

DISAGGREGATING BEEF DEMAND:
DATA LIMITATIONS AND
INDUSTRY PERSPECTIVES

By

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Abstract: The United States beef industry contributes nearly \$70 billion (Industry Statistics, 2019) to the American economy and provides over 27 billion pounds of product each year (LMIC, 2018). The aim of this research was to better understand the complexities of the beef supply chain and what determines beef prices and demand. Through over thirty interviews with individuals representing 21 different companies and organizations, many determinants and factors impacting the beef supply chain were uncovered including exports, increasing carcass size, labor and trucking challenges, bone-in product popularity, food service and retail grocery differences, value-added products, fresh versus frozen product use, and changing consumer trends. Each of these topics are discussed in further detail throughout the report in addition to quantitative results found using the little data that was available. The end result is an aggregated report of challenges and opportunities facing the beef supply chain and evidence that more data needs to be available in order to calculate a complete beef demand system.

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CHAPTER I

INTRODUCTION

Over 30 million cattle are slaughtered in the United States each year, producing 26 billion pounds of beef products (LMIC, 2018). From these carcasses, hundreds of products are fabricated and distributed throughout the country and across the world. Each of these products has a separate demand and end user and there are numerous steps that move the beef product from packer to the end user. Most consumers and many producers do not fully understand or appreciate the complexity of the beef marketing system or how each step impacts total carcass value. There are over 600 thousand restaurants and 40 thousand grocery stores in the United States alone. The result is an array of markets to supply and, with a continually expanding beef demand, the beef industry continues to provide a wider range of beef products to meet consumer demands while improving whole carcass utilization and total carcass value.

Most beef demand research has been highly aggregated, but demand for beef products are separate for each individual item, and therefore, must be disaggregated in order to understand beef demand in total. However, in order to calculate a complete beef demand system, prices from all beef end users, as well as quantity data must be available in a short time frame to be consistent with the perishable nature of beef. Only wholesale price data is available on a weekly basis and no quantity data is available to facilitate

Specification of a complete demand system.

With these and other issues in mind, this research aims to provide producers, consumers, and other stakeholders in the beef marketing system with a more precise description of how each step in the marketing system, each cut, and various other beef demand and consumer issues impact total beef carcass value.

1.1 Objectives

General objective

Increase the efficiency and accuracy of the beef marketing system by identifying factors that determine total beef carcass value.

Specific Objectives

1. Utilize available data to identify possible relationships, trends, and issues among cuts within the beef carcass.
2. Conduct industry interviews with various sections in the beef marketing system to better understand their roles and factors impacting beef demand and carcass values.
3. Synthesize all interview and data research findings to provide a clear description of the beef marketing system and factors determining total beef carcass value.

CHAPTER II

BACKGROUND

In order to fully understand the complete demand system for beef, we must first outline some basic principles of a demand system and the factors affecting this demand. The following section will discuss these topics in more detail.

2.1 Economic Theory Review

Before diving in to demand systems, a thorough understanding of consumer choices, utility, and budget constraints must first be established.

Utility is a measure of the amount of pleasure, satisfaction, or well-being that is derived from the consumption of a certain product. This is a subjective term and therefore it is impossible to accurately measure, or assign a value to, the amount of utility that a consumer gives to each product. Consumers assign differing levels of utility to every product they purchase, from laundry detergent to apples, and even to meat. Consumers aim to maximize the total amount of utility they can gain from all products purchased, constrained by their budget, or amount of disposable income they have to spend on all products. Until recently, it was assumed that utility for meat only differed by species-pork, chicken, beef, et cetera. However, as Eales and Unnevehr, 1988, Coffey, et al., 2011, Yen and Chung, 2002, Dong et al, 2015, and Tonsor et al., 2010, all found in

their respective studies, meat demand should be disaggregated among species and products within those species.

These groups of products or beef categories may also be referred to as bundles of products, which consumers can base their utilities off of. These bundles, and their associated utilities, are subject to several axioms. Axiom 1, completeness, requires that two bundles of products, beef steaks versus beef roasts for example, can be compared and judged separately (Deaton, pp. 26-27).

Transitivity or consistency, axiom 2, states that if a consumer prefers beef steaks to beef roasts, and prefers roasts to ground beef, then the consumer should therefore prefer steaks to ground beef. These axioms define the preference ordering of each bundle of goods (Deaton, pp. 27). The third axiom, continuity, states that bundles of products have their own set boundaries, and with the addition of the previous two axioms, allow for the complete preference ordering of each bundle of goods through a utility function (Deaton, pp. 27-28). The final axiom, non-satiation, states that the utility function for beef products, or any other category of products, is non-decreasing in each argument, and for all bundles of products, the quantity is increasing in at least one of its arguments. These four axioms make up utility and reduces the consumer's choices, constrained by the utility function (Deaton, pp. 28).

Consumer demand is “the various quantities of a particular commodity that an individual consumer is willing and able to buy as the price of that commodity varies, with all other factors that affect demand held constant (Tomek & Robinson, pp. 10). Therein lies a demand relationship between price and quantity which are inversely related, and so, as the Law of Demand requires, the demand curve has a negative slope. This also means that at any point in time, consumers will choose more of a product, but only if that product is at a lower price (Purcell, pp. 3).

In order to compare demand curves between consumers, elasticities are employed, allowing for comparisons of demand curves without the need for consistent units. The simplest elasticity

measure, known as own-price elasticity, is simply the percentage change in quantity demanded divided by a percentage change in the price for that product. Another measure often used in demand system analysis is cross-price elasticity which allows us to measure how the quantity purchased of one product, such as a beef roast, responds to the price change of another commodity, such as a pork loin.. This value is calculated by multiplying the change in quantity of beef roast divided by the change in the price of pork loin, multiplied by the price of pork loin divided by the quantity of beef roast. This is represented mathematically in Equation 2.1 in which E_{bp} is the cross-price elasticity between b (beef roast) and p (pork loin) with regards to Q_b (quantity of beef roast) and P_p (price of pork loin) (Tomek & Robinson, pp. 32):

$$(2.1) \quad E_{bp} = \left(\frac{\Delta Q_b}{\Delta P_p} \right) \left(\frac{P_p}{Q_b} \right)$$

As described further in this section, elasticities play an important role in many aspects of demand system analysis.

Demand functions are subject to several properties by which the consumer decides how much of each good to purchase with given prices.

The relationship of quantity demanded as a function of prices and total expenditure is referred to as a Marshallian demand function (Deaton, pp. 15). These demand functions are also based on the assumption of a linear budget constraint represented by Equation 2.2:

$$(2.2) \quad x = \sum_k P_k q_k \quad (2.1)$$

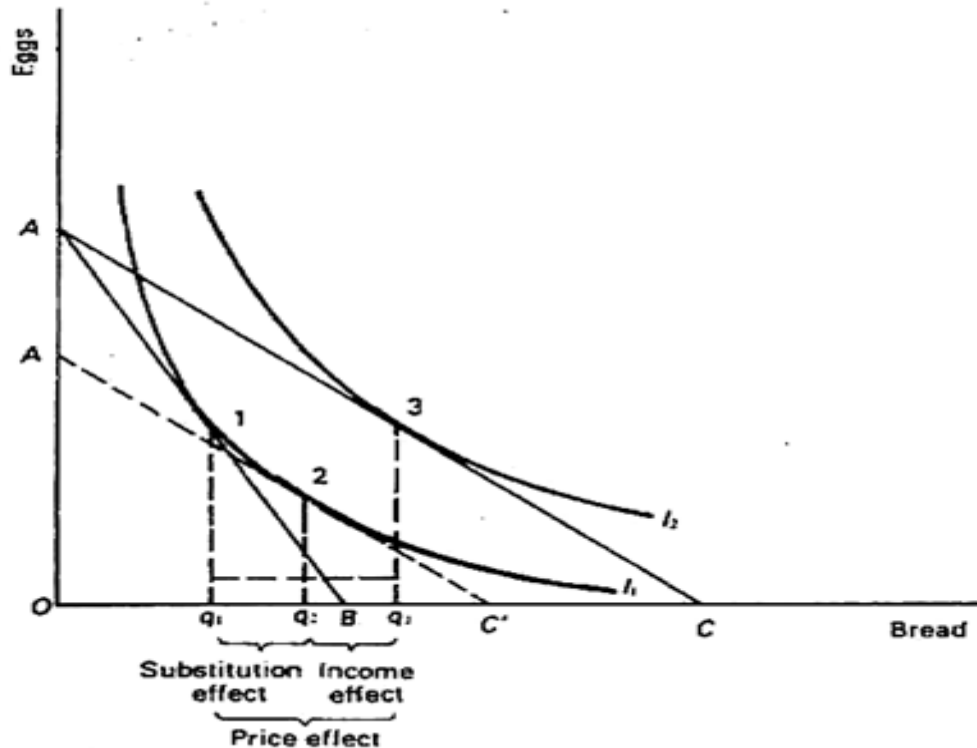
in which x, total expenditure is summed over prices and quantities (Deaton, pp. 14). Due to this budget constraint, the “adding-up” restriction is included, meaning that the sum of all prices and quantities must add up to total expenditure (Deaton, pp. 15). The adding-up condition can also be quantified through the Engel aggregation in which each product’s budget share multiplied by the

expenditure elasticity for that commodity, summed over all products in the consumer's consumption bundle, must be equal to one (Tomek & Robinson, pp. 40).

The homogeneity or "absence of money illusion" restriction implies that the unit in which prices and outlay are expressed does not affect the amount purchased of each unit, and that the demand functions are homogeneous of degree zero. This means that, since the budget constraint is linear and homogeneous in x and p , the vector of purchases, q , will satisfy the budget constraint for any multiple of x and p . In other words, if the consumer triples their total expenditure and prices are thrice as high, the constraint still holds- meaning that the restrictions are homogeneous of degree 0 (Deaton, pp. 15). In terms of elasticities and budget shares, homogeneity can also be tested by the sum of cross-price elasticities between two products plus the expenditure elasticity for one product, summed over all products in the consumption bundle, must equal zero (Deaton, pp. 15-16).

Another important property of demand is symmetry, which can help to answer the question, why do you buy less if the price has gone up? Symmetry requires that the matrix of substitution effects be symmetric. Both substitution and income effects can be illustrated through an indifference map in which indifference curves (which show the combinations of two goods, A and B, which will give the consumer the same amount of satisfaction or utility) and linear budget constraints are displayed. The point at which the budget line touches the highest indifference curve, or the tangency point, is where the consumer's total utility is maximized. This point also identifies the amounts of good A and B that the consumer will consume to maximize their utility, subject to their budget constraint. The substitution effect can be illustrated by moving along the indifference curve, in which the consumer's choice to buy less of good A means that they will buy more of good B or vice versa. Figure 2.1 below illustrates the concept of substitution and income effect, which will be described in the next paragraph, using two goods- bread and eggs.

Figure 2.1: Substitution and Income Effects; Source: Economicdiscussions.net



The income effect, on the other hand, involves adding new budget constraint lines to the indifference map. If the price of good A decreases, that means that the consumer can buy more of good A and will also impact how much of good B the consumer decides to consume. Therefore, a new budget price line may be drawn to illustrate the new maximum amount of good A and good B that can be purchased with the decrease in price A. With a new budget line, there may also be a new tangency point, or maximum utility point, where a higher indifference curve and new price line intersect. The difference between the two tangency lines illustrates the income effect, showing how much the consumption of good A and B will change with a decrease in the price of A. (Tomek & Robinson, pp. 10-12). The substitution effect is always negative as an increase in

price results in a decrease in consumption if there is an offsetting change in money income, which keeps real income constant (Tomek & Robinson, pp. 13). The income effect is usually negative as an increase in price decreases real income, and therefore also decreases demand (Tomek & Robinson, pp. 13). The exception to this rule is with inferior goods in which real income and demand are inversely related and the income effect offsets part or all of the substitution effect. A Giffen good or paradox occurs when the income effect of an inferior good's price outweighs the substitution effect, meaning a price increase would actually increase quantity demanded, creating a positive demand curve and violating the law of demand. For normal goods, the income effect is a positive number.

The concept of symmetry can also be defined by Equation 2.3 below:

$$(2.3) \quad \omega_i e_{ij} = \omega_j e_{ji}$$

The equation states that the budget share of product i multiplied by the cross-price elasticity of product i and j must be equal to the product of the budget share of product j and the cross-price elasticity between products j and i. (Henneberry, pp. 5)

The next restriction to discuss is the Cournot Aggregation restriction. This restriction, or homogeneity and symmetry restrictions are both imposed, but never all three. The Cournot Aggregation is defined by Equation 2.4 below:

$$(2.4) \quad \sum_{k=1}^n \omega_k e_{ki} + \omega_i = 0$$

In which ω_k represents the budget share of product k, ω_i is the budget share for product i, and e_{ki} is the cross-price elasticity between products k and i. (Henneberry, pp. 2)

These restrictions- adding-up (through the Engel Aggregation), homogeneity (or Cournot Aggregation), and symmetry help to reduce the number of parameters to be estimated when estimating a complete demand system (Henneberry, pp. 6).

2.2 Changes in Demand

With the basic theory of and restrictions of consumer demand and the demand and utility curves covered, the next logical topic of discussion is what factors cause changes in demand.

There are four major factors that affect or influence a consumer's level of demand, also known as determinants of demand. These include: population size and its distribution by demographics-age, geographic area, et cetera; consumer income and its distribution; prices and availability of other commodities and services (substitutes and compliments); and consumer tastes and preferences. (Tomek & Robinson, pp. 17)

Before discussing these determinants, it is important to first distinguish between a shift in a demand curve and structural changes within the demand function. A structural change would involve a change in one or more parameters within the demand function or in the algebraic form of the equation. In the case of the consumer's demand curve, a structural change would involve a change in the tastes and preferences of the consumer, as they would affect the consumer's utility and therefore their demand curve. (Tomek & Robinson, pp. 17-18)

Demand changes, on the other hand, occur when the entire demand curve shifts due to one of the determinants of demand described above (Purcell, pp. 5). The rate of population growth and the age distribution of this growth are closely linked with an increase in all food and for individual food products. In the early stages of a population boom, the demand for baby food and formula may increase relative to other products, but as the larger majority of the population moves to adolescence and adulthood, the demand for soft drinks and other high calorie items may increase. The proportion of the population living in rural versus urban areas may also shift demand for certain products such as milk (Tomek & Robinson, pp. 18).

For most agricultural commodities, income and demand are positively related, meaning that an increase in income will increase the demand for these products. There are exceptions, however, with commodities such as bread or rice, in which consumers will choose to purchase less of these products and more “luxury” food products like meat or produce when their incomes increase (Tomek & Robinson, pp. 18). Beef demand can be an exception to this rule as well, however, this will be discussed further in a later section. The quantity purchased of products will generally increase as income rises, but at a decreasing rate, and total expenditure will usually increase even more quickly as consumers switch their consumption from lower to higher quality products and services. The relationship between the amount spent on a particular item and total income is often referred to as the Engel curve or consumption function, as consumption is a function of income (Tomek & Robinson, pp. 19).

Changes in the tastes and preferences of consumers can also shift demand for products and may change for a variety of reasons- age, experience, education, marketing of the product, et cetera (Tomek & Robinson, pp. 20). For beef demand in particular, there have been numerous studies showing the effect that income distributions, household demographics, health concerns, various media and information sources, and other factors have impacted the demand for beef products. These will be discussed further in following sections.

The final determinant of demand are complimentary and substitute products. For substitute products, the increase in the price of one product will usually increase the demand for a substitute good, shifting the demand curve to the right. For instance, if the price of pork or chicken were to increase relative to beef prices, we would expect the demand for beef to increase and shift to the right. Again, there are exceptions to this rule which will be discussed in further detail later on. For compliments, such as pasta and tomato sauce, we would expect an increase in the price of one or the other to lead to a decrease in the demand of the other. So, if the price of pasta sauce increased, the demand for pasta would decrease, shifting the demand curve to the left, assuming that the

demands for these two products are completely separate from one another. (Tomek & Robinson, pp. 20-21).

2.3 Beef Demand Determinants

As mentioned in the section above, there are many factors beyond those listed in Section 2.2 that can determine or affect the demand for beef. This section will explore these determinants in more detail.

It may be best to start with what does not determine beef demand, but may often be confused as such. Beef consumption is often associated with beef demand, but this is highly inaccurate. Beef, like all meat products, is highly perishable, and therefore must be consumed or wasted. Often, consumers and producers view an increase or decrease in beef consumption as a measure of beef demand. However, these values are a better measure of beef supply. As beef production in the United States increases relative to other protein sources, or previous years' production, the amount of beef consumption in the country increases; the opposite is true after drought or other relatively low production time periods. For example, if there has been a surge in weekly cattle slaughter numbers, this means there is a large amount of beef coming through the supply chain that must be sold or consumed at some price. As the law of demand shows, as quantity increases, the price of the product decreases. So, unless there is a positive shift in demand, the increase in supply will be sold at a lower price. Therefore, it is important to understand that demand is not changing just because consumers are buying more beef at a lower price, this is just a change in quantity of beef demanded. Demand will change when consumers change the quantity they will buy at a particular price. (Purcell, pp. 3-4)

As discussed in the previous section, demand can be determined, and shifted by, changes in consumer incomes. It can be assumed that beef demand will increase when consumer incomes increase, meaning more visits to steakhouses, or purchases of higher quality beef products in the

grocery store. However, this is not always the case. As Purcell noted in his beef demand primer, per-capita disposable incomes in 1998 were increasing, but beef prices, adjusted for inflation, were at record lows and consumption was also at a lower value compared to 1996. In this instance, there were other factors determining the beef demand that were stronger than the impact of income change. (Purcell, pp. 5-6)

However, as Buse noted in his presentation at the 1989 Conference on the Economics of Meat Demand, income elasticities were affecting meat demand, but at varying levels. As income increased, meat consumption would increase more for low-income consumers, than for those in higher income brackets (Buse, 40). Buse also suggested that beef purchases increase as household incomes increase, but chicken and pork expenditures do not change and that the amount spent on beef will increase while pork and chicken budget shares will decrease (Buse, pp. 42).

Lusk and Tonsor found differing results in their 2016 study on the effects of price, income, and product category on disaggregated meat demand elasticities. In their analysis, Lusk and Tonsor found that overall, high income consumers were less responsive to own-price changes to food prices compared to low and middle income consumers. Further, these high income consumers also experienced the smallest effect in marginal utility due to an increase in the own-price of various meat options. Low income consumers gained the largest utility through purchases of ground beef, pork chops, and pasta, while high income consumers gained the largest utility through the purchase of steak, deli ham, chicken breasts, chicken wings and rice and beans. Interestingly, middle income consumers benefited least from ground beef, pork chops, deli ham, chicken breasts, chicken wings, rice and beans, and pasta compared to other income groups. Their research also found that high income consumers held the largest market share of steak, pork chop, and chicken breast purchases. Low income consumers purchased the most ground beef, deli ham, chicken wings, and rice and beans, suggesting that these are inferior products; low income consumers were also most likely to choose a no purchase option. These results all indicate that

income does have a significant impact on the demand of various meat products. (Lusk & Tonsor, Table 1).

Tonsor and Lusk also assessed how price changes affect the demand curves for various meat products, and found that the demand curves for ground beef, steaks, pork chops, and chicken breasts were all curved or convex to the origin, signifying that demand becomes more inelastic (or less price sensitive) as prices rise. In the case of steak, a change in income from low to high leads to a large positive shift (increase, to the right) in demand, while there is little effect on demand for pork chops as the income level changes. In all four meat choices, and most markedly in ground beef, the demand curve for low income consumers are more elastic (or price sensitive) than high income consumers. (Lusk & Tonsor, Figure 3)

By comparing the cross-price demand relationships in middle income consumers, it was evident that an increase in ground beef prices had a smaller positive shift in demand for steaks than the size of shift caused by a decrease in the price of chicken breasts (a negative shift in demand). Alternatively, an increase in ground beef or steak had a very minimal shift in the demand for chicken breasts. Both of these examples illustrate why the share of beef consumption has changed so drastically as chicken prices have decreased relative to beef and pork prices, while chicken demand remains relatively stable despite changes in beef prices (Lusk & Tonsor, Figure 4).

Huang and Haidacher found similar results in their 1989 meat demand system analysis. They found that demand for meats and poultry are rather independent when based on cross-price elasticity analysis. For example, if beef prices increased 10 percent, consumers would buy 1.9 percent more pork and 2.9 percent more chicken. Huang and Haidacher also looked at marginal price and income effects on meat demand and found that a ten percent increase in the own price will decrease consumption of beef and veal by 6.2 percent, pork by 7.3 percent, chicken by 5.3 percent, turkey by 6.8 percent, and 13.7 percent for other meats. Further, an increase in income by

10 percent increases red meat purchases by 4.5 percent and chicken and turkey consumption by 3.5 percent. (Huang & Haidacher, pp. 154). Both Lusk and Tonsor and Huang and Haidacher's findings support the hypothesis that prices and income are both significant factors influencing changes in consumer meat consumption.

By analyzing cross price elasticities, Lusk and Tonsor found that ground beef demand is more elastic (price sensitive) than steak demand, pork chops more elastic than ham, and that ground beef, steak, and pork chop demand are all more elastic than demand for chicken breast, which is rather stable, or not as sensitive, to price changes (Lusk & Tonsor, Table 3). Their analysis also found that own-price elasticities (effect on quantity from increase in the price of the same product) are less price sensitive for higher prices than when prices decrease. Similarly, cross-price elasticities (effect on quantity of one product from the change in the price of another) are usually larger for price decreases than price increases. This implies that there is less substitutability among products when their prices are high than when prices are low. This also supports the idea that higher income consumers usually consume a higher market share of high priced meat products compared to lower income consumers and are also usually less price sensitive than lower income households. In addition, cross-price elasticities between ground beef or steak and chicken breast are more inelastic compared to the cross-price elasticity between chicken breast and steak or ground beef (Lusk & Tonsor, Tables 3 & 4).

Tonsor, Lusk, and Schroeder conducted additional research funded by the Cattlemen's Beef Board in early 2018. This research found that beef demand has become less own-price elastic over time, meaning that consumers have become less sensitive to beef price changes (Tonsor et al, pp. 7). However, demand for beef has also become more sensitive to consumer expenditures, meaning that beef demand is also more sensitive to consumer willingness to spend their income. This indicates that higher priced beef products like steak are becoming more of a luxury good as consumers with higher income growth also hold the largest share of additional demand growth

(Tonsor et. al, pp. 7-8). Tonsor et. al found further evidence to support the findings of Lusk and Tonsor's previous work. They found that pork is becoming less of a substitute for beef as was the case previously, and some beef and pork products may actually be closer to compliments, think hamburgers and bacon. As meat prices have increased, Lusk and Tonsor found that cross-price elasticities of disaggregated meat demand will decrease as price increases, which also indicates that pork and chicken prices are not necessarily important beef demand determinants (Tonsor et. al, pp. 8).

Another important determinant of demand changes are consumer tastes and preferences. As Chavas explained in his discussion on the structure of meat demand, there are two broad factors that caused the changes in meat consumption in the United States- changing meat prices and changing lifestyles of the American consumer. The former has already been discussed, but the latter is more difficult to determine and measure. Chavas and Buse both mentioned the change in the amount of women working outside of the home and desire for convenience or quick preparation foods as a change in preferences that have affected the demand for various meat products. As Buse described, there have been many factors leading to an increase in the desire for convenience products. Increasing incomes and more labor force participation from multiple members of a household have raised the value of time for consumers, particularly women. Convenience products, which allow for less time preparing foods and more time with family, at work, et cetera and increasing expenditures at food establishments outside of the home, both show that consumers are willing to spend more for convenience (Buse, pp. 34-35). These products also impact the demand for specific protein products that are used in convenience products or served at restaurants, more specifically in fast food establishments. A 1983 study found that 60 percent of the food dollar was going to convenience foods and meals eaten away from the home (Buse, pp. 35). Grain and beverage products are sold in the majority of convenience stores while dairy and meat products are less likely to be available at such locations,

unless they are already further processed or prepared in some way. This in itself affects consumption of these products and indirectly, the demand for these products. In addition, fast food restaurants, and further processed meat products often include a small variety of protein products- ground beef, chicken, and fish which effects the elasticities of beef and poultry (Buse, pp. 35).

Buse includes the number of wage earners per household and the household's stage in the life cycle as factors impacting beef demand. A 1972 to 1973 and 1980 to 1981 study found that single households devoted nearly 61 percent of their food budget on food eaten away from home and convenience food products. Married couples with two earners are similar, spending 44 percent of their food budget on convenience and restaurant food products (Buse, pp. 46-47). The family life cycle is described as the process by which a family moves from newlyweds to parents and homeowners, then retirement, old age, and dissolution. As the age of the head of the household increases, the portion of income spent on food also increases. Those aged 34 to 44 spend 17.4 percent of their disposable income on food, with the higher food portions attributed to children in the household. Those in retirement age and older (65 and over) spend 23.5 percent of their disposable income on food, perhaps because they have more disposable income in their retirement years (Buse, pp. 46, 48).

Tonsor, Lusk, and Schroeder found other factors that impact beef demand, including food values, household income and size, time of year, and other demographic factors such as age, gender, region of residence, race, and political ideology. Food values included "taste", "safety", "price", "nutrition", "appearance", "naturalness", "convenience", "origin", "animal welfare", "environment", and "novelty". Overall, "taste", "safety", "price", and "appearance" impacted food choices the most among consumers (Tonsor et. al, Figure 4.3). More specifically, when choosing a steak, consumers perceived the product to be "convenient", "tasty", "attractive", and "novel" (Tonsor et. al, Figure 4.5). Ground beef, on the other hand, was viewed as "safe", "well-

priced”, “convenient”, “tasty”, and “attractive” in appearance (Tonsor et. al, Figure 4.6). As other research has found, steak demand increases with household income, but varies little with household size and varies only slightly by age of the consumer.

Other demographic factors also impact the demand for steak. Males are more likely to purchase steaks than females, steak purchases also increase drastically the more politically conservative the consumer is. On average, race has little impact on steak purchases, except for those of Indian origin. Region of residence also has little impact, although those in the Midwest tend to buy slightly more steak compared to a non-meat option (Tonsor et. al, Figure 4.7). When comparing demand for ground beef to a non-meat option, household income has a smaller effect, but demand increases with age and household size. Similar to steak, ground beef demand compared to non-meat options are higher the more politically conservative the individual is, and also higher for males than females. When comparing ground beef demand among races, Asians, non-Hispanics and Hispanics all have a small effect on demand, while white and black consumers have a positive effect, and Indians have a large negative effect on ground beef demand (Tonsor et. al, Figure 4.8).

Tonsor, Lusk, and Schroeder also studied various beef demand drivers in the periods of 1990 to 2007 and from 2008 to 2017. As expected, demand was higher in the months of May and June during grilling season, and lower in February and November. In addition, the effect of media discussion of beef attributes- Taste, Tender, and Flavor (TTF) - has had a positive impact on beef demand, increasing beef demand by 0.48 percent with a one percent increase in TTF media volume (Tonsor et. al, pp. 14). Media coverage of Atkins, High Protein, and low carbohydrate topics have also had positive effects on beef demand, but a smaller marginal benefit in the 2008 to 2017 period than the previous time period. Other media topics such as convenience, safety, climate change/environment and meatless diets decreased beef demand. Beef demand is stronger,

however, when media coverage includes cancer, sustainability, and animal welfare. (Tonsor et. al, pp. 16).

All of this information on tastes and preferences, substitutes and compliments, and income and price effects, should provide the industry with information leading to what is causing shifts in current beef demand. While demographic factors and food values impact tastes and preferences, this effect is small compared to the obvious impact that consumer incomes and changing beef prices have had on beef demand.

2.4 Complete Demand System

With a thorough background in what is included in a demand system and what determines or shifts demand, it may be helpful to explain how a complete disaggregated demand system for various beef products may be created or how other researchers have attempted to create a version of such a system.

To explain this, a review of consumer preferences and restrictions are necessary to complete a demand system. Most consumers are purchasing a wide variety of products and services with their disposable income, and these choices are all influenced separately by different factors. In order to reduce the number of products included in a demand system, products may be combined, or aggregated, into product groups in which price moves are parallel, and can therefore be treated as a single good (Deaton, pp. 121). For example, cereal, rice, bread, and pasta may all be put into a grain consumption group instead of determining the consumer's demand for each product separately. In order for this to occur, however, separability must be determined for each group of goods. If separability holds, then products can be put into separate groups in which preferences for one group is not impacted by preferences for another group of products. If separability does not hold, or is not assumed, then demand must be determined for all individual products that may take up a consumer's income.

Separability can be defined as strong or weak. Weak separability means that the marginal rate of substitution (MRS) between two products within the same product group are not affected by the quantity consumed of a product in another category. For example, the MRS between cereal and rice in the grains category would not be impacted by the quantity demanded of beef in the meat category (Henneberry, 23 Feb. 2018). This can be shown mathematically by the Equation 2.5 below:

$$(2.5) \quad \frac{\partial \left(\frac{\partial f}{\partial q_{gc}} / \frac{\partial f}{\partial q_{gr}} \right)}{\partial q_{m,b}} = 0$$

Where f is a utility function, g is the broad grain group, and c and r are cereal and rice, respectively, in the grain group. Further, m is a separate meat group, and b is beef within that group. (Henneberry, 23 Feb. 2018)

Strong separability implies that the marginal rate of substitution between a product in one group and a separate product in another group is independent of the quantity consumed of a third product in a third group. For example, the MRS between rice in the grain group and beef in the meat group is independent of the quantity consumed of milk in the dairy group. Again, this can be illustrated in Equation 2.6 below (Henneberry, 23 Feb. 2018):

$$(2.6) \quad \frac{\partial \left(\frac{\partial f}{\partial q_{gr}} / \frac{\partial f}{\partial q_{mb}} \right)}{\partial q_{d,m}} = 0$$

Another restriction of demand is additivity. Additivity involves partitioning foods into separate groups and then adding a utility value to each group that, when added together, provides the consumer's total utility. If separability holds, then $u = f_1(q_1) + f_2(q_2) + \dots + f_m(q_m)$ where m is the number of different product groups. (Henneberry, 23 Feb. 2018).

If consumers can allocate goods into two tiers or levels, then two-stage budgeting can occur. In this context, a consumer may first create three broad categories to choose from or rank- food,

shelter, and entertainment. In the second, or lower level, each of the three broader categories are broken down into further categories such as grains, dairy, meat, and produce for food (Deaton, pp. 123). With these assumptions that reduce the number of parameters to be calculated, it may be easier to understand now why a complete demand system for beef products specifically would be very difficult.

To completely understand relationships among all cuts within the beef carcass, as this research aims to discover, a complete demand system for all cuts within the beef carcass, not just aggregated into steaks, roasts and ground beef, would be needed. To do this would require price and quantity data for all cuts produced from the beef carcass, to calculate own-price and cross-price elasticities for all cuts, providing information as to how demand for cuts within the carcass are affected by price changes in other cuts. To further complicate matters, a complete demand system also requires price and quantities for all other meat and food products that a consumer chooses to determine the cross-price elasticities between all of these other products and cuts within the beef carcass. Further, weekly or daily data reports as opposed to monthly or quarterly data would be needed as beef consumption patterns and supply change over short periods of time that would not be reflected in monthly data. Unfortunately, there is not reported price data on all beef cuts, just those sold at the wholesale level, and there is no required quantity reporting for each cut either, so a complete demand system is currently not a possibility with the data available. These wholesale price values, for only roughly 50 beef products, do not give an adequate value as all other end users (exporters, restaurants, retail grocery, et cetera) utilize these wholesale cuts that can be broken down into hundreds of products. Some retail price data is available, but is reported monthly and is only reported for a small set of products. Another issue with retail data is that not only is it only reported monthly as opposed to weekly or daily, it only includes prices at a retail grocery store, leaving out the other major end user of beef products-restaurants and exporters

2.5 Previous Work

In the earliest attempts at beef demand analysis, researchers utilized what price and quantity data they had at a highly aggregated level. This often meant comparing income or price effects on the broad meat categories of beef/veal, chicken/poultry, pork, and seafood. While statistically significant effects on meat demand in each category were found, often their findings were biased and led to confusing results. Huang and Haidacher utilized data from 1956 to 1983 to determine the effects of price and income on meat consumption by broad category. Kesavan et al and Moschini and Milke used an almost ideal demand system in their 1993 and 1989 articles, respectively, to determine long run structural changes in US demand systems. There are several similar research articles published in the 1980s and 1990s utilizing aggregated data that found biased or confusing results. These results included negative cross price elasticities which indicated pork and beef to be compliments, when logically, they were hypothesized to be substitutes. These results provide evidence that a disaggregated approach to demand system analysis would provide a more accurate description of meat demand determinants.

There are many other examples of researchers creating a meat demand system in which beef is disaggregated into at least a few categories, rather than demand as a whole aggregated species. The next section will briefly touch on their work, findings, and which demand model they used.

Coffey, Schroeder, and Marsh employed the Almost Ideal Demand System (AIDS) and the Expectation Maximization Algorithm (EM) to study the utility of consumers of various meat products. Through their approach, a difference in preferences among various beef (ground, roast, steak, other), pork (chops, roast/ham, other), and fish (fin and shell) products were found. These preference differences included a seasonality effect between different products from each meat source throughout the year. For example, miscellaneous poultry demand was the highest in the fourth quarter of the year, most likely from whole turkey demand for Thanksgiving. Beef steaks

and ground beef experienced an increase in demand in the second and third quarters, during peak grilling season.

Dong, Davis, and Stewart employed the Anemiy-Tobin approach and maximum likelihood model using Nielsen Homescan data to estimate a demand model for a similar disaggregated set of meat choices. Beef (ground, steak, other), pork (loin, other), chicken (parts, other poultry), lunch meat, seafood, other meats, total expenditure, and various demographic factors were studied. They found that most consumers will buy a diverse product mix of seven to eight products, even at low meat expenditure levels. Steak purchases increase the most with income and seafood increases the least. It was also determined that all ten of these products are considered normal or luxury goods but the consumer's chosen product mix depends on the level of expenditure (Dong et. al, Section 6). Eales and Unnevehr also employed the AIDS model and through weak separability tests, found that consumers choose among meat products not just aggregated product groups by species. However, contrary to Dong et. al results, they found that whole chicken and beef hamburger were considered inferior products while chicken parts, processed meat products, and beef steak cuts were viewed as normal goods. (Eales & Unnevehr, pp. 526). While Eales and Unnevehr's work is older than the others discussed in this section, they were the first to confirm that it was no longer acceptable to group meat products by just their species but instead into individual types of meat products within each species category- Furthermore, their weak separability tests and separability trees suggested that consumers allocate their choices or utility level within groups of meat based on quality: pork, lower quality beef and chicken in one stage, and higher quality chicken and beef products in the second group (Eales & Unnevehr, pp. 526).

Demographic factors also showed an impact on elasticities among meat products. Increasing the household size by 1 percent decreases steak consumption by 0.08 percent and increases ground beef quantity demanded by 0.07 percent. While food safety and health media information was

also tested, there appears to be little statistically significant impacts of this type of information, either positive or negative, on the demands of any meat products, despite conventional wisdom (Coffey et. al, Table 4). Dong, Davis and Stewart found that the age of the female head of household is the most important factor impacting household meat purchases as younger individuals prefer more ground beef, steak, poultry and lunch meats, and females who have a college degree are more likely to purchase poultry and seafood. Furthermore, African Americans are less likely to buy beef, pork loins, and lunch meats, while Asian households buy more beef, other pork, chicken, and seafood. Chicken and seafood demand is most prevalent among those in the Eastern part of the U.S., pork and lunch meats in the Central Region, and beef and other poultry demand is higher in the Western United States (Dong et. al, Section 5.4).

Tonsor, Mintert, and Schroeder used a Rotterdam model to test the effects of various household demographic and media information on meat demand. Their results found that only recent effects from provided health information were significant. In the long run, however, the effects of negative health information are no longer relevant or effect meat demand. Further, increased information on the links between fat, cholesterol, heart disease, arteriosclerosis, and diet reduced demand for beef demand while increasing demand for other products. Similar to findings by Tonsor, Lusk, and Schroeder's work for the Beef Board, information regarding zinc, iron, and protein health benefits positively impacted both pork and beef demand as did positive information regarding Atkins, high protein, or low-carbohydrate diets (Tonsor et. al, pp. 13). As indicated in earlier sections regarding consumer tastes and preferences, Tonsor, Mintert, and Schroeder found that an increase in the amount of food eaten outside of the home and the number of women in the workforce does affect meat demand. In fact, more consumption outside of the home increased pork and chicken demand while decreasing beef demand by about the same amount (Tonsor et. al, pp. 13-14). More women in the workforce had a significant impact on pork demand but led to few changes in beef or chicken consumption (Tonsor et. al, pp. 14). Food safety recalls were

another subject of study, however, these effects are small compared to household demographic, price, and income effects. Beef was found to be the only demand impacted by its own product recalls and was found to be more sensitive to own product and spillover effects due to recalls of meat products from other species. Beef recalls actually increase poultry demand in the short run and even more so in the long run and pork recalls negatively affect beef demand (Tonsor et. al, pp. 14).

Coffey, Schroeder and Marsh also tested Hicksian price elasticities to determine the substitutability of various meat products. They found that miscellaneous poultry, pork roast, and beef roast are all substitutes, but pork roast is not a substitute for any additional beef products. This confirms that pork roasts and hams are not competing with all beef products available, just beef roasts (Coffey et. al, Table 6). It is also important to note that price decreases do increase beef steak purchases but do not affect the demand of other beef products, suggesting that there are no substitutes for steak within the beef carcass. While previous studies have suggested that roasts and ground beef are in fact substitutes for steak, the thought process of the consumer at the meat counter would not support this suggestion as a roast or ground beef does not provide the same eating experience as a steak does. Furthermore, the results also indicated that a decrease in steak price will reduce pork chop demand but not demand for poultry breasts (Coffey et. al, pp. 2356).

Another study by Yen and Huang used the 1987 to 1988 Nationwide Food Consumption Survey data and the translog demand system to find a disaggregated demand system for beef products (steak, roast, ground beef and other beef) and other meats. Demographic factors similar to others discussed in this section were tested with a few additions- “urban”, “region of residence”, “race”, “homeowner” or not, “female meal planner”, and “food stamp recipient”. Their results indicated that demand for roasts and other beef products are price sensitive (elastic) and demand for steak, ground beef and other meat are inelastic (Yen & Huang, pp. 329-330). It was also determined that steak demand was impacted by age at all levels (less than 20 to greater than 65), urban residence,

all three regions of residence (Northeast, Midwest, and South), Hispanic race, and food stamp recipient. Roast demand was impacted by age less than 20 and older than 65, and Hispanic race. Ground beef was significantly impacted by those aged 20 to 64, live in the Northeast, and white. Other beef demand was impacted by Midwest and Southern region residence, and Hispanics (Yen & Huang, Table 2).

2.6 Beef Market Complexities

To this point, beef demand determinants and factors impacting the demand for the final beef product have been discussed. But, the beef demand reviewed up to this point has been purely for the final meat product, whether at a restaurant or purchased at your local grocery store meat counter. What makes the beef marketing system one of, if not the most, complex of all products is due to a concept known as derived demand.

Derived demand is broadly defined as the demand for inputs that are used in the final product, such as the demand for wheat that will go to a bakery, or corn that will go to a feedlot (Tomek & Robinson, pp. 25). In the beef industry, there are numerous levels of derived demand, and while connected, they often do not directly create the final beef product or its final demand.

From the beginning of the beef supply chain, a discussion of the goals of each step in the marketing system will follow. For a complete system, beginning at the seed stock or purebred level seems most logical. Seed stock operations supply genetics and improvements for other cattle producers. This includes purebred production of bulls, cows, and heifers that can be sold directly to producers to improve herd genetic capabilities. They can also sell semen or embryos from high quality animals produced on a seed stock operation, allowing the owner to maintain ownership of the animal while selling its genetics and allowing other producers to benefit from the genetic qualities of their cattle. Seed stock producers may also exhibit or show their cattle at local, regional, or national livestock shows to market their operation's its high quality stock. The main

goal of this type of operation is to find the best genetic traits for a specific breed of cattle, generate offspring with these traits, and sell their high quality, and often premium priced animals, or their genetic material in the form of embryos and semen to other producers.

Consumers of seed stock operations are usually cow/calf producers. These operations may be purebred or commercial, purchasing and raising cattle of various breeds and crosses to grow as many calves as possible. These operations can be anywhere in the country but often require large land allotments in order to provide enough forage for females which will raise a calf each fall or spring, depending on the calving program of the operation. These operations maintain a herd of cows, replacement heifers, and bulls. Due to the large land requirement, cow/calf operations are usually centered in the Great Plains states of Texas, Missouri, Oklahoma, Nebraska, and South Dakota. However, there is also significant cow/calf production in California, South Dakota, Montana, and other states with ample pasture supply. These operations strive to grow and sell the largest possible calf in the shortest amount of time as their output, calves, are sold on a per pound or hundred weight basis. While producers may also sell bulls, replacement heifers, or cull cows throughout the year, their main objective is to grow calves that will then be purchased by a feedlot or stocking operation. These calves are often sold at weaning (around 205 days of age). However, producers who have the roughage availability or a feedlot may keep the calves until they weigh enough to be sold directly to a final finishing feedlot.

The customer of a cow/calf operation is frequently a stocking or backgrounding operation. These operations buy calves that are not large enough to go directly to a finishing feedlot from cow/calf operations and feed them on rangeland pasture or other roughage. These calves are usually purchased after weaning at weights that may range from 300 to 800 pounds and use a number of production strategies (Johnson et. al, pp. 2). Some stockers may buy light or poorly managed calves, then feed them until they have gained weight, quality, and performance, and then pool these animals into large, uniform lots to be sold to a commercial feedlot. Stocking operations are

centered in the southern part of the country where cattle feeding is also prevalent, mainly Texas, Oklahoma, Nebraska, and Colorado. These operations often emphasize efficiently using forages that are available in order to increase cattle weight gain. In Oklahoma specifically, this is done by grazing cattle on winter wheat pastures which provide an excellent source of nutrition and allow cattle to gain weight quickly. However, other operations may graze stocker cattle throughout the summer, using a native range or pasture as the primary forage base (Johnson et. al, pp. 2).

Regardless of the operation type or production system, their profitability is dependent on managing, growing, and strategically marketing cattle in order to sell them at the highest price possible. Again, these animals will be sold by weight, so selling the largest animal possible with the lowest cost of inputs is the main goal of the stocker or backgrounding operation.

The customer of the stocking or backgrounding operation is the commercial feedlot. Feedlots can house tens of thousands of cattle with the sole purpose of adding weight and performance to these animals through a high energy diet. These animals come from across the country at 7 to 14 months of age and are kept on feed and sold to a processor after 150 to 240 days when the animal has reached market weight or is ready for slaughter. Often, cattle in feed yards are a wide variety of breeds, quality levels, and backgrounds. A significant portion of feedlot cattle in some feed yards are male Holstein or other dairy breed animals. These animals, while often associated with milk production, can produce highly marbled, prime carcasses when fed correctly. Holsteins are fed for ten to twelve months in order to finish, but according to a recent Dairy Herd Management article, contribute roughly 23 percent to the beef supply and 32 to 60 percent of prime carcasses, depending on the year (Boetel, 2017). While black hided cattle who meet certain quality, size, and yield standards may bring a premium at the packing plant, the feedlot is still paid based on the weight of the animals. So, throughout the marketing process, the goal of the producer is to grow and sell the largest animal possible, as their profits depend on pounds of product sold. But,

as will be discussed in a later section, larger cattle are not always what the end user desires or demands, so there appears to be a disconnect between goals of all levels of the beef supply chain.

The customer of the feedlot is the packing plant or processing facility in which the animal is fabricated into hundreds of meat cuts and by-products. Here, the animals are graded based on quality, yield, and other factors that impact the price paid to the feedlot or other producer. While the packer buys by the pound, they also sell by the pound, and the demand for those pounds differs as it exits the packing house doors. Customers range from plants that will further process products to wholesalers, grocery stores, and food service establishments. Each of these customers demand a different product, with different quality, size, and yield specifications. Some wholesalers discount if carcass sizes are too large as they don't meet the demands or requirements of their customers, or worse, they don't even fit into the box. It is at this step in the marketing chain that differing goals and demands are most evident, and that issues with increasing carcass size and other factors that producers may benefit from or ignore, are realized and dealt with as it moves to the end customer.

The further processor takes products needing additional fabrication to beyond the packer level and add value or further fabrication or preparation methods to the beef product. This may include taking trim or other lower quality steak items to be breaded and cooked as a chicken fried steak to be sent to a grocery store or fast food restaurant, or it may include cutting steaks into the correct portion sizes for a restaurant chain or grocery store meat case.

The wholesaler will buy boxed beef, or the sub-primal beef portions fabricated at the packing house, and send them to their own customers who will further fabricate them for their own uses.

The further processor or wholesaler will sell to either a retailer, food service, or both. Grocery stores (retailers) have certain specifications and product mixes that they sell in their stores. They are selling based off of quality, value, and quantity. In the grocery store, it is important that the

products look attractive and appetizing in their packaging, are priced competitively based on quality and consumer demand, and meet the quantity and quality specifications as determined by the store's meat buyer. Food service provides restaurants, convenience stores, cafeterias, nursing homes, hospitals, and anywhere else that serves food, with their products. A high end steak house may have different quality specifications than a fast food or casual dining restaurant. However, in all cases the product needs to be consistent in size and quality so that those who are preparing the food can easily provide a consistent product to the customer. Again, this is where the issue of large cattle and carcass sizes, the goal of most in the live animal production chain, becomes a struggle for those providing to the final customer. Research by Maples, Lusk, and Peel in 2018 found that consumers still prefer a smaller, thicker cut steak to a larger, thinner cut steak. As carcass sizes continue to increase, it is becoming increasingly difficult for packers, retailers, and food service to meet portion specifications without cutting steaks thinner than the customer prefers.

CHAPTER III

BEEF FABRICATION

This chapter provides detailed beef fabrication information which helps to explain the large quantities of beef products, the source of those products in the carcass, and beef fabrication options. As stated previously, wholesale (and some retail) price data is available for roughly 50 products from the beef carcass that are sold to end users from the packing plant. These cuts are fabricated according to the Institutional Meat Purchasing Specification (IMPS) guidelines and are sold by each cut's respective IMPS code and product specification. Each cut is named and categorized by primal (Round, Chuck, Rib, Loin, Short Plate, Brisket, or Flank) and subprimal (muscle group) that the cut is fabricated from. Table 3.1 lists all wholesale cuts with reported prices. It should be noted, however, that IMPS variations for additional cutting or size requirements are also available, but the cuts listed are just for those that are federally reported. A glossary of these and other terms used throughout this report is included in Appendix E.

Table 3.1: Wholesale Beef Cuts by IMPS Number and Primal

IMPS #	Primal	Subprimal/Name
109E:1	Rib	Ribeye Lip-On Bone-In
109E:3		Ribeye Boneless Light
112A		Ribeye Boneless Heavy
113C	Chuck	Semi-Boneless Neck-Off
114		Shoulder Clod
114A		Shoulder Clod Trimmed
114D		Clod Top Blade (Flat Iron)
114E		Shoulder Clod Arm Roast
114F		Clod Tender (Petite Tender)
115		Boneless 2 Piece
116A		Chuck Roll 1x1 Neck Off
116B:1		Chuck Tender
116B:3		Chuck Roll Retail Ready
130		Short Rib
120	Brisket	Deckle-Off Boneless
120A		Point-Off Boneless
121C	Plate	Outside Skirt
121D		Inside Skirt
121E		Outside Skirt Peeled
123A	Short Plate	Short Rib
124	Back Ribs	Fresh and Frozen
160	Round	Bone-In
161:1		Boneless
161:3		Boneless Peeled Heel-Out
167A		Knuckle Peeled
168:1		Top Inside Round
168:3		Top Inside Round
169		Top Inside Round Denuded
169A		Top Inside Round Side Off
170		Bottom Gooseneck
171B		Outside Round
171C		Eye of Round
174:1	Loin	Short Loin 2x3
174:3		Short Loin 0x1
175		Strip Loin 0x1
180:1		Strip Boneless Heavy/1x1
180:3		Strip Boneless/0x1
184:1		Top Butt Boneless Heavy
184:3		Top Butt Boneless
185A		Bottom Sirloin Flap
185B		Ball-Tip Boneless Heavy
185C		Sirloin Tri-Tip
185D		Sirloin Tri-Tip Peeled
189A		Tenderloin Trimmed Heavy
191A		Butt Tender Trimmed
193		Flank
		Cap and Wedge
		Pectoral

In 2000, two researchers, Chris Calkins and Dwain Johnson, of University of Nebraska and University of Florida, respectively, funded by the National Cattlemen’s Beef Association (NCBA), began their research on the Chuck and Round beef primals. The focus of their research was to determine if more value could be found in these primals by cutting steaks from single muscles within these primals as opposed to conventional roasts which are less valuable (per pound) than a steak would be. In 2002, Calkins and Johnson fabricated the “Flat Iron” steak, from the infraspinatus muscle of the Shoulder Clod portion of the Chuck primal. Within 10 years, the cut was responsible for nearly \$80 million in revenue. The duo went on to identify 39 other value-added cuts from the Chuck and Round primals (Roybal, 2009).

The following pages of this chapter provide diagrams that further describe how each primal is fabricated into available cuts. The bolded boxes are those cuts that are price reported at the wholesale level (included in Table 3.1), while the boxes of dotted lines are those products that the National Cattlemen’s Beef Association list as “value added” or “innovative” cuts from the Chuck and Round primals specifically. The meat diagrams were created using information and images from various sources including the North American Meat Institute (NAMI) Meat Buying Guide, the University of Nebraska’s Bovine Myology website, and the NCBA’s “Beef it’s What’s For Dinner” website.

Each cut is labeled by its IMPS number, NAMI given name, and muscle(s) included in the cut or subprimal. In order to save space, muscle names were abbreviated and are included in Table 3.2 which lists the names of each muscle by the abbreviation used in the meat and muscle diagrams.

Table 3.2: Muscle Diagram Name Abbreviations

Abbr.	Muscle Name:	Abbr.	Muscle Name:	Abbr.	Muscle Name:
AD	Adductor	BF	Biceps femoris	CT	Cutaneous trunci
CX	Complexus	GA	Gluteus accessorius	GN	Gastrocnemius
GM	Gluteus medias	GP	Gluteus profundis	GR	Gracilis
IL	Iliacus	IN	Infraspinatus	LC	Longissimus costarum
LD	Longissimus dorsi	LD	Latissimus dorsi	LS	Longissimus
MD	Multifidus dorsi	OAE	Obliquus abdominis externus	OAI	Obliquus abdominis internus
PC	Pectineus	PLG	Popliteal lymph gland	PLG	Prescapular lymph gland
PMa	Psoas Major	PMi	Psoas Minor	RA	Rectus abdominus
RF	Rectus femoris	RD	Rhomboideus	SA	Sartorius
SC	Subscapularis	SD	Serratus dorsalis	SD	Spinalis dorsi
SDF	Superficial digital flexor	SL	Sacrociatic ligament	SM	Serous membrane/ Peritoneum
SM	Semimembranosus	SP	Splenius	SS	Supraspinatus
ST	Semitendinosus	SV	Serratus Ventralis	TA	Transverse abdominis
TB	Triceps brachii	TFA	Tensor fasciae antibrachii	TFL	Tensor fasciae latae
TM	Teres major	TZ	Trapezius	VI	Vastus intermedius
VL	Vastus lateralis	VM	Vastus medialis		

Figure 3.1 contains the Square Cut Chuck, IMPS # 113. The North American Meat Institute (NAMI) has derived eleven cuts from the Square Cut Chuck, however only BF 113C, the Square Cut Chuck, Neck Off, 2 Piece Boneless and BF 130, Chuck Short Ribs are wholesale price reported. The bottom of the page contains an additional table of other products from the Square Cut Chuck that may be available at a retail location. Short Ribs are highly exported to many markets including many Asian markets and Africa and boneless Short Ribs can also be used for 50% lean ground beef.

3.1. Chuck Diagrams

Figure 3.1: BF 113 Square Cut Chuck

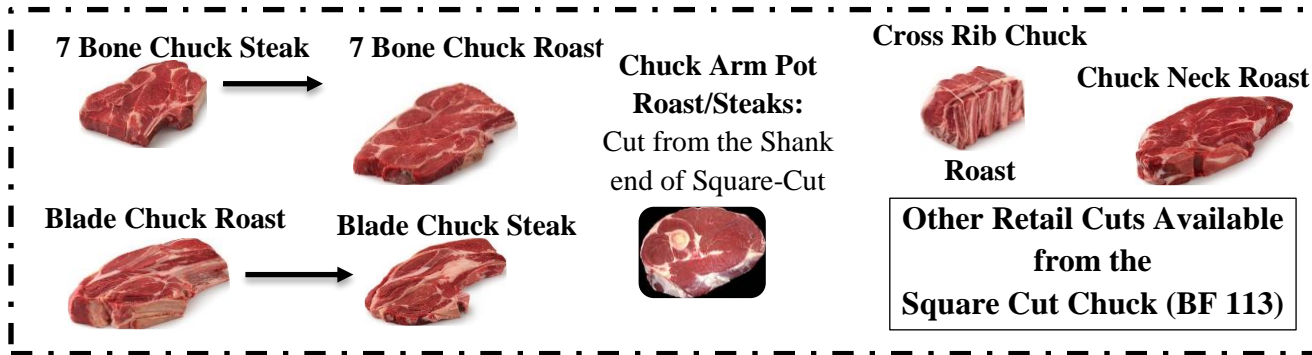
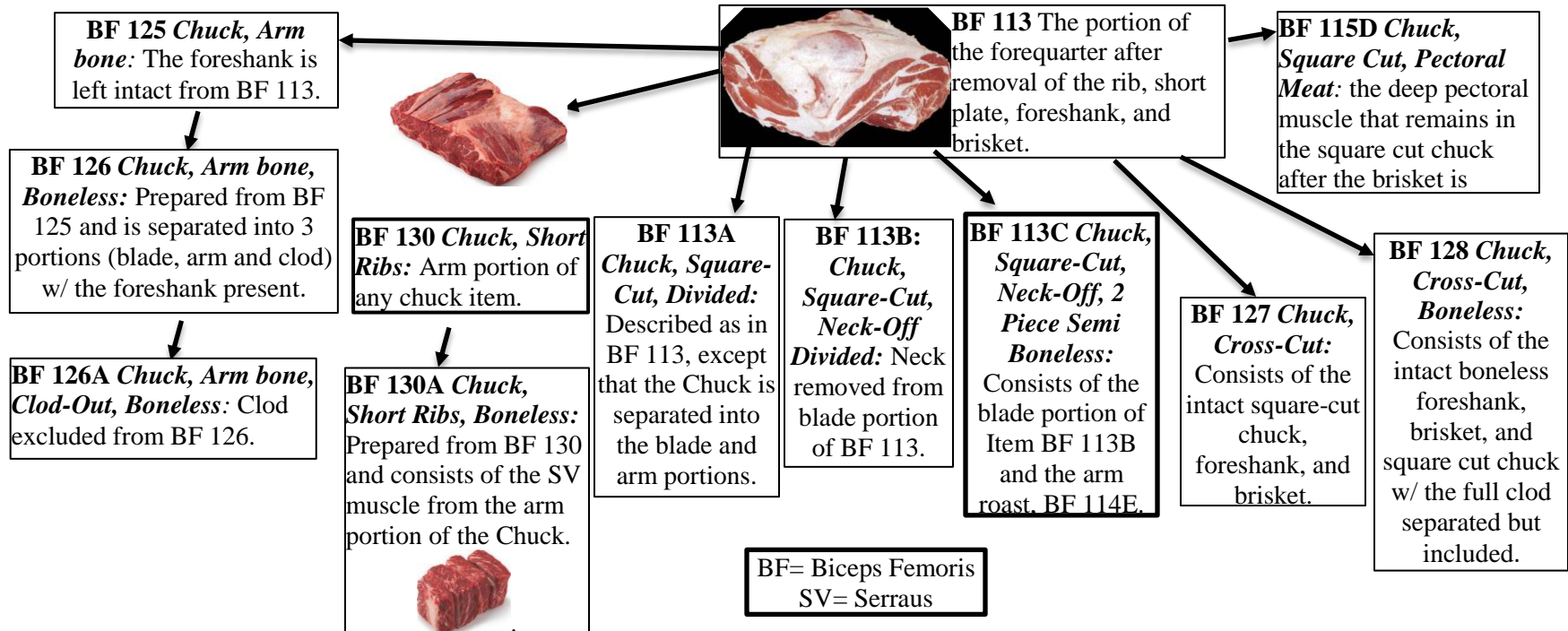


Figure 3.2 contains all cuts produced from the BF 114 Chuck Shoulder Clod, a subprimal that is price reported at the wholesale level. NAMI provides IMPS numbers for 13 products derived from the Chuck Shoulder Clod. Many of these cuts are value added/innovative, including the BF114D “Flat Iron”, produced from the infraspinatus muscle and one of the most popular value-added products available today. The Chuck Should Clod Arm or Clod Heart Roast (BF 114E) also produces an innovative cut, the “Ranch Steak” from the triceps brachii muscle. The Chuck Shoulder Tender (BF 114F), not to be confused with the Chuck (Mock) Tender (BF 116B), is also a widely produced value-added product called the “Petite Tender” Steak, cut from the teres major muscle.

Figure 3.3 outlines BF 116A, the Chuck Roll, also a subprimal with required wholesale price reporting. This subprimal produces 8 cuts as defined by the NAMI, in addition to several value-added cuts. From the Chuck Eye Roll (116D), the “Delmonico” steak and “Boneless Country Style Ribs” are produced from the longissimus muscle, while “America’s Beef Roast” is produced from the remaining portion of the Chuck Eye Roll once the longissimus muscle is removed. From the Chuck Under Blade Roast (116E), the serratus ventralis muscle produces the “Sierra Cut” and the “Denver Cut.” The innovative “Las Vegas Strip” steak is also produced from the Chuck Roll and consists of the subscapularis muscle.

Figures 3.4 through 3.7 show muscle diagrams of the Chuck from the most interior neck/blade portion, the lowermost arm or shank portion, the upper most arm portion, and the Rib end of the blade portion. Each diagram is labeled with the muscles and bones included and what products the muscle is included in.

Figure 3.2: BF 114 Chuck, Shoulder Clod

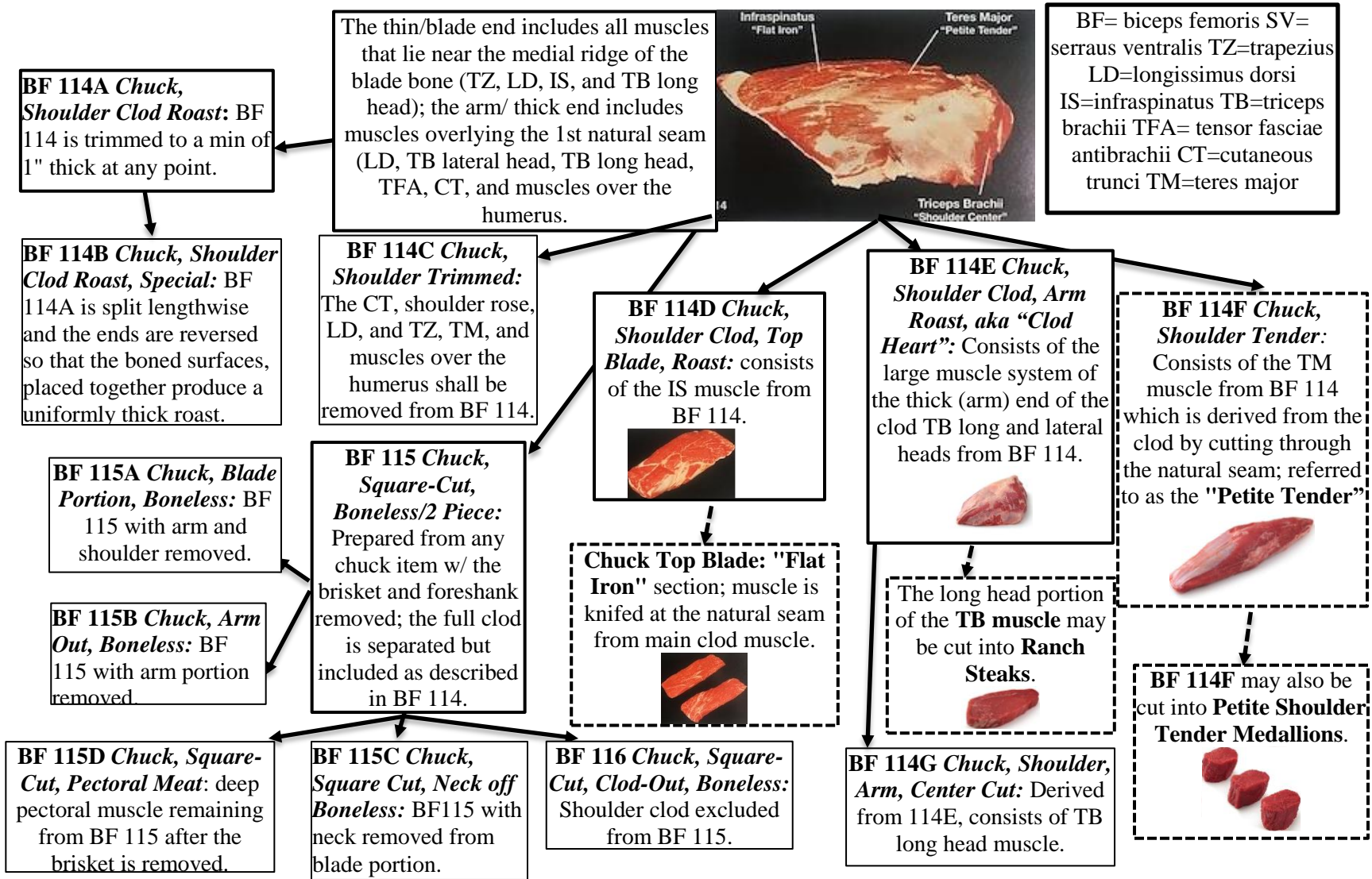
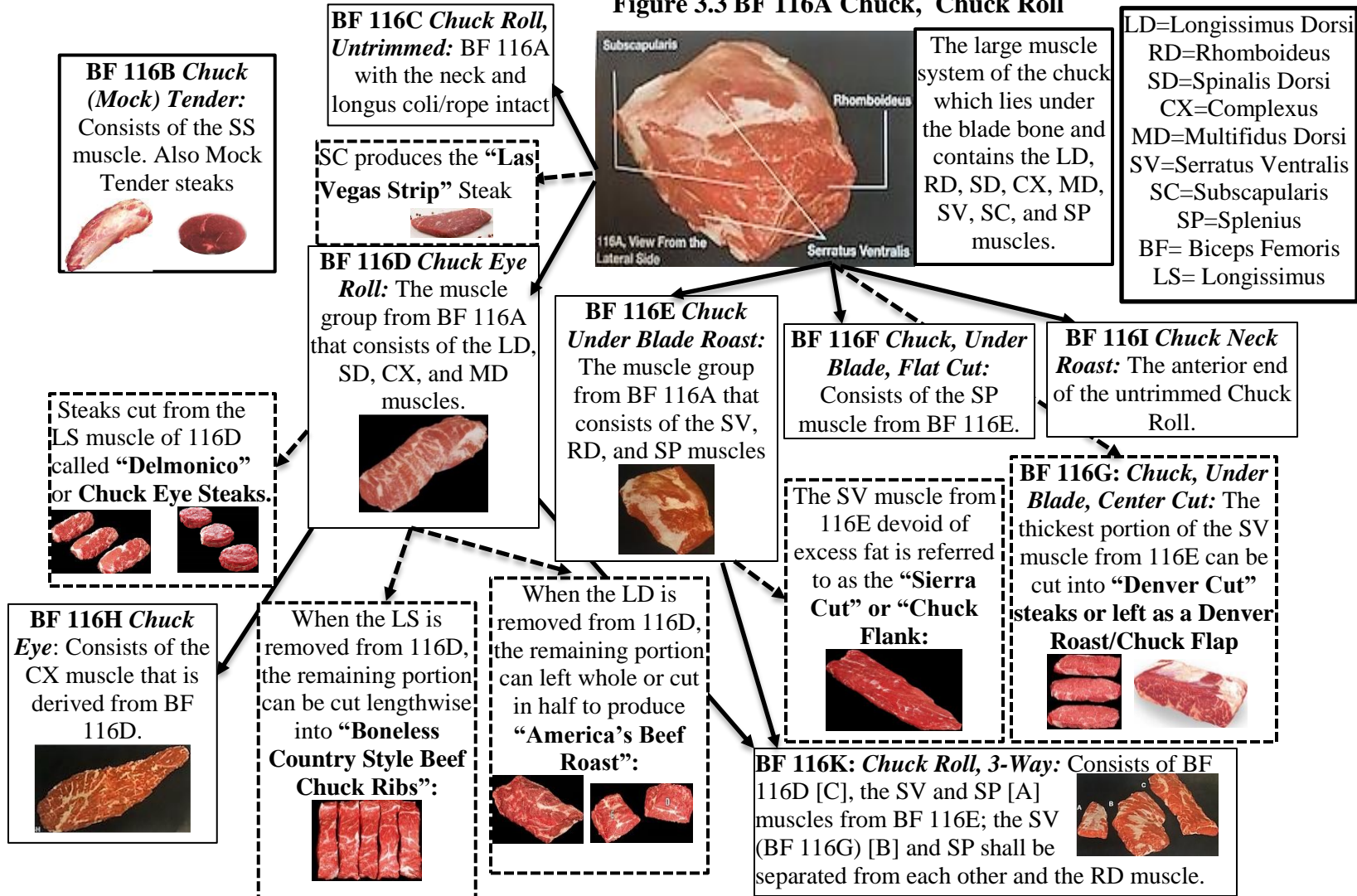
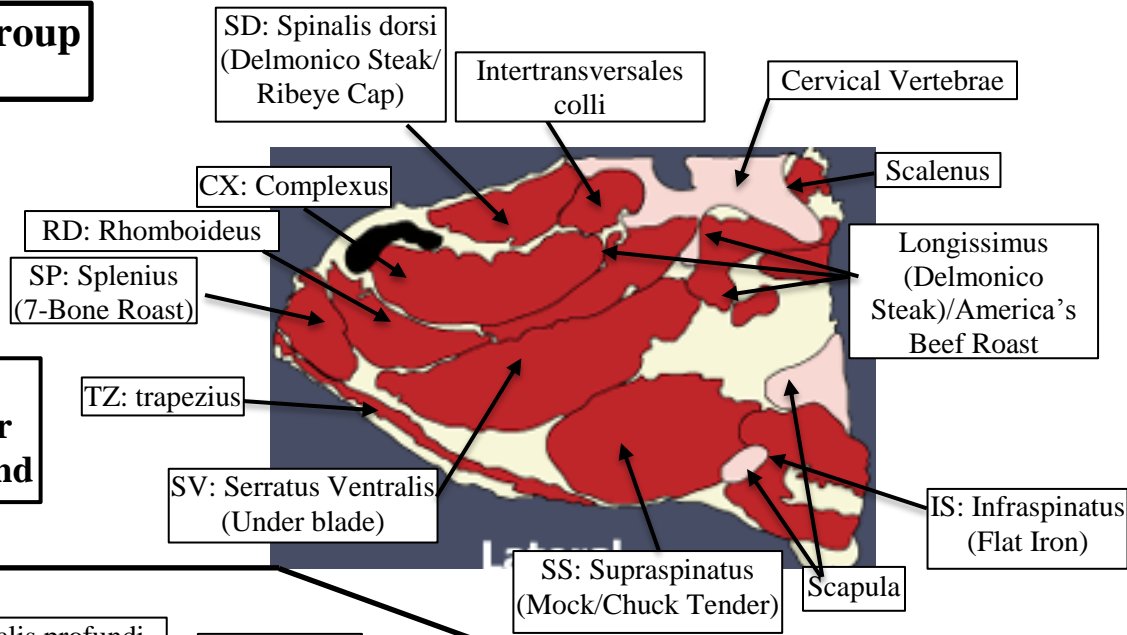


Figure 3.3 BF 116A Chuck, Chuck Roll

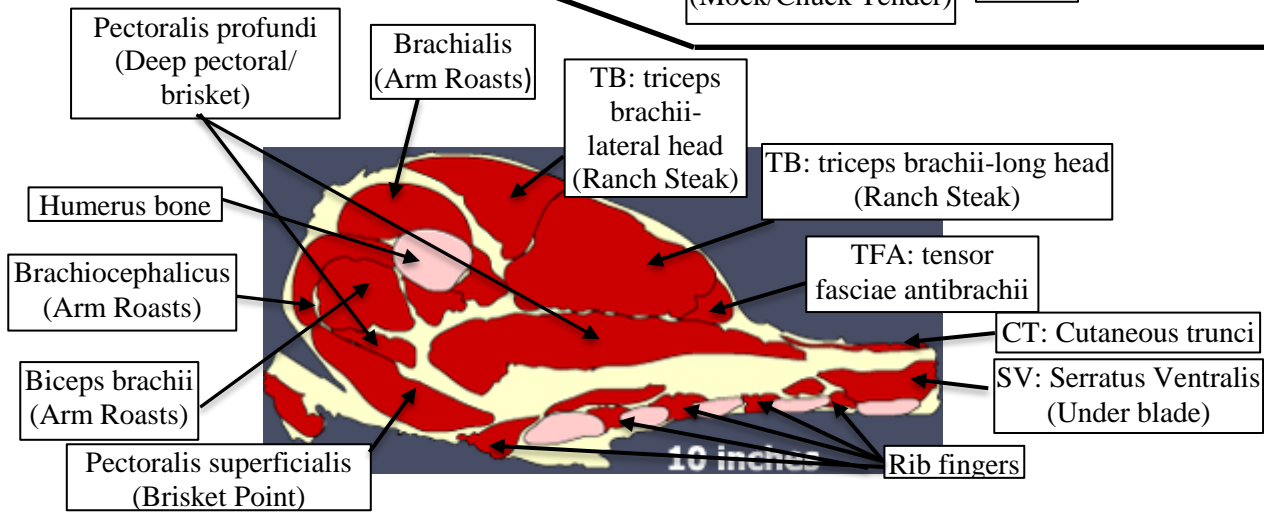


Chuck Muscle Group Diagrams

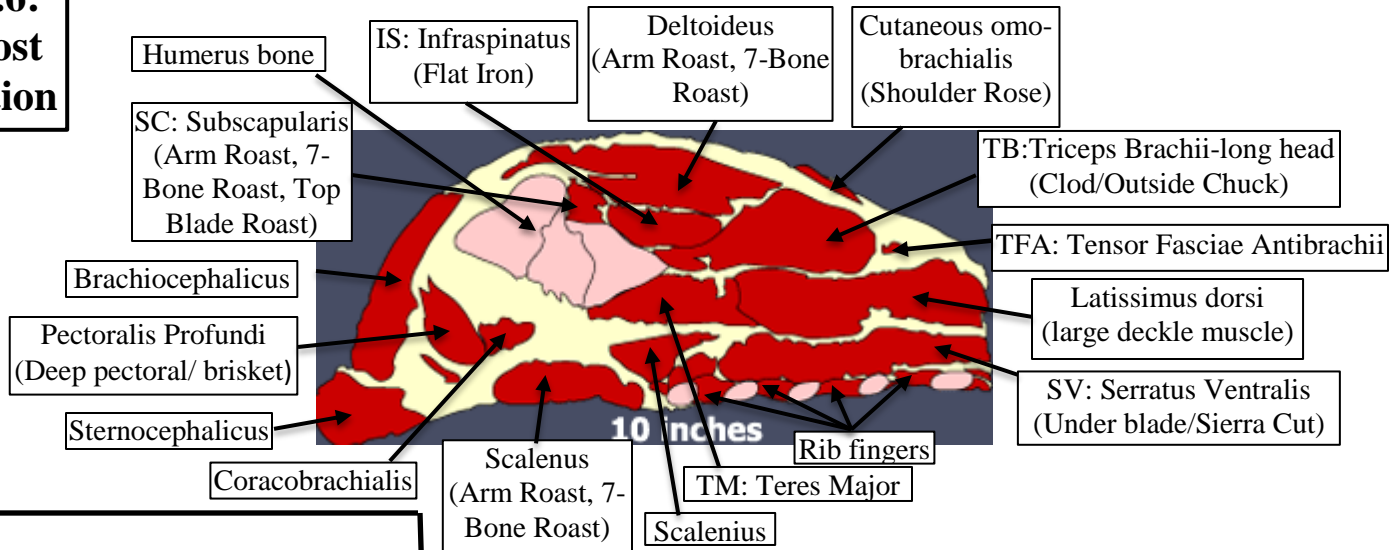
**Figure 3.4:
Most Interior
Neck/Blade End**



**Figure 3.5:
Lowermost
Arm/Shank
Portion**



**Figure 3.6:
Uppermost
Arm Portion**



**Figure 3.7:
Rib End of
Blade
Portion**

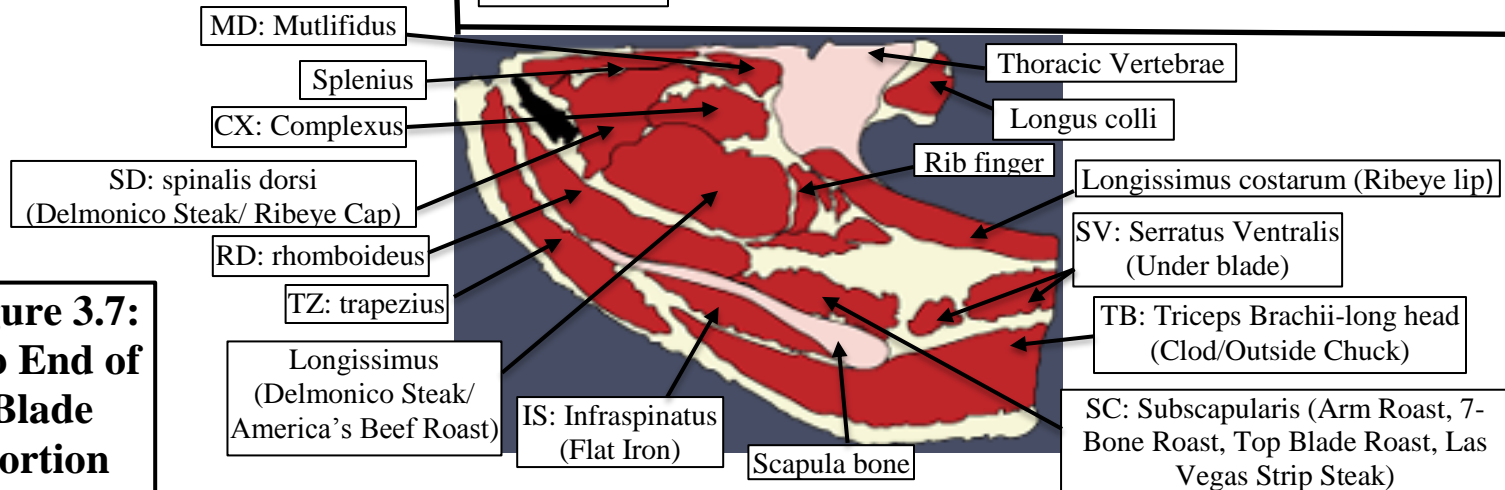


Figure 3.8 shows BF 158, the Round primal which is fabricated into various Round roasts that may be used for ground beef, roast beef for carving stations, or diced or sliced for stew meat.

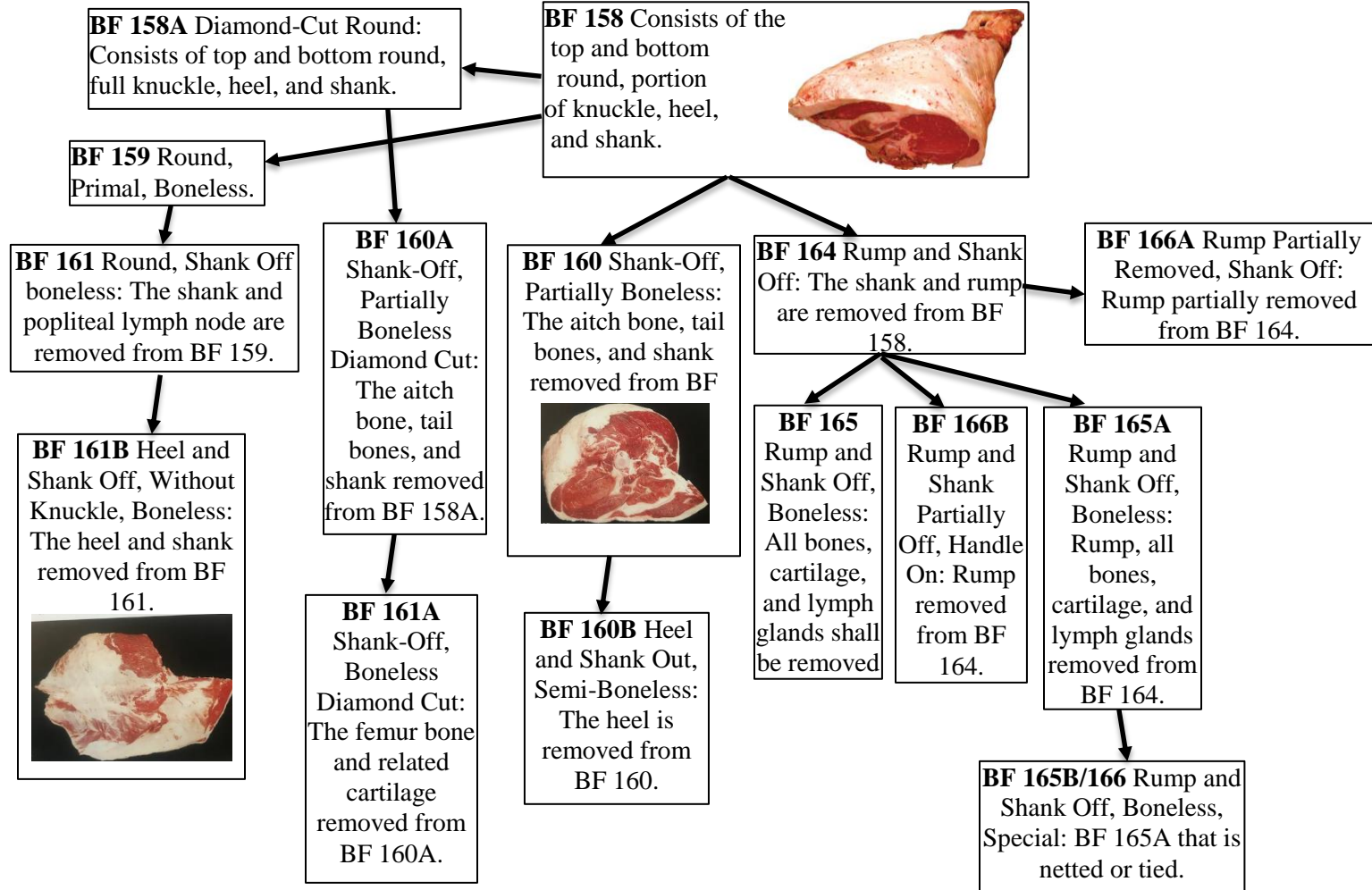
From Figure 3.8, only two cuts, BF 160 and BF 161 are price reported.

Figure 3.9 illustrates how the Sirloin Tip Knuckle (BF 167) is fabricated into several popular cuts including the Sirloin Tip Center, Sirloin Tip Side, and Sirloin Tip Steaks from the rectus femoris, vastus lateralis, and tensor fasciae latae muscles, respectively. 5 cuts: BF 167A, BF 168, BF 169, and BF 169A, have wholesale price reporting. The Top Inside Round (BF 168) is also included in Figure 3.9 and includes descriptions of how it is fabricated into several innovative beef cuts including the “Santa Fe Steak”, Top Front Side Steak, “San Antonio Steak”, and the “Tuscon Cut”, made from the gracilis, pectineus, adductor, and semi-membranosus muscles, respectively. The Inside Round can also be sold as a London Broil in the retail case and is a workhorse for food service, used as steak products, cutlets for chicken fried steak, stew meat, and as roast beef for buffet style carving stations.

The Bottom Round/Gooseneck, BF 170, can be fabricated into the Bottom Gooseneck, Eye of Round, Outside Round/Flat, and the Outside Round Heel. 3 cuts: BF170, BF 171B, and BF 171C, are wholesale price reported. The Gooseneck Round is not generally sold as a whole piece, but rather, separated and sold as the Bottom Round, Outside Round, and Eye of Round and labeled as a 3 Piece Chuck. The Outside Round/Flat produces the innovative “Western Griller Steaks” and “Western Tip Steaks”, and can also be used for ground beef or as London Broil. The Eye of Round produces the innovative “Braison” and “Merlot” cuts from the Superficial digital flexor and gastrocnemius muscles and is also used for jerky, chicken fried steak, London Broil, cube steak, and corned beef; or thinly sliced or diced for meal kits or stew meat.

3.2 Round Diagrams

Figure 3.8: BF 158 Round Primal



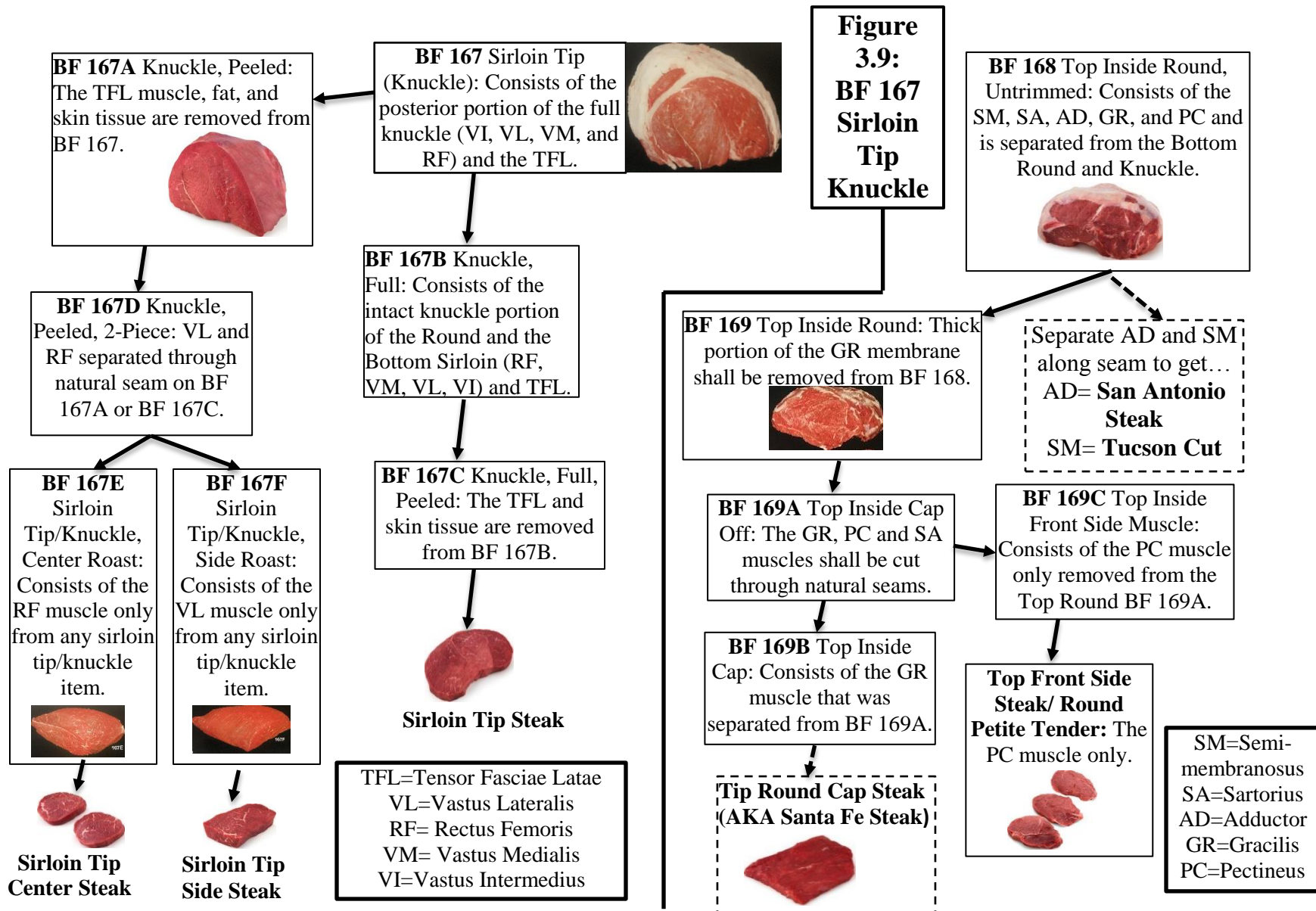
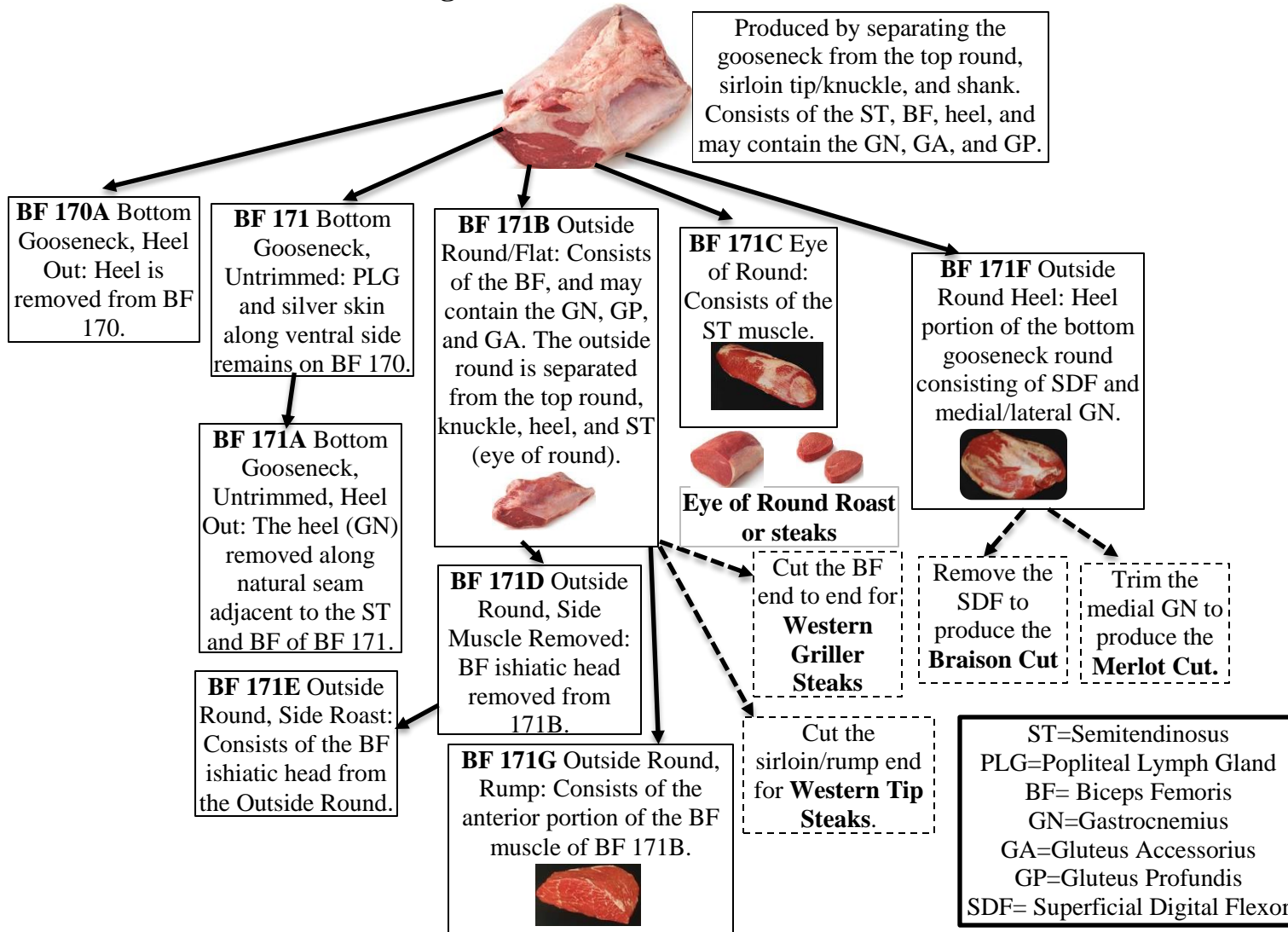
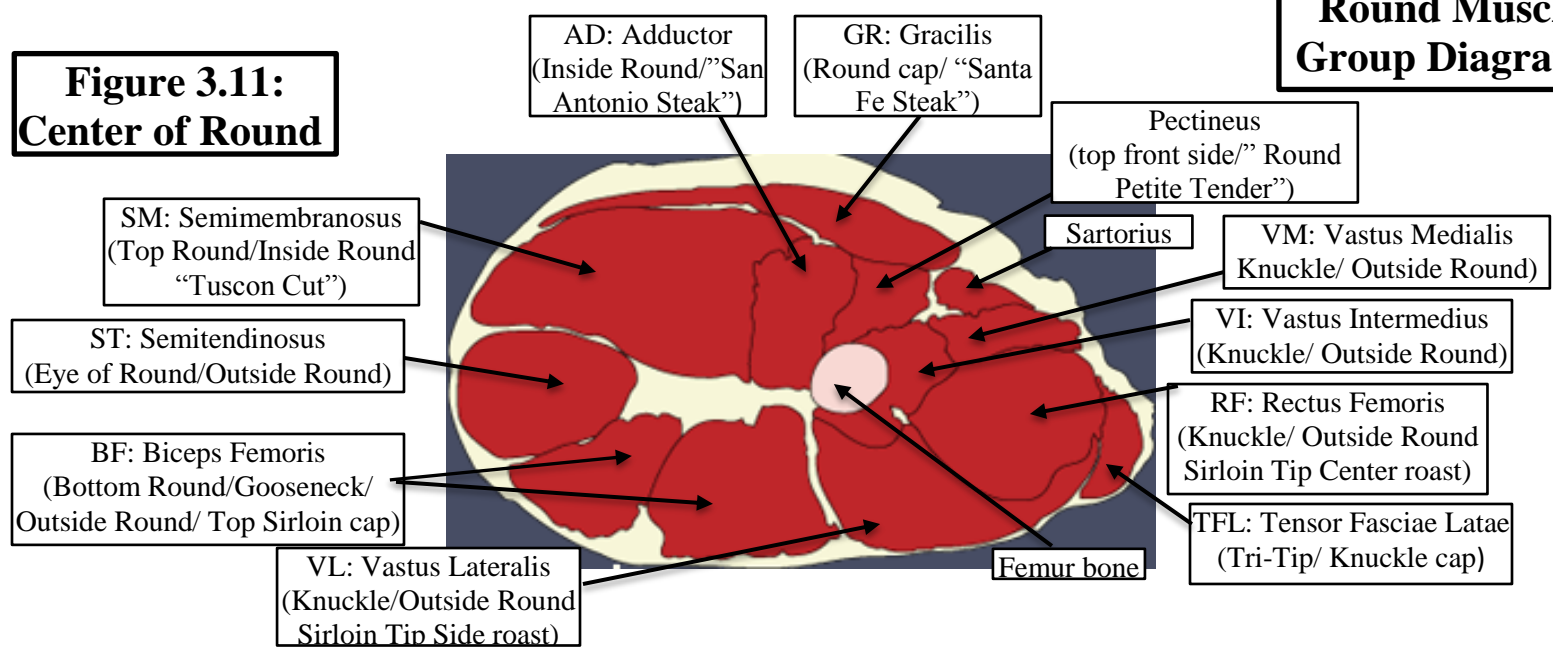


Figure 3.10: BF 170 Bottom Round/Gooseneck

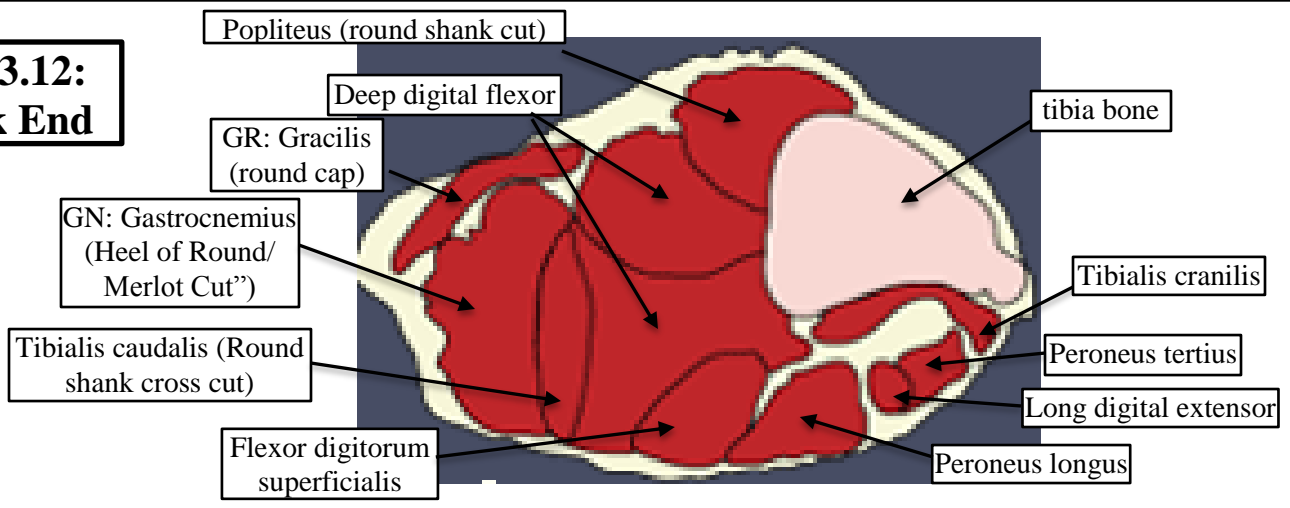


Round Muscle Group Diagrams

**Figure 3.11:
Center of Round**



**Figure 3.12:
Shank End**



Figures 3.11 and 3.12 show a center cut and shank end of the Round primal, respectively, with various muscles labeled, showing where the muscle lies and resulting cuts.

BF 103, the Rib Primal, is outlined in Figure 3.13, with four cuts wholesale price reported, including BF 109E Ribeye Lip-On Bone-In, BF 112A Ribeye Lip-On, Light and Heavy, and BF 123A Short Plate Short Ribs. The Ribeye is very popular in both retail and food service for holiday roasts and Prime Rib specials. The Ribeye Cap Roll and Cap Steak are also included in Figure 3.13 and consist of the spinalis dorsi muscle. These cuts are becoming a popular option for smaller portioned Ribeye Steaks or to serve as a separate steak product.

Figure 3.14 shows the Rib primal from the Chuck end and includes the Ribeye Petite roast and Ribeye filet, which is a conventional Ribeye Roll with the spinalis dorsi/cap removed. The Back Ribs, which are price reported only for Select grade carcasses, is also included, along with Rib Fingers. Figures 3.15 and 3.16 include Rib muscle diagrams from both the Chuck and Loin ends of the primal, respectively.

Figure 3.17 shows the Rib end of the full Loin, including four cuts that are wholesale price reported (BF 174 Short Loin, BF 175 Strip Loin, BF 180 Strip Loin, and BF 181 Strip Loin Boneless). The BF 174 Short Loin produces the Porterhouse and T-Bone steaks, which are differentiated by the width of the Tenderloin muscle (1.25 inches or smaller = T-bone, 1.25 inches or larger=Porterhouse). The BF 175 Strip Loin Bone-in produces the Strip Steak, Top Loin roast, and the Strip Petite roast or Top Loin Petite roast which is the center, longissimus muscle. These cuts are most commonly used as a steak entree.

3.3 Rib Diagrams

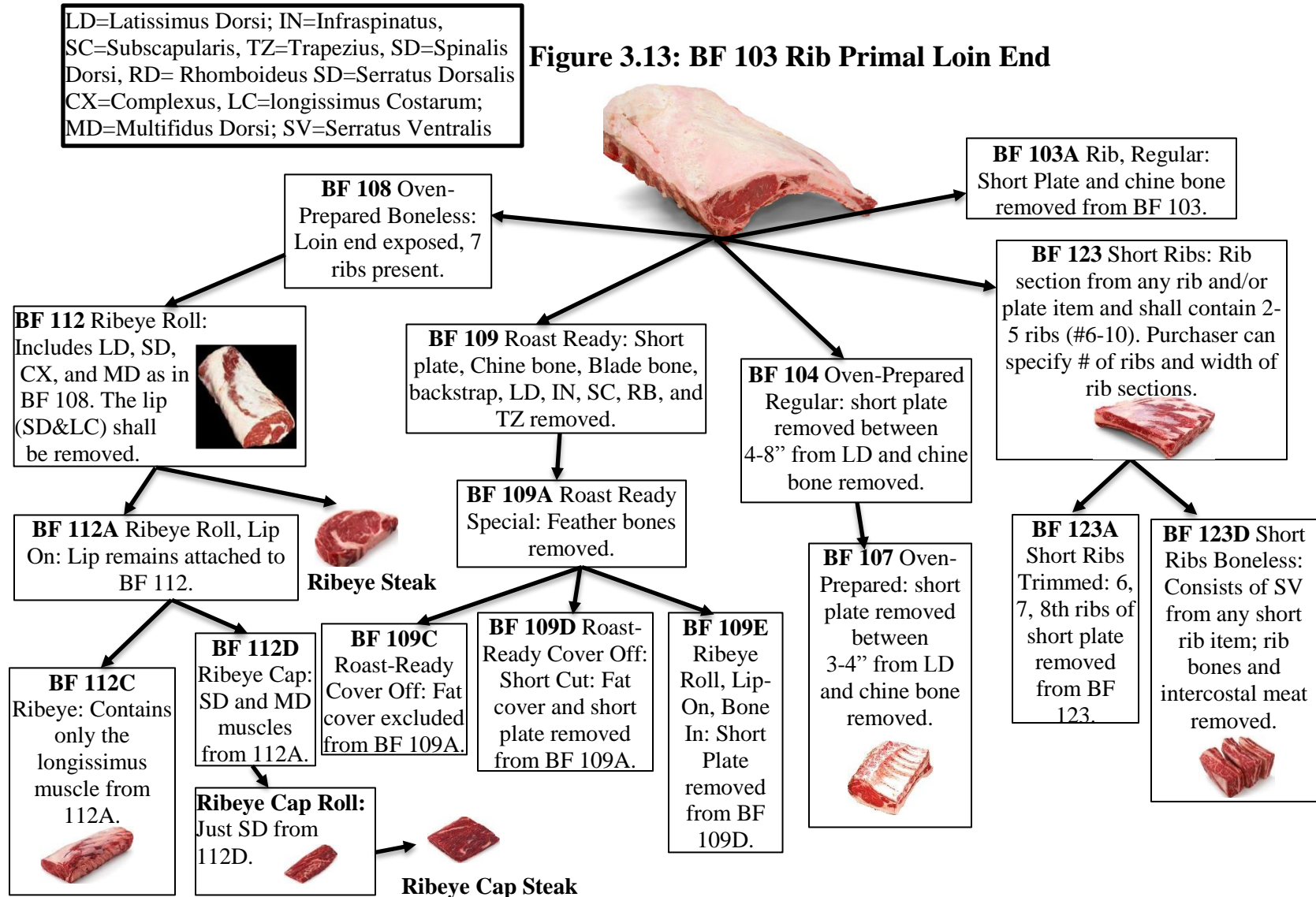
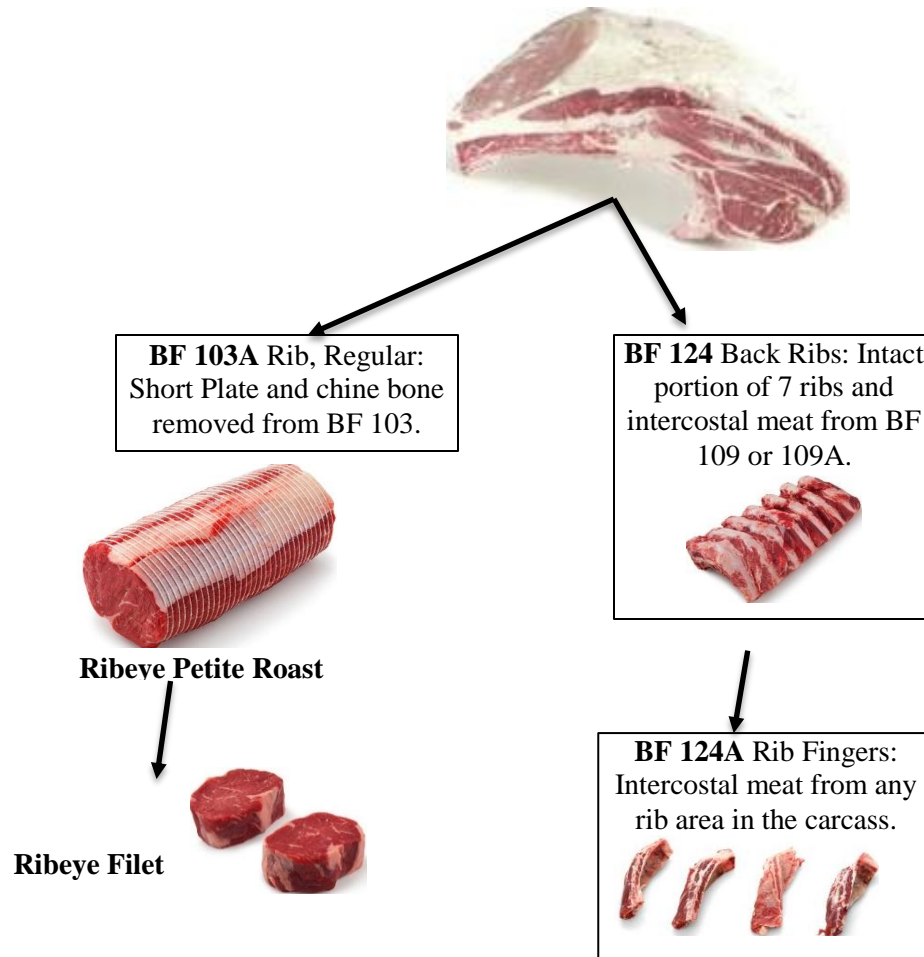
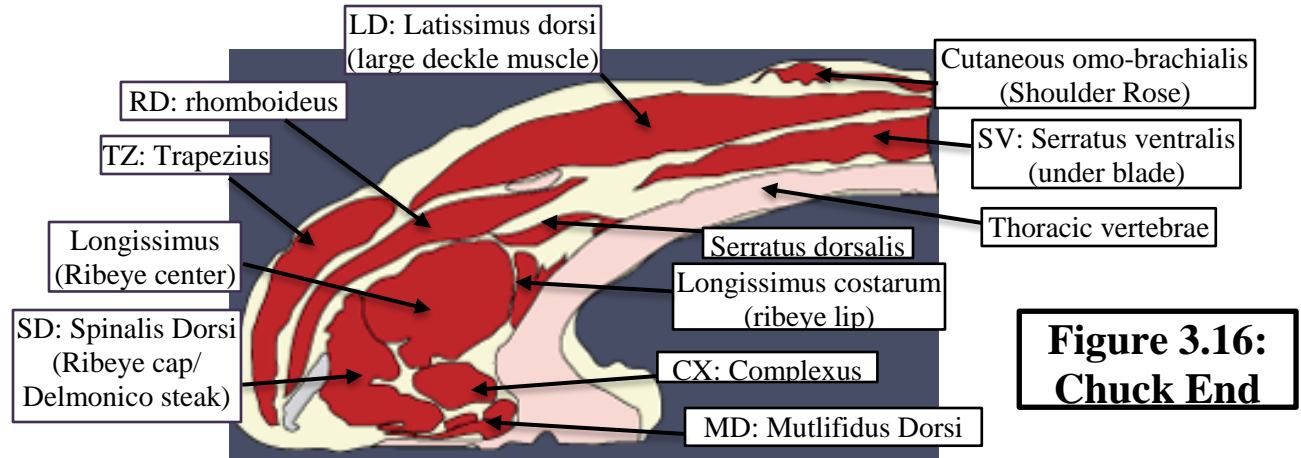
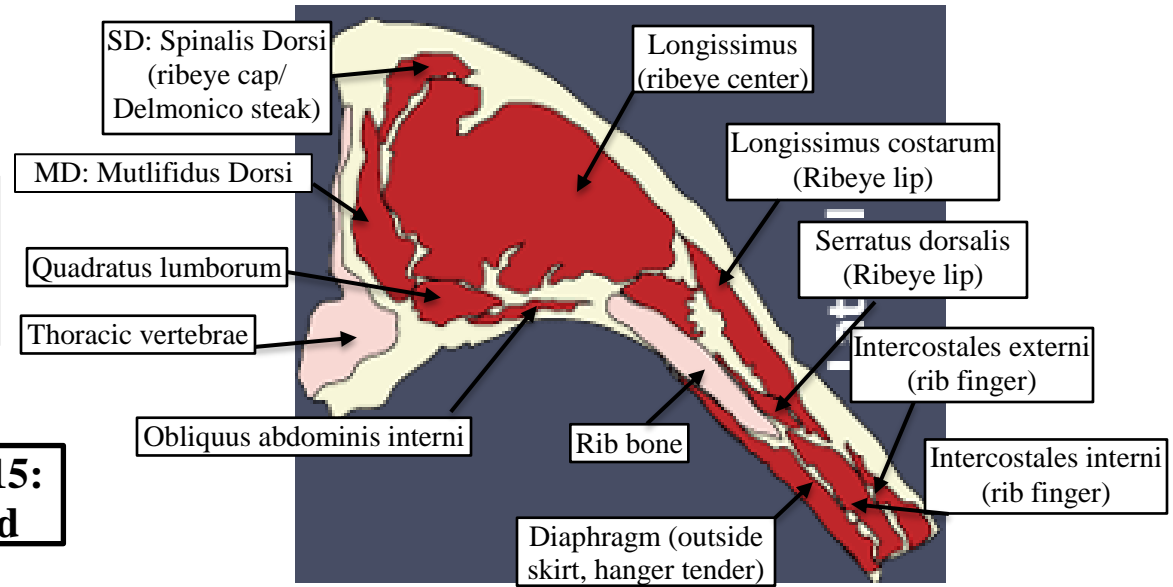


Figure 3.14: BF 103 Rib Primal Chuck End



**Rib Muscle
Group
Diagrams**

**Figure 3.15:
Loin End**



**Figure 3.16:
Chuck End**

3.4 Loin Diagrams

Figure 3.17: BF 172 Beef Full Loin Trimmed (Rib End)

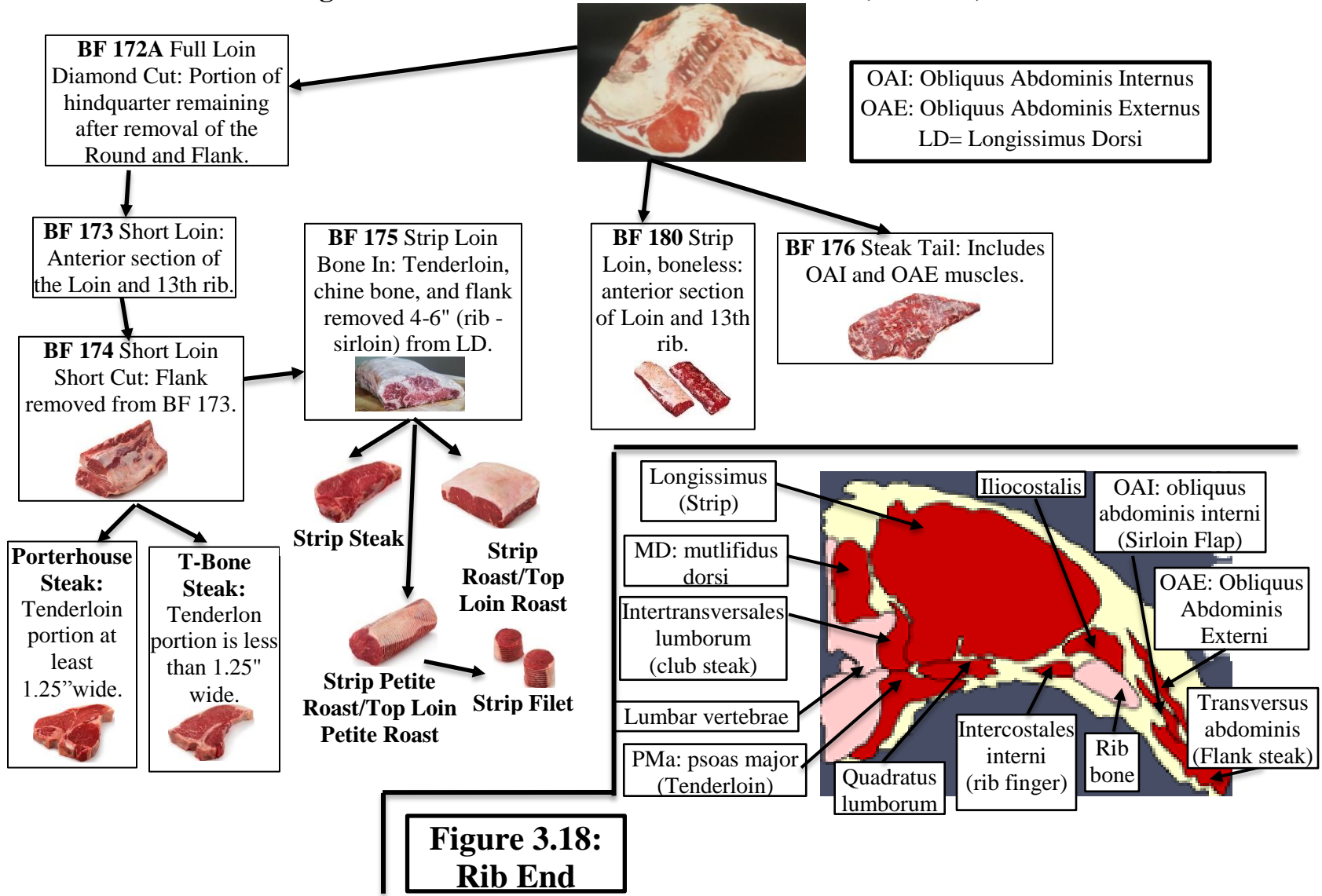


Figure 3.19 shows products fabricated from the BF 172 Full Loin trimmed, from the Sirloin end. The Top Sirloin Butt (BF 184) can be fabricated into several cuts including the BF 184 Top Sirloin Butt, BF 185A Bottom Sirloin Flap, BF 185B Loin Ball-Tip, BF 185C Bottom Sirloin Butt, and BF 185D Tri-Tip. The Sirloin Flap and Sirloin Bavette can be used as a Skirt Steak alternative and have become popular options for steak entrees. BF 184D, the Top Sirloin Cap, or Coulotte roast, can be cut into a Coulotte steak. Sirloins are also being exported to Japan and Korea to feed their growing steak demand, and Sirloin Caps/Coulotte are very popular in Latin American countries, and are also served in Brazilian steak houses, labeled as “Picanha”. Top Sirloin steaks are also workhorses in food service, providing a quality steak entrée at a value price or as a salad or sandwich ingredient. Tri-Tips have become popular across the country and can be used as a Brisket alternative for barbecue, sliced for sandwiches or salads, or further processed into chicken fried steak. The Loin Ball-Tip and Peeled Round Knuckle interact as substitutes, and are utilized as steaks or roasts. Sirloin trimmings or whole Sirloin muscle cuts may also be ground for specific Sirloin ground beef products.

The BF 188 Tenderloin Bone-In is included in Figure 3.20. The BF 189 Full Tenderloin can be fabricated into full Tenderloins, center cut, or with the side muscle removed. BF 189 is where the Filet Mignon is fabricated from and the 190B Center Cut provides the “barrel cut” or Tenderloin filet most common in restaurants and grocery stores. The BF 191 Tenderloin Butt is the end portion of the Tenderloin roast (a muscle cross section diagram is labeled on the page 64) and can provide a value priced Tenderloin steak alternative. The Hanging Tender is also included in Figure 3.20 and consists of the diaphragm that lies in the Loin area, which has become a trendy steak entree. The muscle diagrams for the Loin primal, both as a center section and at the Sirloin end are shown in Figures 3.21 and 3.22, respectively, on page 64.

The Short Plate, Figure 3.23 can be fabricated into the Outside and Inside Skirt Steaks, Spare Ribs, and Short Plate Short Ribs. Skirt steaks are commonly used in Tex Mex dishes like fajitas, tacos, carne asada, and other beef dishes. Short Ribs are highly exported to Asian countries and can be used for braising or stew meat.

The Flank steak, Figure 3.24, is comprised of the transverse abdominis muscle and can be roasted and cut into strips for sandwich or salad toppers or used by food service in Mexican dishes. The Foreshank, Figure 3.25 includes the Brisket, both the point cut and half portions. Briskets are popular for a variety of dishes, including barbecue and high end hamburger products.

Muscle diagrams for the Short Plate (Figure 3.26), Flank (Figure 3.27), and Brisket (Figure 3.28) are on page 67.

Figure 3.19: BF 172 Full Loin Trimmed (Sirloin End)

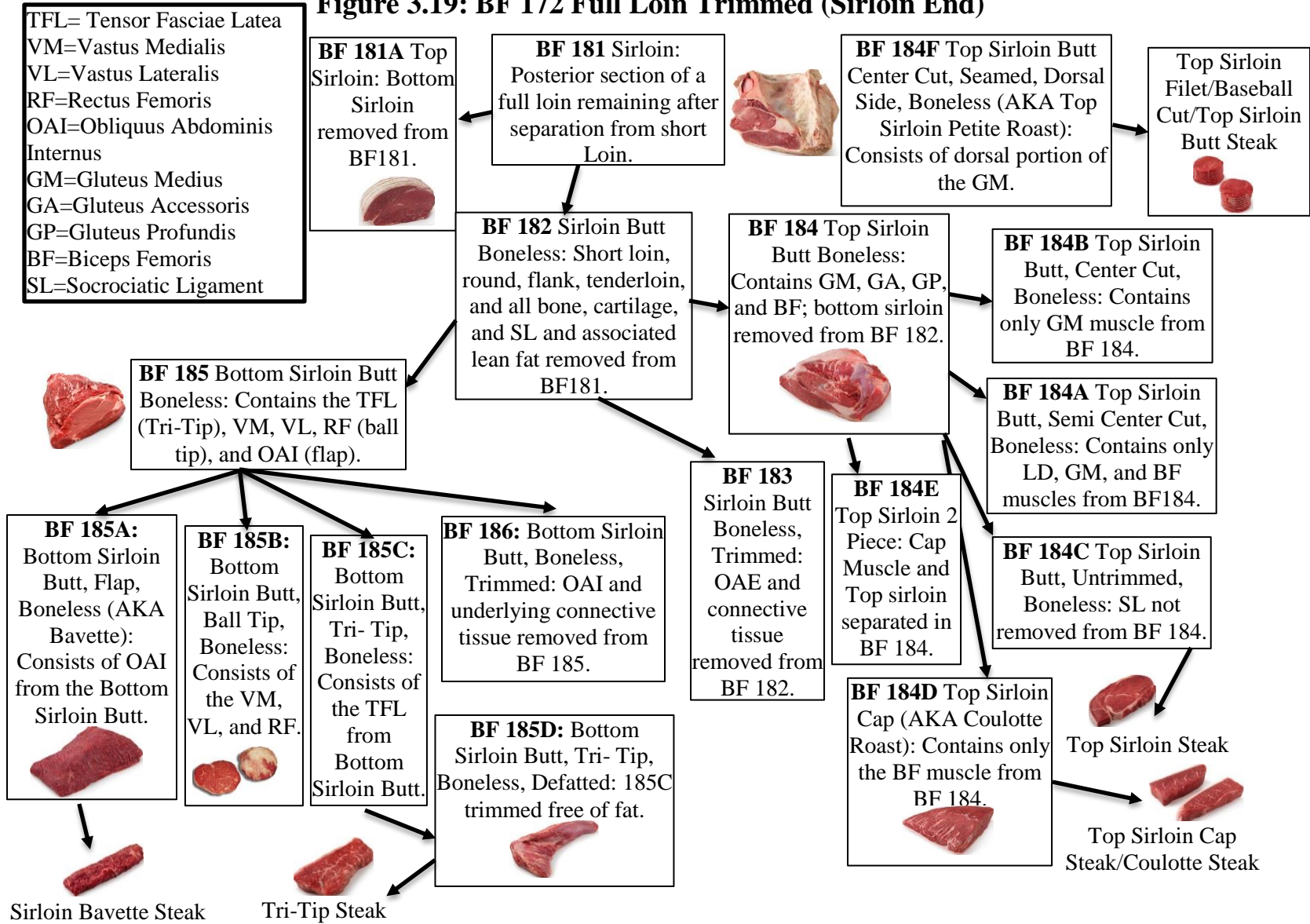


Figure 3.20: BF 188 Tenderloin



BF 188
Tenderloin, Bone
In: Consists of
PMa and PMi

PMa: Psoas Major
PMi: Psoas Minor
IL: Iliacus
OAI: Obliquus Abdominis
Internus

BF 189 Tenderloin, Full: consists of PMa, PMi, IL, and may have the SA.



BF 189A Tenderloin, Full, Side Muscle On, Defatted: BF 189 free of fat and the IL.

BF 189B Tenderloin, Full, Side Muscle On, Partially Defatted: BF 189 that is free of surface fat.



BF 190 Tenderloin, Full, Side Muscle Off, Defatted: PMi of BF 189A removed.



BF 190B Tenderloin, Full, Side Muscle Off, Center Cut, Skinned (AKA "Barrel Cut"): the tenderloin tail and butt Tender are removed from BF 190A.



BF 191 Tenderloin, Butt: Consists of the sirloin portion of the PMa, IL, and OAI will be trimmed.

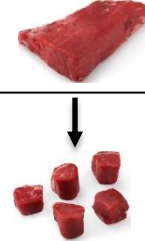


BF 191A Tenderloin, Butt, Defatted: fat trimmed practically free from BF 191.

BF 191B Tenderloin, Butt, Skinned: Tissue covering PMa shall be removed.

BF 192 Tenderloin, Short: Consists of the short loin portion of the tenderloin.

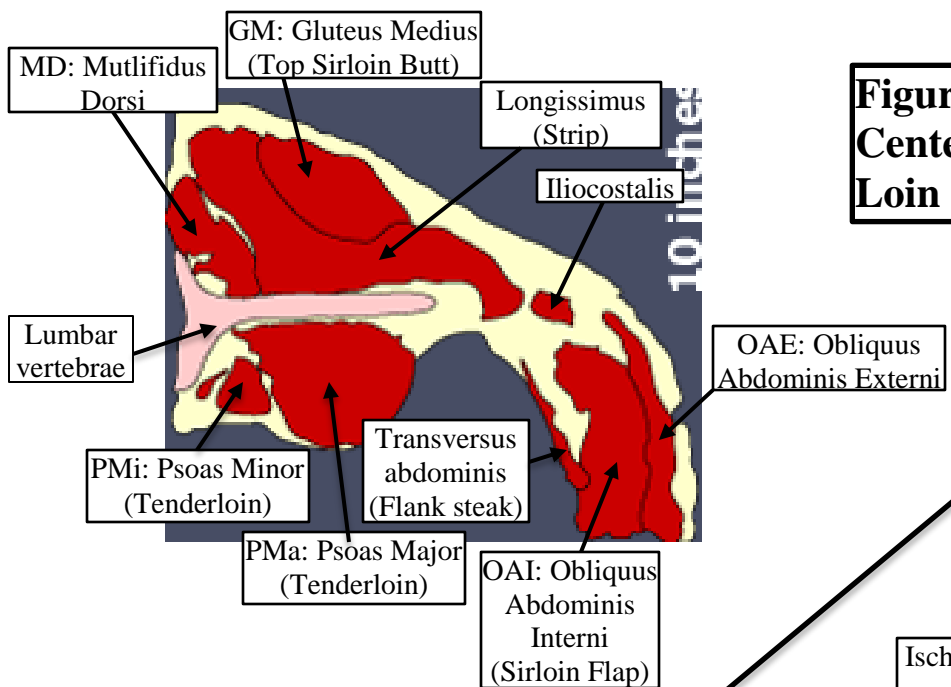
BF 192A Tenderloin Tails: Consists of the thin portion of the PMi.



Tenderloin Tips

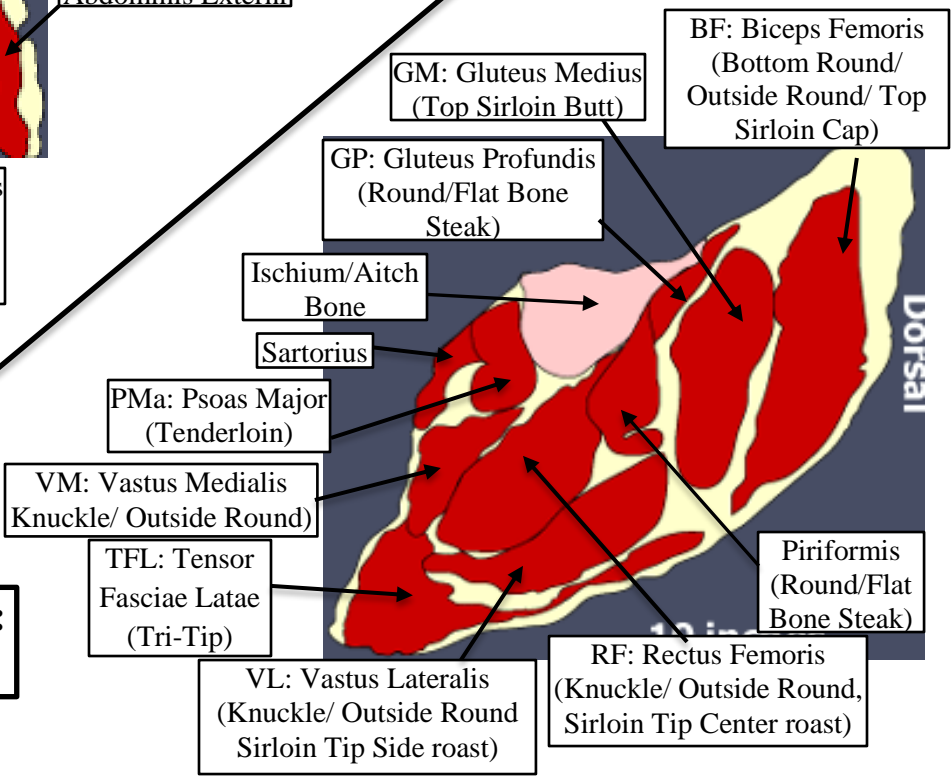
Hanging Tender: Trimmed, boneless portion from the diaphragm; one per carcass; located in the loin area of the open side hindquarter between kidney knob and chine bones.





**Figure 3.21
Center of
Loin Primal**

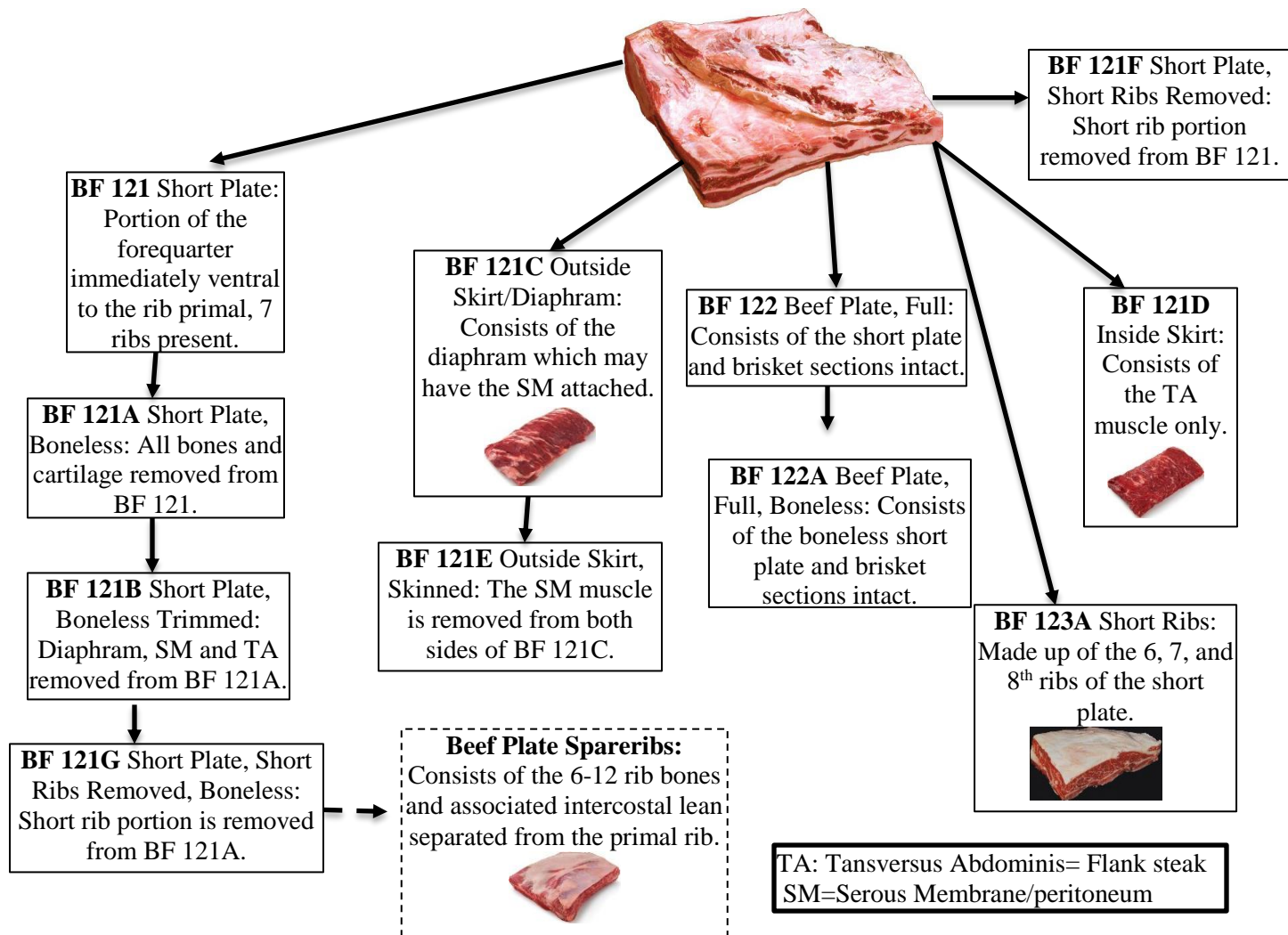
**Loin Primal Muscle
Breakdowns**



**Figure 3.22:
Sirloin End**

3.5: Short Plate Diagram

Figure 3.23: Short Plate Primal



3.6 Flank Diagram

Figure 3.24: BF 193 Flank

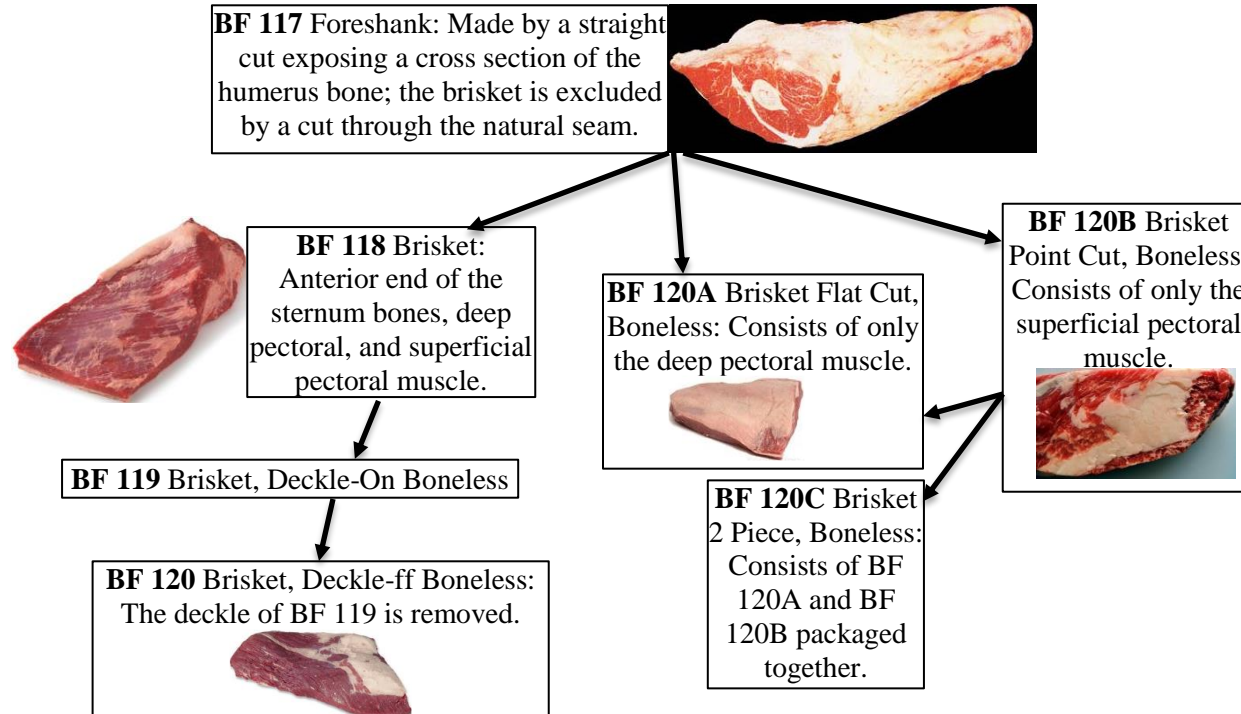
BF 193 Flank Steak: Consists of the RA from the flank region and is separated from the TA, OAI, and OAE through natural seams.

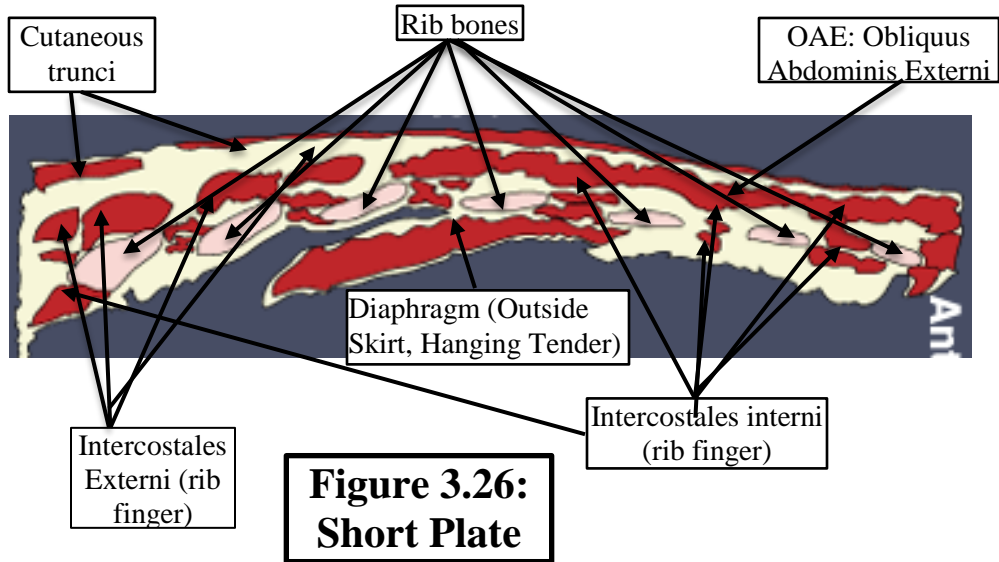


RA: Rectus Abdominus
 SM= Serous Membrane
 TA=Transversus Abdominus
 OAI: Obliquus Abdominis Internus
 OAE: Obliquus Abdominis Externus

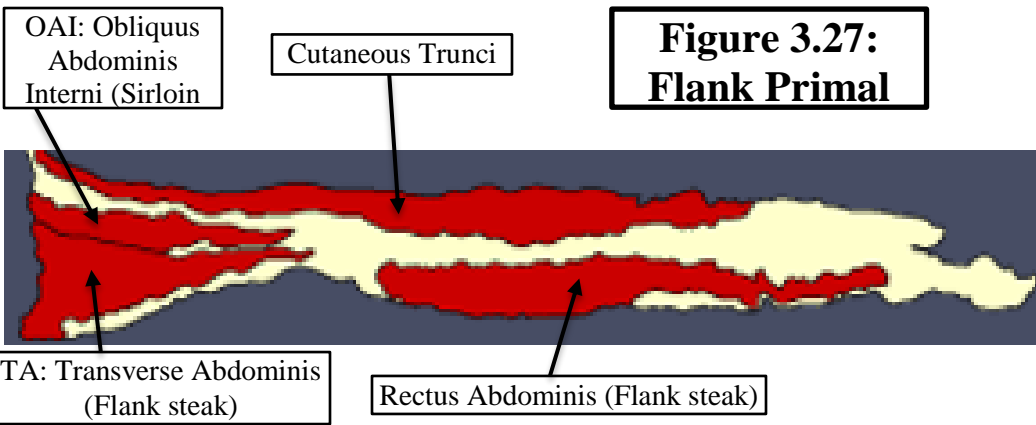
3.7 Foreshank Diagram

Figure 3.25: Foreshank





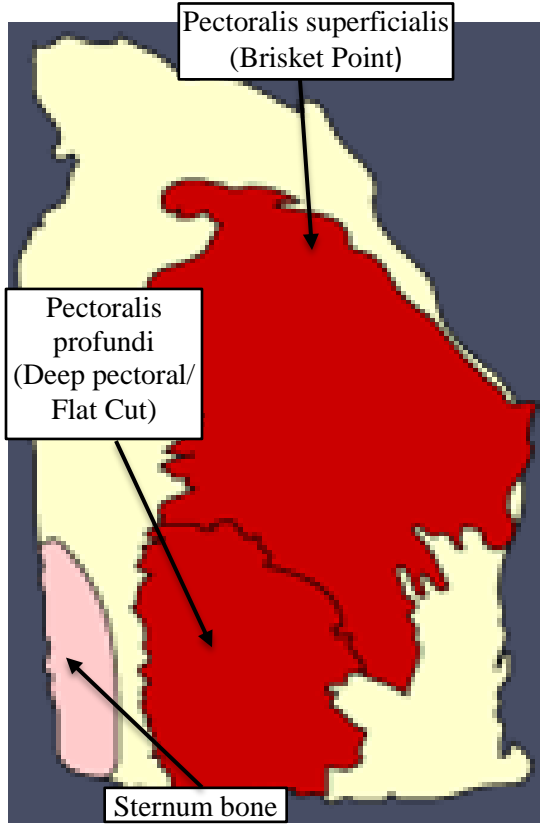
**Figure 3.26:
Short Plate**



**Figure 3.27:
Flank Primal**

3.8 Brisket Diagram

**Figure 3.28:
Brisket Primal**



CHAPTER IV

DATA AND PROCEDURES

This chapter discusses available data, how it was used and its limitations. The procedures for industry interviews which were used to gather additional information are then presented.

4.1 Data Discussion

Available data was utilized to better understand the beef marketing system. USDA Agricultural Marketing Service (AMS) reports boxed beef Cutout, primal, and wholesale beef cut prices daily (report LM_XB403) and weekly (report LM_XB459). Data from these reports are compiled by the Livestock Marketing Information Center (LMIC). These LMIC data files are used extensively in this thesis.

Weekly Choice Cut Prices and Weekly Cut-Out Value were used to calculate and graph prices for various cuts as a percentage of both the Choice carcass cut-out value and to the Choice Tenderloin (BF 189A) wholesale price. A few of these charts are included throughout the complete report and all charts are included in Appendices B and C. The Choice and Select Cut-Out Values and the value of each primal- Chuck, Round, Rib, Loin, Flank, Short Plate, and Brisket were used to graph the value of each primal over time compared to the cut-out value, as well as a seasonal graph showing primal values throughout the year, Figures 4.1 and 4.2. These are shown on the next page.

Figure 4.1: 7 Beef Carcass Primal Choice Values as a Percent of the Choice Beef Cut-Out Value using a 52 Week Average between 2015 and 2019; Data: USDA-AMS, compiled by the LMIC.

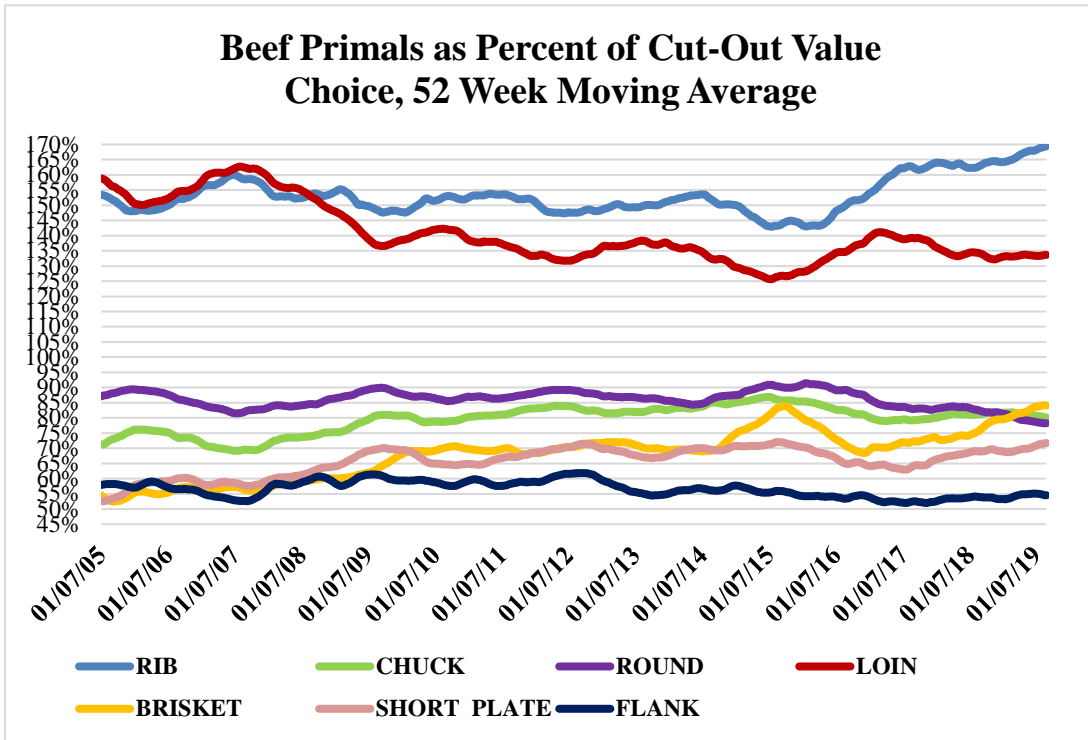


Figure 4.2 4 Beef Carcass Choice Wholesale Beef Price weighted average Seasonality Indices between 2008 and 2018; Data: USDA-AMS, compiled by the LMIC.

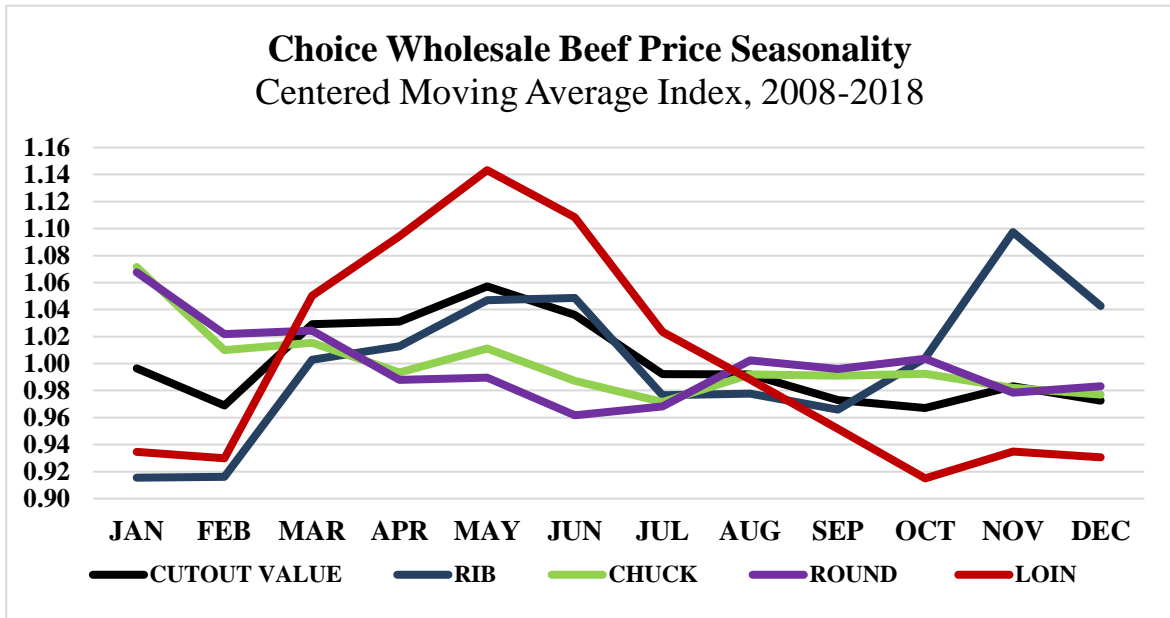


Table 4.1: Choice Cut Rankings based on average price in 2012, 2015, and 2018; Data: USDA-AMS, compiled by LMIC

Table 4.1: Choice Cut Value-Rankings							
2012 Rank	2015 Rank	2018 Rank	2018 Price/cwt	Primal	SubPrimal	Code	Trim
1	1	1	\$988.40	Loin	Tenderloin Trimmed Heavy	189A	4
1	2	2	\$923.30	Loin	Butt Tender Trimmed	191A	4
3	3	3	\$786.14	Rib	Ribeye Boneless Light	109E	3
4	4	4	\$782.34	Rib	Ribeye Boneless Heavy	112A	3
5	5	5	\$689.37	Rib	Ribeye Lip-On Bone-In	109E	1
6	6	6	\$605.19	Loin	Strip Boneless 0x1	180	3
17	17	7	\$567.02	Short Plate	Short Rib	123A	3
8	7	8	\$550.09	Loin	Strip Boneless 1x1	180	1
7	8	9	\$533.55	Loin	Short Loin 0x1	174	3
14	13	10	\$523.24	Loin	Bottom Sirloin Flap	185A	4
12	9	11	\$512.30	Flank	Flank Steak	193	4
10	12	12	\$511.04	Loin	Strip Loin 1x1	175	3
16	15	13	\$456.79	Chuck	Clod Tender	114F	5
15	16	14	\$453.99	Brisket	Point-Off Boneless	120A	3
13	14	15	\$429.55	Loin	Sirloin Tri-Tip Peeled	185D	4
21	23	16	\$372.33	Chuck	Clod Top Blade (Flat Iron)	114D	3
35	35	17	\$368.73	Chuck	Short Rib	130	4
18	18	18	\$331.23	Loin	Top Butt Boneless	184	3
22	22	19	\$319.81	Chuck	Chuck Roll Retail Ready	116B	3
19	19	20	\$315.07	Loin	Top Butt Boneless Heavy	184	1
20	20	21	\$305.42	Loin	Sirloin Tri-Tip	185C	1
27	27	22	\$293.77	Chuck	Chuck Roll 1x1 Neck Off	116A	3
24	21	23	\$264.67	Loin	Ball-Tip Boneless Heavy	185B	1
38	37	24	\$258.07	Brisket	Deckle-Off Boneless		
25	26	25	\$254.86	Chuck	Shoulder Clod Arm Roast	114E	3
23	25	26	\$249.67	Round	Top Inside Round Denuded	169	5
29	31	27	\$232.62	Round	Top Inside round Side Off	169A	5
28	30	28	\$231.51	Round	Knuckle Peeled	167A	4
26	28	29	\$229.23	Round	Eye of Round	171C	3
31	34	30	\$219.02	Chuck	Chuck (Mock) Tender	116B	1
36	32	31	\$218.99	Round	Boneless Round	161	1
42	41	32	\$217.21	Chuck	Semi-Boneless Neck Off	113C	1
33	36	33	\$214.50	Round	Top Inside round	168	3

Table		4.1	Choice	Cut	Value-Rankings	Continued	
2012 Rank	2015 Rank	2018 Rank	2018 Price/cwt	Primal	SubPrimal	Code	Trim
37	40	34	\$213.45	Chuck	Shoulder Clod Trimmed	114A	3
34	38	35	\$212.60	Round	Outside Round	171B	3
40	39	36	\$207.63	Round	Top Inside Round	168	1
39	33	37	\$205.74	Round	Bone-In Round	160	1
43	42	38	\$201.59	Chuck	Shoulder Clod	114	1
41	43	39	\$198.67	Round	Bottom Round Gooseneck	170	1
32	29			Chuck	Boneless 2 Piece	115	1
30	24			Round	Boneless Peeled Heel-Out	161	3
9	10			Loin	Short Loin 2x3	174	1
11	11			Loin	Strip Loin Boneless Heavy	180	1

Table 4.2: Select Cut Rankings based on average price in 2012, 2015, and 2018; Data: USDA-AMS; compiled by LMIC

Table 4.2: Select Value Rankings							
2012 Rank	2015 Rank	2018 Rank	2018 Price/cwt	Primal	SubPrimal	Code	Trim
1	1	1	\$942.59	Loin	Tenderloin Trimmed	189A	4
2	2	2	\$900.99	Loin	Butt Tender Trimmed	191A	4
3	3	3	\$831.05	Plate	Outside Skirt Peeled	121E	6
5	5	4	\$684.33	Rib	Ribeye Boneless Heavy	112A	3
4	4	5	\$663.94	Rib	Ribeye Boneless Light	112A	3
6	7	6	\$635.32	Plate	Outside Skirt	121C	4
7	6	7	\$593.82	Rib	Ribeye Lip-On Bone-In	109E	1
14	12	8	\$503.90	Loin	Bottom Sirloin Flap	185A	4
19	19	9	\$500.77	Short Plate	Short Rib	123A	3
12	8	10	\$497.97	Flank	Flank Steak	193	4
9	9	11	\$464.77	Loin	Strip Loin Boneless 0x1	180	3
8	10	12	\$455.20	Loin	Short Loin 0x1	174	3
10	11	13	\$448.45	Loin	Strip Loin Boneless 1x1	180	1
16	15	14	\$435.58	Plate	Inside Skirt	121D	4
18	18	15	\$407.46	Chuck	Clod Tender	114F	5
15	17	16	\$387.93	Loin	Strip Loin 1x1	175	3
13	16	17	\$362.10	Loin	Sirloin Tri-Tip Peeled	185D	4
37	38	18	\$347.87	Chuck	Short Rib	130	4
21	20	19	\$320.12	Loin	Top Butt Boneless	184	3
22	22	20	\$306.57	Loin	Top Butt Boneless Heavy	184	1
24	26	21	\$284.72		Pectoral Meat		
31	28	22	\$279.97	Chuck	Chuck Roll 1x1 Neck/Off	116A	3
26	27	23	\$276.27		Cap and Wedge		
20	23	24	\$261.28	Loin	Sirloin Tri-Tip	185C	1
38	36	25	\$251.34	Brisket	Deckle-Off Boneless	120	1
25	25	26	\$247.50	Round	Inside Round Denuded	169	5
27	21	27	\$234.80	Loin	Ball-Tip Boneless Heavy	185B	1
30	32	28	\$231.78	Round	Knuckle Peeled	167A	4
29	29	29	\$228.75	Round	Eye of Round	171C	3
33	31	30	\$224.86	Round	Boneless Round	161	1
32	33	31	\$217.18	Chuck	Chuck Tender	116B	1
41	41	32	\$216.50	Chuck	Chuck Semi-Boneless Neck/Off	113C	1
36	40	33	\$215.72	Chuck	Shoulder Clod Trimmed	114A	3

Table 4.2 Select Value Rankings Continued							
2012 Rank	2015 Rank	2018 Rank	2018 Price/cwt	Primal	SubPrimal	Code	Trim
34	35	34	\$214.17	Round	Top Inside Round	168	3
35	37	35	\$211.90	Round	Outside Round	171B	3
39	39	36	\$209.72	Round	Top Inside Round	168	1
43	42	37	\$200.41	Chuck	Shoulder Clod 13/25#	114	1
42	43	38	\$191.61	Round	Bottom Round Gooseneck	170	1
44	45	39	\$121.61		Back Ribs Frozen	124	4
23	30			Chuck	Clod Top Blade (Flat Iron)	114D	3
17	13			Brisket	Point-Off Boneless	120A	3
40	34			Round	Bone-In Round	160	1
28	24			Round	Boneless Peeled Heel Out	161	3
11	14			Loin	Short Loin 2x3	174	1
	44				Back Ribs Fresh	124	4

Wholesale price data for 2018 is listed in Tables 4.1 for Choice and 4.2 for Select quality grades. In order to provide a clearer picture of relative price values among cuts, the cuts in these tables are listed in value order, from the highest to lowest valued product (per hundred weight). The rank is based on the average weekly price in 2018. To illustrate how price values have changed over time, the ranking of the same cuts are listed to the left for the years 2012 and 2015 and the rankings are based on the average weekly price for each cut, for each year, respectively.

The year 2015 was selected as it was a time of record high and irregular price levels and the year 2012 was selected as it was a time of notable price changes preceding the anomalies of 2014 and 2015. Further, the total value of each product may not be reflected in this ranking, as the ranking is only based on price per pound. For instance, BF 189A, the Full Tenderloin, weighs roughly 12 pounds, so the total value of one Tenderloin roast would be about \$119. However, the Inside Top Round, BF 168, weighs roughly 50 pounds, and so one whole Top Inside Round roast would be worth \$115. It should also be noted that some cuts are not ranked in 2018 but are in 2012 and

2015. The USDA reports prices only for particular cuts with significant supply movement, and so the cuts not listed in 2018 likely did not have the same amount of product movement as in previous years. In addition, the unit price of products may not capture differences in product yield that affect relative values of cuts.

For Choice cuts, the top six cuts stay in the same order for all three years, but the Short Plate Short Rib has jumped significantly in 2018 to 7th compared to 17th in 2012 and 2015. This most likely can be attributed to the large growth in exports of Short Ribs which will be discussed in Chapter 5, Section 5.4. Some other products with notable increases in ranking occurred in the Chuck Short Rib (BF 130), Flat Iron (BF 114D), Chuck Roll (BF 116A), and the Semi-Boneless Chuck (113C). These can most likely all be attributed to increased exports to Asian markets.

For Select Cuts, the Short Plate and Chuck Short Ribs jumped significantly (BF 123A and BF 130) among other cuts from the Chuck primal that also shifted rankings in Table 4.1 (BF116A Chuck Roll and BF 113C Semi-Boneless Chuck). The Bottom Sirloin Flap (BF 185A) and Deckle-Off Brisket (BF 120) also improved in value rankings in Table 4.2 due to the increased popularity of Brisket and the Sirloin Flap as a steak entree and further processed product; these products will also be discussed in later sections of Chapter 5.

Weekly Choice and Select Beef Cut Prices were used to calculate correlation matrices, comparing all reported cuts (see Table 1) by quality grade and across quality grades- Choice versus Select and Select versus Choice. Weekly wholesale prices from 2006 to 2017 for all 50 cuts were used and a correlation matrix was calculated comparing each cut within the Choice quality grade data, within the Select quality grade data, all Choice compared to all Select cuts, and all Select cuts compared to all Choice cuts. The resulting matrices are large and rather unwieldy, but do provide insight into which products interact based on their price throughout time. These correlation matrices were created using the actual price over the ten year period, but an additional correlation

matrix of price changes between weeks over the same time period may provide additional insight into how cuts interact with price changes.

In general, high levels of correlation among beef products is likely as all products are produced during carcass fabrication and may be produced from the same primal or subprimals. However, by pinpointing cuts with 75 percent correlation or higher, a few insights can be highlighted.

In the Choice correlation matrix, BF 191A Loin Butt Tender Trimmed, BF 189A Tenderloin Trimmed Heavy, and BF 109E Ribeye Lip-On Boneless Light were not highly correlated with any other cuts, which reinforces the anecdotal evidence that consumers do not see any substitutes for these cuts. Other groups of products show high correlations simply because they are produced from the same primal or subprimal. For example, the Eye of Round (BF 171C) is highly correlated with the Outside Round (BF 171B) and the Bottom Round Gooseneck (BF 170) as the Outside Round and Eye of Round are produced from the Bottom Round Gooseneck. The Strip Loin 1x1 (BF 175) is highly correlated with the Short Loin 2x3 (BF 174), not necessarily due to their substitutability, but because the Strip Loin is produced from the Short Loin. Based on information received during interviews, the Chuck Clod Tender (BF 114F) has become a popular steak entrée and is commonly used in further processing. The correlation matrix supports this anecdotal evidence, listing many other Loin products (Bottom Sirloin Flap, Loin Top Butt, Loin Ball Tip Boneless, and Sirloin Tri-Tip) and the Flank as moderately high correlation (76 to 86 percent). The Flat Iron (BF 114D), another innovative and popular steak entrée alternative, does not correlate with other Loin cuts, but instead with lower valued cuts from the Chuck, Round, Brisket, and the Short Plate. Finally, the Bottom Round Gooseneck (BF 170) is highly correlated with 21 other cuts. Some correlation is simply due to production (from the same subprimal), but others are more surprising, like the various Chuck products that are correlated 90 percent or more with the Gooseneck Round (the Shoulder Clod, Chuck Semi-Boneless, Chuck (Mock) Tender, and Chuck Roll). Anecdotal information suggests that Chuck values are growing relative to

Round cuts due to exports, but the correlation matrix indicates that the Chuck and Round are still fairly correlated in use as they are both lower valued end cuts.

In the Select correlation matrix, the Ribeye and Tenderloin do show correlations with other cuts, in contrast to the Choice correlations. In fact, the BF 189A Tenderloin Trimmed Heavy is highly correlated with 13 other cuts, including the Ribeye, 6 cuts from the Round, 5 cuts from the Chuck, but no cuts from the Loin. It is difficult to pinpoint a reason for this stark contrast in correlations of these products in Choice and Select, but from a cut quality standpoint, a Select Tenderloin, while still relatively tender, is just as lean as many of these Chuck and Round cuts, which could be used as substitutes for value priced steaks, salad, sandwich, or other dish ingredients, or for further processing. The BF 109E Ribeye Lip-On is correlated with 13 other cuts, including 6 Loin cuts, the Inside and Outside Skirt Steaks (BF 121C, D, and E), the Brisket (BF 120), and the Boneless Round (BF 161). Again, there is no obvious reason for these Select correlations compared to the Choice correlation matrix, but it does indicate that the Select Ribeye is a substitute for other steak entrée options and for cuts that may be used as ingredients for various menu items or for further processing. It is also interesting to note that the Outside Skirt (BF 121C and E) is correlated with 23 cuts including the Boneless Ribeye (BF 112A and BF 109E) and Tenderloin (BF 189A). In addition, the Inside Skirt (BF 121D) is correlated with 29 cuts including the Flank (BF 193), Cap and Wedge, Brisket (BF 120), Boneless Ribeye (BF 109E and BF 112A), Tenderloin (BF 189A) and 10 other cuts from the Loin. This is interesting as the Skirt Steak is often used as Tex Mex carne asada dishes or for further processing as it is a rather tough cut that is difficult to prepare in a high quality manner. So, the fact that it is associated with some of the highest quality products in the carcass (the Tenderloin and Ribeye) indicates the difference in product use and quality between Choice and Select quality grade carcasses.

In the Choice versus Select Correlation matrix, many of the cuts are correlated simply due to the fact that they are the same cut in both the Choice and Select carcasses or because both come from

the same primal, although these are usually correlated in the high 70 to mid-80 percent range. However, there are a few notable correlations that are not based on product similarity. The Choice Sirloin Tri-Tip (BF 185C and BF 185D) are slightly correlated with the Select Inside Skirt Steak (BF 121D) and the Brisket (BF 120). The Choice Boneless Ribeye (BF 109E and BF 112A) are highly correlated with the Tenderloin (BF 189A), Loin Butt Tender (BF 191A) and Outside Skirt (BF 121C and BF 121E). This indicates that Choice products most often used for steaks and in further processing (in the case of the Tri-Tip) can be a substitute for lower quality end cuts in the Select carcass, most likely in further processing or as beef ingredients, not as steak entrées. These correlations also give quantitative evidence of products that may be used as substitutes in further processing. This is also true for the Select versus Chuck correlations which indicate many groups of products that may be used as substitutes or are interchangeable based on price point for various uses.

The wholesale data available does provide some useful information, but the wholesale data is pretty limited in its reach. Roughly 50 cuts are reported, but the North American Meat Institute (NAMI) lists nearly 99 separate cuts that can be ordered and many of these may have three to four additional weight specifications. In addition, the data is just at a wholesale level, and does not account for consumer prices at retail or food service or to export customers. There is also national retail data reported through the USDA's Agriculture Marketing Service that goes back to 2000 which lists a selection of widely sold products to retailers, both in aggregate form and separated by region. However, this report also reports only 50 products, with 7 separate ground beef or patty product prices. While this does provide some insight into the retail price environment, the other half of domestic users- food service- is not available. Finally, as over 20 billion pounds of product goes through the beef supply chain each year, it is nearly impossible to get regular quantity data, which would be necessary to calculate a complete demand system over a time frame that would capture products flows and short term inventory management. It is

believed that weekly price and quantity data would be required to adequately specify a complete demand system.

4.2 Interview/Research Process:

Correlation matrices, cut-out, and seasonality chart comparisons created using available data raised several questions about beef demand issues and trends. However, it was evident that the data available was incomplete and would not support a complete demand analysis as described in Chapter Two or answer any question about beef demand. It was decided, based on the questions incurred from analyzing the data, to interview various segments of the beef industry in order to gather additional information and better understand beef products, product flow, and product interactions.

Companies representing all major sections in the beef supply chain- packers, distributors, further processors, retail, and food service- were selected to be interviewed. At least two companies in each section were interviewed so that the finished discussion would be aggregated enough to provide an industry-wide discussion and to not reveal proprietary information. Companies were chosen based on the industry sector, availability of contacts at that particular company, and interview feasibility. Two major packers and two smaller, regional packers were selected and interviewed. Companies in the further processing and distribution sectors were chosen based on the company's production size, region, and contact availability. Retail groups were chosen to ensure a wide range of regions and consumer bases and food service groups were selected based on restaurant type, diversity of restaurant types, and accessibility.

A list of potential interviews was considered to ensure coverage of all sectors. Companies were contacted to arrange interviews in person or by telephone. Most companies were willing and

interested in participating. However, a few companies declined and alternatives in that sector were identified, contacted, and interviewed.

Each company interviewed was provided a letter explaining the purpose of the interview. The letter also included a statement of confidentiality to assure participants that no direct quotes would be attributed to the individual or company and that no proprietary information would be revealed.

A set list of questions was not used in each interview, however, each interviewee was asked about their role in the company and was given a brief description of the research project before the interview began. Each interview covered various topics pertinent to the beef marketing system and to that specific sector or company. Major topics of interest included: exports, increasing carcass size, cow and Holstein market, food service, retail, further processing/value-added, product mix, pricing strategy, boneless versus bone-in, trends in the market, ground beef, cold storage (fresh vs frozen), labor and trucking, seasonality, and regional differences. Each of these topics is discussed in further detail in Chapter 5.

During each interview, Lauren Clark, Graduate Research Assistant, typed notes while Dr. Derrell Peel and Clark conducted the interview. Interviews were conducted with 30 different individuals from 22 organizations or companies. After each interview, notes were further organized into bullet points by topic or category. Once all interviews were completed, individual interview notes were separated into category specific notes, and then each category note document, in bulleted form, was re-formatted into a complete, readable report in paragraph form. Chapter Five includes a synthesis of information gathered in these interviews.

4.3 Industry Sectors

The point of this report is to provide an aggregated description of several central topics of interest. An overview of the companies interviewed is provided in the following sections (4.3A to

4.3D) to highlight the size and scope of the companies as representative of each industry. To maintain the anonymity of each individual and company, the following sections are a synthesis of information across all firms. The list of companies and organizations interviewed is included in Appendix D.

4.3A Packers:

There are four packing companies in the country that slaughter the majority of cattle produced in the country, but smaller regional firms also help to fill gaps in demand and to serve niche markets. Two major packers and two small packers were interviewed. Each packer has unique strategies and objectives for finding and maintaining customers. Large packers have multiple plants that slaughter 30,000 head or more a week, per plant. The packer's primary goal is to process as many cattle as possible and move pounds through the supply chain in the most efficient way possible. Packers also have the difficult task of marketing all products that come from a carcass, from meat and bone, to blood, hides, intestines and other offals, at the highest price possible, all while keeping the product safe and meeting customer specifications.

The large packers capitalize on economies of size and scope. Economies of scope refers to a packer (or any company's) ability to be more profitable or efficient because they are large enough to provide a wide variety of products and find a wide array of customers to serve, all from one location. Economies of size, on the other hand, is the average cost per unit produced, and as major packers are slaughtering immense numbers of cattle each year, they are able to do so relatively cheap and efficient per head compared to what a smaller packer may be able to do. This is the primary reason that small custom butchers struggle to stay in business as they 1) have a small pool of producers to procure supply from, 2) have a small pool of customers to sell products to, and 3) have a difficult time marketing the full set of products produced from the carcass.

Small packers are not as large as the big four, but are large enough to slaughter five to ten thousand head a week and serve more specific niches in the market. With smaller production levels, these companies have the ability to specialize in other product lines, like in-house grinding and patty production and premium, specialized product lines such as wagyu or American style kobe beef.

Most packers have a range of products lines available based on customer specifications or quality sorts, often including at least one Angus program similar to Certified Angus Beef (CAB), requiring black hided cattle and upper 2/3 Choice quality grade carcasses. A natural, antibiotic free line is also common, in addition to more commodity oriented product that may or not be breed specific and can be Choice quality grade or below. Some of these product lines are also food service distribution specific. This means that an individual distributor may have specific requests for a certain sized Ribeye or other cuts that the distribution company can process in their own cutting houses and send to their own customer and niche markets.

For the natural or antibiotic-free product, animals are raised specifically for the product line, but if the animal does get sick or requires antibiotics for any reason, it will be moved to general production feedlots. Due to the high premiums for natural products and the antibiotic free requirement, these cattle may not be processed unless there is an order for the product, as the packer does not want to produce a large supply of premium natural beef if they don't have customers to purchase it. Other premium brands may have carcass or Ribeye size requirements to qualify or must be sourced from particular feedlots within a certain geographic radius. For the most part, carcasses will trickle down through the brand or product line levels. This means that if a black hided steer that fits the qualifications for a natural or CAB type program, but doesn't grade top 2/3 Choice or meet other qualifications for the program, the carcass will then be utilized in the next product line down until the carcass fits all qualifications necessary to be sold under a particular product line or brand name. One large packer interviewed also promotes fed Holstein

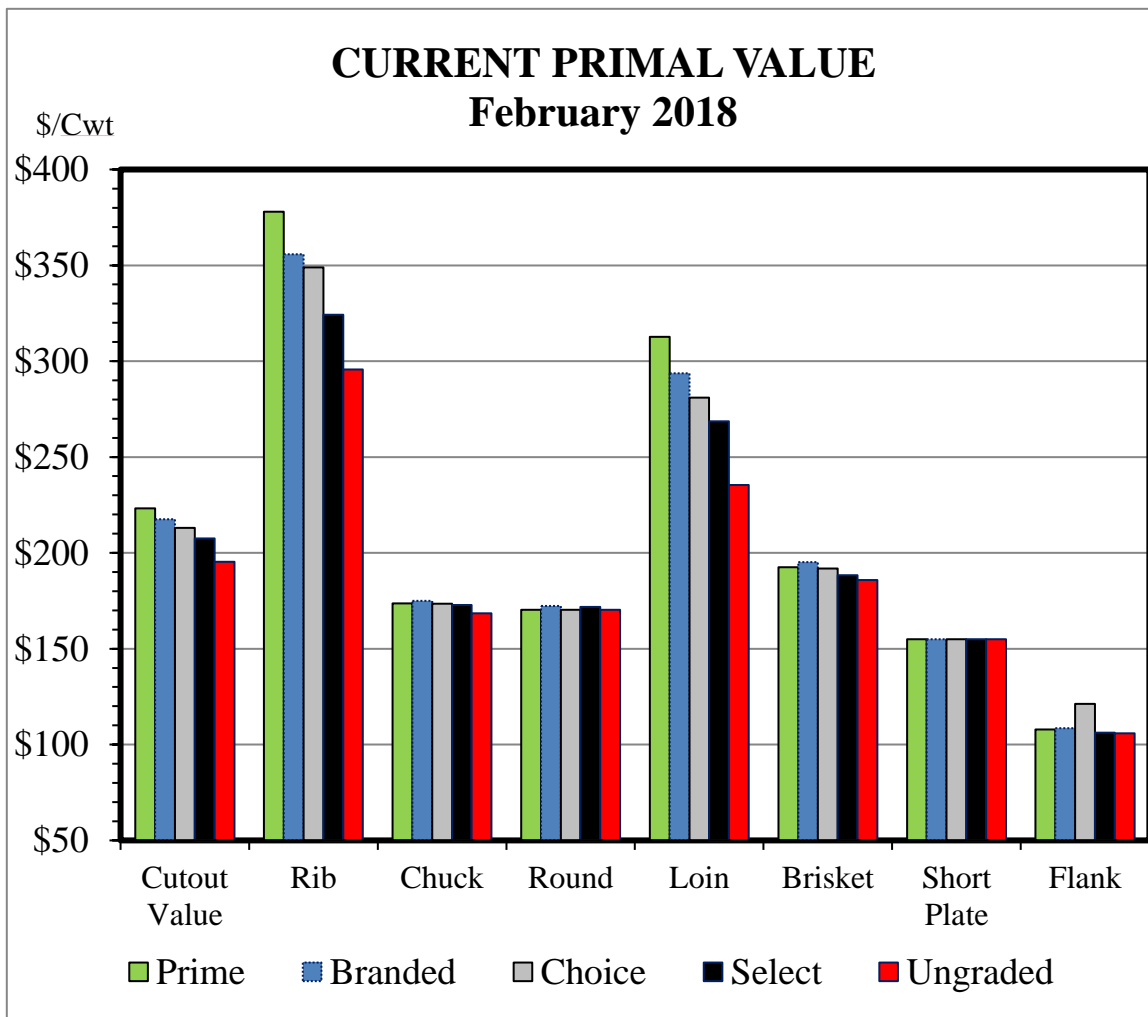
and cow beef products. If needed, Holstein cattle are processed in cow and bull processing plants which handle larger carcasses. With so many product lines and customers requesting various Ribeye size or other sorting protocols, there may be twenty or more separate rail lines in each packer's cooler, separating carcasses by the product line, Ribeye size, or other customer specification.

As previously noted, most packers will have a branded upper 2/3 Choice to Prime quality grade Angus branded program, but these are not the same as Certified Angus Beef (CAB). Beef labeled CAB must meet 10 specific requirements: 1) Modest to high marbling, 2) Medium to high marbling texture, 3) A maturity which indicates an age of 30 months or younger, 4) A 10 to 16 inch ribeye size, 5) A hot carcass weight of 1,050 pounds or less, 6) Less than an inch of back or external fat, 7) Superior muscling shape (this was an attempt to limit, but not exclude, the amount of dairy influenced carcasses that qualified, 8) No dark cutter carcasses, 9) No neck hump exceeding two inches (to exclude bulls or *bos indicus* influenced cattle), and 10) Predominantly solid black hide or other obvious signs of Angus influence. Like other branded programs, if the carcass does not meet all ten requirements, it may trickle down to the next branded program until the carcass meets all brand requirements. The price break between CAB branded and unbranded products is noticeable and this is particularly true in the CAB Brisket, which is the largest Prime product sold in terms of pounds. There is also brand premiums in the Chuck, Flank, and Inside and Outside Skirts, due to some export demand and to the increase in Asian and Mexican or Tex Mex restaurants in the United States.

Branded programs and product lines provide packers and producers with a quality product that is well marketed and identifiable which usually receives a premium over other commodity, or unbranded, beef products. However, as the supply of beef meeting branded program specifications continues to grow relative to standard Choice or commodity type boxed beef, the premium spread may decrease. As Figure 4.3 illustrates, the premiums for branded or Prime

quality grade products are not always significant. In the case of the Brisket, there is little price difference between branded and Prime Brisket. As the number of Prime quality grade carcasses increases, the price spread between Prime, branded, and Choice carcasses also narrows, as proved by the economic theory of supply and demand. It is hard to pinpoint a particular reason, however, for the price discrepancy in the Brisket category. A probable cause may be that the product itself has a high level of fat and flavor regardless of quality grade, so the marginal improvement in eating experience between Choice, upper 2/3 Choice, and Prime quality grades are minimal and prices reflect that.

Figure 4.3: Current Monthly primal values compared by branded and quality grade; Compiled by the Livestock Marketing Information Center.



The two regional packers interviewed specialize in different areas and serve different niche markets. One packer processes older cows and dairy animals to supply the lean, Select or No Roll quality grade, and export markets. This packer also has a locally sourced fed beef program and a premium fed steer program that provides high quality graded products to a variety of retail, food service, and export markets. They are also one of the largest suppliers of fresh trim in the country which goes to further processors and grinders to make ground beef and other products. This packer also has in-house grinding capabilities to produce and sell ground beef and patties to a wide range of customers.

The other regional packer interviewed is unique in that most of its production is vertically integrated. This means that the company owns its own cow/calf operations and contracts with local ranchers who provide calves which are fed in their company-owned feedlots and locally contracted feedlots and are processed in their own packing plants. This packer produces very specialized, branded products, and owns the genetics for their cattle herd and controls the cattle feeding and processing to meet this brand's customer specifications. For this premium brand and the company's upper 1/3 premium Choice product, cattle are not processed until the company receives orders for products in that particular brand. Once these orders are filled, the rest of the carcass will move into the next tier, commodity boxed beef, or house brand product lines. In order to receive the full premium for these specialized products, company salesmen create demand for products, especially those in the Chuck, Round, and other end cuts, at the Prime quality grade price point. This company is also unique because, unlike most processors, they have control over the entire cattle production cycle from calf to feedlot and packing plant. This means that they can provide the bull genetics to their cow/calf or partner ranches, which allows them to control carcass size and other issues that may detract from the final value of the carcass.

4.3B Distributors:

Packers sell product directly to food service, retailers, or to international markets. However, a large share of restaurants source products through a distributor who provide customers with products meeting their individual specifications. Three large broad line distributors were interviewed. Broad line means that the company provides all products a restaurant or other food service entity may need, from meat to napkin holders, and even pantry goods for hotel and movie theater snack counters. These companies often work directly with producers, rather than packers, to source product for their exclusive product lines and brands. One premium beef brand in particular is exclusive to one distribution company and is the first Angus brand to use “Path Proven” technology, which is a DNA based traceability system that ensures that the carcass has verified Angus influence. By sourcing directly from producers, the cattle producer gets a premium, up to \$20 or \$30 per head, to meet certain carcass quality specifications, and the packer also receives a premium for fabricating the carcass to meet brand specifications. These carcasses must grade upper 2/3 Choice and have a hot carcass weight of 850 pounds or less. With a smaller carcass size, food service groups have access to smaller boxes of Ribeyes, containing 2 to 3 per box, which are sold at a premium compared to larger boxes which may hold 5 to 6 Ribeyes. This is especially helpful for food service that may only serve Ribeyes on special or in small amounts.

Like the packer, product that doesn't fit the requirements for a certain product line or brand will move down to lower quality or commodity boxed beef product lines. For product that does fall into the top tier, but aren't already sold, the distributor will create a “push list”, or list of products that can be sold at a discount. While these branded programs do provide premium products to customers, these premium products account for less than 20 percent of beef sales. The bulk of sales are commodity beef products. Distributors service mainly restaurants, but also provide products for institutional customers such as hospital, school, prison, university, and other large scale cafeterias. For the most part, the product orders are stable and consistent, so brokers are

often inventory managers as much as they are salespeople. The product mix primarily purchased by one distribution company is as follows: Chucks, 7 percent; sliced Short Plate and Brisket, 12.3 percent; Loin, 15.1 percent; Rib, 8.7 percent; Round, 3.9 percent; the remaining 53 percent is ground beef. Many restaurants tend to always use the same cut for certain dishes or menu offerings, trading down in quality grade before changing the cut, in response to price changes. Restaurants highly value reputation as in providing the customer with the best product or their famous recipe, so chefs prefer to stick with the same product regardless of the availability of lower cost alternatives. Large national accounts require consistent quality, so they tend to buy products from the same vendor each week, but may buy different products from different vendors. Smaller chains, on the other hand, will shop vendor by vendor to get the best price on less valuable or end cuts, like the Top Sirloin Butt, for example, but will only want top quality for their Tenderloin and Ribeye purchases.

Distribution companies often own further processing facilities. These facilities purchase boxed beef and further trim the product or cut steaks per customer specifications. These further processing plants may also inject product with marinade or add seasoning. Purchased carcass trim or whole muscle cuts such as Chuck Clods and Briskets may also be ground at these facilities for specialty ground beef blends. These facilities may also cut value-added cuts such as the Petite Tender or Flat Iron from the Chuck Clod, as these products are not typically produced during primary fabrication. “Just in Time” cutting houses take orders for Ribeye, Strip Loin, Tenderloin, or other steak entrées from local restaurants, cut them fresh per customer specification, and deliver them to the restaurant within a 24 to 48 hour time period.

4.3C Further Processors:

Three primary further processing companies were interviewed. Further processors purchase boxed beef, trim, and other products and produce value-added or further processed products. Trim

and whole muscle cuts may be ground together to make ground beef products or patties. Trim and muscle cuts are also chopped, thinly sliced, marinated, pre-seasoned, or have other ingredients added to create ready-to-use products for food service and retail. Steak, portion size, and value-added cutters are also included in the food processor category. These companies use boxed beef subprimals and cut steaks to customer specific portion sizes. Interviews were conducted with companies in each of these preceding product categories.

A specialized grinding house was interviewed that supplies ground beef patties for a major quick service restaurant. The majority of their ground beef production is pretty stable, but raw products are priced using a combination of spot, formula, and forward pricing. This restaurant relies on their suppliers for quality and have a set list of approved suppliers who must provide a ground beef product with specific lean to fat percentage. In order to meet the specific lean point, this grinder in particular will utilize fresh 65%, 70%, 75%, 80%, 85%, and 90% lean trim from fed and non-fed processing plants and some imported frozen 80%, 85%, 90%, and 95% lean trimmings. This grinding company constantly monitors market prices to determine the least cost input mix to meet the specified lean to fat ratio at the lowest price possible. Their raw product mix may also include whole muscle cuts, particularly from the Round, if trim prices are too high. Each lot of ground beef is also tested at the plant to ensure that the lean to fat ratio is met. Patties are also tested regularly at the plant to ensure a taste and eating experience consistent with the customer's specifications. If product does not meet quality expectations, adjustments will be made to the raw product mix until the product does meet customer specifications. As the majority of the ground beef product leaving this plant is fresh, stringent food safety protocols ensure all products are free of harmful bacteria and foreign materials.

Some further processors provide products with additional ingredients added or change the form of the product, providing a wide range of items and more flexibility in the inputs used. These companies provide a product that gives flavor, texture, and other qualities to a beef product a

specific price point. Further processors are adding value to under-utilized steak products; marinating and flavoring steak cuts; all of which makes preparation consistency easier for restaurant cooks. While it is easy to sell high valued middle meats, further processors assist the beef industry in selling under-utilized and lower value parts of the carcass. Part of their customer base is high end restaurants who will order high quality boxed beef products and pay the further processor to age and store the product for them.

Another portion of this sector, known as steak cutters or cutting houses, cut steaks into specific portion sizes based on customer specifications- fresh or frozen, quality grade, aging, portion size, and other fabrication specifications. The remaining portion of the further processing sector is processors that further process beef products into convenience type or ready-to-cook or serve products. In both of these sectors, the processor identifies the raw material supplier and adds a processing charge before selling the product to the customer. Some customers may also request that these processors purchase large quantities of raw material when the prices are in their favor and store the product for them until they can use it. Of course, this results in additional storage costs.

After the 2009 recession, many restaurants realized that they could no longer afford to offer every type of steak on the menu, and instead had to downsize their product mix and portion sizes available on the menu. This, along with the need for consistent product portion sizes, increased the need for further processors who provide portioned products, whole primals, or trimmed primals for block-ready retail products. These further processing companies help the beef industry to improve whole carcass utilization. One processor interviewed indicated that their company began by providing a portion cut Tri-Tip steak offering for a national casual restaurant chain. At this time, in the early 1980s, the Tri-Tip was misunderstood and was often roasted or smoked instead of being cut for steaks. At the time, the company was providing 29 million pounds of Tri-Tip steaks to this one restaurant chain, accounting for nearly half of the nation's

Tri-Tip consumption. Due to a new product promotion, this restaurant chain now uses Top Sirloin Butt for the same Sirloin steak offering and today is only supplying 11 million pounds of that product to the restaurant chain. It is important to note that the Top Sirloin Butt and Tri-Tip are both from the Sirloin subprimal, and therefore, are both be considered Sirloin steaks. For this restaurant group, if Top Sirloin steak prices dip, the processor can buy a large amount of the raw material, portion cut it, and then freeze the product, allowing the restaurant to use the product at any time within a six month time period. Steaks for this restaurant are cut into six and eight ounce portions, with tolerance for only half an ounce above or below the specified portion size.

One of the challenges of further processing is meeting a customer's specifications at a certain price point, meaning that yield and cost are large considerations in product sourcing decisions. However, the biggest challenge for this segment of the industry is meeting a customer's tight quality specifications at the price point that they want to maintain. Often times, the customer must choose between one or the other, as they may have unrealistic expectations of what type of product that they can get at their specified price, especially in the natural, antibiotic, and hormone free niche market. As portion cuts steak products are sourced from aged product, the bench trim created from cutting steaks may not be used by these further processors in fresh products, but must instead be sent to cookers who will use it in a fully cooked product.

Steak cutters are also high tech, utilizing laser imaging machines that precisely measure and cut individual steaks into customer specified portion sizes. Much of the steak cutting process is mechanized, but steak cutters still rely on well trained employees to hand trim and cut steaks to meet customer specifications. These companies have also found that female workers provide a consistent, closely trimmed product, due to their superior attention to detail. Some cutters and customers will specify that females cut Tenderloins while male employees cut other steak products.

These further processors also provide other processed products to meet a wide variety of customer needs, following the adage, “We don’t make our product, we make your product.” Some processors make products that another manufacturer will use as an ingredient. For example, one further processor creates beef products for pizzas such as Prime Rib lifter meat for Prime Rib pizza in addition to products for meal kits that will be sold in large national retailers’ ready-to-eat frozen food sections. The majority of dinner decisions occur within the last hour of the work day, so these products provide a convenient meal option. However, this adds an additional challenge for further processors to provide a restaurant taste from a microwave, which requires intense product development and testing to ensure a high quality eating experience from a frozen meal. One frozen Asian cuisine company recently requested that one of the further processors find a Short Rib alternative with a similar texture and flavor profile, but at a lower price. These and other orders help further processors to find and utilize under-used cuts from the carcass.

Other product offerings include marinated, pre-sliced, and chopped products that can be used in a variety of meal applications. Sous vide products, in which product is seasoned, vacuum sealed and then cooked in temperature controlled water, is becoming more popular, and can be used in food service as a Philly cheese steak or salad topping item. Fresh trim products can also be used for taco tips, but most customers want to know what cut the tips are sourced from and may specify a Skirt steak, Tenderloin, or other specific cut for their steak tip product. As processors often don’t produce enough trim when processing these particular cuts, they will instead dice pectoral or Eye of Round for steak tips. Fresh trim products may also be used for a street taco application or, in larger pieces, for an Asian type product. For Tex Mex products, for example, restaurants may accept products with a wider range of product specifications, as long as they meet a certain price point. Other products created by these further processors include diced, marinated, imported, grass fed beef products from Australia and New Zealand for a large fast casual Tex

Mex chain; hamburger patties for a national diner chain; corned beef and burnt ends from the Brisket and bacon wrapped Tenderloin filets for retail and food service.

Growth in the demand for sliced, chopped, and marinated products can be attributed partly to the increasing popularity of meal kits. Meal kits are easy to use and cook and allow for greater flexibility and variability in what products companies can offer in their meal kits. One company interviewed was supplying two popular meal kit programs which included cutting and packaging Ranch Steaks from the Chuck Shoulder Clod for one particular delivery meal kit service. These kits provide small, individually portioned steaks, with an easy to follow recipe, and other ingredients and seasonings, so untraditional cuts like the Ranch Steak work well and allow for better whole carcass utilization.

4.3D Food Service and Retail:

The next step in the supply chain is either food service or grocery retail. Each of these groups will be discussed in further detail in Chapter Five, Sections 5.5 and 5.13, respectively. Interviews included three restaurant groups that have both national chains and local restaurants spanning a wide range of restaurant concepts from burger chains and fast casual Tex Mex to casual Italian and American restaurants and high end Prime steak houses. Two regional retail chains were also interviewed, one with 14 nationwide distribution areas encompassing 33 states and over 2,200 locations and the other encompassing a smaller region with over 1,200 locations.

CHAPTER V

RESULTS

The following section describes the findings from data analysis and interviews. There are several major topics of interest that became common themes among the interviews and are supported or contradicted by available data. These topics are separated into subsections as follows: Boneless versus bone-in products, Cold Storage/Fresh/Frozen, Cow/Holstein Beef Markets, Exports, Food Service, Ground Beef Market, Carcass Size, Carcass Grading and value changes, Labor and Trucking Issues, Pricing Strategies, Seasonality/Regional Differences, Rib/Loin Comparison, Retail, Trends, and Value- Added Products. It should be noted that most of this section is not cited as it is a synthesis of anecdotal information from interviews. This information was provided to the researchers on the condition that no specific identifying comments would be used in order to keep proprietary company information anonymous. This chapter provides a normative, aggregated description of these industry issues. Additional information used to supplement the anecdotal information is cited.

5.1 Boneless versus Bone-In Product:

One notable trend that is being observed in both food service and retail is the increase in demand for bone-in, as opposed to boneless, beef products. Retailers have been driving the demand for these products, as bone-in products can be sold for a lower price per pound than its boneless equivalent as additional fabrication and labor is often needed to de-bone the product. This lower price is only evident to consumers who perceive the value of the product by its per pound cost. However, many consumers look at the per package cost of the steaks instead, in which bone-in product may have a higher total package cost than its boneless equivalent.

From a food service perspective, products like the Tomahawk and Cowboy Ribeye, in which the rib bone is left intact at a length of three or four(Cowboy) to twelve inches (Tomahawk) to the Ribeye steak, have become very popular at high end steakhouses and in some retail meat cases as well. Consumers perceive that bone-in products provide more flavor. However, bones do not provide a more robust, meaty flavor in steaks as the cut does not cook long enough for the collagen in the bone to break down and flavor the meat, as it would in a bone-in roast. Bone-in products cause several issues for food service and packers who don't necessarily want to provide bone-in products, but do want to meet the increasing demand for these products. Bone-in products have a higher menu cost, as the product is sold as a total weight or value and bone adds additional weight to a boneless product. In addition, bone increases the steak portion size, so, if a restaurant is trying to provide a smaller portion size, the steak must be cut thinner than it would be cut as a boneless option for the same cut.

For these reasons, food service establishments often prefer to serve boneless products. In addition to the additional cost and portion size issues, food service establishments often do not have the "back of the house" labor to further fabricate bone-in products. Many steakhouses and other food service establishments will purchase an entire subprimal, such as a Ribeye roast, and will cut

steaks from this subprimal at the restaurant. However, many restaurants do not have saws or skilled employees to cut a bone-in roast in the kitchen.

Boneless and bone-in products have provided additional opportunities for further processors. It can often be difficult to add value or differentiate middle meats, so, based on the customer's demands or specifications, providing a boneless cut that requires additional fabrication and labor to de-bone a product can garner a premium. Further processors may also provide bone-in alternatives such as a split-bone chop. A common example of this is to take a bone-in Ribeye roast and cut steaks between the bones as opposed to cutting the steak with the bone. This provides a smaller, but inconsistently sized, steak with only a portion of the rib bone intact, as opposed to the entire bone, included in the steak portion.

5.2 Cold Storage and Fresh versus Frozen:

Beef is a perishable product with a short shelf life, leaving packers, further processors, and other end users with the difficult task of maintaining product quality and freshness before the product is used. Once an animal is slaughtered, the carcass is quickly broken down and packaged in vacuum sealed bags. By removing oxygen from around the meat product, shelf life is extended, microorganism growth is reduced, and water loss is also prevented ("Aged Beef at Home", 2019). These vacuum sealed packages of subprimals are then compiled by product/subprimal type and placed into size specified boxes termed "boxed beef." These boxes are then transported to further processors, distributors, food service, and retail locations where they may be further aged.

Aging allows the muscle's natural enzymes to break down connective tissues within the muscle fibers into amino acids which improve the muscle's flavor and tenderness ("Aged Beef at Home", 2019). Aging can be done in two alternative forms- dry and wet. Wet aging involves holding the cuts or subprimals in their vacuum sealed or cryovac packaging in cooled storage areas for a

minimum of seven days up to 60 or 90 days, based on customer specifications, but are generally aged for 14 to 45 days.

Wet aging helps to improve the muscle's flavor and tenderness in its own natural juices and decreases the amount of purge (shrink) as it ages in a sealed container. Wet aging is especially beneficial for small cuts and those with less marbling as aging enhances the cut's flavor profile without shrinking. Essentially, all beef products purchased at a retail grocery store or restaurant are wet aged unless otherwise specified. Products available at retail do not typically have aging specifications, but are aged simply because they move through the supply chain from packer to distributor to store which takes time. Food service, on the other hand, typically do have aging specifications for the products that they serve and will pay a premium for aging in the form of storage, handling, and other fees paid to the packer, further processor or distributor.

Dry aging involves removing products from cryovac packaging and holding subprimals and roasts in a temperature and humidity controlled environment which allows for the growth of certain mold species on the surface of the meat ("Aged Beef at Home", 2019). Dry aging leads to a nutty or "funky" flavor similar to blue cheese, but also causes considerable shrink of the product, up to 30% of water weight, through the aging process. Due to the storage and time requirements, in addition to product weight loss and additional labor, dry aged steaks and other products typically garner a premium and are found at higher end steakhouses. While a lengthy aging time used to be a necessity in order to provide a flavorful, tender, and quality eating experience, the recent improvement of carcass quality in terms of inter-muscular marbling and external fat have decreased the aging time needed to insure a quality eating experience. Today, aging requirements are often more a function of customer specification rather than of necessity. The marginal increase in flavor and shrink caused by dry aging decreases over time, so lengthy aging times are not a necessity but rather a matter of preference.

While all fresh muscle products are aged in some way to preserve and improve quality, there is still a time table in which fresh products must be used before their quality diminishes. For fresh trim (which is not aged) going to ground beef, the product must be used within 7-10 days to maintain its status as fresh beef or fresh ground beef. Bench trim, or trim produced from cutting steaks or roasts, and not from carcass fabrication, cannot be considered fresh due to food safety issues concerning *E. coli*, and therefore cannot be used in ground beef, and must go to cookers rather than to other fresh beef processing or manufacturing facilities. (“Ground Beef and Food Safety”, 2012). Cookers utilize bench trim and other products to produce ready-made or pre-cooked items for food service and retail, like taco meat and chicken fried steak.

Fresh beef products are viewed as higher quality by consumers so retailers and food service establishments prefer to provide their customers with fresh, never frozen beef products. This is especially true for steak houses which have a steady demand for steaks and patrons expecting and paying a premium for a high quality steak product.

However, if the consumption time frame for a beef product is uncertain or lengthy, beef products may be frozen. Exported products, including offals, trim, and whole muscle cuts or subprimals, are most often frozen to ensure that the product retains its quality until it reaches its final destination.

Other products are frozen for domestic customers for a variety of reasons. If a food service establishment does not have predictable or steady steak demand, it may choose to purchase frozen subprimals or portioned steaks which they can thaw as they need the product. In addition, ground beef, ground beef patties, and other further processed beef products may also be sold frozen, depending on customer specifications and consumption time frame. Beef may also be frozen if a distributor, food service, or retailer wants to take a position on a large amount of one cut or subprimal. For instance, if the price of Bottom Rounds suddenly dropped, a retailer may buy a

large amount of the product, freeze it, and then thaw it as needed or when they run their winter promotional advertisements for London broils.

Ribeyes are another product that may be frozen in large quantities. Prime Rib or Ribeye roasts are popular on holiday menus both in food service and at retail, however there is a limited supply of the product during the winter months. In preparation for the holiday demand, Ribeyes may be purchased months in advance, sometimes as early as July or August, and are held in cold storage and gradually thawed until they are used during the holiday season. However, as many of these products may be served at high end steakhouses or grocery stores, the desire to store the product and maintain its “fresh” status is very attractive.

To meet this desire for fresh, deep chill and “Suspended Fresh” technology, patented by iQ Foods, is currently being utilized in several U.S. facilities. These facilities hold the meat just above the freezing point, around 26 degrees Fahrenheit. This technology can extend the shelf life of the product 60 to 90 days without impacting the muscle’s structure or taste. While the product still takes up to 3 weeks to thaw completely before use, it can still be sold as fresh. However, utilizing this technology requires additional costs, and is therefore, not a viable option for all beef products. Even with seasonal Rib demand, there has to be enough price volatility on the product or concern about available supply, to make financial sense to take a large position on a product and pay storage costs until the product is sold at a later date. There are only a few products in which this type of storage makes financial sense, but some major retailers utilize the technology in order to buy large amounts of fresh product and hold it until they are further processed into a value-added or “meat-plus-ingredient” product. While some processors and distributors view deep chill as just another form of freezing, others in the industry feel that it provides customers with an additional opportunity to provide a fresh product even with variable product consumption. It may also allow packers or other further processors to slow the aging process and decrease product shrink, which provides value to the industry.

The belief that fresh beef is superior in quality to frozen also applies to ground beef and led McDonald's, Wendy's and other major fast food chains to use fresh beef only for some or all of their hamburger product offerings. This need for a large supply of fresh beef had the industry scrambling to find enough fresh trim or even whole primals with the right lean-to-fat ratio to meet this fresh ground beef demand. As the ground beef section (Chapter 5, Section 5.6) describes, ground beef is produced by combining fat and lean trim to produce a specific lean-to-fat ratio. In order to create this ratio, grinders often purchase imported lean beef trimmings from New Zealand, Australia, and other lean beef markets or grind whole subprimals from fed or cow/bull carcasses. Importing trim is often the most cost effective way to meet the lean point unless whole muscle prices are lower than trim prices.

However, imported trim is received in a frozen form and therefore cannot be used in a fresh-only product, meaning that ground beef suppliers have to find other beef sources to meet these demands. This issue has caused many grinders to buy whole subprimals, including the Round Knuckle and Outside Round subprimals, and grind them. Seasonality also plays a role in the trim market as the amount of cows being slaughtered increases in the fall months. Ranchers cull their herds after calving season, resulting in an ample supply of 90% lean trim, but fewer end primals like the Round to grind. However, processors cannot buy large quantities of 90% trim during this time of the year as the product has a short shelf and must be ground quickly to maintain its quality and fresh status. This means that in other times of the year, whole muscle cuts from the Round are ground, impacting the market for fresh 90% trim and fresh 50% or fat trim to produce the specified lean-to-fat ratio. Seasonality also occurs in cold storage, with seasonal lows occurring between May and August and peaks in December and January following peak holiday demands, which can also influence price levels. Beef products are generally held in cold storage for three or four months, and consists of only 3 percent of total beef production. Products in cold

storage does include Prime Ribs for holiday season preparations, but the bulk of cold storage products are frozen, lean imported beef trimmings and frozen beef products intended for export.

5.3 Cow/Holstein Beef:

An important beef source that is often overlooked is from culled dairy and beef cows. While these carcasses surpass the age rules to grade Choice or better, they still provide middle meats and processing beef for many end users. Some packers even have branded programs specifically created to promote and find a market for these products.

Cow programs are often separated into two categories- white fat and yellow fat. White fat cows are either young dairy cows of three to five years old, or older cows who were fed a grain ration prior to slaughter. Yellow fat cattle are usually older cattle which were not fed in a feedlot setting, but instead are primarily grass-fed, culled cows from a cow/calf operation. Each of these programs have a particular clientele and utilize different muscle cuts based on quality level and marketability of the product.

Due to the low fat levels in yellow fat cattle, approximately 50 to 53 percent of the carcass will be broken down, producing 80 to 90 percent boneless lean trimmings for ground beef. Another 28 to 30 percent of the carcass will be fabricated as whole muscle cuts and the remaining 20 percent of the carcass, consisting of bone (which will go to rendering) and offals and other variety meats will be exported. Based on the price of no roll (ungraded) muscle cuts compared to lean grind, middle meats like the Ribeye Roll, Tenderloin, Tri-Tip, Brisket, Eye of Round, Bottom Round Flats, and other cuts will be sold as boxed beef.

Cow middle meats can be utilized in a variety of ways to obtain as much value from the carcass as possible. Steaks and other whole muscle cuts are often served in lower end food service

establishments like buffets, cruise lines, all night diners, and other value priced cafés. These products will also be exported, especially to Latin American and Middle Eastern countries. These products may also be thinly slice, seasoned, and sent to Asian or Hispanic markets or food service establishments. Tenderloins often go to further processors to be bacon wrapped and for retail or food service. Ribeyes will go to lower end steakhouses or cafés or will be thinly sliced for a Philly cheese steak application. Prime Ribs and some Strip Loins may also be used in gourmet ground beef lines, which garnering a significant premium at retail and food service. Jerky makers also utilize a large share of the 100 percent lean cuts from the Round including the denuded Inside, Eye, and Bottom Round Flats. Based on the available supply of these cuts, jerky processors may move up in quality to a white fat or graded product, based on price point and specific processing specifications or requirements. Round Knuckles and other end cuts may also be sliced, cooked, or further processed for various applications at retail and food service, including roast beef for fast food chains.

White fat middle meats are utilized by similar end users as yellow fat carcasses, but due to the higher marbling and fat content, nearly twice as many whole muscle cut products can be fabricated and sold. Steak products will go to buffets, value cafés, and diners and Rounds will be further processed for food service roast beef. Middle meats will also be sold to smaller retail grocery stores. Various cuts may also be pulled from the carcass, and further processed, chopped, and cooked with moisture for Tex Mex style restaurants.

Due to the higher fat content in white fat carcasses, the trim level is often closer to 85% lean as opposed to 90% lean in yellow fat carcasses. Due to the price of lean compared to fat, 90% lean trim is sold at a premium to 85%, and therefore white fat carcass trim will be utilized by grinders looking for a more cost effective supply solution.

Not only does cow slaughter provide a large amount of lean trim for ground beef and meet the demands of a niche within the beef marketing chain, it also serves as a balancing point for the end cut market. For instance, a Tex Mex restaurant may be able to switch between graded Inside Skirt steak and cow Sirloin Flap meat based on the current price point for its fajita beef offering. In addition, a lower end steakhouse or diner, providing meals at a certain price point and portion size may prefer to use cow steaks as they are naturally smaller in size and a lower price than the graded, fed carcass equivalent. Fed Holstein cows have also been found to be a better fit for food service due to their consistent quality and size. Cow beef also provides a reliable source for grinders and other further processors as an alternative to imported Australian or New Zealand beef. The price and quality levels are virtually the same between the two sources and cow beef is fresh compared to imported beef which is frozen. Branded cow programs are also utilizing, and will continue to grow, the product availability of value-added products.

Fed Holstein cattle are helping to fit a particular niche in the beef supply. Male Holstein calves are being sent to calf ranches and eventually feedlots where they are fed out along with other beef cattle. Historically, Holstein steers were a headache in the beef industry as they graded poorly, had an oblong muscle shape, and didn't have a solid place in the beef supply. Today, 70 to 80 percent of Holstein carcasses grade Choice or better and provide a significant portion of Prime carcasses annually in the U.S. With the help of improved feeding technologies and beta agonists, the Ribeye muscle on Holstein carcasses "pop" from an elongated shape to the rounded muscle shape consumers expect in a Ribeye steak and are often a smaller size than those from beef breed carcasses.

While the quality characteristics of Holstein carcasses continue to improve, the stigma of years past remains in the beef industry, especially in high end steak houses. It is now difficult to differentiate between Holstein and beef carcasses visually, but many Prime only steakhouses still refuse to use Holstein carcasses, even if they are a less expensive source of Prime beef. Holstein

carcasses are helping to fill a niche in the market for smaller Ribeye steaks and roasts. However, from a culinary perspective, Holstein carcasses do not provide the same eating experience, with a less robust flavor and thinner muscle shape compared to conventional beef carcasses. Holsteins are placed in feedlots at a younger age, but are fed for longer periods of time than conventionally fed beef cattle, usually ten to twelve months, and may also have a noticeable texture and flavor difference.

To combat these issues, some dairies have started to cross dairy and beef cattle, using beef bulls and dairy cows to produce a mixed progeny. These crosses, while currently small in number, are beginning to be widely available through semen sales and are even helping Holstein carcasses to qualify for the Certified Angus Beef branded program. To be part of the CAB program, cattle/carcasses have to meet 10 specific standards, one of which being superior muscling, originally intended to prevent dairy influence. However, these beef-dairy crossbred cattle may now qualify for CAB.

5.4 Exports:

We live in a global economy, and the beef marketing system is no exception. Exports play an important role in the beef industry, providing a market for products that aren't used domestically and significantly impact demand and price levels. U.S. beef exports continue to grow and total U.S. beef exports accounted for 11.7 percent of beef production in 2018 (LMIC, 2018). Specific companies have varying estimates of 9 to 30 percent of their domestic beef production currently being exported. Exports provide packers with the additional challenge of deciding which products to fabricate for alternative markets. Packers consider domestic versus international demand and price levels and then decide which product goes where and to whom. Exports help packers to better utilize the carcass, selling variety meats and end cuts overseas, while providing more middle meats for domestic customers, getting as much value as possible from each carcass

fabricated. Middle meats, especially cuts from the Rib and Loin, are easy to sell in domestic markets, particularly through a branded, natural, or other promotional program. However, the challenge then becomes finding a customer base for the other 80 percent of the carcass, at a branded program's premium price, and that is where exports play a particularly important role.

The ability of exports to increase is also dependent on the packer's ability to add more value to the carcass or specific cuts which are often otherwise used for grinding, but have more value in the international market. One particularly popular item in Asian markets is known as the "Tiger Tail", "Candy Stripe", or Plate Extension, which is a boneless cut consisting of a thick piece of fat with a thin layer of lean muscle located below the Chuck Roll and laying along the 9th through 12th ribs. At one time, this product routinely went into 50% trim, however, when cattle prices hit peak levels in 2014 and 2015, Short Rib prices were high and the Asian markets needed an alternative Short Plate option. In addition, Rib Cap plates, the lifter meat over the Ribeye roast, serves as a low cost Sirloin Flap alternative. The Heel of Round is another cut that is rarely sold domestically due to its abundant connective tissue and tough muscle structure. However, this cut is now sold in a 3 piece consumer ready product at grocery stores in Korea.

Adding further complexity to the packer and end user's challenge is the fact that some products are sold both domestically and internationally, at competitive prices. The result is increased competition between domestic and international markets for these products, at least at certain times of the year. Exported products must also be frozen or preserved in some form to maintain its quality once it reaches the end user, requiring additional fabrication costs to these products.

The impact of exports is seen further down the supply chain than just at the packer level.

Providing a steady customer base with U.S. beef in international markets has sustained live cattle prices at a higher level. As international markets often take the product the U.S. does not have a continuous use or demand for domestically, like roasts in the Chuck and Round, the market for

these cuts and the trim market have remained steady. Exports have also changed seasonal peaks and troughs in these cuts which provides challenges to domestic further processors, retailers, and food service buyers who often rely on seasonal low prices to plan retail advertisements or to forecast sales. As prices remain at steady, high prices and domestic supplies continue to go overseas, buyers are forced to find alternative cuts to meet their production needs.

5.4A Exported Products:

In the following sub sections (5.4A through 5.4D), the ground beef product mix and specific export markets are discussed.

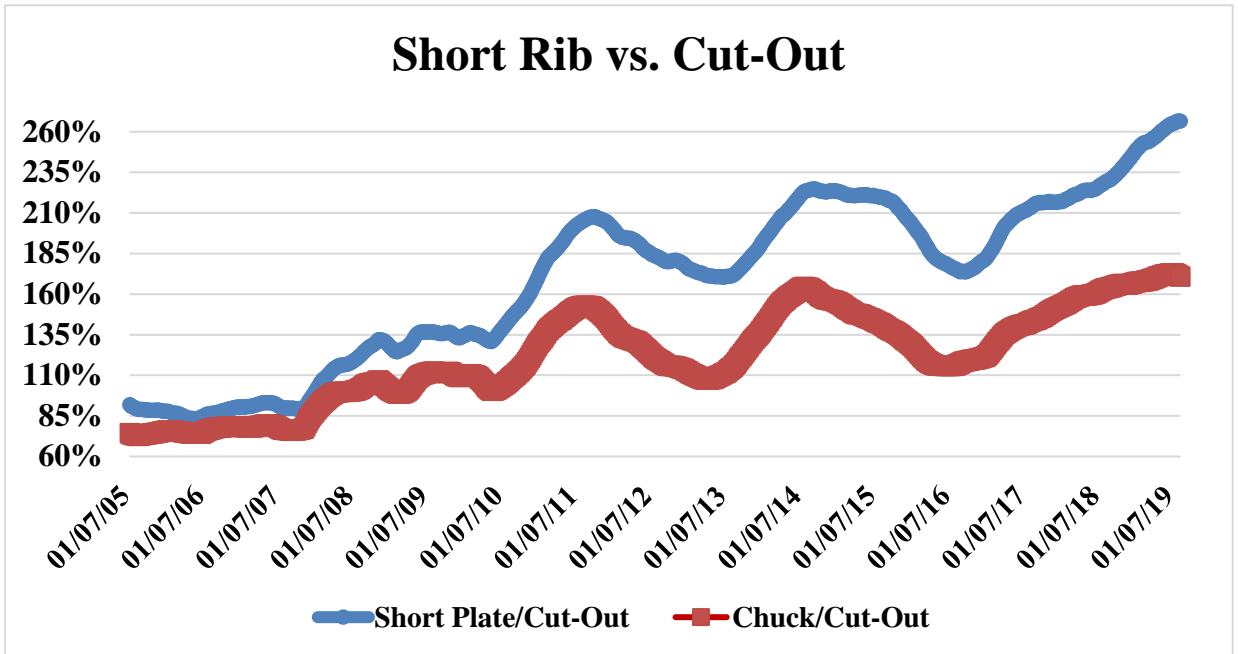
Across many interviews, the product most commonly mentioned as being highly exported is the Chuck Roll, a product that sits ventral, or below, the scapula or blade bone in the shoulder of the animal. Products from the Chuck Roll have a considerable amount of fat and connective tissue, great for Asian style hot pot cooking, in which beef is thinly sliced and cooked in sauce or other liquid. (See the Chuck Roll subprimal breakdown on page 48, Figure 3.3, for additional information on specific cuts fabricated from the Chuck Roll). The Chuck Roll continues to gain popularity in Asian markets, particularly in Japanese and Korean retail grocery stores. Due to its growing popularity, Chuck Roll prices have become more volatile and has shifted its seasonal price patterns which were previously more pronounced and predictable. Previously, when there were consistent seasonal price patterns, retailers would purchase large quantities of Chuck Rolls in the summer months (at seasonal low prices), and freeze it for later sale. However, today, the seasonal low occurs only in July as opposed to April through June as in years past. More detail on these seasonal price changes can be found in Section 5.11, figure 5.12 and in Appendix A: Figure A-5.

Other Chuck and Short Plate products being exported include the Shoulder Clod (which includes the Flat Iron), whole Boneless 3 Piece Chucks, Chuck Clod Hearts, Top Blades, Chuck Edge

roasts, and the Tiger Tail. In domestic markets, the Flat Iron, a steak item, and Chuck Clod hearts, a roast item, tend to have seasonal demand and price differences (steak consumption is high in the summer, with roast consumption increasing in the fall and winter months). However, with increased Asian exports of both of these products for a similar consumption use, the seasonal price patterns for these cuts is shifting. More information on these seasonal price shifts is included in Section 5.11 and in Figures A-3 and A-4 in Appendix A. The Chuck Flap is another popular Short Rib alternative that comes from the Chuck Short Rib and provides a heavily marbled, boneless alternative to the Short Rib.

Other products going to Asian markets include the Short Rib from both the Short Plate and the Chuck, navel complex, Brisket (point and deckle halves), and Short Plates, including Rib Fingers which consist of the intercostal meat between the rib bones. Like the Chuck Roll, these products are high in fat and are desirable for Asian style cooking. The Short Plate is the most exported product in terms of pounds, resulting in a price increase for a product that formally went into 50 percent trim as opposed to a whole muscle cut for export. Figure 5.1 demonstrates how the value of the Short Rib, both from the Chuck and from the Short Plate have increased over time due to an increase in exports.

Figure 5.1: Short Plate and Chuck Short Rib weighted average wholesale price as a percent of Choice Cut-Out value, 2004 to 2019; data: USDA-AMS, complied by LMIC .



These high fat products from the navel, Short Plate, and Chuck have a significant impact on the ground beef and trim market as well. Ground beef is rarely exported, except in small orders to fast food restaurants overseas who are more typically supplied by local producers, or in the form of lean Australian or New Zealand beef. However, whole muscle product exports has an impact on the price of higher fat trim levels, particularly 50%, 55%, 65% and 75% lean point trimmings. If there was no demand for these high fat products internationally, then they would go into trim to be ground with higher lean point trimmings for various ground beef products. However, there is a large demand in Asian markets for products falling within the 50% trim market, elevating the price for 50% lean trim from fed domestic cattle.

Other cuts being exported include the Flank, Inside and Outside Skirt steaks, Eye of Round, Inside and Outside Rounds and the hanging tender (a pillar of the diaphragm). For the most part, Loin products are not highly exported except for the Sirloin Top Butt, Sirloin Flap (or Bavette), Coulotte, Center Top Butt and some Strip Loins going to Canada. While some high quality

middle meats are being exported to other markets, the largest increase in middle meat exports has been to Asian markets, which did not always import middle meat products. The relatively low fat content in the Loin primal is one of the reasons that the Loin continues to lose value compared to the Rib and other primals as shown in Figure 4.1.

5.4B Asia:

Asia has been the largest driver of U.S. exports, particularly in the Short Ribs, navels, Clod Hearts, Flat Irons, Chuck Rolls, Top Blades, Loin Top Butts, Chuck Flap, Hanging Tender, and the Ribeye, for thin slicing. However, a recent steak craze has emerged in Asian markets, particularly in South Korea and Japan, providing a new market for middle meats like USDA Choice Sirloins, Ribeyes, and Chuck steaks. This steak demand began in Asian food service and has spread to retail, leading to additional middle meat volume and increased product mix diversity. As labor is very expensive in Asian markets, a larger product, selling for a higher total cost, is seen as a positive for Asian grocery stores. While Asian consumers are used to seeing thinly sliced products, and may have even used Ribeyes or Chuck Flat steaks before, additional consumer education is required to show consumers how to cut and cook these steak products in their home. Educational initiatives by the U.S. Meat Export Federation (USMEF) is helping to educate consumers to properly prepare a thick steak as compared to thin cuts typically used. In addition, as Asian consumers prefer a highly marbled, fattier type of item, Chuck steaks, even with seam fat and relatively low yields, provide a suitable steak option.

Ten years ago, the Petite Tender, Clod Heart, Chuck Under Blade, and Flat Iron were not common in international markets. However, the demand for these products continues to grow in Taiwan, South Korea, Japan, and Hong Kong as they have a similar level of marbling to the Short Plate. Thus, diversifying the product mix going to Asian markets and providing a consistent consumer of U.S. Chuck products.

Japan and South Korea have been the large volume drivers in recent years. Once Japan began enforcing age requirements for imported beef (20-30 months and younger), other Asian markets followed. As their economies continue to strengthen, these countries are taking traditional cuts and more for middle meats like the Ribeye and some Loin cuts, in addition to Briskets, Rounds, Rib Fingers, and Flanks. With recent American style barbecue promotions, Japan and South Korea are also starting to import a small amount of point half briskets.

Half of South Korea's import volume increase was in the Rib category in 2018 and the other 50 percent increase was in the Chuck category, specifically in Chuck Rolls. 15 percent of exports to South Korea are in the Chuck Shoulder Clod with growth in that category influenced by a major American based retailer and U.S. beef outselling Australian exports. 12 percent of South Korea's import volume is in the Brisket and Short Plate category with the Shank making up the rest. The amount of Loin exports have also doubled between 2017 and 2018 to 9 percent of South Korean beef imports.

Japan and Taiwan were also big volume drivers in 2018. Japan is driving prices for the Outside Skirt due to a lower tariff (12.8 percent) on these products which are considered a variety meat as opposed to a whole muscle cut. Japan buys essentially all fed beef tongues, a large amount of Short Plates, and other products which continue to increase U.S. beef exports to the country. U.S. beef continues to have an advantage in the Japanese market because Australia doesn't have enough supply to meet their demand due to the widespread draught and flooding issues throughout the country. Taiwan is a smaller market and consumes different cuts, driving the demand for Round Heels and other creative cuts. The U.S. is currently their largest import market, with U.S. beef being used in various types of cooking among Taiwanese consumers.

Other areas of Southeast Asia, such as Indonesia, Vietnam, and the Philippines are a price driven, predominantly Short Plate market. Vietnam is currently taking in a mix of U.S. products and is no

longer just an indirect or “gray trade” import channel for China. There is a tremendous opportunity for trade growth in this region as their economy continues to grow and strengthen.

5.4C China:

Another important Asian country in regards to exports is China. There is huge growth potential in Chinese markets, however, only a small amount of U.S. beef products is currently reaching China. China imposes stringent restrictions and rules for beef imported into the country, including requirements for antibiotic free, natural and traceable products, in which only a small portion of U.S. beef production would comply. One major packer has been working to get their natural brand into China. However, recent growth in Chinese beef imports have been met by Australian, New Zealand, Brazil, and Uruguay, leaving little room for U.S. beef.

Similar to other Asian countries, China imports Chuck Top Blades, Rib Lifter meat, Chuck and Short Plate Short Ribs, Bottom Round Flats, and Chuck Rolls. Through Hong Kong, an indirect supply chain, China is also a big driver of the increase in Short Plate demand, which continues to impact the domestic market for 50% lean trim often sourced from Short Plate products.

5.4D Other Export Markets:

Latin America is another important trade region for U.S. beef, particularly for leaner whole muscle cuts. Educational programs through the USMEF and other trade organizations have been implemented to inform consumers about the quality of all U.S. beef cuts. With a strong lean meat preference, consumers in Latin American countries prefer Rounds, Tenderloins and Top Sirloin Cap steaks (Coulotte). However, the USMEF is working to introduce other U.S. beef cuts with more marbling to this region, including Ribeye steaks in local restaurants. These markets also

import products from the Chuck, but often require higher lean and trim specifications than Asian markets for these Chuck products.

South American countries are growing into meaningful markets, especially as chilled beef imports continue to grow. Chilled, rather than frozen, beef has a much shorter shelf life, roughly 50 days, and therefore must be consumed quickly. The opportunity to move chilled beef to these countries only recently become a reality, and indicates significant export growth potential to these countries in both chilled and frozen whole muscle cuts. Chile is importing Chuck Rolls, particularly for retailers, where the product is sold in a whole vacuum sealed package. Peru and Columbia are also growing markets, particularly for Liver and other variety meats.

Mexico is also an important trade partner with the United States. Mexican beef exports have grown dramatically in recent years and the U.S. has become a net importer of Mexican beef. Mexico imports a diverse product mix from the United States, including high end middle meats for border and tourist locations in addition to a mix of lean end cuts and variety meats for its domestic consumers. Mexican consumers highly prefer lean meat products, including Inside Skirt Steaks, which are considered a muscle cut, meaning that they have a higher tariff level (38 percent) compared to a variety meat which often has a smaller tariff level. There has been a steady increase in chilled cuts going to Mexico, up 10 percent in 2018, but imports of variety meats have been slowing down recently. A popular variety meat imported by Mexico is tongue. However, due to the high demand for tongues in Japan, Mexico mostly imports cow tongues as Japan takes the majority of the supply of fed cow tongues. Due to the strong lean preference among Mexican consumers, and the increasing quality of U.S. beef, some packers are worried that there will not be a large enough supply of Select graded U.S. carcasses to meet their demand. Work is also being done to promote barbecue, crockpot, and other styles of American cooking for these lean cuts and show how higher quality U.S. beef products can be prepared using Mexican cooking techniques.

The Middle East currently has little import growth potential for U.S. beef as there is little access and poor trading terms between the United States and these countries. Middle Eastern markets, including Egypt, Kuwait, the United Arab Emirates, Jordan, Lebanon, and Saudi Arabia, have strict halal requirements and primarily import variety meats including livers and kidneys.

However, due to the halal requirements, most large U.S. packers cannot supply these markets.

Morocco currently has a 660 ton quota, but will be moving to unlimited access in 2023, providing a small window for growth in this market, despite their import license restrictions for very specific customers and shelf life challenges.

Livers are often too wet to be rendered, so packers are constantly seeking markets for these products. Egypt is a large market for livers, however, they test for beta-agonists which may exclude U.S. livers from their imported supply. In addition, some Middle Eastern consumers claim that Australian livers have a better color (a quality indicator) so work is being done in U.S. packing plants to improve pre and post-harvest practices to improve liver quality for export.

There is also trade access for U.S. beef in sub-Saharan, non-halal African countries, which also primarily imports variety meats, with a small amount of higher quality cuts being moved by air freight to resorts and other tourist locations in the region. While South Africa is more developed, the process to introduce U.S. products into the country is slow and often starts with the introduction of chicken, then pork, and then beef variety meats, before whole muscle cuts can be introduced into the market. Some U.S. beef middle meats are being imported through established food service groups servicing tourist locations in this region. However, Africa does have its own high quality, low marbled beef supply, and will also import beef from Argentina and other suppliers to meet their demand. There is also a very established beef and pork processing center in South Africa, processing many items including Short Ribs, so if the price is competitive, U.S. Short Ribs can also be sent to this market. While Africa prefers Short Ribs, the high prices that Asian countries are willing to pay for these products results in alternative markets for fully

cooked retail products. For these reasons, there is realistically more room for export growth in Latin American countries than in African markets.

European countries are another untapped market for U.S. beef exports, due to the lack of a free trade agreement between the United States and the European Union (E.U). Currently, there is a 45,000 head fed beef quota in the World Trade Organization (WTO) trade agreement, however, the product has to be exported to the countries within the first two weeks of each quarter, which makes it logistically difficult to organize, process, and send these carcasses within the time frame. The U.S. helped to write rules that would specify higher quality beef products for import into the European Union, but the U.S. was essentially excluded from E.U. imports after the rules were written. Uruguay, Argentina, and Australia usually fill the 45,000 head quota. Another quota, shared with Canada, imposes a 20% tariff, essentially pricing U.S. beef out of the market. There are European consumers who want U.S. beef products, and there are U.S. producers and packers who are willing to produce hormone-free beef to meet the E.U.'s strict hormone-free standards. There is a significant potential for growth in these countries, but without a trade agreement, there is currently little opportunity for the U.S. to increase beef exports to these countries.

Of the small amount of beef that does make it to the European Union, Germany and Sweden are the largest consumers, with France, Italy, Poland, the United Kingdom, and the Netherlands also importing U.S. beef. Russia and other former Soviet Union countries are also un-accessible for U.S. beef due to political conflicts and restrictions on beta agonists in those countries.

5.5 Food Service:

Food service encompasses a large group of end users and is often referred to as HRI or hotel, restaurant, and institutional. "Hotels" includes hotels, motels, resorts, other convention or catered meals, while "Institutional" includes foods servicing hospital, school, prison, and other large scale

cafeterias. However, the bulk of product in food service is supplying the 660 plus thousand restaurants in the United States (Number of Restaurants, 2018). For the most part, food service is serviced by four main broad line distributors which purchase products, and may also further package or process products to supply their food service customers. Restaurants usually purchase a specific, standard, mix of products throughout the year, so if the price for food inputs (as reflected in restaurant menu prices) is too high, consumers will simply eat out less. These product mixes are fairly standard and have not changed much over the past five to ten years, especially in regards to beef products. Restaurant operators have the difficult challenge of differentiating themselves from thousands of competitors by providing a product that the consumer hasn't seen before or has certain quality characteristics which set it apart, including natural, Black Angus, organic, and other specialized product offerings.

From fast food chains to high end steakhouses, the primary goal for food service is the same; provide a consistent, high quality eating experience. However, the trade-offs to produce this outcome differs among restaurant quality levels. Large restaurant chains may have specific requirements regarding where the product comes from, beef cattle breed base (Angus for example), type of product, lean to fat ratio, et cetera, and others are able to be more flexible in these areas. For high end steak houses and other fine dining restaurants, maintaining strict quality standards including specific brand or quality grade of beef is much more important than trading down to a lower quality grade in order to meet a certain price point. Whereas a casual, fast casual, or quick service restaurant may be more likely to substitute a lower product quality to meet their brand's price point for a certain item.

While the researchers originally hypothesized that there was a lot of substitutability between products, it was found that movements are often made vertically by quality grade before moving horizontally among substitutable cuts. There may be times when Select quality grade products are actually priced higher than Choice, and so restaurants will buy the Choice product and market the

product as Select or better. This may also be the case in retail. One distributor interviewed mentioned a national account that switched between Top Blade and Pectoral meat based on price point for chicken fried steak, but this is not a common occurrence.

As many restaurant cooks are not experienced chefs, but rather trained employees, it is important that the product itself has consistent quality and size characteristics so that the cook can provide a consistent food product. Due to the lack of skilled labor in food service, further processors are becoming increasingly important. By purchasing portion cut steaks, the cook simply has to place the steak or other beef product on the cook top and follow cooking protocol as indicated by the restaurant. As Chapter 5, Section 5.7 will discuss, it is increasingly difficult for processors to provide a consistently shaped or portioned steak portion as carcass sizes continue to increase. For these reasons, in restaurants without a well-trained chef, it is often more important if the distributor can provide a pre-cut or other further fabricated product, rather than what the price of the product is. Whether the steak is cut by a machine or by hand by a skilled worker in a further processing center or by the chef in the restaurant, there is additional labor required and the price will be reflected in the wholesale and menu price. When restaurants do purchase these products from further processors, they have several purchasing options. One option is to buy the subprimal directly from a packer which is then sent to the steak cutter. Or, they may provide the steak cutter with product quality, source, and size specifications and the cutting house will then purchase and cut the product to meet these specifications.

Restaurants typically fall in to one of four categories: fine dining, casual, fast casual, and quick service and each group has its own challenges and opportunities. Casual restaurants such as Chili's, Applebee's, and TGI Friday's are being squeezed from both sides. Consumers, especially during strong economic times, are more willing to pay a premium for a high quality eating experience at a fine dining restaurant, but are continuing to find convenient options at fast casual

restaurants. Consumers want to feel good about the food that they are eating and the money that they are spending eating out, and casual restaurants are struggling to balance their desires.

Casual restaurants continue to struggle finding their niche in the market and have resorted to decreasing portion sizes or quality grades in order to meet their price point. One restaurant in particular offered a Tri-Tip steak on their menu for years, but due to increasing Tri-Tip prices, have switched instead to the Top Sirloin. Top Sirloins, cut from the Sirloin Top Butt, have become a “work horse” in the casual restaurant sector, as it is a quality middle meat steak product that can be aged. These restaurants are also an example of an end user that may prefer to use frozen as opposed to fresh beef, as was discussed Chapter 5, Section 5.2. As their steak demand can be variable due to a more diverse protein menu offering which does not regularly include high end middle meats like the Ribeye or Tenderloin, there is little need to maintain an inventory of fresh steaks. For these restaurants, price is very important and the menu offerings of beef versus other protein options must also be competitively priced. This can go to the extent of creating a steep margin on a chicken breast entrée in order to meet a similar price point of a Sirloin steak or other beef entrée option as the consumer may perceive the chicken product to be of inferior quality at a lower price point, even if it is closer to market price.

Fast casual restaurants such as Panera and Chipotle are becoming increasingly popular by creating an elevated eating experience with fast food convenience and offering natural, organic, antibiotic, and GMO free options which are bringing in more consumers. Quick service restaurants such as Wendy’s and McDonald’s are also improving their product offerings, working to meet the demands of educated consumers who want to know where their food is coming from and that it is high quality. As a result, many fast food restaurants are offering some fresh only ground beef and other new product offerings.

Fine dining restaurants, on the other hand, have a very specific customer niche to cater to and must work diligently to provide a high quality eating experience for its patrons. High end steakhouses have very specific quality and brand specifications, and will go to great lengths for their customers, even hand selecting steaks or identifying specific further processing employees to prepare products for them. One restaurant told us that the same woman had been cutting their Ribeye steaks for over twenty years and when they are cut by someone else, the chef can tell a difference in the product's quality. Chefs at these restaurants spend additional time to determine the best source for their products, determining what packer, what branded premium program, and what further processor to source from. These restaurants are end users that will not budge on quality as their customers will not accept a Choice quality steak if they are expecting Prime. For some of these restaurants, patrons come one to two times a year for special occasions and are more concerned about having a quality eating experience than they are about the price that they are paying for it.

High end restaurants serve a fairly fixed product mix which generally includes a Tenderloin, Ribeye, Strip Loin, and an occasional T-Bone, Porterhouse, or Sirloin steak offering, and many of these are hand cut by the chef in the restaurant. These dining establishments try to use as much of the subprimal as possible, cutting as many steaks as possible from the Tenderloin or Ribeye roast and then use the Tenderloin Tails and other residual products for other dishes. In one particular steakhouse, the Tenderloin tails (the tapered end of the Tenderloin roast) are used for a happy hour Tenderloin sandwich offering which reduces their product waste.

These steakhouses are all fighting for product from a small percentage of total beef production, the roughly seven to ten percent of carcasses that grade Prime. While improved genetics continues to increase the amount of Prime carcasses, there is no way for producers or packers to know what will create a Prime steer. One restaurant explained that Prime carcasses provide a more valuable by-product to packers who generally process Choice graded carcasses. If the

number of Prime carcasses increases, the Prime market is flooded, decreasing the price spread between Prime and Choice or Prime and branded beef program beef.

While price is not the primary driver in these restaurants, they would still prefer to have fixed pricing, as their menu price is fixed and are expensive to reprint. Fixed pricing is especially difficult in the Prime beef market, but restaurant groups, depending on their size, can leverage with packers to lock in prices for a certain amount of time based on their product usage. Smaller restaurant groups may also hedge, contract, or even spot buy product, depending on price levels. During the record high beef price levels in 2014 and 2015, packers charged high premiums to lock in prices for months or up to a year in advance, so many buyers switched to the spot market, which can be risky when supply levels are variable. Others may just lock in a portion of their supply for highly demanded products, like the Tenderloin, and utilize other pricing options to purchase the rest of their product mix.

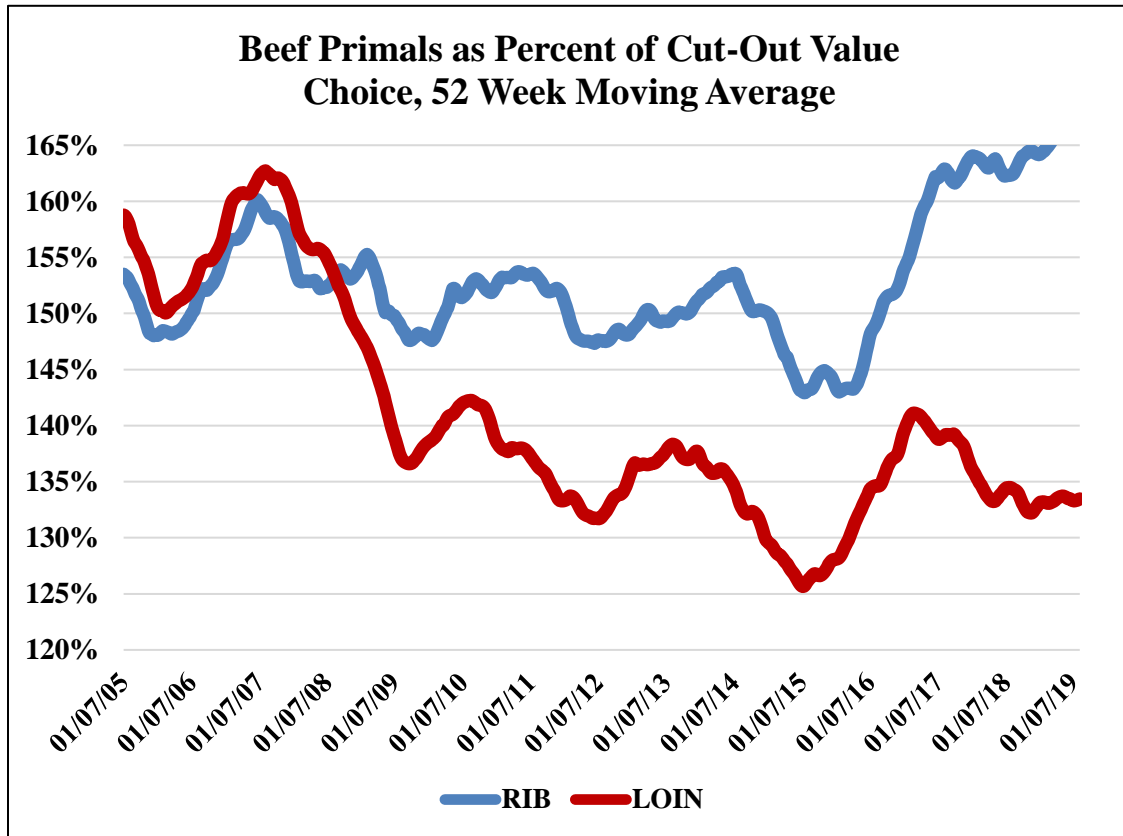
Other challenges for high end restaurant groups are other end users competing for the same supply of Prime beef products. For example, one major big box retailer recently began offering Prime quality graded products in their stores. As retail sells more beef per capita than food service does, retail drives beef sales and can therefore have a noticeable impact on the availability and price of Prime products when they are taking a large position in that market. While the price margin for their Prime beef offerings was relatively narrow for the retailer, it worried Prime steakhouses as retail provides consumers with another avenue to purchase and consume a Prime steak product. The consumer may not have the same eating experience, preparing the steak at home compared to eating a chef prepared steak, but the retail dynamic still plays an important role in beef price forecasting that is hard to understand and plan for. Retail promotions can greatly affect the available beef supply for food service and, as retailers have more flexibility in their product offerings than retailers do, the retail sector can have major impacts on food service.

The product mix for all food service restaurants is fairly fixed, but each sector of the industry uses a different set, or group, of products. For steak houses, the Ribeye, Tenderloin, and a Short Loin option are pretty standard product offerings. In some higher end steak houses, roughly 50 percent of their sales volume is from Tenderloin steaks, usually ordered by female patrons, while the other half is divided amongst the other cuts for male patrons.

For reasons that the researchers and interviewees still don't understand, there is an increasing price spread between Rib and Loin products, especially between Ribeyes and Strip Loins. On menus, there is rarely a price point that will motivate customers to switch from a Ribeye steak to a Strip Loin steak, even with a two dollar spread between the two cuts at certain times of the year. Figure 5.2 illustrates how the spread between the Loin and Rib as a percent of the Choice cut-out value continues to grow.

One possible explanation for this value difference is the wide spread popularity of Ribeye and other Rib roasts, which essentially encompass the entire Rib primal. The Loin primal, on the other hand, does include the very valuable Tenderloin and the valuable Strip Loin and T-bone from the Short Loin, but also includes the less valuable Sirloin cuts- Top Sirloin Butt, Top Sirloin Cap, Tri-Tip, and Ball Tip. The difference may also be attributed to the amount of Rib products being exported while only a few Loin products, particularly from the lower priced Sirloin, are regularly exported. The variable size of the Strip Loin from one end to the other also increases yield loss and utilization concerns among users. Further discussion of the value differences between the Rib and Loin primals is included in Chapter 5, Section 5.12.

Figure 5.2: Loin and Rib Primals as a percent of Choice Wholesale cut-out values; Data: USDA-AMS, compiled by the LMIC.



Traditional steak houses have limited flexibility in the products that they provide, but other restaurants can use other products depending on the restaurant’s price level, cuisine style, and flexibility in special or limited time offerings. Value cuts like the Flat Iron, Petite Tender, and Sirloin Flap meat are also viable steak alternatives when middle meat prices increase. Middle meats can also be crossovers between a steak entrée option or as a dish ingredient, like a Sirloin steak salad topping or Ribeye sandwich. On the other hand, end cuts have different quality characteristics, restricting them to only a few applications. The Top Sirloin steak is also a big workhorse for food service and can be used as both a value-priced steak entrée or for other dish add-ins. Top Sirloin Cap steaks, or Coulotte, are used in Brazilian steak houses for “Picanha” and can also be butterflied and served as a lunch sized portion steak.

From the Round, Knuckles can be thinly sliced and marinated for a fajita or taco application, while the Eye of Round is used for jerky, chicken fried steaks, or as a London broil. A London broil can also be made from the Inside Round or Outside Round (also known as the Outside Round Flat). Steamship Rounds and other large roasts from the Round are still used for roast beef. The Inside Round is also a workhorse in food service, with utilization as a steak offering, cutlets for chicken fried steaks, stew meat, and as roast beef at buffet style carving stations. The Gooseneck Round is no longer sold as one piece, but is instead separated and sold as the Bottom Round, Outside Round Flat, and Eye of Round. Eye of Rounds can also be used for cube steak or corned beef for Saint Patrick's Day. Inside Rounds, Eye of Rounds, and Bottom Round Flats are a good yielding and priced well to be thin sliced or diced for meal kits or sold as winter stew meats. Stew meat can also include pectoral meat or Sirloin tips which are by-products from steak cutters and further processors.

The Sirloin Butt Flap (or Bavette) steak can be utilized as an Outside or Inside Skirt substitute for fajitas and other Tex Mex type products, especially when Skirt prices are high in the summer months. Sirloin Flap meat is also easily interchangeable between Choice and Select product. The Loin Butt Tender (the Sirloin end of the Tenderloin) can be used as a Tenderloin steak alternative, butterflied, or cooked as a whole roast. Choice grade Sirloin Top Butts regularly go to food service, Select quality grade Sirloins will go to retail, and extra trimmed product will go to further processing. Bottom Sirloin Butt Tri-Tips can be roasted, sliced for steaks or salad toppings, served as steaks, or be further processed into chicken fried steak. However, only small independent restaurants primarily offer Tri-Tip on their menus. The Peeled Round Knuckle and the Petite Sirloin or Loin Ball Tip interact as substitutes, being utilized as steaks or roasts depending on their price. Inside and Outside Skirt steaks are used as carne asada or in a fajita or taco application. Flank steaks can be roasted and cut into strips for sandwich or salad toppers or can be cut into steaks as a center of the plate entrée portion, especially for Asian concepts.

Pectoral meat is often further processed into cubed steak for chicken fried steak. Pectoral, Bottom Round Flats, and lifter meat interact as substitutes for Philly cheese steak products. The Brisket has also become a very popular product among barbecue, backyard smokers, and quick service chains and is also traditionally used for corned beef and pastrami.

The Chuck Clod Tender, which includes the Petite Tender, has become a popular food service and retail item as it is easily removed from the carcass on the fabrication line. With the correct preparation techniques, Petite Tenders can be served as a steak entrée or as salad toppers or sandwich ingredients. The Flat Iron, from the Chuck Roll, is can also be a steak entrée or dish ingredient. The Chuck Flap or Chuck Flat, from the Chuck Under Blade Roast, may be roasted or prepared in a similar manner as the Short Rib. Chuck Rolls are utilized primarily as pot roasts domestically where quality grade does not have a large impact on the eating experience. Chuck products will also be cut thinly, sliced, and marinated for Asian and Mexican style cuisines. The Chuck Mock Tender can be bacon wrapped and sold as a lower cost Tenderloin filet alternative. Chuck products are also often ground for hamburger, with some grinders using whole boneless 3-Way Chucks which include the Chuck Roll, Chuck Clod, and Chuck Eye. Occasionally, Chuck products are worth less as whole muscles than as ground beef, and it makes financial sense to grind whole muscles. However, with increased exports in this primal, this is rarely the case. There are many formulations to produce ground beef, including using whole muscle cuts, but most is produced by combining lean and fat trimmings from carcass fabrication into a consistent lean to fat ratio. More information about ground beef sources and topics will be discussed in the next section.

5.6 Ground Beef Market:

Ground beef is a primary component of the American diet, making up nearly 50 percent of beef consumption each year. The popularity of ground beef is unmatched anywhere else in the world and adds an interesting dynamic to the U.S. beef supply chain. In his 2014 article, “Ground Beef

Nation,” Don Close explained how U.S. beef demand has shifted over the past 40 years and that beef consumption has decreased drastically, from 95 pounds per capita in 1974 to 54 pounds in 2014 (Close, pp.1-2). While some considered declining quality to be the cause of this dramatic decrease in beef consumption, a more probable cause is price, especially when compared to other proteins. According to Close and 2012 Beef Checkoff data, 57 percent of beef consumption in food service and retail settings is in the form of ground beef (Close, pp.3). Close and Rabobank believe that ground beef consumption could comprise closer to 62 percent of all domestic beef consumption (Close, pp. 4).

There are significant implications to the beef industry from this increase in ground beef consumption. In order to produce ground beef, beef trimmings containing both fat and lean muscle are utilized and combined together to form ground beef. Beef trimmings are often categorized by its lean to fat percentage, where 50 percent trimmings are combined with 90 percent, 85 percent, 81 percent, 75 percent, 73 percent, or 65 percent lean trimmings in order to get the various lean-to-fat combinations as required or specified by retail and food service establishments. By law, hamburger or ground beef may only contain a maximum of 30 percent fat to be labeled as such (“Ground Beef,” 2012). As 90% lean trimmings contain more lean muscle than 50 percent trimmings, the “90s”, as they are referred to, sell for a higher price. According to Close, over the past few years, the value of high lean trimmings- 85s and 90s- have traded at a higher price than the overall carcass cut-out value (Close, pp. 5). This suggests that consumers prefer lean ground beef and are willing to pay a premium for it over less lean ground beef products and other beef cuts.

An increase in willingness to pay sounds like a win-win for the beef industry, but in reality, it causes more issues and adds another layer of complexity to the beef production and marketing system. Most producers, especially at the feedlot level, concentrate on feeding the animal in order to meet quality standards for the middle meats, the Rib and the Loin, in particular. While this is

where the most valuable cuts in the carcass are located, these primals account for only roughly 20 percent of the carcass. An increase in marbling or fat is less important and often a negative attribute to the remaining 80 percent of the carcass, especially when these primals are used as a source of trim for ground beef. As a reminder, roughly 60 percent of beef consumption is in the form of ground product, meaning that only 40 percent of the carcass is going to stay in the forms of steaks and roasts in which marbling and fat content are important quality factors (Close, pp. 6).

There is more value in selling items as roasts, steaks, or other whole muscle products. So, beef packers and further processors have had to find sources of lean trimmings to grind with 50 percent trim from fed beef production. Lean trim comes from cull cow or bull beef as well as imported lean trimmings from New Zealand, Australia, and other sources. Fed cattle produce roughly 144 pounds of 50% trim per carcass, while another 190 pounds of lean trim is added from other sources to produce around 334 pounds of ground beef per fed carcass (Peel, slide 31).

Domestically, cull cow numbers have decreased as U.S. beef producers continue to rebuild the domestic herd, which means that in order to meet the lean supply requirements to maintain ground beef production, packers will need to slaughter more bulls, import more lean trim, or grind more whole muscle cuts (Close, pp. 6).

Increasing imports is a likely option, but the trend of grinding whole muscles will continue to increase unless, as Close suggests, the U.S. beef industry shifts their production system towards more lean production. While this may seem like a simple solution, in reality, it would mean pre-selecting animals at weaning for which feeding or production system they would fall into. Lower quality animals or those with lower genetic potential to grade Choice or Prime will be fed forage for a longer period of time in order to decrease the cost of gain and will be fed a shorter period of time on a lower energy ration reducing feeding costs. These animals will not grade Choice for middle meats, but may produce 80 percent lean muscle that would be used for ground beef (Close, pp. 7).

This model would have many implications for the beef industry. Due to an estimated 750 to 900 million pounds decrease in overall beef supply due to smaller carcass weights of animals intended for ground beef production, beef prices would most likely increase. This supply shortage could lead to decreased demand for beef as consumers choose other protein substitutes (Speer et. al, pp. 16).

While it is unlikely that the beef production system will shift towards ground beef specific herds, the strong demand for the product will continue to grow and will continue to provide opportunities for grinders and other further processors to meet the growing demand.

The ground beef production process is complex and is dependent on a steady supply of trimmings or whole muscle cuts and intense food safety protocols. Based on the customer or the production facility, trim level, animal age, fed versus non-fed cattle, and approved use of lean finely textured beef (LFTB) may be specified. Due to the *E.coli* food safety concerns with bench trim, trim from cutting steaks and roasts, it is no longer allowed to be included in ground beef production. Based on the specified lean point, fresh 65, 70, 75, 80, 85, and 90 percent lean trim from domestic slaughter facilities may be combined with frozen imported 80, 85, 90, and 95 percent lean trimmings. To make the consumer's specified lean/fat percentage point at the lowest price, the grinder or further processor has to be flexible in the products that they are grinding, based on product availability and price. Once the trim or muscle cuts are ground, a sample is taken either manually or by machine to insure that it matches the specified lean to fat ratio.

Beef trim used for ground beef is produced from breaking down the carcass and includes fat and lean muscle tissue but cannot include bone, tendons, ligaments, or internal organs. Processors are able to sell trim in large combo boxes as a valuable by-product to the fabrication process. Fresh trim passes through x-ray systems in order to locate and remove any foreign material from the product and is placed into individual lots to be tested for micro-organisms such as *E.coli*. These

combo bins are then sent to further processors and grinders that produce ground beef chubs and patties. Trim not used for ground beef can also be used for other fresh products like thinly sliced Philly cheese steak, salad toppers, sausage, and diced and marinated product for fajitas or Asian meal additions.

Bench trim, on the other hand, is trim created from cutting individual steaks and roasts once it is separated from the carcass. This trim spends more time in shipping and is handled by more cutters and machinery, and therefore, cannot be used as fresh trim or for any fresh meat product in order to ensure food safety. This trim is then sent to a cooker who produces a fully cooked product that will be sent to retail or food service. Cookers use bench trim to produce pepperoni, Chicken fried steak, steak fingers, and other fully cooked products.

When trim prices are too high, there are several whole muscle cuts that may be used for ground beef. Chuck Rolls, Clods, and Tenders were often ground prior to the increase in exports of Chuck products which has kept their prices high. When trimmed, Chuck Clods typically produce an 81% lean-to-fat ratio, and 75% or 78% lean when untrimmed. Unless Chuck products are at an unusually low price due to over-supply, it does not usually make financial sense to grind whole Chuck products. More commonly, Round products are ground, including the Knuckle, Gooseneck, Inside Round, and Outside Round. The Gooseneck can also be separated into the Eye, Inside, and Outside Round and ground together. These products typically produce an 85% lean-to-fat ratio, while Round Knuckles produce 90% lean. Boneless products from the navel and the Short Plate can also be ground for higher fat level products and provide 50% and 65% lean-to-fat. However, Short Plate products are popular export products to Asian markets, resulting in a high price point that often does not make financial sense to grind.

Grinders are constantly watching market prices to determine which products to grind, choosing between trim and whole muscle cuts. They will negotiate trim or whole muscle cut prices with the

packer or manufacturer for the raw material, and that will determine the price that they pay for the product. Those who negotiate prices are usually ordering only 90 percent and 50 percent lean trim, but a few may also be ordering a mixture of Chuck, Round, and Short Rib trim. There were a few processors, however, that regularly grind whole primals unless the cost of trim was too high to use. If price spreads between cuts and trim are close, whole muscle cuts may be used as part of the grind mix. For some customers with a more flexible price point and product specification, whole primals including Brisket, Sirloin, and other high valued products may be ground. There is a growing market for premium ground beef products, which are labeled by the subprimal that the product comes from. This, however, does not always mean that the whole muscle was ground to create the product, but rather that it was produced using only trim from that subprimal. For some retailers who still cut products in-house, their store brand ground beef may be produced from trim created when cutting steaks and roasts at the store.

Another interesting addition to the retail ground beef product mix, is the use of brick packs as opposed to chub packaging. Traditionally, ground beef was sold in cylindrical tube-shaped packages with varying sizes, from one to ten or more pounds, in which the product is not visible to the customer. However, many large packers and retailers are beginning to provide brick packs sold on trays covered in clear cellophane wrapping, similar to other case ready beef products. These bricks can be in one, two, four or other specific weight packages and allow the customer see the product. Brick packs are also used for specialized ground beef products such as grass fed, antibiotic free, natural, et cetera. Retailers who grind product in the store may also sell brick packages labeled as ground Chuck, Round, Sirloin, et cetera based on the trim product that it was made from. Case ready burger patties and other prepared ground beef products may also be displayed near these brick ground beef packs.

Customers who purchase chub ground beef products often desire a commodity, no frills product. These consumers know what they want and don't necessarily care about the packaging, just about

the price. However, consumers who purchase brick packs are often those that don't necessarily want to touch the meat, but instead want to purchase the exact amount they need for a recipe and easily prepare it. These customers are often more concerned with product quality and source, so allowing them to see the product helps to bridge the gap and eliminate wasted products. A possible downside to brick packs is the lack of a bright cherry red color (as a result of vacuum, oxygen free, packaging) compared to beef coming out of a chub. With more education, consumers may better understand that the color of meat when exposed to oxygen does not indicate inferior quality.

Certified Angus Beef markets and distributes a significant amount of ground beef, producing around 200 million dollars in ground beef sales annually. CAB has lean point specific products as well as ground Sirloin, ground Chuck, ground Round, and Prime grind products available to retail and food service customers. These products are created by trim and some whole primals depending on the packer, price, and other factors.

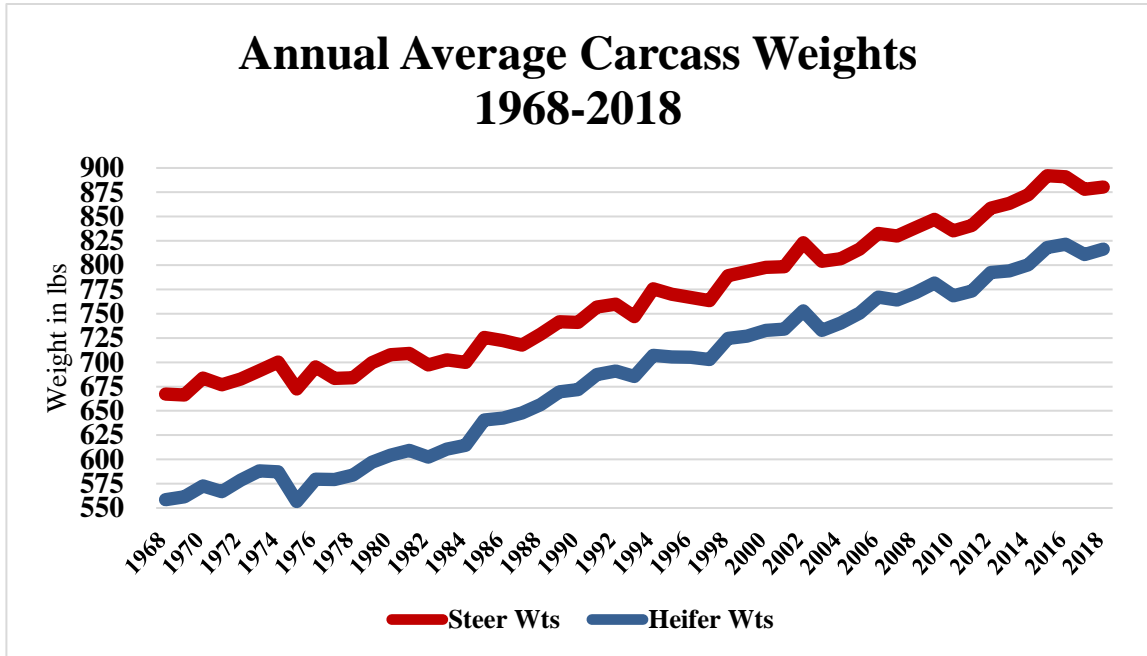
Ground beef is also a staple in retail promotional advertisements, or at least it used to be. One data analyst interviewed who helps retail chains become more profitable, shared that ground beef is viewed by consumers as a convenience item, and does not need to take up valuable advertisement space. Customers will often purchase milk, bread, and ground beef when at the grocery store, so it is more profitable to promote other beef products instead. Others retailers that were interviewed stated that they will only run promotions on ground Chuck or non-primal specific grinds with a higher fat percentage while others only promote lean ground products. Others do not advertise ground Rounds or ground Sirloin, while some retailers find it is beneficial to promote ground Round and Chuck product. Still others will go weeks without running a ground beef advertisement. However, if ground beef is losing market share compared to other low cost protein products like a boneless, skinless chicken breast, an increase in promotional activity may be used to increase sales.

As described earlier in Chapter 5 Section 5.3, increased demand by fast food restaurants for fresh only ground beef, left the beef industry scrambling to find enough fresh trim or primals to meet the fresh ground beef demand. Frozen, imported beef trimmings can no longer be used, so domestic fresh sources must be used. To meet a specific lean-to-fat ratio, cuts like the Bottom Round Flat, Gooseneck Round, and Inside Round can be ground whole. In winter months, when cull cow slaughter increases, a larger supply of fresh 90% lean trim is available to utilize instead of whole muscle cuts. In summer months, Round Knuckles, Outside Rounds, and other Round products will be purchased in large quantities during seasonal low prices. However, when lean trim or whole muscle cuts are no longer readily available at a favorable price point, production costs increase as grinders work to find other lean sources from trim or whole muscle cuts and add separate production lines or additional workers to prepare the fresh product.

5.7 Carcass Size:

Size matters, especially when it comes to the beef supply chain. However, bigger is not always better when it comes to beef production and the difficulties caused by increasing carcass sizes is being felt throughout the beef production system. According to the NASS Livestock Slaughter Monthly Report, the average steer weight is currently around 881 pounds, with heifers carcasses weighing 817 pounds on average, compared to 847 and 782 pounds, respectively, just ten years ago. This is illustrated in Figure 5.3. With more pounds comes more product and larger muscle sizes, and a number of other issues related to increasing cattle and carcass sizes.

Figure 5.3: Annual Average Carcass Weights from 1968 to 2018; Data: USDA-NASS, compiled by the LMIC.



At the cow/calf level, heavy weight bulls and large cows are traditionally sought after in order to produce a fast growing calf. Improved genetic capabilities increase profitability with increased carcass weights, but this trend has also led to large cows. These large framed, heavier cows are less efficient, requiring more feed to support her and her calf’s growth than her smaller herd mates. With improved feeding techniques, beta agonists and relatively cheap feed costs, feedlots are producing heavier, high quality cattle for slaughter. Many of these cattle will then go to slaughter facilities built when carcass sizes were 600 to 700 pounds, and whose rail heights and fab tables have had to expand over time to keep up with the increasing size of carcasses. In some older facilities, carcasses were actually dragging the ground due to low rail heights, causing quality and food safety issues. Other packers do not have big enough fabrication tables to cut the large Rib and Loin primals, leading to slower and less efficient production.

Packing facilities have adapted to bigger carcasses over time and packers generally favor bigger carcasses for increased production and profitability. However, food service and retailers are

dealing with the negative implications of these increasing carcass weights. For packers, larger carcasses mean more pounds of meat to sell and more pounds of trim going to grinders and other further processors. But, larger carcass sizes also mean larger muscle volume and therefore, larger cuts. For some cuts this is not a problem, but for some high valued products in the Rib and the Loin, this is a growing problem. As discussed in Chapter 5, Section 5.5, high end steakhouses typically serve Tenderloin, Ribeye, and Strip Loin steaks on their menus. Their price and portion size is very specific, but when Ribeye sizes grow, it is very difficult to cut and prepare a quality eating experience. The problem is three dimensional: steaks should be cut thick enough to provide a quality eating experience, but this increases the portion size and the product price. However, cutting the product thinner or in half can provide an unpleasant eating experience in the form of an overdone steak in an unrecognizable product form. Before the economic recession, Ribeye steaks were commonly cut into 12 to 16 ounce portions, but many restaurants and consumers prefer a smaller, 10 ounce portion, cut at least an inch thick.

To deal with this issue, food service establishments may specify light Ribeyes when ordering product, however the definition of a “light” versus a “heavy” Ribeye or carcass continues to grow to keep up with continually increasing carcass sizes. These groups expect packers to sort carcasses for them based on size, but this can be increasingly difficult as the supply of lighter carcasses is small and carcasses can be sorted by carcass weight, Ribeye size or weight, and even yield grade, all of which adds more work and complexity for the packer. Currently, a light Ribeye is considered 18 pounds or lighter, and some packers utilize video or dimension sorting in order to sort Ribeyes with a 13 inch diameter or smaller which represents a light weight Ribeye. The desire for smaller Ribeyes is also reflected in the wholesale price for the product. In fact, the average Light Boneless Ribeye (109E) price was \$3.80 per hundredweight more than the Heavy Boneless Ribeye (112A) price in 2018. For the most part, chefs prefer a 14 to 16 pound Ribeye Roll, which allows for optimum steak portions prepared according to customer specification. For

instance, cuts near the ends of the Ribeye Roll are smaller and can be cut thicker, making them easier to prepare rare. While steaks cut from the middle of the roast are larger in diameter, meaning they must be cut thinner to produce a specific portion, and are therefore better suited for medium to well done preparation.

Sorting is also necessary for food service chefs who need consistently cut and portion sized products to streamline their preparation in the kitchen. Cooks are trained to cook one cut of steak with a certain portion size and thickness, so if steaks are not consistently the same thickness or size, the quality of the product, once it is prepared, can be compromised. Packer sorting is providing a more suitable sized product, but the added time to sort carcasses, increases cost, as much as 30 cents per pound for some packers. Small boutique style processors are also providing smaller products based on strict cattle selection practices, but these products are also sold at a large premium. Many food service groups are willing to pay a premium to source smaller Ribeye Roll sizes, but there is not enough premium on these products, which make up only 10 percent of the carcass, to convince producers to raise smaller animals.

Steak cutters and meat distributors who supply products for food service also have the challenge of educating chefs about the product and how difficult it is for them to find a thick cut portion in the right portion size. Customers must often choose between one or the other. One high end steak house is able to specify 12.5 ounce Ribeye steaks from the packer, but this is the only cut on their menu that they are currently able to specify. Ribeye roasts are getting so big that some cutting house portion slicing machinery was not big enough to hold and cut the entire primal. Restaurants strive for a 100 percent consumable product with little waste on the plate, but larger Ribeye steaks have more external and seam fat which may not be eaten, and is therefore wasted.

For Tenderloin and Sirloin roasts, a heavier product is not necessarily bad, as a larger, barrel-shaped Tenderloin yields more plate coverage. However, the wider the barrel, the thinner it has to

be cut, which decreases the desired elevation and dimension on the plate that the customer is expecting. Tenderloins are predominantly cut into six ounce portions, however, with varying Tenderloin roast sizes and its tapered muscle shape, steak cutters and chefs hope to have a variety of roast sizes to cut steaks from. In order to get consistently cut steaks, the tail and head portions of the Tenderloin roast must be removed before the remaining barrel-shaped muscle is cut into steaks. Consumers expect a Tenderloin filet with a tower like presentation on the plate, with at least an inch of thickness. However, as the barrel-shaped Tenderloin muscle gets wider, it is more difficult to achieve the tower elevation on the plate with the optimal thickness and portion size. At larger weights, Top Sirloin Butts can provide better portion and yield with more plate coverage per ounce than a smaller roast. From larger Sirloin Top Butts, once the sciatic nerve is removed, it is easy to produce three equally sized portions with the optimal one and a half inch thickness. One large casual food service chain enforces smaller weight specifications for their Top Sirloin boxes, but this creates additional issues for steak cutters who must find ways to utilize the trim and other by-products created when fabricating the smaller portioned Sirloins.

Retail is often viewed as the primary driver of beef sales, and food service as a whole is waiting for large retailers to specify smaller carcass sizes, which would create a market signal strong enough to change the beef production cycle towards smaller cattle. Retailers are also dealing with carcass size issues in different, and sometimes less severe, ways compared to food service.

Restaurants can't afford to buy or serve larger Ribeyes, but retailers can sell these products to consumers who want to cook a large Ribeye steak at home. From one chef's perspective, "as long as the meat is cherry red and can fit into a tray, grocery stores will sell it."

Retailers do not have to prepare the steaks for consumption or receive immediate feedback from the consumer. They do, however, deal with increasing sizes in a different way. For many large retailers, beef arrives at the store as case ready boxed beef, meaning that the steaks are already cut and in packages, ready to be placed directly into the meat case and these boxes continue to get

heavier as the product size increases. Lifting 90 and 100 pound boxes causes dangerous working conditions for employees, and so some retailers will specify weight limits of Ribeye boxes to reduce these issues. Larger steaks also require larger tray sizes, and with a set amount of shelf space for beef, fewer products will fit into the retail grocery beef case. Many consumers make their meat buying decisions based off of total package cost, rather than per pound. So, a package of two, thick cut Ribeye steaks may have a price tag close to \$30 or \$40, leading some consumers to choose a different, more affordable cut instead.

There is little indication that retail will begin to pay a high enough premium to promote smaller carcass sizes any time in the near future, but the industry is finding ways to deal with the issue in the meantime. Some restaurants are increasing the portion sizes on their menus from 11 to 12 ounce Strip Loin steaks and adding an ounce or more to their T-bone and Porterhouse steak offerings to allow for thicker cut steaks. Food service may, at least initially, absorb the cost of increasing portion size, keeping the price the same, and providing a thicker, better eating experience for the customer. The Top Sirloin subprimal can also be cut as a log shape into three different portions as opposed to two portions by cutting each cut slightly thinner. This cannot be done with Ribeye Rolls, however, as cutting the roast into thinner steaks makes it more difficult for the cook to achieve the optimal medium rare temperature.

Packers and steak cutters have also found creative solutions to deal with larger steak sizes. One popular solution is to separate the longissimus or center/eye of the Ribeye from the spinalis dorsi/multifidus dorsi or cap muscle, located directly above the eye muscle as indicated in Figure 5.4.

Figure 5.4: Boneless Ribeye Steak with Spinalis dorsi Muscle Identified



When fabricated separately, the packer still requires the customer to take both pieces and there is a 30 percent yield loss when the cap is removed from the Ribeye roll. Some restaurants would rather take the spinalis muscle, as it creates an easy appetizer or meal ingredient and can also be a steak entrée or appetizer, rolled into pinwheels for cooking and presentation. Others only want the center which provides a Ribeye steak with smaller portion size and less waste. Some further processors and steak cutters won't pull off the caps because it is cost and labor prohibitive. Some restaurants don't like the appearance of the Ribeye without the cap muscle as it appears smaller compared to a conventional Ribeye steak.

It is easy to sell the spinalis at a high price, but restaurants and packers have to find a balancing point between the two parts as there is a disproportionate weight difference between the cap and center of the Ribeye. The spinalis can also be sold at a higher price per pound than the center. The market is beginning to balance as the product's demand matures, but there are still yield issues and the price has to cover the reduced yield due to kernel fat (large chunks of fat between the spinalis and eye) and how the rest of the eye and spinalis are trimmed. Other restaurants are using the larger Ribeyes, especially those with the rib bone still attached, known as the Tomahawk or Cowboy Ribeye, as a marketing opportunity for a special occasion or to be shared by two people. The Tomahawk sold at a higher price in order to cover additional size and fabrication costs.

However, these products have a small period of high demand, usually during the winter months or for the holidays, Valentine's Day, or for Father's Day.

Another alternative cut becoming popular is a split Strip Loin, which is a Strip Loin sliced in half lengthwise. These cuts aren't just for portion control, but are also used by artistic chefs implementing a new creative product concept. By slicing it in half, the chef can lay the steak on its side, providing lift and altitude on the plate with a steak height similar to a barrel-shaped Tenderloin filet. This cut is an innovative way to prepare the Strip Loin, however it suffers from poor yields and may be unappealing to a steakhouse patron expecting a Strip Loin steak in its conventional form.

5.8 Carcass Grading:

Beef carcasses may be graded for quality, yield, or for both, depending on the specification or requests of the customer. In the United States, the eight carcass quality grades, listed in order of highest to lowest quality are: Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner. These grades are based on the maturity of the carcass and the degree of marbling measured within the Ribeye muscle. The degree of marbling is given a score between 1 and 100 micro units. The yield grades range from 1 to 5 and are based on the Ribeye size measured between the 12th and 13th ribs, hot carcass weight, external fat, and kidney, pelvic, heart fat. More specific information on yield and quality grade calculations can be found at the USDA's Agricultural Marketing Service website under the beef subsection of the "Grades and "Standards" tab.

As genetics and feeding technologies continue to improve, the percentage of carcasses grading Prime and Choice continues to increase, while the number Select carcasses is declining. Figures 5.5 and 5.6, created using data compiled by the Livestock Marketing Information Center show these changes over time.

Figure 5.5 Weighted Average of the Percentage of Carcasses graded Choice and Select from 2003 to 2018; data from USDA-AMS, compiled by LMIC

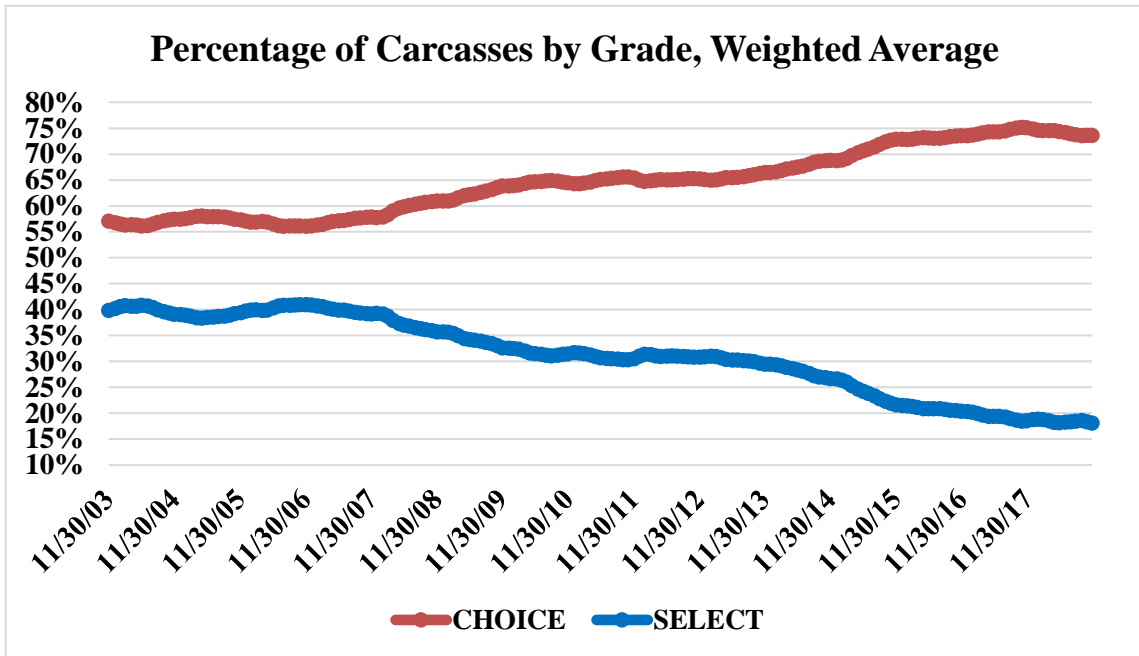
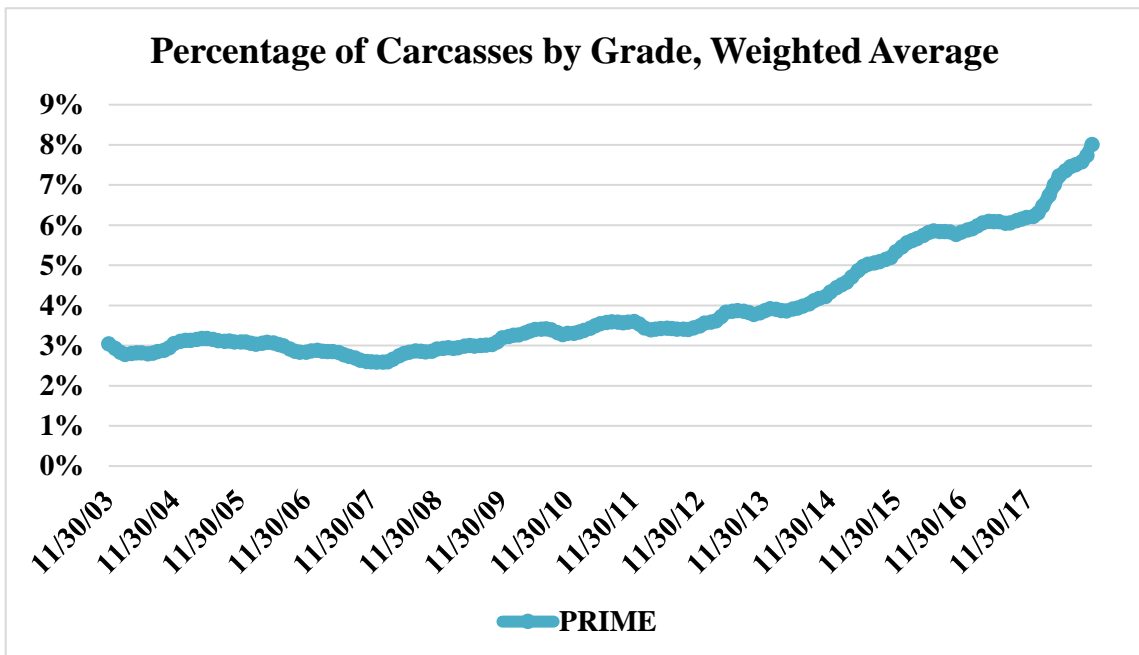


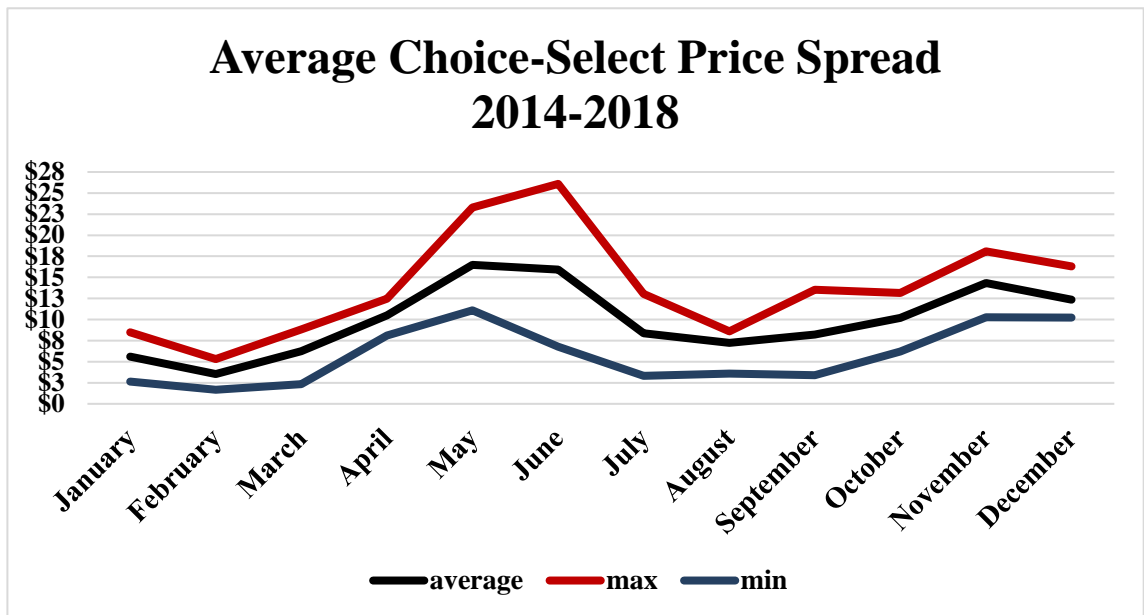
Figure 5.6: Weighted Average of the Percentage of Carcasses graded Prime between 2003 and 2018; data from USDA-AMS, compiled by LMIC.



In years past, carcasses were not graded, or “no rolled”, if the carcass was not perceived to grade Choice or better, so processors had no incentive to grade these low quality carcasses. Today, no roll carcasses are frequently carcasses that are already qualified for a branded beef program through a processor, Certified Angus Beef, distribution, or specific retail brand. USDA grading is a way to market commodity beef, however, beef already labeled with a high quality brand, are marketed in a different way and so labeling in the same way as commodity beef is counterproductive.

Another interesting trend discovered throughout the interview process was the separation in quality grades at the Choice and Select level. Boxed beef cutout values are reported for Choice and Select grades and the average price spread over the past 5 years between Choice and Select carcasses has been \$9.92 per hundredweight. As Figure 5.7 illustrates, this spread is at its highest in May and June, with a secondary high in November and lowest point in February. These price differences demonstrate the consumer’s preference for higher quality beef products, and that they are willing to pay a premium for it. The seasonal Choice-Select spread captures the net supply and demand conditions for higher quality (Choice) and lower quality (Select) beef across a wide range of products that make up the carcass cutout values at different times of the year.

Figure 5.7: 5 Year Average Choice-Select Price Spread; data: USDA-AMS; compiled by LMIC



Carcasses are still separated between the Select and Choice grades (with price reporting also reflecting this separation) but for most branded programs, the separation goes one step further. Most Choice branded programs are not just general Choice graded product, but carcasses grading in the top 2/3 of the Choice grading scale. This means that only carcasses with modest or moderate marbling, which fall within Mid and Upper Choice, respectively, would qualify for branded programs. The Low Choice or small marbled carcasses are still graded as Choice and supply Choice demands for some national retailers and food service groups. There was no evidence that price reporting would be changing anytime soon to reflect the quality differences between low and high Choice, but it is important to note that today beef industry functions on quality and price breaks between low and high Choice, rather than between Select and Choice.

5.9 Labor and Trucking:

Every additional step in the production process- processing, steak portion cutting, seasoning, marinating, trimming for block ready, cutting and wrapping for case ready, aging, and further processing or cooking- requires additional labor. In periods of low unemployment, the meat

industry struggles to recruit and retain skilled labor. Due to the physical labor required, working conditions in cold freezers and other extreme temperatures, attributes of the work itself, and other factors, packers and further processing plants struggle to maintain a consistent workforce. One packer interviewed stated that turnover in some of their plants was as high as 70 percent, but turnover generally falls between 30 and 50 percent industry wide. For some plants located in urban or highly populated areas, it is easier to recruit workers. But packing and further processing plants are also fighting for the same workforce as other manufacturing positions which have the same base pay and often more pleasant working conditions. The meat industry also fights amongst itself for workers, especially when processing plants for other beef companies or other protein products such as chicken or pork have facilities in close proximity to a beef processing facility.

For further processors that are just handling raw materials (as compared to slaughter), maintaining a steady workforce is generally easier. Raises, free meat products, performance rewards, Christmas and referral bonuses, employee barbeques, and other incentive programs help to maintain the further processor's workforce. One further processor stated that 80 percent of their workforce was stable, 10 percent was somewhat stable, and the bottom 10 percent were not stable, leading to high turnover rates and additional effort by management to communicate, engage, and keep these employees interested in order to retain them. Females make up larger shares of the working population than males in further processing plants and steak cutters indicate that they prefer females to cut Ribeyes, Tenderloins, and other high valued cuts due their attention to detail and ability to provide a consistent, correctly trimmed and portioned product. Plants processing specialty products such as wagyu cattle require slower chain speed and additional time and attention to detail.

A shortage of workers and higher turnover often leads to quality issues. Less experienced workers produce a larger number of products that do not meet customer specifications, having too much

external fat or are incorrectly fabricated. In some plants, it is difficult to get standard products fabricated, let alone further trimmed, value-added, or other more labor intensive products. Food service and retail establishments who receive product not meeting quality specifications, will return product back to the plant, requiring additional production and increased cost. Often times, suppliers monitor quality, especially for higher end customers, and will not allow the product to leave the plant unless it meets customer specifications.

The labor shortage in the beef processing industry has caused a beneficial, unintended consequence, however. Labor limitations constrain production below maximum capacity which reduces price and supply swings when cattle supply is at total capacity. Labor constraints are, in effect, moderating supply and muting seasonal patterns of over or under production.

Food service and retail are not immune from labor issues either. Increasing minimum wage levels impact the food service industry, especially in the quick service, fast casual, and casual levels where employees do not benefit from large tip amounts. In higher end, white table cloth restaurants, wait staff can make \$70,000 or more depending on the clientele and location, but even in these establishments, it can be difficult to recruit help. On the retail side, there are fewer and fewer in-house butchers, who cut steaks for customers behind the counter and produce ground beef and other products sold in the meat case. This means that more labor is needed at the packing or further processing level to produce case and block ready products. Case ready products refer to beef products that are already cut, placed into trays, and wrapped in cellophane to be directly placed in the meat counter once it reaches the grocery store. While block ready products are subprimals or roasts that are already closely trimmed, so the store butcher can cut steaks without needing to do any further fabrication of the product before it can be sold to the customer.

The recent passage of the Department of Transportation electronic log (or ELD) regulations, has enhanced enforcement of driving and hours of service limits for truck drivers. Drivers are limited to 11 hours of driving (FMCSA, 2017). Not only did these rules shine a light on the industry-wide lack of adherence to hours of service regulations, but has also caused logistical challenges throughout the beef industry. As a result, packers, further processors, distributors, and other supply chain sectors have changed the way they operate. Logistical challenges lead to late loads, products not being picked up on time, and, at times, loads being days or even weeks late.

Packers rely on truck drivers to deliver live animals and ship raw product, further processors rely on raw product coming in and finished products moving out, wholesalers and distributors rely on shipments coming and going from distribution facilities, and grocery stores and restaurants depend on timely deliveries. In order to insure on-time deliveries, trucking companies are now charging more per pound in freight rates, a penny or more per pound in most cases, and charging packers who do not fill the truck within a certain time frame or do not provide a full load to be hauled. Trucking companies may also require a certain amount of loads before they will add the establishment to their route. Packers and other shipping customers are also charging freight companies for late deliveries and pick-up times and are having to increase rates in order to incentivize drivers to be on time. Dropped trailers may also be filled before the truck gets there in order to incentivize drivers to arrive at the pick-up location on time.

Late night delivery options have provided options for drivers who want to remain close to home and in certain areas can charge a premium freight rate. Some large food distribution companies also maintain distribution hubs which allow drivers to work and live in the area surrounding the distribution hub and decreases the distance required to drop off the product. Others are ordering product earlier than usual to protect against late deliveries. The aging advantages of beef compared to other proteins allow beef product to remain in storage for a longer period of time

before use compared to other protein products, so the beef industry is not dealing with trucking issues as severely as poultry and other meat industries.

There are many companies working to recruit and incentivize short and long haul truck drivers, like Wal-Mart which recently started offering beginning salaries of \$86,000 for drivers (Premack, 2018). However, the need for drivers remains and it is difficult to recruit individuals into the career of truck driving due to long hours, being away from home for multiple days at a time and other unique working conditions. The short supply of drivers has increased the difficulty to move value-added or further processed products even more than commodity products. It is increasingly difficult to maintain long haul drivers especially, but all drivers play a crucial role in the supply chain. Another important, but overlooked role of truck drivers, is their role as the face of the company in which they are delivering the product. To many customers, the driver is the only representation of the company that the customer sees on a daily basis, so it is important that the driver is friendly, professional, timely, and maintains a positive relationship with the customer.

One bright spot in the electronic logging device (ELD) regulation is the recent amendment passed which extends the implementation of the ELD requirements for livestock haulers until September 30, 2019 (Bechtel, 2018). The Transporting Livestock Across America Safely Act was also introduced to the Senate on May 23, 2018 which, if passed, would extend the hours of service regulations in the following ways: would only be implemented outside of a 300 air mile radius from the pickup point, exclude certain activities such as unloading and loading from the hours of service rules, expand driving hours to 15-18 hours, allow for rest periods within the traveling distance not included in the hours of service, and allow the driver to continue to the delivery point if it is within 150 air miles after the hours of service have expired (S.2983, 2018). This is important to the livestock industry as under the general ELD rules, trucks hauling cattle long distances, especially from cow/calf to stocker or feedlot operations could only travel 11 hours before the truck driver had to take a mandatory ten hour rest period, or wait for another truck

driver to take the cattle the remaining distance. For obvious reasons, this led to humane handling issues, leaving cattle without food or water for extended periods of time outside of standard transportation time, which caused increased stress, especially in extreme weather conditions during the winter and summer months. Until this bill passes, the ELD mandate extension will remain in place until September of 2019 to recognize the unique challenges of livestock haulers. Most fed cattle travel short distances to the packing plant, so these rules don't necessarily apply to fed cattle, but are important for cattle being shipped long distances to stocking operations and feedlots.

5.10 Pricing Strategies

Each step in the supply chain is supplying the market with a profitable product, and each company or operation utilizes a unique system to complete this goal. Each packer values cuts differently and will price products accordingly. One major packer has grinding capabilities, so when they can't sell the product, they will grind it themselves. Some put a higher price on their Chuck Shoulders and Chuck Rolls, while others may have a higher price on their Flanks or their Ribeyes due to the packer's perceived quality of fabrication. Highly skilled beef buyers know these intricacies and will use them to their advantage when negotiating prices.

Each packer also has a particular selling style. Some come prepared with a meaningful value and negotiate little, while others may come to negotiations with high prices, negotiating down to a reasonable price point. Buyers are constantly watching prices, trying to predict the market, and getting as much information as possible from each packer or supplier in order to get the most profitable deal. Beef production varies over time and the supply available will impact product price changes. The best case scenario for a buyer is when one supplier has all of the product supply the buyer needs instead of having to purchase smaller amounts from more than one

supplier. Larger orders also give buyers more negotiating leverage to pay a lower price on a larger volume of product.

In general, product can be purchased through three main formats: spot, formula, and forward pricing. Spot pricing essentially means buying the product at the current USDA reported market price, with delivery of the product up to 21 days in to the future. Forward pricing, on the other hand, is negotiating a price based on delivery after 21 days in the future. Forward pricing can be a forward cash price or a formula based forward price. Formula pricing is different for each buyer but is generally the USDA reported market price plus or minus a certain amount or percentage based on the product, seasonality, supplier, or other factors. Forward contracting may lock in a certain supply at the current USDA market price at time of delivery, a contracted price negotiated at the time of sale, or the formula price at the time of delivery. Some suppliers prefer formula pricing, especially for consistent weekly buyers, as it aligns with market prices and allows the supplier to assure supply for the customer while also protecting against price volatility. Others prefer to use neither spot nor formula pricing, instead using the skill set of sales people to price commodities individually in a variety of ways with each supplier. Still others prefer a mix of at least half from formula pricing and the other half of sales as mix of spot and forward contracting.

Some firms will use forward or spot pricing based solely on the seasonality of the item, as a period of low prices in the Short Loin and Strip Loin may be a period of high prices for Tenderloins and Ribeyes. Forward or spot pricing may also be ideal when certain price, supply, or demand factors are in play, impacting price levels on certain products. The spot market also provides a small amount of volume for extra production as brokers will be trying to buy the “Friday push list” or the products that packers are trying to get rid of at the end of the week, providing a discounted price for brokers. Brokers buy and sell a product as an intermediary, at a packer, further processor, distributor, wholesaler, retail, or food service level. Some firms indicated that there are more inexperienced salespeople now who may be more likely to purchase

products at spot price. Without these spot purchases or daily slaughter production variability, there would be less price volatility in the market.

Some firms may use the USDA reported price for their everyday turnover business and others may negotiate with the packer to get a price close the USDA reported price if they can't negotiate the price that they want. For some distribution or wholesale companies, customers may prefer to block products. This means that the product is bought and stored at the distribution center and the customer pays the market price at a later date when the product is delivered or picked up, allowing the customer to hedge the market. Block product is generally bought six to eight weeks out, however, the customer will not pay for the product until after they have received the product at their own facility.

In general, brokers fall into two categories, those who are new to the industry and those who are advanced and well versed in the sales "game." These advanced sellers, especially for packers, do a better job of accurately selling at 13 to 16 weeks out at aggressive prices due to their advanced understanding of the market. Newer salespeople, on the other hand, don't have the negotiating skills or enough knowledge of the product mix to be as competitive as advanced salespeople. In addition, new salespeople are often from non-agricultural backgrounds or degree programs and many have little knowledge of the beef industry. This means that salespeople may be less apt to suggest alternative beef products to their customers because they don't understand the product mix or cut attributes enough to sell outside of their usual make or push list. For instance, the teres major, or Petite Tender steak, may provide a steak entrée alternative for some food service or retail establishments, but many sales people do not even know the product exists, let alone the price that they could sell it for. Lack of knowledge and negotiating skills results in most brokers today simply serving as inventory managers, reordering the same mix of products for customers each week. In order to improve the skills of their salesman, many firms are now providing

additional education in order to improve understanding of the beef carcass and the qualities of each cut within it.

So how do the various supply chain partners make their money and find value? For packers, cattle and carcass cut-out value spreads make up a lot of the profit margin on a particular cut, which is why value-added and other further converted products help to add pennies to the carcass and primal cut-out values. Depending on the customer and their specific buying process, retail and food service customers can purchase the product themselves and are then charged a storage fee by the distributor or further processor. This is especially true for customers who are primarily box in-box out, meaning that they purchase boxed beef from a packer, have the distributor or further processor age the product for them, and then have it delivered in the same form and box that it came in. Others may give the distributor or further processor product specifications and price point and the distributor then goes to the supplier to purchase the product for the customer. Based on what the further processor or distributor does with the product for the customer, they may or may not take ownership of the product before it is delivered to the customer.

Food service generally prefers fixed or contract pricing options due to the fixed price on their menus. However, they are generally open to formula pricing options that help both sides, the packer and the food service group, to get the best price and value possible. While contracting is most preferred, most groups realize that a guaranteed supply will require formula or forward contracting options. Food service groups that own a variety of restaurant brands have more flexibility negotiating with suppliers due to the large product mix that they purchase. Purchasing non-steak products such as Rib Lifter meat (thin muscles removed from the outer portion of the rib), Oxtail (skinned and portioned pieces of the tail), 90% and 50% lean trim, and extra trimmed Chuck Clods, for example, also give food service groups a more diverse product mix. Packers may give these retailers a better price due to the large and diverse product mix that the restaurant is purchasing. For restaurants who do not cut their steaks in-house, the price is not as important as

the supplier's ability to provide a consistently sized portion in order to train cooks on the grill and provide a consistent product. Restaurants buying from steak cutters are also more concerned with the cutter's ability to fabricate the product with consistent size and quality than their price point.

Retailers often prefer formula pricing rather than spot or forward contracting as retail is based on a steadier, weekly product flow. This is also due to high turnover and less expertise among brokers providing these options. Some retail groups prefer to create individual purchasing solutions for each supplier, providing profit and pricing opportunities that formula options don't provide. Retailers also differ from food service as their ad planning and execution process may start months in advance. Retail ads are typically planned or formulated four or six months in advance at which time products are forward priced to lock in the predicted product demand. Retailers then forecast around 13 weeks out, projecting what their stores will sell from that particular advertisement promotion and the quantity of product needed. Some retailers may begin purchasing product 8 to 13 weeks out instead.

Some retailers still purchase a portion of beef in the form of "matched cattle" or cattle packs. In general, this means that the retailer will purchase the entire carcass equivalent in the form of boxed beef, which will be supplemented with additional specific products as needed. This type of beef is feasible only if the retailer is cutting product in the back of the store and producing their own ground beef, so there is no waste of product. But this also provides a stable and consistent buying base for packers and allows the retailer to negotiate with the packer for additional products that may be short in their inventory. Boxed beef prices are also differently priced compared to case ready products as there is less labor required. Products promoted by retailers with in-house fabrication may have varying net margins due to the additional labor and fabrication costs for the promoted products at each store location.

Retail category buyers are rewarded based on sales, profit margin, margin percentage, and sales volume. On the basis of profit margin, ground beef and steaks are not much different, but ground beef will make up a larger margin percentage than steaks. In addition, a larger volume (in weight) of steaks will provide more revenue than the same weight of ground beef, as the price per pound is much different between the two. In general, retail advertisement promotions drive sales volume for the specific cuts being promoted, while other cuts not promoted will drive the profit margin. Large retail chains may change prices less frequently than smaller volume retailers, but they will make smaller profit margin per product than smaller retailers do.

A wide variety of pricing methods are used across the broad set of packers, further processors, distributors, retail, and food service customers. Due to varying product flows, timing and differences among suppliers and the interaction of different business models and strategies used by suppliers and end users, most food service and retail customers use a combination of pricing strategies.

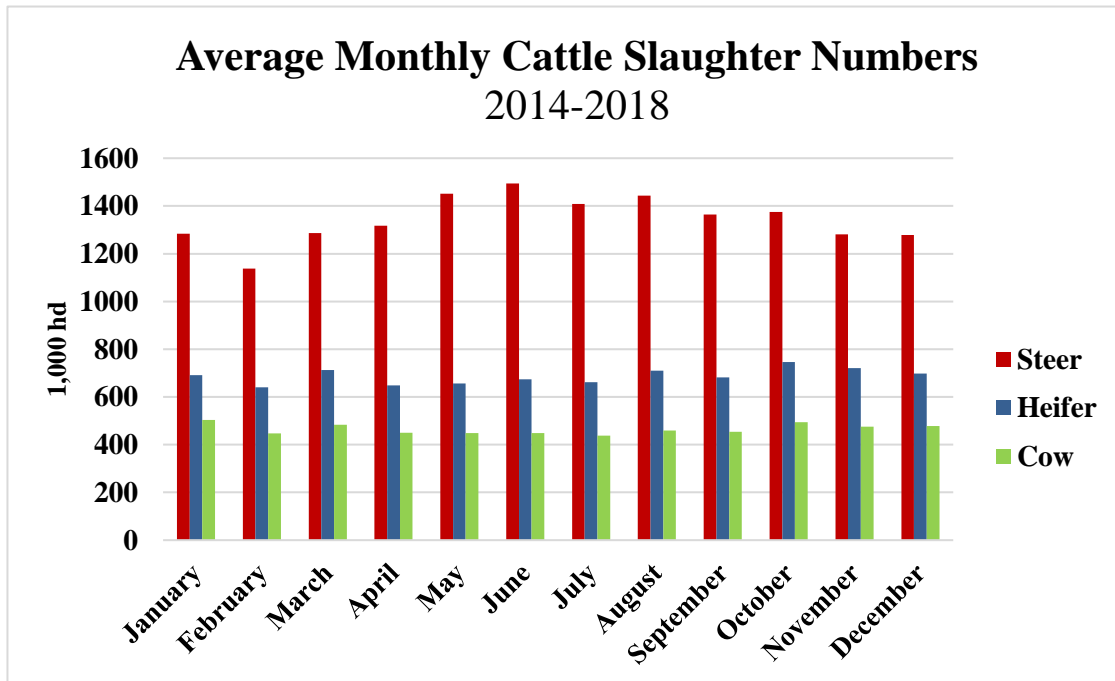
5.11 Seasonality and Regional Differences

Through all links in the supply chain, seasonality impacts price levels and supply availability. From the production side, calving seasons lead to seasonal supply changes, which may not always align with demand changes. Today, demand is not as predictable as it used to be due to additional and more complex product flows. Organizational partners help buyers to better plan for the future rather than basing their predictions solely on historical trends. Retailers and food service attempt to detect increasing demand early in order to capitalize on the opportunity. For distributors and wholesalers, it is generally more important to manage supply rather than use a certain pricing agreement or meet a specific price point. Less spot buying is taking place and suppliers and end users aren't chasing product, but instead, prioritizing updated product make lists and ample inventory to cover orders. Some exporters are more willing to take large positions on products in order to take advantage of a better price and then freeze the product, buffering their inventory.

Evolving dietary trends have also impacted beef demand. For example, the current keto diet trend is bolstering demand for the Ribeye and other steak cuts. In addition, printing calorie counts on many restaurant menus has had little effect on consumer preference for higher fat steak products like the Ribeye.

Suppliers generally do a thorough job of advertising product flows to meet current demand. Peak slaughter months are in the summer months (as illustrated in Figure 5.8), which is also peak grilling and retail season, so retailers take the bulk of the excess supply. In low production cycles, beef imports increase, and retailers and food service seek other protein products as beef prices increase. Retailers will also switch up their product mix to deal with this challenge, increasing the variety of red meat products available at various price levels or decreasing their fresh meat section to instead include more ready-to-eat or convenience type products. Cold storage also helps to balance seasonal supply and demand

Figure 5.8: Average Monthly Cattle Slaughter in 1,000 head. Data: USDA-NASS, compiled by LMIC.



In terms of calendar year seasonality, there are common consumption patterns throughout the year. In January, ground beef increases in demand as consumers recover from the holidays and high-priced holiday meals like Prime Rib. For retailers, the first week of January is generally not a good time to sell beef due to healthy New Year's resolutions for many consumers, so they will instead feature a boneless skinless chicken breast. Retailers may also include a Top Sirloin Butt offering at a competitive price. Retailers avoid putting high priced beef products in the same advertisement with a cheap chicken product, so the Top Sirloin works well as it has a wide range of prices from \$3.99 to \$5.99 a pound which retailers can adjust according to the other product prices included in the advertisement. For food service groups servicing convention halls or large banquet style events, January is also a peak demand time as convention season begins. Leading into the Super Bowl, chicken wings, pizza, hamburger, and rib consumption spikes.

On Valentine's Day, restaurant visits spike after the peak holiday seasons. Lent season has a negative impact on beef demand, but this effect is not as pronounced as it used to be. Brisket prices may also spike in January and February in preparation for St. Patrick's Day corned beef, but Brisket prices have continued to stay at high prices due to the increased popularity of barbecued and other Brisket products.

In March, end cuts from the Chuck and Round are replaced by steak and other grilling items. Demand for Strip Loins, Sirloin Flap meat, and other steak items will start first on the west coast and then spread across the rest of the country, based on weather conditions. Flap meat, Flank, and Skirt steaks will also increase in March in preparation for Cinco de Mayo.

In the spring, smoking and grilling demand increases for steaks and hamburgers, so retail traffic increases. Restaurant visits decline in the spring and summer months outside of spikes on Mother's Day and Father's Day, with the lowest point around the 4th of July holiday before traffic begins to pick up again. Memorial Day to Independence Day is peak grilling season, driving steak

demand in retail and increasing steak offerings while decreasing roast offering in the spring and summer months.

Once kids go back to school and the weather starts to cool off, restaurant traffic tends to increase, but retail demand weakens from the end of September to the middle of October. Strip Loin and Short Loins have price jumps in the fall months and Rib and Tenderloin prices will start to strengthen in preparation for the holiday season. During the fall months, roast offerings will replace steak offerings in grocery stores, including Inside Rounds, Chuck Rolls, Chuck Clods, Bottom Rounds, boneless Chucks, and Shank meat. Going into December, retail and food service are at their busiest with consistent product offerings of Tenderloins, Ribeyes, and some other steak products. For food service, the fourth and first quarters are their highest sales months due to holiday celebrations. December also brings a spike in all primal prices due to holiday event demand.

Variable seasonal price changes for different cuts are indicated by seasonal price indices and were created utilizing monthly wholesale prices for Choice cuts from 2007 to 2018; data was compiled by the Livestock Marketing Information Center. A seasonal price index was calculated for 16 separate cuts by dividing the reported monthly price by the centered twelve month moving average value for each month. For example, the January 2008 price for the 112A Ribeye Boneless Light was \$503.27 per hundredweight, and a moving average for this month was calculated as the average of the July 2007 through June 2008 prices, which was \$552.38. The resulting Seasonal price index was therefore, calculated as \$503.27 divided by \$552.38, equaling 0.9111. Seasonal price index graphs were created, including 2008-2015 average price indices for each month and the 2016-2018 average for each month. 2016 to 2018 was chosen to illustrate how price patterns may have changed recently compared to the previous eight years. The most recent data was used to capture current market conditions. However, this data was incomplete for seasonal index

values for October, November, and December of 2018. Thus, the 2016-2018 indices for those months only include 2016 and 2017.

Figure 5.9 compares the 2016-2018 seasonal price indices for the BF 112A Light Boneless Ribeye, BF 175 Strip Loin, and BF 189A Tenderloin. For the most part, the seasonal indices do support the above statements about seasonal use and price increases. This is true, except for the Strip Loin (BF 175) which actually experiences a drop in prices during the fall months, contrary to previous statements.

Figure 5.9: Seasonal Price Index Comparisons for the BF 112A Light Boneless Ribeye, BF 175 Strip Loin, and BF 189A Tenderloin; data: USDA-AMS, compiled by the LMIC.

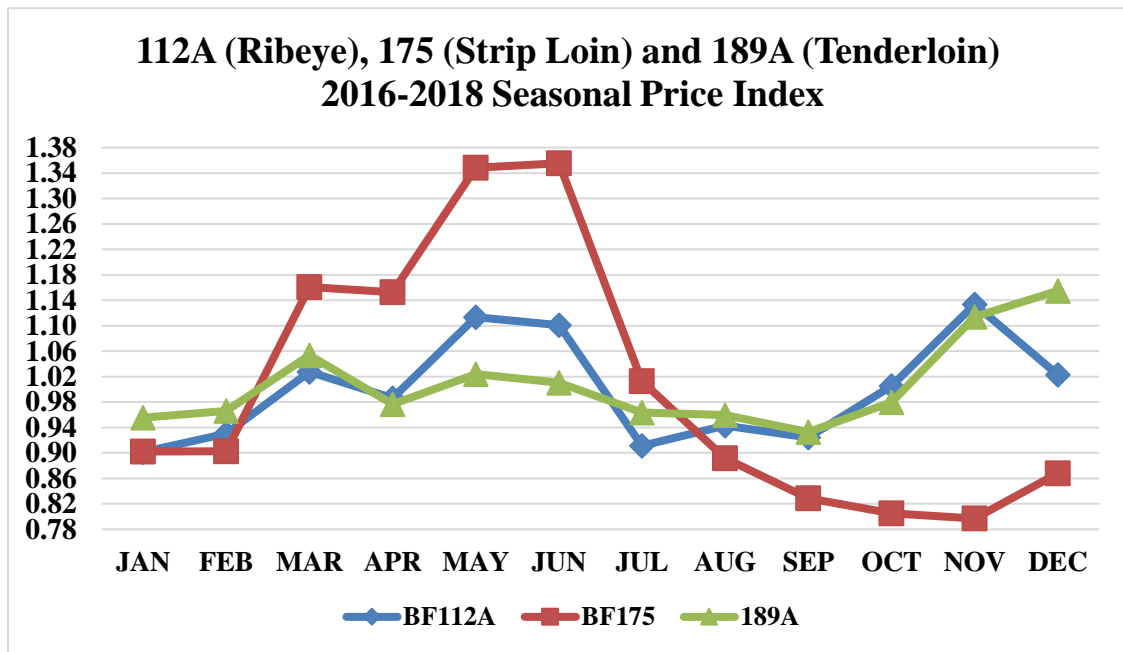
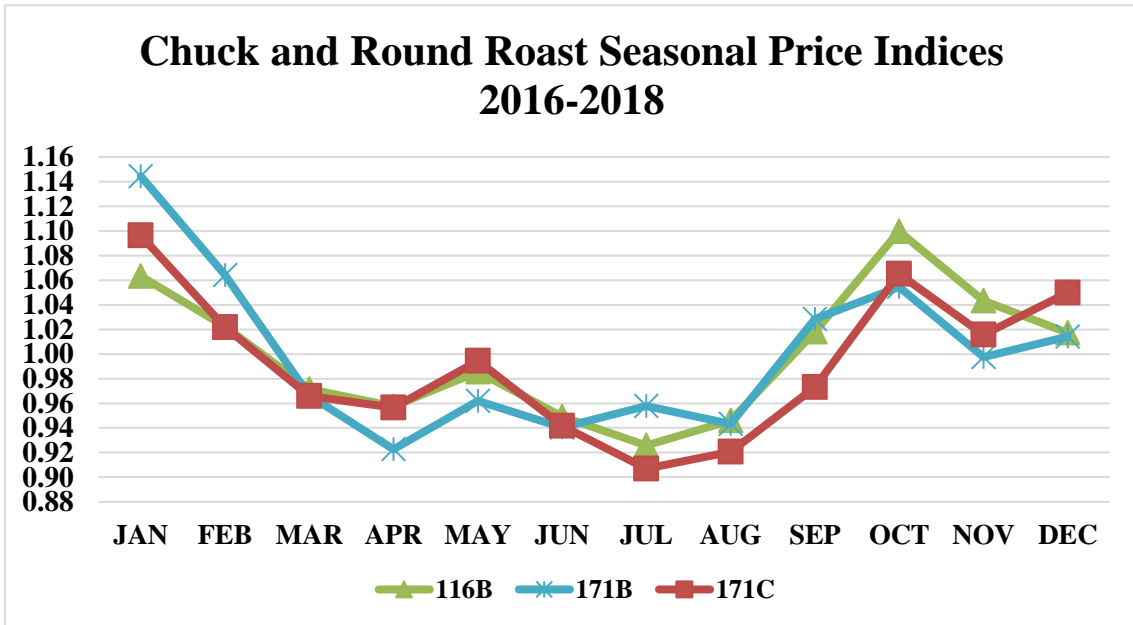


Figure 5.10 compares the seasonal price indices for the BF 116B Chuck Roll Retail Ready, BF 171B Outside Round, and BF 171C Eye of Round. This chart illustrates the increase in use of these cuts during the fall months as roast options increase in retail.

Figure 5.10: 2016 to 2018 Seasonal Price Index Comparisons for the BF 116B Chuck Roll Retail Ready, BF 171B Outside Round, and 171C Eye of Round; data: USDA-AMS, compiled by the LMIC.



Changing seasonal prices not only illustrate changing consumption patterns throughout the year, but also impacts the entire carcass cut-out value. Chuck and Round products tend to increase in the summer and Loin and Rib products increase in the spring and summer months, and vice versa. Briskets, Flat Irons, Tri-Tips, and Strip Loins spike in the spring. All of these seasonal adjustments are reflected in the total carcass cut-out value. While these seasonal charts illustrate changing consumption patterns, they are also important to illustrate how each cut within the carcass, and their demand/consumption patterns, significantly impact the total value of the carcass and help to better explain the importance of disaggregated demand on total beef carcass values.

Seasonal consumption patterns have impacts on beef demand for particular cuts, but consumption patterns also vary by region within the United States. On the west coast, the Sirloin Tri-Tip is very popular and serves as a leaner Brisket equivalent. This region is also known to prefer leaner meat cuts and are less concerned with high quality products, preferring Select quality graded

products and very lean ground beef. This consumption preference may be due to the large Hispanic population on the west coast who have specific diet and consumption patterns.

In the central part of the country, including Texas, Inside and Outside Skirts, Brisket, and Tripe are very popular products. Consumers in the northeast U.S. have a strong demand for Bottom Sirloin Butt Flap meat which is used for steak tips as well as Eye of Rounds which are commonly wrapped in bacon and roasted in Central New York and other consumption regions further north. In Ontario, Canada and other French influenced regions, the Eye of Round is sliced and bacon is placed throughout the roast. The Mid-Atlantic region of the United States has strong demand for Top Sirloin Butt, and the southeast U.S. prefers a higher fat ground beef in the 73% to 81% lean range. Bottom Sirloin Flaps and Oxtails also sell disproportionately well in the Miami area and Brisket continues to be popular in the American south, but is becoming increasingly popular across the country for barbecue, pastrami and corned beef, and even some quick service restaurants beginning to offer Brisket products. Figures 5.11 and 5.12 show how the demand for the Brisket and Bottom Sirloin Flap cuts have had an impact on their value compared to the total carcass cut-out value.

For regions of high tourism, food distribution companies do especially well with convention business. Convention attendees often have company expense cards that they will use to pay for expensive meals for themselves or prospective clients. This was especially true before the economic recession, as visitors for conventions and other events were more frivolous with their spending. This is less common now as many convention attendees are not “foodies” and will instead spend their money on other things while visiting.

Figure 5.11: Choice Brisket Point-Off (BF 120A) as a Percentage of the total Choice Carcass Cut-Out Value; data: USDA-AMS, compiled by the LMIC.

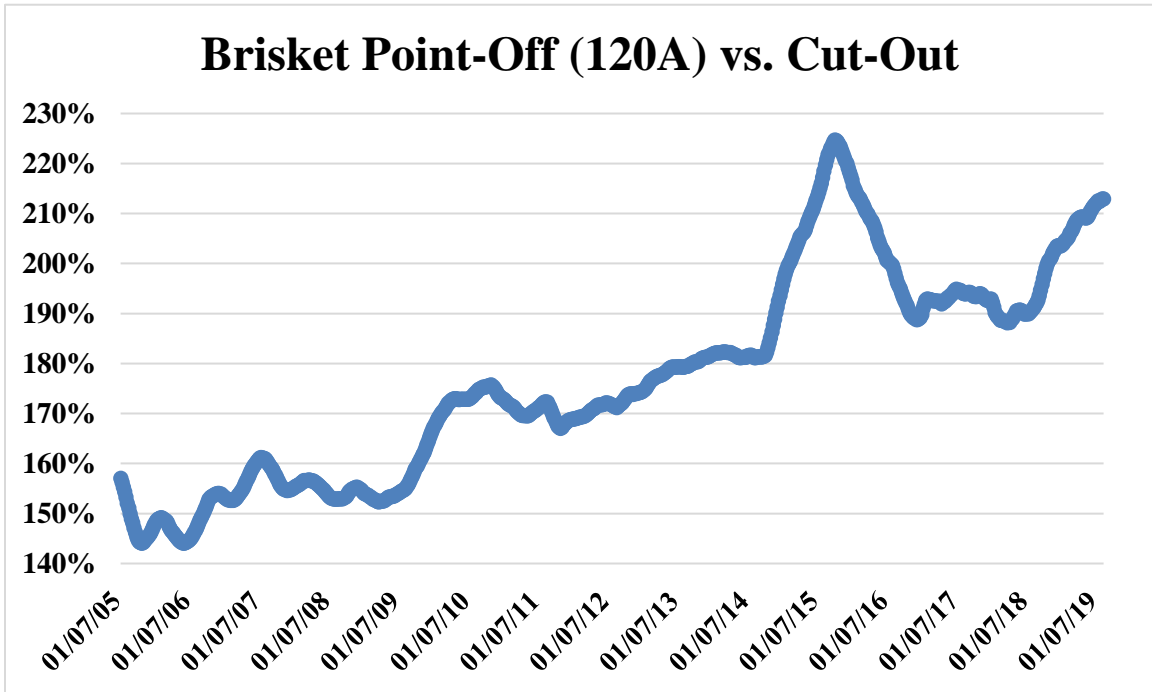
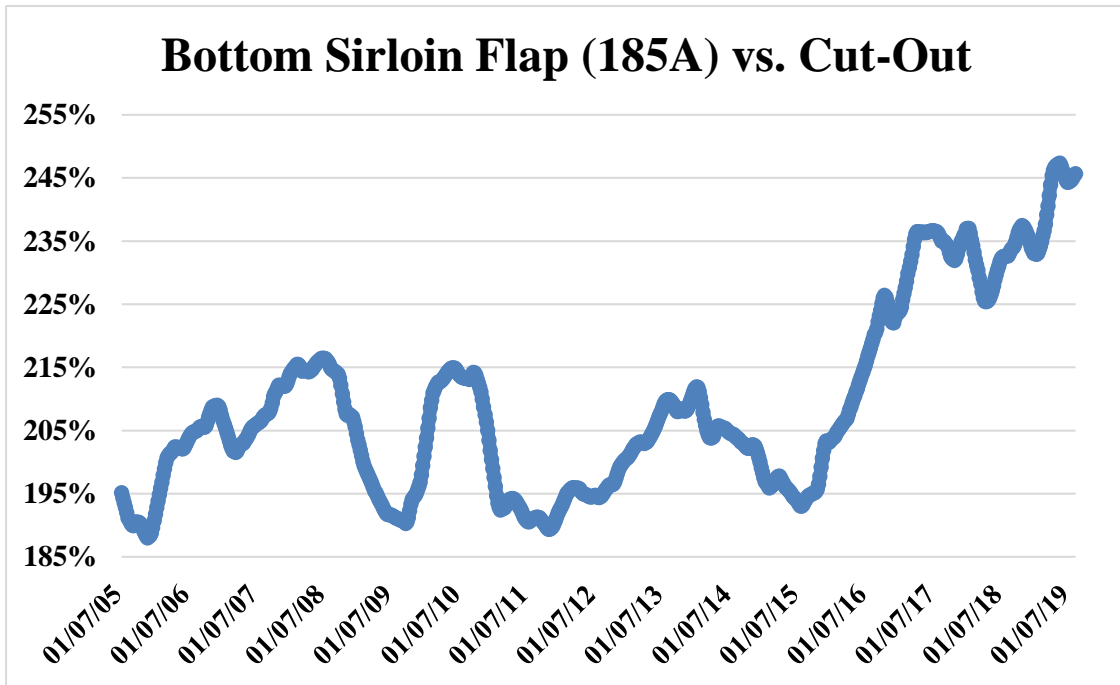


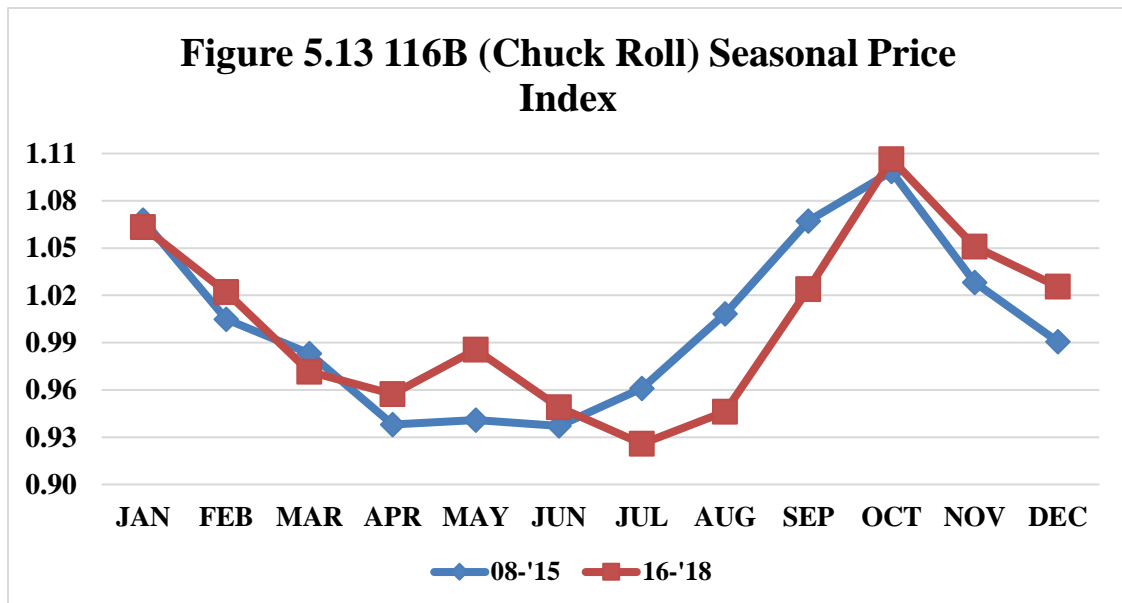
Figure 5.12: Choice Bottom Sirloin Flap (BF 185A) as a Percentage of the total Choice Carcass Cut-Out Value; data: USDA-AMS, compiled by the LMIC.



Several interviewees mentioned that increasing exports have impacted the seasonal price patterns of highly exported cuts like the Chuck Roll, Short Ribs, and Flat Iron, and the researchers wanted to determine if there was any quantitative evidence of these seasonal price changes. The charts for all 15 cuts can be found in Appendix A, s Figures A-1 through A-17.

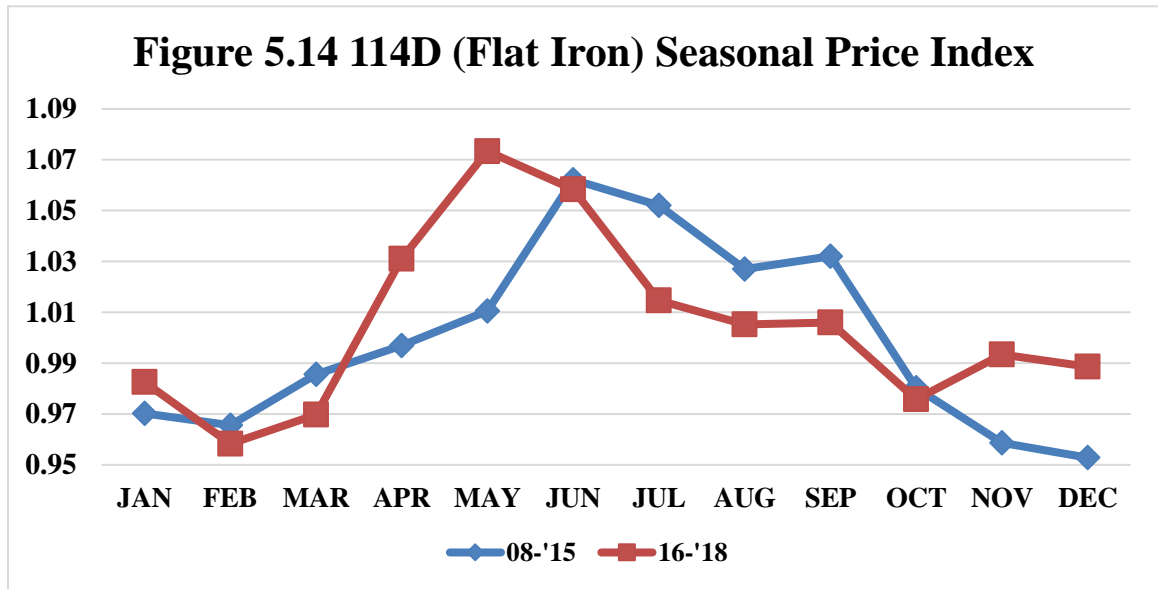
Figure 5.13 (Appendix A: Figure A-5), Chuck Roll Seasonal Price Index comparisons, does not show a pronounced change in seasonal price levels, but still follows relatively the same price patterns in 2016-2018 as the average of 2008- 2015. However, in 2016-2018, a small peak now occurs in May, a new low occurs in July, increases at a lower index value from August to October, and ends at a higher point in December, compared to the 2008-2015 average. There was no anecdotal evidence as to the reason for these changes, but one possible explanation could be the use of Chuck Roll products as a Memorial Day steak alternative or in retail promotions. Nevertheless, Figure 5.13 does not indicate a less severe seasonal price pattern at the wholesale level.

Figure 5.13: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 116B Chuck Roll Retail Ready; Data: USDA-AMS, compiled by the LMIC



The BF 114D Flat Iron, Figure 5.14 (Appendix A: Figure A-3) has also experienced a slight shift in seasonal price patterns from 2008-2015 to 2016-2018, with a new low point in February followed by a peak in May instead of June, and a drop through October followed by a slight increase in November and December. Again, there was no anecdotal reasoning for this new spike from March to May, but it may be due to the increased use of the Flat Iron as a steak alternative in the spring months. The seasonal lows in December evident in the 2008-2015 time frame have been replaced by a small spike in November and December, which may be attributed to export demands.

Figure 5.14: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 114D Flat Iron; Data: USDA-AMS, compiled by the LMIC



Notable changes are also evident in the Short Ribs, both from the Short Plate, Figure 5.15 (Appendix A: Figure A-7) and Chuck Short Rib, Figure 5.16 (Appendix A: Figure A-8). Seasonal price lows have not leveled out, rather, seasonal price swings have become more volatile. In the Short Plate in 2016-2018, a new steep price decrease occurs in April, followed by a significant price peak during the late spring and summer months, followed by a small dip in the fall months and finishing with another spike in December. While there were troughs and valleys in 2008-

2015, the price movements within the index were smaller than in the later time period. It is not obvious if these changes are due to increased exports, but the changes are still evident. The Chuck Short Rib has also experienced a drastic shift in seasonal price patterns with larger price swings in the 2016-2018 time period compared to 2008-2015. These changes could have a significant impact on buyers who, historically, purchased Short Ribs at the low prices in August and who are now seeing prices at this time instead.

Figure 5.15: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 123A Short Plate Short Rib; Data: USDA-AMS, compiled by the LMIC.

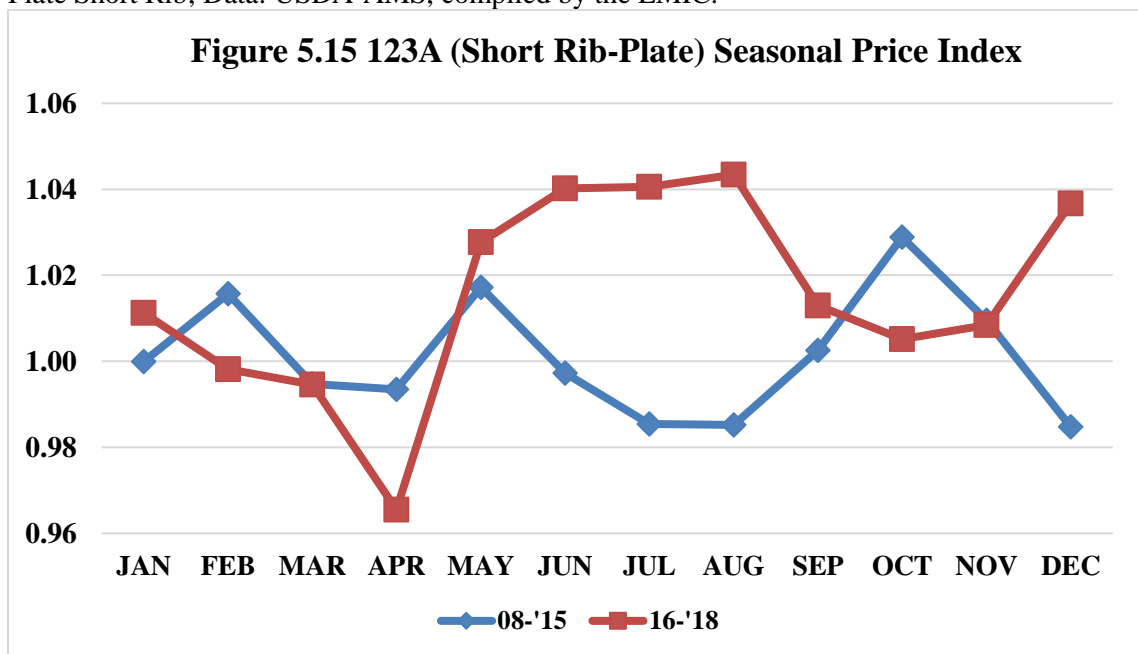
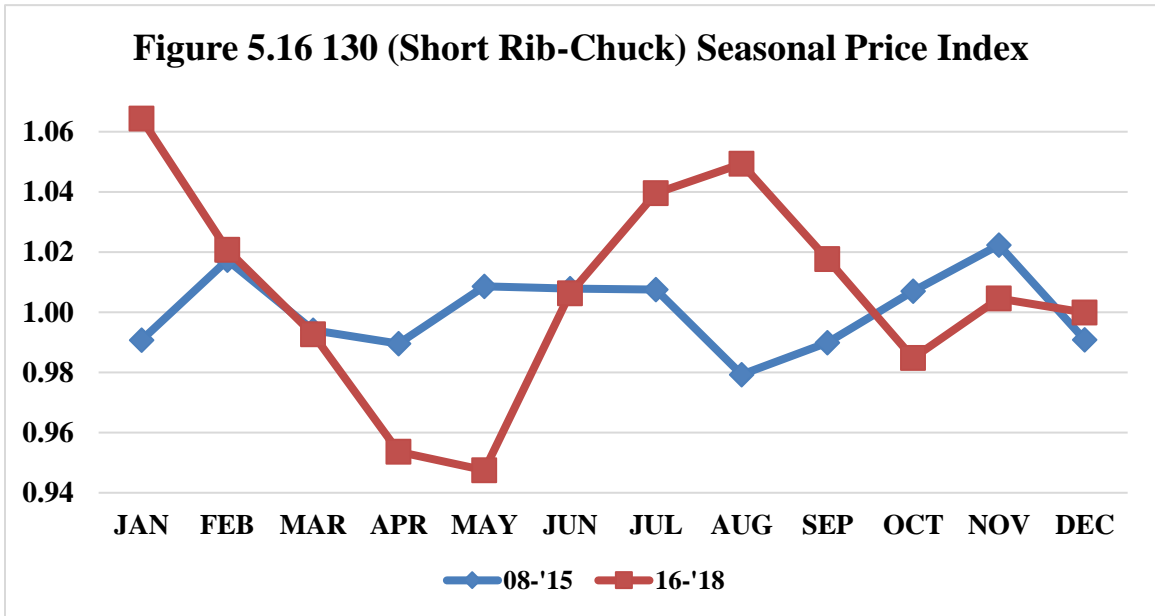


Figure 5.16: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 130 Chuck Short Ribs; Data: USDA-AMS, compiled by the LMIC.



Notable changes have occurred in seasonal pattern for other cuts as well, that are not as highly exported, and so the reasoning for these shifts are still not fully evident. The 112A Ribeye Boneless Heavy Figure 5.17 (Appendix A: Figure A-1) experiences higher peaks in May and June and lower lows in July through September in 2016-2018 compared to 2008-2015. The 114A Chuck Clod, Figure 5.18 (Appendix A: Figure A-2) experienced a seasonal peak in May in 2016 to 2018 where seasonal lows were in 2008-2015 and decreasing price levels from July to November in the recent time period where the long run average was at a higher level.

Figure 5.17: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 112A Boneless Ribeye Roll, Lip-On; Data: USDA-AMS, compiled by the LMIC.

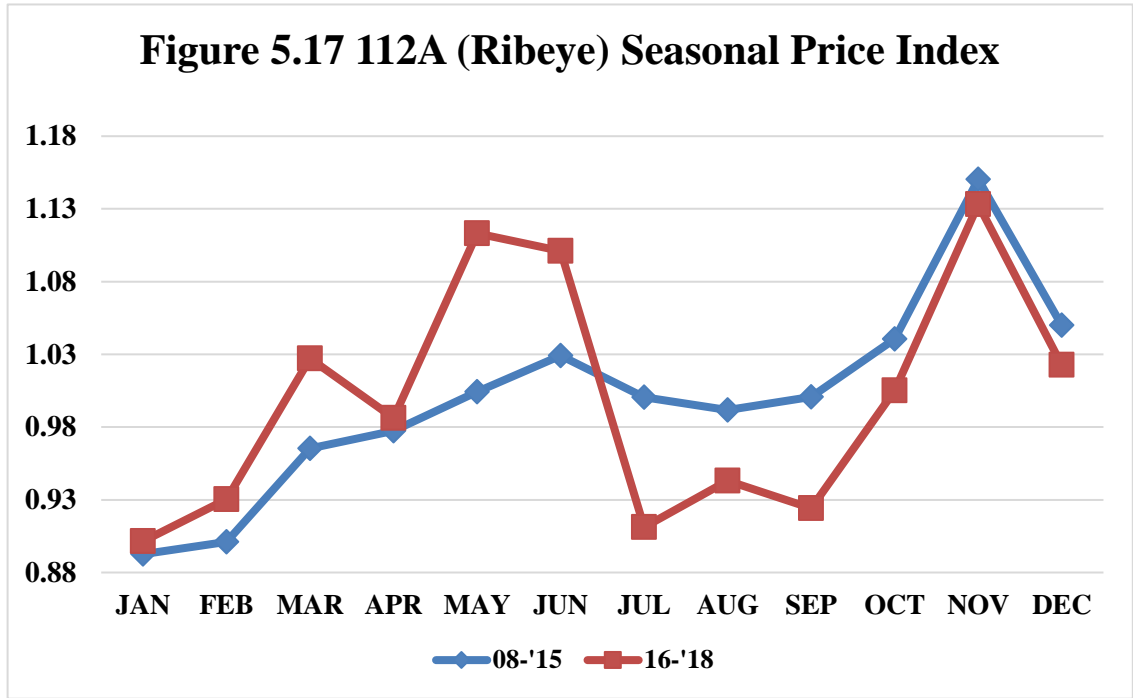
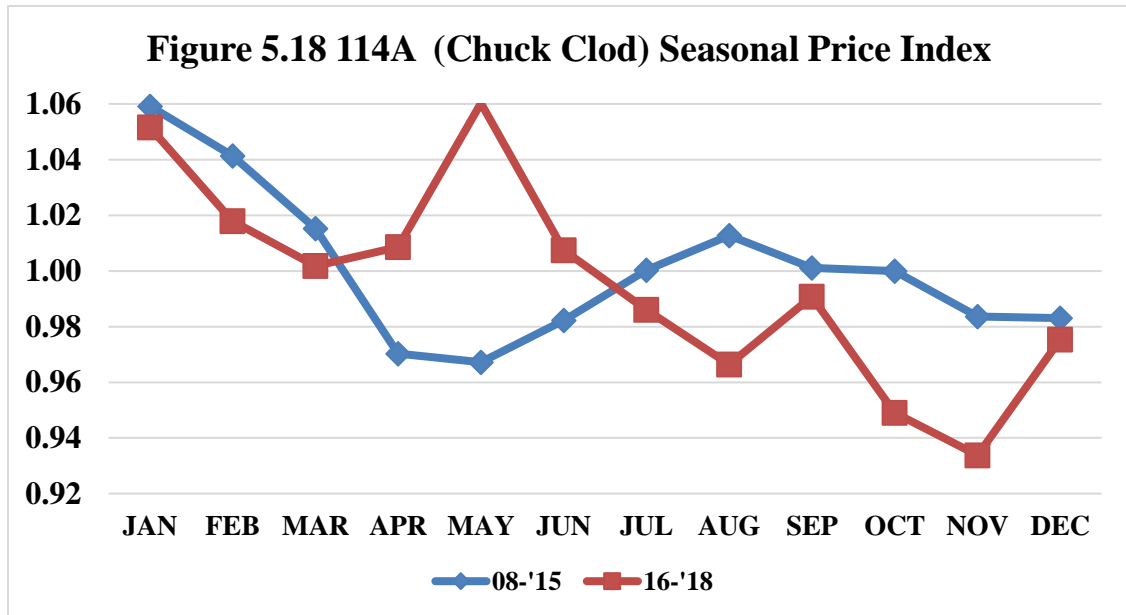


Figure 5.18: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 114A Chuck Clod; Data: USDA-AMS, compiled by the LMIC



The 120A Brisket Point-Off Boneless, Figure 5.19 (Appendix A: Figure A-6) seasonal price index changes are impressive with a huge spike in June followed by a significant drop in August

preceding another increase through December in 2016-2018, compared to the 2008-2015 line.

This may indicate the increase in Brisket use during early summer barbecue season.

Figure 5.19: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 120A Brisket Point-Off Boneless; Data: USDA-AMS, compiled by the LMIC

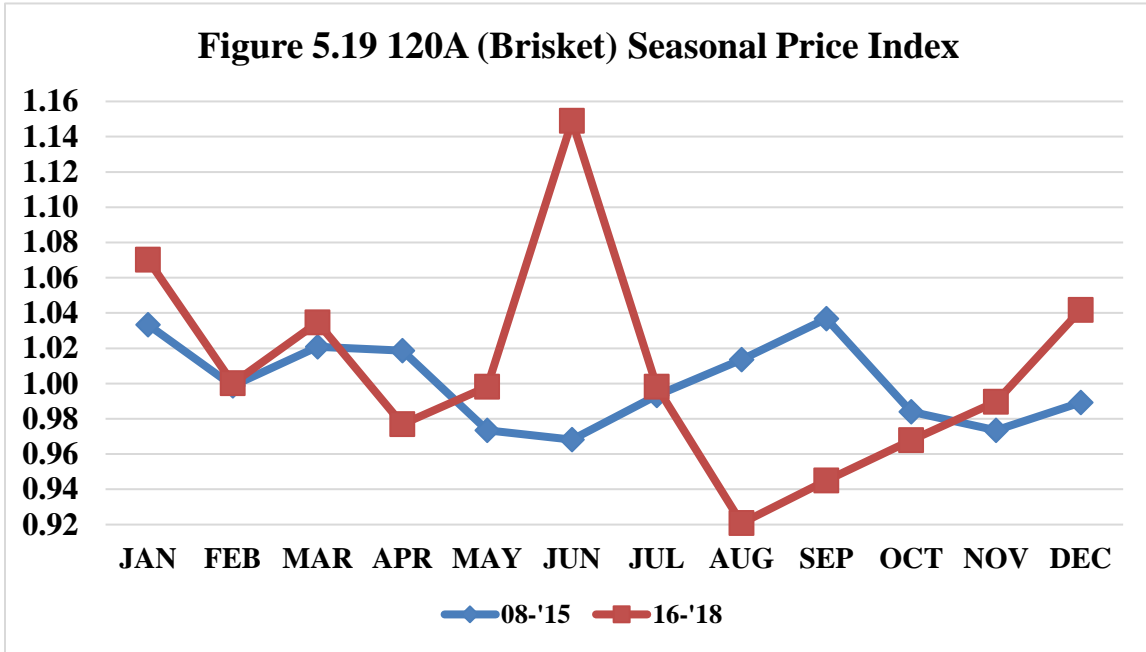
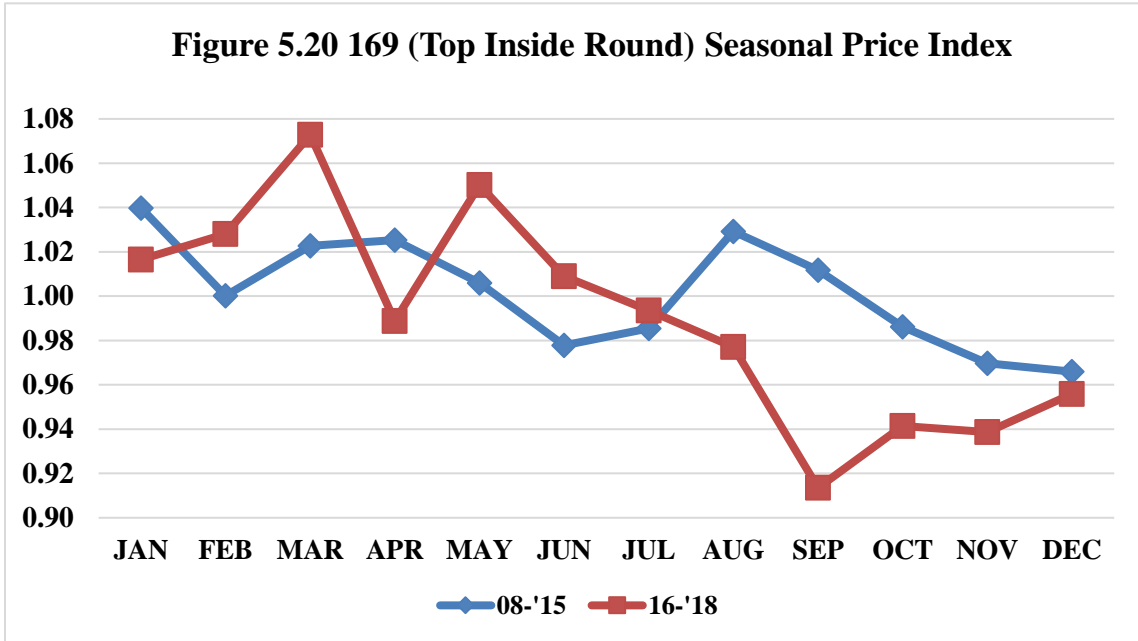


Figure 5.20 (Appendix A: Figure A-9), Top Inside Round Denuded has experienced spikes in March and May followed by a steep decrease from May to September in 2016-2018 where the seasonal peak occurred in August followed by a steady decrease through December in 2008-2015.

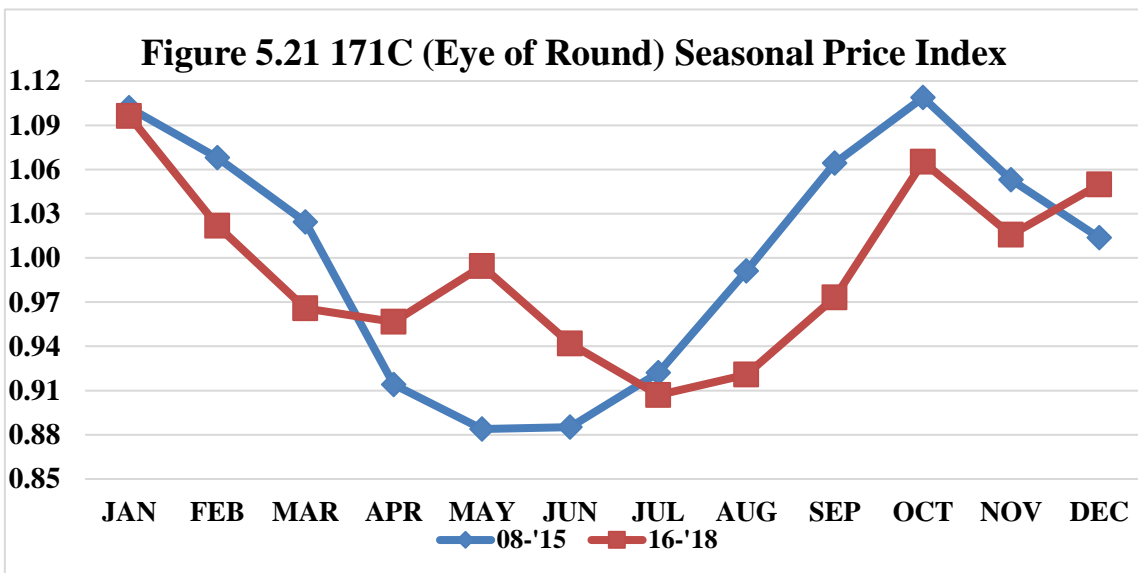
The reason for these changes is not clear

Figure 5.20: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 169 Top Inside Round; Data: USDA-AMS, compiled by the LMIC.



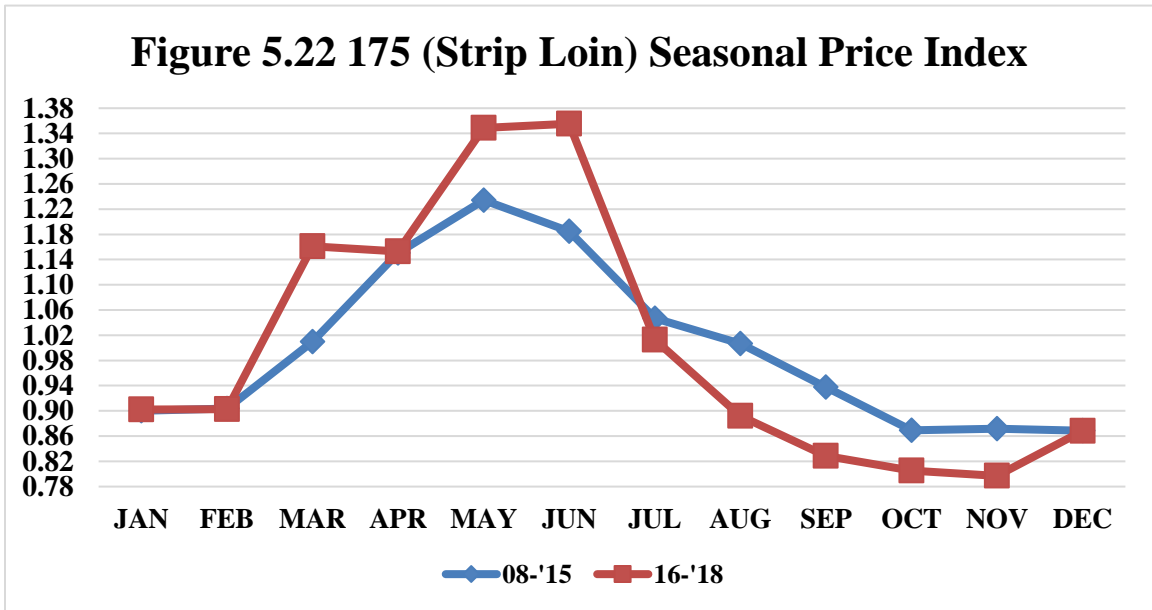
The Eye of Round BF 171C, Figure 5.21 (Appendix A: Figure A-11), has less dramatic seasonal low in 2016-2018 compared to 2008-2015 as well as a less pronounced seasonal high.

Figure 5.21: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 171C Eye of Round; Data: USDA-AMS, compiled by the LMIC



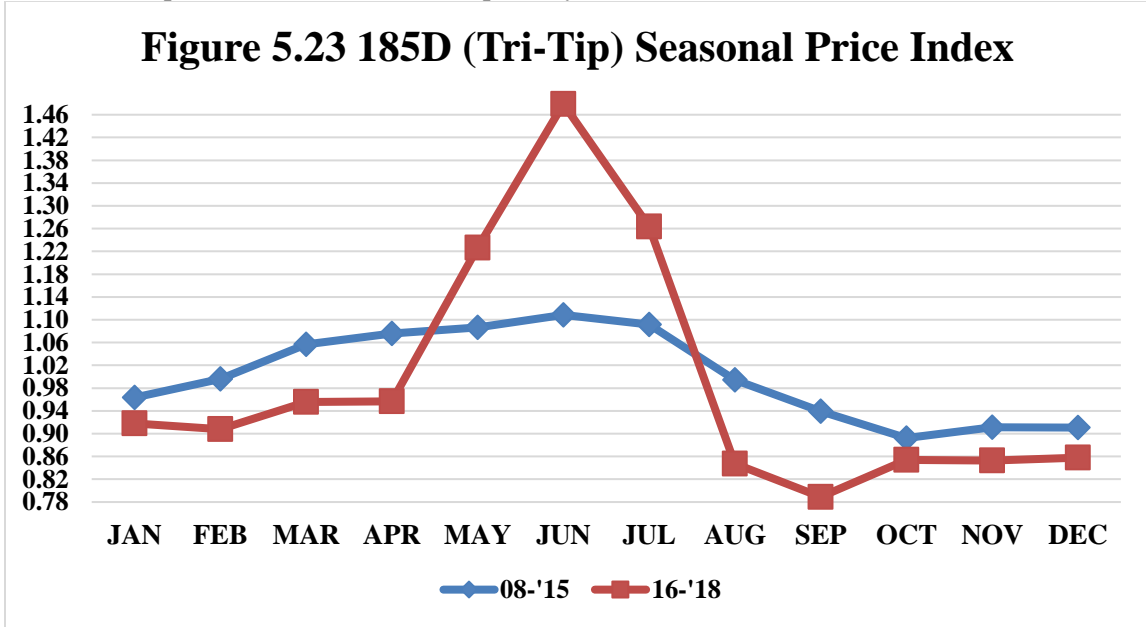
The BF 175 Strip Loin Boneless 1x1 Figure 5.22 (Appendix A: Figure A-12), experienced a higher peak in June and a lower drop in prices through July and November in 2016-2018 compared to the previous time period. This, perhaps, indicates an increase in the use of Strip Loin steaks for summer grilling season and less demand for the product in other times of the year.

Figure 5.22: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 175 Loin Strip Loin; Data: USDA-AMS, compiled by the LMIC



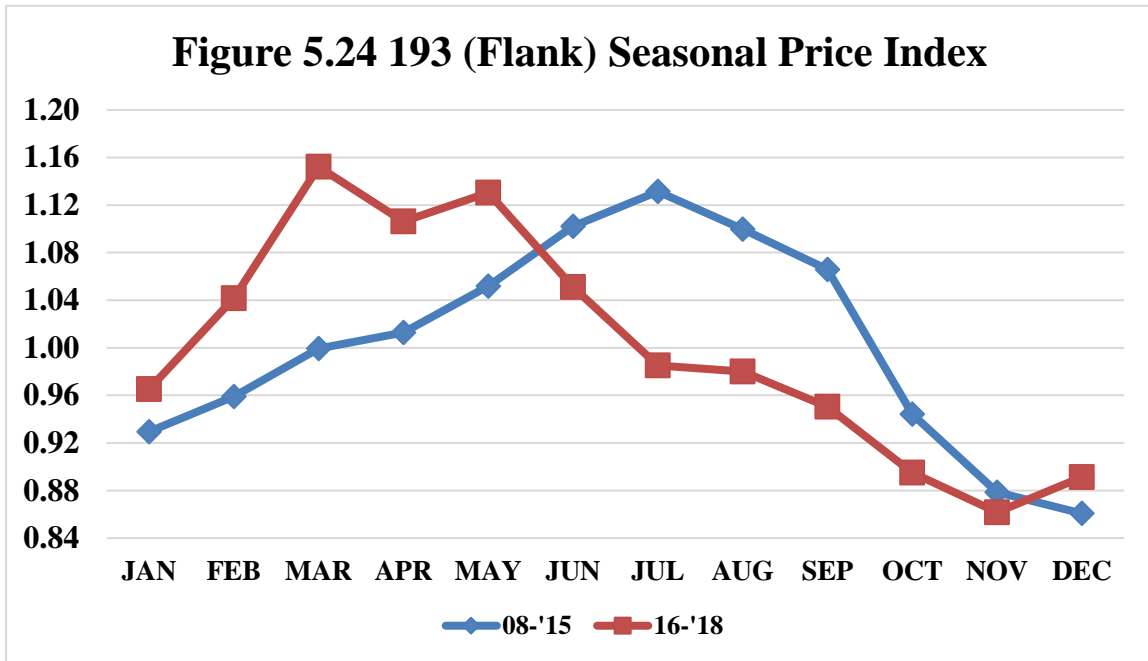
The Tri-Tip, Figure 5.23 (Appendix A: Figure A-15) was mentioned previously as a cut that has gained popularity outside of just the west coast, and the seasonal price index graph shows an impressive spike in prices during late spring and early summer, perhaps as a steak substitute. This is followed by an equally impressive drop from an index of 1.48 in June to 0.78 in September in the 2016-2018 seasonal price index.

Figure 5.23: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 185D Sirloin Tri-Tip; Data: USDA-AMS, compiled by the LMIC



Finally, BF 193 Flank Steak, Figure 5.24 (Appendix A: Figure A-16) has experienced a switch in seasonal highs and lows from 2008-2015 to 2016-2018. Peaks now occur in March and April and a low in November compared to a previous seasonal high in July and low in December.

Figure 5.24: 2016-2018 and 2008-2015 Seasonal Price Index Comparisons for the BF 193 Flank, Flank Steak; Data: USDA-AMS, compiled by the LMIC



5.12 Rib and Loin Comparison

Another interesting phenomenon occurring in the beef industry is the continuing spread in value between the Rib and Loin primals. As Figure 4.1 illustrated, the value of the Rib primal continues to grow compared to the Loin. Figure 5.25 (Appendix B: Figure B-1) compares the weekly wholesale price of the BF 112A Boneless Ribeye Roll Lip-On compared to the weekly wholesale price of the BF 189A Tenderloin and clearly illustrates that the value of the Ribeye has steadily increased compared to the Tenderloin over time, especially in the past 5 years. Figure 5.26 (Appendix C: Figure C-19) compares the Tenderloin value as a percent of the carcass cut-out value and illustrates how the value of the Tenderloin has declined dramatically, especially since 2007.

From a food service perspective, restaurant patrons will select a Ribeye steak over a Strip Loin steak two-to-one and no menu price for a Strip Loin steak appears to change this consumption preference. A spread between Strip Loins and Ribeyes has developed which was not the case

before 2009. Cutting houses sell more Strip Loin steaks than Ribeye steaks as portioned products, but as boxed beef, Ribeyes outsell Strip Loins. As the comparison of the Ribeye to the Strip Loin value in Figure 5.27 illustrates, before 2009-2010, Ribeyes and Strip Loins were essentially the same price, however, since 2010, the value of the Strip Loin has continued to decline compared to the Ribeye. One possible reason for this discrepancy may be due to the Strip Loin's poor yield caused by the heavy connective tissue in the Sirloin end of the roast which accounts for 16 percent of the entire Strip Loin subprimal length. Restaurants do not want to cut or serve steaks from this portion of the roast as the connective tissue is thick, tough, and less palatable compared to other portions of the Strip Loin, thus decreasing the value of the product.

pAt the retail level, there is a dollar difference between the Rib and Loin, but the price spread will have to be closer to three dollars or more before retailers start to buy relatively more Loins. It is also interesting to note that, compared to the high U.S. demand for the Rib, Canada is a stronger Loin market, especially for the Top Sirloin Butt, Strip Loins, and Short Loins, and the country starting to import Bone-In Strip Loins in 2015 and 2016.

Figure 5.25: Choice Ribeye price as a percentage of the Tenderloin Price; data from LMIC National Weekly Boxed Beef Cut and Weekly Cut-Out Value Spreadsheets

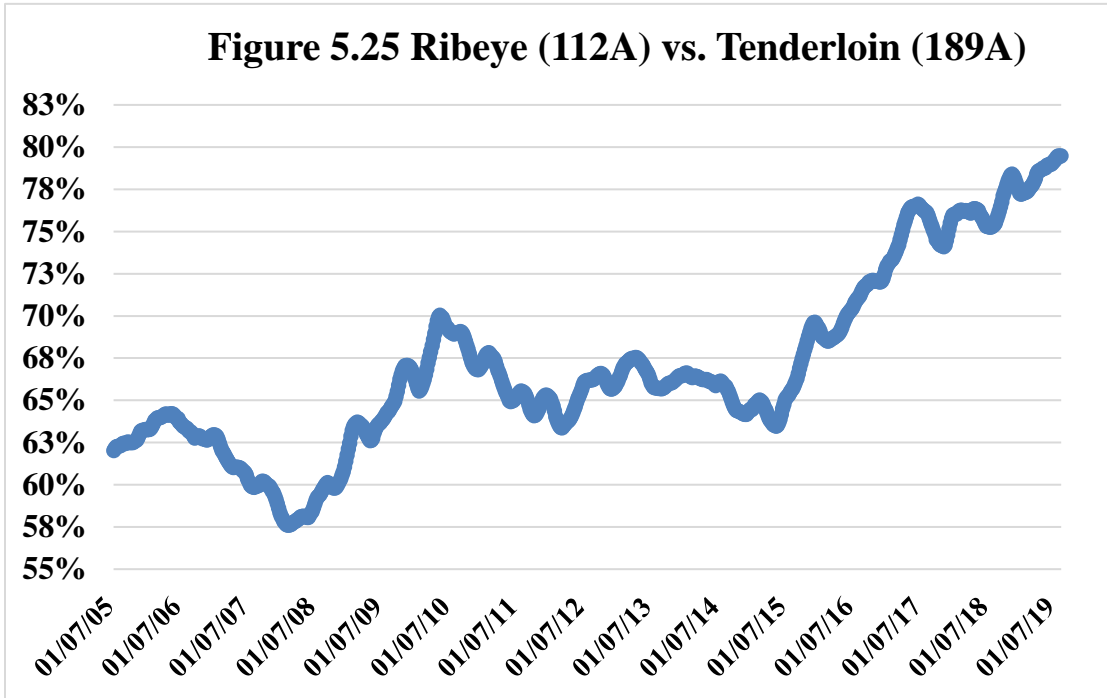


Figure 5.26: Choice Tenderloin price as a percentage of the total Choice Carcass Cut-Out Value; Data: USDA-AMS, compiled by the LMIC

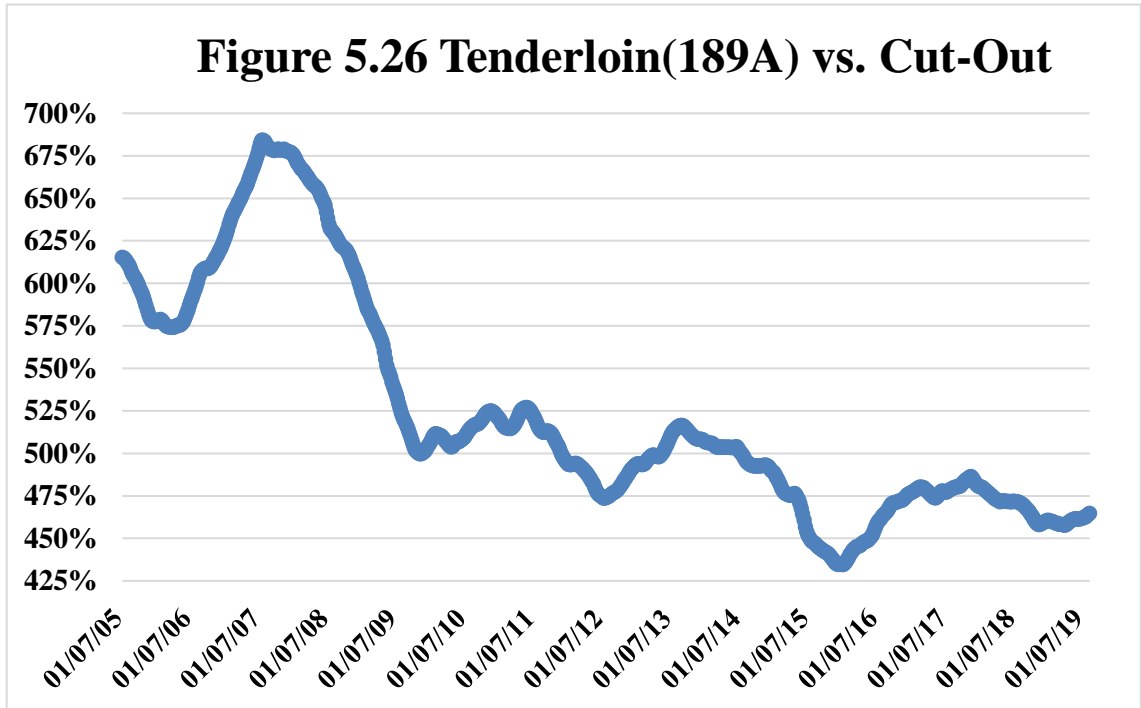
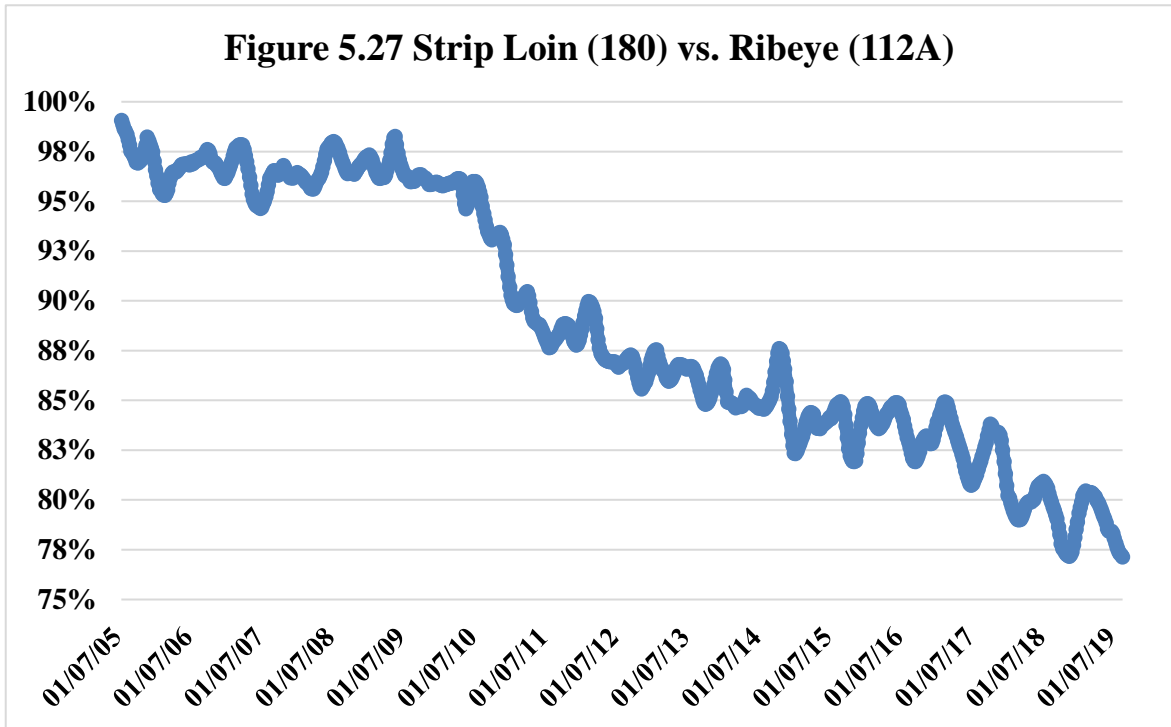


Figure 5.27: Choice Strip Loin (180(3)) price as a percentage of the Choice Ribeye (112A) Price; Data: USDA-AMS, compiled by the LMIC



Food service tends to drive Tenderloin demand while retail drives Rib demand because it is the highest total dollar amount (weight multiplied by price per pound) for grocery store promotions. This is one reason why retailers often run promotions for Ribs more than for the Loin, however, retailers may switch between Loin and Rib features in the spring months every few years. Retailers can also afford to sell the larger Ribeye steaks and Tomahawk or Cowboy Ribeye cuts due to their flexible price point- selling by the pound and not as a set menu price. For consumers wanting to cook at home, Ribeyes are less intimidating than Tenderloin steaks as Ribeyes have a lower price (per pound) and a higher fat content to buffer any cooking mistakes caused by over-cooking the steak. Due to the high price of Tenderloins and the reputation as being extremely tender and best served at medium rare, the amateur backyard chef may be afraid to ruin an expensive Tenderloin steak, and would rather pay an experienced chef to prepare it for them instead.

In order to prepare for the holiday season, in which food service and retail will promote and serve large quantities of Prime Rib and other Rib roast dishes, buyers begin planning for the holiday season as early as July. Many will begin purchasing or scheduling their forecasted need of Ribeyes in July and August, the Ribs will be shipped mid-September to mid-October, and will be deep chilled or frozen and slowly thawed until the holiday season. Many retailers will buy about half of their predicted need early. As more and more retailers and food service groups start to schedule their Ribeye purchases early, they have not only insured that they have enough product to cover their holiday demand, but have also decreased the seasonal price swings of Ribs that were present ten years ago, as fewer buyers are waiting until the last minute to purchase their Ribs for the holiday season. Retailers also want bone-in Rib products which creates a challenge of controlling bone darkening issues for bone in Rib rolls and other packers as packers and retailers hold these products in storage. As bone-in products sit in storage, the cut edge of the bone will start to release hemoglobin which accumulates on the surface of the bone, and over time the hemoglobin changes from red to darker shades of brown and black (Dikeman, 2004). While these darkened bones do not affect the quality of the meat product, the consumer may perceive it to be an indication of unwholesomeness or inferior quality. For fresh only retailers or food service, the ability for them to hold the product for extended periods of time is closely dependent on their specific aging requirements. Food service may prefer to receive their product 28 to 40 days before they plan to sell the product in order to age product in their own facilities.

Packers selling Rib roasts are constantly watching markets and customers' past orders, giving priority to weekly customers who consistently buy a wide range of products. It is becoming increasingly difficult for end users to plan or hedge their Rib purchases as Rib prices have not been as predictable as in years past. The summer of 2017 saw a large spike in Rib Roll prices for an unknown reason but that did not occur in 2018, so it is difficult to determine what Rib prices will do and when the most opportune time to buy is. Rib Rolls tend to increase in price from

September to December, but if prices start to increase seasonally in the summer, it may be difficult to determine the best time to purchase the product.

5.13 Retail:

Retail encompasses the 40,000 grocery stores across the country that offer fresh meat, produce, frozen foods and dry goods (How Many Grocery, 2017). Due to the large amount of beef products that are sold at grocery stores and the pounds per capita sold, it is commonly explained that retail drives beef sales. For this reason, retail has the unique challenge of predicting consumer demand, selling products to meet this demand at an affordable price, while maintaining a margin on the product. Promotional activities are planned months in advance to help create demand for other products in the meat case.

For the most part, retail sells a large range of products and is more susceptible to price volatility than food service. At the same time, retail grocery is quite predictable in seasonal product mixes and they generally don't change this product mix unless forced to. In times of high beef prices, retailers, rather than food service or exporters, are the primary middle meat buyers for packers. At times, a consumer can buy a full steak dinner at a restaurant for the same price as a package of steaks at the grocery store. So, consumers will trade down to an Outside Skirt, Sirloin Flap, Loin Ball-tip steak, Chuck Mock tender or other lower valued steak cuts to serve their steak demand at an affordable price. The wholesale beef data also indicated that, in the years of high prices of 2014 to 2016, consumers were "trading down" in beef products. For example, Figure 5.28 (Appendix C: Figure C-5) illustrates how the value of the Chuck Mock Tender increased during this period and then quickly fell back down once prices leveled out in 2017. Figure 5.29 (Appendix C: Figure C-1) shows the exact opposite occurring in the Ribeye during the same time period. As prices reached record high levels, the value of the Ribeye decreased compared to the

total cut-out value as consumers substituted end cuts like the Chuck Mock Tender for the Ribeye and other high priced middle meats.

Figure 5.28: Choice Chuck Mock Tender as a percentage of the Choice Carcass Cut-Out Value; data: USDA-AMS, compiled by the LMIC.

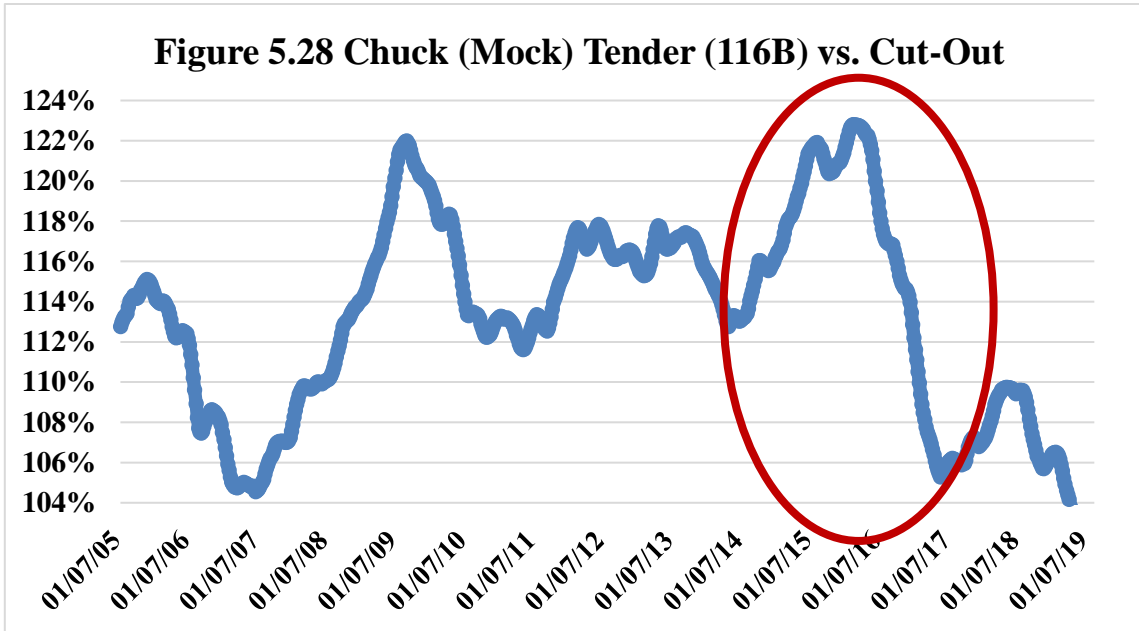
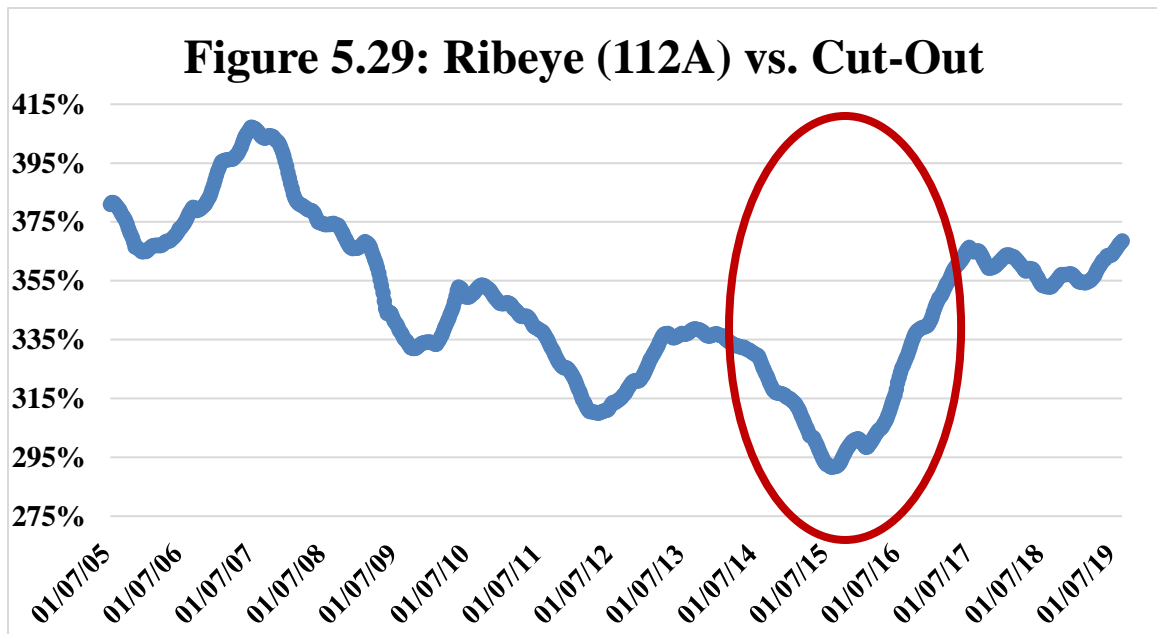


Figure 5.29: Choice Ribeye price as a percentage of the Choice Carcass Cut-Out Value; data: USDA-AMS, compiled by the LMIC.



Today, pork and poultry products are still relatively cheap compared to beef, so retailers will push beef sales for more dollar and pound sales and make a larger profit margin off of chicken and pork products. In times of increasing beef prices, this was the exact opposite, pushing pork and chicken products instead to make up sales. Retailers will run more advertising promotions for middle meats when supplies are down and have also increased their beef promotional activity for Choice quality and higher products in particular because pork and chicken can only be discounted and promoted so much before retailers no longer make a profit margin on the product.

The packers and retailers interviewed mentioned that retailers have been less aggressive recently in their promotions and product sourcing. Beef production has increased by 13.4 percent from the recent low in 2015-2018 and in previous times of short supply and high competition, retailers, especially those in close proximity, would go after each other, being more aggressive in their sourcing and pricing practices.

Case ready products are becoming much more popular among retailers as it removes the need for a skilled in-house butcher to cut steak or roast products. Case ready products come directly from the packer pre-cut, wrapped, and shelf-ready. These case ready products require additional labor, material, and time at the packer level, offsetting reduced labor at retail. Block ready products are relatively less labor intensive for the packer, but still provides the retail butcher a pre-trimmed subprimal that can then be easily cut into steaks for the store's meat case. One retailer interviewed that cuts all beef products in-house, stated that their customer base demands products that are *not* case ready, and so the retailer is able to get a premium for their products cut in-house to meet this demand. This retailer's products are all labeled with the store brand, product name, and other pertinent information. This particular retailer also grinds all hamburger in-house and has a variety of brick style ground beef packages that are labeled by the specific primal that the ground beef was sourced from, most commonly in the form of trim from these primals. Other

special labels for their ground beef products include natural, grass fed, organic, et cetera. A more complete discussion of the ground beef market can be found in the ground beef market section of Chapter 5, Section 5.6.

Retailers have a relatively fixed set of products that they sell throughout the year. The following paragraphs discuss these products and how they are used.

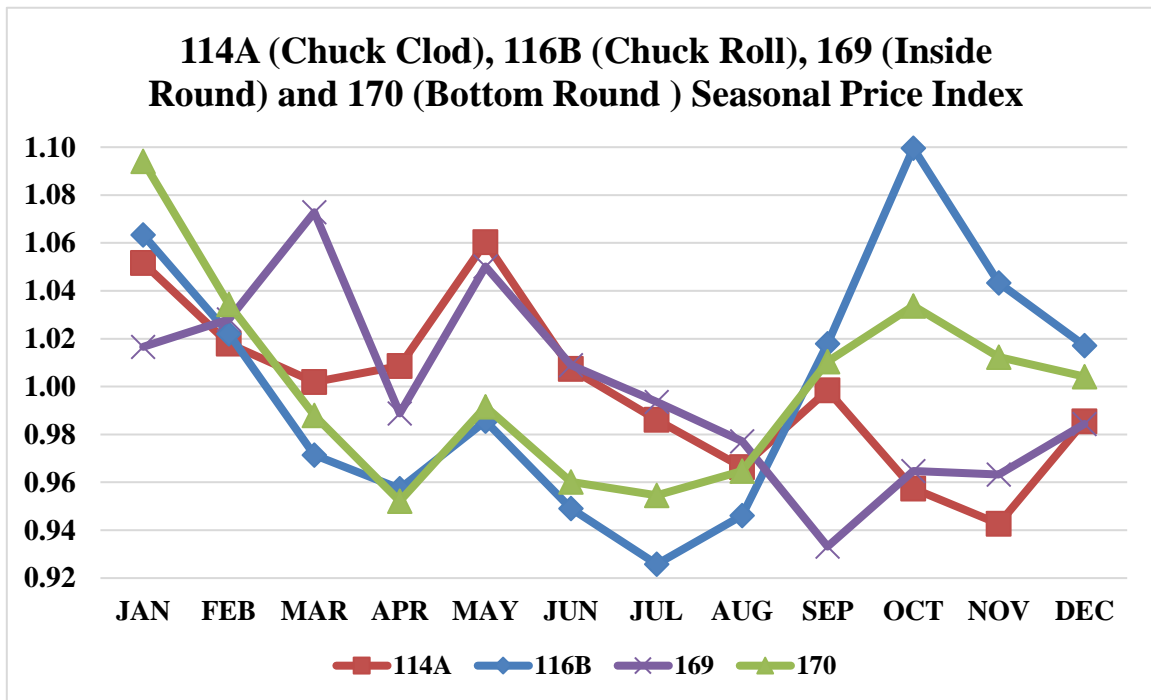
Loin products include the Tenderloin, Strip Loin steaks, Sirloin Flap, Tenderloin Butt steaks (which are considered a value Tenderloin product), and Loin Ball-Tips. The Tri-Tip is slowly becoming more popular across the country, not just on the west coast. The Top Sirloin Butt steak is also a popular cut and are generally center cut steaks with the cap (Coulotte) removed. The Coulottes will then go to further processors or may be sold in ethnic grocery stores as steaks or as a whole roast.

The Brisket, Strip Loin, and Ribeye or Rib roasts are all considered piece cut products because customers will typically just buy enough product for the amount of people that they will be serving. As the Brisket is fairly large piece of meat for a small group of people and has a relatively high total package price, retailers may also cut the Brisket into smaller portions per package. With increased popularity of backyard smokers and barbecue in general, some packers are also creating pre-marinated Briskets for the retail case which allows the customer to just throw the product in the oven or on to the grill to produce a high quality Brisket.

Case ready marinated and pre-seasoned products are also becoming more common, and taking up larger sections of the retail meat case. Flat Iron filets, Flanks, and Outside Peeled Skirts are found in the retail meat case along with products labeled as London broil, which is often the Inside Round or Chuck Clod. Chuck Shoulders and Inside Rounds are often sold as roasts in the winter months as well. Chuck Rolls are heavily retail driven, but due to the increase in exports of Chuck products, retailers will often buy large amounts early when prices are at seasonal lows, freeze it,

and then let the product sit in inventory until prices correct themselves before they sell it. Chuck Clods and Bottom Rounds are the bestselling roasts in winter months, often purchased from packers as block ready. Rounds are not highly exported and have maintained a low price, so stores will run more aggressive advertisements on Chuck products than those from the Round. These cut seasonal indices are included in Figure 5.30 which shows that, for the most part, Chuck Clods, Chuck Rolls, and Bottom Rounds do increase in price in the early fall months, at least in August and September. BF 169, the Bottom Round Gooseneck best demonstrates this seasonal fall increase, with a steady rise from September to December.

Figure 5.30: BF 114A Chuck Shoulder Clod Trimmed, BF 116B Chuck Roll Retail Ready, BF 169 Inside Round, and BF 170 Bottom Gooseneck Round; Data: USDA-AMS, compiled by the LMIC



Depending on the store’s key demographics and price level, retailers may sell no roll (ungraded), Select, Choice, or even Prime beef, with little flexibility in these categories. However, one processor did have a retail partner that would switch between cow Sirloin Flap meat when graded Inside Skirt steak got to a certain price level or vice versa and used these products for taco, stir-

fry, and fajita product offerings created in-house. For the most part, there is little variation in the product mix, but as mentioned before, there is more movement between quality grade instead of between substitutable cuts based on price point.

Advertisements and promotional activities are a major part of retail sales, and work is done months in advance to plan for and execute these promotions. In general, different category managers build different advertisements- protein, produce, bakery, et cetera. There is usually around 28 days between the time that the advertisement is prepared to when the advertisement begins or “drops.” For example, the advertisement being run the week before Thanksgiving will be finished in mid-October and will drop the first two weeks of November.

The first two weeks of each month are a beneficial time to sell middle meats like Tenderloins, Ribs, Strip Loins, pork chops, and boneless skinless chicken breasts because consumers will have more disposable income from SNAP and other food assistance funding which is distributed at the beginning of the month. When creating an advertisement, the category manager has to think about the other protein products being sold and at what price. If the advertised price is too high for one product, it has a domino effect on the next week’s advertisements, and the promotions to follow. Advertisements are planned 8 to 13 weeks in advance, based on demand projections, so supply must be secured to cover the projected sales created by the promotion. However, if the price of the pork product, for instance, is too high, it may lead to more beef purchases from the promotion than the grocery store has supply for, or not sell all of the pork ordered for the promotion.

Product is generally forward priced eight weeks ahead of the 28 day advertisement selling cycle and forecasts will be built for each product looking forward. 75 percent of the promoted product may be forward contracted with the remaining amount spot priced. Some retailers use statistical analysis to determine the best price and quantity for the upcoming promotion. These forecasts

show retailers how much the future or formula prices matched the spot prices, indicating the effectiveness of the promotion.

While retail has a pretty fixed set of products that they promote each week in advertisements, managers will watch markets, and if a certain cut is currently trading above its five year average, the retailer won't promote it, instead looking for cuts within the same product category that are trading below their five year average. In winter roasts, for instance, managers might be comparing the Chuck Clod price to the Bottom Round price. Beef generally creates more sales volume compared to other promoted proteins. Quarterly projections are reviewed in advance to determine a sales objective, plan the advertisement for the quarter, and then calculations are made to determine if those projections meet sales targets. Adjustments are then made in price or quantity to meet sales goals. If there are small price movements in products, retailers will promote those products to increase sales from the previous year. Category managers also look at year-to-year comparisons and calendar year cycling of products, and even if they can source a different product at a cheaper price, if it is not in their ad product cycle, they are unlikely to feature the product.

Retail advertisement planning is multidimensional, and for some retailers the total protein sales volume at the end of the promotional cycle, quarter, or year is more important than volume from a particular product. For this reason, it is the financial responsibility of the advertising or category manager to promote different proteins at varying price levels. The promotional cycle for the year is generally planned out by quarter and once those advertisements are planned they do not change. Product prices cannot typically be increased or lowered enough to make much difference in total sales. Instead, the product mix is more important to increase total sales for a particular promotional cycle. If the sales or profit contribution goal is not met for a particular promotion, retailers will continue to run advertisements and switch product mixes around until a sales goal is met.

It is important to note that most of the retailers interviewed were more concerned about meeting sales goals for all proteins, not just beef, so they work throughout the year to find the correct mix of products at the right prices to meet their annual sales goals for all protein products. This may mean having small margins on an item in one promotional cycle that they could source at a low price and then making up margins on other protein products or in other promotional cycles throughout the rest of the year. The back page of sales advertisements are generally more flexible for value products, like the Flat Iron, that may have a limited supply or price point. Retailers do not want product to be cherry picked, in which a few customers wait for certain products to go on sale and then buy all of it.

Advertising sales goals are usually for the entire protein mix- pork, chicken, seafood, and beef, so, if the advertising manager can get an end cut or roast product relatively cheap and promote it, they may suffer sales on middle meat or other protein offerings, but will be making up sales volume with the cheaper product. For retailers with multiple divisions, retail advertisements may be managed individually by each division's category managers and therefore, may differ in the products that they promote based on the seasonality, region, and other supply or demand factors. Retailers are generally locked into Rib roast promotions for the holiday season, but other seasonal product offerings depend on what is happening financially within the company or division to determine what to promote. Steak promotions for the 4th of July holiday are commonly Bone-In Ribeye steaks for one retailer that was interviewed, and while they could promote other steaks at a lower price for that holiday, their customer base demands Ribeyes and would not purchase the same volume of other steak offerings, even at a higher price. Ribeye promotions typically end the first part of August, but consumers consider a Strip Loin steak priced at \$6 a pound to be a good deal and will purchase it instead of a Ribeye or other steak.

Winter roast promotions are beginning to include more Inside Rounds, but may also be Chuck Clod Hearts (the Chuck Clod with the Top Blade removed) as it has a lower price point than

highly exported Chuck Rolls. Bottom Rounds, Inside Rounds, and Eye of Rounds (in the Northeast: central New York to Ontario, Canada in particular) are also promoted for winter ads. Prime Rib promotions will start the week before Thanksgiving or the week of Christmas.

A well rounded advertisement generally includes a roast, steak, ground beef, pork, chicken, and seafood item, but there were mixed opinions on whether or not ground beef should be included in advertisements. Ground beef is one of the top 30 most common products bought in grocery stores and is seen as a convenience item by consumers who will buy the product, regardless of whether it is on sale or not. For one retailer, ground beef was the only beef item that nearly half of their customers would purchase, comparing it to chicken breasts or pork loins. This retailer also claimed that this product level was where the real substitution among protein products occurs instead of between high priced steaks and other protein options. Another challenge for retailers in regards to ground beef is determining which lean point to put on sale. Generally, ground beef with higher fat content such as 85% or 75% lean will be cheaper than leaner options like 90%, since fat is cheaper than lean muscle. A discount on a high lean product would necessitate discounts on the rest of the grinds to keep the lean point tier structure in line with the discounted item. Other retailers will run ground beef promotions less frequently, once a month, or only for certain primal specific grinds.

Meat counters are generally separated by protein type and then, within beef, between roasts, steaks, ground beef, and natural or other specialty brands or lines. Certified Angus Beef is often included in the specialty brand section, particularly at high end or regional chains. Retail makes up the largest percentage of CAB sales volume on a tonnage basis, accounting for 41 percent of sales in 2017. Growth in retail is attributed primarily to promotional advertisements that increase sales, along with CAB's efforts to seek out and license new retailers to distribute their product.

Retail managers ultimately have the challenge of determining the product mix to offer consumers, predicting their demand, and having enough supply to meet that demand. One retailer explained that consumers see beef as an ingredient, but every product is good and useful, and just needs to be clearly labeled so that the consumer knows how to cook or prepare it. This particular individual viewed the meat case as a mix of ground beef, steaks, and then a “junk drawer” of other products that the younger generation of consumers don’t recognize, and won’t know how to cook, and therefore will not buy. Products like the Braison Cut, Bottom Round, or “Sizzle Steak”, have little meaning to the consumer as they have never seen it on a menu before, and will instead buy a boneless steak product they do recognize. The challenge for all meat managers, is to convert the “junk drawer” section into products that are relevant and useful to the consumer.

5.14 Trends:

At the end of each interview, the researchers asked what trends the individual or company has seen or predicts will be present in the beef market in the near future. This section outlines some of these trends and what it means for the beef marketing system.

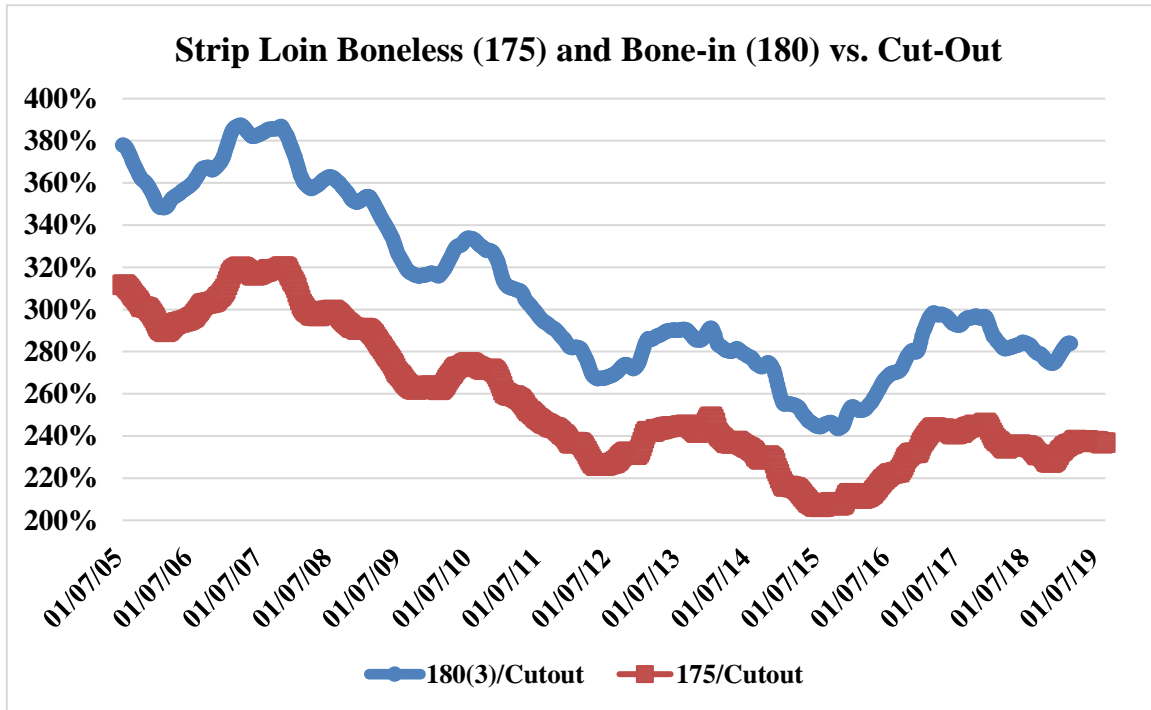
5.14A Product Specific:

In terms of specific products, there are many cuts that have increased in popularity or have been impacted by changing consumption patterns. In general, Chuck Tenders, Skirt Steaks, Flank steaks, London Broil (from the Inside Round or Chuck Clod), Top Sirloin steak, Tri-Tips, and Short Plate Short Ribs have all gained popularity since the 1990’s. The Brisket has been mentioned in a few other sections, but it is also predicted to grow in popularity as the barbecue and gourmet burger trend continues. Briskets and barbecue have become popular across the country, not just in southern states, and Sirloin Flap meat is also becoming popular as a barbecue item in other regions outside of the East where its popularity started. Most food service groups who purchase Brisket for hamburger patties or barbecue want premium brands like Certified

Angus Beef or other premier processor and distributor product lines. Ground Brisket is also available in major retailers in Oklahoma and Texas, as are pre-seasoned Briskets that are hand wrapped and dipped in barbecue seasoning to be cooked on the grill, crockpot, or oven, and includes cooking instructions.

From the Loin, the Tri-Tip is gaining popularity outside of the west coast, northwest, and Phoenix markets, where it first gained popularity. Today, the product is particularly popular in small independent restaurants who are using the product as a steak entrée, roast, or is thinly sliced. Tri-Tip is also being used in meal kits and as a Brisket substitute for some barbecue restaurants faced with increasing Brisket prices. The Sirloin Top Butt is being upgraded and converted into the center and Coulotte steaks. Coulotte steak prices have doubled and are going to retailers cutting Sirloin steaks in-house and to Brazilian steakhouses. Converting the Top Sirloin Butt into two pieces has been popular among Holstein processors for quite some time as their fat content is lower, but fat cattle processors are beginning to split the item into a 2-piece Top Sirloin Butt as well. The BF 180 Strip loin, a bone-in roast item, has also increased in popularity, reflecting the increased popularity in bone-in products. Figure 5.31 shows how boneless strip steaks have consistently stayed about 50 percent below bone-in Strip Loin steak prices compared to the Choice cut-out value. The Porterhouse and T-bone steak are also coming back into popularity along with the widely popular Tomahawk and Cowboy Ribeye steaks now available at retail and food service.

Figure 5.31: Boneless and Bone-In Strip Loin prices compared using Choice Cut-Out Values; Data: USDA-AMS, compiled by the LMIC



The Tomahawk Ribeye first gained popularity on the east coast as competition among grocers grew to see who could clean the bone and sell the steaks the best. When the Tomahawk is created, the rib lifter meat and Short Ribs are removed and sold as is or put into trim, taking away product that could have been sold elsewhere if fabricated conventionally. Tomahawk Ribeyes take a lot of extra time and labor as the bone has to be completely cleaned of meat and fat by hand. Currently, these large steaks can be purchased from one big box retailer who receives the product with a twelve inch rib attached that is cut down in the store to three inches in order to get into a package. It is difficult to get these items into a box or vacuum sealed package without leaking and has increased worker injuries and does not usually garner a high enough premium to make it worth the packer's time or labor to cut the product. Tomahawk Ribeyes and Cowboy Ribeyes are very similar, however, the Cowboy Ribeye has a three to five or six inch rib bone still attached, as compared to the entire 12 inch rib bone on a Tomahawk Ribeye.

End cuts from the Chuck are now taking center stage for retail as they provide a different flavor and are being re-vamped and marketed to a younger generation of beef consumers. New value is also being found in gourmet beef lines at the retail and food service levels. Briskets, Strip Loins, and even whole Prime Ribs from cow carcasses are going into the grinder to produce gourmet burger products. Hanging Tenders (or Hanger Steaks), the pillar of the diaphragm, have become a trendy, regional, item, but there is only one per carcass and they tend to have a metallic or livery taste that some consumers may not find appetizing.

Organic and grass fed cattle bones are now being used for beef broth, dog bones, flavoring, and even as a bone marrow menu offering at high end restaurants. Bones no longer just go to rendering, and therefore have a huge impact on the total cut-out value as bones make up a large percentage of the carcass weight, roughly 17 percent (Breaking Down Carcass Value, 2011). Variety meats are also providing a new avenue for sales in retail stores as a low cost protein option. Tripe, Oxtail, liver, tongue, cheek, soup bones, Shank meat, and other offals have increased in popularity due to an increase in ethnical influence in the population who utilize these products in their traditional cooking methods and have a cheaper per pound price compared to muscle cuts. The availability of these products is dependent on the socioeconomic and demographic factors in each location which determine the optimal product mix with the highest value that retailers will provide for their customer base.

5.14B Consumer Trends:

Natural, organic, grass fed, local; the list of adjectives goes on and on and are seen across almost every product category in grocery stores and restaurants, and beef is no difference. With the demand for these types of specialty products growing, packers have to determine what trends are short term and what will remain as a viable, long term, consumer preference that they then must find a way to satisfy.

High quality domestic grass fed beef has led to a demand for these products, but restaurants and retailers can't charge enough to cover the costs of these products. One restaurant groups said that they could charge more for grass fed beef than for wagyu or American kobe beef, but customers still expect the same eating experience as a grain fed animal when they choose grass fed beef instead. Customers demand grass fed because popular media promotes it as a healthier alternative to corn fed beef, and despite negligible nutritional differences between the two types of products, consumers still expect the grass fed product to have the same flavor and eating quality as corn fed products. But, they do not have the same flavor leaving some consumers disappointed with their eating experience. Interestingly enough, Certified Angus Beef has a natural, antibiotic and hormone free line, but of their three product lines (Choice, Prime, and natural), this brand has not seen any growth in the past six years. Packers, retailers, and food service continue to try and find sustainable ways to provide these products to the consumer, but the price point and eating experience may eventually move these products to serve only very small niches.

Consumers are also becoming more interested in products that teach them how to cook better or that lets them explore new cooking techniques and recipes in a convenient way. Many retailers are beginning to offer more convenience type meals that include ingredients to streamline the dinner decision-making process while giving the consumer the ability to add their own personal touch to the recipe. Pre-seasoned, marinated, chopped, and diced items remove the need for a cutting board, and additional package ingredients like vegetables, sides, or seasonings decrease the time spent shopping at the grocery store. Other products, like pre-cut stew meat with included cut vegetables and instructions, is making the pot roast or stew more accessible to the millennial mom or foodie consumer wanting to use their *Instapot*. These products are also helping to educate consumers, helping them to feel more knowledgeable and comfortable cooking meals at home. This trend has, and will continue, to impact the product mix available at the retail meat counter, which may expand the ready-to-eat or meal solution offerings and decreasing muscle cut offerings. Retailers are also expanding their hot rotisserie and other take away meal lines, with

one retailer working on a ready to eat Tri-Tip roast available next to their rotisserie chicken offerings. The problem with these types of products is higher price (\$19 for the whole roast) compared to a \$5.99 roast chicken, and the cut has to have enough marbling to maintain tenderness and flavor while sitting under store warmers for extended periods of time.

Home meal delivery kits are another avenue for consumers to create meals from home quickly and conveniently, especially in “food deserts”, and have become very popular over the past few years. One further processor has been working with two major meal kit delivery companies and is currently the largest meal kit protein producer in the country. With individually portioned products, unique recipe offerings, and a specific price point, meal kits are providing a new avenue to sell underutilized steak and roast items. During the visit to this processor, they were cutting and packaging “Ranch Steaks”, a value-added item from the Chuck Shoulder clod. The further processor was gearing up for busy demand that comes the first part of the year, when consumers are trying to get healthy and it’s too cold to go to the store or restaurant. Just like restaurants, however, the demand for these meal kit products slows down in the spring and summer months as consumers change their eating and cooking patterns.

Processors and retailers are also getting into meal kit programs, purchasing or creating their own brands available on-line or in stores. According to a recent Meatingplace article, the meal kit market reached \$3.1 billion in 2018, with three of four meal kit purchasers getting their meals from retailers rather than ordering online (Crown, 46). Expanding into the meal kit market may provide another outlet for packers and retailers to meet the time strapped consumer’s demand for a home cooked meal that they don’t have to think or plan ahead for, but it has its challenges as well. Online based subscription services provide products with a 10 day shelf life, however, this tight of a time frame does not work in a retail setting. In addition, many meal kit users are generally included in high income household, urban, or millennial consumer groups in which clean labels like natural and antibiotic free will be of particular importance and a challenge for

packers to meet at a certain price (Crown, 46). Retail meal kit options are more likely to hit the ten dollar per serving economic threshold for consumers to purchase as they don't charge additional shipping or packaging charges, but pre-packaged and portioned meal kits do force processors to do more work and labor on their end to get these products to the retailer (Crown, 46). Suppliers also need to choose which characteristics they want to provide with their meal kits- price, quality or service. National retailers may choose a low price point while smaller shops may prefer to cater to high income consumers with higher prices but increased quality.

This blending of food service and retail is also seen in new retail concept stores popping up throughout the country, particularly in urban areas with high income, millennial, and health conscious consumers. These retailers offer an expanded fresh food section and many ready-to-eat food stations including salad, soup, and olive bars, sandwich or salad stations, and hot food counters with sushi, pasta dishes, barbecue, and other ready-to-eat entrees for lunch or dinner. In one particular northwest location, the concept store has live music each weekend, a full bar, and many other amenities that make the store more of an eating destination than just an errand to run. As consumers continue to desire an eating experience, retailers and food service may soon become complimentary, rather than competitors, creating a one-stop shop for consumers to enjoy dinner and pick up groceries for the week all in the same trip.

In addition to meal kits and the blending of food service and retail is the fast growing restaurant meal-to-go business. GrubHub, Uber Eats, Eat24, DoorDash, Crunchbutton, and other services make food from your favorite restaurants and fast food spots are literally a click away, and will be delivered right to your door. With the boom in food truck eating, some restauranteurs are starting to create their own brick and mortar versions that do not have seating but just a kitchen and location to pick up food items. Many restaurants are also adding pick-up or to-go meals, in which consumers order their meal on-line, drive to the restaurant and someone will deliver the hot meal to their car.

While all of these options are allowing consumers to get dinner in the blink of an eye, delivered to their door, or ready without having to go inside an actual restaurant, there are some quality issues that have to be addressed by the restaurant. When food is served in a restaurant, the cook and wait staff are able to control the quality of the product by how it is prepared, presented, and served to the customer. However, once the delivery person leaves with a customer's meal in-hand, the restaurant has no control over the way the food is transported, kept warm, or how long it may be until the consumer gets to eat it. The restaurant, not delivery company's, reputation is on the line, and an unpleasant eating experience at home may keep the customer from re-visiting the restaurant, in person, or by delivery. Delivery companies also add a twenty to thirty percent upcharge on any products they deliver, so the profit margin is very small, especially for high end restaurants. In order to address these issues, some restaurants are adjusting their preparation or ingredients for to-go meals, finding alternative cuts or cooking methods that may help to retain flavor or tenderness as the product travels. For example, one casual restaurant has started to use a different portion of the Sirloin for their to-go Sirloin steak offering. From the Top Sirloin Butt, the medius, or center cut, steak dries out more quickly, so the to-go orders are prepared using the Top Sirloin Cap instead, which maintains its juiciness and flavor for extended periods of time.

Other consumer trends include sustainability, environmental, animal feed, and direct sales in which the consumer knows the supplier and how they care for the animal, handling the animal in a humane way and being a good steward of the animal and the land. Over 55 percent of millennial consumers know something about the beef producer, while older consumers may not but don't really care enough about it to affect their buying decisions. This desire to know more about the supplier, where their food is coming from, and to have a more sustainable food supply has also led to an increase in the popularity of boutique style custom butchers who are providing nose-to-tail or whole carcass butchery. This blends the lines between informed consumer and foodie

wanting to try new or different products and is also helping to use more of the carcass and improve the overall carcass cut-out value.

Fresh only is another trend impacting both retailers and food service who do not want to purchase frozen products. Buyers don't see a value in frozen steaks, even if they can lock in a certain price point for the entire year for all frozen product. However, as many restaurants become quality driven, they want to portray high quality and give a story to the product, and fresh suggests higher quality to the consumer than frozen.

5.14C Food Service:

In food service, trends are most often seen in the form of Limited Time Offerings, or LTOs, which allow restaurants to test out a new concept for a short amount of time before determining if it is a sustainable menu addition. LTOs help restaurants to test out a new product from a quality stand point, but may take a while to start because they need to secure a price and supply. In food service, beef is king and will remain that way with a large number of beef features taking place. The restaurant industry is highly saturated, so every restaurant is looking for ways to make sales and differentiate themselves. To do this, culinary professionals enjoy exploring new techniques, recipes, or products, but those in the purchasing arm of the restaurant group don't like to change a set product mix. For this reason, LTOs don't generally switch a major protein, but instead, dress it up or prepare it in a different way. In fast food, this has meant adding avocado or bacon to the product, and using fresh ground beef, which has become a long term trend rather than a limited time offering. However, as soon as a new item is added to the menu, other items may have to be pushed off of the menu, or the new offering may be used instead as a special or rotating offer.

The broader trend in food service is giving food a story, so some restaurants are beginning to offer natural, grass fed, and organic items. Even at a higher price, customers are willing to pay

extra for these attributes as they understand enough to know the difference between conventional and these specialty type products. For suppliers, these specialty type products are still priced based on commodity products and then are priced as a value-added product, similar to a fresh chicken breast (commodity) compared to pre-fried and breaded chicken breast (value-added).

Other general trends include products sold in smaller sizes, with less trim and waste, and more portion controlled products which require more labor, work, and complexities to the supply chain. Per capita consumption of all three proteins- chicken, pork, and beef are going up, but the offerings of non-meat substitutes including the “impossible” bleeding burger, driven by millennial consumers, is also growing. More cattle, roughly 73 to 74 percent, are grading Choice today, and Prime brands are also growing as the amount of cattle grading Prime climbs to 8 to 9 percent (AMS, 2019). Export volume is important, but domestic consumption is still the majority of the market, so it is important to understand changing domestic consumer preferences. This had led the beef industry to introduce new cuts to the industry over the past ten years that promote beef over pork or chicken. Depending on the customer segment to attract, these products may provide smaller portion sizes or fill the plate better. There has also been an industry shift to more small boxed beef sizes, which used to be 60 pounds for large portions, and now are closer to 30 or 40 pounds, to decrease worker injuries when moving product. Trends such as grass fed, Angus, ground Round, Sirloin, and Chuck, are also adding complexity to the beef marketing mix. Finally, with an improving economy, consumers have more disposable income, and are continuing to see beef not just a protein choice, but also as a high quality product.

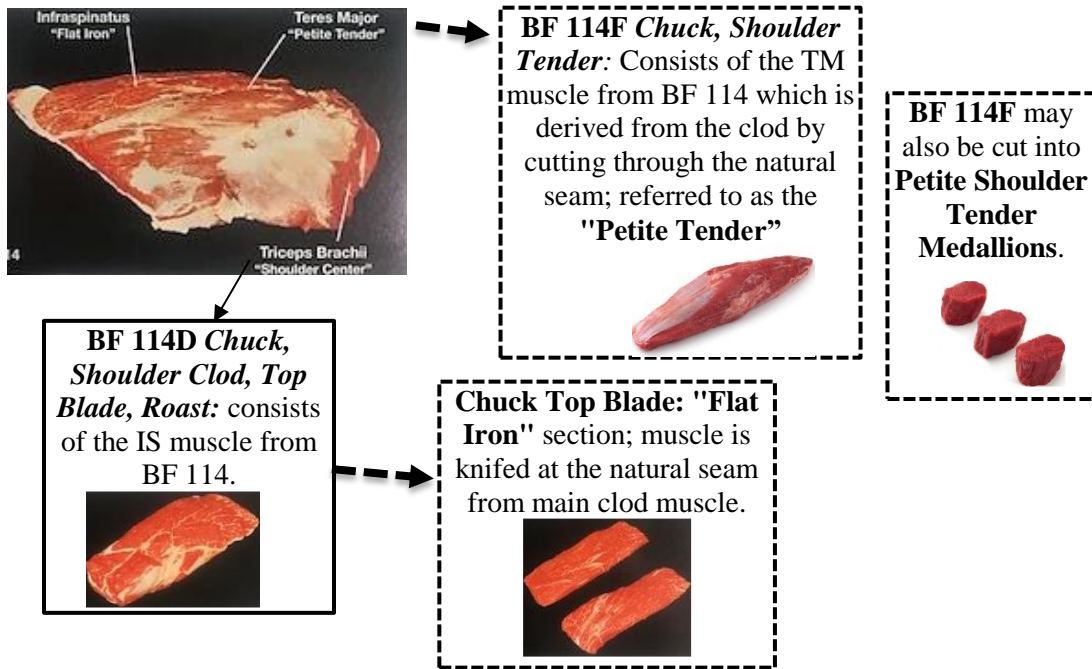
5.15 Value-Added Products:

The term “value-added” has been used a lot already in this report, but can have multiple uses and meanings. There are two separate uses of the term that both apply to beef products, but relate more to how they are produced or fabricated. One group of value-added, or innovative, products refers to the 39 cuts that the National Cattlemen’s Beef Association funded research to find

within the Chuck and the Round primals. Through the Beef Value Cuts Program, muscle profiling, and bovine myology studies, individual muscles within both the Chuck and Round were profiled and studied to determine which muscles could be fabricated and sold as a steak cut as opposed to the conventional roast products typically associated with the Chuck and Round. The two most popular cuts that came from this research, and promotional activities by the beef industry, are the Flat Iron, and Petite Tender, both of which come from the Chuck Shoulder Clod. However, various other cuts from this research are finding their way into retail and food service product mixes. More information on these cuts and how they are fabricated can be found in Chapter Three of this report or at beefitswhatsfordinner.com.

The other type of value-added product is product that has additional fabrication or ingredients added to the product before being sent to the next link in the supply chain. We have already discussed many of these in further detail in the scope of production section and retail sections, particularly in regards to further processors and steak cutters. As we have already covered a considerable amount of information of these meat plus products, this section will instead focus on the innovative beef cuts from the chuck and round. Information on further processors and the value-added products they produce can be found in Chapter 54, Section 4.3.

Figure 5.32: Portion of BF 114 Chuck, Shoulder Clod:



The diagram above, Figure 5.32 is an excerpt from the Chuck Shoulder Clod meat diagram and illustrates how the Petite Tender and Flat Iron are fabricated and where they are located in the subprimal. The Petite Tender, consisting of the teres major muscle, sits on the top of the Chuck Shoulder Clod muscle and is fairly easy and consistently pulled off of the carcass in most major packing plants. If the muscle was to remain on the clod, the whole roast could be sold for \$1.80 a pound but can be sold for \$3 to \$6 a pound as a steak. Removal of the Petite Tender reduces the Shoulder Clod yield and requires extra labor. The remaining portion of the Shoulder Clod can be utilized in the same way as it was as a whole clod, so it is up to the packer to find a break-even price and try to sell the product based on that price, otherwise, it is not worth it for producers to pull the product. Petite Tenders are used widely throughout retail and food service, but this increase in demand has subsequently increased the price of the product to the point that it is no longer a “value” priced item, often competing with Top Sirloin prices. For that reason, one national restaurant chain that used the Petite Tender for years has switched to the Top Sirloin for a popular beef pasta dish. While the product is fairly easy to pull on the fabrication line, there are

only a few pounds of the product per carcass, and as demand has increased, it takes a lot of carcasses to fill enough boxes to meet demand, leading to increased prices. Petite Tenders are also being used in retail as a pre-marinated product or used in ground Chuck products. As a substitute, some packers are taking the entire Shoulder Clod and braising or shredding it as another way to utilize the whole Clod at a lower price point than the Petite Tender.

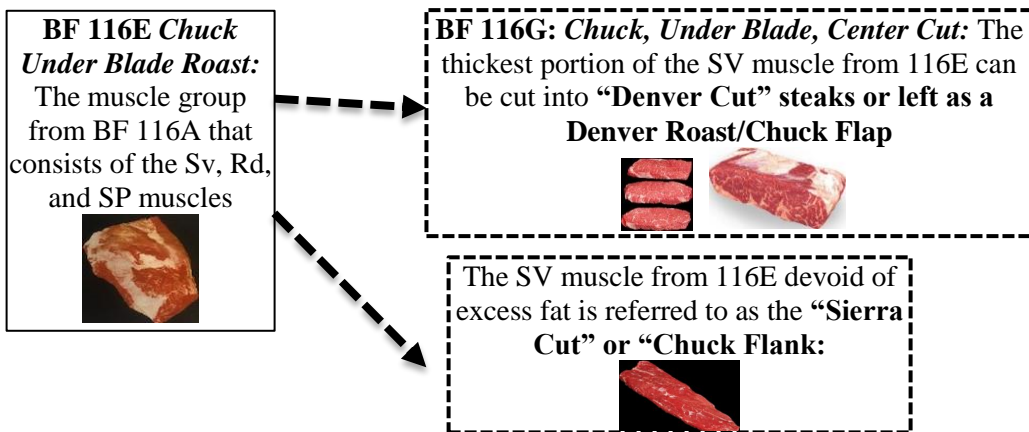
The Flat Iron, on the other hand, is not as easily fabricated and has large yield losses. When the infraspinatus muscle is removed, it can be sold as is as a Top Blade roast or cut into Top Blade steaks. However, when cutting a Flat Iron, the Top Blade is cut horizontally along a seam of fat and connective tissue, and then cut into steaks. When fabricating from a Chuck Clod to a Flat Iron steak, there is roughly only a 30 percent yield, and the rest must go to trim, de-valuing the entire Shoulder Clod for only 30 percent of the muscle. Due to this increased fabrication and loss of value in residual products, Flat Irons have a high price, at times matching a Strip Loin price once it makes it to the retailer or restaurant menu. The extra skilled labor required to fabricate the steak also means that most Flat Irons are not usually cut in the packing plant, but instead are cut in separate value-added facilities that can facilitate a slower chain speed needed to cut these products.

These value-added facilities receive the Chuck Clod, usually with the Petite Tender removed, and trim it down to the Flat Iron from there. However, due to the amount of time between slaughter and fabricating down to the Flat Iron, the trim and residual product from the Shoulder Clod cannot be considered fresh trim and therefore must go to cookers to be utilized, highly devaluing the residual products. Just like the Petite Tender, there is a small amount per carcass, and additional time and labor requirements and increased demand for the product, have driven the product to a price level that some retailers and food service just can't afford to serve, another example of a value product that is no longer value priced. A lot of the demand increase from the retail side came from one national grocery chain that began taking large orders from the packing

house. Top Blade exports influence price and demand for the product as well, with a large amount going to Japan and Taiwan. These markets, however, will take the Top Blade muscle and fabricate the Flat Iron themselves. Extra trimmed Clods are also great alternatives for rib lifter and blade meat for certain restaurant dishes at a lower price.

The Chuck Roll can also be value-added by being broken down into three separate pieces- the Chuck Eye Roll, Under Blade roast, and Chuck Edge roast. The value-added plant will cut them but the buyer has to take all three pieces, because the packer really only has a market for the Chuck Roll. From the Under Blade roast, the “Denver Cut” and “Sierra Cut”, two other innovative cuts, are being produced and sold, but they are very difficult to cut at line speed. Just like the Flat Iron and Petite Tender, the Denver and Sierra Cuts require additional fabrication and labor and decrease Chuck Roll yields, and customers aren’t willing to pay the price to make them feasible options. Further fabricating the Chuck Roll this way (as Figure 5.33 shows) are giving restaurants and retailers more options that can grilled, smoked or ground. The demand for these cuts are still in its infancy, but will continue to grow.

Figure 5.33: Portion of BF 116E Chuck Under Blade



Retail is driving a lot of the converted products in the Chuck and Round by specifying that processors take more trim off for block or case ready products. This includes bacon wrapped Chuck Mock tender and Petite Tender steaks, done at a value-added or further processing plants. Converting these products despite additional labor and fabrication costs are still providing

additional residual cuts that can also be sold separately. Despite the research conducted to find innovative cuts in the Round, none of the companies interviewed had been regularly using these innovative Round cuts. One packer did mention that they struggle to find ways to add value to the Round, but the industry as a whole has done a good job with the Chuck and Bottom Sirloin complex, converting the Bottom Sirloin Flap into a great Skirt Steak alternative.

The Loin Top Butt Sirloin is another steak product being cut in value-added or steak cut shops, however, customers must still take both the Center-Cut Top Sirloin as well as the Cap steak. Some steak cutters have a hard time finding a home for the caps, while others prefer the cap and not the center. The BF 190A, Full Tenderloin, Side Muscle Off, is another product requiring a lot of additional time and labor, as the tenderloin must be hand trimmed of all outer fat. As the Tenderloin is such a valuable muscle, it requires particular attention to detail in order to decrease the amount of muscle trimmed along with the external silver fat that must be removed. Other fabrication extension items include sliced Short Ribs and a highly trimmed shank product referred to as a “banana shank.”

Overall, value-added products are predominantly going to retail as grocery stores can sell more pounds, but food service can also utilize these converted products, especially split primals. If there is more consistency in yield or if trim is able to be utilized, it may make more sense to buy the converted or value-added product. Retail is buying a large amount of converted products, but these values are not required to be reported as only 50 cuts are currently reported to the USDA on a wholesale level. While there is some national retail data available through the Agriculture Marketing Service, all products sold at retail are not represented. Value is also being added to products through multi-vac packaging which provides individually sealed products, not just wrapped in cellophane. Flat Iron filets, Outside Round Flats, Outside Skirts, cube steaks, center cut Back Ribs, and smaller Rib roast portions are among the selection of cuts now available in

this type of packaging. This packaging is also great for those who want individual servings as opposed to a whole roast that has to be cut and packaged separately by the consumer.

CHAPTER VI.

CONCLUSIONS, SUMMARY, AND FURTHER RESEARCH

The beef supply chain is much more intricate and complex than is commonly recognized.

Companies and organizations at every level of the market system are highly proficient in their area of work, but even these experts don't always see the whole picture as it pertains to the complete supply chain. This research provides a detailed synthesis that is intended to be valuable to everyone in the beef industry, from ranchers, packers, and wholesalers to chefs, moms, and economists. This report reveals complexities of the beef market, issues facing the industry as a whole, and how each link in the supply chain handle these challenges. Numerous insights were gleaned from the thirty plus interviews and discussions conducted over the seven months interview process, but a few big points of interest need to be reiterated.

First and foremost, the supply chain links between packer and food service/retail is extremely important and is often overlooked. Further processors, distributors, wholesalers, and cutting houses are providing customer specific products from pre-seasoned Briskets for the retail case to 50 day dry aged Tomahawk Ribeye roasts for high end steak houses. The work of this sector flies under the radar, sometimes on purpose, as they pride themselves on making high quality products that their customers market rather than marketing themselves. Regardless, this sector is instrumental to the food service and retail industries as the distribution and further processing sectors create and provide products that save restaurants and retailers time and money, while providing customers a multitude of ready-to-eat or meal kit type products.

Ground beef is another overlooked, yet critical, component of the beef supply chain, and serves as a balance in the beef market. The United States is unique in its preference for ground beef, with nearly half of the country's beef consumption in the form of ground beef. This vast demand requires an extraordinary amount of trim to produce ground beef products. While the ground beef section of the report (Chapter 5, Section 5.6) gives more detail on what is required to produce ground beef products, the fact still remains that the need for lean trimmings to create ground beef helps to balance imports, cow and bull beef, and whole muscle pricing (particularly in the Round and some Chuck products). Fast food restaurant chains are beginning to offer more fresh, never frozen hamburger products, adding another dynamic to the ground beef market, especially for grinders supplying these restaurants.

The trend towards fresh is not just limited to hamburgers though, and is another consumer trend seen in both food service and retail. There is little strong evidence that suggests that fresh beef has a different eating quality than frozen product, as long as they are thawed correctly. Exported beef is frozen, for obvious reasons, but domestic beef buyers also freeze beef to take advantage of seasonal low prices, or to stock pile supply, especially for the holiday Rib season. Steak houses prefer fresh beef for quality and have enough consistency in product orders and demand to use fresh products quickly. Other restaurants may prefer to have frozen products that can be kept frozen until needed. The desire to keep products fresh has led to an increase in the use of "deep chill" in which beef is kept right above the freezing point, extending its shelf life, and maintaining the product's "fresh" status. The jury is still out as to whether or not this is an advance for the beef industry or just a synonym for frozen.

Demand for bone-in products has rebounded in food service and retail, with unique implications for the industry. Bone-in products are heavier, but cheaper by the pound, so retailers can easily promote bone-in products at a lower price to customers (on a per pound basis). Food service, on the other hand, can and has to, charge a premium for bone-in products as the total plate cost

increases with a heavier and larger bone-in cut. Bone is associated with increased flavor by the consumer (even though a grilled bone-in steak has little difference in flavor as the collagen within the bone doesn't have enough time to break down in the short time that it cooks) and Tomahawk or Cowboy Ribeyes are gaining popularity in both grocery stores and high end steakhouses. These products are simply Ribeye steaks with the rib bone still attached and cut at a length of 3 or more inches, marketed as a shareable entrée, but causing headaches for packers who have to hand trim these products and struggle to package them without puncturing vacuum sealed packaging or injuring workers.

The available wholesale price data indicates a relative decrease in the value of the Loin primal and increase in the Rib primal over the past ten years. None of the individuals interviewed seemed to have a clear answer as to the reason for this increase, but there are a few possibilities. The Loin includes the Tenderloin, the most valuable cut in the carcass, along with several other cuts like the Strip Loin, Top and Bottom Sirloin, Tri-Tip, Ball Tip, and Sirloin Flap meat. These cuts vary widely in value and are generally used in further processing or as a value-priced entrée steak option. Interestingly, while Ribeyes and Strip Loins are on most steakhouse menus, consumers prefer Ribeyes two-to-one, regardless of the price difference between the two steaks on the menu. So, the lower value of the other Loin products compared to the Tenderloin brings the total value of the Loin primal down. The Rib primal, on the other hand, consists of essentially two products, the Ribeye Roll or roast (used for Prime Rib or Ribeye steaks) and Short Ribs. The Ribeye is highly sought after on steakhouse menus, during the holiday season (at retail and food service), and is also exported. The popularity of Ribeyes and Prime Rib during the holiday season is so pronounced relative to supply that major retailers and food service groups start buying and planning for the season as early as July. In order to secure enough supply for retail and restaurant promotions, it is necessary to make purchase orders this far in advance and many will buy at least

half of their estimated need in the summer, take delivery in September or October, and hold in storage until the holiday season (this is one reason for the increased use of deep chill).

While it is hard to verify that exports or changing consumer preferences are influencing increased Rib value, exports are definitely impacting the value of other primals within the carcass. One big success story for U.S. beef exports is the Asian market. Once Japan re-opened their doors to U.S. beef (and changed age requirements to 20 months), many Asian countries followed. These markets demand high fat products that they will thinly slice and cook in liquid, so products in the Chuck and Short Plate have seen a large increase in demand. Specifically, products in the Chuck Roll, Clod, and Short Ribs (both from the Chuck and Short Plate) are being exported in large quantities to these countries. This has increased the domestic price and changed the seasonal pricing patterns of these products. An increase in steak popularity is also spreading across Asia, providing a new market for Ribeye and Chuck steaks. While China has recently re-opened its doors to U.S. beef, the amount currently being exported is very small compared to the amount export prior to the 2001 Mad Cow disease (BSE) outbreak in the United States. China has strict requirements for the beef it does import: no antibiotics, hormone free, and fully traceable from rancher to packer. There are currently only a limited number packers and producers who are willing to provide these products and so U.S. beef exports to China remain small. Latin American countries are also importing U.S. beef. These markets prefer leaner cuts, and take a large portion of the Select beef slaughtered in the U.S., leaving room to grow as they expand their tastes for more U.S. beef products. African and Middle Eastern countries are hard to access and are generally a variety meat market. Due to the lack of a trade agreement between the European Union and the United States, there is very little beef flowing to these countries, although there is a large opportunity for growth if a free trade agreement were to be established.

Another growing market segment is the cow and Holstein beef sectors. Cull cows and white fat (3-5 year old dairy cow) carcasses have long been associated with ground beef, but some packers

are marketing an expanding range of cow beef products. While some end cuts are still ground, middle meats are increasingly being fabricated as muscle cuts and marketed to diners, truck stop restaurants, value steak houses, cruise lines, buffets, and other value priced food service vendors. While these carcasses cannot be graded as USDA Choice or Prime, the middle meats can be used as product substitutes for various applications when price is the deciding factor, and some muscle cuts are being ground whole for primal specific or premium ground beef lines. With advancements in feed technology and beta-agonists, fed Holstein carcasses look very similar to beef carcasses and consistently grade Choice or higher, even producing a significant portion of Prime carcasses each year in the U.S. These brands and beef/Holstein crosses are providing a market for dairy bull calves and a product supply for vendors needing an affordably priced Prime or high Choice product.

Beef carcass quality continues to improve, with over 80 percent of carcasses now grading Prime or Choice, up from roughly 65 percent just 15 years ago. While Choice is still valued above Select carcasses, the industry is shifting towards a different value/price break, between low and high Choice, especially in branded beef programs. The number of branded beef programs continues to climb, and while each brand is slightly different, most specify that beef must grade in the upper two-thirds of Choice. So modest or moderate marbling (middle and high) Choice carcasses only qualify for these branded programs while low Choice is used in retail or food service providing Choice beef at a value price. While there does not appear to be any changes happening in the near future to the grading scale, the real price break is no longer between Select and Choice but between low Choice and high Choice. The concept of no rolling carcasses has also shifted from inferior quality products not likely to grade Choice, to carcasses going into branded beef programs.

Not only are carcasses increasing in quality, but in size as well. Today, the average carcass is nearly 800 pounds, causing issues throughout the supply chain. Some packers have had to

increase rail heights and cutting table sizes to accommodate larger carcass and primal sizes. Simultaneously, further processors are scrambling to find solutions for retailers and food service customers specifying smaller portion sizes. Retailers must use larger trays for bigger cuts which occupy more limited shelf space. Employees struggle to lift and handle heavier boxes of beef, leading to an increase in injuries. Food service is challenged to find a way to cut a Ribeye steak or bone-in Strip Loin steak with adequate thickness and diameter. Some are asking packers to sort smaller carcasses or Ribeye sizes for them, while others are finding more innovative ways to deal with the problem. It is becoming increasingly popular to remove the spinalis dorsi muscle, or Ribeye Cap, from the longissimus (eye) and utilizing them separately. The cap is a popular steak item on its own or as a sandwich or salad ingredient, while others enjoy having a smaller portioned Ribeye steak offering without the cap. The packer or cutting house will separate the two pieces for the buyer, but the buyer must take both halves, and finding a home for both pieces is often difficult. Retail drives beef sales, so food service is waiting for retailers to send a market signal strong enough for producers and packers to stop producing such large carcasses. The problem: feedlots, producers, and packers are paid by the pound and will continue to grow cattle as long as they are efficient. Retail sells a lot of pounds of beef per capita, more than food service, but also sells a larger set of products from the carcass than food service. Further, size is really only an issue in the Rib, and there is no amount of premium on sorted Ribeyes that will push the producer to not produce the largest calf possible.

Retail is said to drive beef sales because the 40,000 grocery stores in the country sell more beef product per capita than the 660,000 plus restaurants across the country. Retail must predict consumer consumption patterns and plan advertisements or promotions to meet these demands. Each advertisement is planned quarterly and supply is secured months in advance to ensure enough supply availability to cover the sales that the promotion generates. A good promotion often includes ground beef, steak, roast, a pork item, chicken item, and a seafood item, and the

sales goal is based on total promotion revenue, rather than from each protein product. So, a cheap beef product will reduce margins for beef but can be accompanied by other protein products that generate larger profit margins. Retailers are also stocking up for holiday Rib season and will buy Rib roasts months in advance and keep it in cold storage until the Prime Rib promotion runs. They will also watch for seasonal price lows in the summer for roast products and keep the product in storage until winter roast season. Inversely, Strip Loin or other steak prices may dip in the winter months, so they will take large positions on these products for summer steak promotions between Memorial Day and Labor Day.

Food service, on the other hand, deals with its own seasonality and product issues. Steak houses are all fighting for the same product mix of high Choice or Prime, which generally includes a Ribeye, Strip Loin, Tenderloin, and occasionally a Top Sirloin or T-bone steak. Food service is also a highly saturated market with over 660,000 establishments nationwide, all trying to differentiate themselves. The fast food and quick casual restaurant sectors continue to grow with upscale sandwich, deli, salad, Tex Mex, Asian, burger, barbecue and other concepts providing the time strapped consumer with a quality product at an affordable price. With a strong economy, high end restaurants are also doing well and differentiate themselves by providing an outstanding eating experience at a premium price. The casual diners and restaurants, however, are getting squeezed between these two sectors, trying to find their niche while providing a diverse product mix at an affordable price point. This has led to a change in menu offerings, including beef products that can compete with chicken prices, and a consumer that wants to have a positive eating experience, not just a meal. Food service is able to be more flexible in its product mix, but menus are expensive to print, and larger carcasses have led restaurants to provide more unique or trendy items on the menu to handle these challenges (like Hanging Tenders, Tri-Tip, or Ribeye caps). Food service business also ebbs and flows throughout the calendar year, peaking during the holiday season through Valentine's Day then dwindles, with spikes on Mother's Day and Father's

Day, reaching a low during the 4th of July holiday. During the summer months, consumption patterns change and consumers would rather cook outside than go to a restaurant. However, once fall arrives and school is back in session, business picks up again.

Various consumer trends are transforming the food service and retail landscape, providing opportunities and challenges for packers, distributors, further processors, and retailers. Today's consumer is time strapped, but want to prepare a wholesome meal with minimal time or effort. This has led to an increase in the popularity and availability of meal kits, both delivered and in the retail meat case. Meal kits, which include pre-portioned ingredients including meat, vegetables, and other sides, along with seasonings and sauces, provide consumers with everything they need to make a meal in one package. There are several popular delivery meal kit companies, and packers, further processors, and retailers are also getting into the business, providing meal kits conveniently in the store. Meal kits provide a market for under-utilized beef cuts, but do require more labor and time for the packer or further processor. This trend is matched in food service, with an increase in restaurant to-go business, and many food delivery companies and some restaurants even providing curbside pickup, or commissaries opening without seating, just a kitchen and physical location to pick up a meal from.

Value-added products are also gaining popularity, which reduce the time and effort needed for retailers, food service, and consumers. Further processors and packers are now pre-seasoning and marinating roasts, Briskets, and other dishes while also dicing, shredding, chopping and adding seasoning and sauces to products that will go into a meal kit or straight to a restaurant. While this does provide a wider assortment of products for restaurants and retailers to serve, it also adds more labor, and cost to the processor.

Value-added also refers to the 39 innovative cuts that the Beef Check-Off funded through the Beef Value Cuts program. Two of these cuts, the Petite Tender, and the Flat Iron, both from the

Chuck Shoulder Clod, were highly promoted by the NCBA, reaching large sales volumes, and are wholesale price reported by the USDA. While these two products are popular, the added costs of labor, processing, and loss of residual product value required to produce the product, add to the cost of the product and reduce its value. Some further processors and regional restaurants may use other innovative cuts, but due to the increased costs associated with fabricating these products, they are no longer seen as a value to the industry, and are priced competitively with other products.

The all natural, organic, never ever, and other adjective market is still strong, but may have seen its peak. Consumers are also demanding more sustainable production and nose-to-tail or whole carcass butchery, providing an opportunity for small boutique butcher shops to provide more products from the carcass like offals, variety meats, and other products not normally seen on a restaurant menu or in a grocery store meat case.

Finally, one big issue affecting the entire supply chain is labor. With a strong economy, jobs are plentiful, and so it is becoming increasingly costly to recruit, acquire, train, and retain highly skilled workers needed in packing plants, further processors, grinders, and steak cutting facilities. Labor is also tight in food service, with trained employees, not skilled chefs, preparing dishes in the kitchen. Retail suffers in a different capacity, as there are fewer skilled butchers to serve retail meat counters, putting more work on packers and further processors to produce case or block ready products for retailers to directly place on their shelves or cut in-store with little skill needed.

New Electronic Log Regulations have also had a huge impact on the entire supply chain, causing late deliveries and extended shipping periods, while highlighting a glaring issue in the accurate (or lack thereof) logs in the trucking industry. Labor is also short in this field and many companies are increasing driver salaries and signing bonuses to recruit drivers.

6.1 Conclusions

This research found and highlighted many interesting trends, topics, and insights in the beef marketing supply chain. But, it also exposes the lack of data available which limits further quantitative work. The original intent of this research was to develop a complete demand system for beef products, which would require price data for all cuts available at the retail, food service, and export levels, and quantity data to match, at a weekly level. It may be impossible to report prices on every single product sold at a grocery store, bought by a restaurant, or sent overseas. However, the availability of price data for more than just 50 cuts, at a level deeper than wholesale, would give more insight into what products are selling in high volumes and at what price. Ground beef data is also under-represented as only large ten pound chubs are reported, even though packers produce smaller chub sizes (1, 2, and 5 pound sizes). Branded Angus ground beef is also not included in reported ground beef prices. Wholesale price data does not capture food service or retail price levels, and is also missing export price data. While exports are only 10 to 30 percent of beef production (depending on the packer and processor), the cuts they produce are not well represented in wholesale price data.

The intent of this research was to better understand the beef supply chain and what factors determine beef demand and prices. Many factors and determinants were identified, and more would undoubtedly have been revealed with more interviews with more companies. However, it was evident that the marginal increase in information decreased as additional interviews were conducted. The research presented in this report is believed to be an accurate representation of the industry which captures the majority of beef demand issues. Hopefully, this report will explain the complexities of the beef marketing system, lead to further research, and motivate the industry to increase data availability for a more complete demand system analysis.

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APPENDICES

APPENDIX A: SEASONALITY CHARTS

Figure A-1: BF 112A Ribeye Boneless Heavy Average Seasonal Price Index for 2008-2015 and 2016-2018

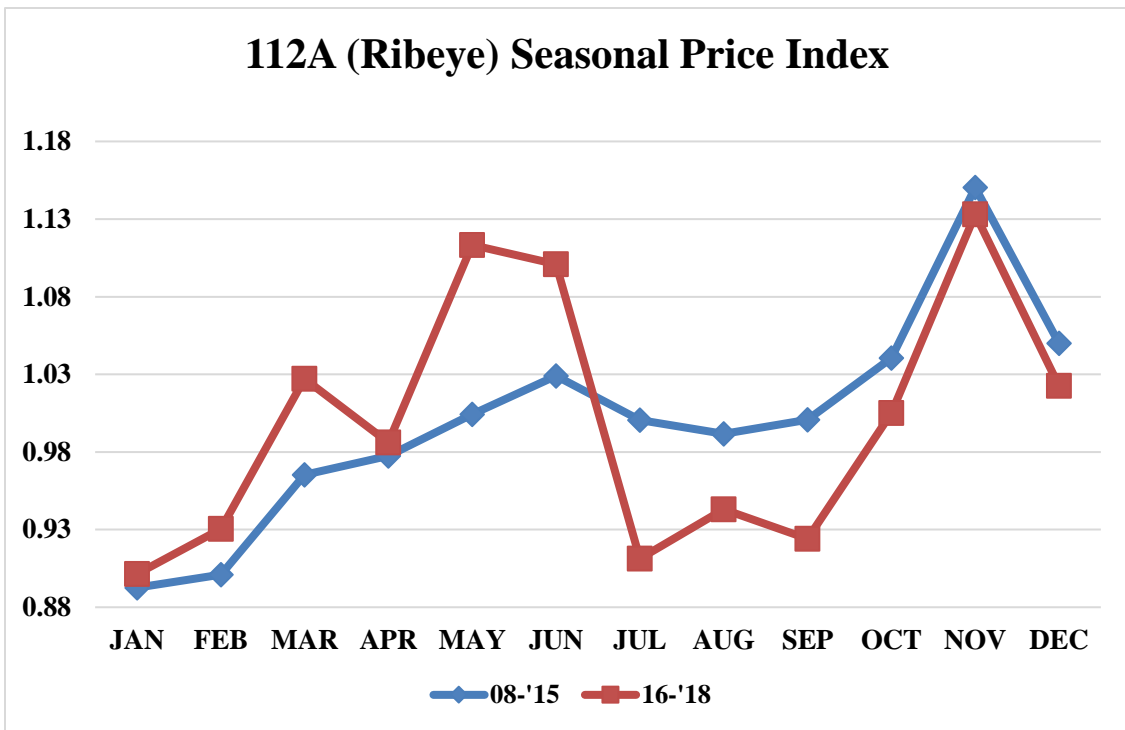


Figure A-2: BF 114A Chuck Shoulder Clod Trimmed Average Seasonal Price Index for 2008-2015 and 2016-2018

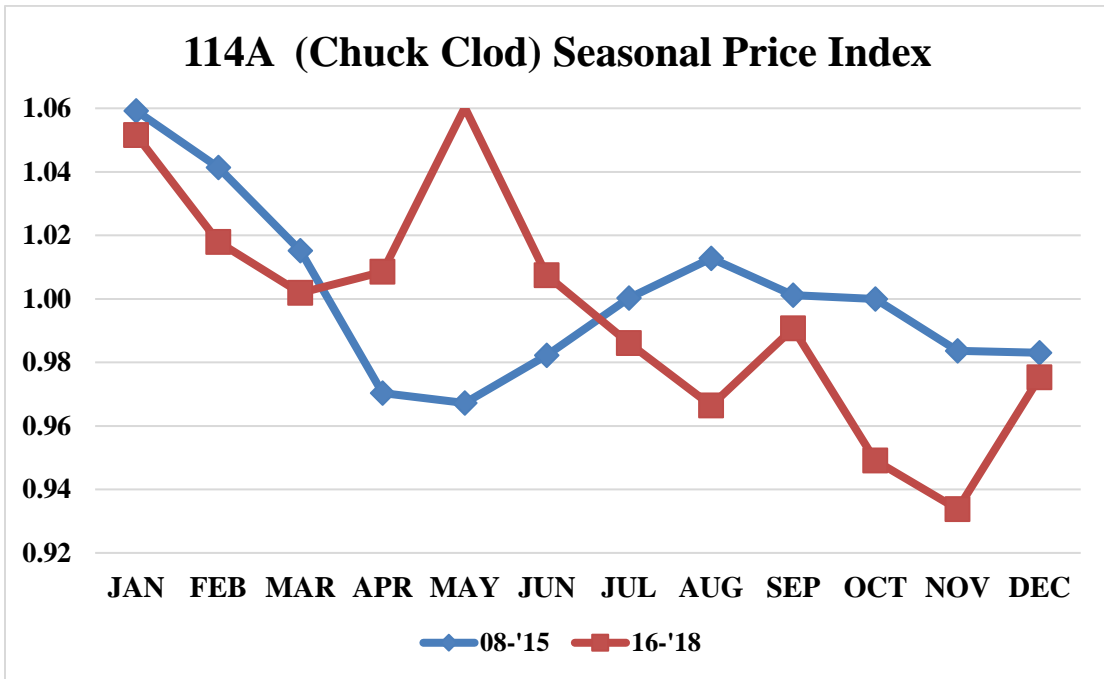


Figure A-3: BF 114D Chuck Top Blade (Flat Iron) Average Seasonal Price Index for 2008-2015 and 2016-2018

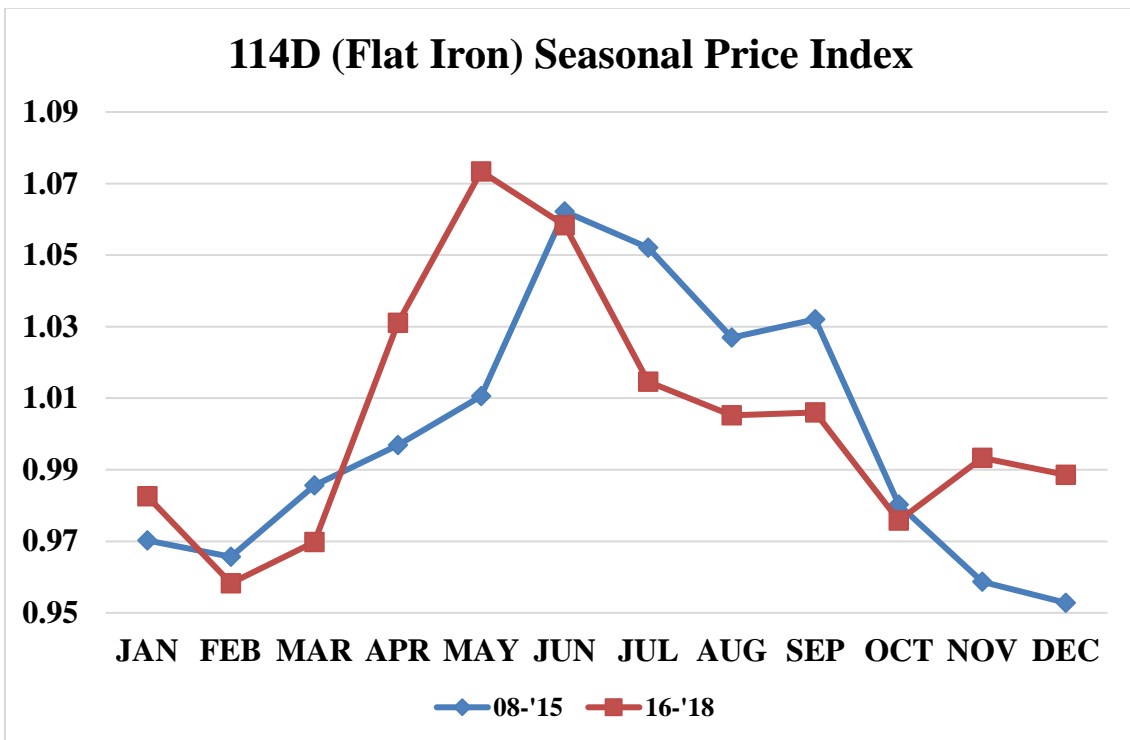


Figure A-4: BF 114F Chuck Clod Tender Average Seasonal Price Index for 2008-2015 and 2016-2018

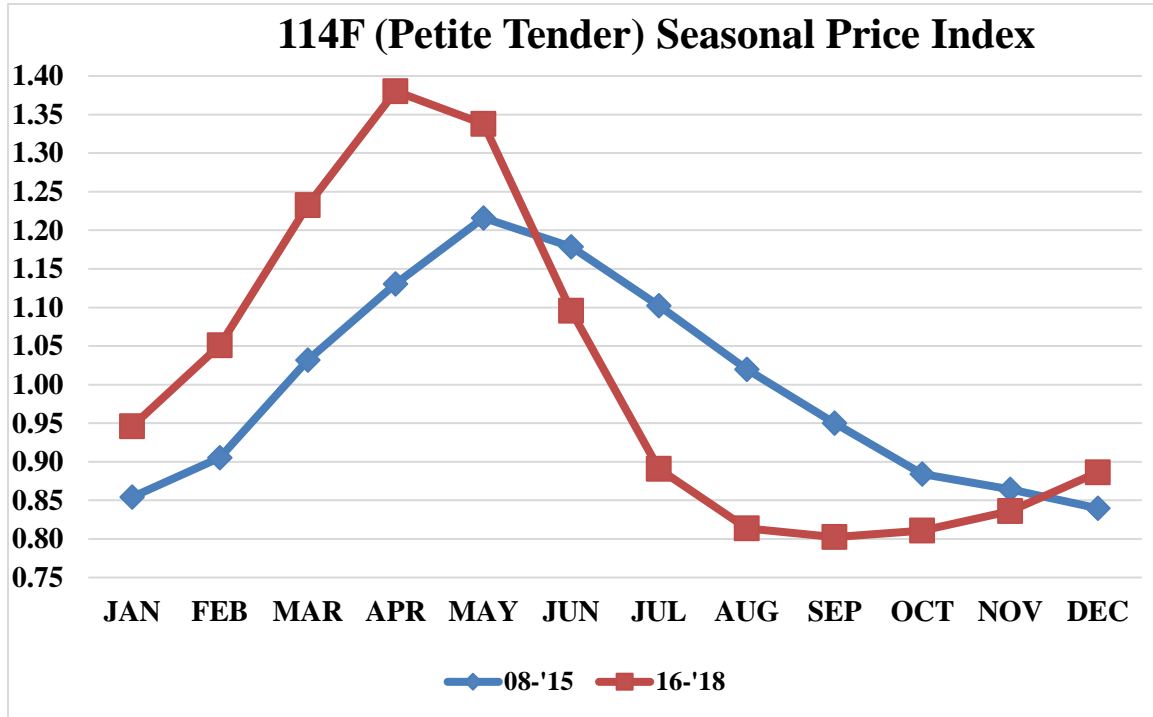


Figure A-5: BF 116B Chuck Roll Retail Ready Average Seasonal Price Index for 2008-2015 and 2016-2018

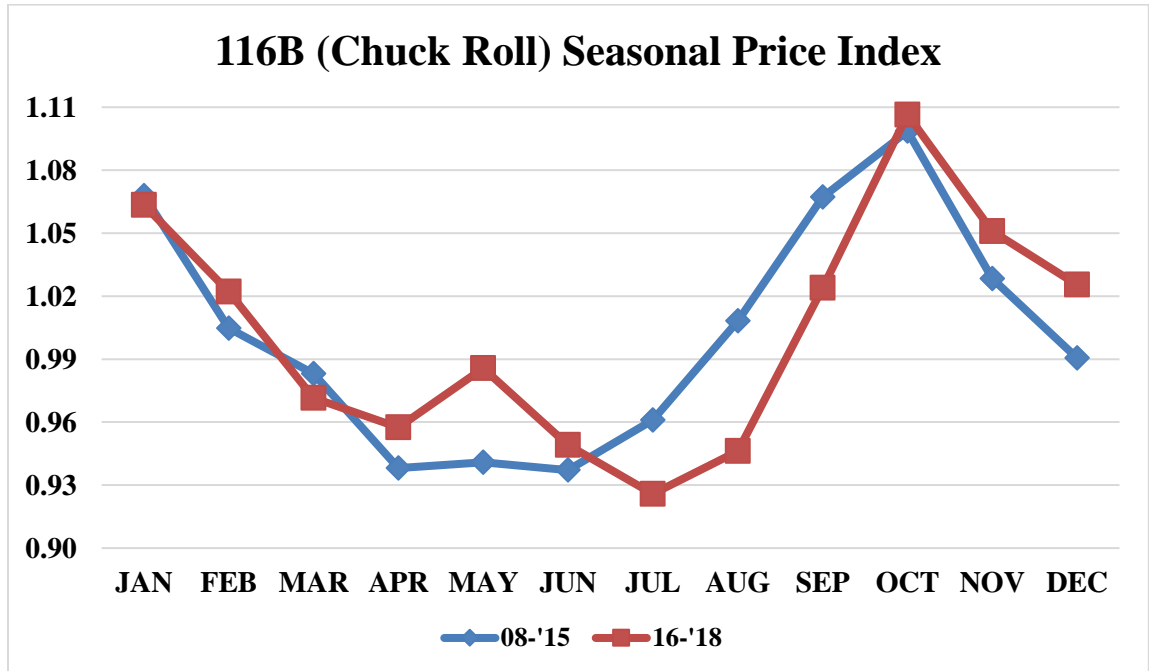


Figure A-6: BF 120A Brisket Point-Off Boneless Average Seasonal Price Index for 2008-2015 and 2016-2018

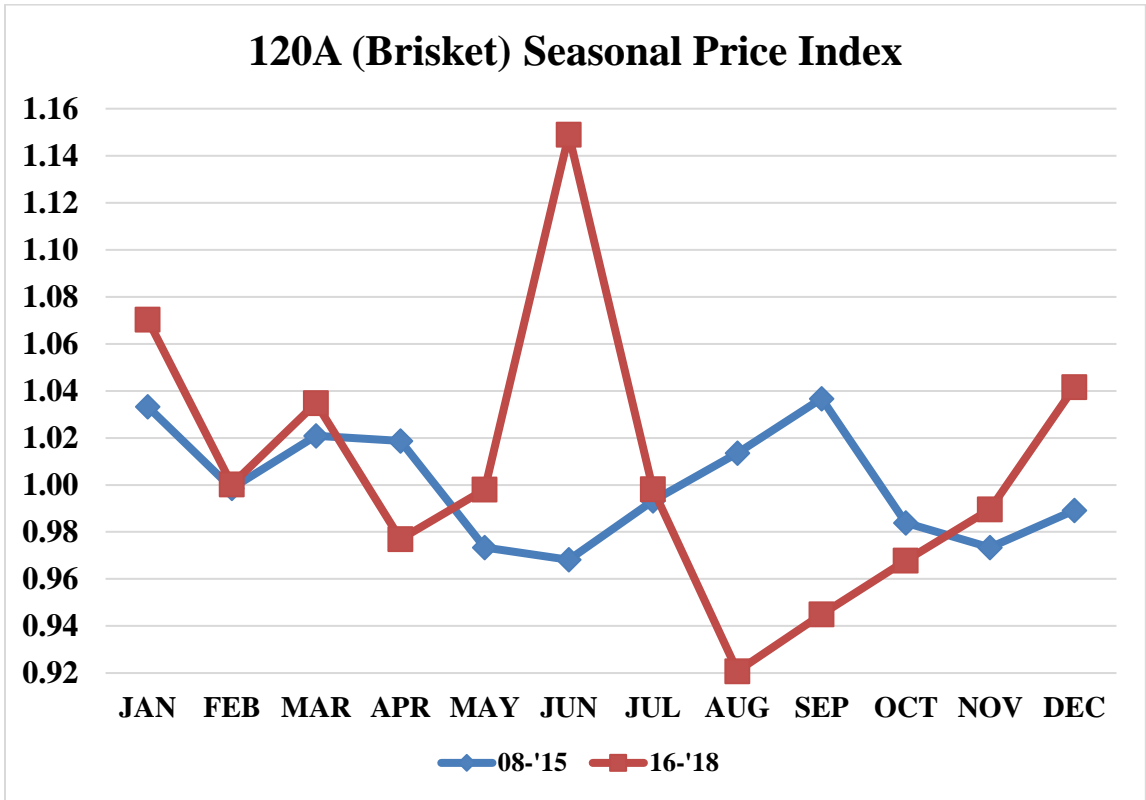


Figure A-7: BF 123A Short Plate Short Rib Average Seasonal Price Index for 2008-2015 and 2016-2018

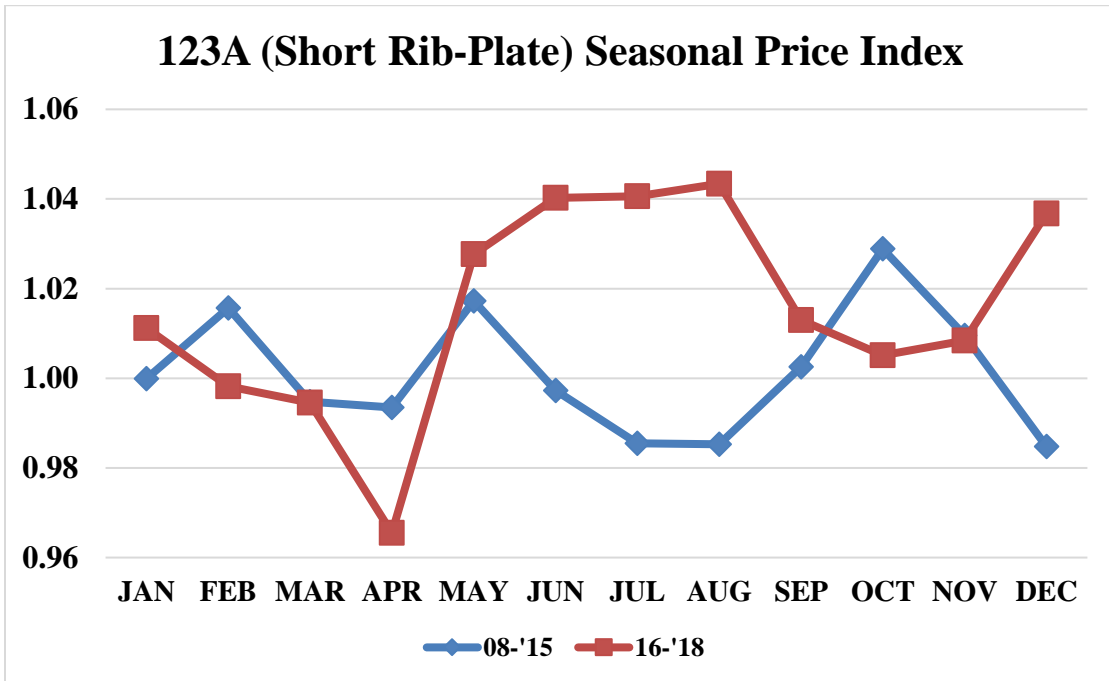


Figure A-8: BF 130 Chuck Short Rib Average Seasonal Price Index for 2008-2015 and 2016-2018

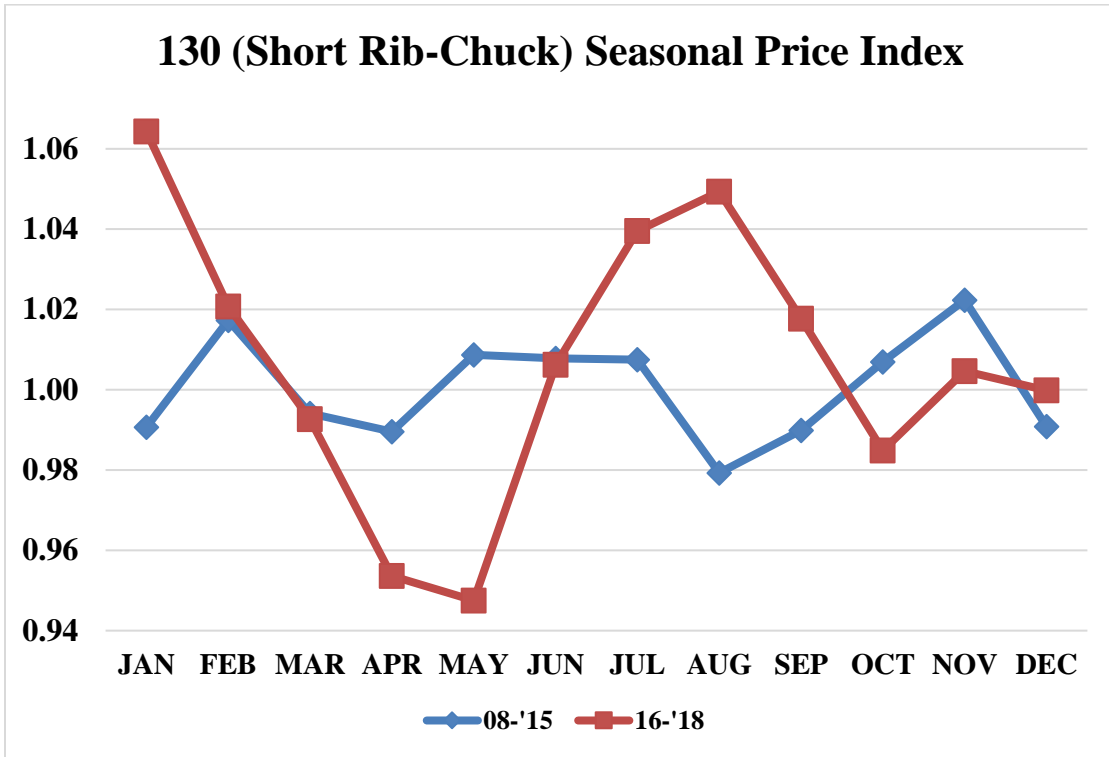


Figure A-9: BF 169 Top Inside Round Denuded Average Seasonal Price Index for 2008-2015 and 2016-2018

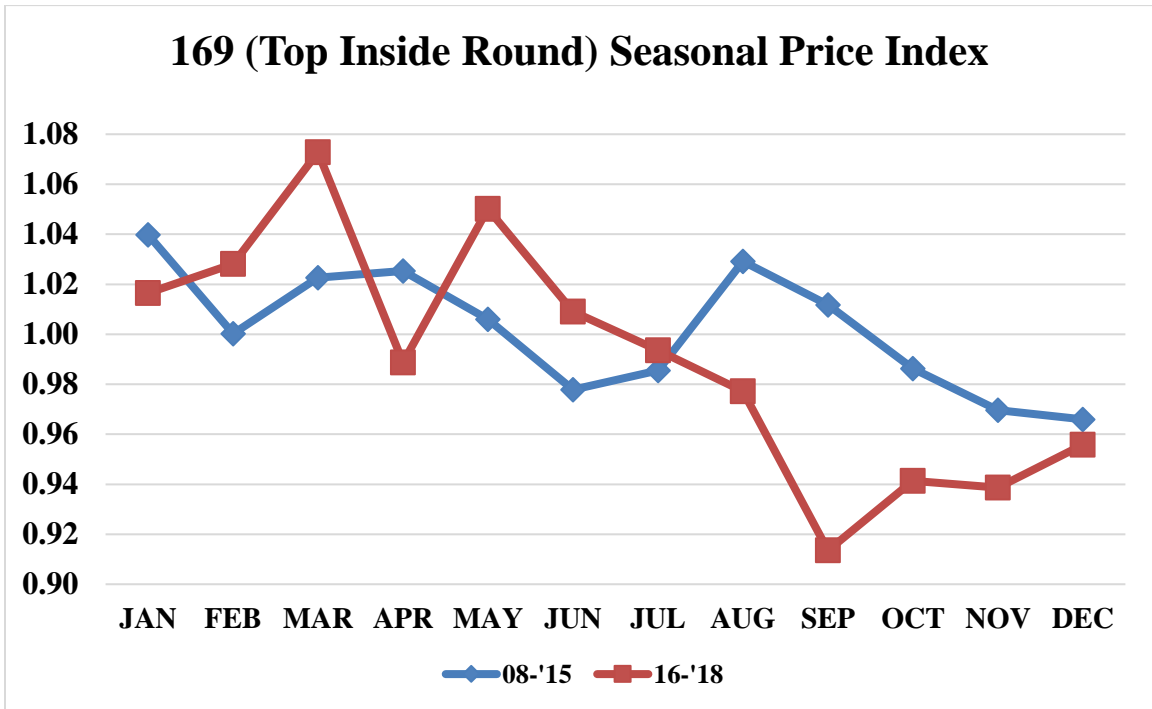


Figure A-10: BF 170 Bottom Round Gooseneck Seasonal Price Index for 2008-2015 and 2016-2018

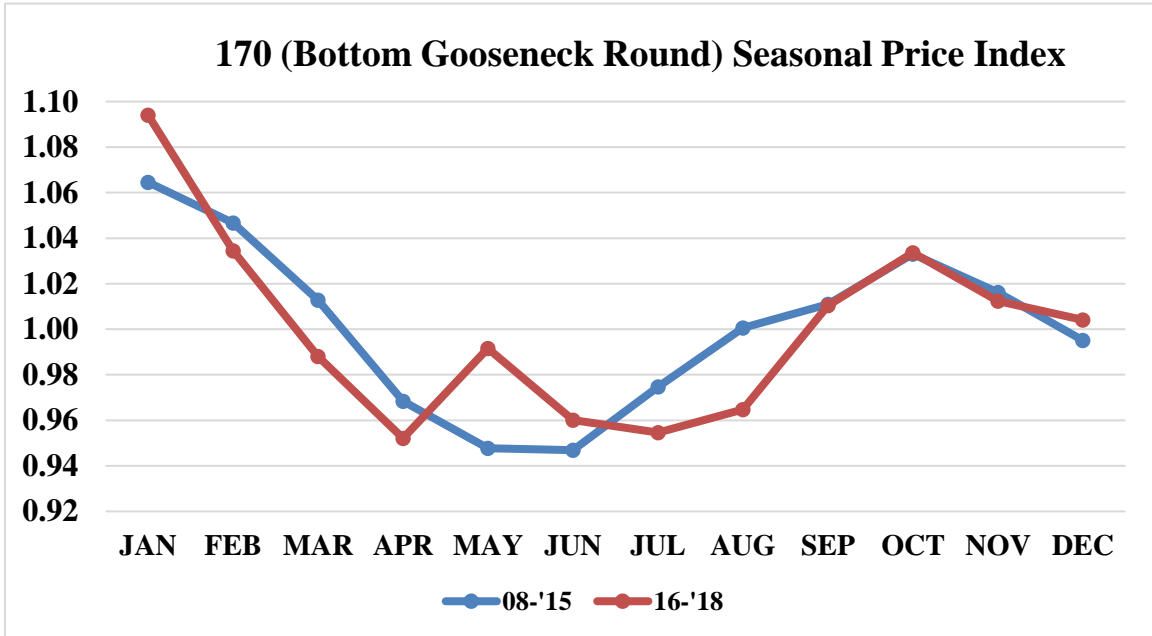


Figure A-11: BF 171B Outside Round Average Seasonal Price Index for 2008-2015 and 2016-2018

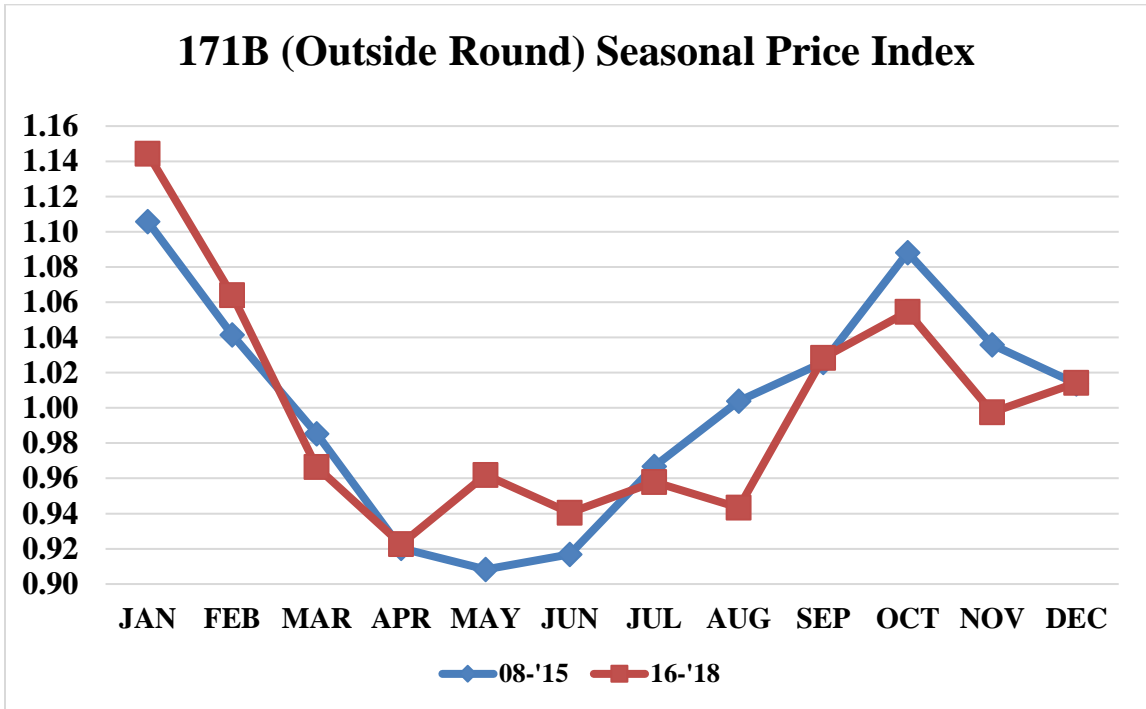


Figure A-12: BF 171C Eye of Round Average Seasonal Price Index for 2008-2015 and 2016-2018

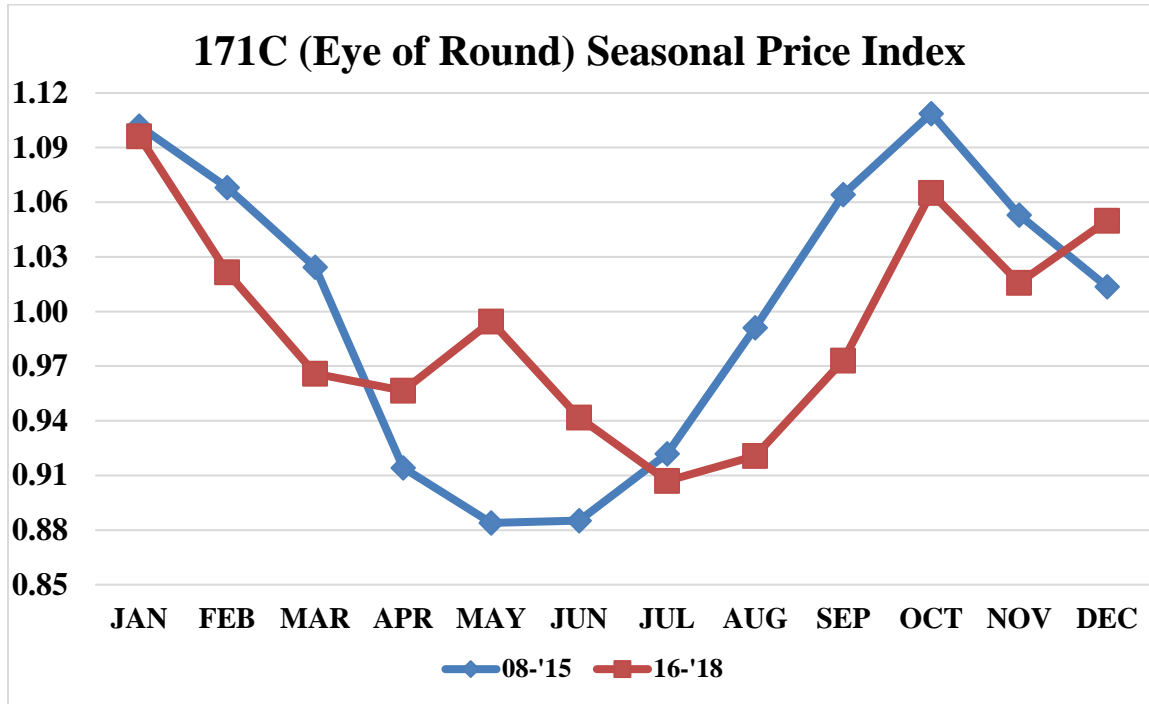


Figure A-13: BF 175 Strip Loin Boneless 1x1 Average Seasonal Price Index for 2008-2015 and 2016-2018

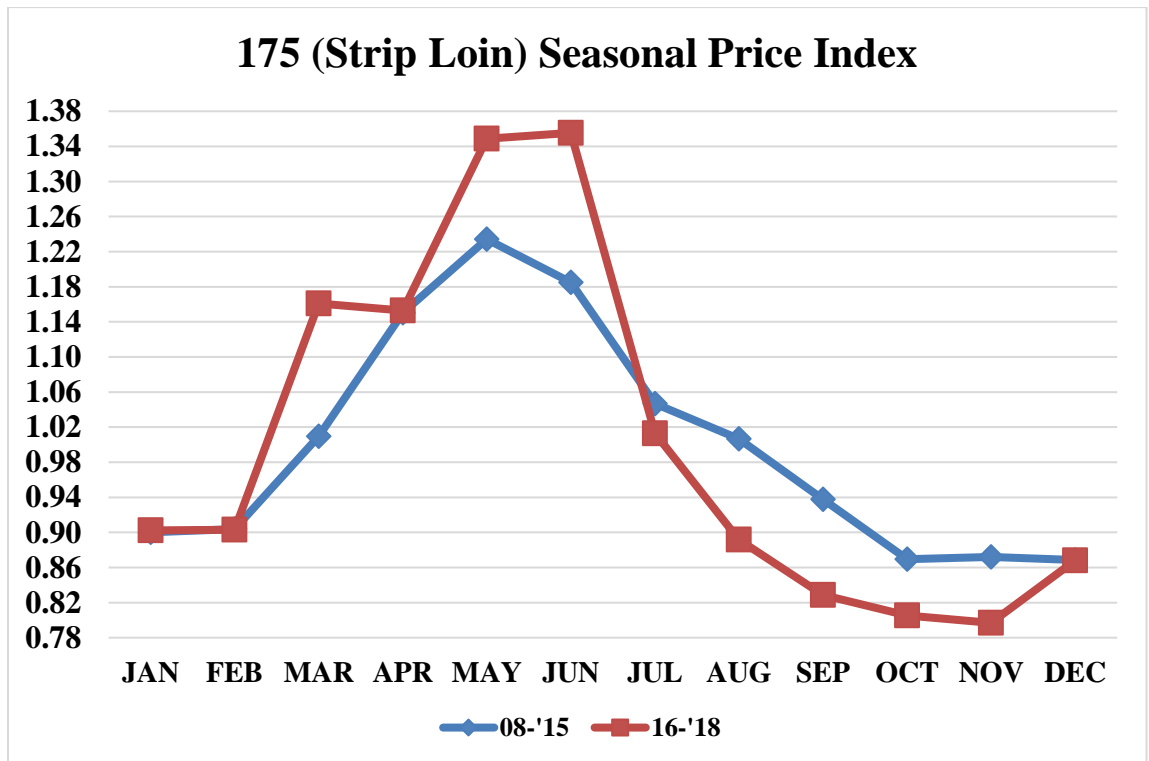


Figure A-14: BF 185A Loin Bottom Sirloin Flap Average Seasonal Price Index for 2008-2015 and 2016-2018

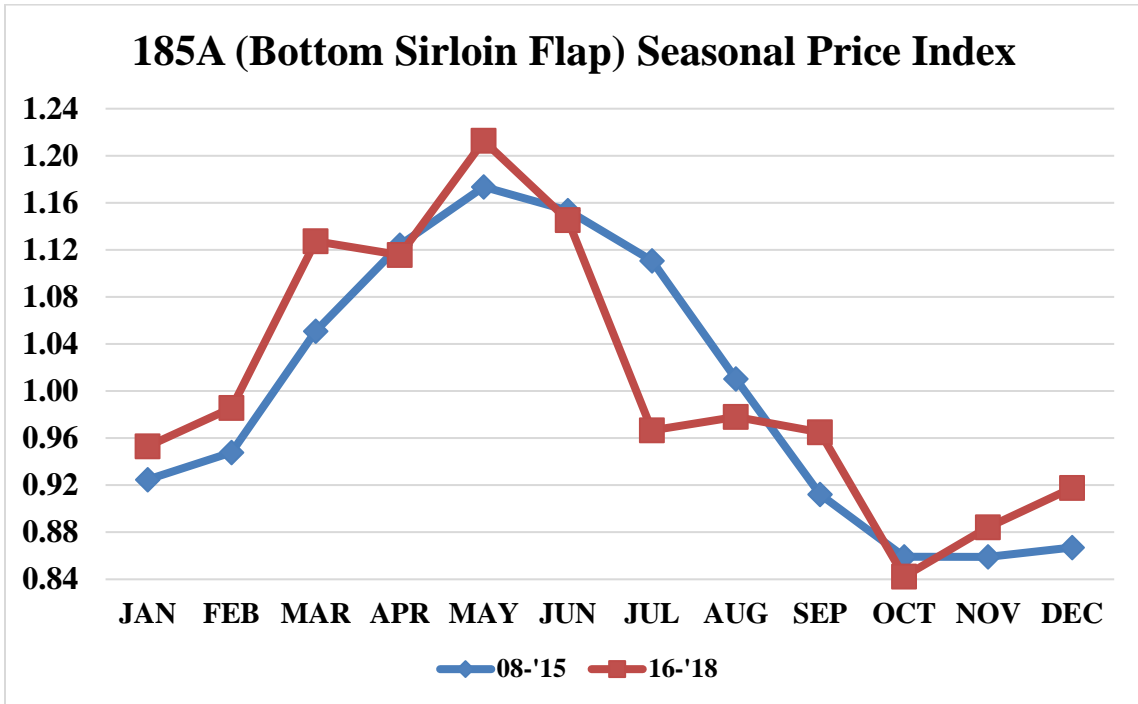


Figure A-15: BF 185D Sirloin Tri-Tip Peeled Average Seasonal Price Index for 2008-2015 and 2016-2018

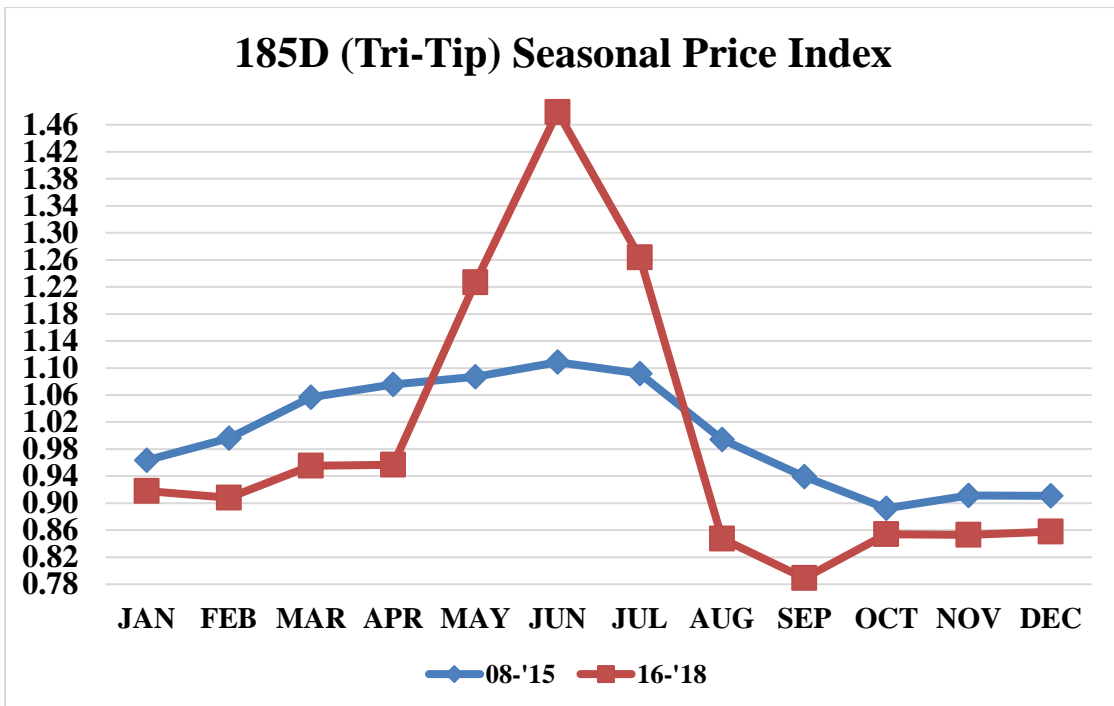


Figure A-16: BF 189A Tenderloin Trimmed Heavy Average Seasonal Price Index for 2008-2015 and 2016-2018

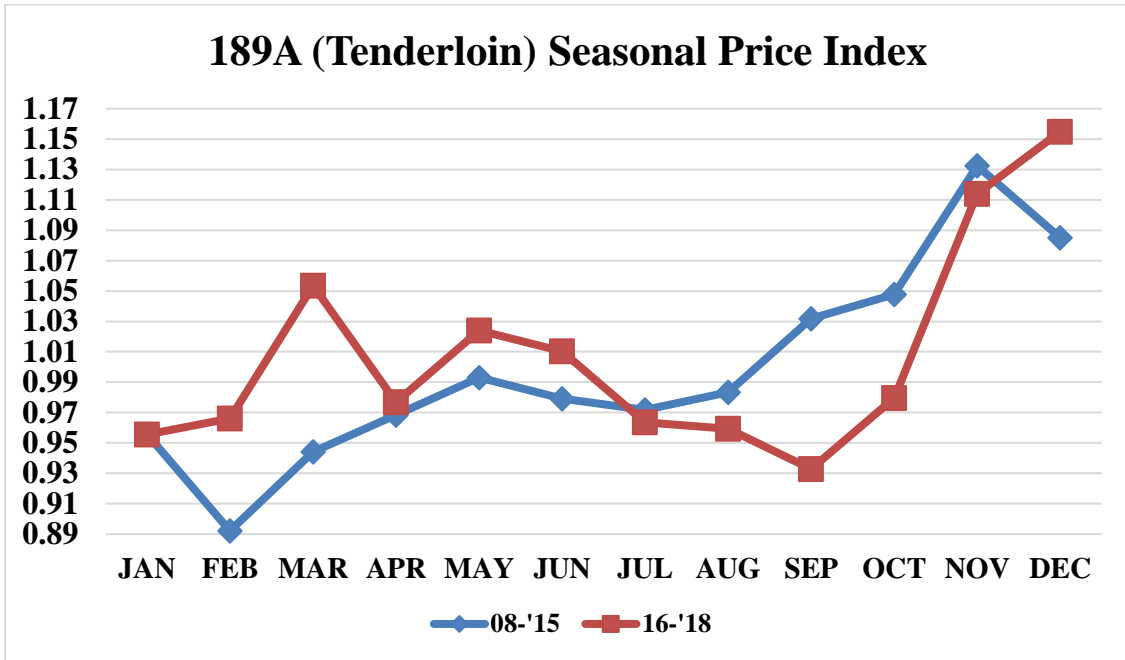
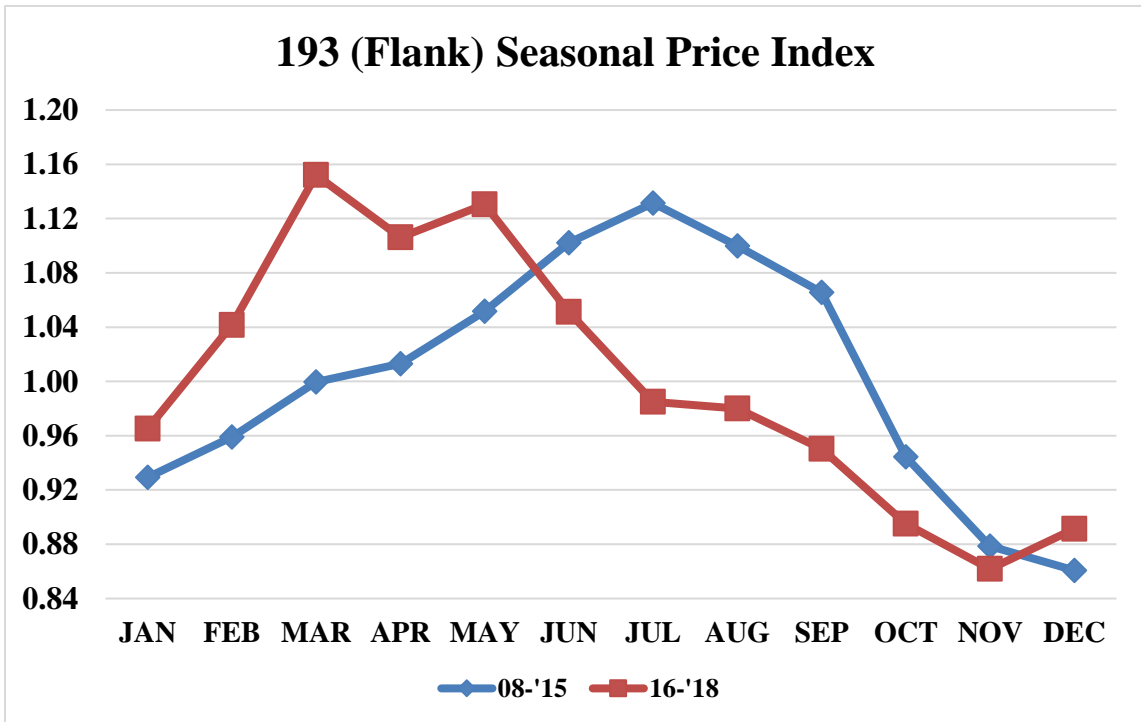


Figure A-17: BF 193 Flank Average Seasonal Price Index for 2008-2015 and 2016-2018



APPENDIX B: CUT VERSUS TENDERLOIN CHARTS

Figure B-1: BF 112A Ribeye Boneless 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

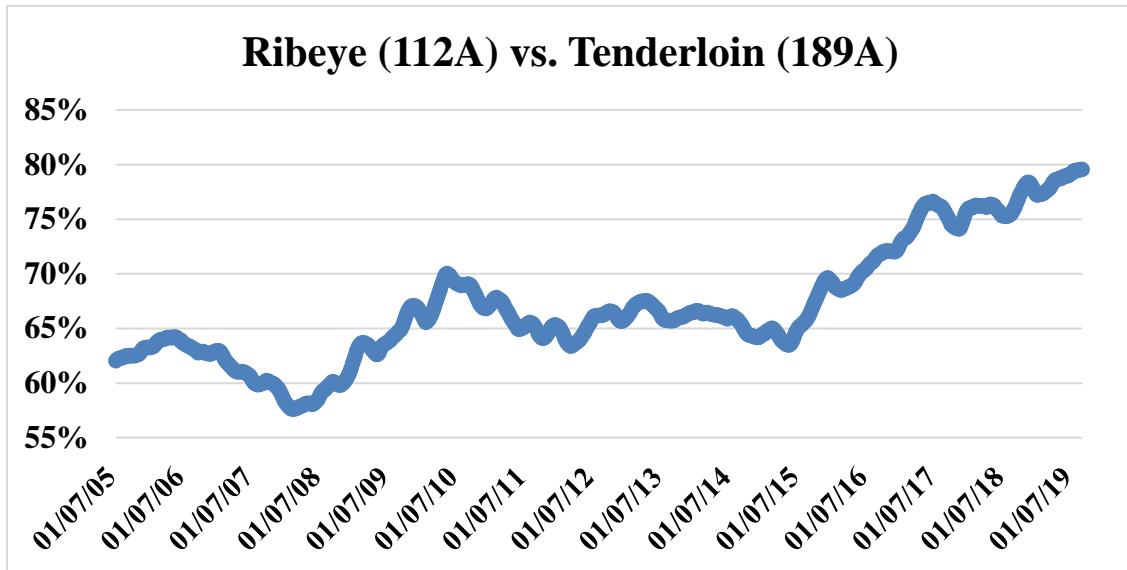


Figure B-2: BF 114A Chuck Shoulder Clod 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

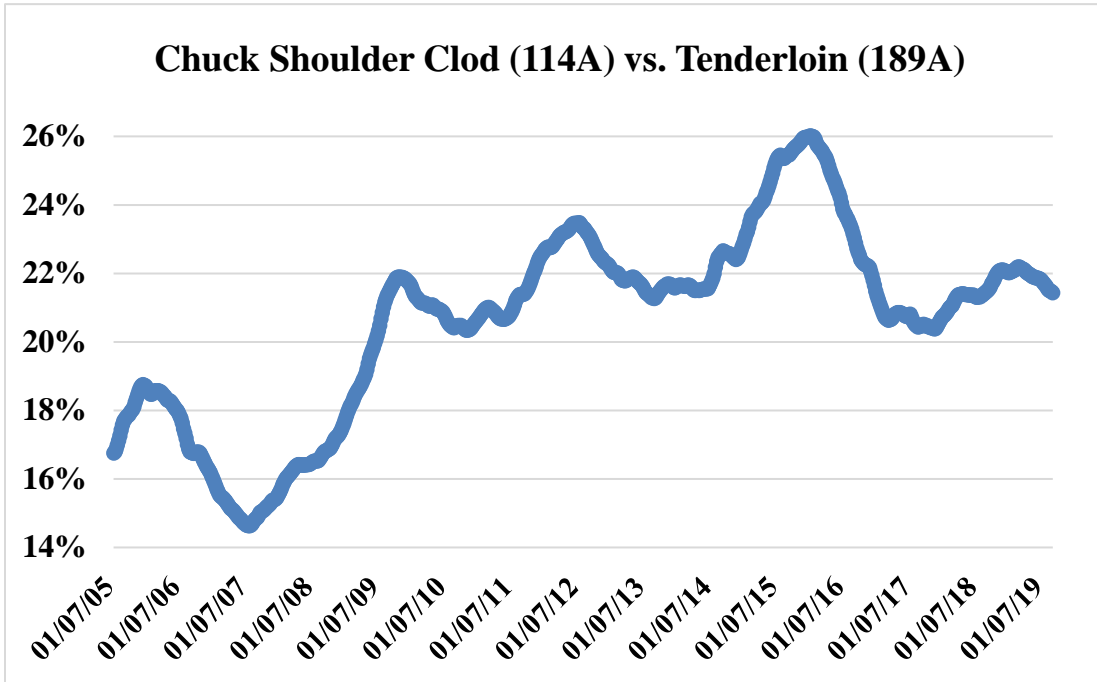


Figure B-3: BF 114D Chuck Top Blade (Flat Iron) 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

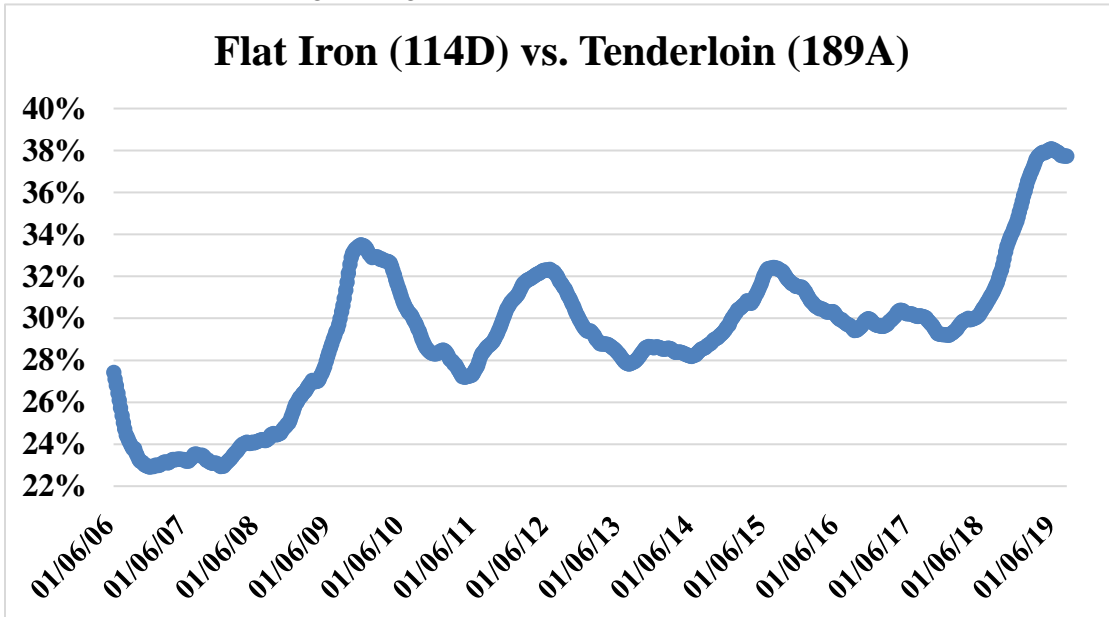


Figure B-4: BF 114F Chuck Clod Tender 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

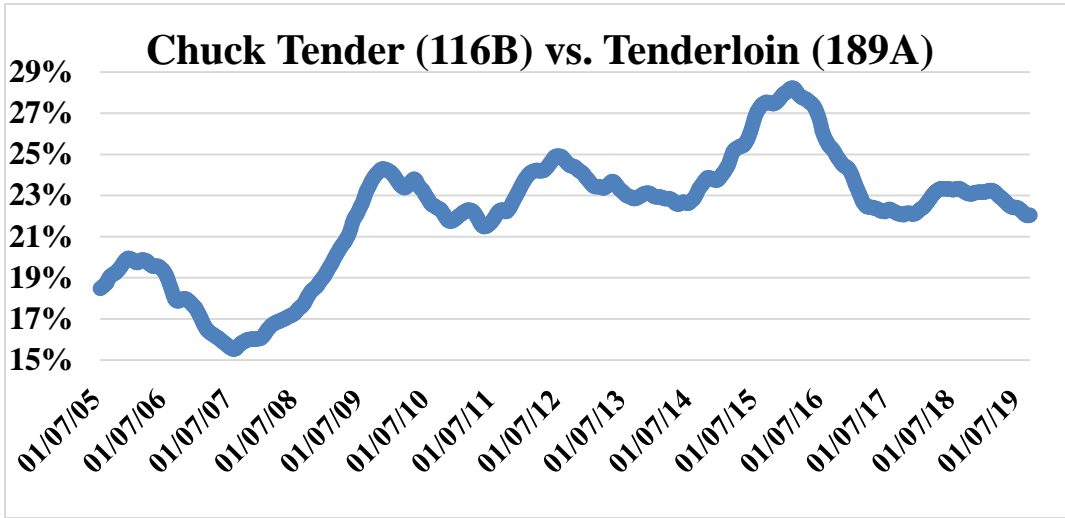


Figure B-5: BF 116B Chuck Tender 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

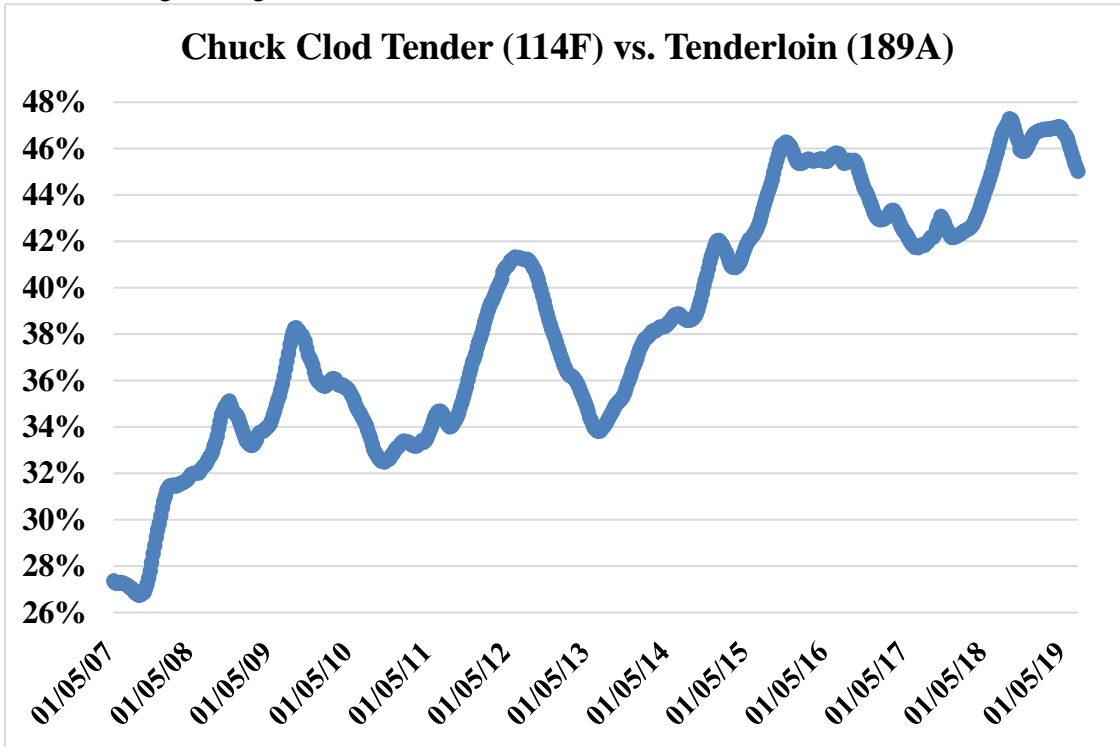


Figure B-6: BF 116B Trim 3 Chuck Roll Retail Ready 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

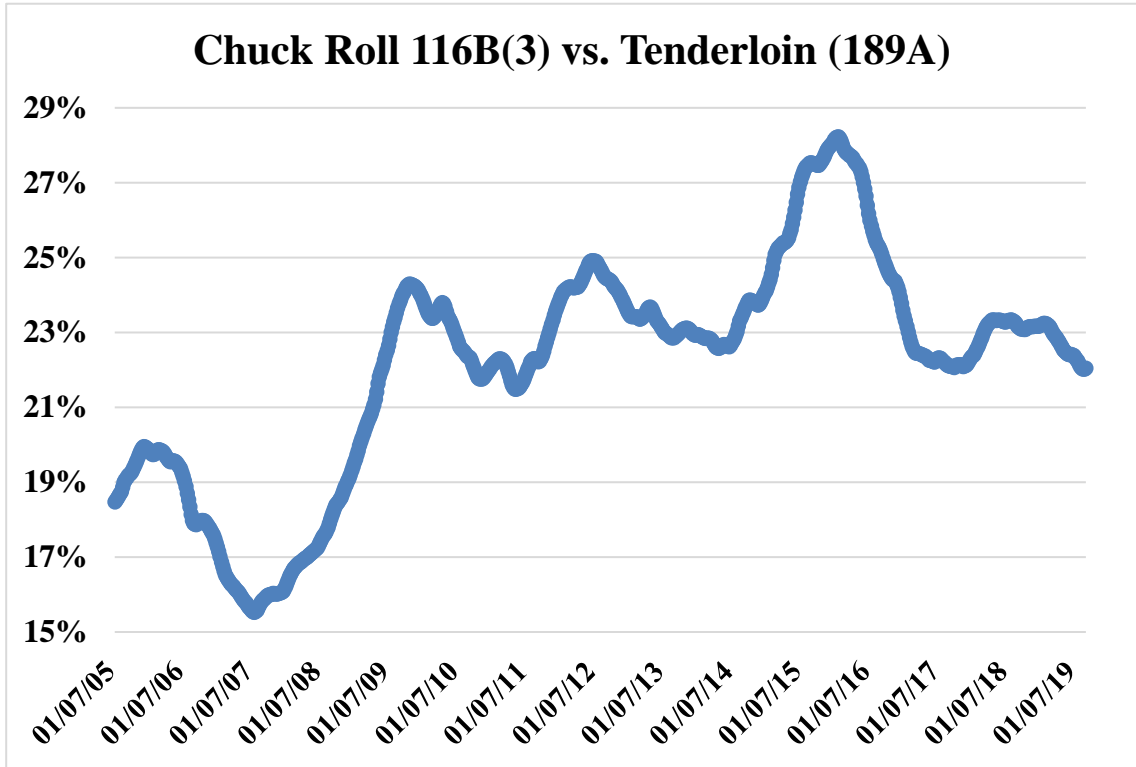


Figure B-7: BF 120A Brisket Point-Off Boneless 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

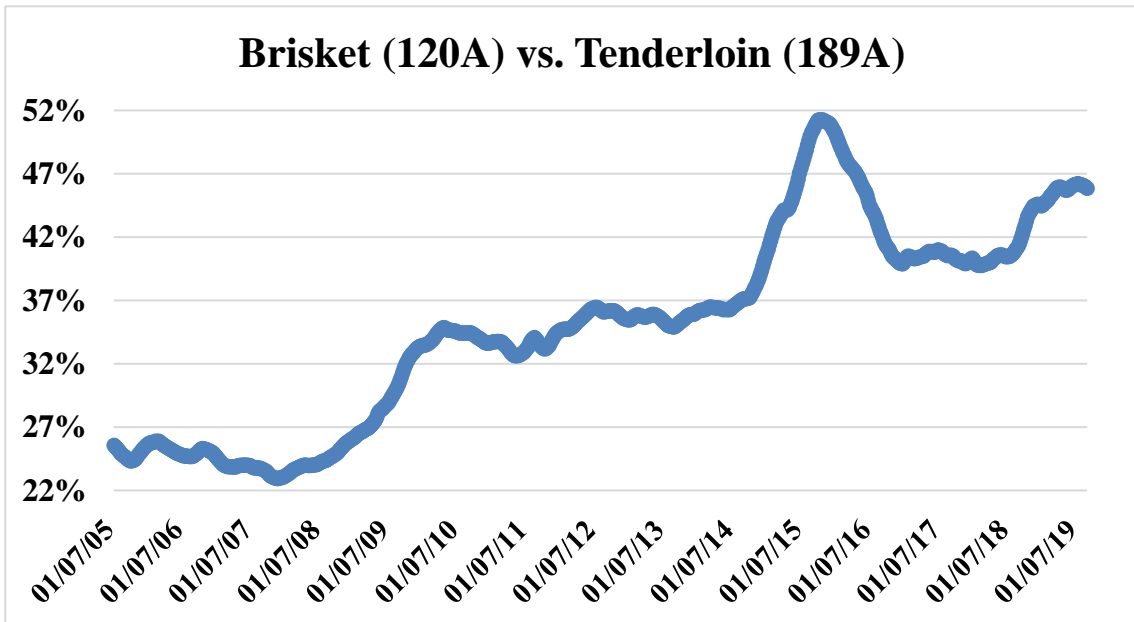


Figure B-8: BF 123A Short Plate Short Rib 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

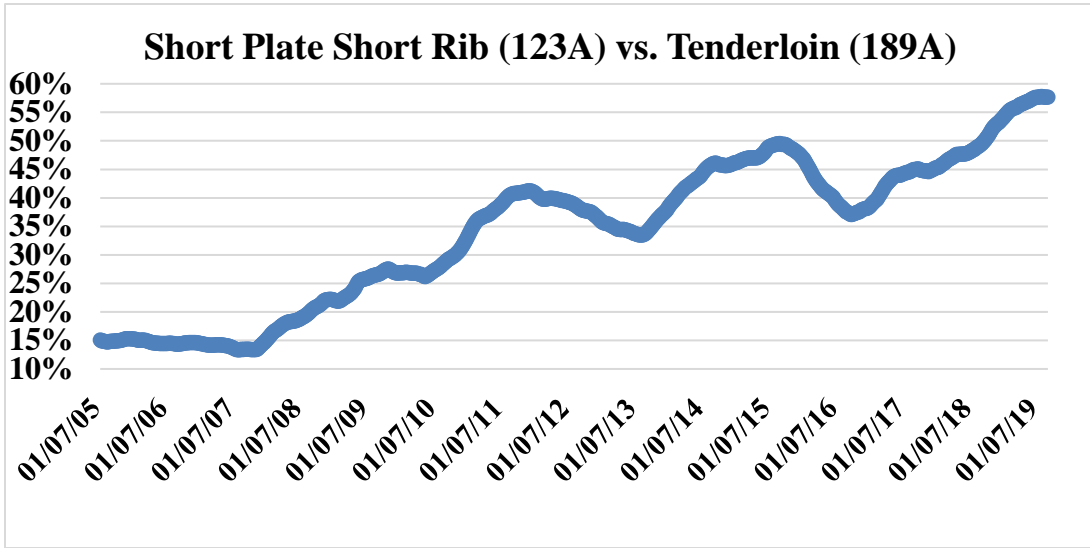


Figure B-9: BF 130 Chuck Short Rib 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

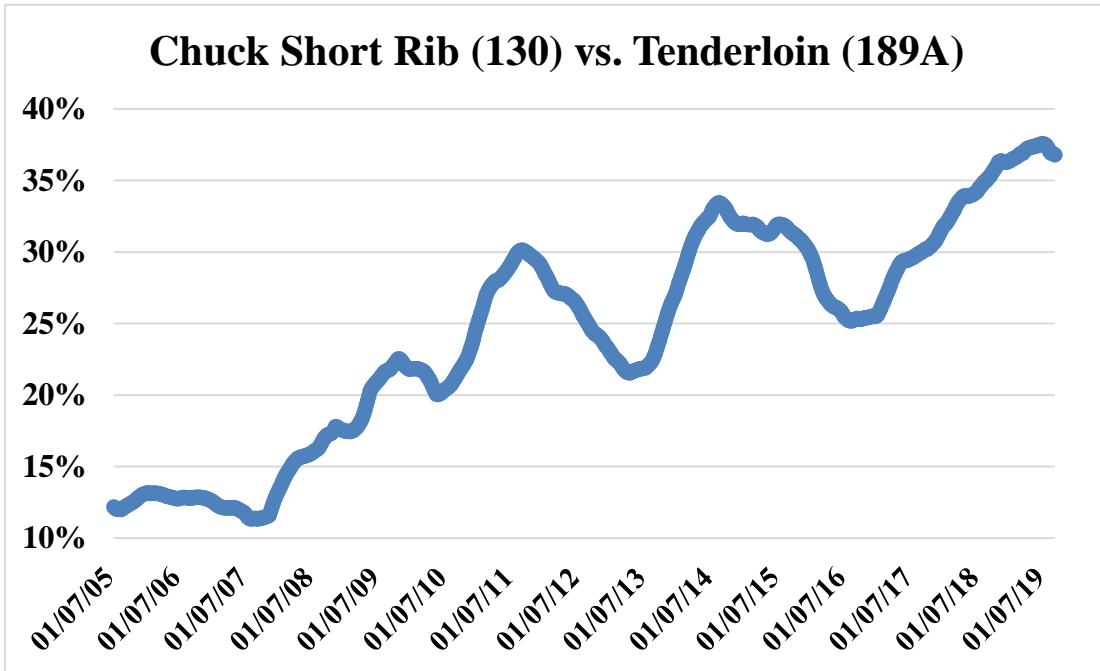


Figure B-10: BF 167A Round Knuckle Peeled 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

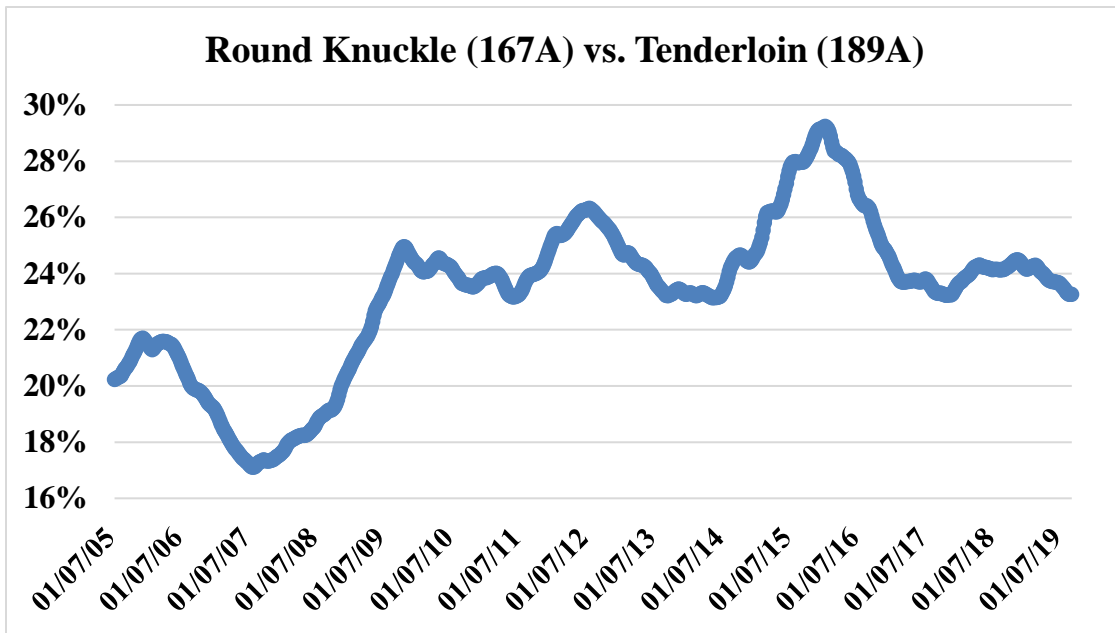


Figure B-11: BF 168 Top Inside Round 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

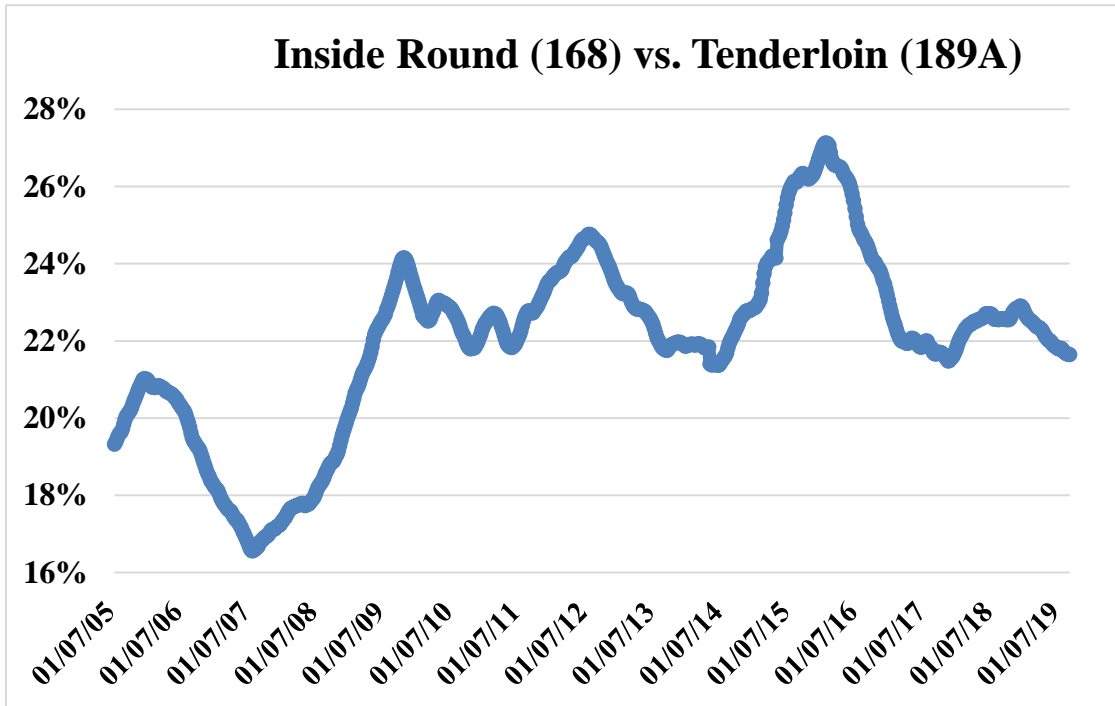


Figure B-12: BF 170 Gooseneck Round 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

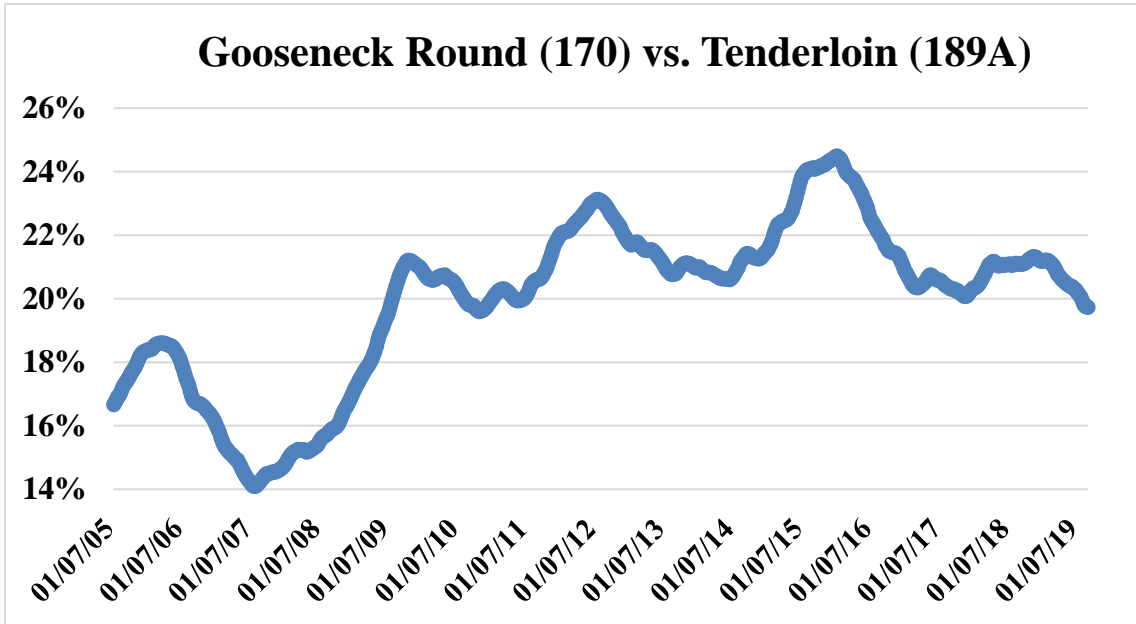


Figure B-13: BF 171C Eye of Round 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

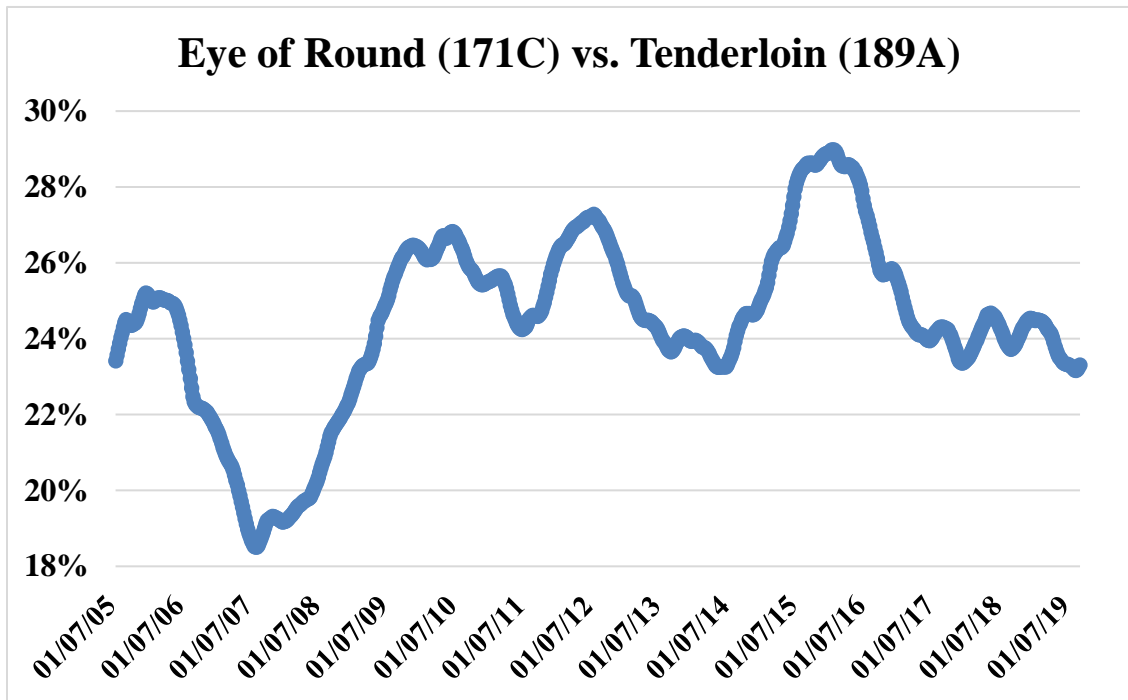


Figure B-14: BF 180 Strip Loin Boneless 0x1 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

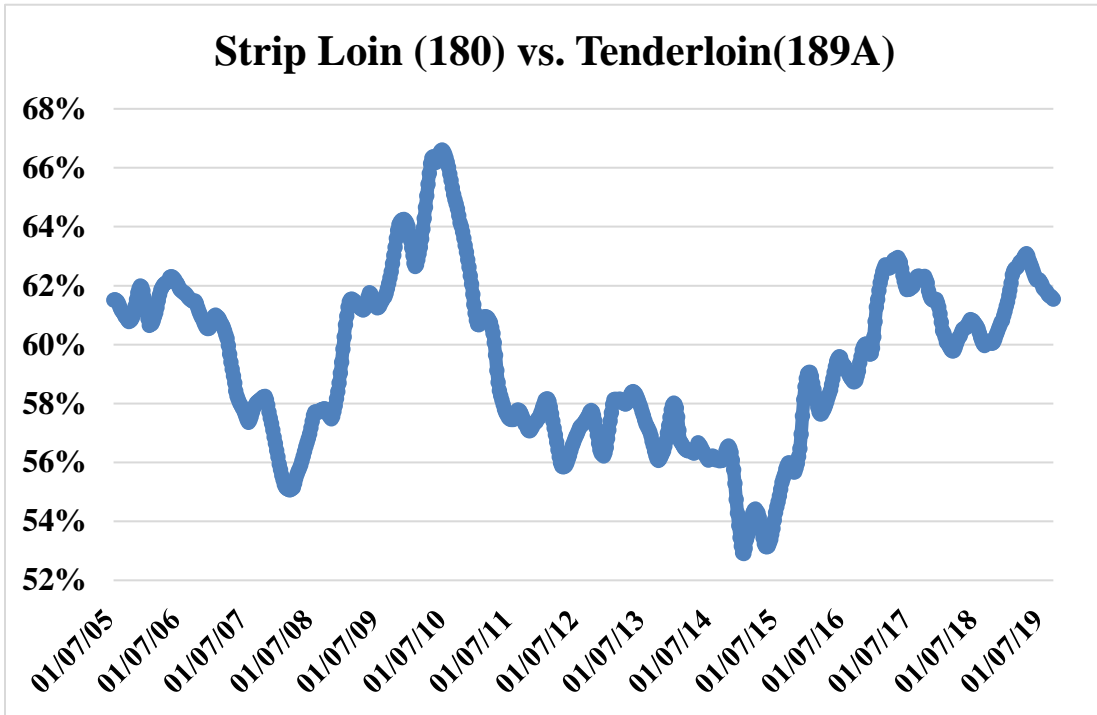


Figure B-15: BF 184 Loin Top Butt Boneless 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

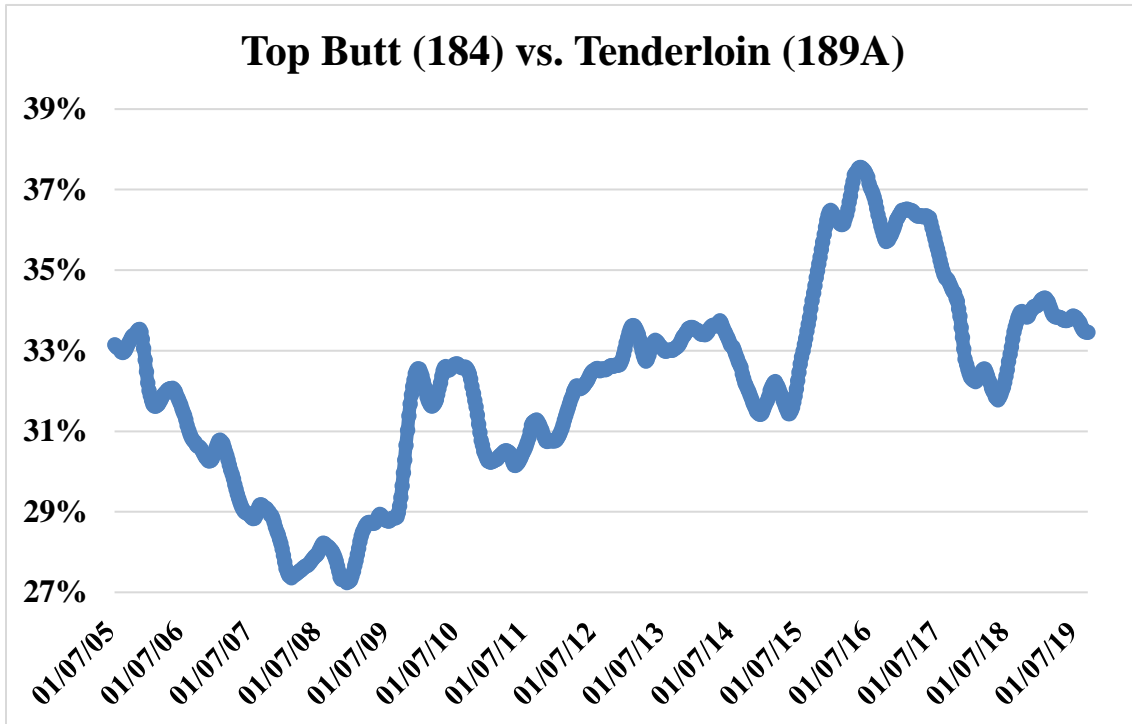


Figure B-16: BF 185A Loin Bottom Sirloin Flap 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

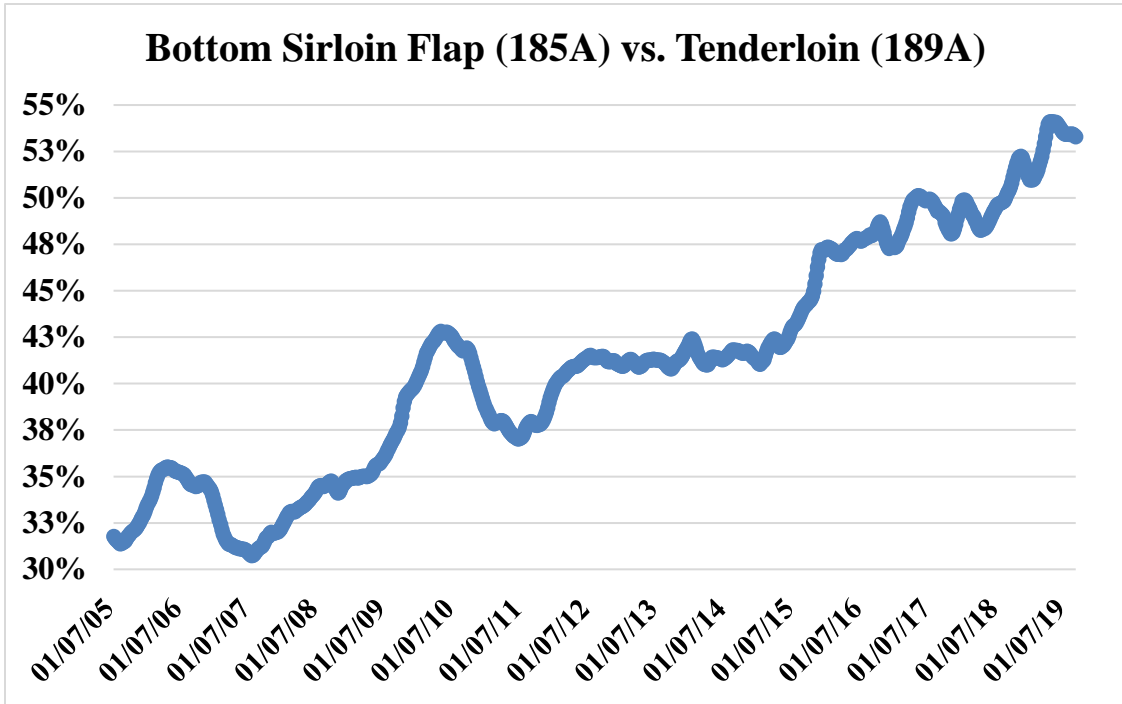


Figure B-17: BF 185B Loin Ball-tip Boneless 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

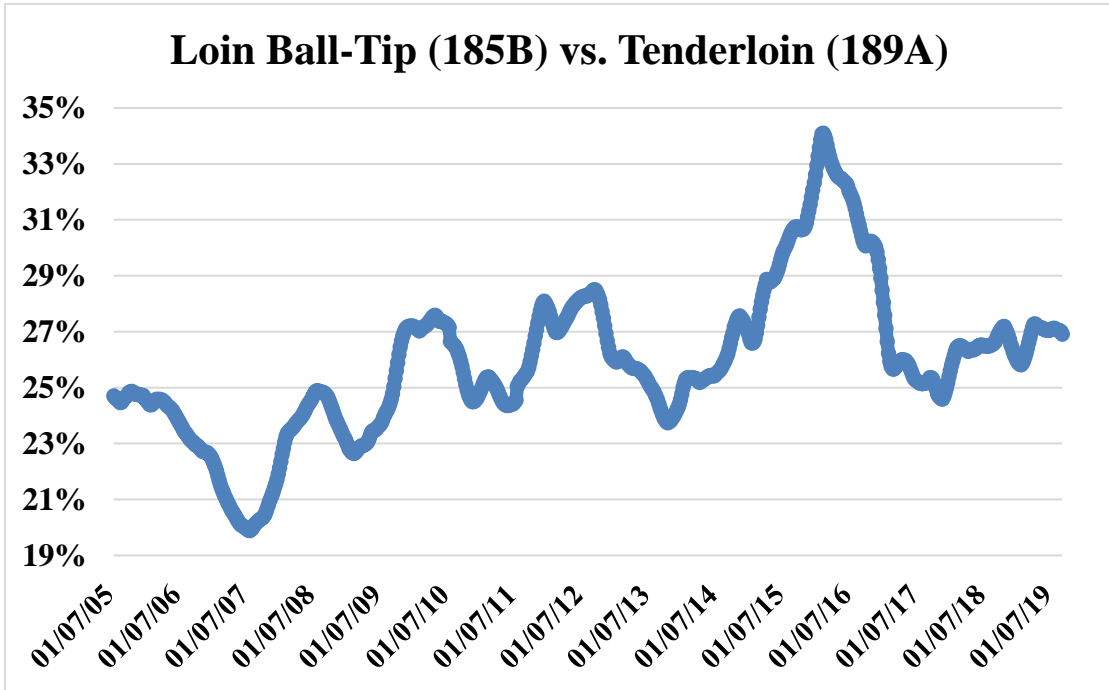


Figure B-18: BF 185D Loin Sirloin Tri-Tip Peeled 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

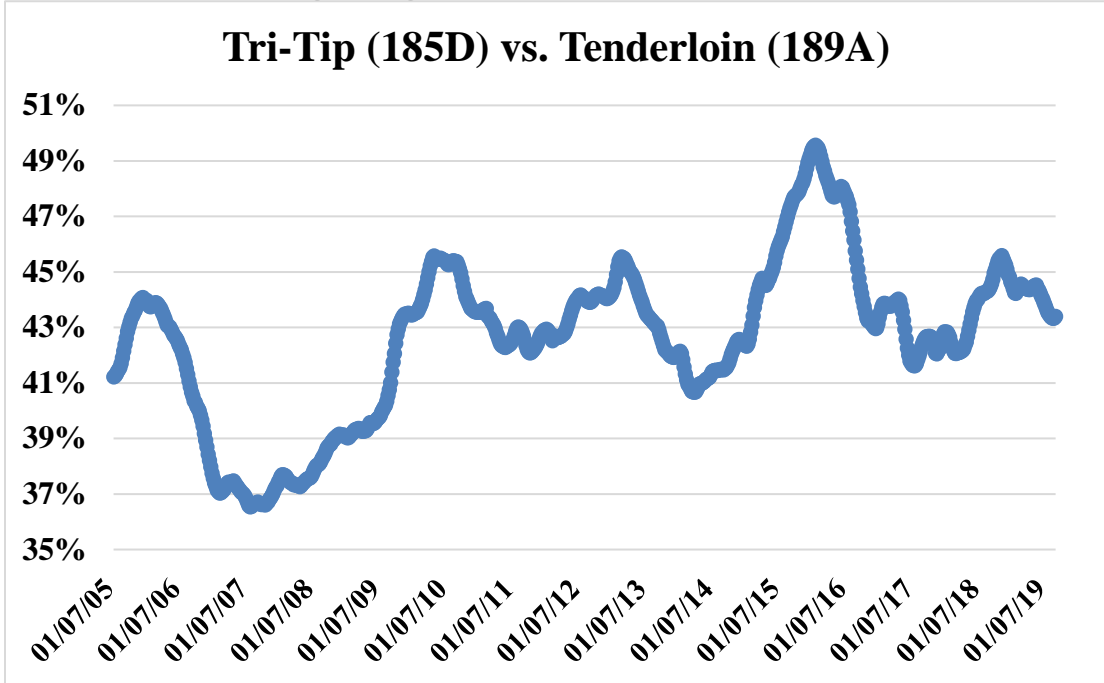


Figure B-19: BF 191A Loin Butt Tender Trimmed 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average

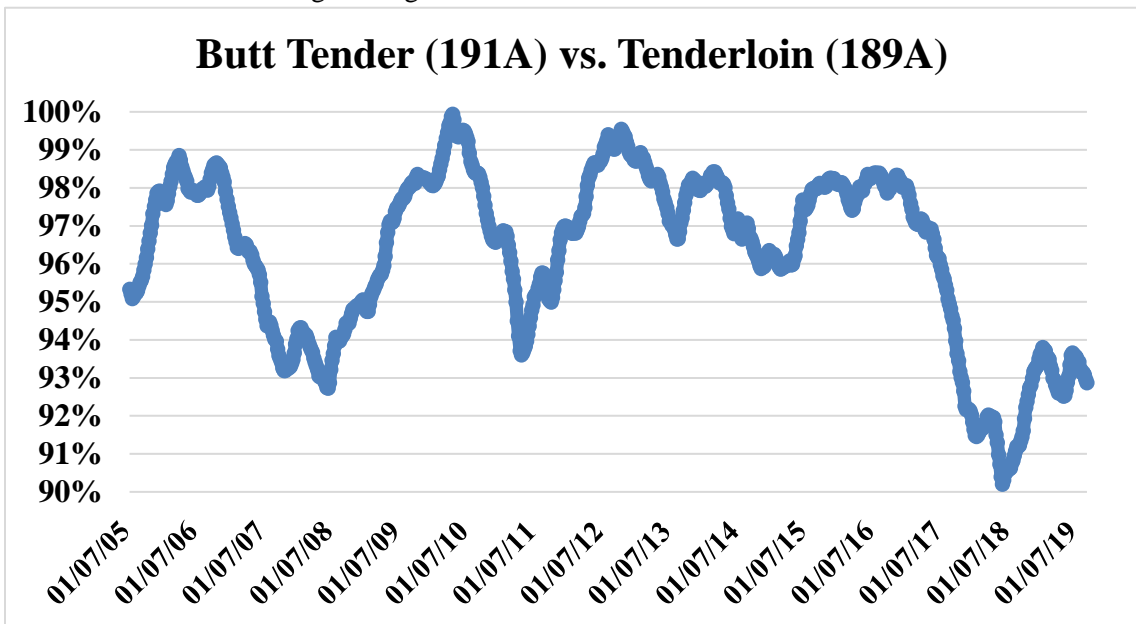
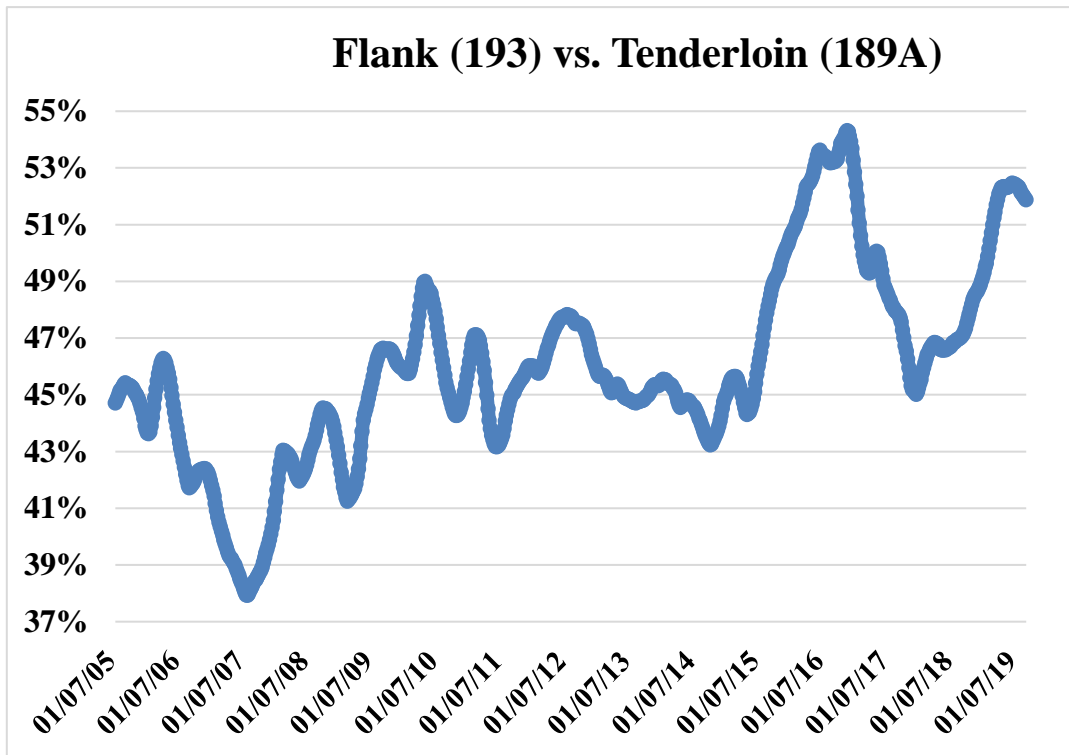


Figure B-20: BF 193 Flank 52 Week Moving Average as a percent of the BF 189A 52 Week Moving Average



APPENDIX C: CUT-OUT CHARTS

Figure C-1: BF 112A Ribeye Boneless 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

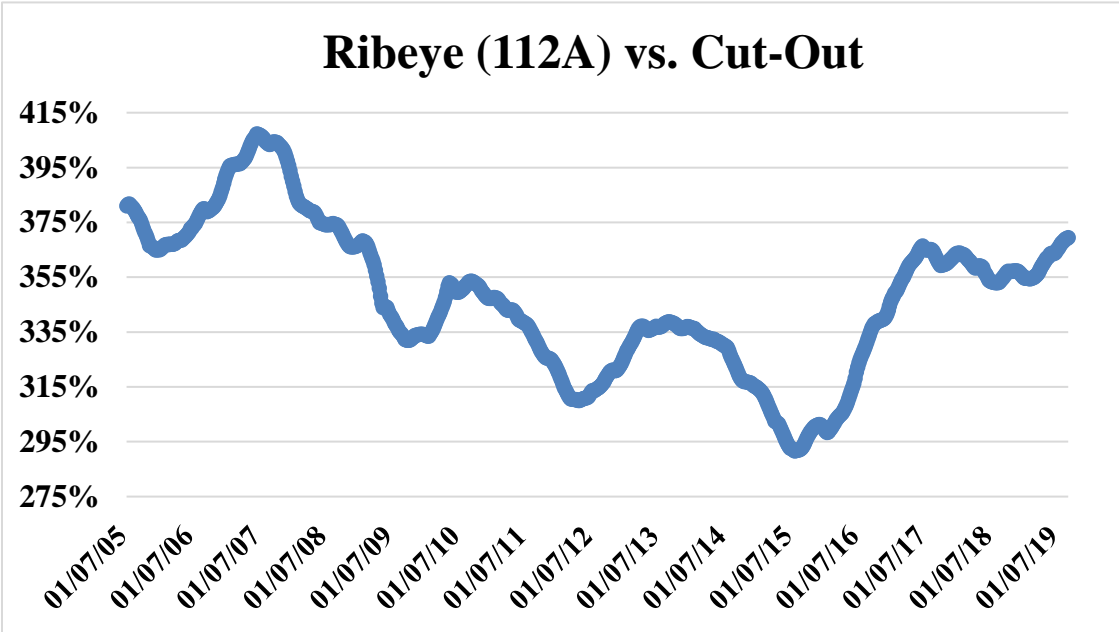


Figure C-2: BF 114A Chuck Shoulder Clod Trimmed 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

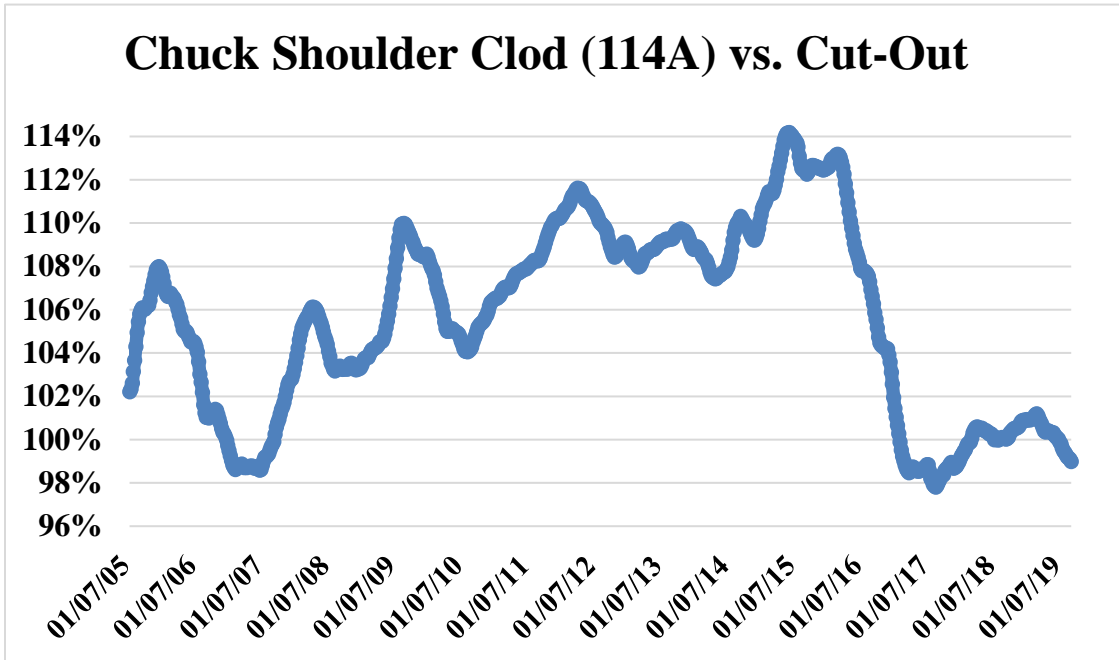


Figure C-3: BF 114D Chuck Clod Top Blade (Flat Iron) 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

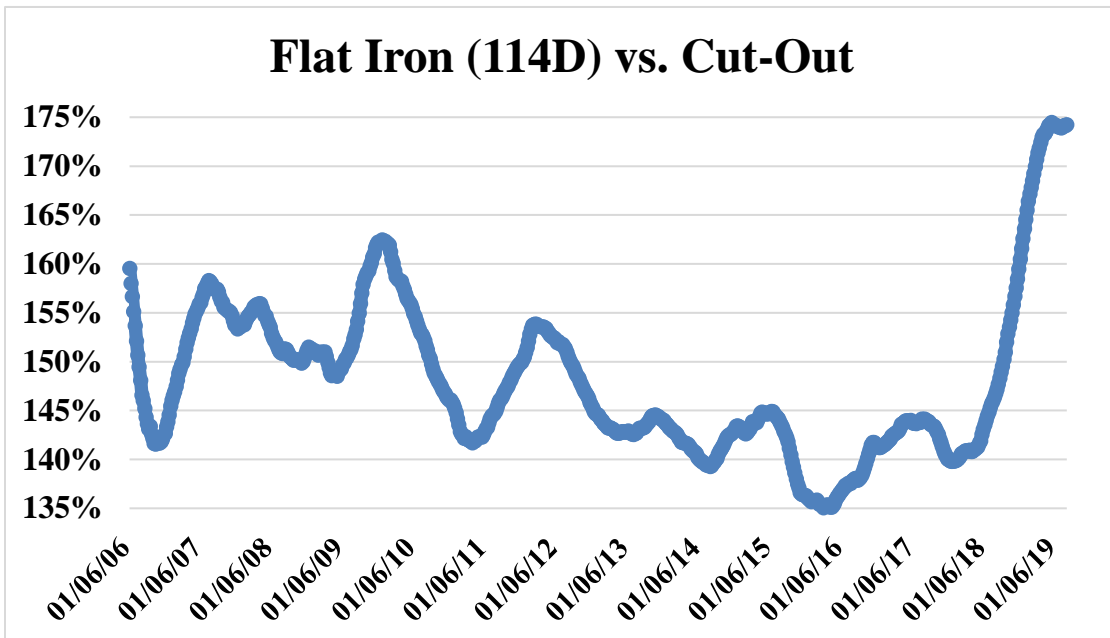


Figure C-4: BF 114F Chuck Clod Tender 52 Week Moving Average as a Percent of Choice Beef Cut-Out Week Moving Average

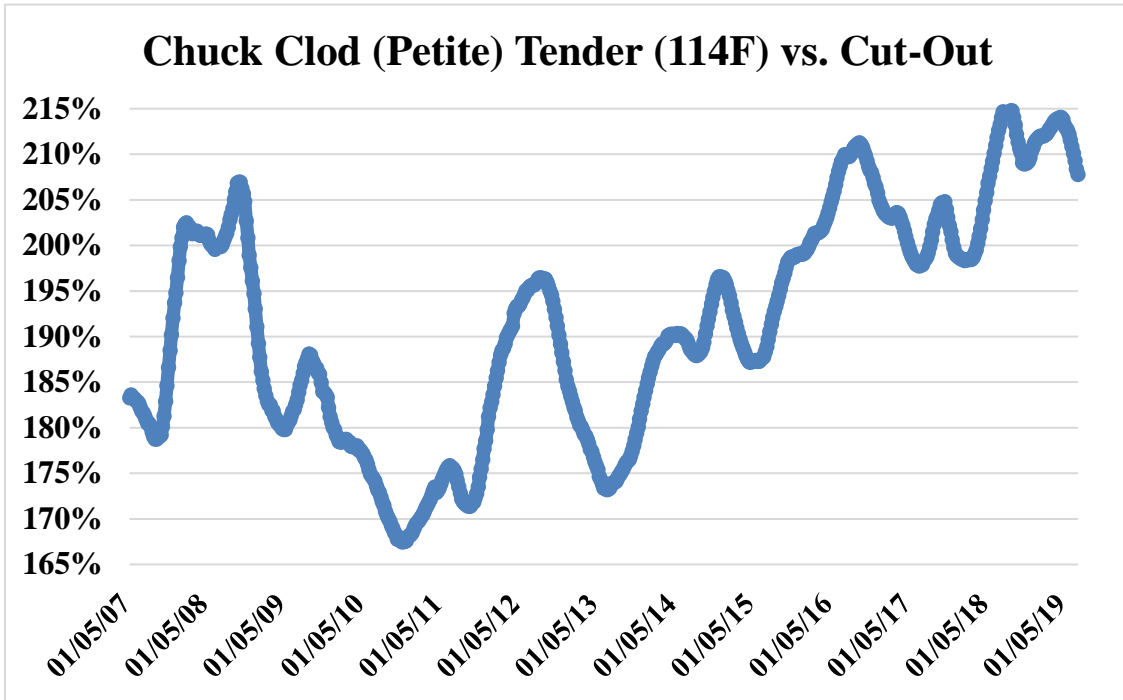


Figure C-5: BF 116B Chuck Tender 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

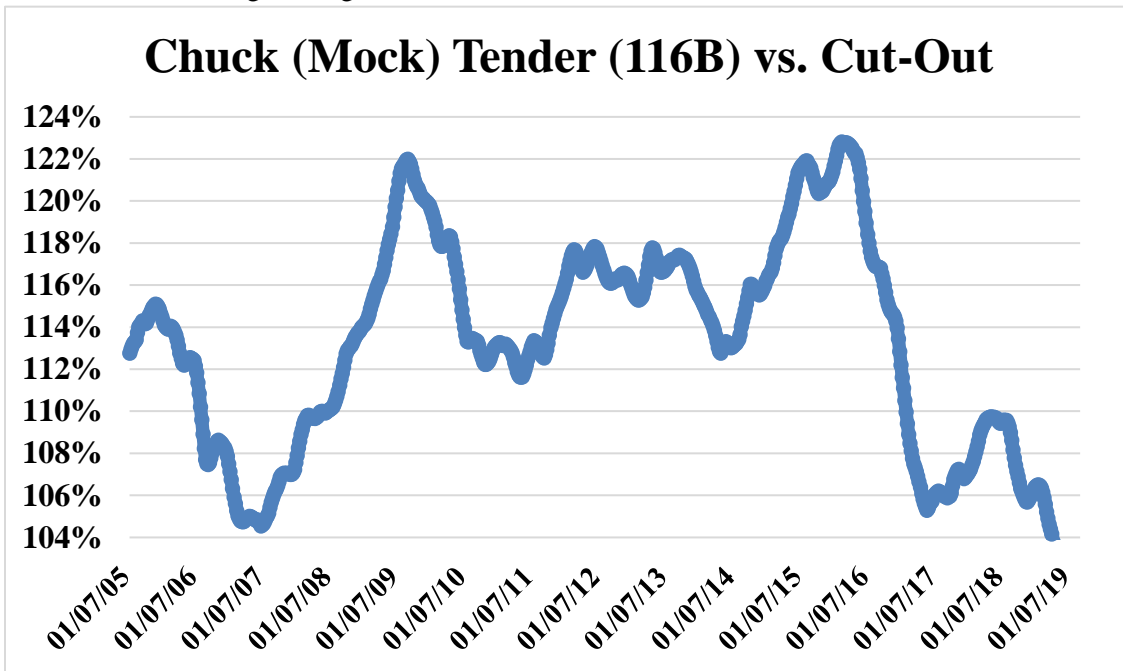


Figure C-6: BF 116B Trim 3 Chuck Roll Retail Ready 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

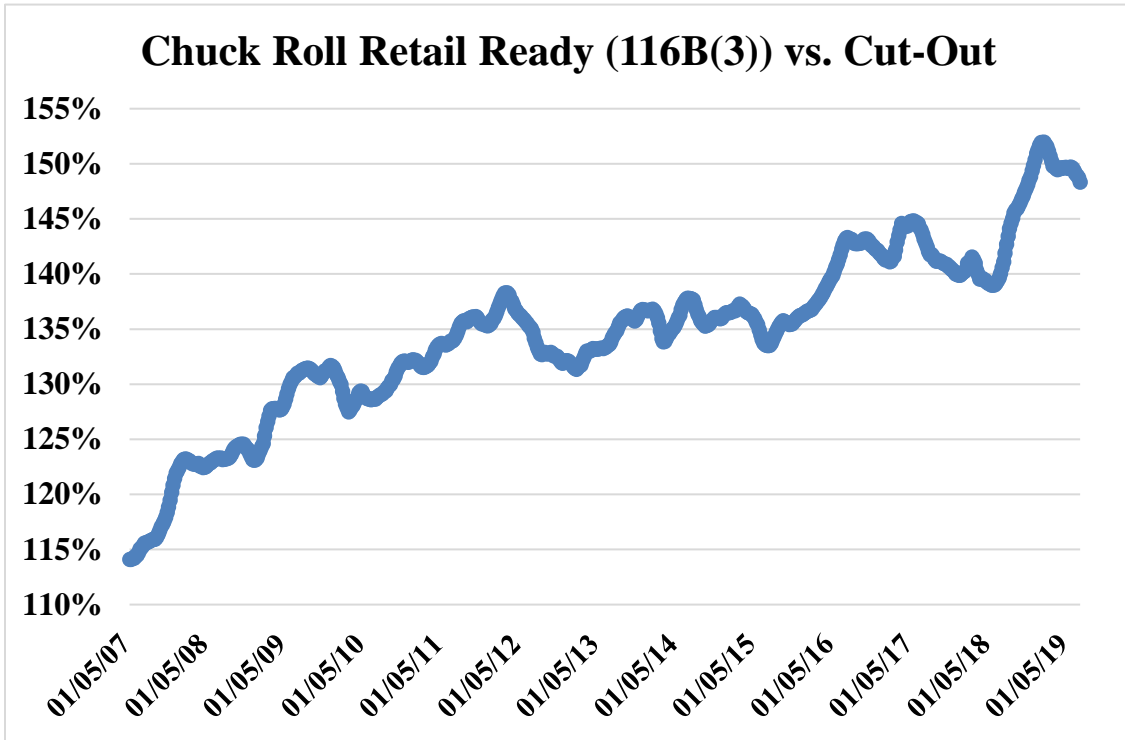


Figure C-7: BF 120A Brisket Point-Off Boneless 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

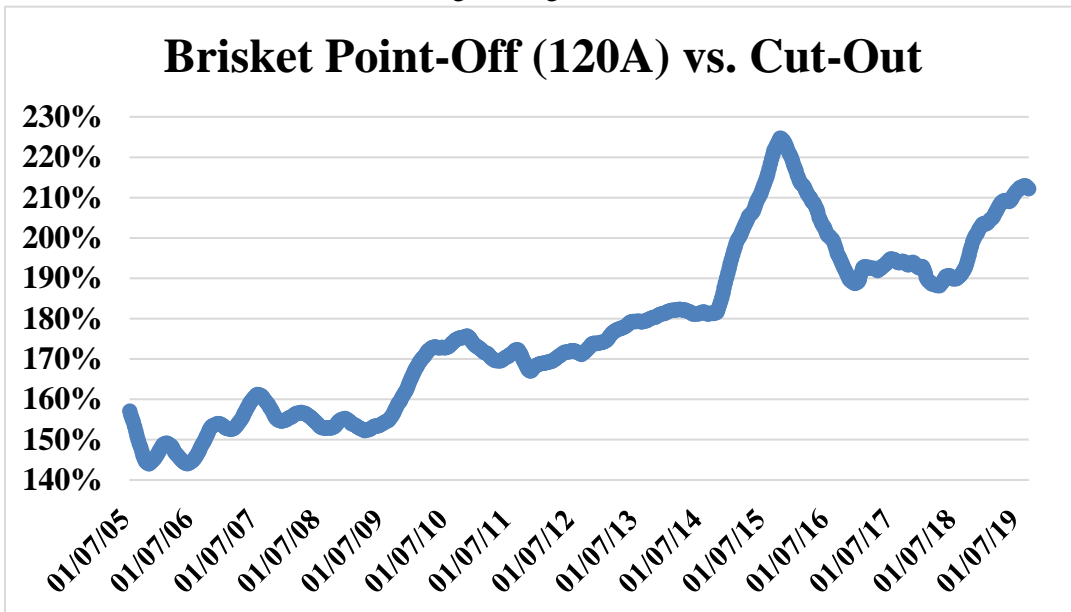


Figure C-8: BF 123A Short Plate Short Rib 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

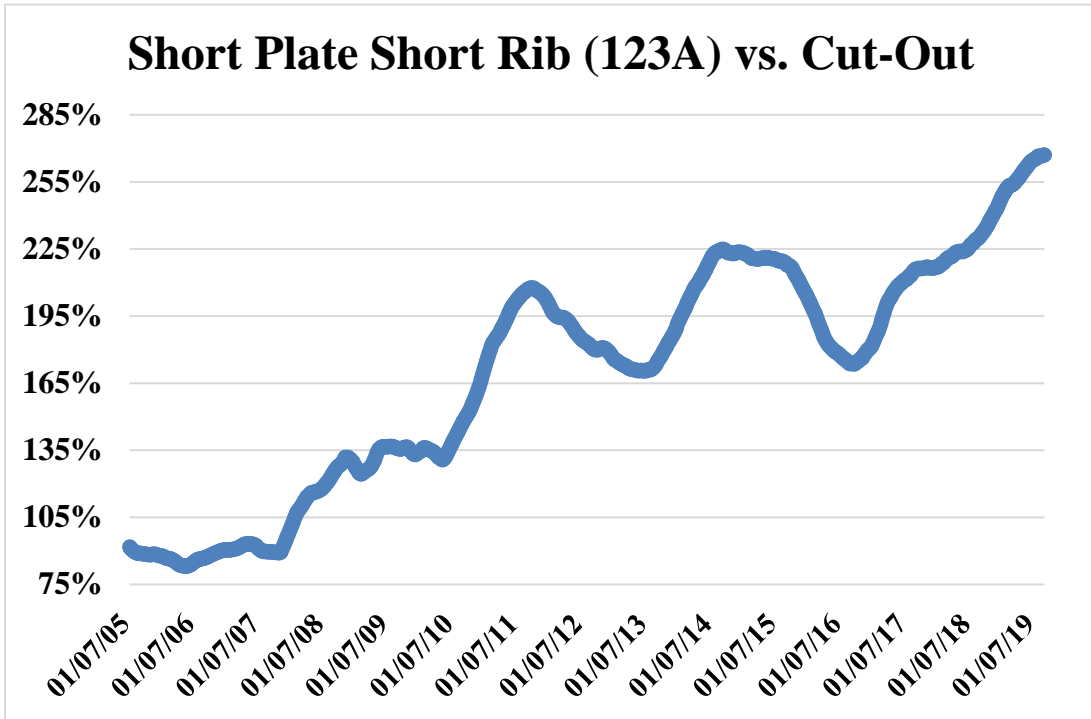


Figure C-9: BF 130 Chuck Short Rib 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

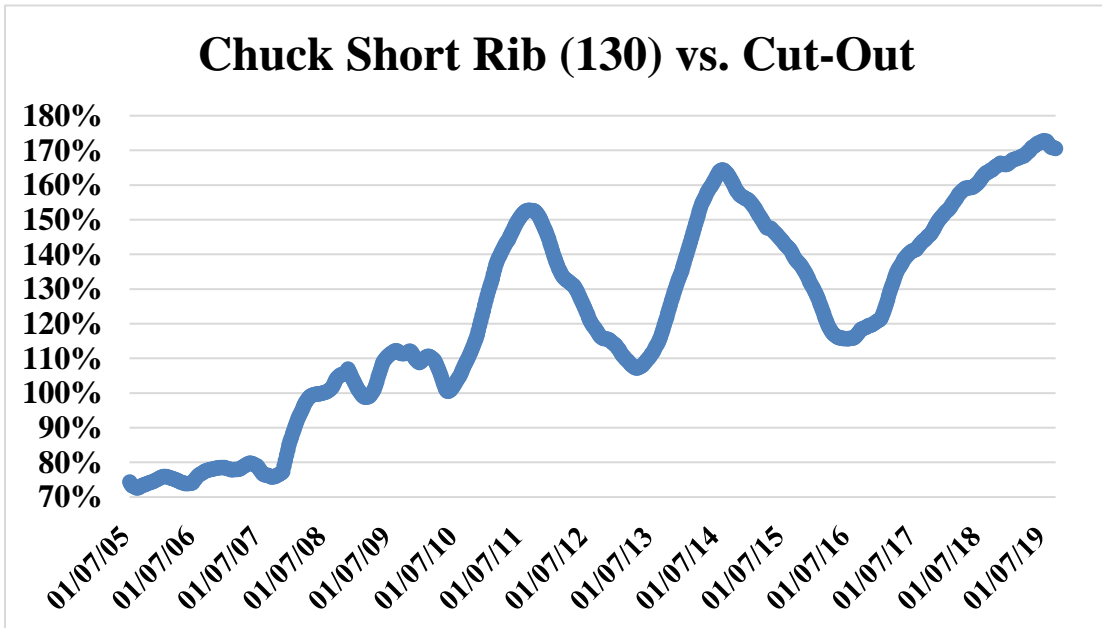


Figure C-10: BF 167A Round Knuckle Peeled 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

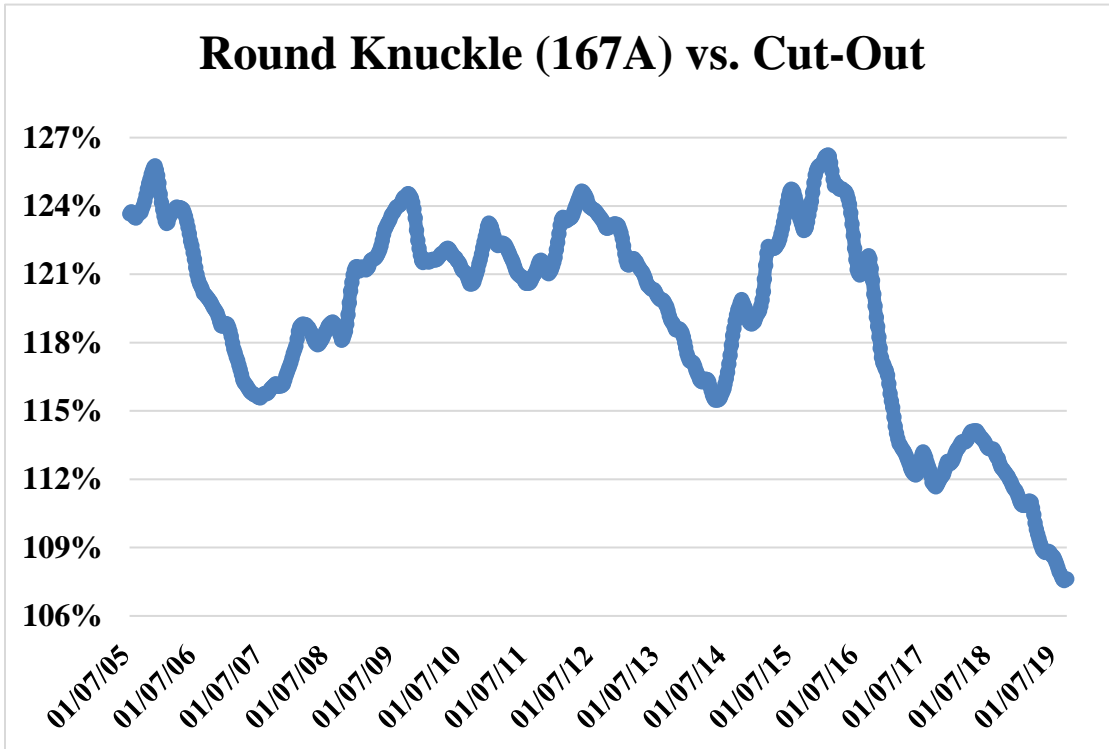


Figure C-11: BF 168 Top Inside Round 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

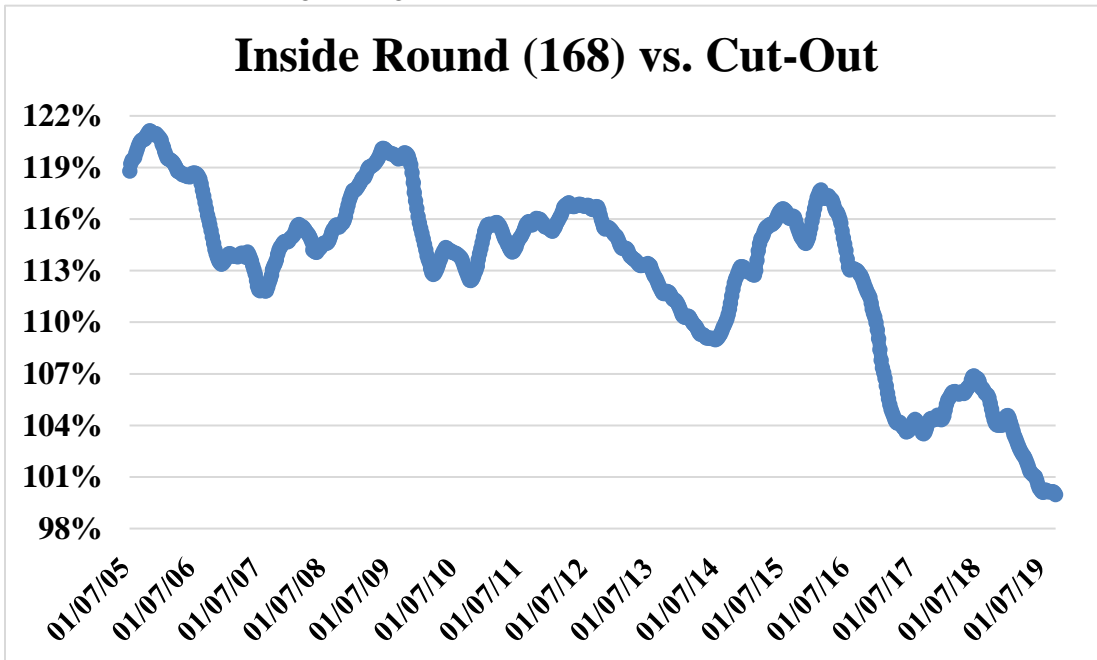


Figure C-12: BF 170 Gooseneck Round 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

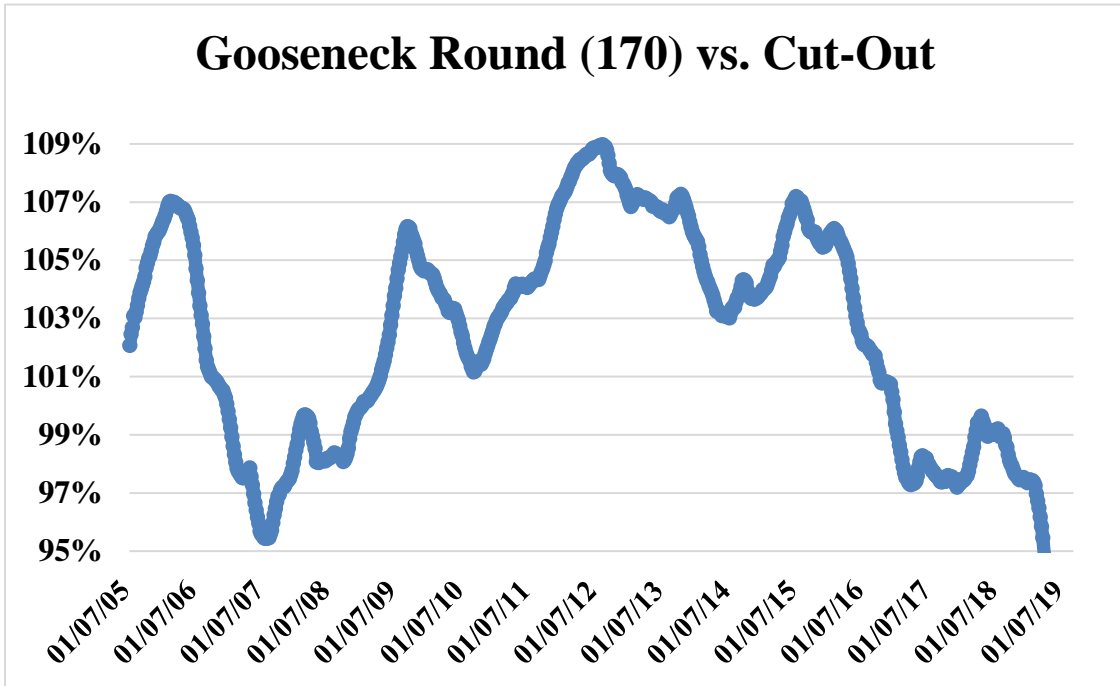


Figure C-13: BF 171C Eye of Round 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

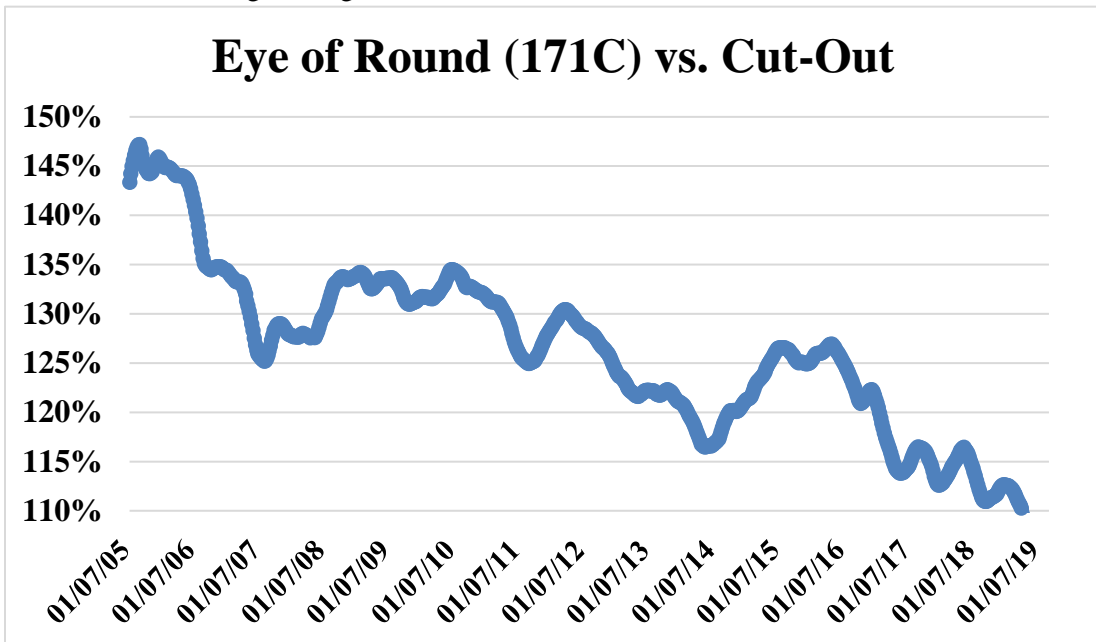


Figure C-14: BF 180 Strip Loin Boneless 0x1 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

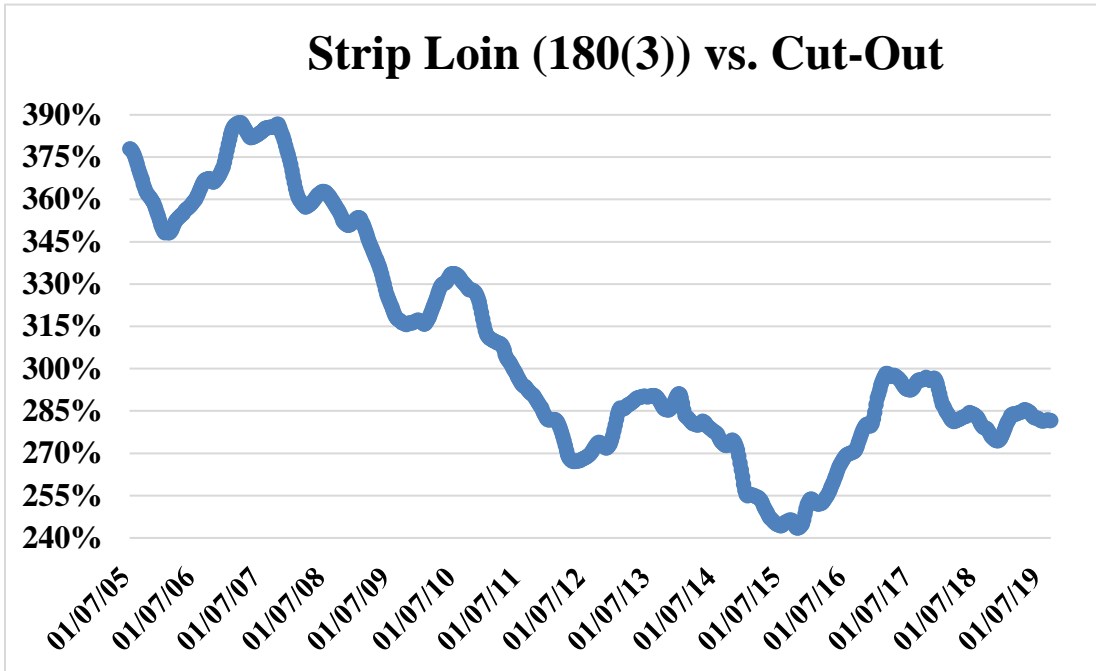


Figure C-15: BF 184 Loin Top Butt Boneless 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

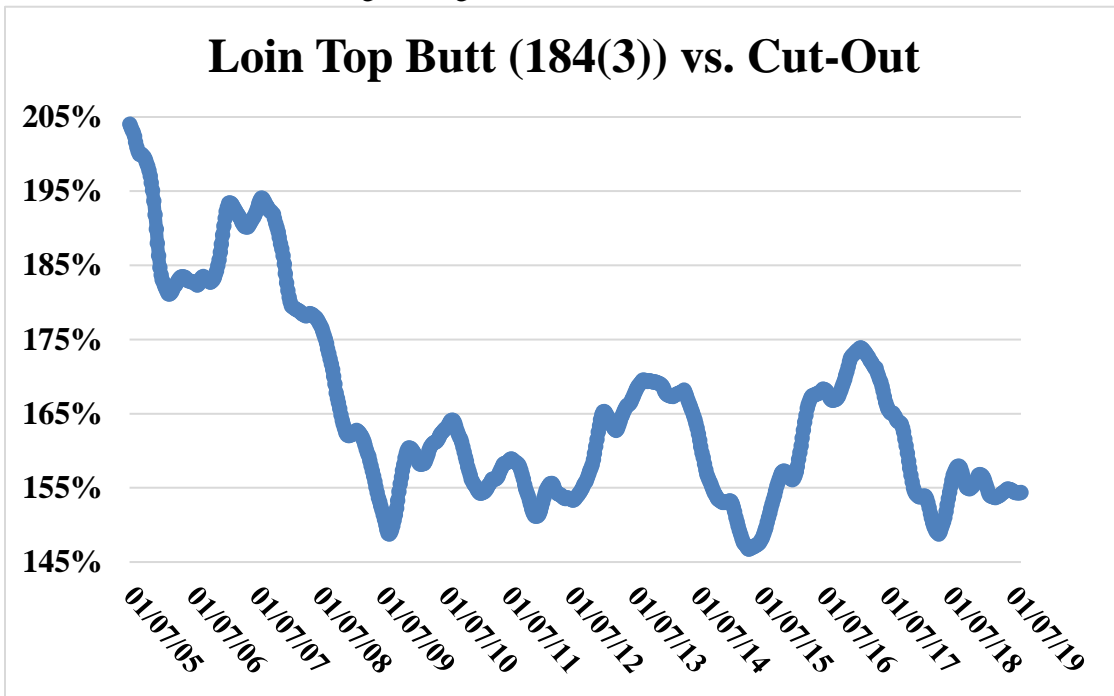


Figure C-16: BF 185A Loin Bottom Sirloin Flap 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

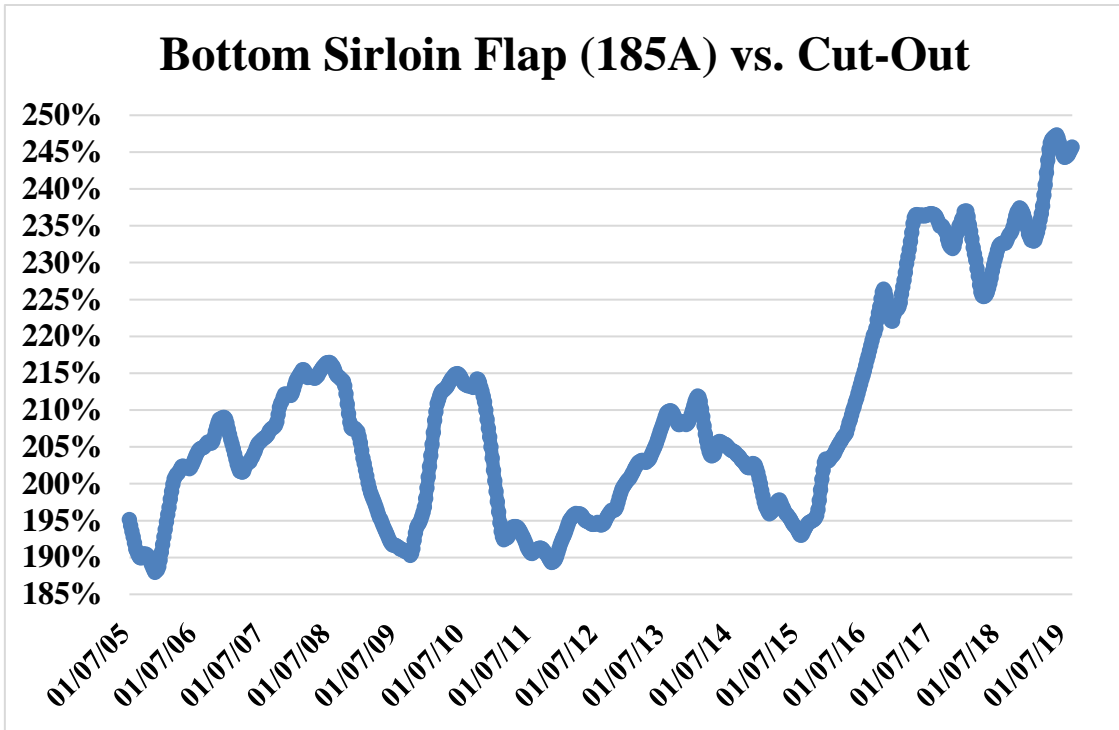


Figure C-17: BF 185B Loin Ball-Tip Boneless 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

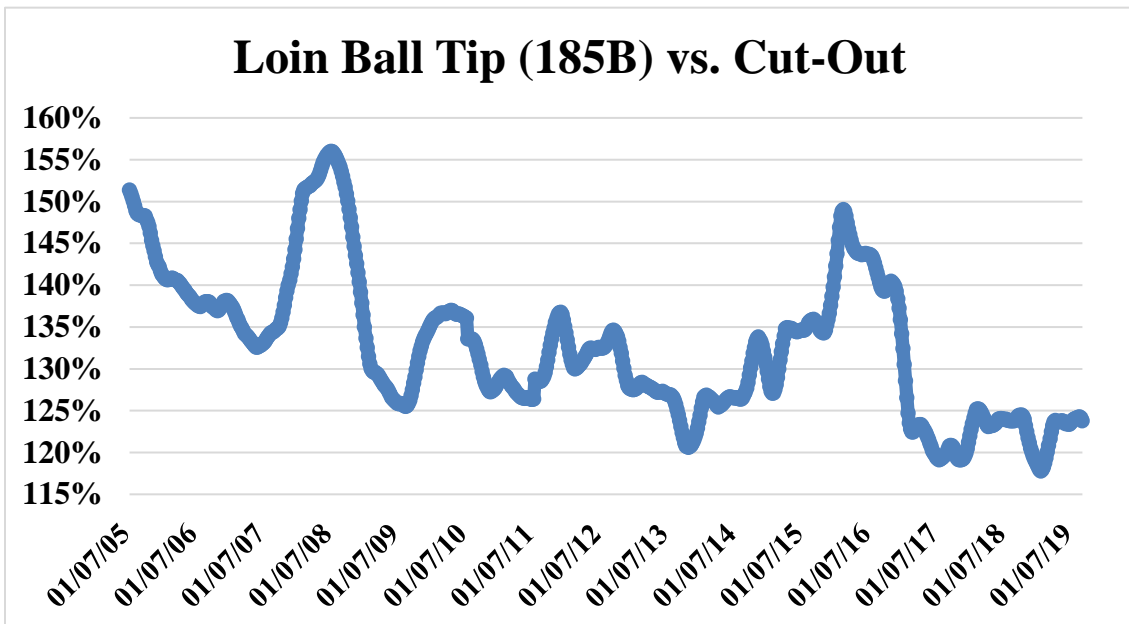


Figure C-18: BF 185D Loin Sirloin Tri-Tip Peeled 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

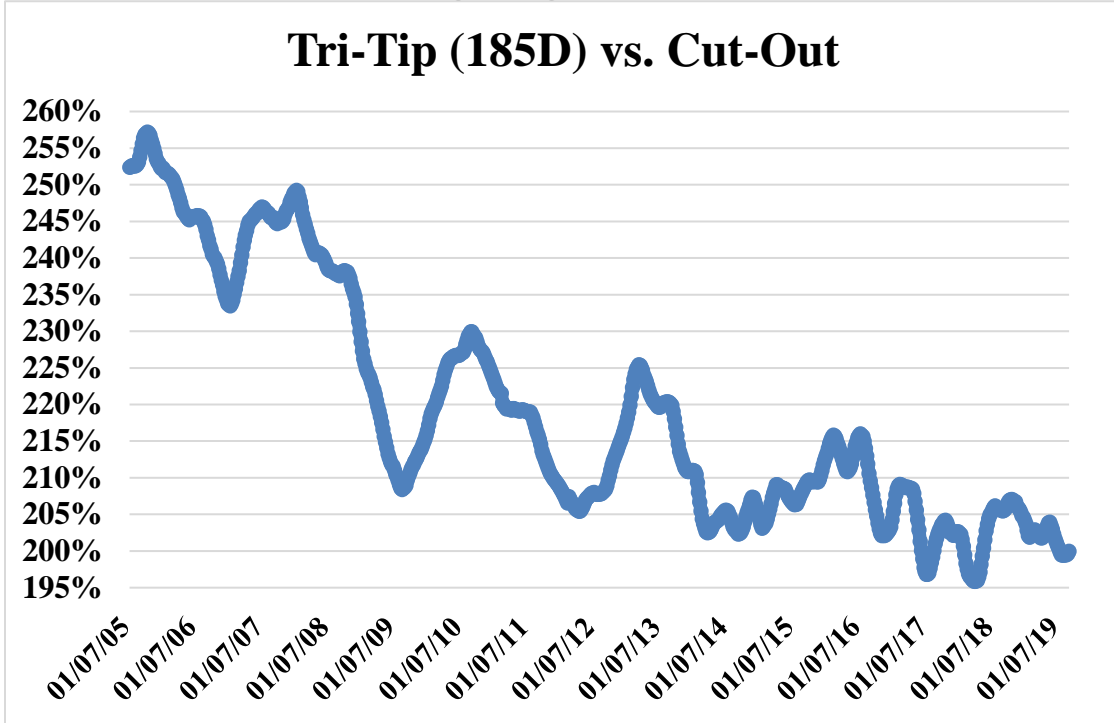


Figure C-19: BF 189A Tenderloin Trimmed Heavy 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

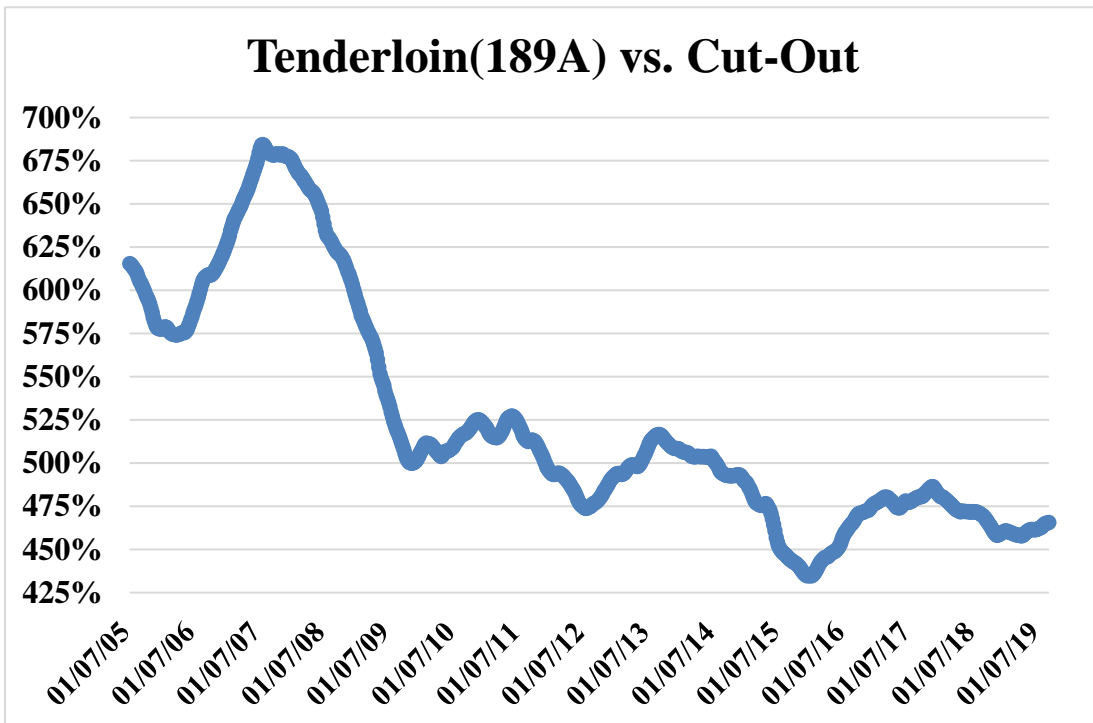


Figure C-20: BF 191A Loin Butt Tender Trimmed 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average

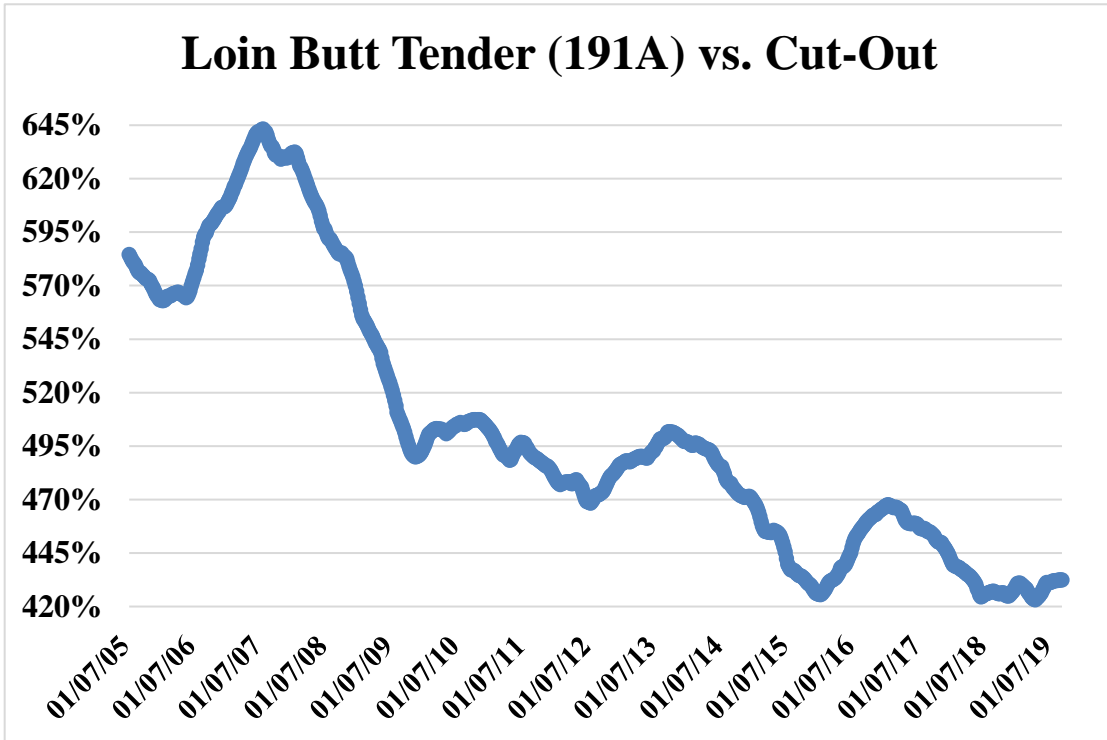
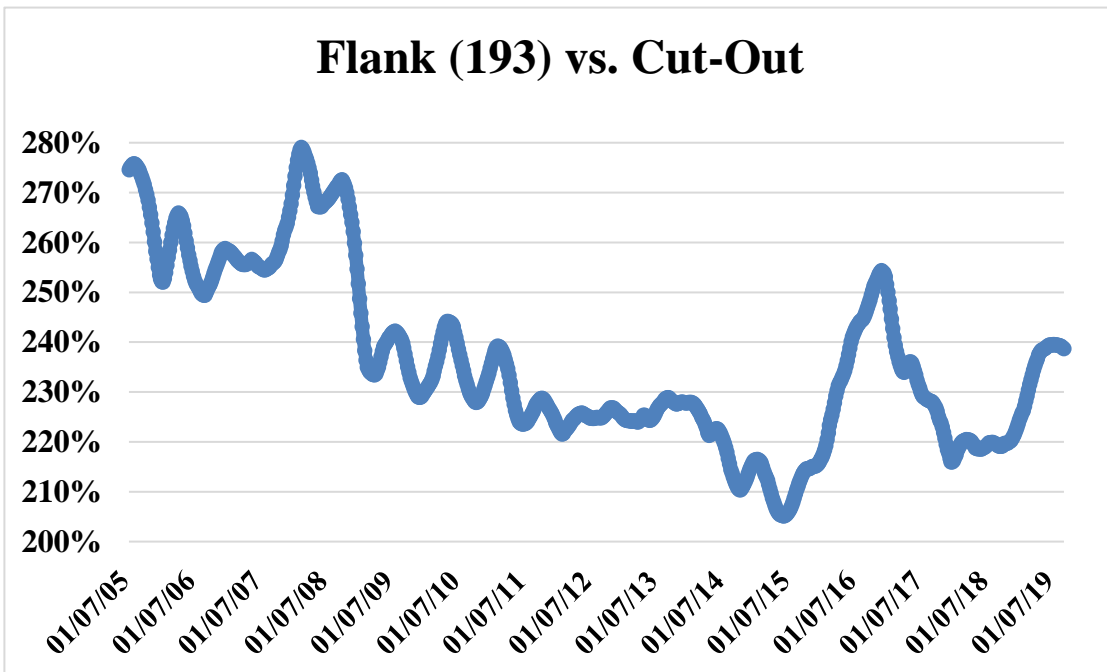


Figure C-21: BF 193 Flank 52 Week Moving Average as a Percent of Choice Beef Cut-Out 52 Week Moving Average



APPENDIX D: LIST OF INDUSTRY INTERVIEWS

CATEGORY	COMPANY NAME
Packer	Cargill Protein
	JBS USA
	Caviness Beef Packers
	AgriBeef Co.
Further Processor	Standard Meat Company
	Lopez Foods, Inc.
	US Foods
	NSP Quality Meats
Distributor	Ben E. Keith Company
	US Foods
	Performance Food Group
Retail	Albertsons Companies
	Safeway, Inc
	Publix Super Markets, Inc
Restaurant Groups	Hal Smith Restaurants
	Ruth's Hospitality Group
	Darden Restaurants
Industry Affiliates	Arrow Stream/ American Restaurant Association
	Certified Angus Beef
	EMI Analytics
	United States Meat Export Federation

APPENDIX E: GLOSSARY OF TERMS:

AMS (Agricultural Marketing Service): Component of the USDA that administers programs that create domestic and international marketing opportunities for U.S. producers of food, fiber, and specialty crops

Backgrounding operation (See also: Stocker Operation): Type of cattle operation in which calves too small to be fed in a feedlot setting are fed a roughage diet to gain weight and performance before being sent to a feedlot.

Beta-agonist: A class of non-hormonal compounds fed to cattle; binds to receptors on fat cells in the animals' body and redirects and reduces the metabolism of fat.

Beef: Any product derived from bovine.

Beef Check-Off: A producer funded marketing and research program designed to increase demand for beef domestically and internationally.

Bench trim: Beef trimmings created while fabricating or cutting beef cuts from cattle that were not slaughtered on site at the establishment. Bench trim is generally created from cutting and trimming steaks and roasts at a steak cutter or further processor, not at a processing plant.

Block pack (ground beef): Ground beef items sold in a clearly packaged tray that allows the customer to visually see the product in the meat case.

Block ready: Roasts or other subprimal cuts that are closely trimmed, generally sold to retail for in house butchers to cut steaks for the retail meat case.

Boxed beef: Wholesale cuts of beef, such as the chuck roll, rib roast, or tenderloin, that are packaged in vacuum sealed packages and placed into a box to be shipped to further processors, grocery stores, distributors, or food service.

Branded program: Packers, distributors, retailers, or other end users that market beef items meeting specific quality requirements under a private brand label.

Brisket: Beef carcass primal located in the chest of the animal, often separated and sold as point and flat halves (front and back).

Broker: Someone who buys or sells beef products, may work for a packer, further processor, steak cutter, distributor, retail, or food service group.

Cap and Wedge (see also: Lifter meat): thin muscle tissue removed from the outside of the rib primal.

Carcass: animal once it has been eviscerated, and the head, tail, feet, hide, and internal organs have been removed.

Case ready: Roast or steak products are cut, trimmed, and packaged in vacuum sealed or foam trays covered in plastic wrap that is prepared by the packer and sent to retailers who can put the product directly in to the meat case.

Chub (Ground beef): ground beef product sold in a cylindrically shaped package in various sizes sold at retail.

Chuck: Beef primal located in the shoulder area of the carcass, comprises roughly 30% of the carcass.

Cooker: A further processor that takes bench trim and other raw protein products and cooks various items like pepperoni, taco meat, and other beef products that are sent to retail or food service as a fully cooked, not raw, product.

Cowboy Ribeye: A bone-in Ribeye steak with three to six inches of the rib bone still attached.

Cow/calf operations: Cattle operation consisting of mother cows who produce calves that will go into the beef supply chain.

Cut-Out (Boxed Beef) Values: The estimated gross value of a beef carcass based on the prices paid for individual beef items from each of the seven primals derived from the carcass.

Cutter/Cutting House: Further processor that cut primals or subprimals into individually portioned steak or roast products per customer specifications.

Distributor: an intermediary which buys boxed beef from packers and sells them to further processors, retail, and food service based on customer specifications.

End cut: Term used to describe cuts or subprimals from the lower valued primals outside of the rib and loin (middle meats).

ERS (Economic Research Service): Component of the USDA and a principal agency of the Federal Statistical System of the U.S.; provides information and research on agriculture and economics.

Export: Products that are sent to another country outside of the United States.

Fabrication: The process of breaking down the carcass, removing hide and internal organs, and cutting out muscle cuts.

Fed cattle: Steers or heifers slaughtered that are fed grain in a feedlot setting before harvest.

Feedlot: Cattle operations in which large numbers of cattle are fed a nutrient dense diet of grain and roughages for several months until they are ready for slaughter.

Flank: Beef carcass primal consisting of the transverse abdominis muscle which lies in front of the rear leg of the beef carcass.

Fresh Trim: The fat and muscle tissue removed from the carcass during the slaughter and fabrication process; can be used for ground beef or other further processed products; not to be confused with **bench trim**.

Food Service (see also: HRI): Restaurants and institutions that provide food products in hospital, university, prison, assisted living, or other cafeterias.

Formula Pricing: Type of pricing agreement between packers and buyers in which a price is negotiated based on a base price and agreed upon adjustments.

Forward Pricing: Type of pricing agreement between packers and buyers in which a price is based on the USDA reported price or other base price either at the time of purchase or for later of delivery.

Further processor: Processor that takes raw beef materials and cuts steaks or roasts, trims, grinds, marinates, slices, dices, adds seasoning, flavoring, sauces, or further processes the item in any other way, converting it from a raw to further processed or value-added product.

Grinder: A further processor that utilizes trim or whole muscle cuts and grinds the raw product into ground beef or ground beef patties for retailers and food service fresh or frozen.

Halal: Refers to meat prepared as described by Muslim law.

Heifer: Young female bovine animal who has not yet produced offspring.

HRI (See also: Food Service): Hotels, restaurants, and institutional customers; provide food products in hospital, university, prison, assisted living, or other cafeterias.

IMPS (Institutional Meat Purchase Specifications): industry-consensus specifications maintained by the USDA, AMS, Livestock, Poultry and Seed Program, Quality Assessment Division, Standard Branch

LMIC (Livestock Marketing Information Center): Provides economic analysis, market projections, market situation, and outlook through support materials utilizing USDA and other data sources.

Lifter meat (see also: Cap and Wedge): thin muscle tissue removed from the outside of the rib primal.

Loin: Beef primal located between the rib and round primals on the carcass. Includes the sirloin, short loin, and tenderloin subprimals, and makes up roughly 17% of the carcass.

Import: Products brought into another country.

IMPS: Institutional Meat Purchase Specifications; universal numbering system for meat products sold which describe specific production specifications for all cuts sold commercially.

Margin: Also, profit margin, the difference between what the product is sold for and what it was purchased for, how beef sellers determine how much profit is made off of each product sold.

Matched Cattle: A term used to describe a buying system in which an entire carcass equivalent in boxed beef is purchased from the packer. Simply purchasing all boxed beef products that would make up one carcass (all boxed beef items available from all primals).

Middle cuts: Cuts from the loin and rib primals.

NAMI (North American Meat Institute): Non-profit trade association comprised of meat processing companies, and supplier and allied members.

NASS (National Agricultural Statistics Service): Component of the USDA; conducts hundreds of surveys every year and prepares reports covering all aspects of U.S. agriculture.

NCBA (National Cattlemen's Beef Association): the marketing and trade organization representing the American beef and cattle industries.

Non-fed: Cattle that are not fed in a feedlot setting with a grain based diet, also includes cattle slaughtered that are bulls, cows, or are past the 30 month age requirement for A maturity carcasses.

No roll: Carcasses that are not graded (do not receive a USDA grade).

Offal: (See also Variety Meat) refers to any internal organs (non-muscle tissue) that are used for human consumption; include tripe, tongue, liver, and kidney.

Oxtail: A beef cut made up of the skinned beef tail removed from the carcass between the 2nd and 3rd coccygeal vertebrae, sold whole or as disjointed sections.

Packer: Refers to any company that slaughters cattle and often includes fabrication of carcasses into boxed beef products that are sold to a variety of end users.

Plate: Beef primal that lies between the flank and brisket, and is made up of the bottom of ribs 6-10.

Primal: Large sections of the beef carcass with similar muscle characteristics; includes the chuck, round, rib, loin, flank, brisket, and short plate.

Retail grocery: Grocery stores or markets that sell meat products directly to consumers.

Rib: Beef carcass primal comprising of the rib section of the beef carcass including ribs 6-12.

Ribeye: From the rib primal, also called prime rib, and can be a steak or roast, a specific cut from the Rib primal.

Round: Beef carcass primal located in the back leg region of the carcass; comprises roughly 23% of the carcass.

Seed stock operation: Cattle operations that provide genetic supplies to other producers to improve the genetic capabilities of a breed or particular herd.

Spot pricing: Type of pricing agreement between packers and buyers in which the product is priced based on the current USDA reported market price.

Stocker Operation (See also: Backgrounding operations): Type of cattle operation in which calves too small to be fed in a feedlot setting are fed a roughage diet to gain weight and performance before being sent to a feedlot.

Sub-primal: Beef carcass primals that are broken down into smaller sections of muscle, bone and fat which are then further broken down into roasts, steaks, and trim.

Steer: Male bovine animal that has been castrated.

Tenderloin: Also, Filet Mignon, filet; subprimal comprised of the psoas major, psoas minor, and iliacus muscles.

Tomahawk Ribeye: A bone-in Ribeye steak similar to the Cowboy Ribeye with the entire rib bone, trimmed of all meat, is still attached to the muscle.

USDA (United States Department of Agriculture): The U.S. federal executive department responsible for developing and executing federal laws related to farming, forestry, and food

Value-Added: Refers to products that are meat plus ingredients or products that are sliced, diced, marinated, seasoned, chopped, et cetera or are innovative cuts as created by the Beef Check-Off Beef Value Cut program funding.

Variety Meat: (See also Offal) refers to any internal organs or entrails that are used for human consumption; include tripe, tongue, liver, and kidney.

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