

Should Beef Quality Grade be a Priority?

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Summary

In the wake of severe weather conditions and higher feed costs in recent years, the U.S. cattle inventory has continually been downsized. The decades-low U.S. cattle inventory has many in the livestock industry discussing the potential for growth. Now, with improved economic conditions and strong beef demand affecting today's market situation, beef producers will likely begin to grow their operations and rebuild their herds in the near future. However, uncertainty regarding the "correct" rebuilding strategy remains.

This study aims to provide insight on the importance of beef quality as part of a rebuilding strategy by differentiating beef demand for various quality types including USDA Prime, USDA Choice/Branded, USDA Select, and the *Certified Angus Beef*[®] (CAB[®]) brand. Ordinary least squares (OLS) regression procedures were used to estimate single demand equations for each quality category, producing monthly own-price, cross-price, and income elasticities.

Own-Price

- Results show Prime beef to be more own-price elastic than other beef quality types at -2.33%. In other words, as the price of Prime beef increased by 1%, the quantity of Prime beef consumed should fall 2.33%. Similar to Prime beef, CAB[®] has an own-price elasticity of -2.26%.
- However, results show Select beef has an own-price elasticity of -1.24%.
- These findings lead to the reciprocal ($1/n$), or Price Flexibility of -.43% for Prime, -.44% for CAB[®] and -.81% for Select. A price flexibility expresses the expected price change that would result from changes in quantity supplied to the market.
 - As the supply of CAB[®] and Prime beef increases, the market premium is less likely to decline than when lower quality beef supply increases. (A 1% increase in Prime beef supply could bring a 0.43% decline in price, but a similar increase in Select beef could bring nearly twice as much price decline.) That's good news for producers who can hit the higher quality targets.

Cross-Price

- Cross-price elasticities were positive across all beef categories, implying substitution among beef quality categories and between beef quality categories and competing meats. However, the degree of substitution differs between quality categories. Lower quality beef faces the strongest price-pressure from competing meats.

Income

- Income elasticities are strong for most beef quality types. As income increases by 1%, demand for CAB[®] products, specifically, increases by 1.63%. As income increases, consumers are likely to eat more beef, especially higher quality beef.

Trend

- A significant trend was found independent of prices and income that suggests stronger demand for higher-quality beef and weaker demand for lower-quality beef. This trend term identifies all factors that influence consumer demand beyond economic factors. Examples include factors such as increased product consistency or quality or marketing programs that build consumer awareness about the products.

Value

- Production of higher-quality beef adds value to the beef industry. From 2005-2013, quality premiums associated with prime and branded grades added nearly \$4.5 billion to the beef industry.

Analyzing beef demand differentiated by quality type suggests that beef quality should be a key component of any rebuilding strategy. However, it is important to remember that quality beef is the result of many factors of production such as genetics, handling, and nutrition. Beef production and management decisions made in the near term will determine the future success of cattle herds across the U.S., and ultimately, the success of the U.S. beef industry.

Introduction

The U.S. cattle inventory was at 87.7 million head at the beginning of 2014, the lowest inventory for the beef industry since 1951 (USDA, 2014). Severe cases of drought, greater instability of markets, and higher feed costs led many U.S. cattle producers to downsize their herds in recent years. Given strong beef demand, cattle producers will be looking to rebuild their herds as more favorable economic conditions arise. Genetics, production, and management decisions made in the near term will determine the future success of the beef industry. More importantly, beef producers must strive to provide products that will meet consumer desires in order to sustain and improve beef demand, the ultimate factor driving the size of the cattle industry moving forward. The objective of this study is to provide empirical estimates of own-price, cross-price, and income elasticities for beef quality types including USDA Prime, USDA Choice/Branded, and USDA Select beef, as well as *Certified Angus Beef*[®] (CAB[®]). This approach allows for comparison of these estimated elasticities to help determine the best production focus for the future of the beef industry.

Regarding consumer beef demand, recent studies suggest a strong consumer focus on quality (e.g. Schroeder et al, 2013; NBQA 2011). Quality can embody many factors in today's beef industry including nutritional value, healthiness, animal welfare, and environmental concerns. However, Schroeder et al (2013) addressed beef product quality, in terms of flavor, color, tenderness, and juiciness. Throughout this study, "beef quality" will refer to these beef sensory characteristics. Beef quality as it is defined here is largely determined by USDA quality grade as beef of a higher quality grade will have more intramuscular fat which improves flavor, juiciness, and perceived tenderness. Such characteristics contribute to an enjoyable eating experience for the consumer which ultimately drives customer satisfaction and beef demand (Schroeder et al 2013).

With product quality being an important and feasibly influenced determinant of beef demand as addressed by Schroeder et al, differentiating beef demand by quality types (USDA Prime, Choice, Select, and Branded) will help determine whether a quality focused rebuilding strategy could pay long-run dividends for the beef industry.

The Importance of Branded Beef: CAB[®] Leads the Way

Looking back at some big events in the beef industry, beef demand fell nearly 50% from the mid 1970s to the late 1990s (Schroeder et al, 2000; Grimes, 2004). Since the late 1990s, the beef industry has made significant progress rebuilding beef demand with the introduction of branded beef programs being one of the industry's most influential efforts. *Certified Angus Beef*[®] (CAB[®]) was introduced in 1978 as the first United States Department of Agriculture (USDA)-certified beef program and has remained the largest beef brand. Additional branded beef programs developed slowly after the introduction of CAB[®], but from 1998 to 2012, 129 new programs hit the market place (Speer, 2013). In 1995, Brester and

Schroeder linked branded beef advertising to increased meat consumption and also found substitution among meat commodities as a result of brand advertising. Due to branded programs' influence on beef demand and their important role in the beef industry, it will be useful to consider branded beef when differentiating beef demand by quality grade. A large portion of today's beef supply is made up of beef grading Choice. Focusing on programs, such as CAB[®], that target the upper end of the Choice grade may provide further information regarding consumer demand for higher-quality beef.

Consumer Demand for CAB[®] branded products and USDA Quality Grades

While there is plenty of research available regarding beef demand, very little research has focused on disaggregating beef demand for various quality grades. Going back to 1966, Colman estimated the elasticity for two grades of ground beef. Although the USDA grading system has gone through several changes since Colman conducted this research, his findings are still useful. He showed that beef is not a homogenous commodity and that each grade has its own demand characteristics, supporting the idea of differentiating beef demand by quality grade. Furthermore, his single equation demand model may still be useful in estimating elasticities across various beef quality types present in the beef marketplace today.

In 2001, Lusk et al estimated demand for wholesale quality differentiated boxed beef and looked at the effects of seasonality on beef demand. Choice and Select beef own-price elasticities estimated by Lusk et al were -0.43 and -0.63, respectively, and demand for Select graded beef was more elastic than demand for Choice graded beef across all four quarters of the year. Additionally, Lusk et al examined seasonality effects, identifying more inelastic demand for both Choice and Select graded beef during the summer months. Lusk et al made significant contributions to differentiating beef demand across beef quality types. However, a more comprehensive study including Prime, Choice, Select, and Branded beef demand analysis will provide a more detailed picture of consumer beef demand differentiated by quality type.

More recent research by Zimmerman and Schroeder (2013) compared CAB[®] with commodity beef to allow for better understanding of consumer demand and where the CAB[®] brand stands within the beef industry. Their study presented estimates for wholesale beef demand separated into USDA Choice-and-higher, CAB[®], and non-branded USDA Choice using USDA boxed beef and CAB[®] data. Demand elasticities were not estimated, but were obtained by surveying expert livestock economists. The survey resulted in an annualized elasticity of -0.54 and -0.87 for USDA Choice-and-higher and CAB[®], respectively. Results from Zimmerman and Schroeder's study showed Choice-and-higher beef demand declined in recent years while CAB[®] demand continued to improve.

This research takes a different approach to evaluate consumer beef demand, estimating own-price, cross-price, and income elasticities for USDA Prime, CAB[®], USDA Branded/Choice, and USDA Select quality categories using monthly USDA load data and single equation OLS regression procedures.

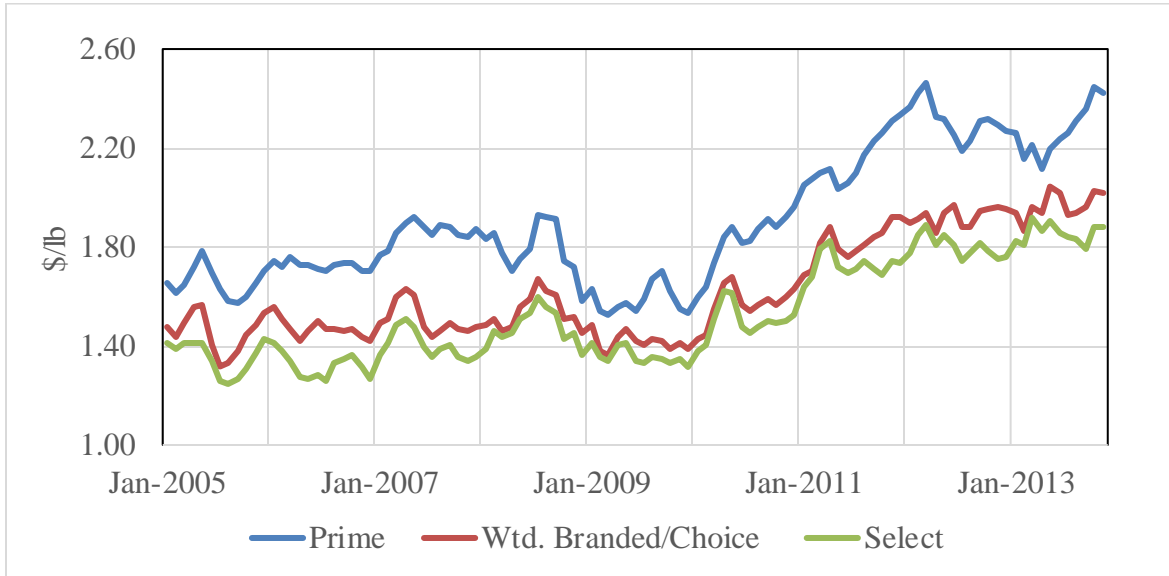
Data

The ultimate focus of this research is to examine consumer beef demand differentiated by quality categories. While retail beef data would prove most useful in estimating consumer beef demand at the supermarket level, analyzing wholesale markets includes the effects of beef demand developments in food service and international markets. Also, given that retail beef data differentiated by quality type is not available, wholesale level beef quantity and price data were used to estimate consumer beef demand from 2005-2013.

Monthly quantity and price data for USDA Prime, Branded, Choice, and Select loads of boxed beef were gathered from the Agriculture Marketing Service (USDA-AMS) through the Livestock Marketing Information Center (LMIC). Since USDA Branded boxed beef is made up of branded upper 2/3 and lower 1/3 Choice beef, Branded and Choice quantity data were combined into one quality category, with price

determined by using a weighted average. Prime, Branded/Choice and Select price and quantity information are shown in Figures 1, 2, and 3 below.

Figure 1. Boxed Beef Cutout Values



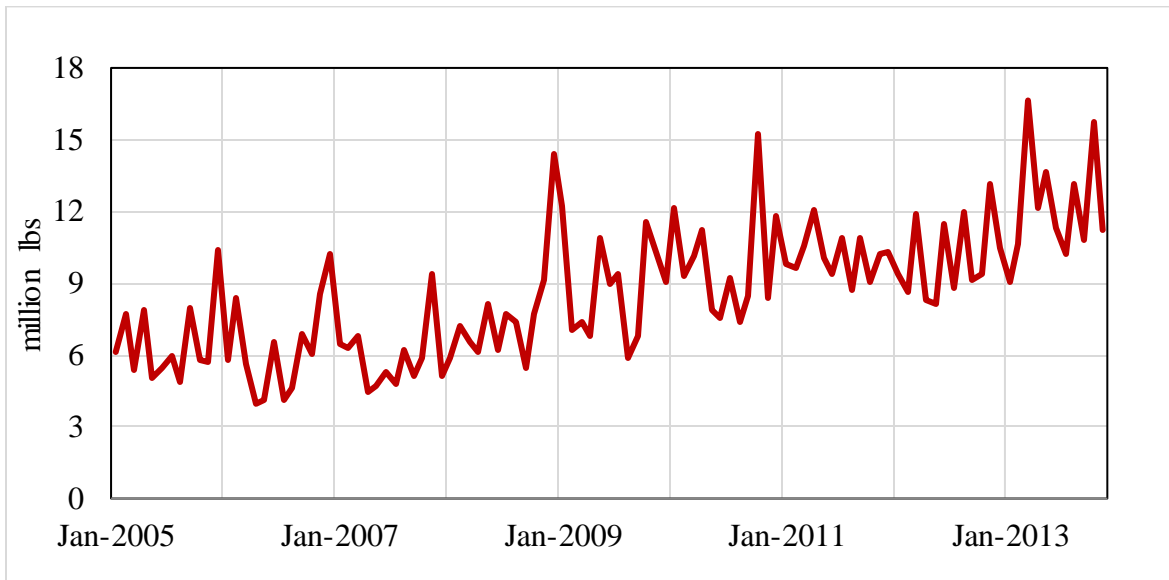
Source: United States Department of Agriculture, Agricultural Marketing Service, Livestock Marketing Information Center

Figure 2. Select and Branded/Choice Quantity Sold



Source: United States Department of Agriculture, Agricultural Marketing Service, Livestock Marketing Information Center

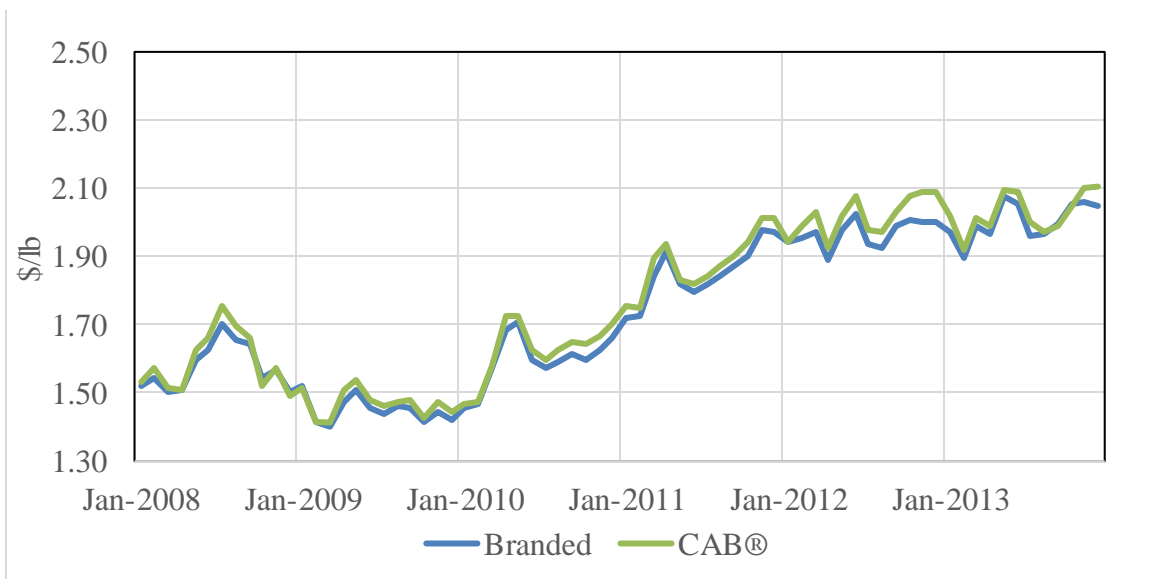
Figure 3. Prime Quantity Sold



Source: United States Department of Agriculture, Agricultural Marketing Service, Livestock Marketing Information Center

CAB[®] provided monthly quantity and price information for CAB[®] product. However, for consistency reasons, CAB[®] price data was only available back to December of 2007, after the latest change in price reporting. Typically, the CAB[®] cutout value is higher than the USDA Branded cutout value, but the two values have very similar price patterns as shown in Figure 4. Thus, USDA Branded cutout values were used to estimate the own-price elasticity for CAB[®] demand over the 2005-2013 estimation period to allow for a longer estimation period than would have been available using the CAB[®] price data.

Figure 4. Branded vs. CAB[®] Cutout Values



Income influences demand for beef and is represented in each model by monthly Real Personal Consumption Expenditure data obtained from the United States Department of Commerce: Bureau of Economic Analysis.

Furthermore, monthly pork cutout values and wholesale chicken prices were gathered from the Economic Research Service (ERS) to estimate cross-price elasticities for these competing meats.

Estimation

OLS regression procedures were used to estimate single demand equations with ln-ln specifications. This approach allowed for the empirical estimation of income and own-price elasticities for USDA beef quality grade categories including Prime, Branded/Choice, and Select, as well as for CAB[®], and to estimate cross-price elasticities between quality grade categories and competing meats. Cross-price elasticities allow us to determine the degree of substitution between beef-quality types and competing meats.

Seasonality of beef demand was accounted for in each model. Pork and chicken prices were combined, using a weighted average, into one competing meats price variable in the Prime, Branded/Choice, and Select beef demand models to reduce the number of estimated parameters.

Because Select and Competing Meats price elasticities are very similar for the Branded/Choice beef demand model, the Select beef price was combined with the Competing Meats price in the CAB[®] model by means of a weighted average.

Results: Prime, Branded/Choice, and Select Beef Demand

Elasticities for Prime, Branded/Choice, and Select graded beef are shown in Table 1. The ln-ln specifications of each equation allow coefficients to be directly interpreted as elasticities.

The estimated elasticities show that a 1 percent increase in the Prime price (cutout value) decreases the quantity of Prime beef consumed by 2.33%. The fact that Fig. 3 shows an increase in Prime consumption in the face of higher prices can only be accounted for by the logarithmic trend (Fig. 2) that shows other factors countering the imputed elasticity.

If the price of competing meats were to increase by 1%, the quantity of Prime, Branded/Choice, and Select beef consumed would increase by 0.21%, 0.24%, and 0.30%, respectively. Those differences appear small, but in relative perspective, Select beef is two-thirds more likely to be affected by a decision to buy competing proteins than Prime.

A 1% increase in income would increase the quantity of Prime, Branded/Choice, and Select beef consumed by 1.34%, 0.03%, and 1.26%, respectively. The apparent discrepancy in Branded/Choice may be due to the wide variation in quality from top to low Choice. For example, income elasticity for CAB[®] (Table 3), is higher than that for Prime at 1.63. The first-, second-, and third-quarter estimates address changes in quantity of beef consumed due to seasonality.

Finally, a logarithmic trend was included in each model to account for additional factors that may influence beef demand. The trend is significant across beef quality types, indicating a 0.16% and 0.07% increase in consumption of Prime and Branded/Choice beef each month and a 0.05% decrease in consumption of Select beef each month, not accounted for by demand factors already explicitly included in each model. Again, the wide variation in Branded/Choice that included CAB[®] product must be noted. With that trend number for CAB[®] showing a 0.14% increase, it is likely that the lower end of Choice included product with a negative trend in consumption.

Table 1.

Beef Demand by Quality Grade			
	Prime Quantity	Branded/Choice Quantity	Select Quantity
Constant	-2.65	-3.17	0.83
Prime Price	-2.33**	0.25	0.30
Branded/Choice Price***	1.53	-1.04	0.13
Select Price	1.18	0.22	-1.24*
Competing Meats Price^a	0.21	0.24	0.30
Income***	1.34	0.03	1.26
1st Quarter	-0.14*	0.00	-0.08
2nd Quarter	-0.29**	0.04	0.07
3rd Quarter	-0.21**	-0.06	0.03
Trend***	0.16**	0.07**	-0.05**
R-squared	0.70	0.65	0.74

^a Competing Meats price is the weighted average of pork and chicken prices.
* and ** indicate significance at the 5% and 1% level, respectively.
*** Wide variability within Choice likely affected data in these categories.

Prime beef is the most elastic beef product.

USDA Prime beef is more own-price elastic than the other beef quality types. As the own-price increases by 1% for each quality type, quantity of beef consumed changes the most for Prime beef at -2.33%. Many in the cattle industry suggest that the premiums available for high-quality beef are driven in large part by limited supplies. While supplies do play a role in determining market clearing prices, relative demand elasticities also play an important role in determining premiums available for high-quality beef, as demonstrated with the Prime own-price elasticity, and its inverse, price flexibility. The latter suggests that a change in quantity supplied elicits a smaller change in price. Thus the market can, to some extent, absorb an increase in the quantity of Prime beef supplied without much of a change in current quality premiums.

Income elasticities are strong for most beef quality types.

Demand for CAB® (Table 3) is the most responsive to changes in income, followed by demand for Prime, Select, and Branded/Choice beef. From these results, we can infer that as incomes allow, consumers will demand more high quality beef.

Significant trend data suggests stronger demand for higher-quality beef products moving forward.

A logarithmic trend applied from 2007 to 2013 is significant across each beef quality category. This existing trend suggests additional factors are increasing demand for Prime and at least the upper end of Branded/Choice beef and decreasing demand for Select beef. While it's difficult to quantitatively identify exactly what is causing this trend, Table 2 shows significant changes in demand of each quality category if the trend were to continue through 2020. While Prime and Branded/Choice beef consumption would increase, Select beef consumption would drastically decrease under the assumption of a continued trend.

Table 2.

Annual Change in Demand if Trend Continues Through 2020 (millions of pounds)*				
	Prime	Branded/Choice	Select	CAB
2015	2.65	47.53	-17.97	15.62
2016	2.40	42.63	-15.89	14.13
2017	2.20	38.67	-14.24	12.91
2018	2.03	35.41	-12.89	11.90
2019	1.89	32.67	-11.77	11.05
2020	1.77	30.33	-10.83	10.32
Total	12.95	227.24	-85.60	75.93

* The Branded/Choice data implicitly includes the separate CAB[®] changes suggesting most of the increase in the Branded/Choice trend results in the upper quality portion of this broad category.

Lower quality beef faces the strongest pressure from competing meats.

The regression results show positive elasticities for all cross-prices across all beef quality categories. These results imply substitution among beef quality grades and between each beef quality grade and competing meats. However, the degree of substitution differs across beef quality categories. According to the results, a change in the price of competing meats elicits the strongest response in quantity of Select beef demanded followed by quantities of Branded/Choice, and Prime beef demanded. In other words, Select beef faces stronger competition with pork and chicken than beef that grades prime. In fact, the competing meats cross price elasticity for Prime beef is only two-thirds that of Select beef.

After several years of high feed prices, the livestock industry is finally seeing lower feed costs. The expected response for both the pork and poultry industry is to increase production. Increased production of these competing meats will drive pork and chicken prices down and create more price pressure on beef. The estimation results show Select has the highest degree of substitution with competing meats, suggesting lower-quality beef will face the most price-pressure from other meats going forward.

Results: CAB[®] Demand

CAB[®] demand estimates in Table 3 can be interpreted in the same manner as the estimates in Table 1. For instance, a 1% increase in the Branded price (cutout value) should result in a 2.26% decrease in quantity of CAB[®] product consumed. The fact that this decrease has not occurred implies a shift toward stronger demand, as suggested by the logarithmic trend. As with the demand estimation for USDA quality grades, a significant logarithmic trend shows alternative factors are positively influencing demand for CAB[®]. Note that a 1% increase in income should elicit a 1.63% increase in CAB[®] quantity consumed.

Table 3.

CAB[®] Demand	
	CAB[®] Quantity
Constant	10.64
Prime Price	0.39*
Brand Price	-2.26
Choice Price	1.33
Competing Meats Price^a	0.28*
Income	1.63**
1st Quarter	0.02
2nd Quarter	0.06**
3rd Quarter	0.05**
Trend	0.14**
R-squared	0.90
^a Competing Meats price is the weighted average of Select beef, pork, and chicken prices. * significant at the 5% level ** significant at the 1% level	

Similar to Prime beef, CAB[®] also has a more elastic own-price.

If the price of CAB[®] branded products were to increase by 1%, quantity of CAB[®] products demanded would be expected to fall by 2.26%. That this has not happened suggests this elasticity is mitigated by logarithmic trend and income elasticity.

CAB[®] demand has strong income elasticity.

As income increases by 1%, demand for CAB[®] products increases by 1.63%. Again, the results suggest consumers are drawn to higher-quality beef as their incomes increase.

CAB[®] demand has a positive trend, in place since at least 2007.

The trend term suggests something external to the own price, cross price and income variables is causing an increase in demand for CAB[®] every month. Continuing this trend term alone through 2020, U.S. consumer demand for CAB[®] is projected to increase by 59.78 million lb. from 2014, as shown in Table 2.

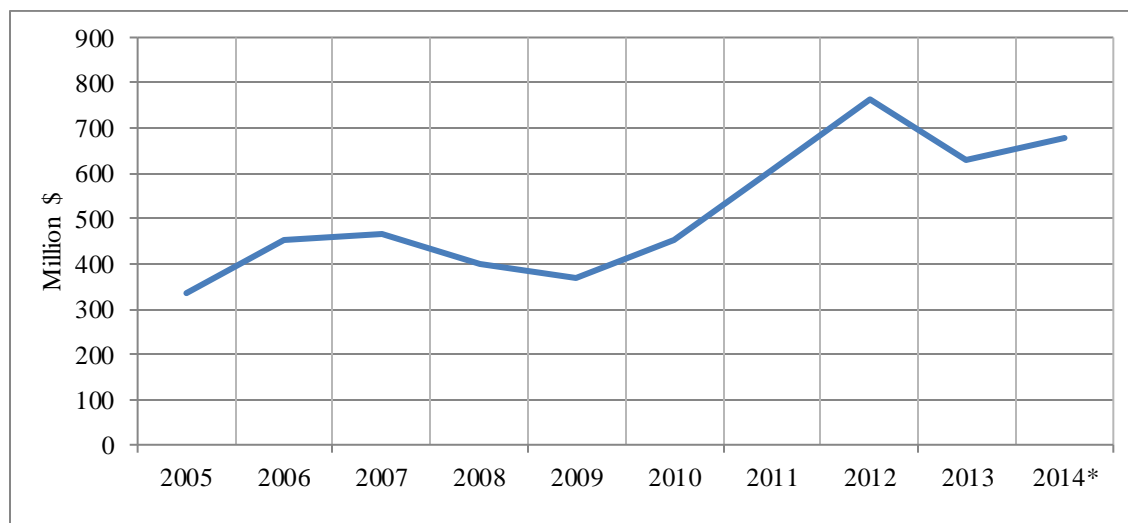
What is the Value of Quality Beef?

In an effort to quantify the added value from quality premiums, a premium cutout value was compared to a baseline cutout value, similar to the methods used in the CattleFax report “Value of Quality Analysis.” The baseline cutout was a composite of USDA Choice and USDA Select cutout values based on grading percentages. The premium cutout followed the same composite method with the addition of Prime and Branded beef values. The comparison of these two values gives an idea of the value of higher-quality beef.

From 2005-2013, quality premiums made up approximately 1.3% of the value of U.S. cattle and calf production, adding nearly 4.5 billion dollars to the beef industry. In 2013 alone, quality premiums

added 630 million dollars to the beef industry. Furthermore, Figure 5 shows the quality added premium/cwt has largely been trending upward since 2005. Increasing demand for higher-quality beef, as suggested in this study, provides an incentive for increased production of high-quality beef. With quality categories such as Prime and CAB[®] being more own-price elastic, the market can, to some extent, absorb an increased supply of beef products in these categories without driving quality premiums down. Consumers have shown a willingness to pay premiums for higher quality beef, and producing a greater supply of higher-quality product will increase the value added by beef quality, an already significant contribution to the beef industry.

Figure 5. Value Added to U.S. Beef Production through Quality Premiums



* 2014 value estimated from eight months of data

Conclusion

The decades-low U.S. cattle inventory has many in the livestock industry discussing the potential for growth. With improved economic conditions and strong beef demand affecting today's market situation, beef producers will likely begin to grow their operations and rebuild their herds in the near future. The intent of this work is to help better define the focus for rebuilding cattle herds in the U.S.

Results imply rising consumer demand for beef of higher-quality such as USDA Prime, USDA Choice, and branded beef such as CAB[®]. Demand figures can be found in the Appendix.

While these findings suggest a focus on beef quality to be an excellent rebuilding strategy, others have suggested a commodity focus toward more ground beef production. Even if the beef industry moves toward more ground beef production it is likely the quality grind products to target price conscious consumers, beef quality can still play an important role in satisfying consumer beef demand with restaurants such as Five Guys[®] and Smashburger[®] creating a place for higher-quality beef in the ground beef market (Corah, 2014).

Looking at beef demand differentiated by quality type suggests beef quality should be a key component of any rebuilding strategy. However, it is important to remember that quality beef is the result of many factors of production such as genetics, handling, nutrition, etc. Beef production and management decisions made in the near term will determine the future success of cattle herds across the U.S. A focus on quality appears to be a viable plan to rebuild the U.S. cattle inventory and sustain and build beef demand going forward.

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Appendix

Figure 1A. Prime Beef Demand

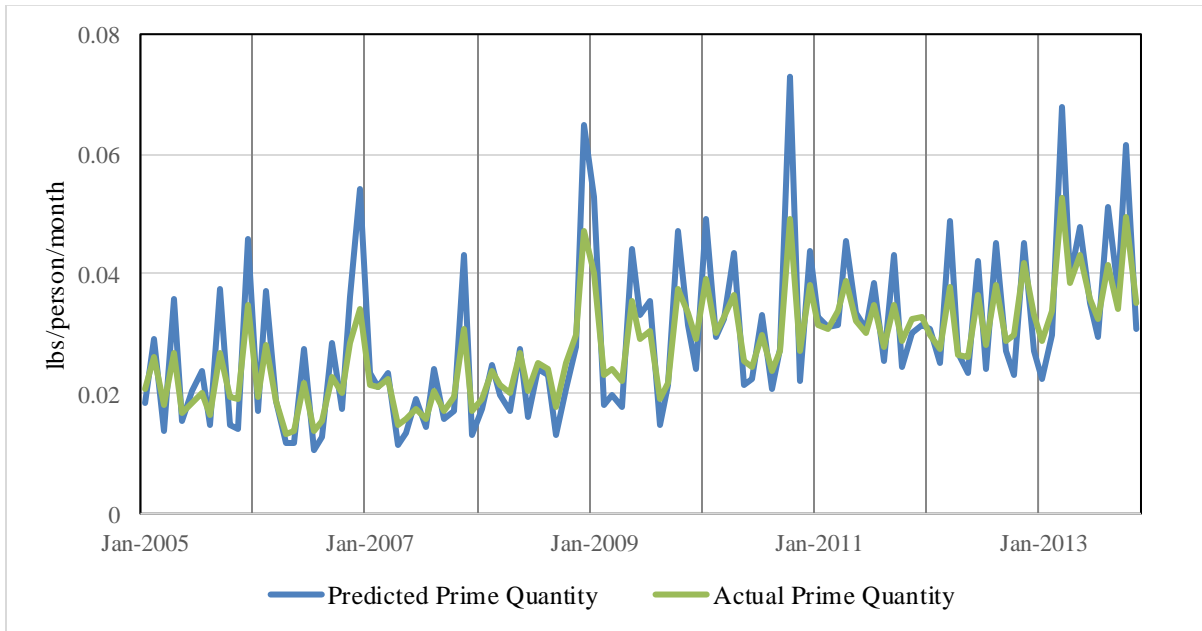


Figure 2A. Branded/Choice Beef Demand

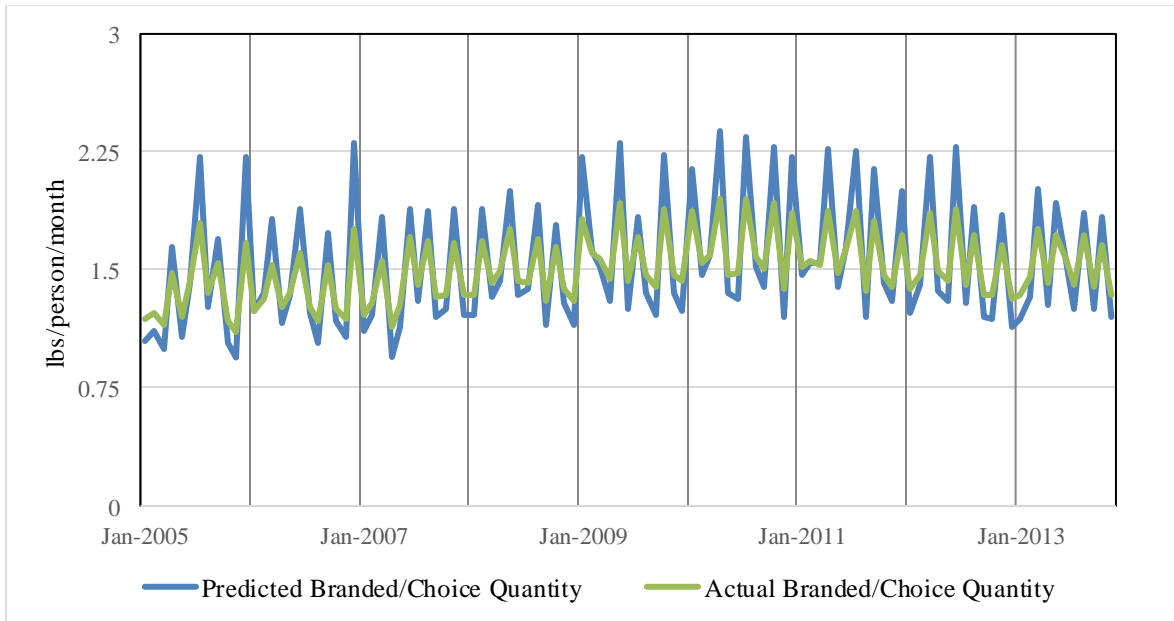


Figure 3A. Select Beef Demand

