Testimony on

State of the Beef Supply Chain: Shocks, Recovery, and Rebuilding

to

U.S. House of Representatives Committee on Agriculture

Subcommittee on Livestock and Foreign Agriculture

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Chairman Costa, Ranking Member Johnson, and members of the subcommittee, thank you for inviting me to join the discussion today. As an animal protein analyst for Rabobank, which is engaged across the entire beef supply chain, I assist in strategic decision making for both the bank and the bank's clients by offering a research-based perspective on fundamental market dynamics and future trends.

Summary

Major US beef supply chain disruptions over the past two years have sent the cattle and beef industry into uncharted, but explainable territory. The imbalance of excess market-ready cattle supplies in the face of reduced operational packing capacity has put downward pressure on cattle prices. Meanwhile, consumer demand for beef and all animal proteins has reached record levels, fueled by pandemic stockpiling, increased and reallocated consumer income, and more recently, restaurant re-openings, not to mention export demand. These dynamics, combined with elevated processing costs, have increased the spread between beef price and cattle price, just as economic principles, past research, and historical market relationships would suggest. Both the direction and magnitude of the price spread are well within the range of expectation.

Like many businesses, the pandemic has created enormous challenges for cattle producers. Seeing the price difference between cattle and beef has only added to the emotional strain. I understand the frustration. I've owned and bred cattle most of my life, and I have friends and family that make a living ranching and feeding cattle. However, with stakeholders that are invested throughout the entire supply chain, from rancher to packer to retailer, I must look at the beef industry from an objective, analysis-based perspective.

First, cattle are not beef. Cattle are one of several inputs into beef production. Other major inputs include labor, physical capital, and technology. These inputs are always seeking, but never finding, the perfect balance between one another. This creates cycles. Input imbalances are communicated through prices, whether that's cattle prices, wages, or investments. Over the past several years,

extreme and unexpected events have severely restricted several of these inputs. Examples include facilities in the August 2019 Tyson plant fire and labor during the pandemic. A working market sends price signals to adjust. These same price signals created record high cattle prices and packer losses in 2014 and 2015.

The biology and natural time-delays of the beef industry make it slow moving and capital intensive. Adjustments take years. While recent, unforeseen events have exacerbated the situation, free market signals, economic losses, drought, and the natural cattle cycle laid the foundation for today's circumstances over several decades.

Beef packing has historically been a low margin business. In the year 2000, with a total cattle population of 98 million head, the US harvested nearly 30 million head of fed cattle. By 2014 and 2015, the total cattle population was below 90 million head with 2015 fed cattle slaughter under 23 million head. Throughout this period of largely drought induced beef cow herd contraction, the most inefficient packing plants were driven out of business as competition for limited cattle supplies drove cattle prices to record highs. From 2000 to 2015, the US beef industry experienced a net decline of roughly 14,000 head per day in fed cattle processing capacity.

Even before the extremes of 2020, recent margins suggest that there is opportunity to add operational packing capacity. However, that opportunity does not come without significant risk. First, the upfront cost of a new or expanded plant is extremely expensive. Based on recent new plant announcements and the current environment of high construction costs, a new plant currently costs roughly USD 200m for every 1,000 head of daily capacity. Then, a new endeavor must meet regulatory requirements, build a labor force, and keep enough cash on hand to absorb losses.

Most crucially, it's not just about building facilities, it's about building a business model. Competing in commodity cattle markets against the efficiency of large, incumbent plants would be extremely difficult for a new entrant. However, if a new entrant can capitalize on a differentiated branding strategy, the premium component may be enough to offset efficiency disadvantages. Differentiated beef requires differentiated cattle. Alternative marketing agreements are the best way to secure a consistent supply of such differentiated cattle. Strong, vertical supply chain relationships will be critical to the success of any new beef business.

In response to the described market signals, numerous plans for greenfield plants or expansions of existing facilities have been unveiled in recent months. These plans come from new entrants, minor incumbents, and major incumbents alike. If all of the announced plans for plant construction and expansion come to fruition, more than 8,000 head of daily fed cattle capacity could be added to the US beef industry over the next five years. Recognizing current drought conditions, if the beef cow herd declines by 2% or less, there's opportunity for about 5,000 head per day of profitable packing capacity expansion.

A note of caution. There is a point where industry capacity expansion goes too far to withstand cyclical periods of tight cattle supplies. The long-term cattle cycle, drought risks, and market fundamentals must be considered.

I want to emphasize that additional operational capacity does not have to come solely from new facilities. Whether in new or existing plants, increased technology implementation will be a critical component of future success. Recently, many packers have revitalized their focus on technology development as a means to address labor challenges, manage processing costs, and reduce product

waste. Enlightened by the pandemic to the long-standing labor shortages in the meat industry, many startups are also bringing outside expertise and perspectives to advance technology and automation in the meat supply chain. Even a one percent improvement in volume efficiency across all existing plants would add 1,000 head of daily fed cattle processing capacity.

With any luck, we will work through the long tail of 2020's cattle backlog in Q3 2021. Year-over-year cattle prices are already improving and should continue to do so through 2H 2021 and beyond. In conjunction with tightening cattle supplies, capacity expansion will come online over the next several years and new technologies will reduce labor constraints, further shifting margins to the benefit of cattle producers.

In closing, the shocks to the beef industry over the last couple years have presented the entire beef supply chain with enormous challenges. The resulting price movements have been frustrating for cattle producers, to say the least. Yet, these same price movements and supply chain disruptions have also contributed to the accelerated investment in packing capacity expansion, new technologies, and new business strategies that will help the beef industry adapt and evolve to ever changing demands. That's the market at work.

Beef Production is a Balancing Act

Before advancing the conversation, it's important to note the difference between cattle and beef. In a simple equation form, a recipe if you will, beef can be represented as the output from the combined inputs of cattle, human labor, physical capital (e.g. facilities), and technology.

$$Beef = Cattle + Labor + Physical\ Capital + Technology$$

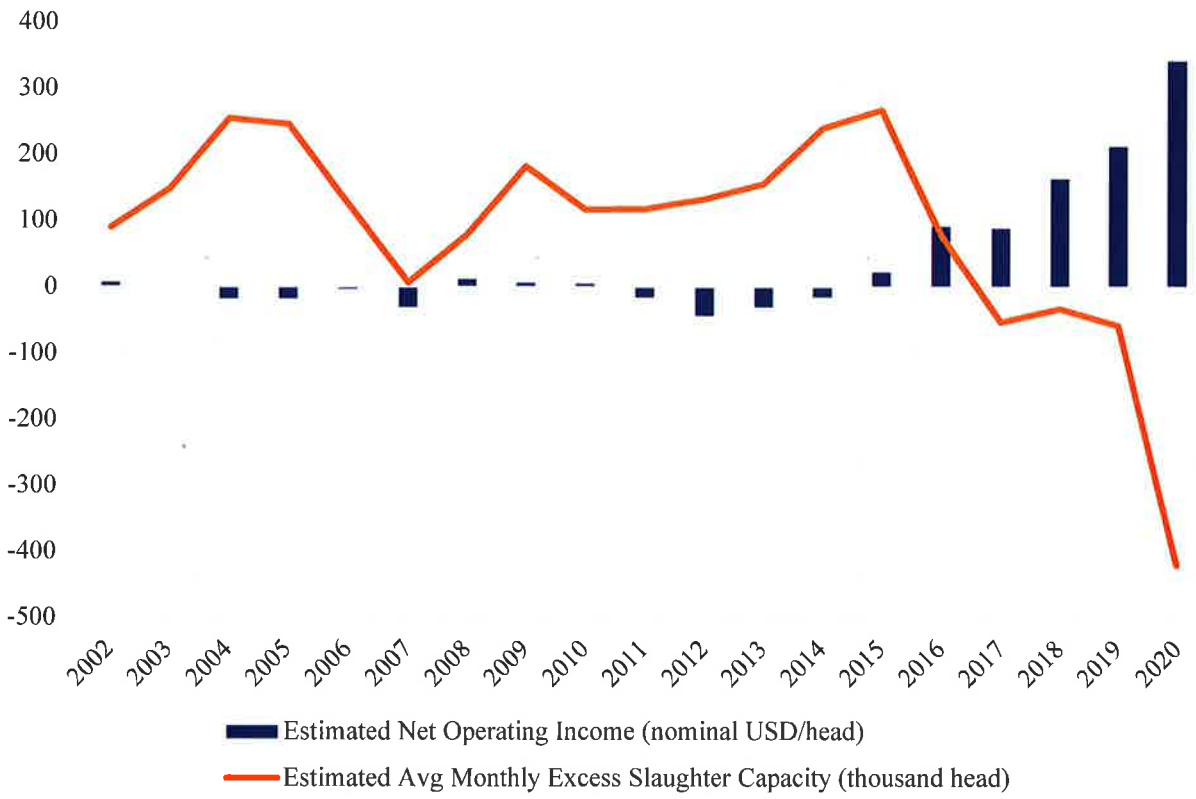
The inputs of this equation are always seeking, but never finding, the perfect balance between one another. Input imbalances are communicated through prices, whether that's cattle prices, wages, or investment/divestment in physical capital and technology. As expected in commodity markets, whether it's natural gas or cattle, the over-expansion/over-contraction and subsequent price signals responding to imbalances generate cycles (e.g. the cattle cycle). If any two inputs in the beef production equation are unbalanced, either the limiting input has to expand or the surplus input has to contract. For example, packing capacity (facilities, labor, technology) expands, or cattle numbers decline. Often, it's cattle numbers that are the most responsive to imbalance. Between the two possibilities, the decision to retain or sell a few head comes much easier for the multitude of cow-calf producers than the high-risk, capital-intensive, regulatory-complex endeavor of packing capacity expansion.

Historical Perspective

Beef packing has historically been a low margin business (*see Figure 1*). Precise estimates of individual company performance are extremely challenging with publicly available, industry average data, but estimates can get close and identify trends. Based on the estimates shown in *Figure 1*, beef packers averaged an annual loss of USD 1,1 per head from 2002 to 2014. In the year 2000, with a total cattle population of 98.2 million head, the US harvested 29.6 million head of fed cattle (*see Figure 2*). By 2014 and 2015, the total cattle population was below 90 million head with 2015 fed cattle slaughter at only at 22.7 million head. Throughout this period of largely drought induced beef cow herd contraction, the most inefficient packing plants were driven out of business as competition for limited cattle supplies drove cattle prices to record highs. From 2000 to 2015, the US beef industry experienced a net decline of roughly 14,000 head per day in fed cattle processing capacity. Today's *maximum* US fed cattle processing capacity (no absenteeism, no equipment breakdowns, flawless logistics, etc.) is estimated at just above 100,000 head per day.

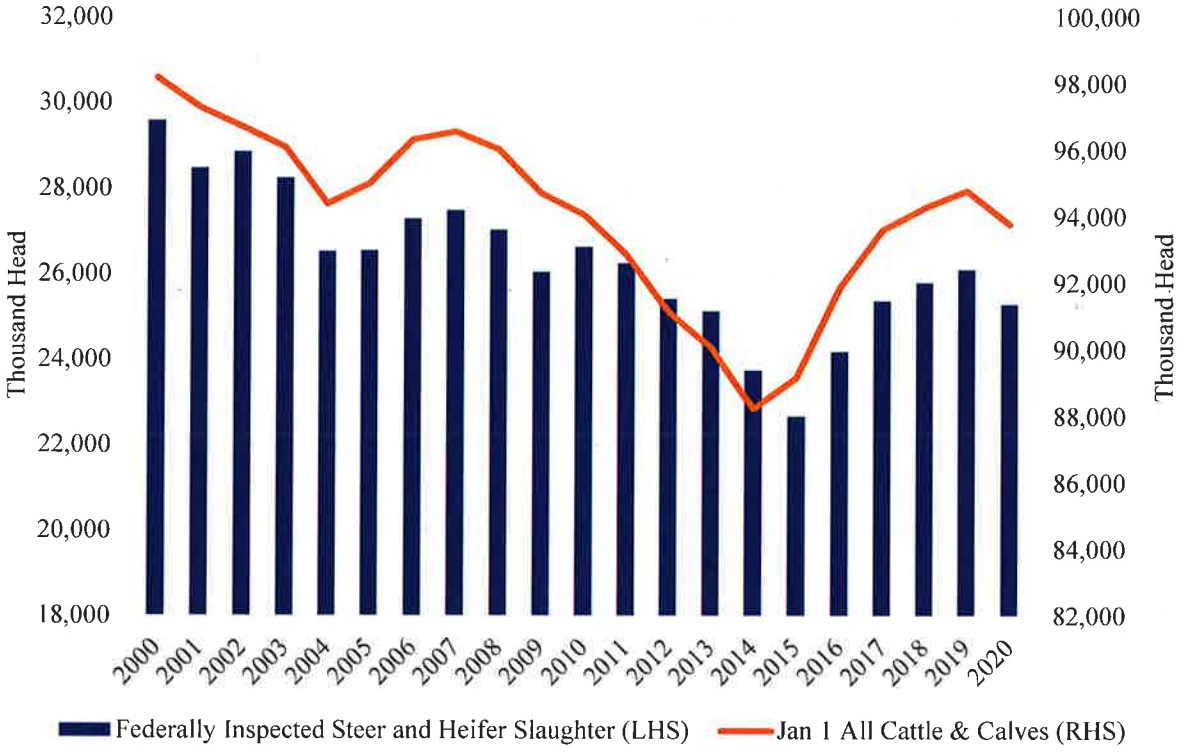
The remaining plants are those that have best managed operating costs through optimal geographic location, supply chain relationships (both suppliers and customers), and economies of scale. However, as cattle herd expansion has outpaced packing capacity and shifted the balance of the beef production equation, packers have been strategically positioned to capture record margins in recent years. This shift was well in place in the years prior to the pandemic. The Tyson-Holcomb fire and Covid-19 only magnified the shift by creating acute and unexpected massive imbalances between cattle numbers and suddenly limited availability of labor and/or facilities. As of mid-June 2021, beef packers are still struggling to utilize more than 90%-92% of daily capacity as a result of labor shortages and additional Covid-19 precautions, even in the face of ample cattle supplies.

Figure 1. Estimated annual beef packer operating income per head and estimated annual average monthly excess fed slaughter capacity, 2002-2020



Note: Operating income = (cutout value + by-product value) - (cattle purchase cost + estimated processing cost). Estimated monthly capacity is the maximum federally-inspected steer and heifer slaughter for a given month over the previous three years, except for 2020, during which Covid-19 related impacts and cattle backlogs were considered.
Source: USDA NASS, USDA AMS, LMIC, Rabobank 2021

Figure 2. Annual Fed Cattle Slaughter and Total Cattle Inventory, 2000-2020



Source: USDA NASS, LMIC, Rabobank 2021

The Relationship Between Cattle and Beef Prices

Packers are margin operators. Thus, operating costs influence the spread between cattle and beef prices, as packers attempt to capture some profit above operating costs. As operating costs increase, packers will attempt to pass some of those costs to their suppliers or customers, depending on who has the most leverage in the negotiation. This is no different than cattle feeders adjusting their feeder cattle bids based on feed prices and expected fed cattle prices.

The relationship between fed cattle prices and beef prices is also driven by the relative balance between fed cattle supply and operational fed cattle processing capacity (the capacity actually achievable given labor conditions, equipment function, weather, and logistics). The greater the fed cattle supply in relation to processing capacity, the greater the spread between cattle prices and beef prices. In such a scenario, packers don't have to compete as aggressively to buy cattle, and cattle feeders are more willing sellers because packers can more easily find cattle elsewhere to meet their needs.

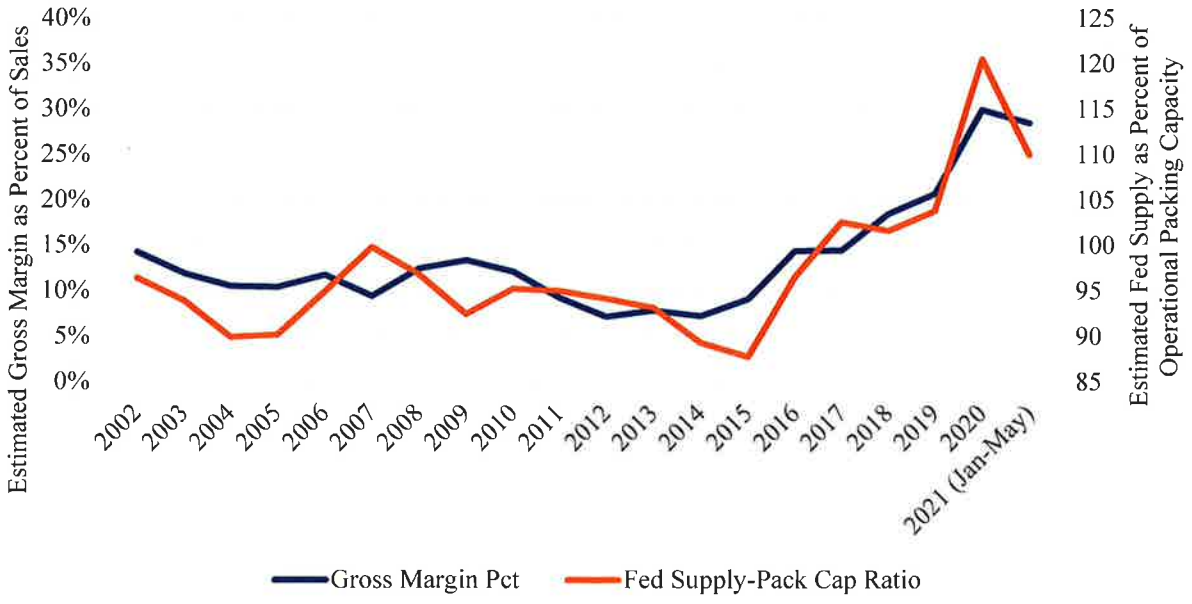
Throughout the pandemic, packers simply haven't had the operational ability to harvest all of the cattle ready to be marketed. While record strong beef demand in both domestic and international markets and, at times, a limited beef supply have driven up beef prices, the bottleneck in packing capabilities has prevented that demand from being transmitted to the cattle sector. Beef cattle value is dependent on the ability to transform cattle into beef. The impacts of both the pandemic and the Holcomb, KS, plant fire severely constrained this transformation. A limited resource, in this case operational packing capacity, will be rationed to those willing to give up the most to access and

incentivize that resource. On one end of the supply chain that means paying high prices for beef, while on the other, that means accepting a lower price for cattle. Under such extreme circumstances, cattle price could even be interpreted as how much cattle feeders were willing to pay (i.e., receive a lower selling price) to get an available harvest slot and clear their cattle backlog.

Increased beef demand, which translates to a higher price for the same quantity of available beef, also seems to contribute to higher packer margins. Using quarterly data from 2002 through 2019, a structural supply and demand model was developed, representing the cow-calf, cattle feeder, and packer segments, along with consumer beef demand. The results indicate that a 1% increase (decrease) in wholesale beef price (comprehensive cutout) is associated with a 0.8% increase (decrease) in fed steer price. Upon inserting 2020's market conditions into the model, accounting for consumer beef demand, fed cattle supplies, and operational packing capacity, it was predicted that the average spread between wholesale beef price and dressed fed steer price would increase by USD 25 per cwt vs 2019. The actual price spread in 2020 increased by USD 26 per cwt compared to 2019. This model does not account for the increased operating costs due to Covid-19 impacts, which would be expected to further increase the predicted gross margin.

Packer gross margin as percent of sales revenue has also behaved within the realm of expectation. From 2002 to 2019, the correlation between annual estimated packer gross margin percent and annual estimated ratio of fed cattle supply to operational packing capacity was +0.73 (*see Figure 3*).

Figure 3. Estimated US beef packer gross margin as percent of sales and estimated fed cattle supply as percent of operational packing capacity.

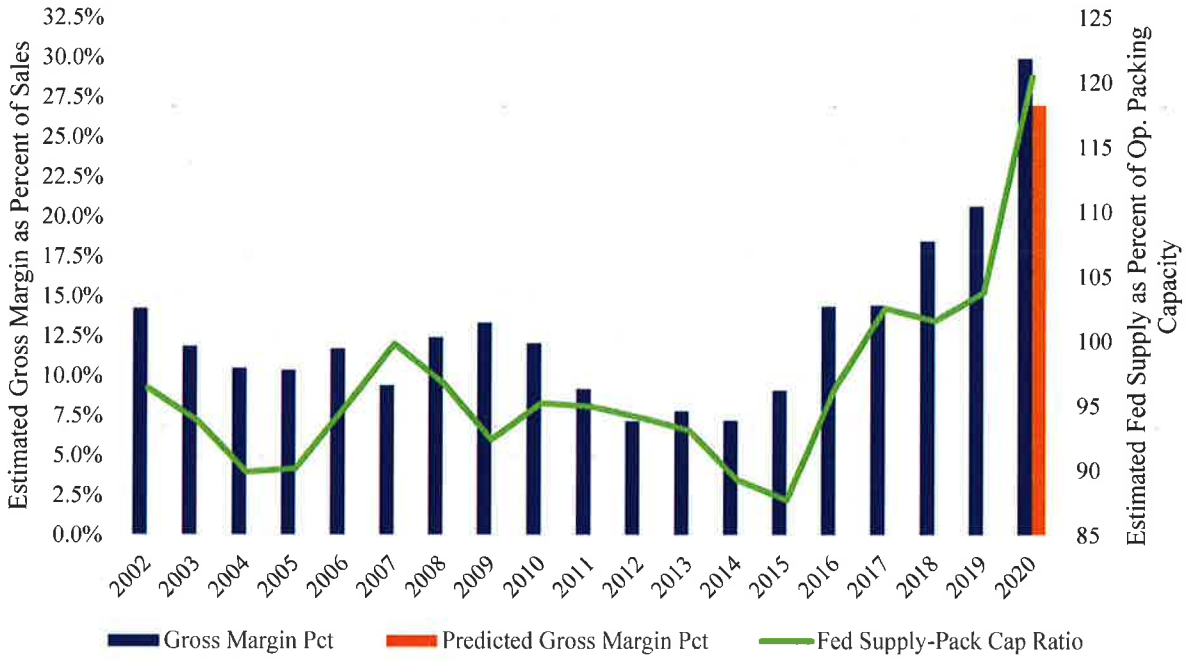


Source: USDA NASS, USDA AMS, LMIC, Rabobank 2021

A simple linear regression model to predict packer gross margin based on the ratio of fed cattle supply and operational packing capacity using the 2002 through 2019 data was estimated. When the resulting equation is applied to the estimated ratio of fed cattle supply to operational capacity for 2020, the predicted packer gross margin for 2020 is 27% (*see Figure 4*). The calculated packer

gross margin based on USDA market data was 30%. Again, this analysis does not account for the increased operating costs due to Covid-19 impacts, which would be expected to further increase the predicted gross margin.

Figure 4. Predicted 2020 US beef packer gross margin as percent of sales



Source: USDA NASS, USDA AMS, LMIC, Rabobank 2021

In both of the exercises described above, it's important to note that 2020 data was not used to train the models. Supply and demand relationships present in the beef industry prior to 2020 were used to estimate price relationships in 2020 with very respectable accuracy. This provides evidence that the same market relationships that were in play when packers were losing money in the early 2010s were also at play during 2020. Based on the conditions of the market in 2020, the spread between beef and cattle price has responded well within the bounds of expectation in both direction and magnitude.

Meeting Consumer Demand

All beef industry value originates with consumers. Over many decades, centuries perhaps, consumers have increasingly demanded high volumes of high quality, consistently supplied, safe, and affordable food. The food supply chain, from retailers and distributors all the way to producers, has evolved to meet these demands through improved quality, safety, and production efficiencies. The beef supply chain is no exception.

There is a small, but growing segment of consumers who place a high priority on sourcing food directly from primary producers or attach significant value to other specific food attributes. The market is naturally evolving to meet these preferences. However, for the vast majority of consumers, price, taste, and safety are still the most important factors.

The use of economies of scale to increase production efficiency and reduce production costs motivated the mid- to late-20th century investment in larger packing plants and consolidation into larger meat packing companies. It also stands to reason that larger beef packing companies can better serve large customers, such as retailers and distributors, who have also grown in size in recent decades. It is worth noting that beef industry concentration has not changed meaningfully in the past 25 years, while beef and cattle prices have fluctuated dramatically based on market fundamentals.

Cattle feeders and packers have turned to contractual agreements, defined as alternative marketing agreements (AMAs), to reduce marketing costs, supply chain risks, and increase capacity utilization, which reduces per head operating costs for both packers and cattle feeders. The inventory management offered by AMAs also helps improve the consistency of beef delivered to consumers by allowing fed cattle to be marketed in a more dependable and timely manner.

Furthermore, AMAs offer convenient implementation of value-based, post-harvest marketing, which directly incentivizes and helps improve beef quality. Over the past 15 years, the share of beef grading Choice or Prime has increased from 55 percent to more than 80 percent. Improved beef quality and consistency grow consumer beef demand.

Mandates Have Costs and Major Risks

If the government mandated a certain percentage of negotiated spot (cash) transactions between cattle feeders and packers, there is an exceptionally high likelihood that cow-calf producers would receive a lower price for their cattle. Cow-calf producers would bear the greatest burden of the negative impacts because they are primary suppliers rather than margin operators (i.e. there's no other market participant further upstream to pass the burden to).

Government intervention into how cattle are marketed does not change the market fundamentals described above and thus will not improve cattle prices. Price discovery in some form or fashion is necessary in any market. It is possible that increased negotiated cash transactions could improve price discovery, but improved price discovery does not mean a better price. Price discovery means that we get closer to the "true", fundamentally driven market price. That "true" price could be better or could be worse. We have no way of knowing exactly what that "true" price is. We can only estimate it based on market dynamics of supply and demand, such as those described above. And based on those dynamics, recent beef to cattle price spreads have been well within the range of expectations.

In this context, a comparison of 2014 and 2020 is noteworthy. In 2014, weekly cash transactions averaged 22.9 percent of all fed cattle transactions. In 2020, that measure was nearly identical at 22.5 percent. The annual average live fed steer price was USD 154 per cwt and USD 108 per cwt for 2014 and 2020, respectively. The difference was fed cattle supply relative to operational packing capacity. In 2014, estimated market-ready fed cattle represented only 89% of operational capacity. In 2020, estimated market-ready fed cattle represented 120% of operational capacity.

It has been suggested that mandating increased cash trade will bring more bids to the open market, increasing competition and increasing cattle prices. If all else stays equal, increased bids would be expected to increase price. But it is almost certain that all else will *not* stay equal. For both cattle feeders and packers, AMAs reduce marketing costs and reduce supply chain risks, while increasing

capacity utilization, which reduces per head operating costs for both packers and cattle feeders. Increasing cash trade would do the opposite. As packer operating costs increase, they will decrease the price they pay for fed cattle. Again, this is no different than cattle feeders reducing their bids for feeder cattle when corn price increases. All told, it is very possible that the net effect of mandating increased cash trade could decrease cattle price while also increasing marketing costs and inventory risks for cattle feeders. Because cattle feeders are also margin operators, increased costs, increased risks, and lower fed cattle prices would ultimately result in cattle feeders paying less for feeder cattle and calves.

All of the above points are supported by an immense body of economic research literature, as well as my own personal research. The most comprehensive research to-date on the topic of fed cattle transaction type and potential market power is the "GIPSA Livestock and Meat Marketing Study-Volume 3: Fed Cattle and Beef Industries Final Report" (RTI, 2007), which was commissioned by the USDA, authored by 16 economists from public institutions and non-profit organizations, and peer-reviewed by multiple anonymous reviewers. Both market participant interviews and quantitative analysis conducted as part of RTI (2007) support the conclusions stated above. While the cattle and beef industry have continued to evolve since 2007, to my knowledge there is no published research that contradicts the full production system impacts that were estimated in RTI (2007).

Keeping the Future in Mind

There is always opportunity to learn, adapt, and improve industries. However, it is important that today's "solutions" do not inhibit tomorrow's progress. Allowing markets the flexibility to adjust to a changing world and consumer is imperative.

Price discovery is necessary for any market, but the source of price discovery can change. While the negotiated spot market currently serves as the primary base price reference for fed cattle formula transactions, other species, swine in particular, have shown that wholesale meat prices (pork cutout value) and futures prices can also serve as reference prices. In some cases, base price for hog formulas is calculated as a combination of negotiated spot, pork cutout, and/or futures price. If cattle producers truly want cattle prices to more closely reflect consumer demand, it may make sense to price cattle based on transactions that occur closer to the consumer (e.g. meat prices) rather than farther away (e.g. negotiated cash). It's important to note that all reference prices have advantages and disadvantages.

AMAs will play a critical role in the market of the future. Consumer, investor, and government demand has positioned sustainability as a major and growing focus across all of agriculture. Marketing beef in grocery stores and restaurants based on sustainable cattle and beef production practices has already begun. Given the sustainability goals of major beef and food companies, beef brands centered around sustainability will continue to grow. Verifying and tracing sustainable production practices throughout the entire beef supply chain and guaranteeing a supply of cattle that meet sustainability standards for a particular brand require information sharing and supply coordination between market participants. As already discussed, one of the best ways to coordinate supply chains and incentivize demanded traits is the use of AMAs or other contractual agreements.

The Opportunity for Packing Capacity Expansion

Even before the extremes of 2020, recent margins suggest that there is opportunity to add packing capacity. However, that opportunity does not come without significant risk. Escalating drought conditions coupled with a currently contracting cow herd foretell of cyclically tighter cattle supplies over the next few years.

Several considerable hurdles must be addressed by both incumbents and new entrants to achieve success regarding new capacity. First, the upfront cost of a new or expanded plant is extremely expensive. Based on recent new plant announcements and the current environment of high construction costs, a new plant currently costs roughly USD 200m for every 1,000 head of daily capacity. Putting together and allocating that kind of capital is not a simple exercise, particularly for a potential newcomer.

Second, it's challenging to compete with the established supply chain networks, markets, and efficiencies of existing plants, even if a new plant were opened by one of the large incumbent packing companies. Not only have major packers achieved economy of scale, but most all have also achieved economy of scope. Packers are increasingly involved in value-added processing that targets specific customers, such as case-ready retail cuts or ground beef products. Most existing plants already proved their competitiveness and fitness for survival when the last cattle cycle forced less-efficient plants out of business in the early and mid-2010s. It's not just about building a facility, it's about building a business model.

Third, the packing sector has been facing labor challenges for years. Building a skilled and dependable work force in what may likely be a region that already has a packing plant presence will be a formidable task.

Finally, the capital depth and longevity required to build and maintain a new plant through its first cattle cycle precludes most would-be investors from considering such a project. If a packing plant project is initiated at peak cattle numbers when packing margins look favorable, it's likely that the cattle cycle would turn over in the multiple years required to build the plant, meet regulatory requirements, and start harvesting and that the new plant would have to operate with tight cattle supplies and negative profit for its first few years of business. That's not a recipe for thin capital or weak hearts.

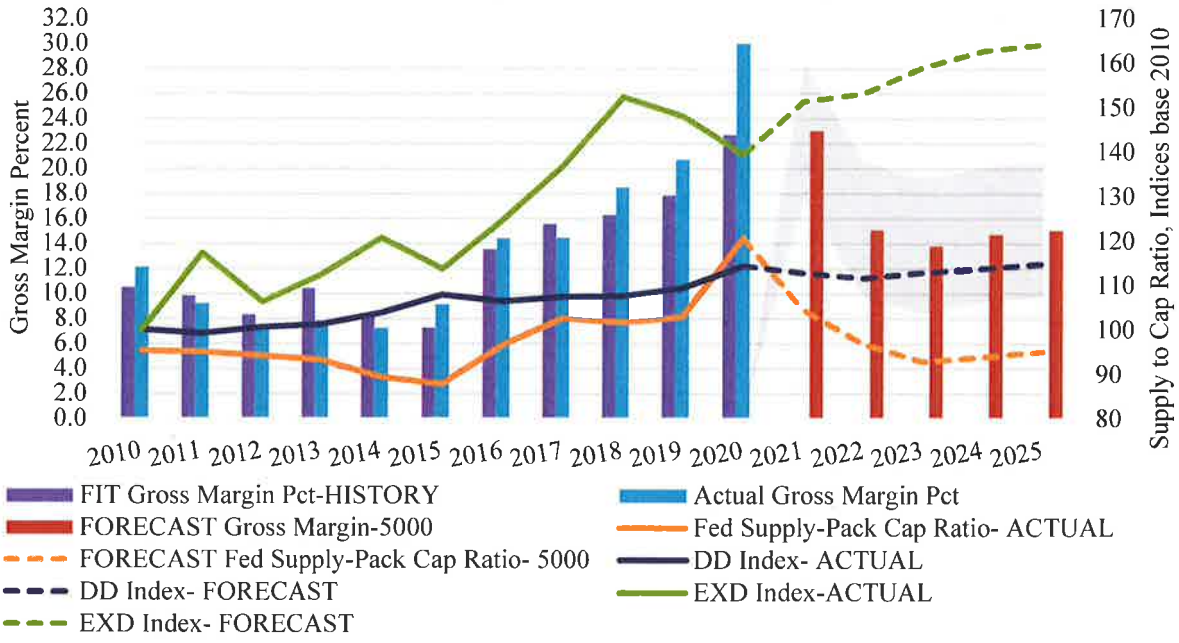
Beef Packing Plant Gross Margin Outlook

Figure 5 and *Figure 6* apply a model that includes the fed supply to operational packing capacity ratio, percent of weekly slaughter on Saturday (which accounts for the strain being put on employees and facilities), US domestic beef demand, and US export beef demand to predict beef packer gross margin as percent of sales. Both figures assume a 5,000 head per day expansion in total industry operational packing capacity by 2023. The key difference is beef cow inventory.

With the Jan 1, 2021 beef cow inventory at 31.2 million, *Figure 5* assumes that beef cow inventory bottoms at 30.5 million head in 2023. *Figure 6* assumes that beef cow inventory bottoms at 30 million head in 2023. *Figure 5* forecasts gross margin to return to levels similar to 2016 and 2017. However, the gross margin forecast for 2023 in *Figure 6* is 2.5 percentage points below the same year in *Figure 5* and dangerously close to the unprofitable early 2010s.

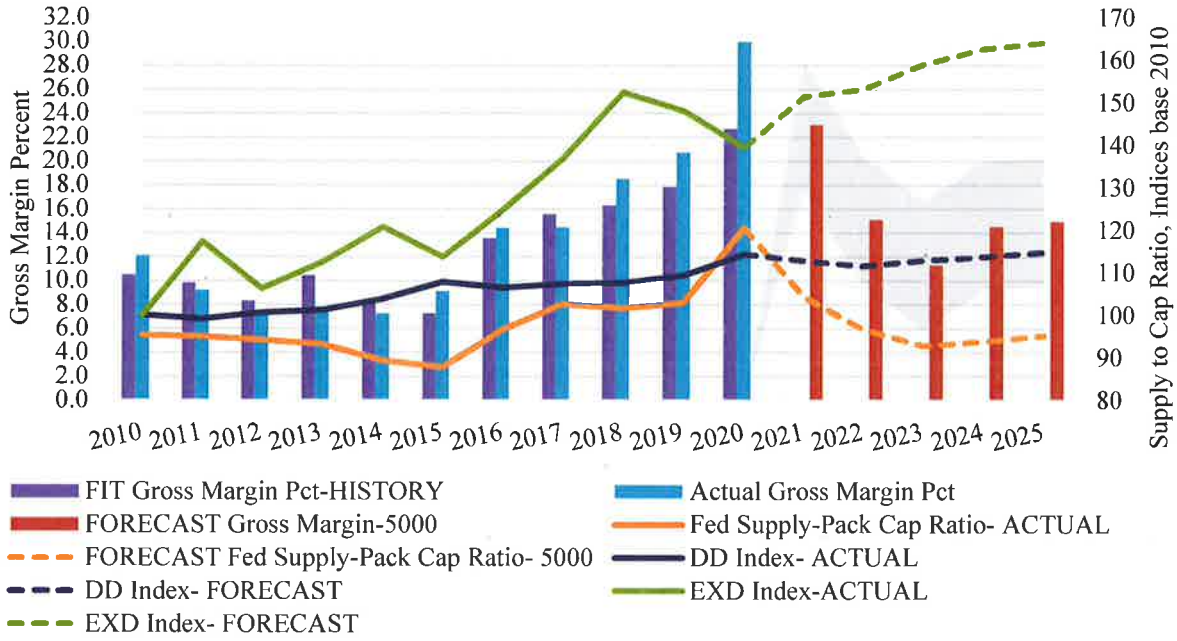
Predicting the future is hard. The point of this exercise is to illustrate that if the beef cow inventory only declines moderately, 5,000 head per day of new packing capacity should have relatively favorable conditions to initiate operations. If the beef cow inventory declines sharply, the first few years of new capacity could be incredibly challenging from a profitability perspective.

Figure 5. Forecast of US beef packing gross margin percent assuming total industry operational packing capacity expands by 5,000 head per day by 2023 and US beef **cow inventory declines to 30.5 million head in 2023**.



Note: Shaded area represents 2 times the 2010 to 2020 RMSE. DD = US beef domestic demand index, EXD=US beef export demand index.
Source: USDA NASS, USDA AMS, LMIC, Rabobank 2021

Figure 6. Forecast of US beef packing gross margin percent assuming total industry operational packing capacity expands by 5,000 head per day by 2023 and US **beef cow inventory declines to 30 million head in 2023.**



Note: Shaded area represents 2 times the 2010 to 2020 RMSE. DD = US beef domestic demand index, EXD=US beef export demand index.
Source: USDA NASS, USDA AMS, LMIC, Rabobank 2021

Industry Response

1) New construction and expansion

In response to the economic signals being sent from the imbalance of cattle supplies and operational packing capacity, numerous plans for greenfield plants or expansions of existing facilities have been unveiled in recent months. These plans come from new entrants, minor incumbents, and major incumbents alike. If all of the announced plans for plant construction and expansion come to fruition, 8,000 to 9,000 head of daily fed cattle capacity and more than 2,000 head of daily non-fed capacity could be added to the US beef industry over the next five years.

Most all of the greenfield construction or new entrant plans are small to medium sized (500 to 1500 head/day capacity), supply chain coordinated, and focused on product differentiation premiums. If these smaller plants are going to compete with the efficiency, economic scale, and scope of the large incumbents, they will have to be successful in these supply chain relationships and product differentiation. Differentiated beef requires differentiated cattle. The best way to secure a consistent supply of such program cattle is through alternative marketing agreements. Not only are cattle supply relationships critical, but strong relationships with buyers (for every piece, not just the high-value cuts) are critical. Again, entering the meat packing space is not just about building a facility, it's about building a business model.

Current consumer and investor trends suggest that moving forward there's real opportunity for beef companies with traceable, well-informed, coordinated supply chains that can verify production practices and differentiate product on more than just eating quality. Thriving export markets and growing export opportunities also point to ever growing demand for US beef. Many of the current plans to build new capacity are a long way from realization with many of the previously described challenges yet to be tackled.

Local lockers and 'micro-plants' have a place in direct-to-consumer marketing and can play an important role in rural communities, however they simply don't offer enough scale to make a measurable, industry-wide impact in the balance of cattle numbers and packing capacity. That said, with the proper business model, they can offer great opportunities for some operations.

2) Technology

Additional operational capacity does not have to come solely from new facilities.Whether in new or existing plants, increased technology implementation will be a critical component of future success. Recently, many packers have revitalized their focus on technology development as a means to address labor challenges, manage processing costs, and reduce product waste. Enlightened by the pandemic to the long standing labor shortages in the meat industry, many startups are also bringing outside expertise and perspectives to advance technology in the meat supply chain.

Maintaining necessary skilled labor has long been a challenge for packers. Covid-19 has magnified labor challenges and revealed the necessity of additional employee safety measures. Although hazard bonuses, additional sick leave, and other costs most directly associated with the pandemic will diminish with time, many additional labor costs associated with employee well-being, including base wages, benefits, and in-plant safety measures will persist into the future.

As the packing plants of the future gradually become more automated, efficiency will improve and throughput volatility will decrease. Operating hours may also become less restrictive, particularly if technology allows for a smaller Saturday workforce. While increased automation in carcass breakdown and fabrication is certainly a long-term goal, improved production-line data collection and machine monitoring have the most near-term promise. Increased real-time production-line monitoring will help identify choke points and inefficiencies while preventing breakdowns and the introduction of foreign material. Estimating current industry daily fed slaughter capacity at roughly 100,000 head, even a 1 percent improvement in efficiency across all existing plants could add 1,000 head daily fed cattle capacity. The final result will be an inherent increase in operational capacity at existing plants. However, these changes will take time.

A Note of Caution

As already described, current market fundamentals suggest that for those willing to take the capital risk and do the work to build a viable, competitive business, today may offer the best opportunity in decades to expand packing capacity. Yet, there is a point where industry capacity expansion goes too far to withstand cyclical periods of tight cattle supplies. Support for new packing capacity that is given too freely, without enough private risk, and with disregard to long-term market

fundamentals, may invite over-expansion, putting all market participants in jeopardy, particularly new entrants.

Cattle Producer Risk Management

Supply chain disruptions presented challenges for all producers, and risk management goals and outcomes vary depending on the individual producer and the strategy implemented. That said, a general conclusion is that risk management strategies performed as expected, or perhaps even better than expected considering the record positive basis during the periods of the most extreme market uncertainty and price declines, and effectively protected prices for those producers who had risk management plans in place.

CME Group offers both futures and options contracts for Live Cattle and Feeder Cattle. While continuous monitoring for potential improvements and changes is necessary, Live Cattle futures and options contracts in their current form are used extensively as risk management tools.

Using Feeder Cattle futures and options can be more challenging. Compared to Live Cattle, Feeder Cattle futures basis has more seasonal and regional variability resulting from seasonal and regional variability in supply of and demand for feeder cattle. For some contracts, the often strong seasonal price appreciation from initial trading to expiration precludes some producers from using feeder cattle futures as a risk management tool. There is also consistently lower volume in Feeder Cattle futures trade. Combined, these factors can limit the use of Feeder Cattle futures.

Livestock Risk Protection (LRP) offers a viable alternative to using commodity futures for risk management, particularly for calves and feeder cattle. Whereas commodity futures contracts have a fixed contract size, LRP's head count flexibility is an attractive feature. With major changes to LRP in recent years, including expanded head count limits, increased premium subsidies, and allowing premium payments to be made at the end of the coverage period, even producers who considered, but decided against implementing the product in the past may find the new specifications more accommodating. LRP can be a reasonable option to protect producer revenue in the case of a general market decline and may be particularly attractive to small to mid-sized producers or producers who are less familiar with or do not care for the attributes of commodity futures.

Forward contracts often utilize futures contracts as well. In many, or probably most cases, forward contracts establish basis at contract initiation and allow producers to lock-in a selling price based on the futures contract that is nearest, but not before the agreed upon cattle delivery period.

In general, risk management tools, used individually or in combination, can be used to achieve two different goals: to either "lock-in" a price or price window, or protect a producer from a price move in the undesired direction (price decrease if a seller, price increase if a buyer). It is important to note that risk management does not guarantee profitability, but it can decrease uncertainty and help prevent catastrophe. While each risk management tool offers unique advantages and disadvantages, many cattle producers have effectively employed the currently available suite of risk management tools. Such risk management tools encompass not only cattle prices, but feedstuffs, such as corn futures and USDA's Pasture, Rangeland, Forage (PRF) insurance program.

Producer Education

Producer education is key to cattle and beef industry success, and university extension programs have a critical role to play. Evaluating current extension programs, practices, and funding for opportunities to revitalize producer outreach, improve effectiveness, and better fit communication strategies with 21st century technologies is necessary and would be an extremely worthwhile endeavor. The wide array of responsibilities faced by beef producers, particularly small and medium-sized owner-operators, often means that financial assessment, business strategy, and risk management take a backseat to immediate animal husbandry demands. Cow-calf producers in particular would benefit from risk management education efforts. The importance of consistent, thorough, and applicable producer education, particularly surrounding business management and risk management, cannot be overstated.

Price Spreads Will Narrow

The biology and natural time-delays of the beef industry make it slow moving and capital intensive. Adjustments take years. Total US cattle numbers peaked in 2019 at 94.8 million head and will likely contract for another couple years. If not for the pandemic disruptions, cattle supplies and packing capacity would already be much better aligned. In such a "No-Covid" scenario, current packer gross margin percent would likely be closer to 2018 levels, 18%, rather than today's 30%.

With any luck we will work through the long tail of 2020's cattle backlog in Q3 2021. Year-over-year cattle prices are already improving and should continue to do so through 2H 2021 and beyond. In conjunction with tightening cattle supplies, capacity expansion will come online over the next several years and new technologies will reduce labor constraints, further shifting margins to the benefit of cattle producers.

Markets At Work

The shocks to the beef industry over the last couple years have presented the entire beef supply chain with enormous challenges. The resulting price movements have been frustrating for cattle producers, to say the least. Yet, these same price movements and supply chain disruptions have also contributed to the accelerated investment in packing capacity expansion, new technologies, and new business strategies that will help the beef industry adapt and evolve to ever changing demands. That's the market at work.