



# Formula Pricing Fed Cattle with Wholesale and Futures Markets

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Increasingly through the 1990s, fed cattle prices were based on carcass weight rather than live weight. In addition, formula pricing of fed cattle increased significantly. The trend toward grid pricing represents an effort to more nearly match price and value; i.e., a move toward value-based pricing. Grid pricing consists of a base price with premiums and discounts for specified desirable and undesirable carcass characteristics. (See also OSU Extension Fact Sheets F-557, "Fed Cattle Pricing: Grid Pricing Basics"; F-560, "Grid Pricing of Fed Cattle: Base Prices and Premiums-Discounts"; and F-561, "Grid Pricing of Fed Cattle: Risk and Information.")

This fact sheet will identify two alternatives to common reference markets for formula pricing fed cattle and discuss an initial effort to show how the base price might be tied via formula to wholesale or futures market prices.

## Alternative Reference Markets

Formula pricing is neither new nor unique to the fed cattle industry. And while formula pricing has several advantages, it creates potential problems for price discovery.

Formula pricing in fed cattle refers to determining a base price for a transaction using a reference price from an external source. The two most common reference prices are based on plant average prices or prices for specific time periods. To arrive at plant average pricing, the base price for purchased fed cattle may be tied to the average price of fed cattle purchased one or more weeks prior to the expected week of slaughter at the plant where the cattle will be slaughtered (Schroeder et al). An alternate method ties the base price to a specific market report or price quote for a specified time period. For example, the base price in grid pricing programs for fed cattle may be tied to the five-state weighted average fed cattle price for a given day or week.

One problem with using a plant average base price is that the quality of cattle processed in a plant varies. Thus, the base price for cattle purchased this week may be based on cattle of a different quality that were purchased in a previous week. Examples can be shown that demonstrate how plant average pricing results in incorrect price signals for producers (Ward, Feuz, and Schroeder). One problem with using reported market prices or price quotes as the external source is that on some days, markets may be thinly or irregularly traded, and reported prices might not accurately reflect true market conditions.

Two alternative reference markets for formula pricing the base price are the wholesale beef market (boxed beef cutout value) and live cattle futures market. The wholesale market represents prices meatpackers receive for the meat products they produce. Since those prices affect packer revenue, packers strive to sell meat for as high a price as possible. Thus, a key reason to tie the base price in formulas to wholesale prices is that the base price is then tied to a price packers have an incentive to keep as high as possible. In contrast, packers have a natural, normal incentive to keep plant average prices and reported fed cattle prices as low as possible. This practice keeps their input costs as low as possible. The boxed beef cutout value represents a broad group of beef products in the market. Thus, tying base prices to wholesale beef prices is believed to be less likely to result in market distortions than base prices tied to plant averages. Finally, the wholesale market is one step closer to the retail market, which is where consumers register their value preferences.

When considering wholesale prices as a reference for the base price, there are still issues to consider (Schroeder and Mintert). For example, forward contracting has become increasingly common in wholesale markets. This trend presents the same potential thin market problem that can exist with fed cattle markets. For some thinly traded cuts on some days, reported wholesale prices might not accurately reflect market conditions. This problem can be partially resolved by using a broad-based wholesale price, such as the boxed beef cutout value.

Futures prices are a potential formula pricing alternative because futures markets promptly reveal new information, are a reasonable source of price expectations, and are readily available (Schroeder and Mintert). Futures markets are relatively inexpensive to use, and substantial trading volume tends to ensure they accurately represent market conditions.

Again, there are other issues to consider when using futures market prices as the external market for the base price (Schroeder and Mintert). The specifications for futures contracts, such as delivery dates, do not always match cash marketing dates. Basis changes need to be taken into consideration when using futures prices as the reference market in a formula transaction. Another concern is that if the cash fed cattle market becomes increasingly thin or disappears, then the futures market for fed cattle will collapse as well.

## Cash-Wholesale, Cash-Futures Relationships

To use either wholesale prices or futures prices in the beef industry as an external reference for the base price in price grids, the relationships between markets must be examined. In one study, weekly average prices from January 1989 to December 1998 were used (Butcher). Data series were: (1) cash cattle market—Nebraska fed steer price, Choice 2-4, 1100-1300 pounds; (2) wholesale beef market—box beef cutout value, Choice 1-3, 700-800 pounds; and (3) cattle futures market—live cattle futures price for the nearby contract.

Ratios were computed between cash and wholesale prices and cash and futures market prices for fed cattle. Absolute price differences could be used, which some may find appealing. Absolute price differences used in conjunction with the wholesale market represent a fixed margin for packers. That fixed margin would remain unchanged through periods of high and low prices. With a ratio, the same ratio could apply regardless of prices, but packer margins could adjust to the periods of higher or lower prices.

Some ratios or absolute price differences might take into account by-products values. The fed cattle-wholesale market ratios used here do not include the by-products value packers receive. By-products revenue for packers tends to cover slaughter-fabrication costs and their profit margin. Including by-products values with wholesale beef prices seemed to limit the incentive packers have of adding value to by-products and enhancing their net margins. Thus, only the ratio of fed cattle price as a percentage of the boxed beef cutout value was used here.

One could argue that price differences should be used with futures markets rather than ratios because absolute differences are the basis. In this study, the ratio of fed cattle price as a percentage of the live cattle futures market price was chosen in lieu of price differences to allow the absolute basis to vary in periods of higher or lower prices.

**Table 1: Forecasted vs. Actual Ratio Differences for Fed Cattle \***

	Mean Difference	Standard Deviation	Minimum	Maximum
<b>Cash vs. Wholesale</b>				
1994	-0.0060	0.0046	-0.0139	0.0035
1995	0.0200	0.0184	-0.0107	0.0511
1996	0.0057	0.0204	-0.0355	0.0366
1997	-0.0023	0.0101	-0.0272	0.0094
1998	0.0176	0.0239	-0.0143	0.0575
<b>Cash vs. Futures</b>				
1994	0.0225	0.0113	-0.0032	0.0414
1995	0.0068	0.0152	-0.0111	0.0328
1996	0.0076	0.0554	-0.0997	0.0848
1997	0.0083	0.0125	-0.0097	0.0336
1998	0.0321	0.0303	-0.0153	0.0878

\* Differences are the actual ratio less the forecasted ratio

Figures 1 and 2 show how the ratios varied over the data period. The somewhat periodic movement of the ratios suggests a within-year seasonal pattern in each ratio series.

## Using the Ratio for Formula Pricing

The following is an example of how each reference market might be used in a base price formula. Feeder A agrees to market fed cattle to Packer B on Packer B's grid with the base price tied to the wholesale beef market. Historically (1989-98), the ratio between the cash and wholesale price was 0.64. Thus, whatever the wholesale market is for the week fed cattle are slaughtered, the base price will be the wholesale market price times 0.64 (or 64%). So if the boxed beef cutout is \$110/cwt., the fed cattle price is \$70.40/cwt. ( $\$110 \times 0.64$ ).

A similar example can be given for using the futures market as a reference. Feeder A agrees to market fed cattle to Packer B on Packer B's grid with the base price tied to the nearby live cattle futures market price. Historically (1989-98), the ratio between the cash and nearby futures market price was 1.00. Thus, whatever the futures market is for the week fed cattle are slaughtered, the base price will be the futures market price times 1.00 (or 100%). So if the live cattle futures market closes at \$71.20/cwt., the fed cattle price is \$71.20/cwt. ( $\$71.20 \times 1.00$ ).

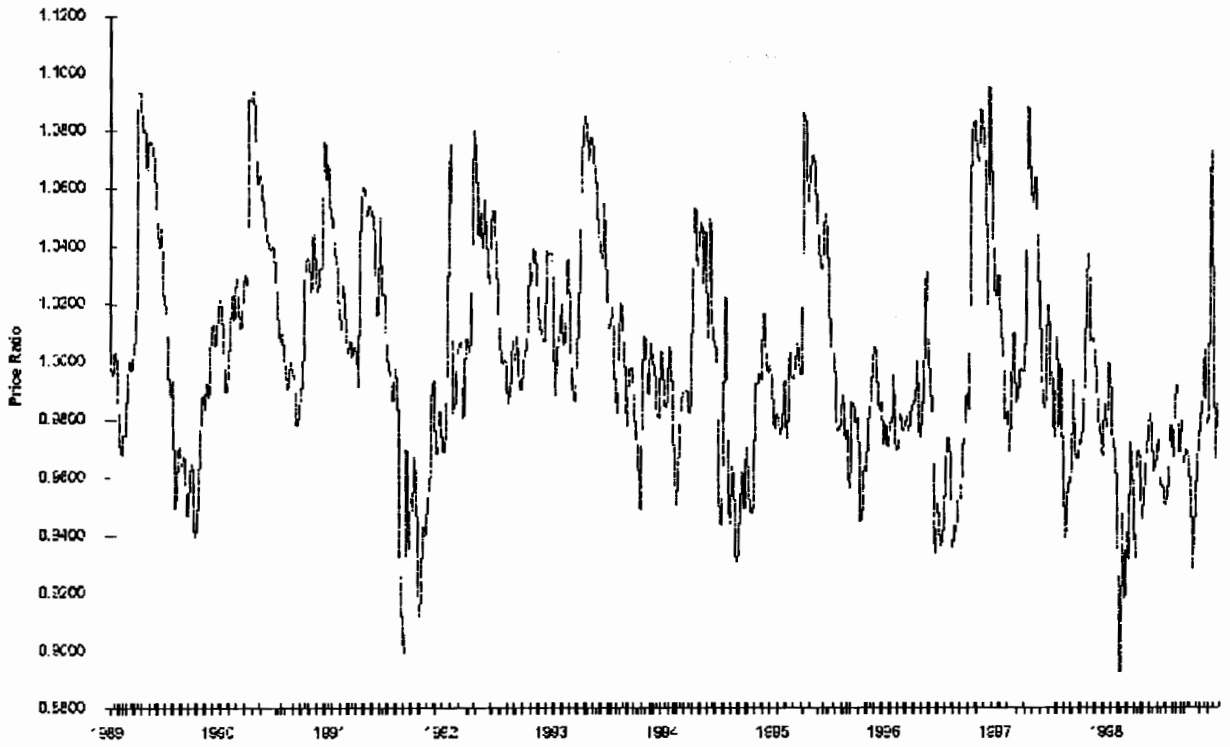
However, given that the ratios vary seasonally (as noted by Figures 1 and 2), a means of adjusting the ratio is necessary to balance the periods during the year when a fixed ratio would favor either the feeder or packer.

## Forecasting Price Ratios

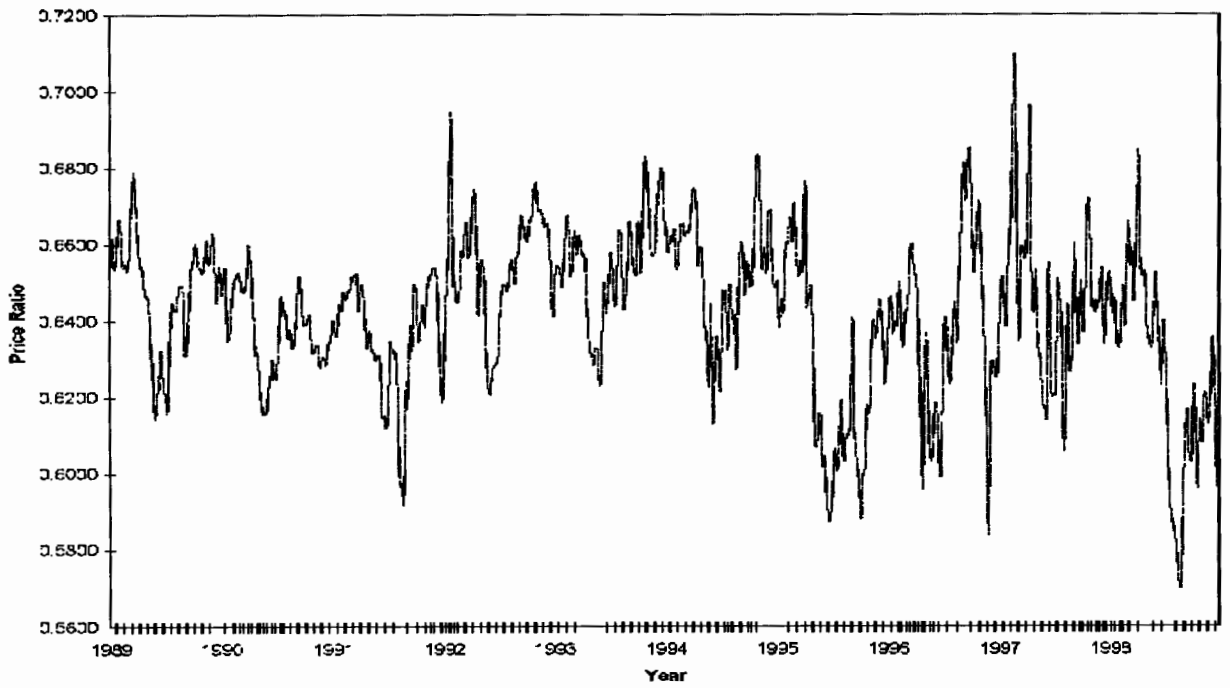
For this study, a simple forecasting method was estimated to arrive at a series of ratios or percentages that potentially could be used in formula pricing (Butcher). These ratios would not likely be used directly. The purpose here is to demonstrate some of what is necessary to consider when formula pricing fed cattle with wholesale and futures markets. The discussion will indicate why this represents a process more than a final product.

Monthly average ratios were forecast based only on seasonality of the ratios. Data for 1989-93 were used to forecast ratios for 1994, which were then compared with the actual ratios for 1994. Data for 1990-94 were used to forecast the ratios for 1995, which were compared to actual ratios for 1995. A similar procedure of dropping the oldest year of data and adding the most recent year was used to forecast ratios for 1996, 1997, and 1998. Regression models accounted for changes in the reported data, such as changes in futures market contracts.

Table 1 shows the forecasted vs. observed (actual) differences for each year. Both for cash-wholesale and cash-futures, the average differences appear relatively small in decimal terms. However, small differences between the forecasted and actual ratios can make a significant difference in the results when using the ratio in a formula. For example, using a cash-wholesale ratio of 0.6400 compared with 0.6576 with a boxed beef cutout of \$110 means the fed cattle price would be \$70.40/cwt (using 0.6400) vs. \$72.34/cwt (using 0.6576). Thus, small ratio differences mean relatively large price differences.



**Figure 1. Ratio of Nebraska Fed Steer Prices to Live Cattle Futures Market Prices, 1989-1998**



**Figure 2. Ratio of Nebraska Fed Steer Prices to Choice Box Beef Cutout Values, 1989-1998**

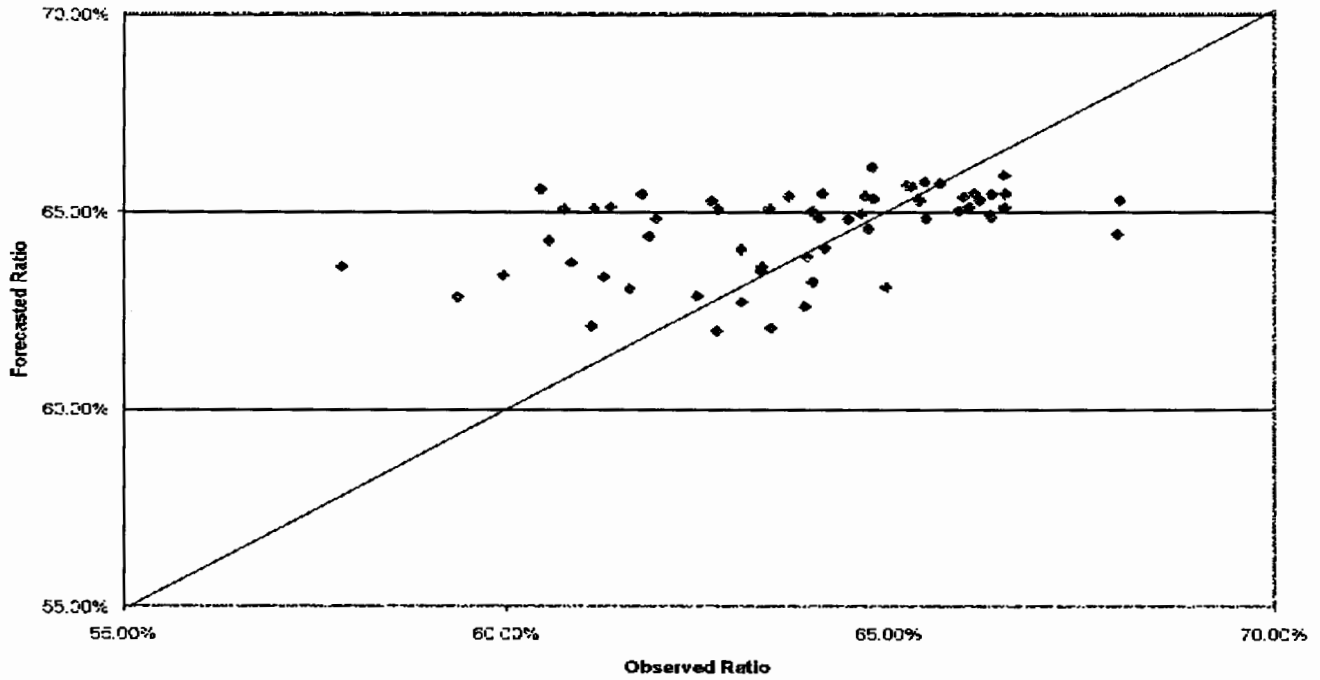


Figure 3. Forecasted vs. Observed Fed Cattle Cash-Wholesale Ratios.

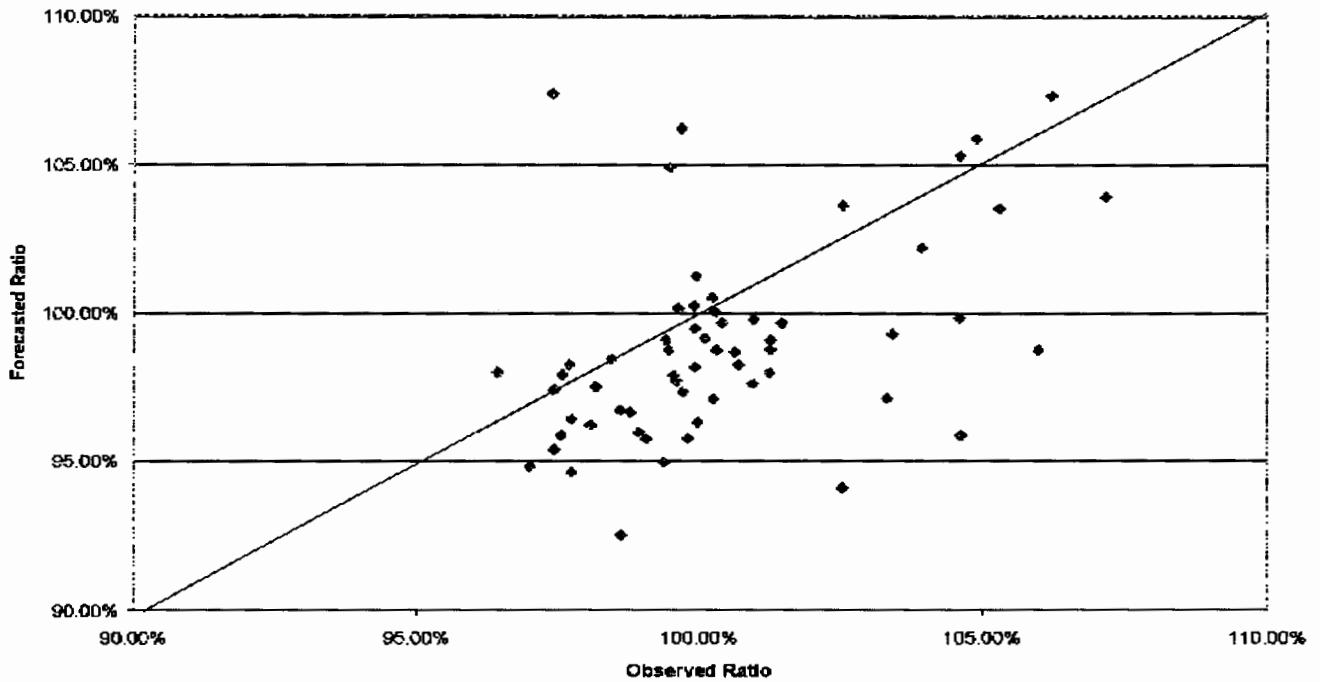


Figure 4. Forecasted vs. Observed Fed Cattle Cash-Futures Ratios.

Figures 3 and 4 show plots of forecasted and observed ratios for 1994-98. If the forecasting model predicted perfectly, the forecasted-observed points on the graph would lie on the diagonal line. Clearly, some of the monthly forecasted ratios were near the observed ratios (i.e., plotted points close to the diagonal) but several points were quite far from the diagonal, thus indicating rather poor forecasting results.

## Discussion and Implications

The wholesale beef market and live cattle futures market could be argued from a conceptual viewpoint to be appropriate reference markets for formula base prices in grids. Wholesale prices and futures market prices could potentially improve the use of formulas by using a base price that reflects market conditions in separate but related markets, thereby improving the price discovery process. Neither is a perfect solution to price discovery problems, but they represent potential alternatives. However, several points need to be considered:

- The ratios computed in this initial study used live weight fed cattle prices. Since base prices are part of carcass merit systems, ratios for carcass weight fed cattle prices would be more appropriate, especially when using the wholesale market as a reference.
  - Given the discussion earlier, price differences may be more appropriate than ratios when using the futures market as a reference.
  - Cash-wholesale price ratios were computed without potential adjustments. For example, wholesale cutout values do not include reported prices for exported beef products. These exported products are higher valued cuts on average, so the reported wholesale cutout values underestimate the true value of meat at the wholesale level. Buyers and sellers could negotiate an adjustment. For example, a ratio might be agreed upon (say 0.64 between fed cattle prices and the wholesale boxed beef cutout), then adjusted for under-reporting at the wholesale level. The ratio could be adjusted by a percentage (say 0.02 above the base ratio of 0.64, resulting in a ratio of 0.66). Or the wholesale cutout value could be adjusted before applying the ratio (say \$2/cwt. more than the reported cutout, then times the base ratio of 0.64).
  - No attempt was made to adjust cash-futures market ratios for any differences between futures market quality specifications and grid quality specifications. Again, buyers and sellers would have to negotiate and agree on the adjustment.
- Earlier it was noted that results of this research would not likely be used in real formulas. One reason is because of relatively large differences in some cases between forecasted and actual ratios. Better forecasting models are needed. Besides simply adjusting for seasonality, the dynamics associated with the ratios themselves and inclusion of other economic variables would likely improve the results. Periods longer or shorter than five years need to be examined. Also, the procedure in this research forecasted monthly average ratios rather than weekly average ratios. The latter would likely be preferable in formula pricing base prices.

## Summary and Conclusions

Moving toward formula pricing the base price in grid pricing systems for fed cattle may have merit compared with current formula pricing methods. However, more work is clearly needed before buyers and sellers will feel comfortable switching from formulas commonly used to alternatives discussed here.

## References

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