



Value Discovery Issues for Fed Cattle

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Fed cattle pricing methods are evolving rapidly. Extension Facts F-585 (Ward et al.) reports on a recent survey of cattle feeders in four key cattle feeding states. The movement from live weight pricing to grid pricing is clear and the shift is occurring quickly. By 2006, grid pricing is expected to reach 62% of marketings while live and carcass weight marketings are expected to decline to about 33%.

Grid pricing of fed cattle enhances value signaling from packers to cattle feeders. However, grid pricing in its current form has some inherent weaknesses. This extension fact sheet discusses issues surrounding base prices in grids, premiums and discounts in grids, and the technology to more objectively measure carcass attributes. This extension fact sheet is excerpted from a more extensive report (Schroeder et al.).

Base Prices in Grids

Grid pricing consists of a base price and a set (matrix or grid) of carcass premiums and discounts. Several different methods could be used to determine or discover the base price. Each of these methods has advantages and disadvantages. Those believed to be the most important are mentioned here.

Cash Market or Plant-Average Formula Base Prices

The most prevalent method of discovering the base price in 2001, and expected to be the most prevalent in 2006 (Ward et al.), is a formula tied to another cash market price. The base may be a market price quote reported by USDA for a given, predetermined time period and location, or a plant average price (i.e., packer cost) calculated by the packer for a predetermined time period at the packing plant where cattle being priced will be harvested. Advantages of this pricing method include the following.

- Formula pricing is easy and low cost.
- Cash market prices (when used as the base) are reported by an independent party.
- Base prices follow cash market prices closely.

However, serious concerns with base prices tied to cash market prices or plant averages are raised.

- Feeders tie fed cattle prices to a price packers have a natural, normal, economic incentive to keep as low as possible. After all, fed cattle prices represent a large component of total input costs to packers.

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- Better quality cattle tend to be priced using a grid and poorer quality cattle are priced on a live-weight basis. Thus, poorer quality cattle serve as the "standard" quality for the base price, even for higher quality cattle. Thus, as more higher quality cattle are priced via grid, lower quality cattle comprise the base cash market price. This alone may cause the observed cash market price to decline over time.
- Price signals may be skewed because cattle marketed to a given plant are being compared to the average of cattle marketed through that plant. Sometimes, better quality cattle marketed at one plant can receive lower prices than poorer quality cattle at another plant under this pricing system.
- Thin cash market trading raises the concern that packers can adversely influence prices due the small number of competing packers.
- Thin cash market trading raises the concern that prices may not truly represent market supply and demand conditions.

Live Cattle Futures Market Base Prices

One alternative is to tie the base price to the live cattle futures market. Using the live cattle futures market to establish the base price has similar advantages as using cash market prices.

- Formula pricing is easy and low cost.
- The futures market is a national market with many traders.
- Futures price quotes are readily available on a continuous basis during trading hours and are easily accessible.
- Tying base prices to futures price quotes reduces basis risk (for the base price) and enhances producer and packer opportunities for price risk management.

Using the live cattle futures market as a base price however, also has problems. Two are.

- Basis risk in live cattle markets is substantial, exhibiting \$4-6/cwt. swings in short time periods (Schroeder et al.). While some variability is seasonal and somewhat predictable, much is not predictable.
- Packers would absorb basis risk, much as they do with basis contracts, and would likely incorporate the cost of that risk into a lower base price.

Negotiated Base Prices

Cattle feeders responding to a 2002 survey expressed a preference for using negotiated base prices (Ward et al.). This method of determining the base price is akin to traditional negotiated cash market trading where price is negotiated between the cattle feeder and the packer. Advantages with this method are.

- The cattle feeder and packer are each actively involved in the negotiation process contributing to overall price discovery in the market.
- A feeder maintains the opportunity to reject a base price bid.
- The feeder knows the base price prior to delivering cattle to a particular packer.

Disadvantages to negotiated base prices include.

- There are only a small number of packers with which to negotiate prices.
- Transaction costs associated with price discovery are higher when negotiating the base price.
- If the buyer is identified well in advance of the sale date, in large part due to the grids available by different packers, the cattle feeder has little leverage in the negotiation process.
- Many packers are reluctant to negotiate base prices with individual feedlots. Thus, this alternative may require an organization representing several feedlots and there is no guarantee, even then, that it will be successful.

Wholesale Boxed Beef Base Prices

Another alternative is to tie the base price to the wholesale boxed beef cutout value. Several economists have expressed their preference for this alternative relative to the predominant formula pricing practice. Advantages include.

- Fed cattle prices are tied to a price that is one step closer to consumers or final demand. As such, there should be more clarity in sending consumer demand signals to producers.
- Packers and producers both have an incentive for the boxed beef price to be high. High wholesale beef prices mean more revenue for packers.
- Composite wholesale boxed beef price reports are readily available and reported by USDA, an independent party.

However, there are problems here as well.

- The calculated and reported boxed beef cutout values by USDA include about 65% of all traded boxed beef products. However, the reported price is an aggregate composite with the volume-weighted mix of different quality grades traded during that week. Thus, while representing a broader group of products than previously, it is also limiting in that one cannot determine a Choice-to-Select price difference from this series.
- The difference between the wholesale price and the live cattle price is the packer margin. This margin fluctuates over time and is perhaps the most difficult obstacle to deal with in using a wholesale boxed beef price as a base. In particular, the packer gross margin has increased in recent years. Before a viable base price formula tied to the wholesale boxed beef price can be developed, a better understanding of changing packer gross margins is critical.

Retail Beef Base Prices

Retail beef prices are yet another possible source for base prices. Certainly, the motivation for wholesale base prices, i.e., moving closer to consumers, is a major motivation for retail base prices. Ultimately, if beef alliances with branded products are developed, using retail price to establish base price may be a natural evolution. In October 2002, USDA began reporting a volume-weighted, average retail beef price series that offers more promise for using retail price for a base. However, the issues regarding variability in margins over time as noted for boxed beef prices are magnified when trying to use retail prices as a base in commodity grids.

Base Price Recommendation

No single base price method is without disadvantages. Given the alternatives and the advantages/disadvantages of each, the authors recommend moving away from formula pricing to the cash market. Continued research is needed to determine how to effectively tie fed cattle base prices to wholesale boxed beef prices. The significant concern over variability in gross margins needs additional attention. Future work should focus on ways to address this issue in a way that both beef producers and packers could agree is an equitable compromise. Crucial in such a formula pricing system would need to be incentives for both parties to improve profitability.

Carcass Premiums and Discounts

The current system of carcass premiums and discounts is a significant improvement, arguably “modification,” of the former grade and yield pricing method of three decades ago. Premium-discount grids are based on quality grades and yield grades. These are overlaid on hot carcass weight and carcasses that have considerably lower value, often referred to as “outs.” Grid pricing offers significant price premiums for certain quality attributes and substantial discounts for others. As such, it is much more discriminating with regard to beef carcass quality traits than average live-weight or dressed-weight pricing. Despite these benefits, grid pricing is not without concerns. These include the carcass quality traits that are contained in most grids, the sharp discounts for subtle differences in carcasses, and subjective measures of carcass attributes. This section addresses concerns about grid premium and discount schedules.

Current Premium and Discount Schedules

Most grids being used today adjust the base price for each carcass according to USDA quality and yield grades, carcass weight, and any “out” carcasses (such as dairy type, hard bones or heiferettes, dark cutters, bullocks or stags, condemned carcasses, etc.). Quality grades are intended to represent eating quality or satisfaction by consumers. However, research indicates current quality grades do not predict eating satisfaction effectively (Wheeler, Cundiff, and Koch). Tenderness, a better indicator of expected eating satisfaction, is discussed later.

A second difficulty with current premiums and discounts for quality grade is the discrete nature of grades and the substantial differences in value small differences in subjective grading can make. Choice-Select price differences within any given year may range from \$5 to \$30/cwt. A subjective error in evaluating one component of the official quality grades can make a significant difference in value. For example, different graders may judge the extent of marbling in the rib eye differently and assign a different quality grade to a carcass. Since a large number of carcasses are borderline between the Choice and Select grade, differences in subjective assessments can result in large differences in grades and value. Some lumpiness in premiums and discounts may be appropriate if packer, retailer, or food service marketing programs are focused on specific quality grades with virtually no chance of substituting other quality grades, e.g., a Prime program, Certified program, or Choice program. In other cases, where some substitutability exists, such lumpiness may not be justified.

Yield grades are a continuous measure but they are grouped into discrete whole numbers for most grids. Official USDA yield grades range from 0.1 to 5.9 but are typically reported as whole numbers for determining premiums and discounts in grids, i.e., yield grades 1, 2, 3, 4, or 5. Like quality grades, some price differences can be large. Price discounts for yield grade 4 versus yield grade 3 may range from \$10 to \$20/cwt. Carcasses that receive yield grades of 3.9 vs. 4.0 are not significantly different in

pounds of retail cuts, but are markedly different in terms of value or prices paid to cattle feeders.

Hot carcass weights are also continuous but grouped into discrete categories for most grids. Typical groups might be carcasses less than 550 pounds, 550 to 950 pounds, and over 950 pounds. Substantial discounts are often associated with carcasses that fall into the light and heavy weight categories (often \$20/cwt or more). Thus, a one-pound increase in carcass weight from 950 to 951 lbs. greatly decreases the price paid by packers for that carcass. Yet, carcass value in an absolute sense changes little.

To explain pen-to-pen variation in fed cattle prices from grid systems, the statistical model would be comprised largely of discrete variables. Such a model would estimate price differences for the discrete quality grades (for example, between Prime, Choice, and Select), yield grades (for example, between yield grades 2, 3, and 4), and carcasses weights (for example, between light, normal, and heavy).

Alternatively, some of the lumpiness of the current grid pricing system might be removed with specific changes. One modification would be to use continuous variables where possible in lieu of discrete variables. For example, quality grade might be a continuous variable where Standard = 5, Select = 4, ... , Prime = 1. Yield grade would be the calculated, continuous yield grade in tenths, i.e., 1.8, 4.2, etc. Hot carcass weight would be actual hot carcass weight. Alternative specifications of the model might be appropriate, such as having squared or cubed variables for quality grade, yield grade, and hot carcass weight.

Alternative Premium and Discount Schedules

Any improvement in more accurately valuing fed cattle by using continuous measures of quality and yield grades would likely be marginal in total. However, the changes could be significant for some sale lots. Larger changes may be needed to make more significant improvements. The following is one alternative.

While quality grade does not accurately predict eating satisfaction, objective tenderness measures are not yet being used in most commercial plants. Therefore, an interim alternative is to rely on marbling as a quality measure. Marbling scores could be grouped into categories, e.g., in increments of 100 as occurs now to arrive at quality grades, or could be a continuous measure of quality.

Red meat yield is a more accurate measure of the meat available for sale than yield grades. Red meat yield can be measured objectively with image analysis systems, thus eliminating the subjective element of assigning yield grades. Red meat yield could be grouped into categories or could be a continuous measure.

Then, instead of the current quality grade and yield grade grid, this alternative might entail a marbling and red meat yield grid. This alternative might be in lieu of and an interim step toward a tenderness and red meat yield grid.

Hot carcass weight could be grouped into smaller increments, e.g., 50-pound increments, or could be a continuous variable.

As with statistical models to explain the variation in fed cattle prices currently, with this alternative grid system, potential models could be similarly specified using discrete or continuous variables. And as before, alternative variable specifications such as quadratic and cubic variables may prove to be more correct.

Premium and Discount Recommendation

The beef industry has considered quality grades and yield grades as the best, practical measures of value for decades. However, other carcass characteristics may be more important determinants of value. More research is needed to determine which carcass attributes best reflect true value. In the interim, more research is needed to determine the extent alternative valuation systems might more accurately reflect value for each carcass and pen of cattle.

Technologies for Objective Measurement of Carcass Value Attributes

One troubling attribute of the entire grading system for many producers and processors is the subjective nature of measuring value-influencing carcass attributes. For at least three decades, the research community has been working on developing accurate and acceptable technology to objectively measure these value-influencing attributes. This section summarizes the status of that on-going search.

Beef Carcass Yield

Numerous technologies have been studied for their potential use as an on-line prediction of beef carcass yield (Jones, Tong, and Robinson). The 1994 NCBA sponsored National Beef Instrument Assessment Plan Symposium identified video image analysis and ToBEC as the most promising technologies and initiated a comparison of them with experts' estimation of yield grade. Dolezal et al. concluded that ToBEC was not easily adapted to commercial chain speeds but that image analysis had potential.

There are now three image analysis systems commercially available for prediction of beef carcass yield. CVS Computer Vision System, VIAscan, and VBG2000 have all been shown to be sufficiently accurate to be useful to the industry and some already are operating commercially in major packing plants.

Beef Quality - Tenderness

The amount a processor can spend on identifying "guaranteed tender" products depends on several factors such as the amount of premium that guaranteed tender products will generate, the proportion of carcasses that will qualify, potential reduction in value of non-qualifying product, and the weight and number of products from each carcass that can be marketed as enhanced in tenderness. The method selected to identify "guaranteed tender" must be accurate enough to create a product that is recognizable by consumers as superior in tenderness. Furthermore, it would seem likely that tenderness certification would be applied to USDA Select and Low Choice carcasses because USDA Prime carcasses and most of the carcasses within the upper two thirds of Choice already receive premiums in the market. Thus, USDA Select and Low Choice carcasses would be logical candidates for increased value by identifying those that are "tender."

Many attempts to identify objective methods for predicting meat tenderness were intended for laboratory research tools and varied widely in their efficacies. In more recent investigations of objective predictions of meat tenderness, the goal has been to develop on-line systems for grading carcasses based on tenderness. The ideal system would involve an objective, non-invasive, tamper-proof, accurate, and robust technology. Technologies evaluated for their potential as on-line tenderness grading tools include Tendertec, connective tissue probe, elastography, near-infrared spectroscopy, ultrasound, image analysis, colorimeter, BeefCam, and slice shear force. A majority of these have been shown to lack sufficient accuracy in predicting meat tenderness to be useful.

The three that appeared to be most promising (BeefCam, Colorimeter, and Slice Shear Force) were recently compared directly in the same study (Wheeler et al.). The high level of accuracy of slice shear force at 2 or 3 days postmortem for sorting carcasses into tenderness groups was confirmed by Wheeler et al. In addition, it appears that accurate early-postmortem longissimus tenderness classification also would enable one to market sirloin and round cuts based on tenderness. However, BeefCam and Colorimeter, which are indirect, non-invasive methods to predict meat tenderness based primarily on lean color were not sufficiently accurate to warrant their use. Thus, the direct method

to predict meat tenderness, slice shear force, is significantly more accurate than currently available non-invasive methods, allows certification of a greater proportion of carcasses, creates a "guaranteed tender" product that consumers recognize as superior, and enables marketing of multiple muscles, not only the longissimus, as superior in tenderness. When this accuracy is combined with estimates of the premium a "guaranteed tender" beef product could command in the marketplace (Boleman et al.; Lusk et al.; Shackelford et al.), it appears that the direct approach of slice shear force would be superior for identifying guaranteed tender beef compared to other methods tested to date.

The National Cattlemen's Beef Association (NCBA) convened a committee on National Beef Instrument Assessment Plan II—Tenderness. This committee evaluated currently available technology and concluded that the only technology accurate enough to be used was slice shear force (NCBA). The committee recommended that the industry proceed with implementing this technology and collect baseline data to determine the level of variation in tenderness that exists so that sources of this variability can be identified and approaches developed to improve consistency. The committee also recommended that development efforts continue for non-invasive technologies. Some non-invasive technologies to predict meat tenderness may eventually have merit. The most researched of these is near infrared (NIR) spectroscopy and several institutions continue to work on this technology.

Beef Quality - Marbling

Image analysis systems have the most promise for predicting marbling score. Three systems are currently commercially available. CVS Computer Vision System, VIAscan, and VBG2000. It does not appear that any of these systems are accurate enough at predicting marbling to replace the AMS on-line grader (Shackelford, Wheeler, and Koohmaraie). Furthermore, even if they were, no instrumental method has yet been developed for measuring carcass maturity so that quality grade could be completely automated.

Beef Quality - Lean Color

Image analysis systems have the most promise for measuring lean color. Three systems are currently commercially available: CVS Computer Vision System, VIAscan, and VBG2000. Theoretically, it appears that these systems should be able to detect differences in lean color that would be associated with different dark-cutter discounts. The accuracy of this process has not been demonstrated.

Beef Valuation and Pricing in the Future

Several challenges have been highlighted with current and prospective fed cattle valuation systems. Evaluating components of grid pricing leads to the following recommendations.

Recommendations

Four closely related fed cattle valuation issues need beef industry attention:

- Base price establishment
- Grid premium-discount structures
- Predicting meat quality
- Predicting red meat yield

Base prices need to move away from cash markets and plant averages and move closer to the consumer. Wholesale boxed beef prices offer considerable promise, but additional work regarding how to most effectively deal with variation in the farm to wholesale gross margin is the primary consideration. Grid premiums and discounts need to more accurately reflect the continuous nature of value differences across animals. Image analysis appears to offer the most promise for predicting red meat yield and is being implemented by several firms. Measuring tenderness with an objective, non-invasive, tamper-proof, accurate, and robust technology is the ideal. Current technology for measuring tenderness has a tradeoff between accuracy (using a shear force test) and being invasive. The industry needs to continue to strive for development of objective, accurate, continuous, discerning meat quality and yield measures related to end-product value.

Literature Cited

- Boleman, S. J., S. L. Boleman, R. K. Miller, H. R. Cross, T. L. Wheeler, M. Koohmaraie, S. D. Shackelford, M. F. Miller, R. L. West, D. D. Johnson, and J. W. Savell. "Consumer evaluation of beef of known tenderness levels." *J. Anim. Sci.* 75(1997):1521-1524.
- Dolezal, H. G., J. D. Tatum, J. B. Morgan, J. W. Wise, C. R. Calkins, and G. C. Smith. "USDA yield grades, total body electrical conductivity, and video image analysis technologies for predicting cutability of sides of steer/heifer carcasses." Interim Report to the National Cattlemen's Beef Association, Denver, CO. 1996.
- Jones, S.D.M., A.K.W. Tong, and W. M. Robertson. "Technologies for objective grading/assessment." *Proc. Recip. Meat Conf.* 50(1997):106-112.
- Lusk, J. L., J. A. Fox, T. C. Schroeder, J. Mintert, and M. Koohmaraie. "In-store valuation of steak tenderness." *Amer. J. Agri. Econ.* 83(2001):539-550.
- NCBA (National Cattlemen's Beef Association). "Summary of National Beef Instrument Assessment Plan II – Focus on Tenderness." Beef Update, Denver, CO. 2002.
- Schroeder, T. C., C. E. Ward, T. L. Wheeler, J. Mintert, and J. S. Drouillard. "Improving fed cattle and carcass value determination." Kansas State University, Department of Agricultural Economics, unpublished paper prepared for the Livestock & Meat Industry Council. 2003.
- Shackelford, S. D., T. L. Wheeler, M. K. Meade, J. O. Reagan, B. L. Byrnes, and M. Koohmaraie. "Consumer impressions of tender select beef." *J. Anim. Sci.* 79(2001):2605-2614.
- Shackelford, S. D., T. L. Wheeler, and M. Koohmaraie. "On-line prediction of yield grade, longissimus area, preliminary yield grade, adjusted preliminary yield grade, and marbling score using the MARC Beef Carcass Image Analysis System." *J. Anim. Sci.* 81(2003):150-55.
- Ward, C. E., T. C. Schroeder, J. Lawrence, and D. M. Feuz. "Cattle feeders' marketing and pricing practices." Oklahoma Cooperative Extension Service, F-585, October 2003.
- Wheeler, T. L., D. Vote, J. M. Leheska, S. D. Shackelford, K. E. Belk, D. M. Wulf, B. L. Gwartney, and M. Koohmaraie. "The efficacy of three objective systems for identifying beef cuts that can be guaranteed tender." *J. Anim. Sci.* 80(2002):3315-27.
- Wheeler, T. L., L. V. Cundiff, and R. M. Koch. "Effect of marbling degree on beef palatability in *Bos taurus* and *Bos indicus* cattle." *J. Anim. Sci.* 72(1994):3145-3151.

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