intensified.

While many researchers have acknowledged the thinness of the negotiated fed cattle market and the potential for price discovery problems which that implies, considerable empirical work with data available through LMR has yet to document significant problems (Crespi, Saitone, and Sexton, 2012; Brorsen, Fain, and Maples, 2018). In a deep-dive into livestock pricing practices initiated by congressional action and making use of a unique data set on individual transactions compiled by USDA's Grain Inspection, Packers and Stockyards Administration, Muth *et al.* (2007) found small negative price effects from the use of alternative marketing arrangements (AMAs, which include formula pricing). However, they also documented significant cost savings and quality improvements facilitated by AMAs – benefits that far outweighed the small negative price effects, such that eliminating AMAs would reduce both producer and consumer surplus in the sector. In a more recent study, Ward, Vestal, and Lee (2014) found that the relationship between negotiated

and formula prices remained remarkably stable even as negotiated transaction volume declined. Thus, while negotiated transactions in the fed cattle market have clearly thinned, dramatically so in some regions, there is little objective evidence that this has adversely affected price discovery generally or that it has compromised the functioning of formula arrangements tied to negotiated prices.

The inability of researchers to document thin-market-related pricing problems in the fed cattle sector is not too surprising for two primary reasons. First, defining the point at which a market becomes “too thin” is notoriously difficult (Adammer, Bohl, and Gross, 2016). Previous work on thinning markets shows that relatively few transactions are required to maintain pricing efficiency as long as negotiated transactions are representative of the market as a whole (Tomek, 1980). Second, due to significant economies of size in packing plants, packers have a strong incentive to offer reasonably fair pricing terms in order to ensure optimal throughput for their plants over a long time horizon (Morrison, 2001; Anderson, Trapp, and Fleming, 2003; MacDonald and Ollinger, 2005; Crespi, Saitone, and Sexton, 2012).

While negotiated transactions in the fed cattle market have clearly thinned, dramatically so in some regions, there is little objective evidence that this has adversely affected price discovery generally or that it has compromised the functioning of formula arrangements tied to negotiated prices.

Fed Cattle Price Discovery: An Event Study Evaluation of Market Efficiency

A natural question to ask, in light of the increased use of formula pricing and associated concern over the effectiveness of price discovery in an increasingly thin negotiated market is which, if any, of the major LMR regional markets best reflect market supply and demand fundamentals in their negotiated prices? We seek to shed light on this issue using an event study approach to measure price responses to unanticipated information contained in monthly USDA *Cattle on Feed (COF)* Reports. The objective of this event study is to determine whether the efficiency of price discovery has been affected by changes in fed cattle pricing practices. Specific objectives are twofold: 1) to determine whether the process of price discovery has changed over time as pricing practices have evolved and 2) to identify any differences in the efficiency of price discovery across regions correlated with regional changes in fed cattle pricing practices.

The issue of cattle market price discovery has drawn much attention in the literature, and a recent study by Coffey, Pendell and Tonsor (2019) found that the role played by the various LMR cash market regions has changed over the years. In particular, they highlighted the growing importance of Colorado as the share of negotiated transactions taking place in more traditional regions – e.g., Texas/Oklahoma/New Mexico – has decreased.

A large amount of literature has shown that grain and livestock market futures prices respond to unanticipated information contained in USDA reports (Grunewald, McNulty, and Biere, 1993; Adjemian, 2012; Garcia *et al.*, 1997; Isengildina-Massa *et al.*, 2008a; Isengildina-Massa *et al.*, 2008b; McKenzie, 2008; Sumner and Mueller, 1989; Karali, Isengildina-Massa, and Irwin, 2019). The unanticipated component of the report, which may be thought of as a market shock, is typically measured as the difference between analyst forecasts of the report and actual report numbers officially released by USDA. Thus, if it can be assumed that USDA reports contain valuable information, then significant price responses that are consistent with that information are indicative of price discovery. With this in mind, we examine the response of the five major LMR regional negotiated cash markets (i.e., Colorado, Iowa/Minnesota, Kansas, Nebraska, and Texas/Oklahoma/New Mexico) to the release of unanticipated information about on-feed inventory, placements, and marketings, contained in *COF* reports. By isolating specific supply and demand shocks, this approach allows us to examine the extent to which market prices respond in a rational manner consistent with effective price discovery. Larger than anticipated increases in on-feed inventory and placements – which reflect larger cattle supplies – should elicit price decreases. Conversely, larger than anticipated increases in cattle marketings – which reflect both increased demand and expectations for smaller remaining short-run supply – should result in price increases.

Each component of the *COF* report provides the market with information that is used to make inferences about current and future beef production. On-feed inventory and marketing more closely relate to near term production, and shocks would be expected to have impacts on current cash market prices or nearby futures contract prices. On the other hand, surprises to cattle placements which have implications for future beef production and affect supplies in future months should influence deferred live cattle futures contract prices and cash prices several months after the *COF* report release date. However, the exact timing of price impacts with respect to surprises in placements is somewhat ambiguous depending upon cattle weights and is ultimately an empirical question. For example, nearby live cattle futures prices and current cash prices could be impacted through a feedback effect whereby the expectation of future price decreases could increase current supplies and depress current cash prices.

Grunewald, McNulty and Biere (1993) found that surprises to both placements and marketings moved deferred live cattle futures prices, but only surprises to marketings affected nearby futures prices. Specifically, when placements are one percent higher than expected, this results in a 0.07 to 0.09 percent decrease in deferred futures prices; when marketings are one percent higher than expected, deferred futures prices increase by 0.15 to 0.18 percent. In contrast, Karali, Isengildina-Massa, and Irwin (2019) showed that surprises to both placements and marketings affected nearby live cattle futures prices prior to 2000, while only shocks to marketings impacted nearby futures prices after 2000. Their results are similar to Grunewald, McNulty and Biere. For example, when placements are one percent higher than expected, nearby futures prices prior to 2000 decrease by 0.04 percent, and when

marketings are one percent higher than expected, nearby futures prices increase by about 0.1 percent over the 1977 to 2016 period.

Data

Monthly livestock market analyst forecasts reported in the *Cattle Buyers Weekly* newsletter and USDA announcements of monthly on-feed inventory, placements and marketings contained in *COF* reports were collected over the January 2004 to December 2020 period.² Each month, between four to eight analysts make projections, which are reported in *Cattle Buyers Weekly* on the Monday prior to a Friday's *COF* release date. The average trade estimate is taken to be the median analyst forecast. USDA numbers and analyst forecasts are reported for the current month as a percentage of the comparable month a year ago. Market surprises, or the unanticipated component of the reports, were then measured as the percentage difference between the USDA numbers and the median analyst forecasts for on-feed inventory, placements, and marketings with respect to each monthly report over the sample period.

In addition, weekly weighted average of live steer and heifer cash prices of the five major LMR regions (Colorado, Iowa/Minnesota, Kansas, Nebraska and Texas/Oklahoma/New Mexico) were collected over the same January 2004 to December 2020 period. *COF* reports are typically released on Friday afternoons each month at 2:00 pm central time.³ To measure LMR region cash price responses to market surprises in on-feed inventory, placements, and marketings, prices for the immediate week prior to a *COF* report release and for the immediate week following a *COF* report release were logged and the percentage change in price around each of the *COF* report months calculated.⁴

Methods

A typical event study model can be written as an Ordinary Least Squares (OLS) regression:

$$1) \quad P_{+1} - P_{-1} = \bar{a} + \bar{b} (COF_{ijt}^{USDA} - COF_{ijt}^{private}) + e_t,$$

where in our study, $P_{+1} - P_{-1}$ represents the logged percentage change in the negotiated cash fed cattle price from the week prior to the report release to the week following the report release. The term $(COF_{ijt}^{USDA} - COF_{ijt}^{private})$ represents the surprise or

² *Cattle Buyers Weekly*, on occasion, did not publish a monthly preview due to a publishing break or business travel. Over the sample period, this occurred twelve times (September 18, 2017, January 18, 2016, December 14, 2015, July 16, 2012, February 15, 2010, April 13, 2009, September 15, 2008, October 16, 2006, January 16, 2006, September 19, 2005, October 18, 2004, and February 16, 2004).

³ There were 4 missing observations for the Texas/Oklahoma/New Mexico series and 26 missing observations for the Colorado series because no prices were reported in those regions in certain weeks. The Colorado missing observations occurred between May 2018 and December 2020.

⁴ It should be noted that the immediate week prior to a *COF* release is actually the 5 days (Monday to Friday) of the *COF* release week. Given that, *COF* reports are released on Friday afternoons at 2pm central time, a small percentage of the week's LMR recorded prices may have occurred after the *COF* release.

shock element of COF reports, where COF_{ijt}^{USDA} represents the USDA forecast of either on-feed inventory, placements, or marketings related information i , observed in month j and year t , and $COF_{ijt}^{Private}$ represents the median livestock market consensus forecast of either on-feed inventory, placements, or marketings related information i , observed in month j and year t (and is a mean zero normally distributed error with constant variance term).

In the traditional event study approach, the estimated regression coefficient measures the average price response to a one percent change in the surprise element of USDA reports. Thus, it is assumed that LMR cash prices only react to the element of COF report information that was not anticipated by the analysts and the private sector livestock industry. While we assume that rational LMR cash price reactions to COF surprises are indicative of price discovery, we acknowledge that these cash prices are also likely influenced by other market conditions and are likely noisy estimates of price discovery.

We present several different event study results based on equation (1) regressions of cash price changes on COF market surprises. First, we analyze our model using data from the full sample period, January 2004 to December 2020. Second, we analyze our model including only observations where placement surprises and marketings surprises would be expected to induce price reactions in the same direction. Our objective is to remove COF surprises associated with noisy price signals and only analyze the price impact of consistent, unambiguous bull or bear market surprises. Given that, *a priori*, we would expect price responses to be negatively correlated to placement surprises and positively correlated to marketings surprises, our goal is to remove monthly observations with either (a) larger



Figure 2.5. Market Surprises or Analyst Forecast Errors (FE) of Cattle on Feed, Placements, and Marketings: 1/16/04 to 12/18/20.

Table 2.1. Correlations between Weekly Changes in Negotiated Live Cattle Cash Prices and Market Surprises to Cattle on Feed, Placements and Marketings 1/16/04 to 12/18/20.

	Feed	Placed	Marketed	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Feed	1	0.81**	-0.31**	-0.14**	-0.13*	-0.11	-0.1	-0.12*
Placed		1	-0.1	-0.12*	-0.13*	-0.1	-0.11	-0.12*
Marketed			1	0.1	0.08	0.09	0.13*	0.06
Texas ^a				1	0.98**	0.93**	0.93**	0.90**
Kansas					1	0.94**	0.94**	0.91**
Nebraska						1	0.96**	0.94**
Colorado							1	0.91**
Iowa ^b								1

* indicates the Pearson correlation coefficient is significant at the 10% level on a two tailed test.
** indicates the Pearson correlation coefficient is significant at the 5% level on a two tailed test.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

than expected placements and larger than expected marketings, or (b) lower than expected placements and lower than expected marketings. Specifically, we only retain observations for months when positive placement surprises are simultaneously observed with negative marketings surprises (bear market shocks) and negative placement surprises are simultaneously observed with positive marketings surprises (bull market shocks). Third, and again to measure price discovery with respect to clear signals, we retain only observations with large placements (3% or larger in absolute terms) and/or marketings surprises (1% or larger in absolute terms) within our second (consistent bull or bear shock) data category.

In addition, and to make a fairer comparison between LMR markets, the second, third, and fourth applications of our analysis only include months where there are no missing observations across all five reporting regions. Finally, using our second (consistent bull or bear shock) data category, we split the sample between January 2004 to December 2013 and January 2014 to December 2020. Our objective in this case is to examine if the primary LMR cash market price discovery locations change over time. Our motivation stems from the fact that since 2014, the percentage volume of negotiated cash transactions occurring in the Texas/Oklahoma/New Mexico region has decreased dramatically. Prior to 2014, this region accounted for 20% to 40% of negotiated transactions, with the number decreasing consistently over the period (Coffey, Pendell and Tonsor, 2019). However, in the post-2014 period, this number had dropped to around 10% of negotiated transactions, which begs the question as to whether the price discovery role played by this market has also diminished over time.

Results

The size of market surprises for on-feed inventory, placements, and marketings is illustrated graphically in Figure 2.5. Clearly, the magnitude of these surprises

Table 2.2. Response of Negotiated Live Cattle Cash Prices to Market Surprises in Placements and Marketings 1/16/04 to 12/18/20.

Parameters	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Intercept	0.002	0.003	0.003	0.003	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Placed	-0.074	-0.076*	-0.063	-0.06	-0.069
	(0.046)	(0.045)	(0.047)	(0.048)	(0.042)
Marketed	0.154	0.122	0.142	0.217	0.073
	(0.130)	(0.125)	(0.132)	(0.139)	(0.118)
R-Squared	0.023	0.021	0.017	0.026	0.017
LM(1)	0.528	1.018	0.297	0.369	0.132
	(0.467)	(0.313)	(0.586)	(0.544)	(0.716)
B-P	0.446	0.198	0.312	0.188	0.751
	(0.800)	(0.906)	(0.855)	(0.910)	(0.687)
F Test	2.169	2.058	1.632	2.198	1.648
	(0.117)	(0.131)	(0.198)	(0.114)	(0.195)
Observations	188	192	192	166	192

Standard errors of coefficients are presented in parentheses in top half of table.
 LM(1) is Breusch-Godfrey (Lagrange Multiplier test for first order autocorrelation). The test statistic is specified as Chi-Squared with 1 degree of freedom and p-values are presented in parentheses below the test statistic.
 B-P is Breusch-Pagan test for heteroscedasticity and p-values are presented in parentheses below the test statistic.
 F-test for the hypothesis that all of the coefficients (excluding the constant) are zero with p-values in parentheses.
 *Indicates significance at the 10% level.
 **Indicates significance at the 5% level.
 *** Indicates significance at the 1% level.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

Table 2.3. Correlations between Weekly Changes in Negotiated Live Cattle Cash Prices and Market Surprises with consistent Bull or Bear Market Surprises to Placements and Marketings 1/16/04 to 12/18/20.

	Feed	Placed	Marketed	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Feed	1	0.86**	-0.80**	-0.25**	-0.23**	-0.19*	-0.15	-0.14
Placed		1	-0.67**	-0.29**	-0.30**	-0.24**	-0.23**	-0.20*
Marketed			1	0.27**	0.26**	0.24**	0.20*	0.21*
Texas ^a				1	0.97**	0.89**	0.89**	0.84**
Kansas					1	0.92**	0.93**	0.87**
Nebraska						1	0.95**	0.94**
Colorado							1	0.88**
Iowa ^b								1

* indicates the Pearson correlation coefficient is significant at the 10% level on a two tailed test.
 ** indicates the Pearson correlation coefficient is significant at the 5% level on a two tailed test.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

has remained constant over time, suggesting that the price discovery role played by *COF* reports has likely not diminished. Surprises to placements are typically much larger than either marketings or on-feed inventory surprises, with the latter by far the smallest. In addition, there does not appear to be any systematic bias in

Table 2.4. Response of Negotiated Live Cattle Cash Prices to Consistent Bull or Bear Market Surprises in Placements and Marketings 1/16/04 to 12/18/20.

Parameters	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Intercept	0.001	0.001	0	0	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Placed	-0.102	-0.118	-0.078	-0.1	-0.049
	(0.074)	(0.078)	(0.080)	(0.084)	(0.076)
Marketed	0.183	0.154	0.203	0.119	0.198
	(0.195)	(0.205)	(0.211)	(0.221)	(0.199)
R-Squared	0.096	0.094	0.07	0.057	0.051
LM(1)	0.562	0.617	0.365	0.171	0.293
	(0.453)	(0.432)	(0.546)	(0.679)	(0.588)
B-P	2.116	0.88	1.053	0.244	1.705
	(0.347)	(0.644)	(0.591)	(0.885)	(0.426)
F Test	4.028**	3.955**	2.847*	2.303	2.058
	(0.022)	(0.023)	(0.064)	(0.107)	(0.135)
Observations	79	79	79	79	79
Placed	-0.148***	-0.157***	-0.130**	-0.130**	-0.100*
	(0.055)	(0.058)	(0.060)	(0.062)	(0.056)
R-Squared	0.085	0.087	0.058	0.054	0.039
Marketed	0.361**	0.361**	0.341**	0.294*	0.285*
	(0.146)	(0.153)	(0.156)	(0.165)	(0.148)
R-Squared	0.074	0.067	0.058	0.04	0.046

Standard errors of coefficients are presented in parentheses in top half of table.
LM(1) is Breusch-Godfrey (Lagrange Multiplier test for first order autocorrelation). The test statistic is specified as Chi-Squared with 1 degree of freedom and p-values are presented in parentheses below the test statistic.
B-P is Breusch-Pagan test for heteroscedasticity and p-values are presented in parentheses below the test statistic.
F-test for the hypothesis that all of the coefficients (excluding the constant) are zero with p-values in parentheses.
*Indicates significance at the 10% level.
**Indicates significance at the 5% level.
*** Indicates significance at the 1% level.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

analyst forecasts with over-estimates equally as likely as under-estimates.

Correlations between market surprises and LMR cash price changes around the *COF* report releases for our whole January 2004 to December 2020 sample period are presented in Table 2.1 and highlight several important implications of the data. First, on-feed inventory and placement surprises are highly positively correlated (0.81), such that including both as explanatory variables in a regression would likely lead to problems of multicollinearity. With this in mind, and given that preliminary specifications indicated that on-feed inventory surprises were insignificant and added no explanatory power beyond placement surprises, we present models and results with on-feed inventory surprises excluded. Second, as expected, on-feed inventory and placement surprises are negatively correlated to marketings. Larger than expected on-feed inventory and placement numbers, which correspond to higher supply, tend to occur when marketings, which are

Table 2.5. Correlations between Weekly Changes in Negotiated Live Cattle Cash Prices and Market Surprises with only large Surprises in both Marketings and Placements with consistent Bull or Bear Market Surprises to Placements and Marketings 1/16/04 to 12/18/20.

	Feed	Placed	Marketed	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Feed	1	0.88**	-0.81**	-0.35**	-0.32**	-0.25*	-0.23*	-0.19
Placed		1	-0.67**	-0.33**	-0.32**	-0.23*	-0.23*	-0.17
Marketed			1	0.33**	0.32**	0.27*	0.24*	0.25*
Texas ^a				1	0.97**	0.87**	0.89**	0.82**
Kansas					1	0.91**	0.93**	0.86**
Nebraska						1	0.96**	0.94**
Colorado							1	0.89**
Iowa ^b								1

* indicates the Pearson correlation coefficient is significant at the 10% level on a two tailed test.
** indicates the Pearson correlation coefficient is significant at the 5% level on a two tailed test.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

associated with lower supply and higher demand, are lower than expected. Third and consistent with economic theory, on-feed inventory and placement surprises – supply side shocks – are negatively correlated to LMR cash price changes, while marketings surprises – demand side shocks – are positively correlated to LMR cash price changes. Fourth, cash price changes across all five LMR market regions are highly positively correlated ($\rho > 0.9$), suggesting that these markets are well integrated and that price discovery signals are quickly transmitted.

Regression results based on equation (1), which measure immediate LMR cash price responses to *COF* surprises for the full sample period, are reported in Table 2.2. Results show that although all cash price responses are of the expected signs, only Kansas prices have a small but significant response to placement surprises. A 1% larger than expected increase in placements results in a 0.076% decrease in Kansas prices, which is roughly in line with previous research measuring cattle futures price reactions (Grunewald, McNulty, and Biere, 1993; Karali, Isengildina-Massa, and Irwin, 2019). Also, R-squared values of around 2% show that *COF* surprises explain little of the price variation across LMR markets. If anything, *COF* reports, on average, provide very noisy price signals.

Consistent Bull and Bear Market Pricing Signals

Turning to results for our models designed to measure clearer bull and bear market pricing signals, we can see much stronger correlations between LMR cash prices for all regions and *COF* surprises in Table 2.3. However, a natural and expected effect of organizing our data in this manner is to induce a high degree of correlation ($\rho = -0.67$) between placements and marketings. As such, our regression models based on this data will suffer from multicollinearity between placements

Table 2.6. Response of Negotiated Live Cattle Cash Prices to only large Surprises in both Marketings and Placements with consistent Bull or Bear Market Surprises to Placements and Marketings 1/16/04 to 12/18/20.

Parameters	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Intercept	-0.001	-0.002	-0.003	-0.002	-0.004
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Placed	-0.083	-0.092	-0.039	-0.058	-0.008
	(0.075)	(0.080)	(0.083)	(0.085)	(0.079)
Marketed	0.225	0.215	0.259	0.191	0.265
	(0.196)	(0.207)	(0.215)	(0.221)	(0.205)
R-Squared	0.129	0.123	0.079	0.066	0.061
LM(1)	0.26	0.084	0.273	0.381	0.452
	(0.610)	(0.772)	(0.601)	(0.537)	(0.501)
B-P	2.11	0.927	0.451	0.015	1.306
	(0.348)	(0.629)	(0.798)	(0.993)	(0.521)
F Test	3.862**	3.659**	2.22	1.828	1.681
	(0.027)	(0.033)	(0.119)	(0.171)	(0.196)
Observations	55	55	55	55	55
Placed	-0.141**	-0.148**	-0.106*	-0.107*	-0.076
	(0.056)	(0.059)	(0.061)	(0.063)	(0.059)
R-Squared	0.107	0.105	0.053	0.052	0.031
Marketed	0.370**	0.376**	0.327**	0.292*	0.278*
	(0.145)	(0.154)	(0.158)	(0.163)	(0.150)
R-Squared	0.109	0.101	0.075	0.057	0.061

Standard errors of coefficients are presented in parentheses in top half of table.
 LM(1) is Breusch-Godfrey (Lagrange Multiplier test for first order autocorrelation). The test statistic is specified as Chi-Squared with 1 degree of freedom and p-values are presented in parentheses below the test statistic.
 B-P is Breusch-Pagan test for heteroscedasticity and p-values are presented in parentheses below the test statistic.
 F-test for the hypothesis that all of the coefficients (excluding the constant) are zero with p-values in parentheses.
 *Indicates significance at the 10% level.
 **Indicates significance at the 5% level.
 *** Indicates significance at the 1% level.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

and marketings. It should be noted that the consequences of multicollinearity is to reduce the precision or accuracy of our coefficient estimates and increase their standard errors, reducing our ability to detect significant effects in our multiple regression models. However, importantly, the predictive and explanatory power of such models in terms of R-squared values is not diminished, and the joint contribution of our explanatory variables (placement and marketings surprises) can still be measured. Therefore, in the top half of Table 2.4 we present our consistent Bull or Bear market surprise models results for our multiple regression specifications (with both placement and marketings surprises included as explanatory variables), and for comparison purposes we present regression results for placement and marketing surprises modeled separately as explanatory variables.

Table 2.7. Correlations between Weekly Changes in Negotiated Live Cattle Cash Prices and Market Surprises with consistent Bull or Bear Market Surprises to Placements and Marketings 2004 to 2013.

	Feed	Placed	Marketed	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Feed	1	0.88**	-0.81**	-0.22*	-0.21	-0.18	-0.15	-0.12
Placed		1	-0.71**	-0.25*	-0.25*	-0.21*	-0.2	-0.16
Marketed			1	0.29*	0.27*	0.24*	0.2	0.21
Texas ^a				1	0.97**	0.88**	0.90**	0.83**
Kansas					1	0.91**	0.93**	0.87**
Nebraska						1	0.96**	0.94**
Colorado							1	0.89**
Iowa ^b								1

* indicates the Pearson correlation coefficient is significant at the 10% level on a two tailed test.
** indicates the Pearson correlation coefficient is significant at the 5% level on a two tailed test.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

Table 2.8. Correlations between Weekly Changes in Negotiated Live Cattle Cash Prices and Market Surprises with consistent Bull or Bear Market Surprises to Placements and Marketings 2014 to 2020.

	Feed	Placed	Marketed	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Feed	1	0.84**	-0.72**	-0.43*	-0.38	-0.4	-0.31	-0.44*
Placed		1	-0.70**	-0.43*	-0.45*	-0.43*	-0.41*	-0.46*
Marketed			1	0.33	0.37	0.46*	0.41*	0.44*
Texas ^a				1	0.98**	0.95**	0.89**	0.93**
Kansas					1	0.96**	0.95**	0.92**
Nebraska						1	0.92**	0.95**
Colorado							1	0.86**
Iowa ^b								1

* indicates the Pearson correlation coefficient is significant at the 10% level on a two tailed test.
** indicates the Pearson correlation coefficient is significant at the 5% level on a two tailed test.
^aTexas refers to the Texas-Oklahoma-New Mexico market.
^bIowa refers to the Iowa-Minnesota market.

Although, as expected, coefficients are not significant for our multiple regressions, the R-squared values are much higher in comparison to our full sample results presented in Table 2.2. The Texas/Oklahoma/New Mexico and Kansas markets appear to best incorporate the *COF* information with around 10% of the weekly price variation following the report release dates explained by surprises to placements and marketings. In contrast, only 5% of the weekly price variation is explained by the surprises in the Colorado and Iowa/Minnesota markets. These price impacts are confirmed by our separate regression results shown at the foot of Table 2.4. Clearly, by focusing on unambiguous bull and bear market signals in *COF* reports over the full sample period, our results show that the primary price discovery markets are Texas/Oklahoma/New Mexico and Kansas. These results are perhaps not surprising given that the Texas/Oklahoma/New Mexico

Table 2.9. Response of Negotiated Live Cattle Cash Prices to Consistent Bull or Bear Market Surprises in Placements and Marketings 2004 to 2013.

Parameters	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Intercept	0	0	-0.001	-0.001	-0.002
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Placed	-0.048	-0.063	-0.05	-0.068	-0.007
	(0.093)	(0.097)	(0.104)	(0.107)	(0.101)
Marketed	0.255	0.222	0.228	0.151	0.249
	(0.207)	(0.216)	(0.232)	(0.239)	(0.225)
R-Squared	0.086	0.078	0.061	0.045	0.045
LM(1)	0.177	0.16	1.508	0.475	0.487
	(0.674)	(0.689)	(0.220)	(0.491)	(0.485)
B-P	0.434	0.151	0.756	0.211	1.384
	(0.805)	(0.927)	(0.685)	(0.900)	(0.501)
F Test	2.713*	2.451*	1.889	1.368	1.358
	(0.075)	(0.095)	(0.161)	(0.263)	(0.265)
Observations		61	61	61	61
Placed	-0.129*	-0.134*	-0.123*	-0.116	-0.087
	(0.066)	(0.068)	(0.073)	(0.075)	(0.071)
R-Squared	0.062	0.061	0.045	0.039	0.024
Marketed	0.331**	0.322**	0.308*	0.257	0.26
	(0.145)	(0.151)	(0.162)	(0.167)	(0.157)
R-Squared	0.081	0.071	0.057	0.039	0.045

Standard errors of coefficients are presented in parentheses in top half of table.
 LM(1) is Breusch-Godfrey (Lagrange Multiplier test for first order autocorrelation). The test statistic is specified as Chi-Squared with 1 degree of freedom and p-values are presented in parentheses below the test statistic.
 B-P is Breusch-Pagan test for heteroscedasticity and p-values are presented in parentheses below the test statistic.
 F-test for the hypothesis that all of the coefficients (excluding the constant) are zero with p-values in parentheses.
 *Indicates significance at the 10% level.
 **Indicates significance at the 5% level.
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^aTexas refers to the Texas-Oklahoma-New Mexico market.
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and Kansas markets accounted for around 50 to 70% of the overall volume of negotiated transactions/marketings over the sample period (Coffey, Pendell and Tonsor, 2019).

Large Bull and Bear Market Pricing Signals

We find similar results when we further breakdown the consistent bull and bear market data to focus only on large surprises to placements and marketings. The correlations between surprises and prices presented in Table 2.3 and the large bull and bear market pricing signal regression results shown in Table 2.6 again highlight the importance of Texas/Oklahoma/New Mexico and Kansas markets for

Table 2.10. Response of Negotiated Live Cattle Cash Prices to Consistent Bull or Bear Market Surprises in Placements and Marketings 2014 to 2020.

Parameters	Texas ^a	Kansas	Nebraska	Colorado	Iowa ^b
Intercept	0.005	0.005	0.005	0.006	0.004
	(0.005)	(0.006)	(0.005)	(0.006)	(0.004)
Placed	-0.21	-0.208	-0.104	-0.137	-0.126
	(0.174)	(0.184)	(0.158)	(0.182)	(0.133)
Marketed	0.199	0.451	1.042	0.887	0.669
	(1.198)	(1.264)	(1.084)	(1.250)	(0.916)
R-Squared	0.189	0.207	0.23	0.195	0.241
LM(1)	0.823	0.824	1.159	0.368	0.359
	(0.364)	(0.364)	(0.282)	(0.544)	(0.549)
B-P	0.478	0.229	0.123	0.617	0.797
	(0.788)	(0.892)	(0.941)	(0.735)	(0.671)
F Test	1.748	1.959	2.238	1.82	2.383
	(0.208)	(0.175)	(0.141)	(0.196)	(0.126)
Observations	18	18	18	18	18
Placed	-0.230*	-0.254*	-0.211*	-0.228*	-0.194*
	(0.120)	(0.127)	(0.112)	(0.127)	(0.093)
R-Squared	0.188	0.2	0.183	0.168	0.214
Marketed	1.216	1.457	1.547*	1.553*	1.279*
	(0.862)	(0.905)	(0.756)	(0.875)	(0.648)
R-Squared	0.081	0.071	0.057	0.039	0.045
<p>Standard errors of coefficients are presented in parentheses in top half of table. LM(1) is Breusch-Godfrey (Lagrange Multiplier test for first order autocorrelation). The test statistic is specified as Chi-Squared with 1 degree of freedom and p-values are presented in parentheses below the test statistic. B-P is Breusch-Pagan test for heteroscedasticity and p-values are presented in parentheses below the test statistic. F-test for the hypothesis that all of the coefficients (excluding the constant) are zero with p-values in parentheses. *Indicates significance at the 10% level. **Indicates significance at the 5% level. *** Indicates significance at the 1% level. ^aTexas refers to the Texas-Oklahoma-New Mexico market. ^bIowa refers to the Iowa-Minnesota market.</p>					

price discovery. Again, *COF* surprises account for twice as much of the weekly price variation in these markets compared with Colorado and Iowa/Minnesota markets.

Consistent Bull and Bear Market Pricing Signals over the 2004 to 2013 versus the 2014 to 2020 Period

Tables 2.7 and 2.8 show surprise and price correlations over the 2004 to 2013 and 2014 to 2020 periods, respectively. The most noticeable difference is that the correlation between placement and marketings surprises and all LMR cash prices has doubled over the more recent 2014 to 2020 period. LMR cash markets are now more responsive than ever to unambiguous price signals contained in *COF*

reports. Our regression model results presented in Tables 2.9 and 2.10 confirm this finding. Turning first to Table 2.9, our results highlight the important price discovery role played by Texas/Oklahoma/New Mexico and Kansas markets over this earlier period. R-squared values and F-tests are much larger for these two markets compared with the others and, in particular, the Colorado and Iowa/Minnesota markets. In contrast, the 2014 to 2020 regression results presented in Table 2.10 with respect to R-squared values show that prices responsiveness and discovery is now more equally shared across LMR markets. However, a word of caution is in order as the 2014 to 2020 results presented in Table 2.10 are only based on 18 observations and are subject to high levels of multicollinearity. This issue is reflected in the lack of precision of the coefficient estimates (high standard errors) and insignificant F-tests.

Implications for the Fed Cattle Market

Because the fed cattle market has become a highly concentrated market characterized by a relatively low volume of negotiated cash transactions, questions about the efficiency and accuracy of prices ought to be taken very seriously: such markets are undoubtedly susceptible to price discovery problems, including intentional manipulation. Evidence of such problems in the fed cattle market is sparse, however, despite intense investigation by numerous researchers using varied data and methodology over many years. Results presented here are broadly consistent with those previous findings. Analysis of fed cattle cash price response to unanticipated information in the monthly COF report suggest that all regions respond to such information in a manner consistent with active price discovery – that is, prices adjust quickly and consistent with the expectations of economic theory in response to unanticipated information.

Much of the present concern over fed cattle price discovery has focused on the Texas/Oklahoma/New Mexico reporting region because of the relative thinness of negotiated trade in that region in recent years (see Figure 2.4). The analysis presented here suggests that price discovery in this region has actually been among the most active of any of the reporting regions over the period of this study.

Much of the present concern over fed cattle price discovery has focused on the Texas/Oklahoma/New Mexico reporting region because of the relative thinness of negotiated trade in that region in recent years (see Figure 2.4). The analysis presented here suggests that price discovery in this region has actually been among the most active of any of the reporting regions over the period of this study. While negotiated prices in the region have become less responsive to unanticipated information since 2014, the (admittedly limited) data on response to information shocks since then does not suggest that the price discovery process

in Texas/Oklahoma/New Mexico is notably different than in any other region, including regions (e.g., Nebraska, Iowa/Minnesota) with much higher proportions of negotiated transactions.

Summary and Conclusions

A clear understanding of price discovery processes and mechanisms in the fed cattle market is important because a number of policy interventions have been proposed with the specified intent of improving price discovery. Without question, the fed cattle market has thinned rather dramatically over the past decade or so in terms of negotiated spot market transactions as a share of total transactions. While this situation raises legitimate concerns – particularly in light of formula transactions that rely on negotiated trades for price benchmarks – there is little evidence that the effectiveness of price discovery in the fed cattle market has been compromised, either by the thinning of negotiated trade or by market concentration in the meatpacking sector.

The fact that the thin and highly-concentrated fed cattle market does not exhibit clear signs of non-competitive pricing behavior does not suggest that market participants should have no concerns about price discovery. The reliance of formula prices on negotiated prices is reason enough to pay particular attention to the manner in which prices are established in the market. Negotiated prices not only reveal information about supply and demand fundamentals in the fed cattle market; they also contribute substantially to formula prices that control two-thirds or more of fed cattle trades. For both of these reasons, negotiated trades in the fed cattle market have some characteristics of a public good; therefore, market participants have a strong interest in ensuring that negotiated trades occur in sufficient quantity to fulfill this public good role (Koontz and Purcell, 1997). A number of complicated issues arise with respect to how this interest is best addressed. What volume of negotiated trades is necessary for efficient price discovery? Theory and empirical work, as reviewed in this volume, suggest that the figure may be quite small – smaller than market participants (at least on the selling side) are apparently comfortable with. If interventions to increase negotiated trade volume are undertaken, what form of intervention is appropriate? Market-based incentives or regulatory decree? In either case, it may well be that intervention disrupts the organic development of market institutions (both formal and informal) that are appropriate and effective for the circumstances of this particular market. After all, formula pricing has not been imposed on the fed cattle market by force: packers and feeders have mutually decided that it presents an effective and efficient way for them to transact routine business. It may well be that in seeking to preserve price discovery by familiar means, beneficial market innovations may be undermined, with unforeseen consequences for both individual market participants and for the sector as a whole.

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Chapter 3

How Market Institutions, Risks, and Agent Incentives Affect Price Discovery: Fed Cattle Market Implications

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Introduction

Concerns continue to grow regarding declining negotiated cash trade volumes and related impacts on fed cattle market price discovery. Various policy proposals to address these concerns center on the premise that mandating increased volumes of negotiated cash trade will fix the fed cattle market environment and price discovery will be improved (Brown, 2021; Nepveux, 2021). It is important to understand what price discovery is, and how various factors such as market institutions, risks faced by buyers and sellers, and related market agent incentives impact price discovery and resulting price levels (also called price determination). Such knowledge will improve our understanding of the potential success of policy proposals aimed at addressing price discovery concerns in fed cattle markets.

Price Discovery versus Price Determination

As noted in Chapter 2, price discovery refers to the process by which a buyer and seller arrive at a price for a specific transaction. Negotiations that include all of the buyer's bid prices and the seller's asks or offer prices are part of the price discovery process. Price discovery directly relates to the mechanics by which individual transaction prices (and other terms of trade) occur rather than general market price levels.

Price determination refers to the general price level that prevails after a number of individual transaction prices occur. Once the buyer and seller come to agreement on the terms of trade, including price, that individual transaction price

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becomes a potential piece of information signaling what those particular cattle were worth. Generally, an average of the individual fed cattle transactions prices during a specified time period, for a particular region, is reported by the United States Department of Agriculture Agricultural Marketing Service (USDA-AMS). Negotiated cash transactions are reported twice daily to AMS, and price information from these transactions appears in various reports. Transaction prices for other marketing methods are reported after the cattle are delivered to the packers, and this price information may be based on market conditions one to two weeks earlier (Schroeder, Tonsor, and Coffey, 2019). These publicly available prices represent price determination information for the fed cattle market for the reporting period.

Factors Affecting Price Discovery and Price Determination

What factors affect price discovery? Anything that impacts buyers' bids, and/or sellers' offers during bargaining affects price discovery. Economic theory and research indicate a number of factors influence price discovery in fed cattle markets, including knowledge of supply and demand, trading institutions, risks traders face, risk preferences of traders, and expectations of value formed via multiple sources of old and current market information.

Supply and Demand

Individual buyers and sellers adjust to supply and demand factors at the time they negotiate price. For example, if feedlots have a higher number of cattle available, the supply of cattle has increased. This in turn means an individual buyer representing a packer could bid lower prices and still attract cattle. A seller (feedlot) would likely accept a lower price in this situation in order to sell cattle currently nearing slaughter weight. Alternatively, if demand for beef strengthened and resulting boxed beef prices were increased, buyers would need to increase bid prices to attract cattle into packing plants, and sellers would likely only accept a higher sale price during bargaining. Thus, price discovery adjusts to, and reflects, supply and demand conditions. As a result, the forces of supply and demand for a particular product or commodity generally drive price determination or price levels (Tomek and Kaiser, 2014).

Trading Institutions

Trading institutions are the mechanisms, including both formal and informal rules defining how agents interact, through which buyers and sellers discover transaction prices and other terms of trade (Nagler *et al.*, 2015; Tomek and Kaiser, 2014; Davidson and Weersink, 1998). The three most relevant trading institutions for cattle markets are Double Auction, English Auction, and Private Negotiation.

The double auction is the trading institution used in live (fed) and feeder cattle futures transactions. Buyers start at low bid prices and sellers start at high-

er ask or offer prices. During haggling, buyers raise their bid prices and sellers lower their offer prices until a buyer's bid equals a seller's offer (Menkhaus, Phillips, and Bastian, 2003). During bargaining, multiple buyers and sellers may be haggling for the same futures contract or set of contracts. The double-auction institution is information rich since all buyers and sellers can see each other's bids and offers during bargaining. This information allows agents to know what level successful bids and offers need to be. Discovery of transaction price occurs relatively quickly in this trading institution.

The English auction is a trading institution commonly used in livestock cash market transactions. Its use has declined significantly for fed cattle, but it remains relatively prominent in feeder cattle markets. Sellers bring their cattle to the auction site, and a number of cattle are brought into a sale ring around which buyers and sellers are typically seated. Some information about the cattle is given prior to the sale, and then an auctioneer calls out a beginning bid level. Buyers signal to the auctioneer their willingness to pay higher prices, as the auctioneer indicates higher bid levels. This continues until no buyer is willing to pay a higher bid price (Menkhaus, Phillips, and Bastian, 2003). The buyer agreeing to the highest bid price purchases the cattle as long as the seller agrees to accept this price. Buyers are competing against each other to "win" the cattle with the highest bid price they are willing to pay. Sellers are passive and either accept or reject the winning bid for their cattle. Since buyers and sellers at the sale ring hear the bid prices, the English auction also is a relatively information-rich trading institution.

Private negotiation is a less formal trading institution where one buyer and one seller negotiate privately. During negotiation, the buyer starts at a low bid level and increases that level while the seller starts at a high offer price and reduces that level (Menkhaus, Phillips and Bastian, 2003). Trade occurs when the buyer and seller agree on price and any other relevant terms of trade. As there are no other buyers or sellers involved, the only information available during bargaining is the bid and offer prices given by the buyer and seller pair. This institution is less information rich when compared to auctions as other buyers' bids (as in the case of the double and English auctions) and other sellers' offers (as in the case of double auction) are not available to the two traders while discovering price.

Research conducted at the University of Wyoming used experimental economics methods to test whether differences in price discovery and price levels occur in these trading institutions (Menkhaus, Phillips, and Bastian, 2003). The laboratory setting allows researchers to control the market environment including supply and demand conditions, trading institution, and number of buyers and sellers transacting in the market (Friedman and Sunder, 1994; Roth, 2015). These experiments rely on induced-value theory and pay participants based on their trading behavior to create economic incentives similar to what is seen in cattle markets (Friedman and Sunder, 1994; Roth, 2015). These experiments are used because data for privately negotiated transactions in cattle markets are usually not available. Additionally, econometric analyses of transactions may suffer from dy-

namic supply and demand conditions that affect variability of price levels, making it difficult to determine the impact of the trading institution alone.¹

Since the underlying supply and demand conditions are known and constant across the trading institutions in the laboratory market experiments, the research compared market outcomes to predicted competitive equilibrium price levels (Menkhaus, Phillips, and Bastian, 2003). The resulting price levels were nearly 17% higher in English auction and 4% higher in double auction than the predicted equilibrium, but price determination for private negotiation was nearly 10% below the competitive equilibrium price (Figure 3.1).

The underlying supply and demand conditions as well as number of buyers and sellers were exactly the same across each institution in these markets. Thus, no arguments of market structure or concentration giving buyers an advantage in private negotiation could be made in these experiments. Trading institution alone was the only difference across each set of experiments.

Why did English auction result in a price that was higher and more favorable to sellers while private negotiation resulted in price being lower and more favorable to buyers? The English auction institution facilitates prices being driven up as buyers must compete against each other to purchase product while sellers are passive during bargaining. The double auction has lower price levels than the

¹ These results come from laboratory market studies. Some have criticized that subject pools used in such experiments do not behave the same as agricultural producers. Nagler *et al.* (2013) test behavior in laboratory market experiments across students and agricultural professionals. They find the same treatment effects across the two subject pools. Bastian (2019) examines bargaining behavior across market experiments using students and agricultural professionals and generally finds no difference across the bargaining strategy variables tested. Further, Frechette (2015) examines the broader experimental literature and concludes that results are generally consistent regardless of subjects used, lending further support to these experimental results.



Figure 3.1. Percent Difference in Price Level from Competitive Equilibrium by Trading Institution.

English auction, but very near the competitive equilibrium. The only difference is that sellers are also competing with other sellers for buyers' bids in the double auction. The simple addition of sellers competing amongst each other while simultaneously buyers are competing amongst each other leads to lower transaction prices that are closer to the predicted value than in the English auction. This result also is partially driven by individual bids and offers being known to all traders during price discovery.

Private negotiation, which is the dominant trading institution found in fed cattle markets, results in much lower price levels than auction markets. Given the low-price level in private negotiation, can we conclude the price discovery process is broken in private negotiation? No. First, it is important to understand that a major difference in this institution is the lack of buyers competing against buyers and/or sellers competing against sellers during bargaining. Additionally, an individual buyer and individual seller don't have the benefit of seeing other bids and offers during price discovery. Thus, individual bargaining behavior may impact price discovery and resulting price determination in private negotiation, which is likely mitigated by agent competition and bid/offer information in the auction institutions. One factor affecting bargaining behavior during price discovery in private negotiation relates to actual or perceived risks faced by participants in the market. Research indicates that advance production risk, matching risk, and negotiation failure risk greatly impact trader incentives and resulting behavior when transactions are privately negotiated (Menkhaus *et al.*, 2007; Sabasi *et al.*, 2013; Jones Ritten *et al.*, 2020).

Risks and Agent Incentives

Advance Production Risk

Sellers in agricultural markets, including fed cattle markets, generally make decisions to produce inventory or product prior to sale (Nagler *et al.*, 2015; Menkhaus *et al.*, 2003). When sellers produce goods in advance of sale, this requires sellers to incur production costs prior to any promise of revenue. Thus, sellers are at risk of losing some or all of their production costs if prices fall below cost of production, or when sellers fail to reach an agreement with any buyer. This risk of losing some or all of the production cost is called advance production risk or inventory loss risk (Sabasi *et al.*, 2013; Menkhaus *et al.*, 2007).

Research finds that advance production risk affects price discovery and price levels in privately negotiated markets (Menkhaus *et al.*, 2003; Menkhaus *et al.*, 2007). Sellers facing this risk are more likely to make concessions during bargaining and accept lower trade prices rather than risk losing all of their production cost for a product. Moreover, buyers knowing sellers face this risk are less likely to offer high bid prices given sellers signal they are willing to accept lower prices (Menkhaus *et al.*, 2007). Research compares prices in private negotiation markets where sellers only produce what they agreed to sell (i.e., produce only what they have forward sold) to sellers producing inventory prior to negotiating price

(Menkhaus *et al.*, 2003). They found price levels were near equilibrium when inventory was sold prior to incurring production cost (2.75% above equilibrium) and nearly 10% below the competitive equilibrium when inventory was produced in advance (Figure 3.2).²

Matching Risk

This advance production risk is coupled with what is called matching risk (Menkhaus *et al.*, 2007). This is the risk of being matched with someone in the market that has already traded and feels less pressure to trade compared to their trading partner. It also encompasses trading with someone who is better at bargaining. For example, if you as a seller are paired with a buyer who has already purchased cattle and is less interested in your cattle, that buyer may bid less aggressively, making it harder to reach agreement on price. This can also occur if a buyer meets with a seller who has already sold what they planned to that period. This risk creates a potential cost for the trader to try and find someone else interested in trading. Research indicates that what happens with traders affected by this risk is they become more willing to make concessions when haggling over price to ensure a trade occurs rather than risk being matched with someone they are unable to trade with (Menkhaus *et al.*, 2007).

Research investigating the impact of increased and decreased opportunities to match with a trade partner finds matching risk can have a significant impact

² It should be noted that other research using the same supply and demand conditions find similar tendencies for private negotiation with advance production, but the magnitude of difference is somewhat smaller. Rahman *et al.* (2019) find price levels are 6.55% below the competitive price with private negotiation and advance production.

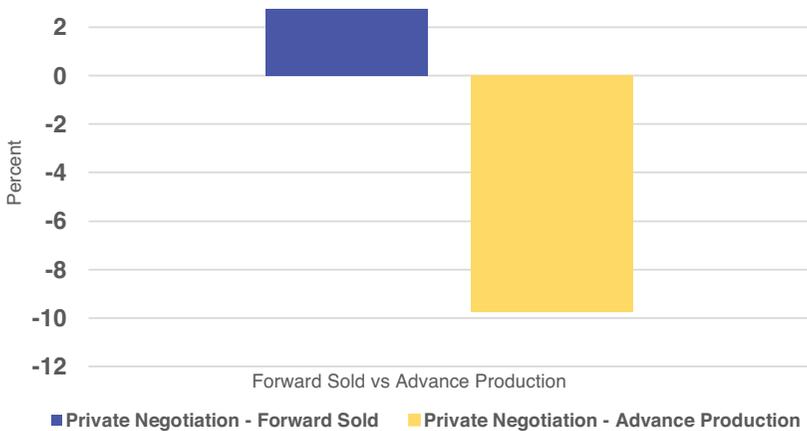


Figure 3.2. Percent Difference in Price Level Given Advance Production Risk.

on price discovery and price levels (Menkhaus *et al.*, 2007). The research compares the following matching scenarios: 1) All traders in the market are able to match three times with different trade partners (used previously by Menkhaus *et al.*, 2003); 2) All traders in the market are able to match five times with trade partners; 3) Concentrating the market by cutting the number of buyers in half but doubling each of the buyers demand schedules and having five potential opportunities to match per trading period; and, 4) Concentrating the market by reducing the number of sellers by half but doubling supply schedules and having five matching opportunities per trading period. By doubling the demand (buyers) or supply (sellers) schedules, the underlying supply and demand remained constant and the predicted equilibrium was consistent across treatments (Menkhaus *et al.*, 2007). In this study, sellers also faced advance production risk.

Results show that increasing the number of matches from three to five with all trade partners, increased prices from about 9% under the competitive price to only 3% under the competitive price (Figure 3.3). By concentrating the number of buyers, doubling the demand of each buyer, and forcing the market to have five matches, matching risk had a large impact on price discovery and price level. With these big buyers, half the sellers were not matched with a buyer during each matching opportunity (there were two buyers as opposed to four sellers). The simple change of having fewer buyers relative to sellers increased matching risk. During this experiment even though there was a chance to be matched, half the sellers were randomly matched with buyers while half were not matched with a buyer during each matching opportunity. Unmatched sellers were forced to wait for an opportunity to sell, and once matched, these sellers faced the risk that the buyer had the supply needed. As a result, sellers were willing to make concessions

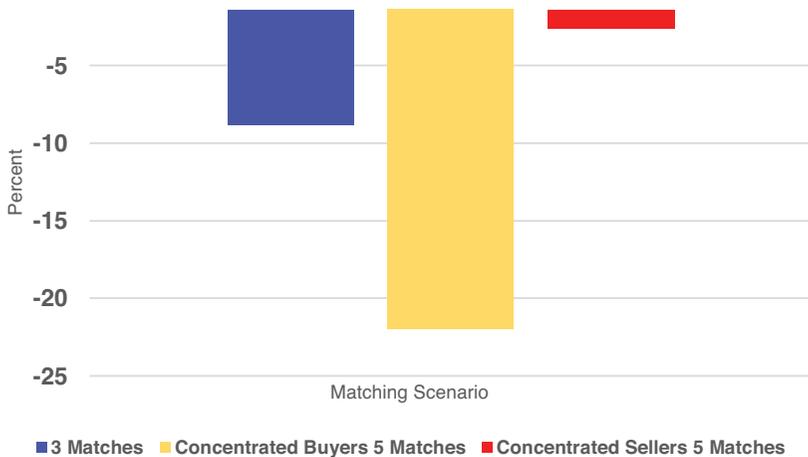


Figure 3.3. Percent Difference in Price Level Given Matching Risk.

in bargaining to reduce the chance they would be stuck with unsold inventory. Moreover, buyers experiencing less aggressive offer prices and bigger concessions from sellers, bid lower prices during bargaining. Average price levels were 22% below the competitive equilibrium in this scenario (Figure 3.3). When sellers were concentrated, buyers faced the same random chance of not being matched with a seller, as was the case in the concentrated buyer scenario. That is, half of the buyers were waiting to bargain with a seller during a matching opportunity while the other buyers bargained to purchase inventory. Thus, unmatched buyers faced the risk of less inventory being available for purchase once they had an opportunity to match with a seller. Sellers were able to increase their offer prices and buyers bid higher prices when matched with sellers to ensure product purchases. Price levels in this concentrated seller scenario were only one percent below, and not statistically different from, the competitive equilibrium price (Menkhaus *et al.*, 2007). We don't see the same magnitude of price difference between the concentrated scenarios because sellers still face and respond to advance production risk. Thus, the simple act of not being able to meet with a trade partner can make a significant difference in price discovery and resulting price levels.

Negotiation Failure Risk

Negotiation failure risk is the risk of not coming to agreement. Even though time and effort are spent bargaining, there is a risk that no price or terms of trade are agreed upon (Jones Ritten *et al.*, 2020). If such a risk is realized, the persons involved must search for someone else to trade with. At that point, valuable time has been lost, increasing the chance that the next trading partner has either acquired or sold what they need to, i.e., matching risk increases. In the case of the fed cattle market, this realized risk could result in sellers holding onto cattle longer while incurring more costs until they find a willing buyer. For buyers, it could mean not having the amount of cattle desired for the slaughter plant at a given time.

Focus group results in Wyoming found that producers generally felt they had to accept a buyer's terms rather than risk a failed negotiation (Bastian *et al.*, 2018). At the time of this writing, empirical research indicating the magnitude of impact from negotiation failure on commodity prices was unavailable, but it is expected that negotiation failure exacerbates the impact of both advance production and matching risks.

Given the nature of these risks (advance production, matching, and negotiation failure) research suggests sellers are more likely to be at a bargaining disadvantage than buyers when private negotiation is the trading institution (Bastian, 2019; Menkhaus *et al.*, 2003; Menkhaus *et al.*, 2007). Moreover, recent empirical research related to producers and bargaining outcomes in other commodity markets supports these findings (Courtois and Subervie, 2015; Shokoohi, Chizari, and Asgari, 2019). Price discovery within this institution, where these risks are present, generally results in price levels below the predicted equilibrium even with the same supply, demand, and number of firms.

Risk Preferences

Individual risk preferences affect bargaining behavior and resulting price discovery. Those agents who are more risk averse (buyers or sellers) tend to bargain for less advantageous transaction prices, leading to low individual earnings (Muthoo, 1999; Krishna, 2010). Risk averse buyers involved in auctions or private negotiation tend to have higher bids to reduce the chance of not purchasing product, and risk averse sellers tend to give lower offers or asking prices to ensure a successful sale. Jones Ritten *et al.* (2020) tested risk preferences across groups that first participate in a privately negotiated market experiment versus those that do not. The authors confirm previous findings that higher risk aversion resulted in lower earnings for market participants. Additionally, those who participated as a seller in a market experiment had significantly higher loss aversion compared to buyers, and those with higher loss aversion tended to bargain less aggressively and earned significantly less in the market.

Market Information

The above factors: trading institution, various risks, and risk preferences all interact with expectations of value when buyers and sellers enter into a transaction. One factor affecting expectation of value is product quality. Quality in fed cattle markets is generally measured in terms of yield and quality grades. Expectation of animal value generally increases as perceived quality increases. Increased quality, in turn, alters the levels at which bids and offers and resulting transaction prices occur (Jones *et al.*, 1992; Ward *et al.*, 1996; Ward, 1992).

Market information helps market agents form expectations about animal value prior to negotiating price. Research indicates that several sources of market price information affect price discovery and price determination for fed cattle. These market price sources include negotiated cash prices, boxed beef prices, and live cattle futures prices (Jones *et al.*, 1992; Matthews *et al.*, 2015; Ward *et al.*, 1996; Ward, 1992; Ward, 1981).

It is important to understand how these sources of market information affect price discovery. Reported prices are based on transactions that happened from one day to one or two weeks prior (for alternative marketing methods) when traders enter into negotiation, which give traders a general idea of price level. This information is tempered by any knowledge of other factors that could be affecting value of the animals available for sale. For example, let's say you expect the number of cattle to come out of feed yards this week is going to be down compared to last week. This signals that current supplies could be less than last week, so bids and offers should reflect that current information or expectation. Perhaps recent news indicates an increase in demand for beef in the near future, which signals to traders that current demand conditions are changing compared to last week. Thus, the price discovery process utilizes past price information, but traders also add any other current knowledge or expectations to their bids and offers.

Market traders are continually updating their information and expectations as they enter into negotiations. Together with the factors discussed previously, market information plus any current supply and demand information affect price discovery. Different individuals with different risks and risk preferences are using that information, weighting its importance, forming expectations and making bids and offers to discover price. Thus, the price discovery process becomes dynamic and constantly incorporates new and updated information while being filtered through individual traders' perceptions of risk, quality, and animal value during bargaining.

Trade Volume and Price Discovery

How does trade volume impact the price discovery process? Let's start with the idea of a single transaction between a buyer and seller. Since the agents may face different risks and risk preferences, and weigh market information differently, bids and prices could result in a price that may be different than what current supply and demand conditions indicate. The difference between the transacted price versus what supply and demand conditions indicate could be large or small. As other transactions occur, the probability that prices are incorporating current supply and demand information more appropriately should increase. Thus, agricultural economists view more transactions as improving the accuracy of price determination and reported information about price levels. Tomek (1980, p. 435) states, "If ... the average of transaction price is an estimate of the true equilibrium price, the variance of the mean of transaction prices decreases as the number of transactions increases...". Thus, increased trade volume should improve the chance that an average reported price is accurate. Moreover, with more transactions, price determination generally adjusts more quickly given current supply and demand conditions, i.e., is more efficient (Fama, 1970; Janzen and Adjemian, 2017).

Given the above discussion, it is expected that volume affects the accuracy of past market price information used in the price discovery process. Research has found efficient price discovery and good market outcomes can occur with relatively low volumes of transactions or trade across various agricultural products and may change with differing supply and demand conditions (Peel *et al.*, 2020; Adjemian *et al.*, 2016; Adjemian, Saitone, and Sexton, 2016; Tomek, 1980).

Fed Cattle Market Implications

Factors motivating current concerns and the resulting calls for policy related to price discovery are understandable. Increased use of Alternative Marketing Agreements (AMAs), which rely primarily on previously reported negotiated cash prices, have reduced the volume of cattle being traded in cash or spot transactions (Peel *et al.*, 2020). Moreover, private negotiation is the primary trading in-

stitution through which negotiated cash prices are discovered for fed cattle.³ Thus, sellers (feedlots) transacting fed cattle in cash markets face advance production, matching, and negotiation failure risks. It is likely that increased use of AMAs exacerbates these risks for those feedlots only selling cattle via negotiated cash trade, and puts them at a relative bargaining disadvantage (Sabasi *et al.*, 2013).

A potential outcome of a policy mandating increased cash trade volume is that buyers will transact more cash-traded cattle, thereby reducing matching and negotiation failure risks for those feedlots (sellers) relying solely on cash trade.⁴ Hence, policy proposals aimed at reducing the use of AMAs and mandating increased cash trade volumes seemingly address a primary issue for sellers relying on negotiated cash trades. The current expectations of fed cattle sellers seem to be that mandating increased negotiated cash trade volumes will improve price discovery and potentially increase price levels.

A primary question is whether policies mandating increased levels of negotiated cash trade volumes fully address risks and incentives for all agents trading in fed cattle markets, and thus making expectations of improved price discovery and price determination a realization. The reality is that feedlots will still face advance production risk, and while potentially reduced, they will still face some level of matching and negotiation failure risk even with a policy mandating increased negotiated cash trade volumes in place.

Research at the University of Wyoming tested scenarios where 25%, 50%, and 75% of the traders transacted produced inventory in an initial bargaining period, while those not allowed to trade in the first period (75%, 50%, 25%, of traders, respectively) waited for a second bargaining opportunity in which all market participants could trade (Sabasi *et al.*, 2013). The first bargaining period mimicked incentives faced by buyers and sellers in a market environment with the existence of AMAs. These AMAs scenarios were compared to a base scenario of no pre-committed trade (Sabasi *et al.*, 2013). Results indicate average prices were generally slightly higher in the AMAs bargaining period versus the second bargaining period mimicking the spot market, but they were generally not statistically different from each other. The researchers then compared agents not allowed to trade in the first period versus those that did. They found that generally sellers not allowed to trade in the first period negotiated for slightly lower prices compared to those that did, but seller price levels were not statistically different across the two groups. So, sellers not involved in the first bargaining period (AMAs) seemed to be somewhat disadvantaged, but the non-existence of AMAs in the base treat-

³ At the time of this writing the authors are not aware of any English auctions still being used to sell fed cattle. If any do exist, it is expected that the volume sold via auction is very small relative to the total volume being traded in fed cattle markets. This decline in English auction has likely occurred due to increased transactions costs and risks related to both quantity and quality variability for buyers relative to current market institutions being used.

⁴ The realization of this outcome depends on the inability of buyers to adapt current AMA purchasing behavior to meet regulatory agent definitions of “negotiated trade” (Peel *et al.*, 2020). It seems feasible that buyers could potentially record a small amount of bid and offer communication related to last week’s price, while using the structure of current AMA contracts with sellers, thereby meeting the regulatory definition but not fully meeting the intended policy objective. If this occurs, the likelihood of any change in current market outcomes is minimal.

ment did not result in significantly higher price levels for sellers. This result is very similar to empirical analyses that have examined the impact of AMAs on spot prices (Key, 2011; Muth *et al.*, 2008; Schroeder *et al.*, 1993; Vukina, Shin, and Zheng, 2009; Ward, Koontz, and Schroeder, 1998).

Why weren't price levels higher in the non-AMAs scenario? First, it is important to remember that supply and demand conditions generally drive price levels, and the supply and demand levels were the same across all scenarios. Second, sellers still faced advance production risk and matching risks associated with bargaining ability of buyers during the first bargaining period. Generally, AMAs reduce the advance production risk for sellers and matching risk for both buyers and sellers engaged in those agreements. These reductions in risk create significant incentives for buyers and sellers to be involved with AMAs. A probable outcome of mandating increased negotiated cash trade is that some feedlots may have improved bargaining outcomes because of reduced matching risk, but those feedlots who have reduced sales opportunities via AMAs due to the policy will have worse outcomes. Thus, it seems unlikely that mandating increased volumes of negotiated trade will achieve desired expectations of increased price levels overall.

Summary and Conclusions

Recent policy proposals to address price discovery concerns in fed cattle markets assume that mandating increased volumes of negotiated cash trade will improve the fed cattle market environment and price discovery (Brown, 2021; Nepveux, 2021). It is important to understand that a number of factors impact agent incentives when transacting fed cattle and resulting price discovery. Private negotiation is the dominant trading institution in fed cattle markets, and as a result, advance production, matching, and negotiation failure risks greatly impact bargaining outcomes. Policies focused on reducing AMAs and increasing negotiated cash trade volume do not fully address these risks and resulting incentives of agents involved in fed cattle markets. Some feedlots who sell fed cattle via negotiated cash trade may have reduced matching and negotiation failure risk as a result, but it is likely that economic surplus will be redistributed from agents (both buyers and sellers) utilizing AMAs to those benefitting from the policy.

Trade volume impacts the potential accuracy of past price information used in price discovery. Research varies regarding necessary threshold levels of trade volume needed for improved price discovery, and as a result, the dynamic process of price discovery likely will be marginally impacted by policies aimed at increasing negotiated cash trades. Moreover, as price determination is generally driven by supply and demand conditions, expectations that policies aimed at increasing negotiated cash trade will significantly raise price levels are generally not supported by economic theory or numerous research findings.

An additional issue is that such policies may have a negative impact on total economic surpluses generated by current fed cattle markets. AMAs reward quality, create improved production and processing efficiencies, reduce production costs per head through better plant utilization and spreading of fixed costs, and re-

duce search and transaction costs for cattle (Peel *et al.*, 2020; Koontz and Lawrence, 2010; Anderson, Trapp, and Fleming, 2003; MacDonald *et al.*, 2000). Research also indicates average beef quality has increased given the use of AMAs thereby creating value for consumers (Muth *et al.*, 2007). These outcomes mean greater economic surplus has been created due to the use of AMAs.

Thus, a potential outcome is that policies aimed at increasing negotiated cash trades and thereby reducing AMAs may have the unintended consequence of reducing overall economic surpluses currently achieved in the fed cattle and beef sector.

Policies aimed at improving fed cattle markets and related economic surpluses must take into account the risks and incentives faced by all market agents. Peel *et al.* (2020) propose that adding a transparent electronic trading platform for spot market transactions could improve price discovery in fed cattle markets with even a small amount of transactions. We extend that suggestion here as an alternative for consideration to policies focused on mandating increased negotiated cash trade. Research suggests that a double auction would likely be the best trading institution for such an endeavor (Menkhaus *et al.*, 2003). Price discovery will tend to be efficient in this institution provided a sufficient number of buyers and sellers participate. This trading institution also would mitigate some of the risks that seem to dominate bargaining outcomes in private negotiation. Any market alternative must reduce transaction costs for participants in order to be viable (Davidson and Weersink, 1998). Thus, development of several contracts with different specifications related to quality and yield grade that seem to be sought after in both negotiated cash and AMAs transactions, as well as specified premiums and penalties for spot delivery of cattle not meeting specifications, could be used to facilitate quicker trade. Resulting trade information would be reported and thereby add to price discovery. The question is whether enough incentives exist or whether other incentives would have to be provided to attract sufficient buyers and sellers. This alternative ultimately seems more beneficial than mandating increased volume of negotiated cash trades.

A potential outcome is that policies aimed at increasing negotiated cash trades and thereby reducing AMAs may have the unintended consequence of reducing overall economic surpluses currently achieved in the fed cattle and beef sector.

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Chapter 4

Enhancing Supply Chain Coordination through Marketing Agreements: Incentives, Impacts, and Implications

Ted C. Schroeder, Brian K. Coffey, and Glynn T. Tonsor

Prologue

The U.S. cattle sector is an important segment of the overall farm economy representing about 18% of agricultural commodity receipts.¹ The cattle and beef industry, in addition to being a massive economic sector, is immensely complex, diverse, and dynamic. The vast array of cattle and beef operations and associated business interests naturally creates a diversity of perceptions, opinions, and tradeoffs associated with alternative policies. As public university economists, our goal is to provide information, analysis, and opinions regarding how and why the industry has evolved so interested parties can better understand economic drivers of industry change. We provide this information using publicly available data, review of published work, and through countless industry participant discussions and interviews over the years to appreciate the intricate workings of the industry. We expect a variety of opinions will be present relative to issues addressed in this chapter. We hope our thoughts help guide and inform the dialogue.

Introduction

Dramatic changes in the ways fed cattle are being purchased and valued through marketing agreements have occurred because of substantial economic incentives to improve vertical coordination and align value signals along the supply chain. Packers and feeders have forged marketing agreements because they address supply chain coordination challenges more effectively than negotiated cash fed cattle trade. Incentives to adopt marketing agreements are multi-faceted, interconnected, and emanated in part to better meet customer demands. Having evolved over a few decades, marketing agreements have become integral in coordinating the beef supply chain. Structural changes in how fed cattle value is determined

¹ <https://www.ers.usda.gov/topics/animal-products/cattle-beef/sector-at-a-glance/>

have resulted in thinly traded negotiated cash markets in some regions, raising concerns about reliability of reported trade and efficiency of cash market price discovery. Thinning negotiated cash cattle trade has resulted in reduced transparency of market information apprising industry participants of evolving supply and demand fundamentals. Tradeoffs between supply chain enhancements facilitated through marketing agreements and reduced market information due to thin negotiated cash trade need to be more clearly understood as strategies and policies are deliberated to address concerns.

The purpose of this chapter is to identify and discuss major economic drivers of marketing agreements and associated outcomes. We also assess market information needs in light of shifts away from cash negotiated fed cattle trade toward marketing agreements. Specific objectives include:

1. Document changes over time in how fed cattle are marketed.
2. Identify and summarize the major incentives for cattle feeders and beef packers to adopt marketing agreements and associated tradeoffs relative to negotiated cash trade.
3. Outline current challenges regarding market transparency in marketing agreements that need to be addressed.
4. Present potential methods Livestock Mandatory Reporting (LMR) might capture and illuminate improved market information contained in marketing agreement price reporting.
5. Outline summary thoughts and recommendations.

Changing Marketing Methods

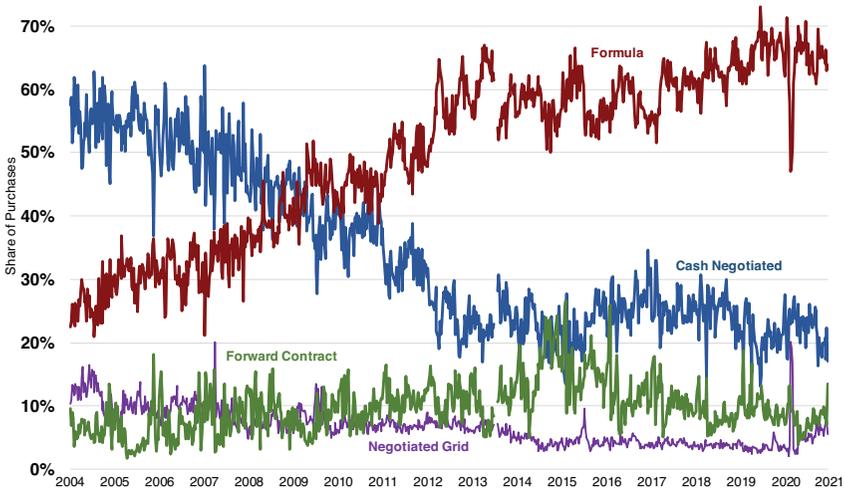
Fed cattle marketing methods have undergone a major transformation over the past 15 years, as illustrated in Figure 4.1. In the early 2000s, cash negotiated trade represented about 55% of typical weekly national fed cattle volume. Negotiated grid and forward contract trade represented roughly 10% each with the remaining 30% being formula trade. Around 2007, formula trade started to increase its relative share of fed cattle marketing so that by 2020 about 60 to 70% of fed cattle were formula purchases. During this same time cash negotiated trade dwindled to 20 to 25% with negotiated grid and forward contracts combined representing the remaining 15% of trade volume.

Integral to understanding what these major trends imply about market performance and associated supply chain impacts are the definitions of what types of fed cattle transaction types are included in each category by the United States Department of Agriculture Agricultural Marketing Service (USDA-AMS, 2020):

1. *Cash negotiated* trade represents cattle purchased by the packer where the price is negotiated with the seller and cattle scheduled to be delivered to the plant within 30 days.

2. *Forward contract* trade is an agreement for the purchase of cattle in advance of slaughter where the base price is established referencing the CME Live Cattle Futures contract.
3. *Negotiated grid* purchases involve negotiating the base price between the packer and cattle feeder at the time of the agreement with delivery expected within 14 days. The final net price is determined after slaughter and carcass grading by adjusting the negotiated base price by grid premiums or discounts based on carcass attributes.
4. *Formula* trade represents cattle committed for slaughter by any means other than cash negotiated, forward contract, or negotiated grid.

These delineations are important because as we discuss marketing agreements in this chapter, we are essentially referring to formula trade (although in places we also include negotiated grids and we specifically note when we do so). However, formula trade, as reported by USDA, is a broad category and details vary considerably across associated transactions. Variation within formula trade compounds market transparency concerns as formula trade has increased in popularity. This issue is addressed specifically later in this chapter.



Source: USDA-AMS archived by LMIC. All live, dressed, steers, heifers, other fed cattle, cows and bulls. Negotiated grid was not tracked prior to April 2004.

Figure 4.1. Shares of Weekly National Live Cattle Purchases by Transaction Type, April 11, 2004 - March 14, 2021.

Incentives and Tradeoffs of Marketing Agreements and Cash Negotiated Trade

In this section we summarize past research that has investigated incentives associated with adoption of marketing agreements and consequences of reduced cash negotiated trade. Much of the synthesis in this section originates from information gleaned from work by Anderson and Trapp (1999), Boykin *et al.* (2017), RTI International (2007), Schroeder and Graff (2000), Schroeder *et al.* (2002), Schroeder *et al.* (1997), Tonsor *et al.* (2010), Liu *et al.* (2009), Peel *et al.* (2020), and numerous discussions with industry participants over the years by the authors.

Tradeoffs associated with wide-spread adoption of marketing agreements displacing cash negotiated fed cattle trade are both numerous and complex. Private incentives of cattle feeders and beef packers to adopt marketing agreements are well documented and straightforward. However, there are also broader supply chain forces which encourage marketing agreements. Furthermore, externalities associated with widespread decline in cash negotiated trade can create adverse consequences associated with the transition to marketing agreements.

A stylized summary of cattle feeder and beef packer incentives and implications associated with various ways fed cattle are purchased is provided in Tables 4.1 and 4.2. We compare *Live* and *Dressed Negotiated* (i.e., cash negotiated trade); *Forward Contract*; *Negotiated Grid*; and *Formula* separated into two alternative valuation methods of *Marketing Agreement Non-Grid* and *Marketing Agreement Grid*. The color coding (red, yellow, and green shading in the tables refer to relative effectiveness of each marketing method in addressing each consideration) used in the tables is based on a synthesis of past research noted above, numerous informal discussions with industry participants, and our assessment. Specific selection of colors in some cells entails some subjectivity; the overall implications we report across marketing methods are stark and, we argue, robust.

Cattle Feeder Incentives and Tradeoffs

For cattle feeders, the various fed cattle pricing and valuation methods offer highly varied incentives that differ across marketing methods (Table 4.1). To facilitate interpretation, we grouped the various individual impacts of each marketing method (individual rows in Table 4.1) into 1) Cattle Pricing and Value Signals; 2) Marketing Cost, Flexibility, & Risk Management; 3) Market Information; and 4) Supply Chain Coordination.

Cattle Pricing and Value Signals

As noted in Chapter 1, there exists a long history of concerns that fed cattle pricing mechanisms being used to market fed cattle using cash negotiated methods (often referred to as average pricing) were insufficient at sending value signals and providing incentives to cattle feeders to improve fed cattle quality. This is not a new concern. Conferences held some 30 years ago organized by the *Research*

Table 4.1. Relative Ability of Alternative Fed Cattle Marketing Methods to Address Cattle Feeder Considerations.

	Cattle Feeder Considerations	Live Negotiated	Dressed Negotiated	Forward Contract	Negotiated Grid	Marketing Agreement Non-Grid	Marketing Agreement Grid
Cattle Pricing & Value Signals	Quality Premiums/ Discounts	Not Effective	Not Effective	Not Effective	Moderately Effective	Not Effective	Moderately Effective
	Yield Grade Premiums/ Discounts	Not Effective	Not Effective	Not Effective	Moderately Effective	Not Effective	Moderately Effective
	Dressed Weight Payment	Not Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective
	Access to Carcass Performance	Not Effective	Not Effective	Moderately Effective	Moderately Effective	Not Effective	Moderately Effective
	Branded / Certification Premiums	Not Effective	Not Effective	Not Effective	Moderately Effective	Not Effective	Moderately Effective
Marketing Cost, Flexibility, & Risk Management	Price Discovery Cost	Not Effective	Not Effective	Moderately Effective	Not Effective	Moderately Effective	Moderately Effective
	Secure Market Access	Not Effective	Not Effective	Moderately Effective	Not Effective	Moderately Effective	Moderately Effective
	Price Risk Management	Not Effective	Not Effective	Moderately Effective	Not Effective	Not Effective	Not Effective
	Delivery Timing	Not Effective	Not Effective	Moderately Effective	Not Effective	Moderately Effective	Moderately Effective
	Leverage to Negotiate Weekly	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Not Effective	Not Effective
	Flexibility to Accept/ Reject Offers	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Not Effective	Not Effective
Market Information	Contributes to Cash Price Discovery	Moderately Effective	Moderately Effective	Not Effective	Moderately Effective	Not Effective	Not Effective
Supply Chain Coordination	Establishes Relationship / Resolve Issues	Not Effective	Not Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective
	Enabling Downstream Alliances	Not Effective	Not Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective



Institute on Livestock Pricing focused on concerns associated with inadequate value signals being sent through traditional fed cattle negotiated cash trade. These concerns, still present today, led to the design and adoption of value-based grid pricing of fed cattle. Variation in grid premiums and discounts across packers due to differentiated customer demands, coupled with varied cattle feeder comparative advantages, encouraged cattle feeders to target specific packer grids. Feeders consider their particular grids in feeder cattle procurement, feeding management,

and marketing decisions. These actions naturally led many feedlots to form direct ties to a single packer with whom they entered into a marketing agreement.

Grid pricing is the main way value signals associated with quality, yield, and various differentiated branded programs are sent to cattle feeders. As such, the most effective cattle marketing methods to ensure price differentials reflect quality is through use of grids. Negotiated grids and marketing agreements with grids are the most effective of the marketing methods used in the industry to directly link value with quality. Furthermore, grid information sent back to cattle feeders to enable them to better manage feeder cattle procurement, feeding protocols, and cattle harvest timing created even greater value for cattle feeders to enter into marketing agreements.

As we present later, growing incentives to continue to develop marketing agreements have arrived or are on the horizon. For example, various certification systems and brands have developed. Such programs require feeders to invest in genetics, upstream alliances, and production practices to consistently meet specifications. Marketing agreements assure feeders financial rewards for incurring added costs associated with these practices. There is no such guarantee when selling specific cattle in the negotiated spot market. This is immensely important to recognize as we consider the future implications of marketing agreements in the fed cattle and beef supply chain.

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Marketing Cost, Flexibility, & Risk Management

In the late 1980s, Cactus Feeders and IBP, Inc. entered into what was recognized as the first large-scale fed cattle marketing agreement between a cattle feeder and beef packer (Stalcup, 2004). Among major incentives noted at the time were reducing costs and eliminating distractions associated with weekly negotiating of fed cattle trade. Not long after, other cattle feeders entered into agreements, adding market access to a growing list of recognized incentives. Reduced costs and market access, which are present with or without a grid, remain among the most prominent reasons cattle feeders enter into marketing agreements. Most recently during the COVID-19 pandemic that reduced packing plant operational capacity, discussions with industry participants suggested some producers with marketing agreements had higher priority, more reliable, and more timely market access than cattle feeders who were attempting to negotiate spot trade each week. As packer operational capacity was challenged, contractual commitments for fed cattle to be delivered would be prioritized by packers over purchasing cattle in the spot market.

Though marketing agreements reduce week-to-week marketing and price discovery costs and ensure market access, they also reduce flexibility for the cattle feeder and packer. Negotiated cash trade enables producers to readily reject cattle purchase offers and, if leverage swings in their favor, utilize that leverage to pursue more desirable terms of trade. When leverage is unfavorable for the cattle feeder, spot markets tend to have greater challenges in negotiating desirable outcomes. Cattle feeders who prefer greater independence, have comparative advantage for negotiating individual transactions, and value increased ability to accept or reject prevailing offers are more inclined to negotiate weekly trade on the spot market. Opportunities to take advantage of short-term leverage swings are largely non-existent in marketing agreements.

Most recently during the COVID-19 pandemic that reduced packing plant operational capacity, discussions with industry participants suggested some producers with marketing agreements had higher priority, more reliable, and more timely market access than cattle feeders who were attempting to negotiate spot trade each week.

Market Information

Perhaps the single most common concern about not negotiating spot market prices regularly is the associated impact on market information. This concern has circulated across industry participants as well as policy-making arenas for a long time (Peel *et al.*, 2020) and was a major reason Livestock Mandatory Reporting (LMR) was launched some 20 years ago (Parcell *et al.*, 2016). However, with the recent precipitous decline in negotiated cash market fed cattle trade together with large fed cattle suppliers challenging packer slaughter capacity, focused effort on finding ways to “fix” this problem has again elevated. We address the issue of market information and formula trade later. For now, we simply note cash negotiated trade is reported by USDA-AMS during the week the price is agreed upon. In contrast, formula trade price information is reported the week the cattle are delivered to the packer and often based on reported negotiated prices from one to two weeks earlier. As such, formula trade does not contribute much new information to price discovery. Furthermore, because of how broadly the formula price category is defined and reported by USDA (i.e., it encompasses all trade that is not categorized into one of the other reported methods), formula market information currently reported is not highly informative. Concerns are compounded by formula trade often relying on reported negotiated prices as a base price. As formula trade volume grows, a larger portion of cattle are partially priced by a negotiated price based on a thinner market (Schroeder *et al.*, 2018).

Supply Chain Coordination

The cattle producer – beef packer relationship has often been described as confrontational. Whether that is widely true or selectively present is debatable, but it is not ubiquitous. Having an adversarial relationship with your customers as a cattle feeder or your main suppliers as a packer is not conducive to coordinating the supply chain, quickly resolving conflicts that might arise, or working together to solve problems. The importance of establishing strong buyer-supplier relationships (SBSR) has been clearly established in the supply chain literature (Board, 2011; Kannan and Tan, 2006). Recent literature has focused even further on advantages of multiple vertical layers of supply chain relationships (e.g., think of cow/calf-backgrounder-feeder-packer) (e.g., Kataike *et al.*, 2019). Established marketing agreements where both the supplier and buyer mutually benefit from the agreement creates strong business relationships that facilitate a collaborative relationship. This directly improves several dimensions of the supply chain, which is further discussed in the next section addressing impacts of cattle purchasing methods on packers/customers.

When a catastrophic event occurs, such as the Holcomb plant fire in August 2019, those with established relationships are able to more effectively work together to mitigate negative impacts. Due to the strong and lasting business relationship, both the feeder and the packer have an incentive to work together to adjust timing, scheduling, logistics, and other coordination issues to continue serving downstream customer needs.²

Packer/Customer Incentives and Tradeoffs

Table 4.2 summarizes a similar color-coded matrix to that of Table 4.1 but is focused on beef packer/customer considerations regarding fed cattle marketing agreements. Similar to the previous discussion relative to cattle producer considerations, we focus on relative rankings of the various fed cattle purchase methods for beef packers. Since the noted attributes also often influence beef customers who are further downstream in addition to packers, we refer somewhat more generally to fed cattle and beef customer impacts.

Meeting Beef Customer Demands

A host of factors influence beef packer ability to meet downstream customer demands. Many of these refer to specific product and service differentiation including Certifications, Product Branding, Quality Assurances, Process Assurances, and Traceability. Having a known supply of cattle and known suppliers enables better quality control and production process assurances. These motives are further emphasized later in this chapter, but they are not only immensely important to customers – their importance will continue to grow in the future as consumer

² These sentiments were shared with us in personal confidential discussions with several industry participants.

Table 4.2. Relative Ability of Alternative Fed Cattle Marketing Methods to Facilitate Meeting Beef Customer Preferences.

	Beef Packer Considerations	Live Negotiated	Dressed Negotiated	Forward Contract	Negotiated Grid	Marketing Agreement Non-Grid	Marketing Agreement Grid
Meeting Beef Customer Demands	Certifications	Yellow	Yellow	Yellow	Yellow	Green	Green
	Branding	Red	Red	Red	Yellow	Red	Green
	Quality Assurances	Red	Red	Red	Green	Red	Green
	Process Assurances	Red	Red	Red	Yellow	Green	Green
	Traceability	Red	Red	Yellow	Yellow	Green	Green
	Assured Sourcing	Red	Red	Yellow	Red	Green	Green
	Facilitates Vertical Alliances	Red	Red	Yellow	Yellow	Green	Green
Firm Operations	Operating Efficiency	Red	Red	Yellow	Red	Green	Green
	Risk Management	Red	Red	Green	Yellow	Green	Green
	Flexibility	Green	Green	Red	Green	Red	Red



demands and expectations evolve. These considerations are most effectively accomplished through marketing agreements with known sources of fed cattle in the production pipeline.

Having assured sources of fed cattle through marketing agreements also makes animal traceability easier and product volumes assured so the packer is a reliable supplier to downstream customers with product-specific demands. Predictable supply is essential for product branding, whether at retail or food service. Supply chain management incentives related to certification and branding are a major part of marketing agreements discussed regarding cattle feeders.

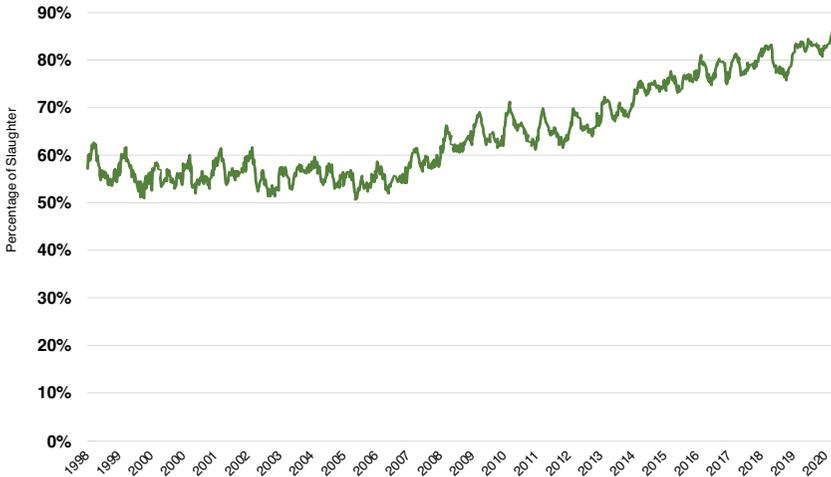
Firm Operations

Incentives for packers to enter into early marketing agreements in the late 1980s and 1990s were mostly associated with enhancing firm operations. In particular, marketing agreements reduce the cost of regularly searching for and bidding

on cattle. The agreements provide consistent, predictable slaughter quantities in a business where operating plants at capacity provides substantial per-unit cost savings (Barkley and Schroeder, 1996). These incentives alone were enough to encourage packers to enter into marketing agreements even without the further supply chain enhancements noted above. Since the time of the early agreements, meeting customer demands has become a much more prominent incentive to establish marketing agreements (RTI International, 2007).

One noteworthy tradeoff for packers that use marketing agreements is reduced flexibility. If a packer, for whatever reason, wishes to increase slaughter volume significantly relative to existing marketing agreements, their main option is to use the negotiated cash market for sourcing. If, on the other hand, they wish to reduce slaughter volume, adhering to existing agreements may not allow it. As such, packers give up flexibility in cattle procurement when they enter into marketing agreements. However, counter-balancing the reduced cattle purchasing flexibility, RTI International (2007) packer surveys revealed marketing agreements increased packer flexibility in meeting downstream customer demand.

Enhanced vertical supply chain coordination among cattle producers, processors, and other participants is probably the most important benefit that has resulted from marketing agreements. Better buyer-supplier communication improves value signals, reduces costs, improves scheduling, enhances ability to resolve problems, and enables downstream alliances. These outcomes are all beef supply chain benefits associated with marketing agreements that ultimately benefit beef consumers.



Source: USDA-AMS as compiled by LMIC.

Figure 4.2. National Weekly Percentage of Steers and Heifers Grading Choice and Prime, 1998-March 2021.

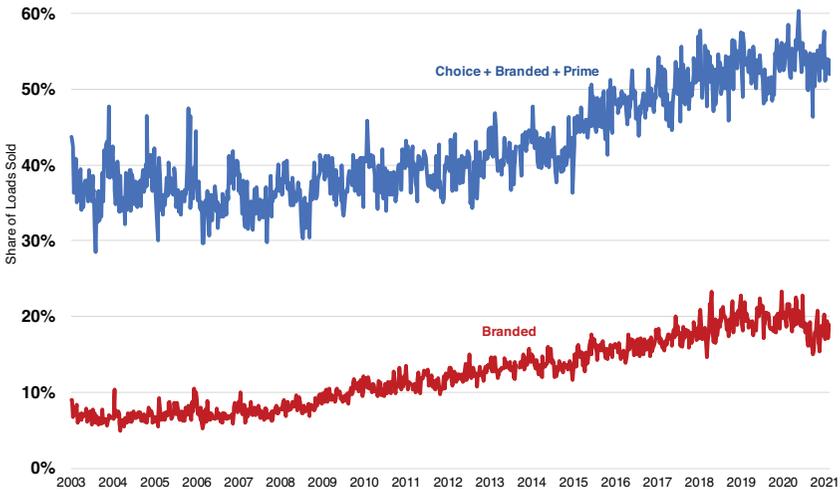
Evidence Summary of Cattle and Packer Marketing Agreement Incentives

Quality Grade Impacts

It is abundantly clear from the previous discussion that marketing agreements have incentivized higher-quality fed cattle production, especially through the use of grids. This begs the question: *Has the increase in marketing agreements led to higher quality beef being produced?*

USDA Market News publishes weekly in the NW_LS196 estimated grading percent report a breakdown of steers and heifers offered for quality grading by grade category. Figure 4.2 illustrates the trend over time in percentage of steers and heifers grading Prime or Choice (the two highest grades) from 1998 to March 2021. During the late 1990s to about 2007, roughly 55% of steers and heifers graded Choice or higher. The percentage of steers and heifers grading Prime or Choice trended upward since 2007 to greater than 80% in 2020 to 2021. Prime and Choice beef has increased substantially resulting in higher quality beef available for consumers at a more affordable price.

Further demonstration of increasing beef quality over time is apparent in wholesale boxed beef sales. Figure 4.3 illustrates sales of Choice and higher-quality boxed beef (Choice + Branded + Prime) as well as just Branded boxed beef sales on a weekly basis starting in February 2003 when USDA-AMS first started reporting. Branded sales data are reported separately. Choice and higher-grade



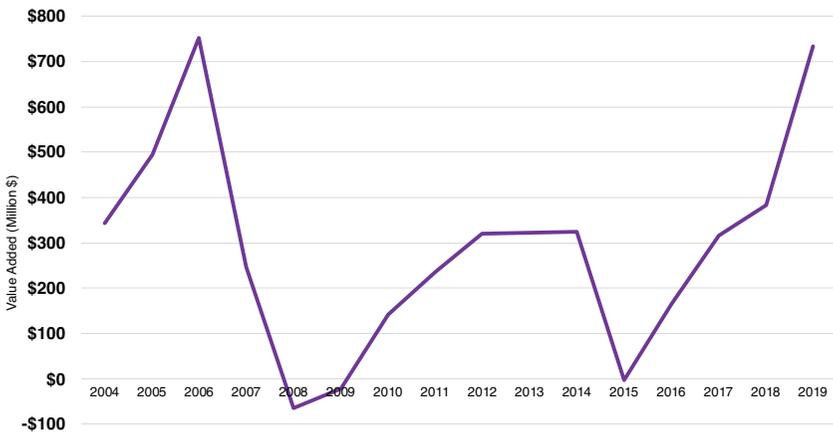
Source: USDA-AMS.

Figure 4.3. Shares of Choice and Higher Grade and Branded Boxed Beef Sales (Loads), Weekly February 28, 2003 - March 12, 2021.

sales went from representing about 35% in the early 2000s to about 55% since 2017. Branded beef increased from about 7% to about 20% over the same time frame. Marketing agreements rewarding higher quality grades through grid premiums have increased concurrent with beef quality over time, providing evidence grid pricing incentives have been effective.

To provide an estimate of the value added to wholesale beef as a result of the higher quality grades being realized, we calculated the net gross dollars added by Prime, Branded, and Choice beef. To get this measure we multiplied premiums over Select for Prime, Choice, and Branded beef by their respective loads marketed. From that, we subtracted the discount of Ungraded beef relative to Select times Ungraded loads marketed. This step is necessary as the growing demand for high-quality beef likely increased penalties for lower-quality beef. This created a net gross dollars added (adjusted to 2019 dollars) over the 2004 to 2019 time period. The net gross value is illustrated in Figure 4.4. The net value changes across years as volumes, premiums, and discounts change. However, since 2015, consistent with when formula trade reached a plateau at about 60 to 70% of fed cattle trade (Figure 4.1), the value added has increased from zero to greater than \$700 million in 2019. This means the volume-weighted premiums associated with higher quality beef net discounts for ungraded volume added some \$700 million to wholesale beef value in 2019 alone (greater than \$25/head of fed cattle slaughtered).

Additional insight follows from combining beef grading shares and prices of boxed beef cutout composites by grade. Specifically, we can easily identify years of obvious demand growth from this information. Considering year-over-



Source: Calculated using USDA-AMS and BLS data.

Figure 4.4. Net Gross Real (2019=100) Dollars Added by Prime, Branded, Choice, and Ungraded Boxed Beef Relative to Select, Annual 2004-2019.

year changes, if the price premium for Prime over Select increased and the share of wholesale beef loads grading Prime grew while the share grading Select declined, then we know demand for Prime wholesale beef grew relative to Select. Applying this approach over the 16 years from 2005 to 2020 to Prime, Choice, and Branded wholesale beef relative to Select, we identify 6 years of obvious demand growth for Prime (2010, 2011, 2014, 2016, 2017, 2019); 3 for Choice (2011, 2016, 2017); and 5 for Branded (2010, 2011, 2016, 2017, 2019). The multiple years since 2010 of clear demand growth for higher grading and branded wholesale beef is consistent with the monetary contribution noted in Figure 4.4. We see no years of clear demand growth for Ungraded beef. This a very conservative approach which identifies the minimum number of years with demand increases.

The previous charts are simply trends; one cannot definitively conclude whether there is causality. That is, one cannot say conclusively that marketing agreements caused beef quality to increase. However, causality can rarely be proven; instead, often the best we can do is identify common trends and interpret them in light of context-specific knowledge. Marketing arrangements are inherently prevalent in branded product supply chains. The coordination of production, distribution, and marketing of branded items is challenging to accomplish in traditional spot markets (see Tables 4.1 and 4.2). Producers will not invest in expensive quality grade enhancing production practices unless incentivized to do so. Grids connect the net fed cattle price directly to quality. No other pricing mechanism does this nearly as effectively. Recognizing many formula traded cattle are purchased using grids that pay quality grade premium incentives makes it logical to conclude there likely is at least some causality between grid premiums and markedly improving beef quality.

Producers will not invest in expensive quality grade enhancing production practices unless incentivized to do so.

Recognizing many formula traded cattle are purchased using grids that pay quality grade premium incentives makes it logical to conclude there likely is at least some causality between grid premiums and markedly improving beef quality.

Beef Trade Implications

International trade in beef products has become a major factor driving industry prosperity. For example, in 2019, beef and variety meat product exports equated to \$309.75 per head according to the U.S. Meat Export Federation.³ The top U.S. beef importers in 2019 are summarized in Table 4.3. The ten largest importers represented 90% of beef export volume with Japan and South Korea each representing more than 20%.

³ <https://www.usmef.org/about-usmef/faq/>

Table 4.3. U.S. Beef Imports by Country, 2019.

Country	1,000 Pounds, Carcass Weight	Share (5)
Japan*	799,227	26%
South Korea*	683,791	22%
Mexico	424,455	14%
Canada	267,990	9%
Hong Kong	231,942	8%
Taiwan*	197,843	6%
Philippines	45,729	1%
Vietnam	37,783	1%
Indonesia	33,734	1%
China*	32,098	1%
Subtotal	2,754,592	90%
Others	303,087	10%
Total	3,057,679	100%
* Indicate restrictions placed on animal age, requires export verified systems, and/or zero tolerance restrictions on specified residues.		
Source: USDA-ERS		

Meat trade in general, and beef trade in particular, faces a number of trade restrictions (U.S. Trade Representative, 2021).⁴ For example, exports to Japan, South Korea, and Taiwan (three of the top ten importers) each require a USDA Quality System Assessment (QSA) verifying the products were derived from cattle less than 30 months of age (USDA, FSIS, 2020). Several countries require beef products be produced in a way that ensures the product is free of harmful residues. Restrictions also apply to where the animal was raised and/or slaughtered. China has zero tolerance for ractopamine in beef products as well as stringent maximum residue limits for zeranol, trenbolone acetate, and melengesterol acetate which are used to enhance feed efficiency and weight gain (USDA FSIS, 2020). Also important to recognize are countries that, because of their stringent import rules, greatly restrict import of U.S. beef. For example, EU member countries preclude meat imports from livestock treated with hormonal growth promotants (USDA FSIS, 2020).

Synthesizing the varying requirements for U.S. beef by importing countries (with no assessment of the legitimacy and/or legality of those restrictions), it is apparent cattle production protocols are essential to gain export market access. Age and source verification requirements are present in some countries. Restrictions on residue levels on products used in cattle feeding are common. Precluding use of feed additives and/or hormonal growth promotants is prevalent. While verification of these production protocols can be accomplished in several ways, they all entail some form of assurance, third party verification, and potentially formal documentation from the producer to the packer in order to ensure the protocols are being adhered to. This provides another incentive for engaging in marketing agreements and contracts: to match up production protocols with packer-customer requirements. In general, adoption of many export requirement protocols by

⁴ <https://ustr.gov/sites/default/files/files/reports/2021/2021NTE.pdf>

producers increases production costs. Establishing and maintaining export relationships is a costly venture. Beef packers will not take on the added costs without an agreement in place to consistently source cattle that meet the specifications of exporting countries. Likewise, cattle feeders will not take on costs of protocols to meet the standards absent associated premiums to offset added costs.

Marketing Agreements and Market Transparency

One of the major concerns surrounding marketing agreements and formula fed cattle purchases are how they impact price reporting and market transparency. To understand the concern and ultimately determine ways to address it, the nature of the concern must first be delineated, as it is multidimensional.

First, marketing agreement purchases do not contribute directly to the current week's cash market price discovery, though they contribute indirectly through anticipated volumes and impacts on market "currentness." This is because marketing agreements tend to be formula pricing with the base price in the formula established by reported negotiated prices from one to two weeks previous. As such, a voiced concern is that in thinly traded spot markets, there may be insufficient negotiated trade to establish reliable and representative cash market information. Furthermore, in some important cattle producing market regions (e.g., Texas-Oklahoma-New Mexico), during certain weeks no negotiated cash price information is reported by USDA. The essence of this concern is that formula trade causes declining spot trade volume thus reducing market transparency. As long as formula prices are based on prior negotiated prices, they do not represent current prices. Switching to use of an alternative base price such as live cattle futures or some other concurrent price that matches the delivery date of formula purchased cattle could alleviate the time matching concern. However, it does not address the concern about the price not directly contributing to today's price discovery.

A second dimension of the concern over formula trade, not unrelated to the thin market concern, is data confidentiality. USDA-AMS uses a set of confidentiality guidelines to determine whether particular market information is publicly reportable. If guidelines preclude reporting, the information may be either not reported or combined with other data and reported in more aggregated form to preserve confidentiality. The confidentiality guidelines USDA-AMS employs are at times binding and impact reporting, especially in market regions where there are only a few major packers and markets are thinly traded (Schroeder *et al.*, 2019). There are strategies to consider in reducing confidentiality constraints including:

- 1) Modifying the confidentiality guidelines used by USDA-AMS to lessen reporting constraints,
 - Would need careful research to determine feasibility and possible impacts.
- 2) Aggregating information over time; for example, combining multiple days/weeks of data in USDA-AMS reports,
 - Not likely to reduce the problem appreciably because in some cases

it is endemic with the regional market packer structure and market thinness.

- Makes reported information dated and as such reduces value in information content.
- 3) Aggregating information across purchase methods (e.g., combining negotiated cash, negotiated grid, and formula trade into a single category rather than separate categories),
 - USDA aggregates now across these pricing methods as well as adding in forward contract trade in the weekly national comprehensive report. This is always reportable and provides a national fed cattle composite net price/value.
 - Removing the forward contract price data from the reported composite prices has been recommended in the past to make this price reflect more current prices, but to date that has not been done by USDA (Schroeder and Tonsor, 2017).
 - Aggregated national price reports do not reveal price variation present across market regions at times (Schroeder *et al.*, 2018 and Schroeder *et al.*, 2019).
 - 4) Aggregating across larger market regions when reporting USDA-AMS data,
 - Has been explored and could work but can reduce the quality of the information in combined regions. For example, Texas-Oklahoma-New Mexico negotiated trade could be combined with Kansas and be reportable more often, but since Kansas is already generally reportable, this would slightly dilute the Kansas report with prices

 National Daily Direct Slaughter Cattle - Formulated And Grid Purchases - Summary Agricultural Marketing Service Livestock, Poultry, and Grain Market News July 27, 2021 LM_CT109 Email us with accessibility issues regarding this report.						
For Primarily Monday, 07/26/2021						
Formula Net - Dressed Basis						
	Head Count	Wtd Avg Dress Pct	Weight Range	Avg Wt	Price Range	Avg Net Price
Steer						
Over 80% Choice	15,398	63.8	792 - 1,048	935	186.06 - 232.29	197.93
65 - 80% Choice	8,780	64.0	757 - 985	897	183.81 - 203.84	193.33
35 - 65% Choice	4,230	64.4	737 - 962	880	178.99 - 198.77	188.81
0 - 35% Choice	73	64.2	857 - 857	857	185.69 - 185.69	185.69

Source: USDA-AMS, https://www.ams.usda.gov/mnreports/ams_2659.pdf.

Figure 4.5. Snapshot of Part of USDA-AMS Daily Market Formula Cattle Purchase Report.

from outside the region and it would not add information value to the existing Kansas report (Schroeder *et al.*, 2019).

- 5) Reporting price summary information in a new way using statistical modeling such as a hedonic model (discussed in more detail later),
 - Has been explored in preliminary work with USDA-AMS transaction data and may have promise, but needs more assessment (Schroeder and Tonsor, 2017).

Finally, a third concern relative to market transparency is related to the information that is and is not reported in formula trade market reports by USDA. Since formula trade is a “catch-all” category of transactions that are not negotiated cash, negotiated grid, or forward contract, there is considerable heterogeneity across transactions. For example, non-hormone-treated cattle (NHTC), grass-fed, organic, specific export-certified, grid cattle, and non-grid cattle purchased under marketing agreements are all included in formula trade market information reporting under LMR by USDA. As such, the reported price range in the formula trade category, representing by far the largest volume of cattle of the four categories, typically exceeds \$30/cwt dressed weight (see example of partial recent daily market report in Figure 4.5). Such a large price range makes it difficult to interpret the information reported. The weighted-average price represents a broad array of types of cattle and transactions as the price range suggests. As such, there is no way to know why the range is so wide or what exactly the mixture of volumes of various types of cattle are that comprise the weighted average without having more data and completing careful analysis of the data.

Resolving the issue of excessive heterogeneity in formula trade is an issue that USDA may be able to partly address through modifications to LMR and/or how it is implemented. LMR began in 2001, when fed cattle trade was still mostly negotiated cash and has had only modest changes since inception. Over the same time, formula trade has become the dominant purchase method. A few options exist for providing more transparency in formula trade cattle. One proposal suggests having USDA publish a data library of marketing agreements similar to what has been done for years in the swine market. We will let others opine on the value of publishing contracts, but we suspect the value for weekly price discovery and market transparency is relatively low. A more obvious way to increase transparency is to detail more what the large price range represents in formula trade reports. A few possible ideas come to mind each of which would need to be tested using LMR transactions data collected under LMR that is currently not published:

- 1) Split formula trade market information into more refined categories for i) grid, ii) non-grid, and iii) specialty (non-hormone treated, naturally raised, etc.) for price reporting. Currently, this level of transaction detail is not collected by USDA under LMR so it would require a change in data collection protocols.⁵ Such further refined reporting though could

⁵ Any considered adjustment in the level of transaction detail collected by USDA would warrant careful assessment and would apply to all forms of reportable transactions, not just formula trade.

be subject to confidentiality challenges which can only be determined by collecting and analyzing the data.

- 2) Combined with the above recommendation, we have also recommended USDA report percentiles of prices in addition to simple high and low prices in formula trade. For example, in Figure 4.5 rather than reporting the high and low, USDA could report the 15th and 85th percentile prices. These are much tighter ranges than the absolute high and low and will exclude extreme prices that are likely not relevant to many producers (Schroeder and Tonsor, 2017).
- 3) Develop some form of hedonic modeling to refine price/value reporting. We have proposed this concept to USDA in past exploratory analysis of LMR transaction sample data, though only through preliminary testing (Schroeder and Tonsor, 2017).⁶ The idea with hedonic modeling of LMR transaction data is that it might be capable of increasing pricing transparency while also maintaining confidentiality of actual reported prices if structured accordingly. This approach necessarily entails economic and statistical modeling of reported data to arrive at a reportable price and not just publishing reported prices themselves. However, what we are proposing is not as different as it might first seem since weighted-average prices regularly reported by USDA-AMS also require a statistical price summary method and are not prices themselves. One of the flexible advantages of using hedonic modeling to facilitate market information reporting is subsets of trade can be aggregated over time or space if necessary to ensure confidentiality while not withholding all the information. For example, if only a small number of NHTC traded this week, they could be included in the hedonic model with the previous week's NHTC transactions so an NHTC price differential could still be reported.
- 4) Combine currently reported separate categories with a goal towards more frequent reporting with details of most importance to the industry. Past research has considered alternative aggregation across market regions regarding negotiated trade (Schroeder *et al.*, 2019). Here possible enhancements in formula reporting may include merging steer and heifer categories (or live and dressed; or splitting % Choice categories into two groups rather than four) with a goal of enabling other – perhaps more desired – breakouts on reports such as specialty (e.g., NHTC) vs non-specialty distinctions.

Inherent in these possible suggestions, as is the case throughout this topic of discussion, are the trade-offs between what is reported and not reported that are directly influenced by private decisions regarding market channels used to transfer ownership of fed cattle.

⁶ Hedonic modeling is routinely used by other federal agencies in price reporting (e.g., Bureau of Labor Statistics).

Conclusion and Recommendations

Fed cattle marketing agreements were launched some 30 years ago and focused on ensuring market access, enabling greater capacity utilization, and reducing transaction costs. Since then, marketing agreements have evolved to become instrumental in improving overall supply chain coordination. In addition to the original benefits, cattle producers now also utilize marketing agreements to secure higher prices associated with producing higher quality cattle, producing cattle to match downstream customer preferences, establishing stronger ties and relationships with cattle and beef customers, and building downstream alliances. Together, these provide important economic benefits to the cattle producer that collectively improve overall beef industry value and better serve end consumers. Any limits imposed on cattle feeders' ability to utilize marketing agreements would directly reduce the benefits such agreements have provided producers, packers, customers, and, ultimately, consumers.

Development of marketing agreements have also reduced weekly visible price discovery information. The increased popularity of marketing agreements, combined with the ways marketing information is reported by USDA, makes the associated price information challenging to interpret. Some suggest this reduces market transparency. Indeed, difficult to discern marketing agreement price information is not entirely transparent. However, neither is cash negotiated trade where only limited details about the cattle (sex, market region, and visually estimated quality grade) are known. We have suggested several ways to improve information and transparency for marketing agreement transactions. The ideas we put forth include:

- Consideration of several possible ways to adjust USDA-AMS market reporting confidentiality constraints.
- Modifying LMR information collection and reporting, particularly for formula trade cattle, by USDA to better illuminate reported price information.
- Utilization of new methods of cattle price reporting using statistical models well suited for summarizing such diverse transactions. However, this would require more research to effectively design such statistical models and more detailed data collection by USDA under LMR.

As we noted in the prologue, in an industry as large and diverse as the U.S. cattle and beef sector, there are a wide range of situations and hence opinions on many topics. Our goal in this chapter was to guide and inform discussions to increase industry efficiency, effectiveness, and global competitiveness that elevates aggregate economic well-being. A myriad of economic incentives and market forces have led the fed cattle and beef sectors to the current situation. As such, any efforts to redirect or alter ongoing changes must appreciate the complexity, inter-relatedness, and tradeoffs associated with many of the issues. Further, along with any drawbacks of the current situation, it is important to not lose sight of the

efficiency and consistency of the fed cattle sector in producing high-quality beef that meets demands of many types of consumers around the world. This chapter was composed with this goal and we hope it proves helpful accordingly.

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Chapter 5

Another Look at Alternative Marketing Arrangement Use by the Cattle and Beef Industry

Stephen R. Koontz

Introduction

Marketing arrangements that are alternatives to the negotiated cash trade are important to the cattle and beef industry. These Alternative Marketing Arrangements (AMAs) improve efficiency in the system, improve coordination, often communicate information in addition to price, and are important for risk management purposes. These arrangements also impart a cost on the remaining cash market, but the cost evidence is a simpler conversation and has impacts that are more limited when compared to the benefits of AMAs.

This chapter offers a research-based discussion of benefits and costs from the use of AMAs in the cattle and beef industry. AMAs are primarily and specifically formulas and forward contracts. The discussion offered here is mainly developed and synthesized from research conducted prior to 2007 through participation in the USDA Grain Inspection, Packers and Stockyards Administration (GIPSA) RTI Livestock and Meat Marketing Study (LMMS). This research is over fifteen years old, but the economic fundamentals remain applicable, and the results are relevant. Price levels and quantities have changed, but the principles of supply – as determined by the cost of services at issue and demand beginning with the consumer and transferred to the farm-and ranch-level by provision of marketing services – have not. The discussion will offer a summary of the LMMS findings and attempt to consider how those findings might change with the subsequent changed market environments, underlying magnitudes, and considering inflation. The discussion will also place the results of the LMMS in the context of considerable other research on the market organization and performance of fed cattle and beef markets.

Evidence from three of the four LMMS sections will be presented in turn. Dollar impacts and magnitudes are quoted from the LMMS research, with a base inflation year of 2004. Between 2004 and 2021, the Producer Price Index (PPI) showed an inflation rate of about 40%. While the Consumer Price Index (CPI) measured inflation is higher, the PPI rate better measures impact within

the raw material portion of the food system. Thus, extending this prior work to now involves impacts that are at least 30 to 40% larger, as long as there is not some compensating or exacerbating change in industry structure.

The main purpose of this chapter is to offer a research perspective on the “30/14” and “50/14” proposals that have been circulated and supported by various organizations of cattlemen and state producer associations. “30/14” refers to the requirement that each beef packing facility must procure 30% of fed cattle needs through the negotiated cash market for delivery within a 14-day period. “50/14” is similar with a 50% negotiated cash trade requirement. A number of similar proposals have been introduced – for example, S.543 (117th Congress), the *Cattle Market Transparency Act of 2021*, which was introduced by Senator Deb Fischer (R-NE), would require USDA to, among other things, establish regional mandatory minimums for negotiated trade.

Currently, just less than 70% of cattle marketings are through formula methods. Formula methods imply that the price for the transaction is discovered through some other transaction. Most commonly, a USDA Agricultural Marketing Service (AMS) reported regional price is used. Approximately 10% of fed cattle marketings are forward contracted. Forward contracts are transactions for cattle to be delivered 30 or more days in the future. This leaves about 20% that is transferred through the negotiated cash market, with a small portion (2%) using a negotiated grid pricing structure. Variations in these amounts differ greatly across the five USDA-AMS Livestock Mandatory Price Reporting regions. All of the policy proposals would involve substantial changes to how cattlemen and those in the cattle industry do business with packers. These proposals, if adopted, are mandates that require changing entire business models and practices.

Mandates to negotiated cash trade are limitations on AMA use. LMMS was a research project which examined the benefits and costs to AMA use, mandated and funded by Congress. It was a project to address a similar policy mandate in 2002 within a proposed amendment to the Farm Bill: “The Johnson Amendment.” This amendment sought to prohibit or limit AMA use – the purpose of some of the legislative proposals currently under consideration. Thus, there is scientific research which addresses mandated-cash-trade questions.¹ There are six total volumes of work from four teams comprised of 30 researchers totaling almost three years of effort, an interim report, peer reviews, and comments of the effort are also available. The LMMS was not the first in-depth look at “captive supplies”, or AMAs prior to the LMMS effort. LMMS was, however, the most comprehen-

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¹ The original research project publications can be found online at https://www.gipsa.usda.gov/psp/publication/live_meat_market.aspx and the specific reports used in this chapter are Muth *et al.* (2005) and Muth *et al.* (2007).

sive benefit/cost analysis supported by multiple efforts, whereas the 1996 GIPSA Concentration Study looked more specifically at market power (Ward, Koontz, and Schroeder (1996), Azzam and Schroeter (1996), Kambhampaty, Driscoll, Purcell, and Peterson (1996), and Williams *et al.*(1996)), as did the “Panhandle Study” (Schroeter and Azzam (1999)). An assessment of the policy proposals is offered in the context of having participated in both the LMMS and the Concentration Study.

The bottom-line impact of any intervention into the cattle market is the fact that there are modest benefits and considerable costs due to lost efficiency and product quality from mandates. Similarly, but context reversed, this is because AMA use has considerable benefits and modest costs due to solid economic foundations. This was the conclusion across the fed cattle and beef, hog and pork, lamb and lamb meat, and downstream meat distribution industries in the LMMS. For the cattle and beef industry, the costs are ultimately incurred by cow-calf producers and beef consumers. The short-term impact for a policy most like that being considered is a \$2.5 billion negative impact in the first year and a cumulative negative impact of \$16 billion over 10 years, inflated to 2021 dollars. This cost is leveled mainly on cattle producers. The 50/14 proposal would have these negative impacts and the 30/14 would have similar negative impacts albeit approximately halved.

It is also important to recognize the regional distribution of impacts across the United States. Current policy proposals will have an impact on the upper Midwestern cattle feeding and packing industry, but there will be a substantial impact in the Southern Plains and on producers that supply calves into that system. The negotiated cash trade is only a small portion of the volume of animal marketings in the Southern Plains.

Returning to details of the synthesis, the main cost to the cattle and beef industry of AMA use is the potential for beef packers to exercise market power. The main benefit to the cattle and beef industry of AMA use is that feeding and processing facilities can operate more efficiently, manage risks, and provide higher quality beef products to consumers. The market power versus efficiency question is of interest to producer groups, industry groups, and policy makers, and is often the bottom line in many discussions.²

A second cost of AMA use to the cattle and beef industry is the potential detrimental impact on the quality or effectiveness of price discovery. The LMMS did

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² Examples of the research perspective on this question include: Azzam (1996), Azzam (1997), Azzam and Schroeter (1995), Lopez, Azzam, and Liron-Espana (2002 and 2003), Ward (2002), and Ji and Chung (2016).

not address this issue, whereas some ongoing research work does. As discussed in Chapter 2, improving the quality of price discovery does not fundamentally change supply and demand, and will therefore not change the costs and benefits as measured in the LMMS. Substantial AMA use and limited use of the negotiated cash market can result in prices that are biased too high or too low or are inefficient, with more underlying volatility than need be. However, there is no empirical evidence supporting this concern.

Four portions of the 2007 LMMS Final Report provide direct research results that can respond to the proposed policies. First, the LMMS measures the effect of market power stemming from AMA use on fed cattle transaction prices. Fed cattle prices change with a variety of market factors, quality factors associated with the cattle in the transaction, and the extent of AMA use by the packing industry at the time of the transaction. This “cost” associated with market power and AMAs was analyzed in the report.

Second, individuals associated with businesses in the cattle feeding industry and in the beef packing industry were interviewed to assess the reasons for AMA use and to attempt to place a value on these alternatives to those businesses. AMA use was always part of a cost-reducing, efficiency-increasing, and product quality-increasing exercise with all the businesses interviewed. AMA use allowed for reductions in personnel, increases in capacity utilization, and improvements to cattle and beef product quality. These changes were all communicated as important.

Third, packer plant-level profit and loss (P&L) statements were analyzed in the LMMS. The focus was to determine the impacts of AMA use on the reported costs of slaughtering and processing fed cattle. The study examined supply chain management questions associated with AMA use. Specifically, did plants with higher levels of AMA use have lower cost of slaughter and processing? More efficient slaughter and processing results in higher prices to producers selling cattle and lower prices to consumers buying beef and is a benefit to the industry. This efficiency benefit was measured in the study.

Fourth, these three results were combined in an economic model representing the cattle and beef markets so the net impact could be estimated. The net impacts were measured across the different segments of the industry – from the consumer to the producer – and over different time horizons, from the current year out to 10 years in the future. A summary of this overall assessment is offered at the end of the chapter.

A further section will communicate the importance of economies of size to the beef packing industry. These economies are orders of magnitude larger than established measures of market power. Also, before the overall market impacts are presented, a market power discussion of AMA use will be offered. AMAs are often discussed with respect to impacting underlying market fundamentals. This is an improper assessment; an alternative assessment will be offered. This additional sixth section will offer a detailed example of AMA use across hypothetical markets for fed cattle. The example incorporates the structure of formulas and details the decision-making processes, while also illustrating how formula marketing volumes do not impact overall supply and demand nor does formula marketing empower downstream firms (packers) with a tool to exercise market power.

Finally, the chapter will conclude by returning to the overall assessment and offer ideas for future research. The policy interventions being considered are substantial and would likely have far reaching impacts on the cattle and beef industries. The existing research remains clear but may also be dated. If there is an interest in updating this research – or making the research on a persistent issue more ongoing – there are some suggestions for helping to better understand what we do not know from existing scientific work.

Impact of AMAs on Cattle Prices

This is the first section of this chapter to summarize findings from the LMMS.³ The LMMS project used packer data on fed cattle transaction prices between October 2003 and March 2005 to examine specifically if AMA volume impacted fed cattle prices. These databases were maintained by packers for accounting purposes for the payment for cattle and are reported in aggregate terms by the USDA-AMS under Mandatory Price Reporting. USDA GIPSA has the authority to compel packers to provide transactions and financial data for study.

The transaction databases contain a wealth of detail about the cattle procured including animal breed, number of head, percent of animals in various USDA quality and yield grades, percent of out-weight carcasses (too light or too heavy), cattle destined for branded or certified programs, and the method of pricing and marketing. Pricing methods include liveweight, carcass weight, and carcass weight with grid premiums and discounts. Marketing methods include individual negotiated (cash market), forward contracted, packer-owned, formula, and auction barn or dealer purchased. This price database is not a sample, but rather the population of transactions as maintained by packers. As a result, impacts found here are not merely generalizations based on samples but are, in fact, the actual impacts on the market in the study period.

Statistical analyses were used in which fed cattle transaction prices were explained by market conditions, animal quality, and AMA use. Market condition variables included the USDA reported boxed beef cutout value, the nearby CME live cattle futures prices, the prior week's AMS reported cash market price for the packer's region, and the volume of animals on the showlist. Animal or transaction quality is measured by the variables listed earlier. Another important variable in the analysis was showlist. Showlist size is not observed in the data directly nor reported by the USDA; it is the inventory of cattle for sale at any point in time. Cattle slaughtered on any one day must have been for sale – or on the showlist – for at least the prior two-to-three weeks. So, the showlist on a given day is the sum of cash market animals slaughtered over the next 14 days. Similarly, 21 days into the future were used, but the results were the same. AMAs were measured as a percent of plant weekly purchases or capacity, or the percentage of cattle slaughtered in each week that were AMA cattle. This variable provides a measure of market power.

What are the results? First, economic fundamentals and animal quality are significant in explaining transaction prices. Higher boxed beef cutout values, fu-

³The findings are reported in Muth *et al.* (2007), Muth *et al.* (2008), and Liu *et al.* (2009).

tures prices, and prior week cash prices all result in higher transaction prices. Further, higher quality cattle earn premiums and lower quality cattle receive discounts relative to average quality animals. Larger numbers of animals in a transaction result in a premium. The model also shows that showlist size is important – outside of the showlist variable itself. When cattle prices are strong relative to market conditions then they tend to stay strong and when prices are weak then they tend to stay that way. All these results show that many things impact cattle prices and that there is considerable momentum in prices. The impact of AMA volume on price cannot be examined in isolation. The impact is residual, as these other economic factors are the most important determinates of price.

The average fed cattle price in the sample period was \$1.38 per pound of carcass weight. All prices, carcass, grid and liveweight, were converted to in-the-beef (or dressed weight). Once all the above things were accounted for, then the impact of AMAs can be measured. It was found that when AMA volumes are higher, relative to plant capacity, fed cattle prices are lower, but the impact is small. On average, a 1% increase in AMA cattle is associated with \$0.04 per hundredweight decrease in transaction price. If all AMAs were eliminated (for all plants the average utilization was 17%), the associated price increase would be \$0.68 per hundredweight of carcass. This would be \$6.12 for a 900-pound carcass. The impact was small but statistically significant. Further, it is important to recognize that this measure is from all the plants in the US. The result is a weighted average across all plants. The national average result is small, and this is because all the regional or plant specific impacts were small as well.

This conclusion is also in agreement with a substantial majority of research on market power in the cattle and beef industries. There are examples where market power is a large percentage of fed cattle price,⁴ but far more scientific work suggests the impact is small.⁵ Older research results from the Structure-Conduct-Performance paradigm (Bain 1968) tend to be larger than the more contemporary results from the New Empirical Industrial Organization paradigm (Bresnahan 1989). The results from the theoretical studies also suggest large impacts which are at odds with the empirical work.⁶ There are also a variety of works that examine market power over time or over different market conditions, or for changes in the market power exercising conduct,⁷ and research just on the impact of captive supplies.⁸

Market power is a well-studied question, but there is no definitive study as there are a variety of approaches and assumptions needed to produce estimates.

⁴ These works include Marion and Geithman (1995), Quail, Marion, Geithman, and Marquardt (1986), Hall, Schmitz, Cothorn (1979), Azzam and Pagoulatos (1990), and Menkhaus, St. Clair, and Ahmaddaud (1981).

⁵ See, for example, the works of: Azzam and Schroeter (1991), Koontz, Garcia, and Hudson (1993), Koontz and Garcia (1997), Elan (1992), Schroeter and Azzam (1990, 1999, 2003, and 2004), Ward (1981, 1982, and 1992), and Muth and Wohlgenant (1999 and 1999).

⁶ See Xia and Sexton (2004), Zheng and Sexton (2000), and Zheng and Brorsen (2010).

⁷ See Schroeter (1988), Crespi and Sexton (2005), Crespi, Xia, and Jones (2010), Boyer and Brorsen (2013), Ji, Chung, and Lee (2017), Brorsen, Fain, and Maples (2018).

⁸ See Schroeder, Jones, Mintert, and Barkley (1993), Ward, Koontz, and Schroeder (1998), Azzam (1998), and Love and Burton (1999).

The main conclusion from a reading of this empirical research is that market power, while persistent, is not the primary determinate of fed cattle price. This is specifically the case when the market power assessment is viewed in the context of economies of size.

However, extending these results to the current time period is the most questionable part of this process: taking results from the early 2000s and interpreting in light of market conditions in the early 2020s. AMA cattle are 60 to 70% of plant capacity and supplies are currently in excess of plant capacity if plants only operate five days per week. Market power measures may be higher in the 2016 to 2021 period than most of the research that has been done prior to 2015. This is a research question which will be answered by an analysis of the price history record. Regardless, it is doubtful market power measures are larger than economies of size, which will be discussed in several remaining sections.

Impact of AMAs on Cattle Feeding and Packing Operations

This is the second section of this chapter to summarize findings from the LMMS. Part of the LMMS project involved interviewing cattle feedlots and packers in person and asking a series of questions regarding how restricting packer procurement would impact business. The questions asked included:

- What kind of immediate adjustments would your company have to make if packer procurement relationships were restricted?
- What effects would restrictions on packer procurement relationships have on how your company operates in the long run?
- If this method affects costs, what would you estimate is the percentage change in costs compared to using the negotiated cash market?
- If this method affects quality, what would you estimate is the percentage change in value compared to using the negotiated cash market?

The cattle feeder responses to the question of immediate adjustments were mixed. Some thought they would go out of business and that the adjustments would have a dramatic effect on the structure and stability of the industry. Others thought the adjustments would have no impact on their business or that effects would depend on how narrowly packer procurement relationships were defined. Still others had no opinion.

One implication of restricting AMAs noted by several respondents was the impact on risk-bearing ability and capacity utilization. Outside investor capital reduced the equity that the cattle feeding business must provide to feed cattle, and known marketing arrangements allowed cattle feeders to secure both outside investment and better terms from lenders. Without AMAs, the cattle feeding business would feed fewer cattle and would have to borrow more against the cattle. The individual feeders would have underutilized capacity or would have to find new investors to replace the capital that investors who sought specific marketing methods once provided. There is investment capital that will feed cattle when the

cattle were forward contracted or marketed under formula. This investment capital has much less interest in feeding cattle if animals must be marketed through negotiated cash trade.

To attract capital that is not in cattle feeding would require a higher rate of return than cattle feeding currently offers. Otherwise, that capital would already have been invested in cattle feeding. Given that the supply and demand of beef is relatively fixed in the short run, fed cattle prices are not expected to change substantially. Thus, higher rates of return would have to come from downward pressure on feeder cattle price. Likewise, if feedlots have more debt and/or more risk, the higher cost of borrowing will result in lower bids for feeder cattle.

Packers indicated that in the short run they simply would adjust to the new restriction and the extent of adjustment would depend on how the restrictions were defined and that over time, any costs implied by restrictions would be internalized and impact fed cattle bids. In the short run, feedlots and packers would adjust to restrictions on packer procurement relationships. Packers face the same beef demand and cattle supply, but they would buy more cattle through other methods. Individual feedlots that have AMA cattle would face increased risk and higher financing costs because they must own or find owners for the cattle. Packers expect they would have to reduce capacity utilization if procurement relationships were limited. In the short run, because cattle supplies are fixed, someone would own and feed the cattle, but there would be a higher rate of return or higher finance costs to replace the capital that is removed, thus leading to downward pressure on fed cattle and feeder cattle prices.

Feedlots and packers identified two primary long-run effects of restricting packer procurement relationships of cattle. The first effect, consistent with short-run impacts, would be increased risk and reduced capacity utilization due to removing capital from the feeding sector. The second effect would be reduced product quality by moving back to a commodity market. Feedlots and packers expressed concern about the difficulty of meeting the needs for customized product in branded programs. New strategies would have to be developed to meet demand in this segment of the market. Otherwise, feedlots and packers would miss out on these higher-value consumer markets.

Several respondents had the expectation that removing or restricting capital to the sector will lead to reduced capacity, particularly during downturns in the market. Greater quality concerns, more risk, and less capital will lead to a smaller beef industry. Feedlots thought their costs would increase if packer procurement relationships were restricted. Cost savings associated with AMA cattle come in the form of operational efficiency and lower average overhead cost through improved throughput.

Operational efficiency from packer procurement relationships results in more consistent operations: the number of cattle in the feedlot is more consistent from month to month and labor is used more efficiently because of this predictability. For example, a labor efficiency of one person per 1,500 cattle may be achieved using packer procurement relationships rather than an industry average of one per 1,000 cattle. Feedlots with AMA cattle have more consistent cattle and feeding

programs and the consistency improves efficiency; a feedlot might need fewer feed trucks and could have larger feed batch runs, because a high percentage of the cattle would be on the same program (instead of having many different types of cattle and rations). Some feedlots reported close to a 20 percentage point increase in capacity utilization due to packer procurement relationships, which spreads overhead costs over more cattle.

Some feedlots reported close to a 20 percentage point increase in capacity utilization due to packer procurement relationships, which spreads overhead costs over more cattle.

Packers' concerns were related to beef quality and loss of customers for higher quality products.

Cost savings were estimated in the 17% to 22% range across those interviewed. With \$0.30 per day yardage cost (not including feed) and 150 days on feed, total feedlot cost per head is \$45.00; thus, cost savings would be \$7.65 to \$9.90 per head. Labor cost savings estimates account for much of this gain and were reported to be in the \$1.25 to \$10.00 per head range. Quality premium loss estimates are over and above the efficiency gains and ranged from \$15.00 to \$17.00 per head.

Packers estimated their change in costs from restricting packer procurement relationships would be less than those reported by feedlots. They noted some lost efficiencies and the need to add more cattle buyers to return to an all-cash procurement system (for example, an additional buyer costs \$0.40 per head). Packers' concerns were related to beef quality and loss of customers for higher quality products.

Feedlots and packers expressed concern about the impact on quality if packer procurement relationships were restricted. They expected to revert to a commodity market with few incentives for higher quality cattle. Feedlots reported this loss to be worth \$1.00/cwt or higher. The interviews and economic model results (in the last section) agreed that the changes in quality and prices are expected to be small because of restricting AMAs. They also agree that everyone from consumers to cow-calf producers would be worse off because of the restrictions. That is, quality would be reduced, costs would increase for feedlots and packers, and cattle supplies would decline.

The costs and benefits as discussed in this section are in 2004 dollars. These can be reasonably inflated to 2021 dollars; however, the development of specific attribute beef products is far more prevalent today. For certain, the magnitudes of AMA benefits are not less. Further, many of the businesses interviewed are more entrenched in current business models that make substantial use of AMAs – these business models were more reasonably new during the LMMS project.

Impact of AMAs on Packer Plant-Level P&Ls

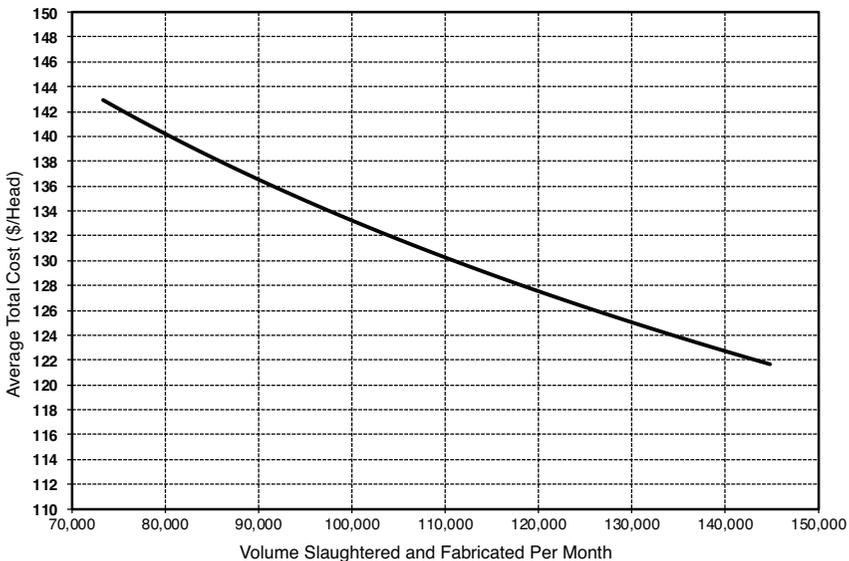
This is the third section of this chapter to summarize findings from the LMMS. Monthly P&L statements from October 2003 to March 2005 were examined for

all the plants operated by the four largest packers. These plants accounted for 83% of USDA Federally Inspected Fed Steer and Heifer slaughter numbers. This was one of the unique portions of the LMMS as packer P&L data are almost never examined in published research.⁹

The P&L data were used to examine four questions. First, what is the average total cost (ATC) of slaughter and processing? Statistical models were used to explain ATC as a function of volume and other things. The project was interested in the shape of the curve – how steep is it, is the bottom flat, and does it increase at higher volumes? Second, do plants with higher AMA volumes have lower costs all else constant? Third, do plants with higher AMA volumes have higher throughput than those with less? Fourth, do plants with higher AMA volumes have more predictable volumes?

The results indicate that ATC was a function of volume, and modestly, other economic factors. Each plant is somewhat different in technology and engineering and therefore all have modestly different costs. Larger plants had lower ATC than smaller plants and the more cattle pushed through a plant, the lower the costs were per head. The ATC curve for a representative plant is presented in Figure 5.1. Packer slaughter and processing ATC decreased sharply over the entire range of processing volumes. Plants that operated at the low end of ATC are 5 to 7%

⁹ This work is reported in Muth *et al.* (2007) and Koontz and Lawrence (2010).



Source: Muth *et al.* (2007) and Koontz and Lawrence (2010).

Figure 5.1. Average Total Costs of Slaughter and Fabrication for a Representative Beef Packing Plant from Firm-Level P&L Financial Statements and Measured in \$2004.

more efficient than those that operated in the middle and 12 to 15% more efficient than those on the high end. Large plants have significant cost advantages over small plants. This is likely the main reason for increasing concentration in the beef packing industry; big plants are less expensive to operate per head than are small plants. However, large plants require large volumes to realize these efficiencies. Consequently, securing supplies is crucial. Further, these economies are much greater than measures of market power.

In combination, packing industry slaughter and processing costs are 4.7% lower because of the use of AMAs.

The project also found that plants with higher AMA volumes had lower costs, after accounting for other factors like volume. If AMA usage was eliminated, then costs would increase by 0.9%. The average cost of slaughter and processing for this period was \$138.61 per head. Thus, the industry was saving \$1.22 per head through direct use of AMAs. But the direct impact was not the only impact nor the most important. We also found that plants with higher AMA volumes had higher average monthly slaughter and processing volumes. In the absence of AMA usage, average monthly volume would be 8% lower and increase costs by 2.6%. Finally, we found that plants with higher AMA volumes had more predictable average monthly volumes. Without AMAs, average monthly volumes would be 70% more variable and cause a 1.2% increase in cost. In combination, packing industry slaughter and processing costs are 4.7% lower because of the use of AMAs. This was approximately a \$6.50 per head cost savings. During this period, the four largest packing firms had an average loss of \$2.40 per head. AMAs were important to the packing industry, and to the cattle industry, from the standpoint of efficiency. The dollar impacts may have been small because of the short period for which P&L data were available. Over a longer period than 18 months, cattle supplies and costs would be more variable, and more variation in cost might be associated with AMA use.

These costs and values are in 2004 dollars and should inflate to 2021 dollars with reasonable transparency. It is also likely impacts are greater now than in the early 2000s as AMA use is more common and more integrated into supply chains and plant management. Finally, the overall results and magnitudes reveal how out of balance the supplies of fed cattle were relative to packing capacity. Packing firms are under severe profit pressure and there are economic incentives to not invest in plant and packing infrastructure nor to maintain some plant operations.

The Importance of Economies of Size

This section discusses work separate from the LMMS, continued after the LMMS was completed in the process of communicating and understanding the economic issues underlying growth and innovation in the beef packing industry. This work was reinforced by events experienced prior to the pandemic and during the closure of the economy during the COVID-19 outbreak.

In today's dollars, a large efficient commercial slaughter and fabrication beef facility can run at a cost that is reasonably and approximately \$180 to \$200 per head, if the plant is of substantial size and runs multiple shifts per day over the entire week. These are also pre-COVID costs. Importantly, if the plant is operating at an efficient rate with high and steady throughput, then the plant can obtain its potential operating capacity. Commercial plants operate two shifts per day, for six days a week, and typically process at least 300 head of fed cattle per hour. These plants will process 25,000 to 35,000 head per week. Reducing the operating rate relative to potential capacity increases the cost per animal incurred during operations. Most of a packer's expenses are for the physical facility, equipment, plant management, portions of the meat sales force, and company management.

Labor, energy, and materials costs are also important, but these variable costs are substantially less than fixed costs. The fixed costs do not vary in the short run, if a plant or a variety of plants owned by the firm do not operate at potential capacity. Reducing operations volumes by 20% then increases non-animal costs per animal by 7% to 10% relative to the lowest potential costs. Reducing operations volumes by 40% then increases costs per animal by 15% to 20%, again relative to the lowest potential costs. Reducing the operating rate of packing plants increases the costs of operating and increases costs at an ever-increasing rate. The most expensive-to-operate commercial plants when operated at reduced capacity incur costs of about \$300 to \$350 per head, compared to very small packing operations that serve the freezer beef market with best-case costs of \$600 to \$800 per animal pre-COVID.

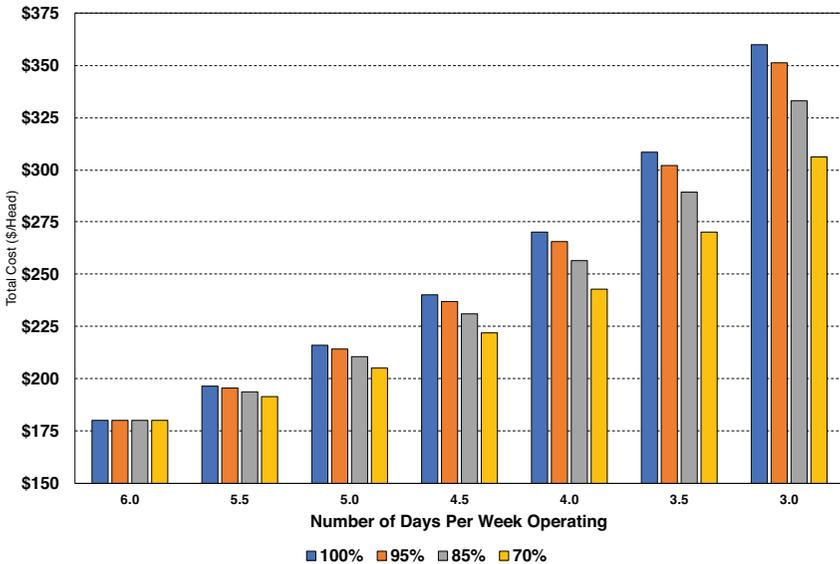
For a given facility, costs are lowest when running the plant at closest-to-potential capacity. Across the spectrum of possible plants, the larger plants have lower costs per unit processed. It is possible that plants can be so large as to have capacity larger than the regional supplies of animals and that transportation costs from bringing in animals from other regions may make the facility uneconomical. However, this does not appear to be common, nor is it discussed by packing industry members.

It is difficult to estimate costs for the plants whose operations were so dramatically impacted during the spring of 2020. In all the meat packing plant operations data that have been reported, it is unprecedented for plant volumes to decline so steadily to such low levels. In any other situation, plants would simply cease operations. The managing firms would have temporarily closed the plants rather than operate at such low levels. However, the 2020 situation is unlike any other. Economics are not driving meat packing plant operations – rather, the pandemic is the driving factor.

The following estimate is based on economic logic and not accounting data: if a plant is slaughtering and fabricating 312.5 animals per hour, operating two shifts per day, and running six days per week, the total weekly volume is 30,000 head. Suppose operating costs are \$180 per head at this volume and level of throughput. This is the top line in Table 5.1. The remainder of the table calculates the increased cost per head of reduced operations. Suppose the plant operates five days per week; then the cost per head jumps to more than \$200 per head. One less

Table 5.1. Calculated Cost Per Head for a Hypothetical Large Plant Operating at Various Below-Capacity Volumes. (Throughput is 312.5 head per hour, shifts are 8 hours, there are two shifts per day and operating ½ day is one shift.).

Days Per Week	Percent Capacity	Volume Per Week	Reduced Volume	Cost Per Head	Cost Increase
6	100%	30,000	0%	\$180	0%
5.5	91.67%	27,500	-8.33%	\$196	9.09%
5	83.33%	25,000	-16.67%	\$216	20%
4.5	75%	22,500	-25%	\$240	33.33%
4	66.67%	20,000	-33.33%	\$270	50%
3.5	58.33%	17,500	-41.67%	\$309	71.43%
3	50%	15,000	-50%	\$360	100%
2.5	41.67%	12,500	-58.33%	\$432	140%
2	33.33%	10,000	-66.67%	\$540	200%
1.5	25%	7,500	-75%	\$720	300%
1	16.67%	5,000	-83.33%	\$1,080	500%



Source: Author calculations.

Figure 5.2. Total Slaughter & Fabrication Cost Per Head for Efficient Beef Plants Across Numbers of Operating Days (with Two Shifts per Day) Per Week and Varying the Percent of Total Costs that Are Fixed Versus Variable (100%-95%-85%-70%) and a Base Cost of \$180 Per Head.

day of operations results in a 20% increase in costs per head. If the plant operates four days per week, then the cost per head is \$270 per head, a 50% increase in costs. Reducing plant operations by one or two days per week is not uncommon with reduced cattle supplies but are reasonable variations in plant operations. The variation in actual costs may be less as less energy, materials, and labor are required. Labor is often guaranteed a weekly number of hours, and plants are not simply turned off but have operations scheduled for multiple weeks.

Figure 5.2 illustrates the total cost per head of slaughter and fabrication under alternative scenarios whereby the base cost is not entirely fixed costs. Scenarios are shown where variable costs are 5%, 15%, and 30% of the base \$180 per head cost. Costs per head do not increase as dramatically when more of the base cost is variable, as that portion of the cost decreases as fewer animals are processed and fewer shifts are run. By far the largest portion of base packing costs are fixed and reducing the volume of processing necessitates allocation of a higher portion of fixed costs to the individual animals processed.

The prior discussion is a synthesis of interview information and economic logic. It is a simple example, but the conclusions are supported by all prior research on packer costs.¹⁰ Economies of size are a prevalent finding for the beef processing industry.

Packer plant-level profit and loss (P&L) statements were analyzed in the LMMS. The focus was to determine the impacts of AMA use on the reported costs of slaughtering and processing fed cattle. The study examined supply chain management questions associated with AMA use. Specifically, did plants with higher levels of AMA use have lower cost of slaughter and processing? More efficient slaughter and processing results in higher prices to producers selling cattle and lower prices to consumers buying beef and is overall a benefit to the industry. This efficiency benefit was measured in the study. As a backdrop to the AMA-related findings, there was also the more general interest in understanding packing costs as related to volumes. The P&L data research agreed with much prior research that there are substantial economies of size within individual plants and across plants of different sizes. The greater volumes individual plants processed lower the costs of processing, and across plants of different size, lower the costs of the large plant relative to modestly smaller plants.

A More Precise Example of “Captive Supplies” and the Cost of AMAs

AMAs prior to the LMMS were referred to as “captive supplies.” This was a label heading chosen in a USDA GIPSA report where this activity was first reported. Captive supplies may be an inappropriate description in that the inventory of fed cattle are not captive or under the control of the packer. The animals are committed to the packer in a formula relationship. Feedlots control the marketing of formula animals because most formulas have a premium/discount structure

¹⁰ Including: Ward (1987, 1988, 1990, 1993), Ball and Chambers (1982), Logan and King (1965), Logan (1963), Matthews, Hahn, Nelson, Duewer, and Gustafson (1999), MacDonald, Ollinger, Nelson, and Handy (2000), Morrison-Paul (2001), and MacDonald (2003).

for meat quality. Feedlots determine the week the animals will be slaughtered, and the packer determines the day of the week. There is additional communication in that packers are informed about the placement of animals in anticipation of being marketed on the formula and the performance of animals in the feeding process. There are informal arrangements as to the total volume and variability in the timing of marketings. Feeding performance as related to weather mainly also impacts this timing. Some of these issues have been discussed earlier in the chapter.

Further, the prices for both negotiated cash and formula are quality adjusted equivalent. Both sides of formula arrangements do not negotiate the base price, but both sides want to trade fed cattle, and communicate that the interest is in having that happen at the market price. This has been communicated in interviews with cattle feeders and packing entities. The interest is in trading cattle, “at the market.” There are not separate markets for formula and cash cattle; the base price is similar if not equivalent. USDA-AMS regional reported prices are commonly used for the region where the formula arrangement is in place. Commonly, the TX-OK-NM price, Kansas price, or Nebraska price as reported for the prior week is used. This price is the base of many formulas, and grid premiums and discounts are negotiated but infrequently. The premiums and discounts may be determined by the product end market – USDA Quality Grade or Yield Grade. The base price has changed over time – early formula arrangements used a plant-average price. Packers were willing to trade cattle through the formula at the value at which the packer was securing all other fed cattle purchases for the plant to which the cattle were sold.

Opponents of AMAs and some academics often use the following argument illustrating the negative impact AMAs have on the negotiated cash market: supplies of captive cattle allow the packer to not bid in the cash market and thereby reduce demand in the cash market and depress price in the cash market. This is the argument used with policymakers and in legal settings to mandate negotiated cash trade. It is one of the arguments in *Picket v. Tyson Fresh Meats* from 2004. However, it remains an incomplete argument as it ignores the supply side of the market. If the packer does not have to bid on the cattle, then it also is true that the cattle feeders do not have to offer the cattle for sale. AMAs do not change the market fundamentals – they do not change the total supply nor total demand. AMAs only change the channel in which animals are marketed.

The markets for negotiated cash and formula animals are also not separate markets where packers can choose to buy more or less in the formula or cash market. Separating markets is a strategy for exercising market power. Formula cattle

AMAs [previously] were referred to as “captive supplies.”

Captive supplies may be an inappropriate description in that the inventory of fed cattle are not captive or under the control of the packer.

Table 5.2. An Illustration of How Variation in AMA Volumes Do Not Impact Cattle Market Fundamentals.

	Scenario 1: Low AMA Volume	Scenario 2: High AMA Volume	Scenario 3: Excess Fed Cattle Demand	Scenario 4: Excess Fed Cattle Supply
Feedlot Availability:	100,000	100,000	90,000	110,000
Formula	40,000	80,000	80,000	90,000
Cash	60,000	20,000	10,000	20,000
Packer Needs:	100,000	100,000	100,000	100,000
Formula	40,000	80,000	80,000	90,000
Cash	60,000	20,000	20,000	10,000

are not “captive.” The cattle feeding organization decides the week the cattle will be marketed, communicates that to the packer – and it is usually not a surprise as communication between the seller and buyer is ongoing – and the packer decides the day of the week cattle will be delivered. The marketing decision belongs to the cattle feeders, and almost all formula cattle are grid marketed and thus receive premiums and discounts. Marketing cattle early will result in more discounts and fewer premiums to the cattle owner on those animals.

Table 5.2 attempts to illustrate how to think about AMA cattle in a manner that accounts for both demand and supply impacts on the market. The top three rows, after the row headings, are the feedlot availability of animals from an illustrative region. Round numbers are used for simplicity. In the first column, the cattle feeding sector in this region has 100,000 head of fed cattle available in each week. Cattle feeders will market 40,000 head through formulas and 60,000 head through negotiated cash trade. The last three rows are the packing sector’s needs for a given week in this example region. Also, in the first column, the packers need 100,000 head and will procure 40,000 head through formula and 60,000 head through cash. This is because the methods are agreed upon and used by both the cattle feeding businesses and packing businesses. Whatever the packers’ formula purchases are, they must match the formula sales from feedlots. Formulas cannot be used to depress demand as formula cattle are pulled from feedlot availability.

The first column illustrates a low-AMA scenario, and the second column illustrates a high-AMA scenario. In the high-AMA scenario, packers procure 80,000 head per week through formula and the cattle feeders will market exactly that amount through formula. The remaining purchases are 20,000 head through cash trade. In these two scenarios, the market is in balance as the availability of cattle from feedlots is the same as the packer needs. This illustrates that AMAs do not change market fundamentals. High versus low AMA use does not create a disadvantage or advantage for either buyers or sellers.

The issue emerges when supply and demand are out of balance. This is when cattle availability is high or low relative to packer needs. These two examples are illustrated in the third and fourth columns. In the third column, the packer has incentives to purchase 100,000 head that week but there are only 90,000 head available, with 80,000 head already accounted for via formula. Competitive pres-

sure across packing firms would cause them to bid aggressively to secure a larger portion of 10,000 head that is available to satisfy a demand for 20,000 head. This is close to the actual fed cattle and beef market scenarios in many years prior to 2016. Formula use was high and the demand for the remaining cash cattle was aggressive. This period was characterized by excess capacity in the packing industry along with increasing returns to size. Packers bid aggressively for fed cattle and this impact spilled over into the valuation of formula cattle. High or low use of AMAs does not create this market scenario, and there is essentially one price across both formula and cash cattle.

The same argument holds for the excess supply scenario. This is the fourth column of Table 5.2, and it is a reasonable facsimile of the fed cattle and beef market since late 2016 and early 2017. The packer has incentives to purchase 100,000 head that week but there are 110,000 head available. There is little competitive pressure across packing firms and cattle can be secured with relative ease. Further, it is likely there would be additional formula cattle, which are valued no different than cash. In the end, more cattle are available than are needed and the cause of the issue is this supply/demand imbalance and not the use of formulas. In this market environment, there are more animals available than needed. Cattle prices must be lowered, and beef prices also increased to encourage the processing of the excess supplies. Again, negotiated cash trade feedlots may go weeks without a bid in this environment. The problem is not how the available supply is split across marketing methods.

This section, in part, helps address the question of AMA use and market power, and reveals why the impact of AMA use on fed cattle prices are small. AMAs do impart a cost on fed cattle markets, but it is not market power related. The cost is related to the provision of information. The marketing of fed cattle through AMAs makes use of the price information discovered by those that negotiate in the cash market. Formulas are almost always based on a USDA-AMS price reported in one or more of the five major regional markets. Likewise, forward contracts make use of basis information – basis of cash relative to futures prices – where the underlying cash price is a USDA reported price. Finally, almost all cattle feeding operations benchmark transactions against some reported USDA-AMS reported price. Price discovery and the information provided through that process is a public good. The many marketing methods that do not use the cash market make use of information provided by that process. Price discovery is work, and users of AMAs avoid that work. Users of AMAs make use of cash price information, save the cost of negotiating and the cost associated with the risk of the negotiation failing, and contribute little. This is the tragedy of the commons and is a market failure. Public goods are underprovided in a market economy – this is the case with negotiated fed cattle cash price information – and it is made worse by AMAs.

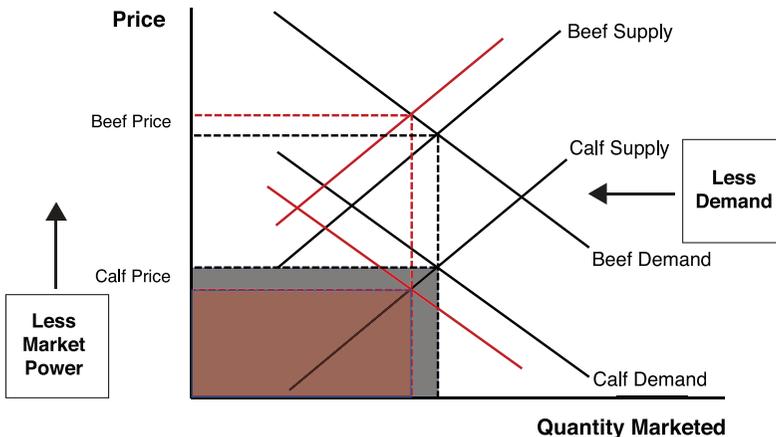
The issue is not that the market failure exists. Under provision of public goods is more or less a tautology. The examples of portions of our economy and society that benefit from the benevolence of others – without payment – are substantial and numerous. The issue is: Are the remaining and resulting cash market

transactions not accurate? Are the transactions that take place in the resulting thinned cash market biased or inefficient? Are the resulting transactions systematically incorrect? There is no research evidence of this. This is a result that cannot be found in the scientific literature. There are changes to marketing institutions that can improve market function – and limit market power – but are more sophisticated than volume mandates.

The end conclusion from this section is that AMAs do not create market power as they do not change the supply and demand fundamentals, nor do they change control of the transaction process. AMAs do impact the provision of information, but there is no evidence that the resulting prices are somehow wrong. Market participants need to work to improve market function, but there remains balance between innovation, knowledge, and mandates. Changing one thing will not improve market prices for cattle producers, nor change the supply and demand picture, but it has the potential to disrupt efficient operations and make things worse for producers.

Market-Wide Impacts of AMAs

This is the fourth and final section of this chapter to summarize findings from the LMMS. Market-wide impacts of AMAs were estimated using an economic model that can simulate the variety of market interactions in the cattle and beef industry. The demand side of the model starts with the consumer demand for beef and then demand is derived for the upstream products of boxed beef, fed cattle, and feeder



Source: Muth *et al.* (2007), Section 6, Figures 6-1 through 6-4.

Figure 5.3. Simplified Beef and Cattle Market Channel Equilibrium.

cattle. The supply side of the model starts with feeder cattle supplied by producers and then downstream supplies are derived for fed animals, boxed beef, and retail product. United States imports of fed cattle and beef exports are also included in the model. All the models are dynamic, but most of the action occurs on the supply side. Price incentives at the retail level take time to filter down to the cow-calf producer and the producer's response is different for an incentive that lasts one year when compared to multiple years.

Figure 5.3 illustrates a simplified version of this model. There are no dynamics in the graphic and the industry segments are simplified to beef at retail and cattle at the producer level. Consumers pay the retail price and buy the equilibrium quantity. Consumer expenditure is the total revenue for the beef industry, calculated by price multiplied by quantity, and is represented by the size of the largest box with dashed black lines. Marketers provide services and these services have costs. The marketing margin is the top portion of the large box. Marketers receive consumer expenditures and pay producers the cattle price multiplied by the quantity. Revenue to cattle producers is the dark shaded bottom portion of the large box. In percentage terms, this is the producer's share of the consumer dollar.

Increasing marketing costs requires the businesses that provide services between the producer and the consumer to capture a larger portion of consumer expenditures to maintain equivalent returns. Marketing costs will increase if AMAs are limited based on the interviews and the P&L analysis in the LMMS. Packers with AMA cattle have lower costs. If AMAs are limited, then marketers must pass on these cost increases – some to consumers who buy beef and the rest to producers that sell cattle. Beef prices will increase, and cattle prices will decrease. These changes are represented by the red lines in Figure 5.3. The derived supply of beef and the derived demand for cattle both will shift left. However, consumers do not take higher prices without reacting – they buy less beef. Consumer expenditures are the large box with dashed red lines. Likewise, cattle producers will supply less when prices are lower or there are fewer cattle producers. It is less profitable to produce cattle so fewer cattle are produced. The overall impact is that the marketing margin portion of consumer expenditures and industry revenue must increase, and the remaining payment to cattle producers is smaller, and is represented by the red shaded box.

The magnitude of the changes depends on the relative size of all the supply and demand elasticities. Thus, all must be estimated, and these estimations are presented in the LMMS Final Report. The reported and used elasticities are very similar to much other research. Once the elasticities are measured, the market model can be used to measure the changes in all the different prices, the change in the quantity (including imports and exports), and the changes in revenues for the different industry segments. Further, there were two additional things that were considered and incorporated into the simulation.

First, if there is market power and it is due to the use of AMAs, the cattle price may be too low initially. We know there is market power from the analysis of fed cattle transaction prices. It is not in Figure 5.3, but the market power will cause the cattle price to be too low and that piece of marketing margins can be

Table 5.3. Percent Changes in Prices and Quantities Given a 25% Reduction of AMAs in the Cattle and Beef Industry.

Variable of Interest	Short Run (1 Year)	Long Run (10 Years)
Retail Beef Price	0.46%	0.17%
Retail Beef Quantity	-0.43%	-0.24%
Wholesale Beef Price	0.70%	0.66%
Wholesale Beef Quantity	-0.82%	-0.83%
Slaughter Cattle Price	-1.43%	-0.81%
Slaughter Cattle Quantity	-0.25%	-0.38%
Feeder Cattle Price	-0.10%	-0.08%
Feeder Cattle Quantity	-0.94%	-0.34%

Table 5.4. Billions of Dollars of Changes in Producer and Consumer Surplus Given a 25% Reduction of AMAs in the Cattle and Beef Industry Measured in \$2004.

Industry Segment of Interest	Short Run (1 Year)	Cumulative Long Run (10 Years)	Percent Change in Total Surplus
Consumer Surplus			
Retail Beef Consumer	-\$0.371	-\$2.539	-0.83%
Producer Surplus			
Retail Beef Producer	-\$0.098	-\$1.504	-0.36%
Wholesale Beef Producer	-\$0.143	-\$1.654	-0.86%
Slaughter Cattle Producer	-\$0.558	-\$3.886	-1.35%
Feeder Cattle Producer	-\$1.069	-\$5.141	-2.67%
Total of All Producers	-\$1.867	-\$12.184	-1.14%

given to the producer. (The idea is expressed by the text in the box.) Second, the original demand may change. Beef demand has seen improvement since 1998 and if some of this is due to improved quality and consistency facilitated by AMAs so that limiting them would adversely impact demand. This point is backed up in the LMMS in the interview results, survey results, analysis of gross margins in the P&L data, and market modeling done to estimate the elasticities. (Again, the idea is in the other text box.)

So, what is found when everything is combined, and all the market interactions are considered? Even if all market power is due to AMAs and if there is no link between AMAs and improved beef quality – both of which are unlikely – limiting the use of AMAs does economic harm to producers and consumers. The impacts are presented in Tables 5.3 and 5.4. This is the best-case scenario for producers, as all other cases have larger negative impacts. The specific policy considered in the LMMS was a 25% reduction in the use of AMAs. For the cattle and beef industry, this means formula cattle. Changes in prices and quantities are

presented in Table 5.3 for some of the different segments of the cattle and beef industry. Impacts on non-U.S. producers and consumers are not presented. Changes in the wellbeing of the beef industry and its different industry segments and in the wellbeing of the consumer are measured through the economic concepts of producer and consumer surpluses. One-year impacts and cumulative 10-year impacts are presented in Table 5.4.

Changes in producer and consumer surpluses can be a difficult concept. These are not changes to revenues or expenditures. There is more to it than revenue (costs also change), but it is also important not to get tangled up in the subtleties of the question: Are consumer surplus and producer surplus the appropriate measure? The important thing is that the surplus changes are measures of changes in economic wellbeing. The measures are well-accepted and are bottom-line dollar impacts. If you want to know what the economic impact of a policy will be on producers, then you are asking about producer surplus. Likewise, the economic impact of a policy on consumers is consumer surplus.

Let us outline producer surplus a little more first. In Figure 5.3, if marketing costs increase, then producers will receive lower prices and will produce fewer cattle. The portion of the gray box outside of the red box is the loss in revenue to producers – there is a vertical piece and a horizontal piece. The economic harm to the producer is not the entire change in revenue, however. The vertical portion of the gray box is a loss of revenue due to actions by producers (their response to lower market prices), so it is not counted. It can be viewed as producers responding rationally to economic incentives, and as the highest cost producers being pushed out of the business. The resources in the vertical portion move to other industries, lost to the beef industry, but not to the economy. So, the loss in producer surplus is the horizontal portion of the gray box. This can be viewed as lost profitability to the beef industry and lost wealth to the economy. This portion is due to the price decrease and is outside of the producer's control.

Let us turn to the consumer next. In Figure 5.3, if marketing costs increase then consumers pay higher prices and purchase less beef. The price increase is larger than the quantity decrease because beef demand is inelastic, so consumer's expenditures on beef increase. However, the economic harm to the consumer is not the change in expenditure. Like the producer, the vertical portion of the change in expenditure is the consumer rationally responding to higher prices – they buy less beef. The vertical portion is shifted to consumption of other food products. However, the change the consumer can do nothing about is the change in price. This is the loss of surplus for the consumer.

Let us look at the magnitude of the impacts on prices, quantities, and surpluses from limiting AMAs. Consumers of beef and producers of cattle are impacted the most. Consumers face higher beef prices and eat less beef. If a policy change drives up beef prices, consumers eat more chicken or pork. A policy that reduces AMA use will cost consumers close to \$370 million in the short run and \$2.5 billion in the long run in 2004 dollars. The impact is 0.8% of the size of total surplus the consumers get from beef.

The downstream industry segments face changing prices and quantities, but most of the impact is due to fewer cattle. Retailers and wholesalers (packers are part of the wholesale segment) see higher prices but sell smaller quantities. The cost of limiting AMAs is about \$200 million in the short run and \$3 billion in the long run. These impacts are just over 1% of the total producer surplus for retail and wholesale industries and are, again, in 2004 dollars.

Producers of slaughter cattle and feeder cattle (and cow-calf producers) are impacted the most. The simple fact is that the industry segment furthest upstream is the residual claimant on the consumer's dollar. Producers of cattle benefited the most from improving demand in the early-2000s and producers will be the most harmed from any policy that increases costs in the marketing system. Slaughter cattle and feeder cattle prices would decrease, and the numbers of animals produced are also less. The policy costs slaughter cattle producers \$558 million in the short run and \$3.9 billion in the long run. The policy costs feeder cattle producers \$1 billion in the short run and \$5 billion in the long run. These impacts are 1.4% and 2.67% of the total producer surplus for the slaughter cattle and feeder cattle industries.

The total cost to all producers and marketers in the cattle and beef industry was about \$1.9 billion in the short run and \$12 billion over ten years, in 2004 dollars. This is 6% of the total producer surplus that all industry segments capture. These losses are significant percentages of the surplus that each industry captures, and the impact is mainly leveled on feeder cattle producers. The bottom line is that the market power was a lot smaller than the efficiency savings from the use of AMAs. Limiting AMAs loses producers a lot of efficiency downstream and gains producers little.

These costs and values are in 2004 dollars and should inflate to 2021 dollars with reasonable transparency. It is also likely impacts are greater now than in the early 2000s, as AMA use is more common and more integrated into supply chains and plant management. Baseline costs are higher now and mitigation of those costs through coordination is also likely higher. Further, demand improvements as communicated by premiums and improved beef product quality are greater now and losses to the sector if these improvements are lost due to lost coordination would be greater. Simple inflation of the impacts would likely underestimate true impacts but provide information about minimum impacts.

Regional Distribution of Impacts

While the market-wide impacts are clear, it is important to also discuss potential differences in the impact across regions of the country as represented by the US-DA-AMS price reporting regions. Regional differences were not considered with the LMMS. Thus, this section is not a synthesis of that report but is based on an understanding of current market conditions. Nevertheless, the regional distribution of impacts is clearly levered on specific regions and businesses.

Nationally, AMA use is about 80% of fed cattle trade. The remaining 20% of national fed cattle marketings are through negotiated cash trade. However, in the Southern Plains and specifically in the Texas-Oklahoma-New Mexico

region, just over 90% of cattle marketings are through formula methods, approximately 5% are forward contracted, and about 5% are marketed through negotiated cash trade. In the upper Midwest, 10 to 30% of cattle marketings are through formula methods, 10 to 30% are forward contracted, and about 40 to 60% are marketed through negotiated cash trade. Based on the national marketing method amounts, negotiated cash trade volumes will have to increase from 20% of the total to 30% or 50% if either of the minimum cash participation mandates is legislated. In the furthest southern plains, the negotiated cash trade will have to increase from 5% of the total to 30% or to 50%. This is between a tripling and a five-fold increase in the average use of negotiated cash trade marketing methods for the southern cattle feeding and packing industry. The costs of all mandate proposals are overwhelmingly leveled on the southern United States and producers that supply that system.

It is important to consider the lower bound usage of negotiated cash trade. Week to week variation in cash market use is substantial. Mandates are not focused on averages but require minimums, so all regions will be impacted. Clearly, the two regions that will be most impacted are Texas-Oklahoma-New Mexico and Colorado. The two regions of Nebraska and Iowa are least impacted, with Kansas falling in the middle. It is also important to not dilute the impacts through averaging. A region that is historically one in four weeks below the mandate threshold is not necessarily impacted by 25% of any total. Disruptions in supply chains in a single week or month do have the potential to persist for weeks or months.

Thus, it is reasonable that the “50/14” proposal is most like the 25% AMA reduction considered in the LMMS. The “30/14” proposal would be approximately half the impact of the 25% AMA reduction but could potentially be larger. Further, there are packing companies with well-known business models that emphasize product development, product uniqueness, and an integrated relationship with downstream businesses. These business models rely on coordination above what can be secured through procuring fed cattle in the negotiated cash market. This innovation is at risk without the additional coordination.

Summary and Conclusion

Limiting the use of AMAs by the cattle feeding and beef packing industries will decrease efficiency, increase processing and marketing costs, and has the potential to reduce beef product quality. In today’s dollars, the impact is at least \$10 per head for the packer and at least \$25 per head for the cattle feeding industry. The dollar amounts in this summary are converting the LMMS impacts to today’s dollars and placing them in context based on continued communication with the cattle feeding and beef packing industries. In today’s dollars, the total direct impact to the marketing system ranges reasonably from at least \$35 per head to more reasonably \$65 per head. The larger amount is based on recent communications. The costs at the industry level would potentially be over \$2.5 billion per year in today’s dollars, with the industry making economic adjustments and reducing in size, so that over a 10-year horizon the cumulative costs would be over \$16 bil-

lion. Much of the impact would be borne at the cow-calf producer level by farms and ranches. Further, the impact is distributed substantially on the industry that does business or supplies those in the Southern Plains of the United States.

A further look at AMAs and captive supplies does not change what we know about these marketing methods. The stack of benefits and strong economic justifications remain while the costs and concerns remain small. Policy directions are clear but not comfortable. Mandates create winners and losers but also will leave a marketing system worse off.

So, what are the research needs to support policy actions? What are the needs to assure producers their interests are not being trampled? One of the main research needs is support for a long-term research program into the market organization and performance of cattle and beef markets. (There is also a supporting need for research into the market organization and performance of hog and pork markets and sheep and lamb markets. The cattle and beef markets are less problematic from a structural standpoint.) There is not long-term support for this type of research like there is for issues related to crop production, farming, crop usage, product development, and trade.

There is a need for updating the 2007 RTI GIPSA LMMS. The economic fundamentals have not changed, but the price levels, total dollar magnitudes, and the percentage of animals moving through the marketing system via AMAs have. The beef packing industry is a substantially concentrated industry – although the levels of concentration have not changed markedly since the 1990s – and because of this, there is a need for long-term monitoring. Any industry restructuring or growth and change continues to emphasize economies of size rather than some other form of innovation. There is a reasonable need for continued research on the question of power versus these economies.

Prior research has been coordinated and delivered to the USDA Packers and Stockyards Administration (P&S). This is the coordinating administrative branch. P&S also can compel provision of data from the packing industry for analysis, but the period of the P&S authority is limited to 18 months. There is a need for longer examination of price discovery. All live-stock industries participate to some

The costs at the industry level would potentially be over \$2.5 billion per year in today's dollars, with the industry making economic adjustments and reducing in size, so that over a 10-year horizon the cumulative costs would be over \$16 billion. Much of the impact would be borne at the cow-calf producer level by farms and ranches. Further, the impact is distributed substantially on the industry that does business or supplies those in the Southern Plains of the United States.

Mandates create winners and losers but also will leave a marketing system worse off.

degree in mandatory price reporting to USDA-AMS and AMS has data from 2002 until the present. Price discovery questions eliciting the call for policy action can be examined in this data; additionally, questions about bidding, the number of market participants, and the impact on farm gate prices could be answered if this data were available. Future studies will need congressional funding and authority to examine USDA-AMS LMR price data. Future funding also needs to be made more persistent.

Finally, there is a need for a more formal examination of the meat supply chain. Figure 5.3 is an accurate representation of the market channel from an equilibrium perspective. While the supply models are appropriate for driving market dynamics, there is a need to specifically study the supply chains. The market channel model does not well-integrate economies of size within the plant nor coordination of multiple plant firms with economies of size. The market channel model also does not well-account for product differentiation and the underlying changing product quality, branding, and credence characteristics that are emerging and becoming more prevalent. There is a need to understand, recognize, and measure coordination in the supply chain so that costs of policies that will disrupt the supply chain can be better understood.

There are substantially less expensive methods for improving the quality of price discovery in fed cattle markets than by legislating mandates, but these mandates do offer an unprecedented experiment. The existing research is clear but are also conclusions drawn for a world that has not happened. Measurements from the real world must be made and extended to the policy proposed through economic concepts. That is the nature of and the common approach to this type of question. However, the mandate proposals, if enacted, will allow researchers to test if our economic thinking is correct. Actual cost and benefits of the policy can and will be measured.

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Chapter 6

Market Reporting and Transparency

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Introduction

The reliable reporting of trusted market data is critical for cattle market participants. Market price levels, especially as they relate to other markets, are the key driver of resource allocation and price discovery. This process can be hindered if available market information is limited or irregular. Without regular price reporting in which participants are confident, the dynamic process of cattle buyers and sellers discovering the market-clearing price would be subject to inefficiency. Market reporting alone is not price discovery; however, it certainly contributes to the price discovery process.

Regular and reliable reporting of live cattle transactions provide a more transparent view of supply and demand conditions than would be possible without it. Publicly reporting market transactions increases the information available to all participants. Live cattle market reporting is generally a public good in that everyone can consume it and any one participant's use of it does not exclude others from using it. A primary motivation for government involvement in collecting and disseminating this information is that the private sector would be unlikely to provide these data at a socially optimal level.

Market information available to everyone can improve market efficiency and help markets more quickly reach the market clearing price (C-FARE, 2013). Market participants generally look to public sources of data for information because they have confidence the data are reliable, complete, and free of any manipulation. Seminal research in this area has shown that when market participants possess incomplete information, price dispersion can occur (Stigler, 1961). Reductions in public cash market information has also been found to increase price variance and decrease production efficiency (Anderson *et al.*, 1998). So, if price data are perceived as credible and accurate, it can speed up market convergence, which is the process by which prices gravitate to a market level.

Publicly reported market information can also reduce uncertainty. The C-FARE 2013 publication noted that many agricultural producers and processors are risk averse. For a risk averse participant, increased uncertainty tends to lead to lower output than the competitive level (Newberry and Stiglitz, 1981). Boyer and Brorsen (2013) showed that cattle sellers benefit from publicly available data

because it reduces price uncertainty. This reduction in uncertainty led to reduced bid shading and more competitive bidding from buyers.

There are many motivations for the collection and public dissemination of market data for agricultural markets, including live cattle markets. In this chapter, we discuss market reporting for live cattle. We begin with the background and evolution of the current market reporting system. This is followed by an overview of the data collected, how it is reported and limitations on reporting due to confidentiality. Next, we pay particular attention to the types of transactions that are reported, which has garnered much attention in recent public debates. We discuss how these transaction types are defined and how they could be used if incentives to choose one over another existed. Finally, we discuss the concept of a contract library and its potential to increase transparency for certain types of cattle transactions.

Background

The desire and need for market reporting of cattle transactions likely go back as far as cattle trading in general. In the United States, these efforts gained structure in the 1940s with the *Agricultural Marketing Act of 1946*. This effort led to voluntary reporting of cattle market prices and was the general structure for price reporting for more than 50 years. The cattle and beef industry, and other livestock industries, continued to evolve over the decades during which voluntary reporting was the standard. Most of the concerns that exist today also existed then. Improvements to market reporting as a method for more transparent markets were often discussed and changes were made. These concerns were again highlighted in the late 1970s with hearings before Congressional subcommittees across multiple years.

In a particular 1979 hearing before the Subcommittee on Livestock and Grains of the Committee on Agriculture in the U.S. House of Representatives, statements from USDA's Agricultural Marketing Service (AMS) administrators addressed mandatory price reporting. Among many other issues, this discussion included thin markets and formula trading (Committee on Agriculture, 1979). At this hearing over forty years ago, it was "strongly emphasized" that "price reporting service improvements alone will not resolve problems resulting from a thin market." It was also discussed that mandatory price reporting was "premature" at that point and could be avoided through increased voluntary reporting. There was much more that was discussed in this hearing that is still applicable to cattle markets today.

In 1999, the calls for mandatory price reporting led to Congressional action. *The Livestock Mandatory Reporting Act (LMRA)* was passed by Congress in 1999 and the system began in 2001. The act mandated USDA-AMS to implement a new mandatory system of price reporting. The LMRA modified the *Agricultural Marketing Act of 1946* and is up for reauthorization about every five years, though there have been challenges with reauthorization. There is no "fall-back" legislation similar to those in farm bills. This recurring sunset provision allows

frequent input by market participants but can lead to issues with longer term market reporting needs. Wachenheim and DeVuyst (2001) discussed the advantages and disadvantages of mandatory price reporting and the debate at the time.

Koontz and Ward (2011) provide an excellent literature review and synthesis of market information research discussing the change from voluntary to mandatory reporting. In particular, they note that some of the calls for mandatory price reporting were to expose “sweetheart” deals and that there was no referenced research to support those positions. Perry *et al.* (2005) also discussed the impact of the mandatory requirement on fed cattle markets and found that, “prices received with formula purchasing arrangements, which were not comprehensively reported under the voluntary system, appear to closely match prices received with negotiated purchases.”

Livestock Mandatory Reporting (LMR) is the primary vehicle for cattle market price reporting in the United States. LMR requires packers to submit purchases and sales of livestock and livestock products to AMS. LMR originated from producers seeking greater transparency in livestock markets and this effort has broadly been accomplished. Pertinent to the current public discussion, in addition to the reporting of cash transactions, prices and volumes also began to be gathered under LMR for non-cash market transactions such as forward contracts and marketing agreements. These non-cash transactions were not captured under the voluntary price reporting system as they were considered by the AMS to be private treaties and outside of the purview of reporting the cash market (Koontz and Ward 2011). Through their inclusion, comparison of negotiated prices and non-negotiated prices was possible, which brought another level of increased transparency.

Of course, the cattle industry has continued to evolve since 2001. Changes and enhancements have been proposed and continue to be implemented. Purcell, Schroeder, and Tonsor (2016) provide an excellent discussion of the structural changes in livestock production and packing and the implications for LMR.

While we discuss some potential changes in this chapter, it is clear that LMR has significantly contributed to increased market transparency. Regardless of any issues with current LMR or needed adjustments, the data it provides is far preferred to not having any public price data at all.

LMR for Live Cattle

The amount of LMR cattle data that is reported on a regular basis is substantial. In a presentation to stakeholder groups in 2016 to 2017, AMS stated that LMR covered 92 percent of fed cattle transactions, 33 percent of cow and bull transactions, and covered 38 live cattle plants (Pitcock, 2016). This amounted to 5,000 to 8,000 records per day that fed between 29 and 53 reports on a daily basis. Four reporters carried out these tasks in 2016 – two reporters covered negotiated cash and negotiated grid base, one reporter covered formula, forward, and negotiated net purchases, and one reporter covered cows and bulls.

For LMR purposes, the term packer includes only a federally inspected cattle processing plant that slaughtered an average of 125,000 head of cattle per year

during the immediately preceding five calendar years. Smaller packers are not subject to LMR reporting requirements.¹

LMR relies on submitted forms from packers to compile, and ultimately release, data to the public. Daily reporting requirements include the LPS-113 form which packers must submit twice per day at 10:00 am and 2:00 pm central time (Figure 6.1). This form must contain all fed cattle transactions that occurred since the previous reporting period. A similar form, LPS-114, requires twice daily reporting of the volume of fed cattle committed and delivered (Figure 6.1).

While an example is not included in this book, there are also weekly requirements including LPS-115A and LPS-115B which require packers to report head count totals of Imported and Domestic Formula, Forward Contract, Negotiated Cash, and Negotiated Grid cattle slaughtered in the prior week and packer owned cattle (Figure 6.1). Another weekly report includes the premiums and discounts for various standards.

Packers are expected to meet specific deadlines for each report and AMS reporters will review the submitted forms to ensure all expected plants have reported. All lots of fed cattle with 10 head or fewer are automatically excluded. If a reporter sees an invalid record or notices a data outlier, they will contact the packer to learn more or correct the data prior to generating reports. Some transactions that appear to be outliers (e.g. price appears too high or too low) may be excluded from reports while the reporters check with the packer to confirm the price is correct.

Two reports summarize excluded transactions each month. One is made for boxed beef cutout and boxed beef cuts (USDA, AMS, 2021a) and another is made for negotiated slaughter cattle purchases (USDA, AMS, 2021b).

Packers are also subject to two audits each year where they must provide documentation to the auditors (Koop, 2016). The audited information includes buy sheets, grading or settlement sheets, scale tickets, kill line-ups, sales invoices, and copies of checks, among other documentation. These audits help to ensure that packers are reporting correctly and are in compliance with requirements.

Confidentiality Guidelines for LMR

Confidentiality guidelines are in place to protect the identity of individuals and individual firms through the Livestock Mandatory Price Reporting Program. At the onset of the LMR program, AMS originally adopted a policy that three entities must report in a given area and that no entity could account for more than 60% of the market volume. However, this resulted in significant exclusions. Starting in 2001, a new confidentiality guideline was established, referred to as the 3/70/20 guideline. It requires that the following conditions be met over the most recent 60-day period: (1) three reporting entities provide data at least 50% of the time, (2) no single entity provides more than 70% of the data for a report, (3) and no single entity is the sole reporting entity for an individual report more than 20% of the time. This change resulted in significant reductions in exclusions (Greene 2019).

¹ The federal regulations covering LMR for fed cattle can be found in 7 C.F.R. § 59 or online at <https://www.govinfo.gov/content/pkg/CFR-2011-title7-vol3/pdf/CFR-2011-title7-vol3-part59.pdf>

 UNITED STATES DEPARTMENT OF AGRICULTURE AGRICULTURAL MARKETING SERVICE LIVE CATTLE DAILY REPORT (Current Established Prices)		PURCHASE TYPE CODE	CLASS CODE	CLASSIFICATION CODE
1. IDENTIFICATION NUMBER		1 = NEGOTIATED CASH 2 = FORMULA NET 3 = FORWARD CONTRACT NET 4 = NEGOTIATED GRID NET 5 = FORMULA BASE 6 = FORWARD CONTRACT BASE 7 = NEGOTIATED GRID BASE	1 = MIXED STEER/HEIFER 2 = STEER 3 = HEIFER 4 = DAIRYBRED STRH/RF 5 = MIXED STRH/RF/COW	1 = PRIME 2 = CHOICE 3 = SELECT 4 = STANDARD
2. COMPANY NAME		NOTE: According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0186. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.		
3. PLANT STREET ADDRESS		USDA's Nondiscrimination Statement: In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.assr.usda.gov/complaint , filing, cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-6992. Submit your completed form or letter to USDA by Mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW Washington, D.C. 20250-9410. Fax: (202) 690-7442; or email: program.intake@usda.gov . USDA is an equal opportunity provider, employer, and lender.		
4. PLANT CITY				
5. PLANT STATE				
6. PLANT ZIP CODE				
7. CONTACT NAME				
8. PHONE NUMBER (include area code)				
9. REPORTING DATE (mm/dd/yyyy)				
10. REPORTING TIME (1 = 10:00 a.m.; 2 = 2:00 p.m.)				
11. LOT IDENTIFICATION		23a. PREMIUM PAID - WEIGHT (\$/cwt.)		
12. SOURCE (1 = Domestic; 2 = Imported)		23b. PREMIUM PAID - QUALITY (\$/cwt.)		
13. PURCHASE TYPE CODE		23c. PREMIUM PAID - YIELD (\$/cwt.)		
14. CLASS CODE		23d. DISCOUNT PAID - WEIGHT (\$/cwt.)		
15a. SELLING BASIS (1 = Live; 2 = Dressed)		23e. DISCOUNT PAID - QUALITY (\$/cwt.)		
15b. SELLING BASIS - Shipment (1 = FOB; 2 = Delivered)		23f. DISCOUNT PAID - YIELD (\$/cwt.)		
16. HEAD COUNT		23g. PREMIUM PAID - OTHER (\$/cwt.)		
17. ESTIMATED AVERAGE WEIGHT (pounds)		23h. DISCOUNT PAID - OTHER (\$/cwt.)		
18. AVERAGE PRICE (\$/cwt)		24a. PACKER FINANCING (1 = yes; 2 = no)		
19. % CHOICE OR BETTER		24b. DELIVERY LOCATION (1 = producer; 2 = packer)		
20. CLASSIFICATION CODE		24c. DELIVERY DATE (1 = producer; 2 = packer)		
21. DRESSING PERCENTAGE		24d. DELIVERED (1 = 1-14; 2 = 15-30)		
22. ORIGIN (2-Letter State postal abbr.)				

LP-113 (exp. 6/30/2022) Destroy previous edition

 UNITED STATES DEPARTMENT OF AGRICULTURE AGRICULTURAL MARKETING SERVICE LIVE CATTLE DAILY REPORT (Committed and Delivered Cattle)		PURCHASE TYPE CODE	CLASS CODE
1. IDENTIFICATION NUMBER		1 = NEGOTIATED 2 = FORMULA NET 3 = FORWARD CONTRACT NET 4 = NEGOTIATED GRID NET 5 = FORMULA BASE 6 = FORWARD CONTRACT BASE 7 = NEGOTIATED GRID BASE	1 = MIXED STEER/HEIFER 2 = STEER 3 = HEIFER 4 = DAIRYBRED STEER/HEIFER 5 = MIXED STRH/RF/COW
2. COMPANY NAME		NOTE: According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0186. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.	
3. PLANT STREET ADDRESS		USDA's Nondiscrimination Statement: In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.assr.usda.gov/complaint , filing, cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-6992. Submit your completed form or letter to USDA by Mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW Washington, D.C. 20250-9410. Fax: (202) 690-7442; or email: program.intake@usda.gov . USDA is an equal opportunity provider, employer, and lender.	
4. PLANT CITY			
5. PLANT STATE			
6. PLANT ZIP CODE			
7. CONTACT NAME			
8. PHONE NUMBER (include area code)			
9. REPORTING DATE (mm/dd/yyyy)			
10. REPORTING TIME (1 = 10:00 a.m.; 2 = 2:00 p.m.)			
11. LOT IDENTIFICATION			
12. PURCHASING BASIS (1 = Delivered; 2 = Committed)			
13. SOURCE (1 = Domestic; 2 = Imported)			
14. PURCHASE TYPE CODE			
15. CLASS CODE		19a. PACKER FINANCING (1 = yes; 2 = no)	
16. SELLING BASIS (1 = Live; 2 = Dressed)		19b. DELIVERY LOCATION (1 = producer; 2 = packer)	
17. HEAD COUNT		19c. DELIVERY DATE (1 = producer; 2 = packer)	
18. ORIGIN (2-Letter State postal abbr.)		19d. DELIVERED (1 = Less than 7; 2 = greater than 7 less than 14)	

LP-114 (exp. 6/30/2022) Destroy previous edition

Source: <https://mpr.ams.usda.gov/mpr/manuals/help/lsFormInfo.htm?sellItem=lp-113&formName=LS113&product=livestock>.

Figure 6.1. USDA-AMS Mandatory Livestock Reporting Forms LP-113 and LP-114.

While the 3/70/20 rule was a significant improvement over 3/60 in terms of the amount of data released, there are still times when confidentiality precludes release. For example, the weekly weighted average live cattle prices in Colorado have been rarely reported since 2018 because there are often not three reporting entities. Unlike the exclusions based on price mentioned above, there is no report of transactions excluded for confidentiality because it would be fairly easy to “back-out” to which packer the excluded transactions belong.

It is critical to recall that current LMR transaction types were not designed to enforce volume requirements. In particular, the definitions are useful to understand the market but may have enough overlap to allow switching between formula and negotiated without significantly changing how a transaction occurred.

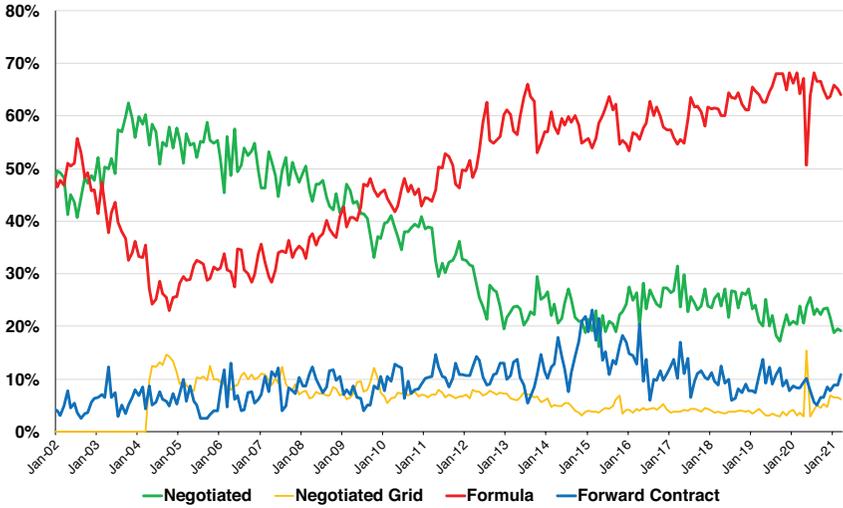
The primary driver of confidentiality requirements is legality. *The Livestock Mandatory Reporting Act of 1999* specifically requires the USDA to publish mandatory data on livestock and meat price trends, contracting agreements, and supply and demand conditions “in a manner that protects the identity of reporting entities and preserves the confidentiality of proprietary transactions.” We acknowledge these legal reasons and the need to protect the identity of reporting firms.

However, given the goal of this chapter is to discuss market reporting and transparency, we focus simply on the economic implications. Any changes to confidentiality requirements will require careful study of unintended consequences. This was true when the confidentiality rules changed from the original 3/60 rule to 3/70/20. Potential unintended economic consequences of this change have been debated in depth. While these concerns might also exist if confidentiality requirements are further relaxed, these concerns may not offset the potential benefit of more complete and transparent information available for price discovery and price determination.

With respect to confidentiality, it is also important to understand that as additional details are required, the likelihood of confidentiality becoming an issue increases. This occurs because total market volume is spread across the various transaction types that are reported. The more specific the type of transaction that is required to be reported, the fewer transactions there will be to fall into that category. The fewer the transactions that fall into a given reporting category, the more likely something like the 3/70/20 rule will be breached. In order to better understand this issue, a discussion of the various types of live cattle transactions is warranted.

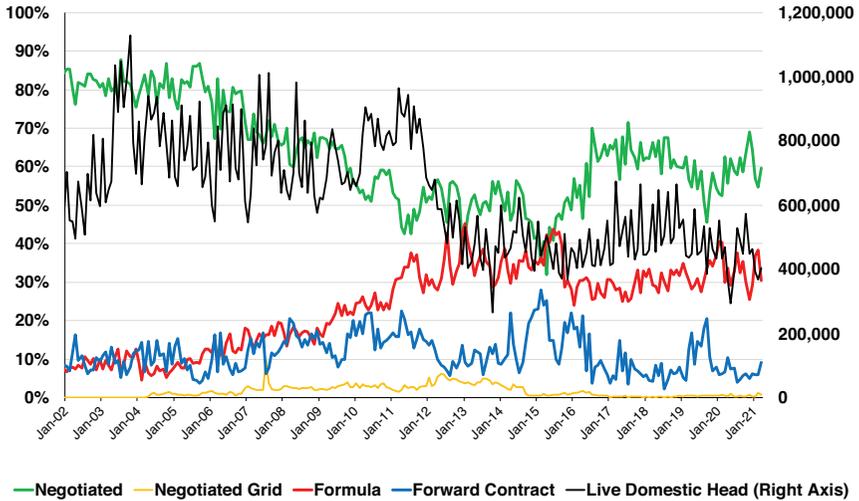
Live Cattle Transaction Types

The data by transaction type was an important result of the change from voluntary to mandatory price reporting in 2001. Figures 6.2, 6.3, and 6.4 show the percentage of domestic cattle slaughtered by transaction type for total, live basis, and dressed basis, respectively. These transaction types were included in LMR to



Source: USDA-AMS.

Figure 6.2. Total domestic cattle slaughter percentage by transaction type. 2002 - 2021.



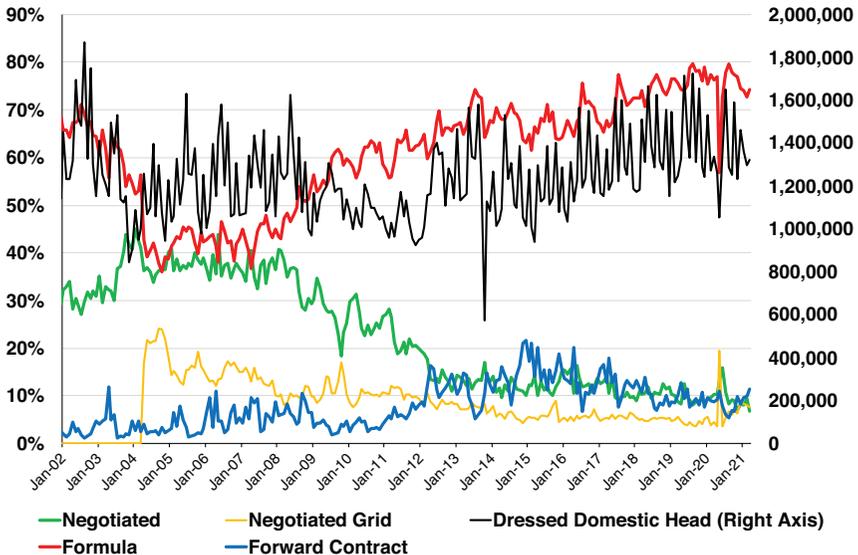
Source: USDA-AMS.

Figure 6.3. Live basis domestic cattle slaughter percentage by transaction type. 2002 - 2021.

gain a better understanding of how cattle are traded. Currently, much discussion centers around using these transaction types to regulate volumes. Because the data were not collected, this was a discussion that was not possible in previous decades when producer pushes for change led to action.

While the addition of these transaction types increased market transparency, it is critical to recall that current LMR transaction types were not designed to enforce volume requirements. In particular, the definitions are useful to understand the market but may have enough overlap to allow switching between formula and negotiated without significantly changing how a transaction occurred. The complete definitions for cattle are:

- *Negotiated purchase* is a cash or “spot” market purchase by a packer of livestock from a producer under which the base price for the livestock is determined by seller-buyer interaction and agreement on a delivery day. Cattle are delivered to the packer within 30 days of the agreement.
- *Negotiated grid purchase* is the negotiation of a base price, from which premiums are added and discounts are subtracted, determined by seller-buyer interaction and agreement on a delivery day. Cattle are usually delivered to the packer not more than 14 days after the date the livestock are committed to the packer.
- *Forward contract* is an agreement for the purchase of livestock, executed in advance of slaughter, under which the base price is established by



Source: USDA-AMS.

Figure 6.4. Dressed basis domestic cattle slaughter percentage by transaction type. 2002 - 2021.

reference to publicly available prices. For example, forward contracts may be priced on quoted Chicago Mercantile Exchange prices or other comparable public prices.

- *Formula marketing arrangement* is the advance commitment of live-stock for slaughter by any means other than a negotiated or negotiated grid purchase or a forward contract using a method for calculating price in which the price is determined at a future date.

At the center of the difference between negotiated and formula trades is the seller-buyer interaction to determine price and agree on delivery day. The types of formulas used are not publicly available for fed cattle, though there are calls for a contract library which will be discussed later in this chapter. Anecdotal evidence suggests that many formulas use some adjustment of the previous week's negotiated price for their region as the base price. Strictly from a reporting standpoint, there is not an obvious incentive to classify one transaction type over another. A volume requirement for negotiated trade would create such an incentive for a packer to report more negotiated transactions.

The introduction of an incentive or requirement to report more negotiated transactions would lead to changes in the number of cattle that fit the negotiated trade category. However, it is less clear that it would fundamentally change how those cattle exchange hands.

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If an incentive for more negotiated trade existed, formula traders would need to either formally negotiate more cattle or modify their formula trading practices to fit within the negotiated transaction definition. Due to the significant cost advantages of formula trades, there would be a cost incentive to increase reported negotiated transactions while retaining at least some of the benefits of formula trades, whenever feasible. The key question is, can slight modifications of current formula trading practices allow these trades to be reported as negotiated trades without having to incur the cost of negotiation?

This question is particularly relevant for well-established relationships between parties who use a formula. For example, if a long-standing formula agreement between a feedlot and a packer needs to be broken to meet negotiated requirements, could these two parties easily structure an ongoing negotiated trade arrangement? And could such an arrangement still avoid many of the costs associated with negotiation, especially the potential cost of a failed negotiation? And if such modifications to meet definitional requirements can be made, how much improvement to the price discovery process has actually occurred?

Generally speaking, if packers are forced to more often classify transactions as negotiated instead of formula, rational participants would be expected to seek legal ways to meet the negotiated definition while minimizing the cost of doing so. Further, the packers and feeders with the best relationships will be best positioned to minimize the cost of swapping from formula to negotiated transactions. Additionally, it is unclear if these converted negotiated transactions would add significantly to the price discovery process.

Generally speaking, if packers are forced to more often classify transactions as negotiated instead of formula, rational participants would be expected to seek legal ways to meet the negotiated definition while minimizing the cost of doing so.

Many other questions remain about how participants would respond to a new incentive or requirement over negotiated trades. How would market reporting shift in the presence of regulation on volume by transaction type? Can AMS reporters and the twice annual auditing process easily determine which category a transaction should be in? Can the transaction types be better defined? Also in question: which cattle that are currently on a formula are likely to be shifted to negotiated? Information does not exist on the structure of current formulas.

The Potential Role of a Contract Library

Another interesting aspect of the market transparency discussion involves details of non-negotiated trades. Non-negotiated trades include formula trades, forward contracts and packer owned cattle. While there have been legitimate reasons for movement away from negotiated trade and to alternative marketing agreements (AMAs), there are also significant concerns about the impact continued reductions in negotiated trades has on price discovery and the value of negotiated price information. Formula transactions now comprise the majority of fed cattle transactions and have become the source of much contention in the cattle sector.

Much of the contention comes from the fact that a limited amount of information is truly known about the nature of these formula pricing agreements and that they are likely to be less reflective of current market conditions than negotiated trades. For the most part, cattle producers are unaware of the basic price formulas, premium and discounts, and other elements of these transactions that are key in arriving at the formula price. As price discovery discussions have taken center-stage, and transparency has become more important, the development of a contract library for cattle has been included in recent proposed legislation. A contract library would provide increased transparency as it would create a catalog of the types of contracts offered by packers to producers of fed cattle. This section will focus on outlining what would likely be included in a cattle contract library, as well as the potential benefits and limitations, if one were to be developed.

The concept of a contract library is by no means new, as one was created for swine through the amended Packers and Stockyards Act. The existing Swine Contract Library (SCL) likely provides some perspective on what a beef cattle contract library might look like, and what information would be available, if one were created. Swine packers above a specific size are required to report written and verbal contracts to the USDA Grain Inspection, Packers, and Stockyards Administration (GIPSA). These provisions are then released by GIPSA through publicly available monthly Contract Summary Reports, although confidentiality is maintained. Producers do not know contract provisions being offered by individual firms, but they are able to see base price formulas, premiums and discounts, and other contract terms across a wide range of contracts (USDA-AMS, 2018).

Assuming that a contract library for cattle looked similar to what exists for swine ... it is hard to argue that there would not be some benefits to cattle producers from the development of such a library and their ability to access it.

Assuming that a contract library for cattle looked similar to what exists for swine, the library would provide a range of pricing agreements that are currently being used and would provide perspective on the variation in net price that is actually received from formula and contract transactions. It is hard to argue that there would not be some benefits to cattle producers from the development of such a library and their ability to access it.

First, a cattle contract library would provide perspective on the markets that existing formula trades are based upon. It is likely that many formula prices are based on the cash prices for a given regional market, CME futures market, or based on a measure within a nearby plant of the buyer. Following are three examples (A, B, and C) of contracts pulled from the SCL (Figures 6.5-6.7). Contract A represents one of the simplest contract arrangements reported in the SCL for the market formula category in the western cornbelt for sows (Figure 6.5). Note

All Reports Referenced

LM_HG231, 300-450 pound sow, Day of Delivery

Other Terms

Final Price = Market Price + Contract Premium

Premium/Discount Type: Contract Premium, \$2.50

Source: Swine Contract Library.

Figure 6.5. Contract A: Determination of Base Price 401.

that Contract A specifies the market report upon which the price is based, LM_HG231, for 300 to 450 lb sows on the day of delivery. The price for this contract is simply this price, plus a \$2.50 contract premium. A similar formula contract can easily be imagined for live cattle such that the price is established as a certain amount above the previous week's price.

Many existing swine contracts utilize a weighting of multiple prices to arrive at the contract price. For example, some base a percentage of the price on a specific hog market and a percentage of the price based on a pork carcass value with

All Reports Referenced

LM_HG203, Negotiated Base Weighted Average, Average - 3 days prior to delivery

LM_PK602, Pork Carcass Cutout, Average - 3 days prior to delivery

Other Terms

Final Price = 50% (Weighted Average + Contract Premium) + 50% (Cutout Percentage * Cutout Value) + Carcass Merit Adjustment.

Premium/Discount Type: Sort; See Schedule: 78

Premium/Discount Type: Carcass Merit; See Schedule: 18

Premium/Discount Type: Contract Premium, \$1.00

Premium/Discount Type: Cutout Percentage 91%

Source: Swine Contract Library.

Figure 6.6. Contract B: Determination of Base Price 1504.

All Reports Referenced

LM_HG206, Weighted Average, Average - Previous Week

Other Terms

Floor Price: 0.28; Ceiling Price: 0.56

If Market Price (MP) > \$50, then Base Price = MP - \$0.50

Premium/Discount Type: Contract Premium, \$7.25

Premium/Discount Type: Gender Mix, \$6.25 > 60% barrows in load

Source: Swine Contract Library.

Figure 6.7. Contract C: Determination of Base Price 2911.

a specified cutout percentage. Contract B is an example of a contract that places 50% emphasis on two prices and includes a carcass merit adjustment (Figure 6.6). It is possible that similar arrangements exist in cattle markets. A better understanding of what markets are used as the base for price formulas, and how often those market references show up in contracts, would provide valuable information to market participants.

Second, producers would also benefit from seeing the premiums and discounts used when employing those key markets. Lots of questions have surfaced over the last couple years about how representative the shrinking negotiated volume is of most cattle transactions. Seeing the adjustments used with base prices would shed some light on these types of questions as can be seen with the \$2.50 and \$1.00 contract premiums shown in Contracts A and B, respectively. A large number of contracts in the SCL specify contract premiums and knowing the range of these premium levels could be useful as producers attempt to understand the value of the cattle they produce and negotiate with buyers.

Third, while base prices and premiums or discounts are likely to be the focus of most contract library discussions, there is additional value in other contract provisions that would be available. Beyond the variation in values that can potentially be learned from a contract library, seeing the individual elements within existing contracts would likely increase transparency about the various components being used. Pricing agreements can be complex and seeing all the elements of these contracts will provide more perspective on the nature of the agreements. Some of the reported swine contracts include price floors and ceilings, cost elements such as feed prices, transportation cost or delivery arrangements, etc. Contract C is a relatively simple contract based on a single market report from the previous week but adds the elements of both a price floor and ceiling in addition to a contract and gender percentage premium (Figure 6.7).

Having access to this information would increase their level of marketing knowledge and provide them with additional tools as they develop their own pricing agreements.

Another specific element that would likely be of considerable value to cattle producers would be the bonuses/premiums paid for certain programs such as naturally raised or produced without antibiotics. Some such references appear in the SCL and would presumably appear in a similar library for cattle. It is likely that a cattle contract library would reveal many contract elements that have not been considered by many producers. Having access to this information would increase their level of marketing knowledge and provide them with additional tools as they develop their own pricing agreements.

While there are likely benefits of having a cattle contract library, there are certainly limitations to what one can be expected to provide. A contract library is a database of existing contracts for the purchase of livestock. Contracts listed would not be identified as being offered by a particular entity. Additionally, it

would not provide perspective on the volume of cattle that are purchased under any individual contract. Just because a specific contract exists, does not mean that it is available to an individual producer. Some contracts may have been entered into under very different market conditions but remain in existence, or contracts may exist in the library but may be very rarely utilized.

Still, by knowing the potential provisions that exist across contracts, producers may be in a better position to evaluate offers, negotiate terms, and compare pricing opportunities. Access to this information could provide a deeper understanding of formula and contract values. For example, understanding how much variation exists across formula values may well be more important to an individual producer than the average formula price in the market. Seeing what additional contract provisions accompany the more attractive pricing arrangements may explain some of this variation.

The other interesting aspect of Swine Contract Library is the required reporting of contract purchases 6 and 12 months in the future, which is also referenced in recent proposed legislation with respect to the cattle industry. These data are made public by GIPSA on a monthly basis. While it does not include pricing information, it does provide an indication of contracted volume, which may shed some light on volume still needed for purchase. This has been another contentious issue in the beef sector and regular reporting of contracted volumes would increase market transparency.²

Like most things with respect to price discovery, a contract library is one piece of a very complex puzzle. A contract library has the potential to provide some valuable information about contracts currently in use by market participants and could likely do so in a way that does not violate confidentiality guidelines, though there would likely be instances that run into confidentiality restrictions. This is a level of transparency that does not currently exist in the cattle sector. However, one must also understand the limitations of a contract library. It is not going to show what individual entities are paying for cattle, how they are arriving at those values, or how many cattle are truly being sold using those contracts. Further, compliance and reporting will create additional costs for market participants, which has the potential to be passed back in the form of lower cattle values.

Summary and Conclusion

There are several points that should be emphasized with respect to market reporting and the importance of transparency in that process. The first point is simply how crucial market reporting is to the price discovery process and how important it is that this system remain in place. Reliable and transparent price reporting may not be a sufficient condition for desirable market qualities, but in most all cases, it is a necessary condition. Other chapters in this volume discuss that most of the present issues surrounding price discovery are not new and similar calls for action to improve price discovery have occurred with varying degrees of inten-

² As a reference, the most recent such report can be found at <https://www.ams.usda.gov/sites/default/files/media/SCLMRSummary.pdf>.

sity over the past 50 years (and even further back). It was producer and producer group concerns, in the name of improving price discovery, that led to producer support for the mandatory price reporting system that is in place today. It is easy to take the market reporting system for granted, but to do so is to risk losing a key element for efficient markets. Required LMR reauthorization keeps this issue on the forefront about every five years. LMR provides much of the data to allow for discussions about price discovery to occur.

Second, one must also understand what can realistically be expected from LMR. While a lot of the issues of concern today are not new, the current setting of increased concern of live cattle marketing issues is different from past decades because of the presence of LMR data. In particular, the LMR data on transaction type was not available under the voluntary framework prior to LMR. Many of the current proposals focus on these data and would rely on them for regulation. It is crucial to recognize that while these transaction types are informative, they were not designed to support a regulatory framework. LMR is a reporting tool and cannot be expected to deal with many of the issues that are often mentioned in pricing discussions such as market concentration, margins at different levels of the marketing chain, etc.

Third, opportunities likely do exist to improve the information made available through market reporting. One potential step toward increased transparency could be the development of a contract library for cattle, similar to the Swine Contract Library. These trades can take on many different forms and a catalog of these contracts would increase transparency in the industry. Informing the public about markets that formula prices are based upon, how formulas are calculated, premiums and discounts, and other contract provisions would provide a deeper understanding of formula trades than prices alone. Clearly the cost of developing the library should be weighed against the benefits of its existence, but benefits in the form of increased transparency would exist.

Fourth, confidentiality should be reviewed through the filter of the current market environment. Confidentiality requirements have been a concern for LMR since inception and these concerns will only increase as the cattle industry continues to evolve. It has been 20 years since guidelines were last revised and marketing conditions have drastically changed during that time. A basic question that could be asked is simply if all trades are worthy of being reported, even if the potential exists for those prices to be linked back to an individual entity? Clearly, confidentiality concerns are less of an issue in more competitive markets. Reporting more transactions could simply be considered a downside for buyers that are operating with fewer competitors.

Overall, the relaxation of confidentiality requirements, combined with a better understanding of contracts, has the potential to benefit price discovery. In a setting where all proposed prescriptions to improve price discovery likely exhibit increased costs and/or unintended consequences, relaxing confidentiality, and improving descriptions of formula/contract trades might lead to the largest net benefit as compared to other proposals. This is likely especially true for cattle producers who would benefit from better price discovery without absorbing the larger costs associated with other proposed prescriptions.

Finally, it is certain that technological advances will continue to impact all aspects of the cattle industry, including how cattle are marketed. Efforts exist to use online auctions for fed cattle which would allow buyers and sellers to observe the negotiation process and see posted prices. This may in fact illustrate the most important point of all. The cattle marketing system is continually evolving and LMR must find a way to evolve if it is going to continue to provide the reliable and transparent data that is necessary for efficient markets.

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Chapter 7

What Can the Cattle Industry Learn from Other Agricultural Markets That Have Limited Negotiated Trade?

Scott Brown

Introduction

Many agricultural product markets have experienced thin markets and questions have arisen about whether these markets have adequate cash trade for reliable price discovery. Although this has been a more recent issue for cattle markets, the chicken and dairy industries have faced the issue of thin markets for decades while the pork industry dealt with declining levels of cash trade in the 1990s.

The experiences of these other agricultural sectors can provide a useful point of reference for the cattle industry as it grapples with adequate price discovery in fed cattle markets and the reduction in negotiated trade. In some of these markets, there has been a high level of government support to help deal with pricing issues while in other markets there has been little government involvement.

Clearly, each of these agricultural markets are unique. As such, there is no single solution to the issue of declining cash trade and how it is handled in a particular agricultural market. However, studying how these other markets have addressed thin market issues can provide some context for cattle markets.

Thin markets have been defined as having a weak or no cash market and no related derivatives, little public market data, and little understanding by outsiders (Adjemian, 2016a). However, the definition of a thin market is often qualitative in nature (Anderson, 2007). The qualitative nature of the thin market definition makes it difficult to determine an exact threshold where a market becomes too thin. As discussed at length in Chapter 3, robust price discovery does not necessarily require a large number of cash transactions, though more trades reduce potential problems with price discovery.

Dairy Markets

The U.S. market for cheese has often been described as a thin market. For many years, the National Cheese Exchange (NCE) located in Green Bay, WI, served

as the primary cash market for cheese produced in the United States. The NCE was closed in 1997 amid expressed concerns of market manipulation and the spot cheese market was moved to the Chicago Mercantile Exchange (CME) where it remains in operation today. In response to the thinness of spot cheese markets, the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS) began a voluntary survey of cheddar cheese prices in May 1997. In October 1998, NASS expanded the survey to include butter, nonfat dry milk, and dry whey.¹

In late 2000, Public Law 106-532 was passed which created mandatory price reporting for dairy products. USDA's rulemaking process first concluded in June 2008 creating the Dairy Products Mandatory Reporting Program. By 2012, USDA's Agricultural Marketing Service (AMS) also had a mandatory sales reporting system for dairy products with the first report (National Dairy Products Sales Report) being released in March 2012.² Dairy product prices remain important for dairy producers because Federal Milk Marketing Orders (FMMOs) use these dairy product prices to determine minimum classified milk prices that processors must pay into the FMMO pools.

The Wisconsin Cheese Exchange was launched in 1918 to trade spot cheese (Hamm, 1995). It was officially renamed the National Cheese Exchange in 1974. The NCE was a weekly exchange that traded carloads of block and barrel cheeses each Friday. Although other exchanges existed to trade cheese, the NCE became the dominant exchange. Other spot prices did exist through the 1970s including the Wisconsin assembling points price which provided spot prices where the first handler could obtain alternative supplies (Lough, 1980). The NCE was described for decades as a thinly traded market. In the late 1970s, trades on the NCE represented less than one percent of all cheese produced (Mueller, 1996). Despite the small quantity of cheese traded on the NCE, the market price reported at the NCE was still the dominant base price used in contracts of all types of cheese.

As concerns about possible manipulation of the NCE grew, pressure for changes to the NCE intensified until it was ultimately closed. One issue raised was the behavior of NCE market participants. First, as reported by Mueller, the nine leading NCE traders accounted for 94 percent of all purchases and 94 percent of all sales over the 1988 to 1993 period (Mueller 1996). In addition, those dominant traders that benefited from lower prices sold 1,806 loads while those dominant traders that benefited from higher prices bought 1,947 loads. These results lead some to suggest these players were attempting to manipulate prices to their advantage. That is, selling loads could drive market prices lower and those participants that sold most of the loads would benefit from lower prices. The converse of those buying loads and benefiting from higher prices is also a possibility.

Beyond the issues of market thinness and market dominance, other issues have been raised surrounding the NCE. Price volatility and how representative the NCE was of overall cheese pricing have been highlighted (Hamm, 1995). Dairy markets had exhibited little price volatility through most of the 1980s as government support programs provided a strong price floor and little opportunity

¹ <https://usda.library.cornell.edu/concern/publications/bn9996777?locale=en#release-items>

² <https://usda.library.cornell.edu/concern/publications/zs25x847n?locale=en>

for price volatility. As non-American cheeses grew in importance, it was questioned whether NCE trading of American cheese captured these new market developments. Amidst the growing concerns about the thinness of the NCE the spot cheese market moved to the CME in 1997 and the CME remains the spot cheese market today. Upon moving to the CME, the market began trading daily Monday through Friday.

Even with the changes that came with the move of the spot cheese market to the CME, market thinness has remained a concern of many market participants. According to GAO research, over the 1997 to 2006 period, the average number of daily transactions was 1.2 for cheese barrels and 2.5 for cheese blocks (GAO, 2007). The largest participants also represented a large percentage of trading. Over the 1999 to early 2007 period, the two largest buyers of block cheese represented 74 percent of trading and the four largest buyers of barrel cheese represented 56 percent of trading (GAO, 2007). The largest three sellers of block cheese represented 67 percent of block cheese trading and the top two sellers of barrel cheese represented 68 percent of trading (GAO, 2007). Trading on the CME remains small today. For the week ending May 21, 2021, each day saw 10 or fewer transactions in either block or barrel cheese markets.

Although the CME and the Commodity Futures Trading Commission (CFTC) provide oversight of all dairy product cash markets (cheese, butter, non-fat dry milk, and dry whey), there are still possible price manipulation issues that remain. A civil penalty was agreed to be paid by dairy participants for attempting to manipulate milk futures prices through CME cash cheese purchases in 2004 (Shields, 2009).

The NASS survey for dairy prices that gave way to the AMS mandatory dairy product prices has provided another check on cash markets. The use of mandatory AMS dairy product prices in the formulas that calculate minimum federal order class prices have relaxed at least some of the concerns of the thinness of the CME cash dairy product markets. A unique piece of the pricing puzzle for dairy producers is that FMMO minimum milk prices for the four classes of milk are determined by formulas that are driven in part by the mandatory dairy product prices reported by AMS. Built into the formulas are fixed production coefficients and make allowances that provide a fixed margin to a processor of milk products. This adds additional complication to the milk pricing process for dairy producers and can lead to further concerns about their milk checks.

Dairy producers continue to worry that the days of cooperatives taking all the milk they want to produce are coming to an end and the assembly cost of milk for cooperatives continues to offer scale economies for the larger producers they service. It's important to draw a few observations about dairy markets and how they relate to the cattle market:

1. If dairy product market participants feel that cash markets are being pushed or pulled to prices not in alignment with underlying supply and demand conditions, it is easier for dairy interests to take a market position on the opposite side. In the negotiated market for fed cattle it is not

as simple to move from a buyer to a seller except for the use of futures markets for live cattle.

2. Exceptionally thin markets for dairy products can operate successfully, especially when mandatory prices help to provide additional market information. However, adequate price discovery is often difficult to measure.
3. The prevalence of dairy cooperatives may be providing a way for dairy producers to better negotiate with upstream users of milk even though at times producers have expressed concerns about the function of dairy cooperatives.

Other Markets

Hog markets have experienced a substantial decline in negotiated trade over the past three decades. In 1994, 62 percent of the hogs were sold on the negotiated market and by 2000 that percentage had fallen to 26 percent (Grimes, 2003). Current negotiated trade stands at a little more than 1 percent according to AMS mandatory price reporting data. Swine or pork market formula and packer-owned hogs have been the two largest categories of monthly hog slaughter for the past several years. The combination of these two categories is responsible for roughly two-thirds of all hogs marketed. The small percentage of negotiated trade has been a concern in hog markets for several years. There have been more hog formulas based off of the wholesale pork cutout value recently, which has some advantages in terms of the base price being closer to the consumer so that demand signals reach producers more quickly and both producers and packers can more quickly respond to changing pork cutout values. Hog pricing became an issue in the 1990s as negotiated trade fell dramatically as processors and producers took advantage of economies of scale. Mandatory price reporting for hogs has helped many market participants, but adequate spot trade will continue to be an issue for the foreseeable future.

As the hog market has evolved, enough time has passed to make permanent structural changes in how hogs are produced and priced. Relatively little negotiated trade remains, and there are even fewer auctions where finished hogs are bought and sold. The passage of time has solidified a new market and has lessened the call for policy-mandated changes. The time element in market changes appears to have been given little attention in the literature.

Chicken markets have reached a point where it is difficult to even find a cash market for chickens. The chicken industry has experienced vertical integration as market participants all along the marketing channel focus on transmitting consumer wants to all market participants to maximize overall demand for chicken.

Market coordination and efficiency has moved the chicken industry to the point where individual complexes produce one type of bird for one type of outlet or even one customer. Recent completion of Costco's Lincoln Premium Poultry is a market innovation where Costco has built out the production capacity to supply chickens for their in-house rotisserie market. The birds are produced with

contracted growers, as in other companies, but Costco has expanded into agricultural production. Complaints remain about tournament system pricing and the lack of ability to switch to different integrators, creating the risk for even more market power. But, to date, little has been done to change this system.

A wide variety of vegetables and field crops, like malting barley, are examples of crops dominated by contracting. In many cases, the farmer grows the variety prescribed by the company and in the manner required. Often, there are few market prices reported or products traded. These are all considered to be thin markets, with the potential for problems associated with thinly traded markets. How might these other markets compare with fed cattle markets?

It's well known that agricultural markets are becoming more concentrated; there are fewer buyers and sellers. Cash markets have dwindled, having been replaced by contracts or vertically integrated firms owning much of the production. Yet, these arrangements can produce economically efficient outcomes. Three conditions have been postulated as necessary for buyers to get a stable supply of farm products: (1) source enough product to efficiently operate facilities, (2) produce in a least cost or profit maximizing method, and (3) procure products efficiently (Adjemian, 2016b)

For the market to work in the long run, buyers must pay a high enough price to keep farmers and ranchers producing. A market power argument that buyers force lower prices to producers means that, over time, resources in production will exit, resulting in buyers or processors losing their investment as well. Two conditions have been suggested that would allow competitive returns in agricultural production under alternative marketing arrangements: (1) the benefits of preserving resources in production agriculture are maintained and (2) buyers (processors) and sellers (farmers and ranchers) value the future enough (have a low enough discount rate to value the future). When these conditions are met, buyers and sellers can find grounds to create supplies to meet demands at a profitable price to the farmer.

The agricultural markets mentioned above continue to produce agricultural commodities entering the processing and distribution systems. But, the transactions are not made in negotiated cash markets. The evolution of these markets was not pain free, meaning that many producers and processors exited as the market consolidated and concentrated. The fed cattle market might be thought of as being in this process now. Many other markets are years ahead in this process, leading to alternative marketing arrangements being the norm.

Why might cattle be late to these changes that have occurred around much of agriculture? One reason is likely the nature, or structure, of production. Cattle and beef production begins extensively, out on ranges and pastures. All told, huge investments in land are necessary to consolidate production, and more profitable uses of capital are available. That dynamic makes cattle different from hogs or chickens. The fed cattle segment of the industry aggregates cattle into relatively small geographic areas, similar to other industries.

Consolidation and concentration in feeding is happening now, leading to policy concerns that have already happened in other agricultural markets. At the

same time, product differentiation into more varied market niches is happening. Beef is late to product differentiation as well. Niche markets such as grass-fed, organic, and other production system defined products are relatively new entrants. Branded beef products are even newer product niches compared to other agricultural products. Successful branded meat products have been slow to develop. Pork has long been branded in hams, sausage, and bacon by recipe differences. Fruit and vegetables are differentiated by variety. Milk and dairy products have long been successfully branded. Product differentiation and more niche markets lead to thinner markets and more alternative marketing arrangements.

Summary

Many agricultural markets have seen cash markets for their products dwindle or completely vanish over the past several decades. This has led to many questions about adequate price discovery in many of these agricultural markets. The discussion around price discovery has been complicated as the capture of economies of scale has made all market segments of many agricultural commodities become more concentrated. Economies of scale reduce the costs of delivering farm products to consumers but often cause the volume of trade that occurs in cash markets to dwindle. Coordination of market participants at each step of the marketing channel has helped maximize efficiencies at the expense of cash trade.

While many agricultural products moved in this direction long ago, the fed cattle market – and market participants – are now going through these growing pains. Yet, these markets mentioned above have found transaction mechanisms that ensure continued production and some kind of adequate market returns. Observing the changes that have occurred in other markets is helpful in thinking about alternative paths for the cattle market going forward.

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Chapter 8

Implications of Fed Cattle Pricing Changes on the Cow-Calf Sector

David P. Anderson, Charley C. Martinez, and Justin R. Benavidez

Introduction

Sometimes lost in the debate over negotiated sales versus alternative marketing arrangements (AMAs) is that, primarily, it is a fed cattle pricing issue. The debate taps into long held views, sometimes correct, about market structure, changing markets, and perceptions of buyer's market power. Some of these views have been shaped from a time when the cattle market was very different from today, and some are formed by recent events.

There is no doubt that fed cattle prices impact calf and feeder prices, wholesale prices, and retail prices throughout the supply chain. These price relationships are described in any basic price analysis class that one might (or might not) remember from college. Market signals are passed throughout the supply chain and reflect not only basic supply and demand, but incorporate information, quality, and production characteristics that are important at each production level. Market signals have changed dramatically over the last 40 years. Events such as the industry-led beef quality audit increased feeding, breed changes, and value-based marketing, and caused industry participants at all levels to work to improve production efficiencies and profits.

This chapter examines the potential impact of changes to fed cattle pricing alternatives on cattle and calf prices through the transmission of imposed costs. The second part of the chapter explores several hypotheses about market premiums and price signals that have emerged in a changing cattle market.

Impacts on the Cow-Calf Sector

This analysis begins with several premises: 1) the market has evolved over time to rely more on formula pricing, 2) moving to formula pricing has increased efficiency through the reduction of transaction costs in the industry, and 3) the reduction in transaction costs have affected farm, wholesale, and retail prices.

Given the assumptions, what would happen if the market reverted to more negotiated pricing? Moving away from reliance on formula pricing and back to greater reliance on negotiated pricing, then, results in an increase in transaction costs between feeders and packers. The cost increase can be expected to change live cattle prices, calf and feeder prices, and wholesale and retail beef prices. There is a long literature of research on these types of topics spanning technical change, transaction costs, changes in demand, and various other changes in the marketplace. The basic marketing margin description and graphical analysis can be found in most price analysis textbooks but is referred to in this chapter from Tomek and Robinson (1981). In this basic framework, an increase in transaction costs results

in a decrease in the derived demand for fed cattle and a reduction in supplies of beef. This means that the cost increase is passed from where it occurs through the marketing channel, both backwards and forwards in the supply chain. The end result is lower farm level prices (fed cattle) and higher retail beef prices.

This analysis uses an equilibrium displacement model (EDM) to quantify the effect of an increase in costs at the feeder-packer level on cattle and beef prices. This type of model has been widely used previously (Brester, Marsh, and Atwood, 2004; Gardner, 1975; Hanselka *et al.*, 2005; Schroeder and Tonsor, 2011; Wohlegent, 1989). EDMs utilize previously estimated supply and demand elasticities to evaluate the impact of exogenous shocks. In this case, the exogenous shock in question is the imposition of increased transaction costs from reduced transaction efficiency due to reduced AMA use. This work follows an EDM developed by Johnson (2016). Supply and demand elasticities are taken from the literature for each production level. These estimates are used to estimate price and quantity changes through the marketing chain given a change in costs, supplies, or demands. Table 8.1 contains the elasticity estimates in the cattle and beef portion of the model.

Koontz (2020) estimated that the value of formula pricing in efficiency, or reduced costs, was \$25 per head. Several caveats are in order when using this estimate. As noted in Chapter 5, the first is that the estimate is 16 years old and would not reflect changes since that time. It is likely that the value of efficiency is much larger than that today. The \$25 per head is applied across all fed cattle, not

Koontz (2020) estimated that the value of formula pricing in efficiency, or reduced costs, was \$25 per head.

The \$25 per head cost increase applied to all cattle assumes that all fed cattle are traded in a negotiated cash format.

As expected, increasing transaction costs results in lower live animal prices and higher wholesale and retail beef prices.

If the live-to-cutout spread is a concern, the end result is a widening price spread.

Table 8.1. Supply and Demand Elasticities Used in Estimating Impact of Reducing AMA Use.

Name	Elasticity
Own-price Elasticity of Demand for Retail Beef	-0.841
Own-price Elasticity of Supply for Retail Beef	0.352
Own-price Elasticity of Demand for Wholesale Beef	-0.567
Own-price Elasticity of Supply for Wholesale Beef	0.274
Own-price Elasticity of Demand for Slaughter Cattle	-0.291
Own-price Elasticity of Supply for Slaughter Cattle	0.254
Own-price Elasticity of Demand for Feeder Cattle	-0.137
Own-price Elasticity of Supply for Feeder Cattle	0.215

Table 8.2. EDM Results of the Impact of a \$25 per Head Cost of Returning to a Negotiated Cash Market.

	2019 Base Price	Change
Calf Price \$/cwt	163.40	-\$2.62
Feeder Price \$/cwt	144.67	-\$2.32
Fed Cattle Price \$/cwt	116.78	-\$1.75
Cutout Value \$/cwt	219.51	1.55
Retail Beef Price \$/lb.	6.04	0.03

just those traded by formula. The year 2019 is used as the base year for analysis in the model to avoid 2020 given disruptions due to the pandemic (Martinez *et al.*, 2020). The \$25 per head cost increase applied to all cattle assumes that all fed cattle are traded in a negotiated cash format.

Table 8.2 contains the model estimates of the impact of a \$25 per head increase in transaction costs. As expected, increasing transaction costs results in lower live animal prices and higher wholesale and retail beef prices. The impact on live prices ranges from -\$1.75 per cwt for fed cattle to -\$2.62 per cwt for calf prices. Beef prices at the wholesale (cutout) and retail levels increase. The impact on live prices are larger, in percentage terms, than meat prices. If the live-to-cutout spread is a concern, the end result is a widening price spread. Work by Brestler, *et al.* (2009) provides a good analysis on why farm share of the retail dollar is not necessarily a good base for policy-making.

Cow-Calf Market Emerging Premiums

During uncertain times for beef demand in the 1980s, the industry began a series of studies including the National Consumer Retail Beef Study (Cross, 1986). Prior

to the National Consumer Retail Beef Study, Rhodes *et al.* (1978) summarized the state of producer alternatives in marketing cattle and beef and discussed the direction of value-based marketing, which is what the industry now knows as AMAs. While focused on retail demand, the National Consumer Retail Beef Study identified changes needed throughout the industry, from the cow-calf through feedlot sectors. Packer survey respondents indicated concerns about hide problems, injection site blemishes, implant related problems, and a lack of uniformity of cattle and carcasses as management problems. These were identified in phase III of the study as areas to improve cattle management (Savell, 1993).

Two consensus points from the National Consumer Retail Beef Study were of particular interest to the live cattle side of the industry. The first was that fed cattle should be valued on an individual basis rather than an average live price. At that time, most cattle were sold on the average, meaning that an average price was negotiated and applied to all cattle in a pen regardless of each animal's quality. This means that the risk was left in the hands of the buyer (Ward *et al.*). Second, the study results revealed a need to identify genetics of carcass merit, to make changes to the cowherd, and to select breeding stock for improved carcass merit. Since the late 1980s, it is hard to argue that the cow herd has not changed dramatically with more focus on carcass quality.

A large body of research has been done on identifying the value contributions of various cattle characteristics. It has often been the case that price signals can be muted and different segments of the cattle industry value different traits (Outlaw, *et al.*, 1997; Feuz, 1999). The growth of value-based marketing and AMAs, as that value mechanism, has created a series of premiums and discounts reflecting quality. In the era of only negotiated prices, these premiums and discounts are likely to exist in limited forms due to on-average pricing.

If formula pricing in fed cattle is a way to increase profits by reducing transaction costs, some studies indicate strategies to reduce transaction costs are at work in the cow-calf, stocker, and backgrounder segments, as well. The implication is that market signals to reduce costs, or increase profits, are at work in all segments of the industry and the result is an evolving market.

A host of studies have examined factors affecting calf prices (Faminow and Gum, 1986; Marsh, 1985; Zapata, *et al.*, 2020, Martinez, 2020). The usual factors include weight, sex, breed type, color, castration, and horns. Looking at studies over time indicates that premiums between breeds have shifted. Early on, Angus (or black) calves sold at a discount to Herefords. That has changed over time to breeds selling at a discount to Angus (or black) calves. Past studies have shown higher prices accruing in video auctions compared to traditional auction markets. The increased prices were attributed to reducing transactions. Other studies have examined value added programs like VAC45, special sales of pre-conditioned calves, and marketing of commingled sales to capture volume premiums (Mathews, *et al.* 2007; Schulte, 2001; Lawrence and Yeboah, 2002; Ward, Ratcliff, and Lalman; King and Seeger, 2005; Vaaler, Schroeder, and Boland, 2005).

The Beef Quality Assurance (BQA) certification program is a byproduct of the beef quality audits. The program targets a set of management practices to in-

crease quality. A survey of BQA certified cattle in Montana indicated that BQA members received \$1.56 per cwt premium for steers and \$1.09 per cwt premium for heifers (Brester, 2009). These premiums were realized after accounting for normal trait differences like weight and sex.

Mooney *et al.* (2019) examined the effect of BQA certification on video prices in the Western United States. This work indicated a premium of \$2.69 per cwt due to BQA certification. Interestingly, the analysis indicated that the premium had grown from \$1.14 per cwt earlier in the study period. Participation in more value-added programs yielded even higher premiums.

The work on valuing characteristics can be summarized into three areas: cattle characteristics, management activities, and premium certifications. Cattle characteristics in the form of breed choice can be shown to have changed over time to more highly-valued Angus (or black calves). Management activities can be thought of as including selling in larger lots, pre-conditioning calves, selling by video auction vs. traditional auction, or other preparation activities prior to sale. Larger lots and different selling venues are examples of ranchers selling calves in a way that reduces transaction costs, much like AMAs reduce transaction costs. Premium certifications, like BQA, are another method of adding value through information.

Many of these value-adding traits are the direct result of producers looking to increase profit through the application of value-based marketing from fed cattle to calves and feeders. The beef quality audits indicated a set of desirable producer management changes to boost beef quality. Many of these practices that deliver premiums can be traced directly to the beef quality audit and its influence in moving the industry to value-based marketing.

It might be hard to conceive of market-based premiums and discounts going away if changes were made to AMAs. However, it is worth considering the impact of value-based marketing premiums and discounts that have occurred over the last few decades to avoid unintended consequences of potential legislative changes.

Conclusion

The beef industry's move to AMAs represents part of the progression to value-based marketing and economic pressures to reduce transaction costs. Legislation or efforts to increase negotiated trade will increase industry costs. Those increased costs are estimated to result in lower calf prices and higher beef prices.

Cattle pricing and market signals have evolved over the last 40 years. Premiums that were not present prior to AMAs are now common. One of the challenges is maintaining the reward for quality if the method of pricing changes. Thinking through the effect of the pricing mechanism on market signals is an important consideration to prevent even more negative impacts of potential changes.

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Chapter 9

Examining Negotiated Cash Trade Targets

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Introduction

On the evening of August 9, 2019, a fire caused severe damage to Tyson's beef processing plant in Holcomb, KS. The damage from the fire kept the plant and its base capacity of 6,000 head per day offline for the remainder of 2019. The decreased supply of beef to the open market led to a temporary spike in the price of boxed beef. At the same time, the decreased demand for fed (fattened, live) cattle resulted in a temporary decline in the price of fed cattle and feeder cattle.

Similar dynamics overtook the cattle market eight months later with the onset of COVID-19. As the pandemic took hold in packing plants, federally inspected weekly cattle slaughter fell from 684,000 head to 438,000 head in just five weeks, a 36% decrease (Martinez *et al.*, 2020). Federally inspected weekly cattle slaughter was 180,000 head below the five-year average. Two weeks later, the boxed beef negotiated cutout value reached \$459.04/cwt, while fed steers and feeder steers fell to some of the lowest levels in recent years. Three weeks before negotiated boxed beef prices peaked, the price of fed steers on the southern plains dipped to \$99/cwt.

Fundamentally, the recent market disruptions were the result of low demand for live cattle, some high demand for beef products, and tight supplies of beef, all resulting from limited live cattle processing capacity (Martinez *et al.*, 2020). These two events exacerbated concerns in the industry about price discovery, lower prices, market manipulation, capacity and utilization, and how fed cattle are bought and sold. The growth of alternative marketing arrangements (AMAs) have fueled concern about the lack of price discovery and their effect on prices. Some industry participants consider the divergent prices to be signs of, at minimum, a broken market. The United States Department of Agriculture (USDA) conducted investigations into beef and cattle price spreads. Others called for more packing capacity. At the same time, vocal groups within the largest cattle and beef trade organization in the United States began calling for changes to market structures as a solution.

The National Cattlemen's Beef Association (NCBA) set about seeking solutions for the cattle and beef industry and in July 2020 announced support for a

voluntary framework to “increase frequent and transparent negotiated trade to regionally sufficient level” to achieve robust price discovery (Bohn *et al.*, 2020). The idea is that increased negotiated trade volumes improve price discovery for fed cattle. Increased negotiated trade will result in a decrease in alternative marketing arrangements (AMAs) that, some argue, prevent adequate price discovery through creating markets that are too “thin.” Others suggest that increased negotiated volumes will prevent price divergence like those resulting from the Tyson fire or the onset of COVID-19.

NCBA’s “75% Plan” is a voluntary framework that establishes ‘triggers’ for each of the major cattle feeding regions (Bohn *et al.*, 2020). The objective of this study is to evaluate the probability of tripping established triggers in different regions over time and, as a result, the probability of NCBA supporting legislative changes to cattle trading methods. The remainder of this chapter includes a brief review of cattle trading methods, a review of the data utilized for the 75% Plan, an overview of the methods used and the simulation itself, and a discussion of results and conclusions.

Negotiated Trade

As noted throughout this book, USDA recognizes and records several types of fed cattle sales methods. These sales methods are grouped into two types of fed cattle trade, negotiated and non-negotiated. Negotiated fed cattle sales categories include negotiated cash and negotiated grid. Negotiated trade is, “[a] price ... determined through buyer and seller interaction [where] the cattle are scheduled to be delivered to the plant within 30 days of the agreement” (Agricultural Marketing Service, 2020). Non-negotiated fed cattle sales categories include formula sales, non-negotiated grid sales, and contract sales. There are pros and cons to each type of sale, and they vary depending on the party (buyer or seller). Some methods decrease transaction costs, others change the risk borne by each party, and still others provide quality incentives.

Negotiated trade is valuable in that the spot market contributes to price discovery. Price discovery is the means through which an asset’s price is set by matching buyers and sellers according to a price (Tomek and Kaiser, 2014). There is a bid and ask which leads to price *discovery*. Prices are set in other ways in non-negotiated trades. It might be plant average price, a USDA-AMS regional price, a futures price, or some other price (Agricultural Marketing Service, 2020). There is not a bid and ask to negotiate the price, and sellers do not know the price before the cattle are delivered. Research identified a clear and significant relationship between historical cash market volumes and the strength of price discovery in each USDA-AMS regional market.

The share of cattle sold via AMAs rose quickly from the late 2000s to the present (Figure 9.1). Much of the growth of cattle sold via AMAs was at the expense of cattle sold via negotiated methods.

The growth in AMAs was not equal across regions. Figure 9.1 contains USDA reported AMA sales which appeared earliest in Texas-Oklahoma-New



Source: USDA/AMS.

Figure 9.1. USDA Weekly Reported Trade 2002-2021, by Region and Total Cattle Sold via Alternative Marketing Arrangements and Cattle Sold via Negotiated Sales.

Mexico. When USDA began reporting non-negotiated sales separately in 2008, sales of fed cattle via negotiated trade averaged 44,509 head per week in Texas-Oklahoma-New Mexico. From 2015 to 2019 (the last full five years before the 75% Plan), sales of fed cattle via negotiated trade averaged 7,666 head per week in the same region, or 17% of 2008 weekly average negotiated volumes. Similar trends took hold shortly after in Kansas. In 2008, sales of fed cattle via negotiated trade averaged 38,323 head per week in Kansas. From 2015 to 2019, sales of fed cattle via negotiated trade averaged 17,274 head per week in the same region, or 45% of 2008 weekly average negotiated volumes.

Though AMAs are used in Nebraska-Colorado and Iowa-Minnesota, their share of total head sold is significantly smaller and did not begin until much later in the 2010s. In 2008, sales of fed cattle via negotiated trade averaged 70,653 head per week in Nebraska-Colorado and 28,404 in Iowa-Minnesota. From 2015 to 2019, sales of fed cattle via negotiated trade in Nebraska-Colorado averaged 41,113 head per week, 58% of 2008 weekly average negotiated volumes. From 2015 to 2019, sales of fed cattle via negotiated trade in Iowa-Minnesota averaged 24,115 head per week, 85% of 2008 weekly average negotiated volumes. Some of the changes in negotiated volume are due to fluctuations in the size of the cattle market over time. However, in Texas-Oklahoma-New Mexico and Kansas, most of the decline in negotiated fed cattle sales is directly inverse to the rise of AMAs.

The 75% Plan

The 75% Plan was developed and approved by NCBA's Live Cattle Marketing Working Group in 2020. The 75% Plan is a voluntary approach designed to, "increase frequent and transparent negotiated trade to regionally sufficient levels, to achieve robust price discovery determined by NCBA funded and directed research in all major cattle feeding regions" (Bohn *et al.*, 2020). The plan is split into two silos: a packer silo and a feeder silo. At present, the rules of the packer silo are incomplete and therefore we will focus our attention primarily on the feeder silo.

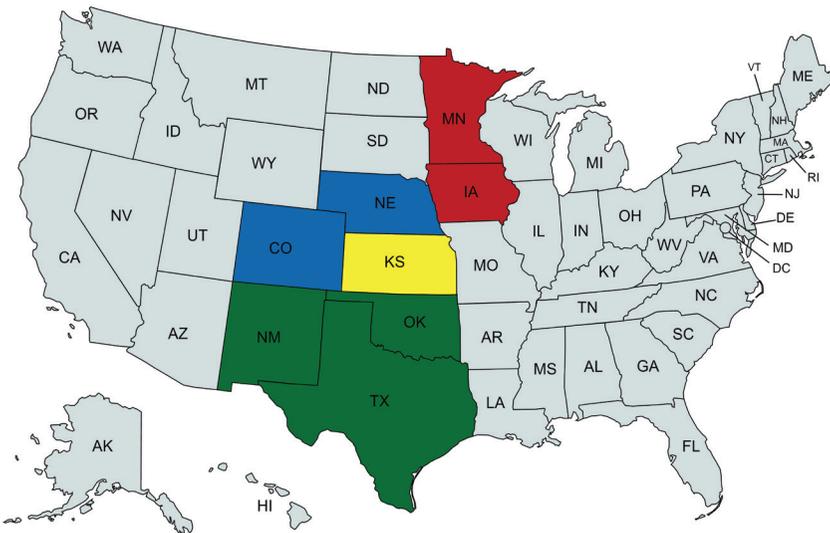
The plan utilizes a set of triggers specific to each AMS reporting region. These regions are Texas-Oklahoma-New Mexico, Kansas, Nebraska-Colorado, and Iowa-Minnesota (Figure 9.2). Nebraska and Colorado are reported separately by AMS but the 75% Plan combines them to account for nonreporting occurrences in Colorado.

Under the voluntary 75% Plan, each region is expected to trade 75% of the negotiated volume, as defined by measurements developed by Koontz (2017), needed to meet robust price discovery in a given week. Each region must achieve these volumes 75% of the weeks in a quarter, i.e., 10 weeks or more. Koontz's work established an estimated volume of cattle needed to be sold on a negotiated basis in each region to achieve minimum and robust price discovery (although, as noted in Chapter 10, Koontz has called into question the way in which his results were being used to justify changes to current practices). Table 9.1 lays out the volume of negotiated trade needed each week in each region to achieve robust price discovery. Table 9.1 also provides the NCBA's 75% of robust trade threshold.

Table 9.1. Negotiated Volume to Achieve Robust Price Discovery and the Minimum Negotiated Volume Required by the 75% Plan (Koontz, 2017; Bohn *et al.*, 2020).

Region	Negotiated Volume Needed to Achieve Robust Price Discovery (Head/Week)	75% of Negotiated Volume Needed to Achieve Robust Price Discovery (Head/Week)
TX-OK-NM	13,000	9,750
KS	21,000	15,750
NE-CO	36,000	27,000
IA-MN	16,000	12,000

These four weekly regional trade obligations are independent of one another. Increased negotiated volume in Texas-Oklahoma-New Mexico does not contribute to the obligations of Kansas regional trade. The failure of a given region to meet its obligations in a quarter constitutes a minor trigger. Note that there will eventually be eight potential triggers: four potential feeder triggers and four potential packer triggers. Three or more minor triggers (out of the eight) in the same quarter constitute a major trigger. Two major triggers in rolling set of four quarters will result in the NCBA Live Cattle Marketing Working Group recommending that, "...NCBA pursue legislative or regulatory measures to compel adequate negotiated trade for robust price discovery" (Bohn *et al.*, 2020).



Source: National Cattlemen’s Beef Association.

Figure 9.2. National Cattlemen’s Beef Association’s 75% Plan Regions.

Table 9.2. Sum of Weekly Fed Cattle Sold via Negotiated Methods by NCBA 75% Plan Region, First Quarter 2021.

	Negotiated Trade Head/Week			
	TX-OK-NM	KS	NE-CO	IA-MN
75% Robust Threshold	9,750	15,750	27,000	12,000
1/4/2021	13,621	13,360	31,637	21,314
1/11/2021	9,285	17,184	27,763	19,414
1/18/2021	12,224	14,824	36,234	27,355
1/25/2021	8,344	24,001	35,109	18,887
2/1/2021	9,627	12,703	38,561	24,220
2/8/2021	12,088	21,589	36,383	26,081
2/15/2021	10,131	14,729	34,120	21,443
2/22/2021	10,393	9,692	30,191	20,342
3/1/2021	13,480	14,916	34,238	23,336
3/8/2021	15,041	19,242	24,210	22,939
3/15/2021	12,729	20,855	37,309	21,816
3/22/2021	6,327	17,237	26,066	29,424
3/29/2021	13,306	22,535	35,299	24,965
*Red values indicates a week in which total head sold by negotiated methods fell below the threshold established by NCBA's 75% Plan.				

For an example of minor triggers, consider the first quarter of 2021 in Table 9.2, which lists weekly combined sales of negotiated cash and negotiated grid sales of fed cattle by region. From January through March, Texas-Oklahoma-New Mexico failed to meet the 75% of robust threshold four of 13 weeks. During the same period, Kansas failed to meet the 75% of robust threshold six of 13 weeks. Allowances were made for force majeure for two weeks in Kansas. With that adjustment, Kansas failed to meet the 75% of robust threshold four of 13 weeks. Nebraska-Colorado met the 75% of robust threshold all but two of the 13 weeks. Iowa-Minnesota did not fail to meet the 75% of robust threshold at any time during the first quarter of 2021. Therefore, two minor triggers were tripped in the first quarter of 2021 (in TX-OK-NM and Kansas). A major trigger was not tripped because only two minor triggers were tripped in the quarter (recall that our stylized example does not include the packer silo).

Simulation of Minor and Major Triggers

The remainder of the study is dedicated to evaluating the likelihood of possible outcomes under NCBA's 75% Plan. Using the Microsoft Excel plugin SIME-TAR, a simulation model was developed to analyze the 75% plan using historic weekly USDA-AMS data to examine the probability of tripping minor and major

triggers in the feeding silo and reveal the quarters and regions within a given year most at risk for tripping triggers. The data informing the simulation is weekly data collected and reported by USDA-AMS (Agricultural Marketing Service, 2021). Data includes formula, grid, and contract purchases as well as negotiated purchases for each of the four regions defined by NCBA's 75% Plan (Bohn *et al.*, 2020).

Anecdotal discussions with industry stakeholders indicated that the announcement of the 75% Plan may have induced changes in negotiated trade volumes in some regions as early as July 2020. Statistical testing confirmed that hypothesis, meaning that to accurately forecast future trade volumes the model must be adjusted for the change in behavior.¹

If behavior has changed since (possibly as a result of) the announcement of the 75% Plan, then forecasting with historic negotiated volumes will underrepresent the potential negotiated sales. To base the forecasted negotiated volumes on data since then, while accounting for the low number of observations since July 2020 we developed an empirically distributed stochastic negotiated sales inflation factor (NSIF). The NSIF for each region is the difference between weekly negotiated sales since July 2020 and average weekly sales in the same week from 2015 to 2019.

$$NSIF_{i,x} = \frac{\text{Negotiated Head Sold Since July 2020}_x}{\text{Negotiated Head Sold 2015 - 2019}_x}$$

where i is one of the four NCBA 75% Plan fed cattle regions and x is a vector of weeks, $x \in \{1,2,\dots,52\}$ representing individual weeks in a calendar year. The average NSIF for Texas-Oklahoma-New Mexico is 1.7, Kansas is 1.24, Nebras-

¹ A two-sample t-test of negotiated sales volumes from July 2020 through March 2021 when compared to the same period a year prior, a previous five-year average of the same period, and the previous five years in general rejected the hypothesis that the mean weekly negotiated trade of the compared periods were equal in Texas-Oklahoma-New Mexico and Kansas. An F-test of the same periods rejected the hypothesis that the variances are equal for the same two regions. Stepwise regressions revealed that, before the announcement of the 75% Plan, a time trend and total fed cattle sales in a given week in Texas-Oklahoma-New Mexico explained 72.5% of the variation in negotiated sales in Texas-Oklahoma-New Mexico from 2010 to 2019. A time trend and total fed cattle sales in a given week in Kansas explained 67.8% of the variation in negotiated sales in Kansas from 2010 to 2019. The same measures in Nebraska-Colorado and Iowa-Minnesota explained only 39.1% and 31.0% of the variation in negotiated sales in those regions, respectively. As previously discussed, Texas-Oklahoma-New Mexico and Kansas are the two regions with the lowest negotiated trade and therefore pose the highest risk of tripping a minor trigger. Therefore, the duration of the study utilizes methods best-tailored to predicting changes in Texas-Oklahoma-New Mexico and Kansas. Upon including data from July 2020 to March 2021, post 75% Plan announcement, the explanatory value of the previously discussed regression models are reduced. The coefficient of time trend becomes insignificant; however, the total fed cattle sales in Texas-Oklahoma-New Mexico and Kansas remains significantly predictive of negotiated fed cattle sales, though with lower R-squared values.

ka-Colorado is 0.83, and Iowa-Minnesota is 0.99. Simply put, negotiated trade in a given week in Texas-Oklahoma-New Mexico was 1.7 times greater on average from July 2020 to March 2021 than it was from 2015 to 2019. Tests of the values of the NSIF adjusted values and actual values in the testing period fail to reject the validity of the NSIF as an accurate adjustment value.²

The NSIF yields several advantages. First, it accounts for the effort of different regions to adapt to the announcement of the 75% Plan. Second, it incorporates the seasonality of fed cattle sales by inflating or deflating values in accordance with historic average volumes in a given week. Accounting for seasonality provides more clarity in determining at-risk quarters. Finally, the NSIF can be varied artificially to easily test the system. For example, what would a 65% Plan or 85% Plan look like given the current NSIF? If a 65% or 85% Plan were enacted, how much would negotiated trade need to change to avoid tripping newly inflated or deflated triggers? One disadvantage is the assumption that negotiated trade continues to trade at increased levels one, two, and even five years out. However, with regular updates, a decreasing NSIF will reveal industry changes quickly.

To forecast weekly negotiated sales for 2021, we multiply stochastic draws of NSIF by the five-year average of negotiated sales in the corresponding week, $x \in \{1, 2, \dots, 52\}$. To forecast weekly negotiated sales for 2022 to 2025 we multiply stochastic draws of NSIF by the previous year's negotiated sales in the corresponding week, $x \in \{1, 2, \dots, 52\}$. Due to the previously discussed relationship between total fed cattle sales in a region and negotiated fed cattle sales in a region, we also accounted for the declining size of the U.S. cattle herd. The 2021 Cattle report described a decline in all cattle and calves from 93.8 million head on January 1, 2020 to 93.6 million head on January 1, 2021, a 0.2% decrease (Cowen, 2021). A review of cattle and calf inventory from 2000 to 2020 reveals that when the cattle herd is declining in size it declines 0.5% to 2.0% annually. To account for cattle herd declines, we draw stochastic, normally distributed values of herd decline from 0.5% to 1.0% and apply those values independently to each week from 2021 to 2024. In 2025 we apply a 0.5% to 1.0% stochastic, normally distributed value of herd increase independently to each week to account for a potential change in the direction of the cattle cycle at that time. Accounting for the NSIF adjustments to negotiated trade, we forecast values of negotiated trade from 2021 to 2025. The model then records weeks in which negotiated volumes in a region did not meet the 75% Plan threshold for that region. The model then counts the number of weeks in a quarter for which volumes did not meet the 75% Plan threshold. Finally, the model reports the number of quarters in which a minor

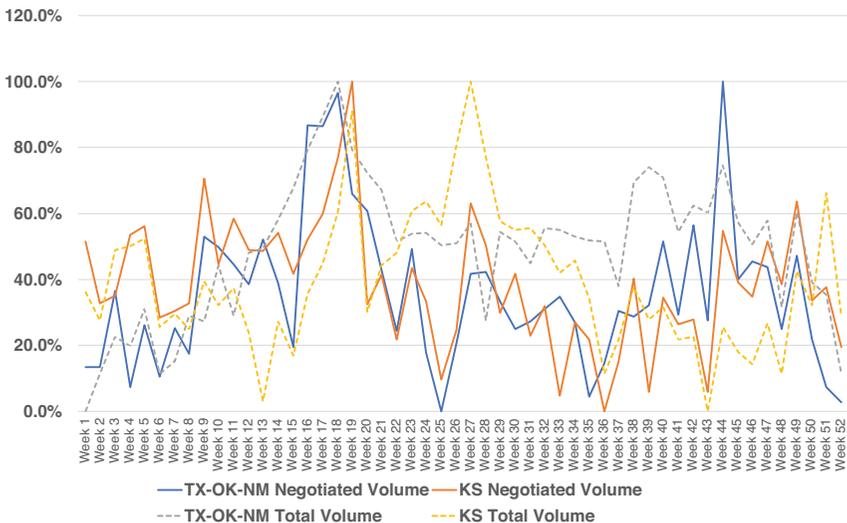
² A two-sample t-test failed to reject the hypothesis that the actual means of January 2021 to March 2021 values and NSIF adjusted predicted means for the same period were equal for all regions (P-Value = 0.638 for Texas-Oklahoma-New Mexico; P-Value = 0.597 for Kansas; and P-Value = 0.237 for Nebraska-Colorado; P-Value = 0.967 for Iowa-Minnesota). An F-test revealed the same outcome for variances between the two samples in Texas-Oklahoma-New Mexico (P-Value = 0.064) and Kansas (P-Value = 0.532). The same test rejected the hypothesis of equal variance in Nebraska-Colorado (P-Value = 0.000) and Iowa-Minnesota (P-Value = 0.008). Again, we chose to tailor our methods on forecasting outcomes for the at-risk regions and applied those methods equally to the regions with very low chances of tripping minor triggers.

trigger is tripped, the number of quarters in which a major trigger is tripped, and whether two major triggers were tripped in a rolling set of four quarters leading to NCBA support of legislative action. We then simulate 500 potential outcomes for the entire system using the SIMETAR[®] plugin for excel.

Results

The relationship between negotiated volumes sold and total volumes sold is as expected. Figure 9.3 shows that the periods of the year in which total volumes sold are highest in the two most at-risk regions roughly correlate to the periods in which negotiated volumes sold are highest. Differing incentives throughout the year may induce different negotiated sales volumes as a percent of total sales, but when you consider Figure 9.3 in a quarterly breakdown, the relationship between the two is clear. The reason for this relationship is simple: more fed cattle sales increase the likelihood that some buyer and seller will have some cattle sold via negotiated methods. The relationship between negotiated volume sold and total volume sold in a given quarter becomes important over time as the 75% Plan evaluates trade on whole values rather than percentages; quarters with seasonally lower sales may be more at risk for tripping triggers than quarters with higher total sales.

As the 75% Plan is evaluated on a quarterly basis and with the relationship between total trade and negotiated trade, it is important to know the quarters most at risk of failure in any given year. The Cumulative Distribution Functions (CDF)



Source: USDA/AMS.

Figure 9.3. 2015-2019 Five-Year Average Index of Negotiated Volume Sold and Total Volume Sold in Texas-Oklahoma-New Mexico and Kansas.

in Figure 9.4 contain the probability of different counts of cumulative weeks that meet negotiated trade levels necessary to avoid tripping a regional trigger during the first, second, third, and fourth quarters in Texas-Oklahoma-New Mexico, and Kansas (the two at-risk regions) in a given year.

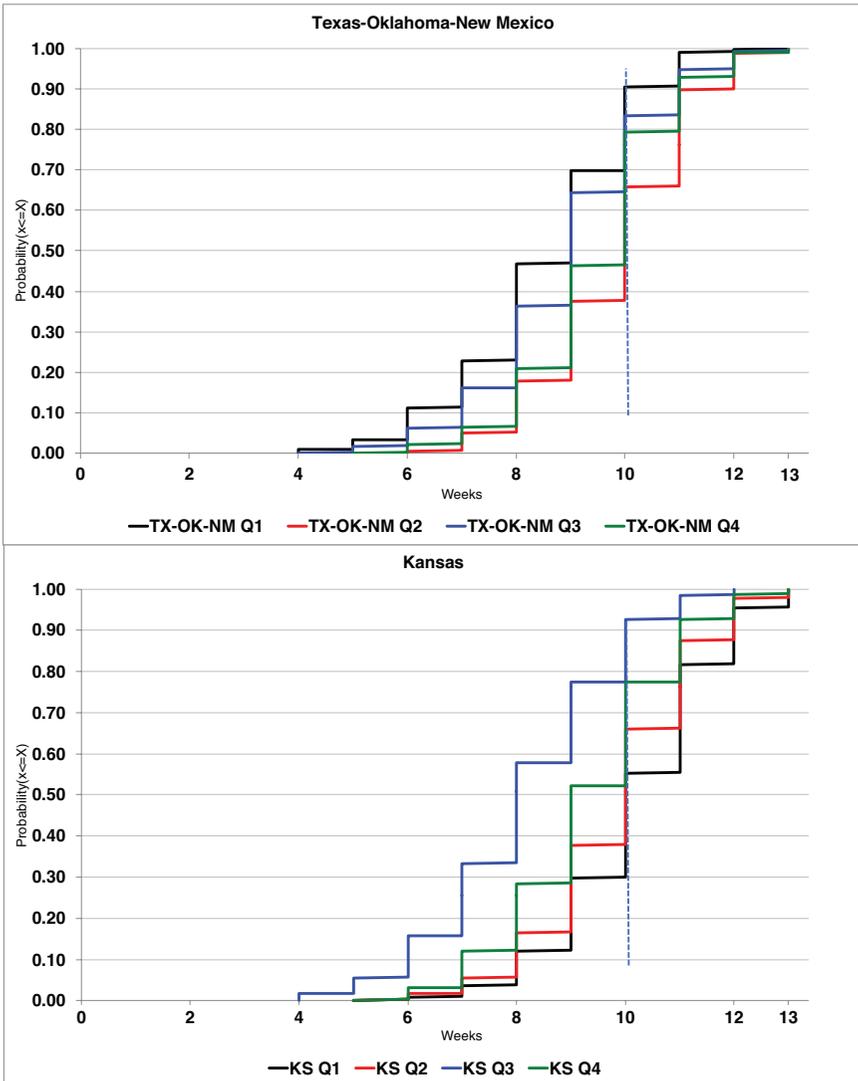


Figure 9.4. Cumulative Distribution Function of Weeks Meeting Negotiated Trade Meeting Regional Requirements Under the 75% Plan, Texas-Oklahoma-New Mexico and Kansas.

The further to the left a CDF falls, the greater the likelihood that negotiated trade during that quarter in that region will not meet the weekly threshold necessary often enough to avoid tripping a minor trigger. For example, in Texas-Oklahoma-New Mexico there is approximately a 70% chance that, during a given first quarter, negotiated trade will exceed 9,750 head fewer than 10 weeks. However, there is only a 37.8% chance that during a given second quarter negotiated trade will exceed 9,750 head fewer than 10 weeks.

The risk of failing to trade at 75% of negotiated volumes needed for robust price discovery for at least 10 weeks, per the NCBA 75% Plan, varies substantially by quarter. Figure 9.5 contains the probability of each quarter in each region tripping a minor trigger in a given year.

Since the Nebraska-Colorado feeding sector is expected to trip its minor trigger rarely, and Iowa-Minnesota is not expected to trip its minor trigger at any point, it is important to focus on the two at-risk regions. The risk of a major trigger represented in Figure 9.6 only represents the feeding sector and so half of the potential triggers are not included in those outcomes. Therefore, until the packer silo's triggers are set, the risk of simultaneous minor triggers being tripped in Texas-Oklahoma-New Mexico and Kansas is a better measure of the overall system risk. Figure 9.7 charts the same information as Figure 9.6; however, Figure 9.7 only includes the probability of simultaneous minor triggers being tripped in Texas-Oklahoma-New Mexico and Kansas.

The risk of Texas-Oklahoma-New Mexico and Kansas simultaneously tripping minor triggers before 2025 is substantially higher than the risk of the feeder

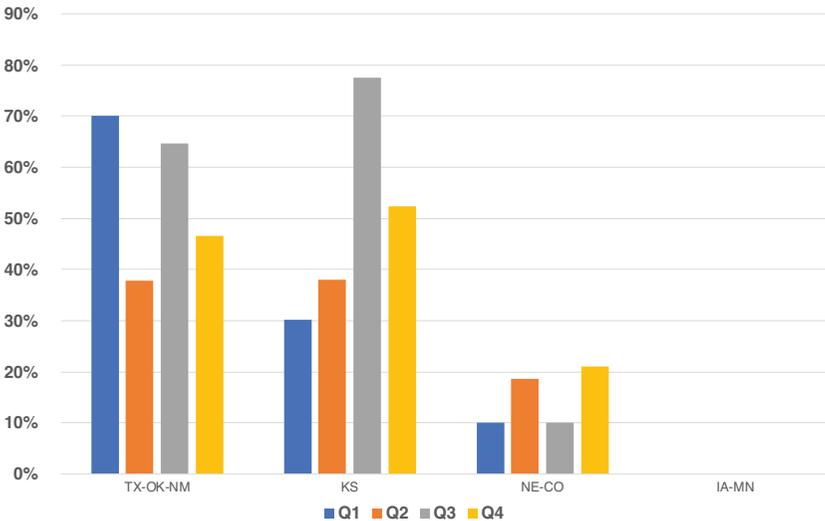


Figure 9.5. Probability of Failing 75% Volume > 3 Weeks in Quarter X, by Region.

silo alone triggering NCBA support for legislative action. In fact, on average the risk of Texas-Oklahoma-New Mexico and Kansas simultaneously tripping minor triggers before 2025 is 44 times the risk of the feeder silo triggering NCBA support for legislative action. Overall, it is 14 times more likely that Texas-Oklahoma-New Mexico and Kansas will simultaneously trip minor triggers than the likelihood that the industry will fail the 75% Plan based on the feeder silo alone.

Discussion

Why does the discrepancy in total system probability of triggering vs. the probability of at-risk regions matter? With the packer silo still not formed (as of this writing), there is no way to accurately measure the probability of those additional four triggers being tripped. In the best-case scenario, the risk of each minor packer trigger being tripped will be zero, and the overall risk distribution of the industry failing the 75% Plan over time will look like Figure 9.6. However, if we assume that there is any possibility of a packer silo trigger being tripped, the risk of the industry failing the 75% Plan over time looks like Figure 9.7. There is approximately a 48.8% chance of Texas-Oklahoma-New Mexico and Kansas simultaneously tripping their minor triggers in a given set of rolling quarters. That level of risk suggests that half the time that a single packer silo trigger is tripped, it will constitute a major trigger.

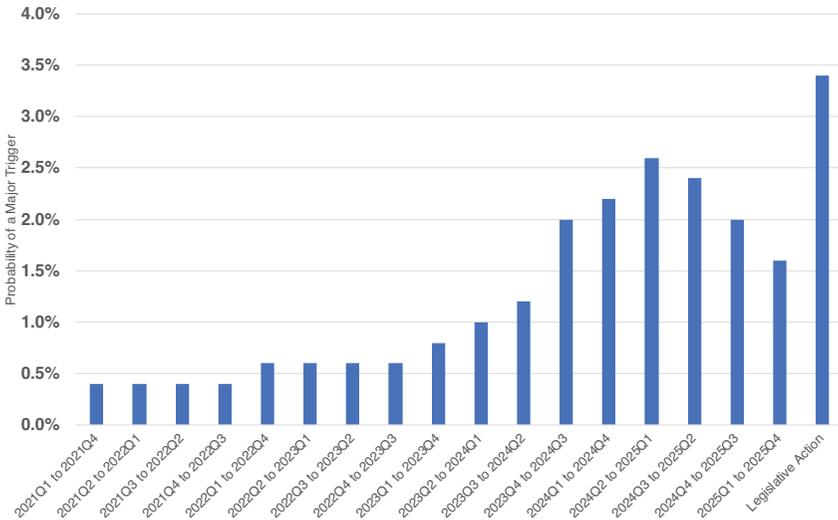


Figure 9.6. Probability of Only Feeder Silo Tripping a Major Trigger, Rolling Quarters 2021-2025; Probability of 75% Plan Triggering Legislative Action Before 2025.

The number of fed cattle sold via negotiated methods has increased since the 75% Plan was introduced. The need to construct the NSIF alone suggests that the announcement of the 75% Plan induced a change in negotiated volumes. During the first quarter of 2021, both Texas-Oklahoma-New Mexico and Kansas tripped their minor feeding silo triggers, but the number of fed cattle traded via negotiated methods grew over 2020. Every week in Texas-Oklahoma-New Mexico, and six of 13 weeks in Kansas, fed cattle traded via negotiated methods was above the minimum volume needed to achieve price discovery. In Texas-Oklahoma-New Mexico the number of fed cattle traded via negotiated methods was above the volume needed to achieve robust price discovery four of 13 weeks, robust price discovery being a higher threshold to cross. The same was true of Kansas three of 13 weeks.

The final outcomes of the 75% Plan will depend largely on two things; the structure of the triggers in the packer silo and continued efforts of cattle feeders to trade fed cattle via negotiated methods. If the rules of the packer silo yield similar results to the feeder silo as it stands, it is very likely that the industry will fail the 75% Plan. One region’s packer silo minor trigger tripping regularly suggests an approximately 50% chance of the industry failing the 75% Plan.

There are potential fixes from the cattle feeder side. The need for further research remains and questions still need to be answered. How much will negotiated trade from the feeder side continue to exceed negotiated trade in previous

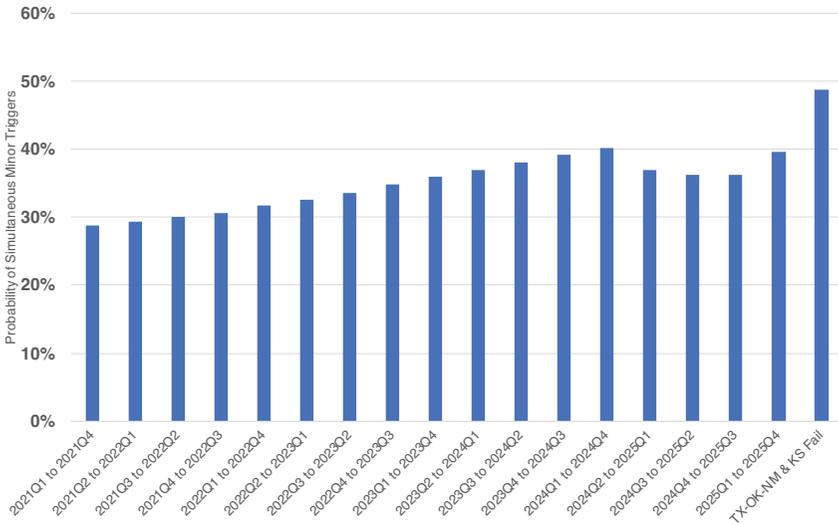


Figure 9.7. Probability of Texas-Oklahoma-New Mexico and Kansas Simultaneously Tripping Minor Triggers, Rolling Quarters 2021-2025; Probability of Texas-Oklahoma-New Mexico and Kansas Simultaneously Tripping Minor Triggers Once before 2025.

years? On average, how many more fed cattle must be traded weekly via negotiated methods to lower or eliminate the risk of one or two simultaneously tripped triggers in the at-risk regions? Will drought-induced liquidations force lower total fed cattle sales in the future once the cow herd is reduced, and if those lower total sales lead to lower negotiated sales, does long-term drought constitute force majeure? Are adjustments to the plan necessary to facilitate more realistic outcomes? Is a hard number of negotiated volume the best way to ensure increased prices? Most importantly, what is the ultimate impact of the 75% Plan on prices received at the fed cattle and feeder cattle levels?

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Chapter 10

Workshop Discussion Summary

David P. Anderson

The authors of the various chapters in this book presented their findings at a two-day workshop in Kansas City, MO, from June 3-4, 2021. The workshop was open to the public, and time was reserved for Q&A following each presentation. In addition, at the end of each day, a formal discussion panel offered feedback on the presentations.

The discussants were selected to represent a diverse cross-section of the industry. Following are their bios at the time of the workshop:

- **Michael Nepveux** serves as an Economist at the American Farm Bureau Federation. His issue portfolio consists of livestock and dairy markets, farm bill and federal crop insurance, renewable fuels, and hemp issues.
- **Shelby Horn** is currently part of the management team for Abell Livestock, a commercial cow-calf/stocker operator with ranches in Texas, Florida and New Mexico. Horn serves on the Board of Directors of Texas and Southwestern Cattle Raisers Association and is a member of the National Cattlemen's Beef Association Marketing Committee.
- **Don Close** is the cattle market analyst for Rabobank, one of the largest agricultural lenders in the world. He has had a 40 year career in agriculture and livestock markets, including at a packer startup and as a market analyst at the Texas Cattle Feeders Association. He speaks around the country on cattle market issues to audiences of ranchers and other segments of the industry. He is a well known and respected cattle market analyst.
- **Justin Tupper** is the owner and operator of St. Onge Livestock Auction Company. He is a leader in cattle organizations, including serving as Vice President of U.S. Cattlemen's Association, and a participant in recent leadership meetings of all the national livestock organizations. He has also testified before Congress on livestock market issues. He brings an important perspective as a livestock auction company owner to the fed cattle price discussion at the workshop. He also brings an important regional perspective on fed cattle pricing issues.

Initial drafts of the papers (that eventually became chapters in this book) were provided to the discussants in advance so they had time to prepare for the workshop. They were invited to highlight where they agreed or disagreed with the presentations and to identify issues they thought were not sufficiently addressed. The discussion panels also spurred a number of audience questions and comments.

While it is virtually impossible to fully capture two days of formal and information discussions in a succinct manner, this chapter attempts to highlight the major themes/comments that arose from the discussants and/or the audience. Further, it was made clear at the workshop that any comments would not be attributed to individual participants so as to encourage robust discussion; as a result, the comments below are offered as-is with no attribution to individual participants.

Complexity

- In responding to Dr. Derrell Peel's point about the complexity of the beef industry (as noted in Chapter 1), one discussant observed that there are no easy solutions to solve the problems of price discovery (and others) addressed in this workshop. The complexity of the system suggests that it might be likely that proposed solutions are either ineffective or are counterproductive.
- One view expressed by a discussant was that, while complex, efficiency in the marketplace is quite strong. The efficiency of production practices and the speed with which information moves through the marketplace is incredibly fast. Market information and price signals move through the market faster than legislation.

AMAs Have Value

- The general view was that AMAs have value to both buyers and sellers. AMAs have led to the implementation of value-based marketing that has increased cattle and beef quality throughout the industry. Ranchers have drastically changed the genetic makeup of their herds due to value-based marketing. There appeared to be little interest in the audience in going away from (or backtracking from) the improved beef quality that AMAs have fostered, although some did question if the value provided by AMAs is worth the perceived tradeoff in transparency.
- Some pointed out that premiums and discounts for quality are not going away and, in fact, are going to become more valuable over time, including for both feeder cattle and calves. In fact, the entire beef supply chain has had to adapt to accommodate the production of beef with specific attributes. To that end, the days of buying on average (i.e. not differentiating for quality) are numbered.

Packing Capacity

- One view of capacity constraints might suggest that one part of the industry has low barriers to entry and a very liquid market; the other side of the industry has high costs of entry and limited liquidity. These conditions describe cattle production and meat packing, respectively. Cattle producers, at times, outproduce fixed plant capacity to process the cattle. With those industry differences, there are times when the supply of cattle is out of balance with the ability to slaughter those cattle. The relative balance of the supply of cattle and capacity creates leverage for either the buyer or the seller.
- One estimate was that packing capacity needs to increase 4,000-5,000 head per day to alleviate the packing capacity constraint. Recent press releases have indicated about 9,000 head per day in expansion is currently planned. While not all of the proposed facilities may be built, when some of those come on line – coupled with fewer cattle, cyclically – cattle prices may take off like a rocket. In this case, packing capacity exceeds the number of cattle produced, leading to a change in the competitive position of feeders and packers.
- Another concern expressed was about reinvestment by current major packers into new plants. The level of profits generated over the last 2 years has not resulted in expansion and that has led to frustration by many cattle producers.
- Others noted there are constraints to packing expansion, and the labor constraint is an important one. One solution to the lack of labor is additional investment in robotics. There might be a role for government action in this area by funding research on robotics. Those systems might be targeted to smaller plants, whose success would expand capacity, increase competition, and might increase price discovery.
- A question came from the audience about whether or not new small plants would participate in the negotiated cash market and if it matters how they buy cattle? The answer from one discussant was that it shouldn't matter how they buy cattle, but at least they would provide more competition in the marketplace.

Risk Management

- One discussant noted that price discovery is important in another way that was not addressed by the presenters. Accurate spot prices, discovered prices, affect the futures market. If cattle prices are not accurate, then there's no way to have a viable risk management tool to hedge

risk. Or, at least, futures market prices would have to rely on some other mechanism than inaccurate spot prices to be useful. A downstream impact of inaccurate price discovery would be spill-over effects in the futures market and the loss of useful risk management tools. Livestock risk management through crop insurance policies like Livestock Risk Protection (LRP) also relies on the futures market.

A Profitable Industry

- The discussion made it clear that certainly some of the worries about price discovery exist because of difficult times for cattle producers. Low prices and the lack of profits have occurred at the same time as, seemingly, record profits for packers. Some of the discussion centered around the need for a profitable industry in all segments and not just one. The view was expressed for the industry to be healthy long-term, there need to be profits in every segment.

Market Transparency

- One discussant addressed the topic of confidentiality. The prevailing view expressed was that if a trade happens, USDA should report the price, arguing that eliminating confidentiality constraints would greatly increase transparency. They argued it would also reduce worries about “sweetheart” deals where the playing field is not level. Trades often happen very quickly, over the course of only an hour. In that quick market action, does confidentiality really matter?
- The contract library addressed in some legislation was viewed positively by the discussants. The library would, at least, add some information for producers to know what has been offered. Examples from the hog market contract library were discussed as an example of how a cattle contract library might work. While the contract library was viewed positively, it was noted that there are clear limitations on what a contract library can be expected to solve in terms of price discovery and/or transparency.

Market “Rules of the Road”

- Several discussants expressed a series of ideas that might be termed “defining the rules of the road for the market.” The losses suffered by cattle producers compared to the apparent profits by the packing sector over the last 2 years suggests to some that there is a problem. One view is that there needs to be a referee. Recent legislative options offer some additional rules for the market. More effective Justice Department actions would also provide some market oversight.

Price Discovery

- There was a general discussion about the fact that price discovery is important throughout the industry, not just for fed cattle. Prices at the fed cattle level certainly affect calf prices and wholesale and retail beef prices. Every price throughout the beef value chain is related to fed cattle prices.
- One of the interesting issues in price discovery (or in the market working) is the issue of having a second bidder in the market. This idea was brought up in the second day's discussion session. The view of one discussant was that he views this bidder as the most important. A second bidder, in this view, is someone who is actively bidding for cattle and they want to buy. They force the bid winner to really work for the cattle. So, the second bidder has to be honestly bidding to get the cattle, it just so happens that they don't win. But, the problem was viewed that there is often no second bidder in cattle markets. This issue is also related to competitiveness and market power.
- Discussion on both days included how thin is too thin for adequate price discovery. During the discussion, one of the authors noted that if all the research on price discovery was summarized very briefly it would say that markets can be a lot thinner than you think and still work very well. While the academics in the room seemed reluctant to drive a stake in the ground and say this is all you need, it is because there are times in the market that you need a lot more trades to get price discovery because there is some uncertainty in the market. A good example might be in the height of the COVID-19 pandemic, or when a cow with bovine spongiform encephalopathy (BSE) was discovered, or when some other economic turmoil hits and there is a huge amount of uncertainty, then you need more cattle traded. But, when there are not big events happening that cause turmoil, then the number needed to trade is likely very small. So, there is no right number that works for every week. The number that need to trade is likely different depending on events.
- Others noted that it is also not clear what low price discovery means. It's not clear that we are close to losing it either. Many people assume that if we had more discovery, we would see higher producer prices. That is not at all clear and the end result might be the opposite.
- One participant expressed the notion that giving up known benefits for an unknown cost is a difficult policy step to take.

Research

- Discussants identified a need for more research on these topics to be able to make the most informed decision they can. There is a lot of research about the value of AMAs and estimated costs of not having AMAs. But, there are other questions about what happens in the market if there is no discovery or if trading becomes so thin there is no confidence in the market.
- There was general discussion about a view of research – related to price discovery – that we can't destroy price discovery in the pursuit of efficiency. In pursuit of efficiency, we may lose price discovery to the detriment of cattle producers. Research could build on what has been presented in this conference to explore how far negotiated trade can be pushed and still have adequate price discovery. Research might also examine the tradeoffs between efficiency and discovery.
- The view was expressed that a lot of price discovery questions could be answered with more access to LMR data. There is a lot of data that is not publicly released. Obtaining some access to that data to answer a variety of price discovery research questions would likely help in shedding light on the market for buyers and sellers.
- While most research shows that very little market power is exerted by packers, the view was expressed that this topic needs to be monitored and periodically revisited due to the concentrated nature of the industry.

AMS and NASS

- Discussion also revolved around the good work that USDA's Agricultural Marketing Service (AMS) does in disseminating information. While they face many constraints, some self inflicted, they do a tremendous amount of good work in reporting prices to help producers know what is happening in the marketplace. USDA's National Agricultural Statistics Service (NASS) was also praised for the job they do in developing market data. The lack of data in other countries was viewed as a real constraint.
- Another comment focused on the difficulty in getting more market data reported by AMS because it often requires industry consensus. That is difficult to get sometimes given competing interests.

Voluntary Solutions

- Participants discussed the fact that voluntary industry efforts have increased negotiated trade. Those efforts have resulted in more feeders offering more cattle in negotiated trade. However, packers are not showing up to buy them. There are packers who refuse to buy cattle in a negotiated format. So, voluntary solutions have worked to some extent, but it does take more buyers to be willing to participate.
- There is a view that there are some packers who are tone deaf to the problems in the market. Those sharing that view expressed frustration that the packers have been unwilling to participate in voluntary solutions. The view is that they will not work on voluntary measures unless they are required to.

The discussion as a whole illustrated that in an audience of cattle industry stakeholders, the viewpoints on solutions to current concerns about cattle markets are highly diverse. There was general agreement that price discovery matters to the functioning of cattle markets, including fed cattle markets, but any needed policy changes remain an open question. With that said, there seemed to be general agreement on concerns about unintended consequences of otherwise well-intentioned policy changes.

In 2020, at the request of the bipartisan leadership of the Committee on Agriculture in the U.S. House of Representatives, USDA was asked to commission a study to look into the issues surrounding fed cattle pricing. Ultimately, USDA partnered with the Agricultural and Food Policy Center (AFPC) at Texas A&M University, and this book is a culmination of that request.

In carrying out our work, papers were commissioned from noted experts around the country on a variety of topics, ranging from a history of how the industry arrived at this point to an initial evaluation of voluntary proposals introduced by industry to address some of these pressing challenges. AFPC hosted a workshop in Kansas City, MO, on June 3-4, 2021, where the authors of the respective papers presented their findings. Four discussants – representing a diverse cross-section of the industry – were invited to offer a formal response. The workshop was open to the public, and participants offered a number of helpful comments.

