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Relative Volatility in the U.S. Beef Market

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Objective

Analysis

for Informed

Decision Making

Profits for U.S. cow-calf producers and cattle finishers depend upon livestock revenues and feed and non feed costs. Some factors that influence profits are subject to management decisions such as technology adoption, health and feed nutrition programs, genetics, and marketing strategies. However, the market components of revenues or costs such as cattle prices, feed prices, interest rates, fuel and energy prices, etc. are normally not subject to producer control.

Cattle prices receive considerable attention when evaluating the economic health of the beef industry. The years 2002 to 2004 demonstrated such attention. From November 2002 to November 2003, prices of feeder cattle increased 26 percent from \$85.00/cwt to \$107.25/cwt. Prices of fed slaughter steers increased 48 percent from \$69.35/cwt to \$102.35/cwt. Then, from the last week of December 2003 through the first two weeks of January 2004, feeder cattle and fed cattle prices declined about 15 percent due to the Bovine Spongiform Encephalopathy (BSE), in the state of Washington. As of May 2004, however, cattle prices were relatively strong and exceeded their corresponding 2003 levels by about 10 percent.

Economists partly attribute the sharp increase in 2003 beef prices to the U.S. moratorium on Canadian live

cattle and beef imports due to the single Canadian BSE occurrence in May 2003. However, other factors such as reduced domestic cattle inventories (since the mid 1990s) and increased demand for beef products (since the later 1990s) played significant roles. The “BSE” decrease in beef prices from the last week of December 2003 into early January 2004 resulted from the closure of U.S. beef export markets and market uncertainty. The major export customers of U.S. beef have been Japan, South Korea, Mexico, and Canada. Canada never “officially” closed its border to U.S. beef, while Mexico in early March 2004 reopened its market to U.S. boneless beef from cattle slaughtered at under 30 months of age. In early April 2004, Mexico also reopened their markets to U.S. beef by products. As of May 2004, Japan and South Korea had not reopened their markets. The USDA was also finalizing the process for eventual reopening of U.S. border to Canadian live cattle. As of April 26, 2004, R-Calf USA recently won a district court order injunction that bars expanding Canadian beef product imports of beef trimmings and bone-in beef into the U.S. Overall, the post-BSE increase in beef prices has reflected continued strong consumer demand for beef, government implementation of BSE safeguards, and reduced domestic cattle inventories.

Relative Volatility

As with many agricultural commodity prices, the trademark of U.S. beef prices is variability. A standard measure of price variability is “relative volatility” (V), which is the standard deviation of a price divided by its average price. The larger is V, the higher is the volatility of the price variable. Or, the lower is V, the lower is volatility of price. For example, for the period of 1980 to 2002 real fed steer and feeder steer prices had relative volatilities of 23 percent and 19 percent, respectively (Table 1). These are high in relation to volatilities of other variables such as domestic cattle slaughter and calf crop, which had V’s of about 5 percent. However, they are relatively smaller compared to beef demand and corn price which had V’s of about 34 percent and 37 percent, respectively. Beef demand is measured as an index (Marsh 2003).

Economic Factors

Producers, economists, and public officials often debate the relative importance of economic factors in terms of changes in U.S. beef prices. For example, disagreements exist regarding the relative effects of U.S. livestock and meat trade (particularly NAFTA), increased meat packer concentration (i.e., cost savings versus market power), and market demand and supply conditions on U.S. beef prices. Specific to demand and supply, some producers feel that supply primarily drives livestock prices and the importance of the consumer dollar vote at the meat counter is less important. Thus, if there is an increase in retail beef demand, they surmise the effects are primarily captured in the margins of grocery retailers and meat packers. Other important factors that often receive less attention include meat packer sales of by products, USDA farm programs, and interest rate policies of the Federal Reserve. Knowledge of factors affecting cattle

Table 1: Relative Volatilities of Economic Variables in Beef Market, 1980-2002

Variables	Mean	Standard Deviation	Relative Volatility (percent)
Slaughter Price	\$53.30/cwt	\$12.01/cwt	22.5
Feeder Price	\$60.56/cwt	\$11.31/cwt	18.7
Cattle Supply: Calf Crop Cattle Slaughter Average Weight	40.34 mil hd 33.76 mil hd 1163.53 lbs	2.18 mil hd 1.63 mil hd 64.17 lbs	5.4
Retail Demand	60.50	20.31	33.6
Marketing Cost	308.91 cents/lb	24.04 cents/lb	7.8
By Products	14.06 cents/lb	2.72 cents/lb	19.3
Feed Price	\$2.03/bu.	\$0.76/bu	37.4
Net Trade	1.88 bil lbs	0.37 bil lbs	19.7
Prime Interest	8.19%	3.46%	42.2

Note: Retail Demand is an index with 1970 = 100 as the base year, and Marketing Cost is an index with 1967=100 as the base year. Relative Volatility is the Standard Deviation divided by the Mean. Cattle Slaughter is domestic cattle slaughter (excluding live cattle imports) and Net Trade is imports less exports of live cattle and beef (carcass weight).

prices may suggest public and private policies needed to deal with potential financial risks. Examples of these policies include government sanctions in international trade, enforcement of antitrust laws, USDA animal health and marketing regulations, and producer risk management involving cash markets, commodity hedging, forward contracting, or marketing alliances.

A statistical demand and supply model of the fed cattle (slaughter steers and heifers) and feeder cattle sectors was employed to estimate the relative importance of economic factors contributing to long term variability in beef prices. The model included the years 1970 through 2002, a period sufficient to cover several cattle cycles. The economic arguments hypothesized to determine fed and feeder cattle prices were grouped into several categories: (1) supply factors including (separately) calf crop inventories, domestic cattle slaughter, and average slaughter cattle weights; (2) retail beef demand

(represented by a beef demand index); (3) meat packer-to-grocery retailer marketing costs (represented by a food marketing cost index); (4) beef by product values (hides, offal, and tallow) (5) feed costs (represented by corn price); (6) U.S. net trade in live cattle (Canada and Mexico) and beef (all countries); and (7) the prime interest rate to represent macroeconomic factors.

A statistical approach was used to calculate the relative importance (or ranking) of these variables on cattle prices (Marsh 2003). Elasticity estimates of the model, which are percentage changes in cattle prices due to 1 percent changes in the economic variables, were multiplied by relative volatilities (V) of the economic variables given in Table 1. The resulting numbers, shown in parentheses Table 2, are labeled as *percentage ranks*.

The higher the percentage ranks the more important were the variables in impacting cattle prices. Or, the lower the percentage ranks the less important were the variables. Thus, it is possible for one variable to have a smaller elasticity than another variable; but because the variable with the smaller elasticity has a much higher V, it could have a higher percentage rank in terms of impacting cattle price.

Table 1 gives the relative volatilities of market variables listed above. A more recent period of 1980-2002 was selected. Cattle prices, food marketing cost, by product value, feed cost, and prime interest rate are adjusted for inflation. Results show a wide range of Vs. For example, the Vs for supply related variables (calf crop, domestic cattle slaughter, slaughter weights) are relatively low, ranging from 4.8 percent to 5.5 percent. Relative volatilities for other variables such as retail beef demand and prime interest rate are relatively large at 33.6 percent and 42.2 percent, respectively. The model does not explain the reasons for these volatilities, only that they occurred and subsequently affected cattle prices.

Ranking Results

Table 2 presents the rankings of the economic factors affecting real cattle prices for the 1980-2002 period. The rankings are stated in terms of dollars per hundred weight and are listed in order of importance. The dollars per hundred weight numbers are calculated by multiplying the percentage ranks in Table 2 by average fed cattle and feeder cattle prices given in Table 1. Thus, variability in economic factors explains the variability in cattle prices. The slaughter price effect of \$12.09/cwt, for example, is calculated by multiplying the model elasticity coefficient for demand (0.675, not shown) by the relative volatility of demand (0.336 or 33.6 percent) in Table 1, and then multiplying the resulting percentage rank (0.227) by average real fed steer price of \$53.30/cwt.

Overall, consumer beef demand (represented by the retail beef demand index) was the most important factor affecting slaughter and feeder cattle prices, amounting to \$12.09/cwt and \$19.78/cwt, respectively.

The second most important source impacting cattle prices was beef

supplies. The supply effect on slaughter cattle price amounted to \$7.09/cwt, which was the sum of cattle slaughter (\$3.89/cwt) and average slaughter weight (\$3.20/cwt) effects. The supply effect on feeder price was \$10.46/cwt, which was the sum of the calf crop (\$5.23/cwt) and average slaughter weight (\$5.23/cwt) effects. The top ranking influence of beef demand emphasizes the role of consumer sovereignty in terms of affecting the welfare of beef producers. As an example, we see that the strength in post-BSE beef prices of 2004 owes greatly to domestic consumption. These results emphasize the importance of fundamental demand and supply conditions in affecting price volatility in the beef industry.

The third most important factor on cattle price variability is packer-to-retail marketing costs. Marketing cost effects on fed and feeder cattle prices were \$2.85/cwt and \$4.66/cwt, respectively. This result emphasizes the importance of costs incurred by livestock-meat marketing firms. Studies have shown, for example, that technology adoption by meat packers and cattle finishers increases cost efficiencies. This has resulted in increasing input demand, hence, prices paid for fed cattle and feeder cattle by meat packers and feedlots (Brester and Marsh 2002).

The remaining factors demonstrated smaller effects on cattle prices. The trade effects, which usually receive much public attention, are relatively small. The market share of *net* live cattle and beef imports (carcass weight) averaged about 7 percent of total U.S. beef supplies (production, stocks, and imports) for the 1980-2002 period. The trade impact on fed and feeder cattle prices amounted to about \$1.51/cwt and \$2.48/cwt, respectively. For 1200 pound fed steers and 650 pound feeder steers, this was equivalent to about \$18 and \$16 per head, respectively.

Table 2: Relative Importance of Economic Factors Affecting Cattle Prices

Variable	Cattle Prices	
	Slaughter Steer (dollars/cwt)/percent	Feeder Steer (dollars/cwt)/Percentage Ranks
Retail Demand	12.09 (22.68)	19.78 (32.66)
Cattle Supply	7.09 (13.30)	10.46 (17.28)
Calf Crop		5.23 (8.64)
Cattle Slaughter	3.89 (7.30)	
Average Weight	3.20 (6.00)	5.23 (8.64)
Marketing Cost	2.84 (5.34)	4.66 (7.69)
By Products	1.75 (3.28)	2.86 (4.72)
Prime Interest	1.62 (3.04)	2.79 (4.60)
Net Trade	1.51 (2.84)	2.48 (4.09)
Feed Cost	1.44 (2.69)	2.31 (3.81)

Note: The effect of Cattle Supply on Slaughter Steer price is the sum of price effects of Cattle Slaughter and Average Weight. The effect of Cattle Supply on Feeder Steer price is the sum of Calf Crop and Average Weight. The first numbers in each row are in dollars/cwt and the numbers in parentheses are the percentage ranks.

By product revenues often pay meat packer slaughter costs—their impact on fed and feeder cattle prices amounted to \$1.75/cwt and \$2.86/cwt, respectively. Interest rates (proxied by the prime interest rate) represent opportunity costs of cow-calf producers engaged in retained ownership programs and finance costs of cattle feeders and meat packers. Interest rate affected fed and feeder cattle prices by \$1.62/cwt and \$2.79/cwt, respectively.

Feed cost is a major factor that affects feedlot cost of gain and cattle slaughter weights, hence, the demand price of feeder cattle placements and the supply price of fed cattle. This variable affected fed and feeder cattle prices by \$1.44/cwt and \$2.31/cwt, respectively.

Conclusions

The relative volatilities of several economic variables affected the variability of fed cattle and feeder cattle prices over the 1980-2002 period. Relative volatility in retail beef demand and cattle

supplies accounted for about 43 percent and 25 percent, respectively, of cattle price changes. (For example, the retail demand effect of \$12.09/cwt divided by the sum of slaughter steer dollar/cwt figures (\$28.34/cwt) in Table 2 gives the retail demand contribution of 43 percent). Packer-retailer costs accounted for about 10 percent, while U.S. net beef trade accounted for about 5 percent of the cattle price changes. Thus, it appears consumer sovereignty in the beef market looms large. The size of the demand effect suggests the importance to the beef industry of health information, food safety, product quality, and price competitiveness with other meats. Food safety is particularly critical with the recent (2003) outbreaks of BSE in North America.

Meat packer-to-retailer marketing costs affected cattle prices, but producers also question the effects of increasing meat packer concentration. From 1980 to 2002, the four-firm concentration ratio in the beef packing industry for steer and heifer slaughter increased from 36 percent to 80 percent. However, the study was not statistically

conclusive about the impact of packer concentration on cattle prices. One reason may be technological cost savings and economies of scale that have occurred in the meat packing industry, which have reduced per head slaughter and fabrication costs. Some studies have indicated that the positive effects of packer technological cost savings have more than offset any negative effects of market power on cattle prices.

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