A NEW LOOK AT BEEF CATTLE PRICE REPORTING CLASSIFICATIONS

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Beef production has become a series of highly specialized enterprises, consistent with technological and temporal developments throughout agriculture.Technological developments in forage and grain production, feed processing, feedlots, and transportation systems have helped physically transform the beef production industry and altered the flow patterns of beef cattle and carcass beef throughout the United States. A weanling calf produced in Virginia may be hauled to southern Georgia or Louisiana to be wintered on pasture, shipped to a Colorado feedlot for finishing, slaughtered in Colorado and the carcass shipped to Pennsylvania to a retail chain which services stores in Virginia.

Improved transportation facilities also have increased the importance of market location as a pricing factor. Sellers, as well as buyers, are no longer limited to one or two local markets. Market location effects become especially important for production planning when animals can be purchased and sold in different markets.

Farmers with beef production operations and those considering beef programs are confronted with many planning and production decisions. Calves can be sold in September at 370 pounds, in December at 450 pounds or grazed on winter forage and sold in May at 625 pounds. These production decisions are important to beef cattle producers with sufficient flexibility in their farm operations to provide these alternatives. Decisions about the type of cattle to purchase for grazing on winter forage or for a feeding program, whether to purchase cattle in a particular year and when to buy and sell during the year may be equally important decisions for the modern farmer. Price data needed for these kinds of management decisions must be sufficiently detailed to account for trends, seasonal variations and the influence on price of weight and/or type of animal.

LIMITATIONS OF PRICE INFORMATION

Cattle price reporting traditionally has emphasized the current market situation. While useful for current marketing decisions, price reporting categories used in these daily or weekly reports, which become the recorded (historical) price information, are inadequate sources of price data for planning beef cattle production.

Reporting classifications, such as used in the Louisiana *Livestock Market Report* [1] (slaughter calves, slaughter steers and heifers, stocker calves, stocker steers and stocker heifers), are too broad and ill-defined to provide price information useful for planning. Furthermore, reporting personnel are inconsistent in the interpretation of these classifications. For example, a 450-pound animal may be classified as a stocker calf in one auction market and as a stocker steer in another. Additionally, with the decline in calf slaughter and the number of slaughter plants throughout the Southeast, slaughter classifications for lightweight animals in auction market reporting are more descriptive of the buyer than the animal. This is characteristic of areas such as Louisiana where most cattle under a year old are purchased for either stocker or feedlot programs.

Recently, some market news reports, such as *The Drovers Journal* [2], have included 100-pound weight intervals in price reporting classifications. While these

arbitrary weight intervals greatly improve the quality of information available to livestock producers for making management decisions, they may not necessarily reflect patterns inherent in the pricing of beef cattle.

ANALYSIS OF LOUISIANA CATTLE PRICES

A research project was initiated in August, 1972, to evaluate calf and yearling prices and price patterns in Louisiana. The study was designed to determine what modifications, if any, were desirable in price reporting classifications to provide beef producers with adequate price data for sound production management decisions.

Methods and Procedures.

Weight, price and sex data were secured from one representative auction located in each of four areas of Louisiana: Northeast, Northwest, Central and Southwest. Data were obtained from all regular weekly sales of calves and yearlings within the 150-800-pound liveweight range for the two-year period June 28, 1970, through June 27, 1972. The sample included 158,192 observations (animal sales) consisting of 73,937 steers, 41,655 heifers, and 42,600 head upon which sex identification could not be determined. Animals are not graded at Louisiana auction markets; therefore, information on grades was not recorded.

Analyses were made for each of the four auction locations separately and for the four auctions combined. The relationships found for the individual auctions indicated the data could be treated as single population.

Simple linear regression equations were fitted to the combined data to determine the effect of weight on price for all animals, for steers, and for heifers.

Data for the two-year period were combined by weeks for the determination of seasonal price patterns. Animal weights were categorized into 26 groups of 25-pound intervals each. The Dummy Variable Method, which accounted for the trend during the two-year period, was used to compute the seasonal pattern of prices for all animals for each of the 26 weight groups. Regression model (1) was used to calculate the seasonal price patterns.

$$(1) \qquad P = bT + \sum_{i=1}^{52} a_i D_i$$

where:

P = average weekly prices,

b = coefficient of regression for trend,

T = time (weeks, 1, 2, ..., 104),

a_i = regression coefficient for the dummy variable, and

D_i = dummy variable (1 for the ith week in the year, 0 otherwise).

Similarity of seasonal price patterns for successive weight groups [equation (1)] were tested by equation (2).

$$(2) \quad F = \frac{(\Sigma d^2 t - \sum_{i=1}^{k} \Sigma d_i^2) / (k - 1)}{\sum_{i=1}^{k} \Sigma d_i^2 / \sum_{i=1}^{k} n_i - k}$$

$$d.f. = (k - 1); \left(\sum_{i=1}^{k} n_i - k \right)$$

where:

$\Sigma d^2 t$ = residual sum of squares for total regression,

$\sum_{i=1}^{k} \Sigma d_i^2$ = sum of individual sums of squares,

k = number of weight groups, and

n_i = number of observations in the ith group (i = 1, 2, ..., k).

Successive weight groups were combined if their seasonal price patterns were not significantly different at the .05 probability level. The six weight groups which resulted from this analysis of the combined data for all animals were used for further analyses.[1] Equation (1) was used to compute the seasonal pattern of prices for all animals within each of the six weight groups. Analysis of co-variance was used to determine the effects on price of animal weight, auction location, sex of animal, weight group and the double and triple interactions of these variables. Only animals identified by sex were included in the analysis of co-variance.

Results and Interpretation.

The simple linear regression of weight on price

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[1] This procedure resulted in four weight groups for animals between 150 and 600 pounds and three weight groups for animals between 601 and 800 pounds. A comparison of these weight groupings with those obtained from similar analyses conducted for each of the four auction markets separately (using all observations and with due recognition of missing data) suggested that the three weight groups from 601 to 800 pounds could be combined into two weight groups. Seasonal price patterns for the groups combined in this manner were not significantly different at the .06 probability level.

for all animals indicated that weight accounted for more than 27 percent of the variation in price. Similar analyses showed that weight accounted for nearly 33 percent of the variation in price when steers and heifers were considered separately (Table 1). The linear effect of weight on price for all animals was a decline in price of $3.70 per hundredweight for each 100-pound increase in liveweight. Similar effects for steer and heifer prices were $4.30 and $3.30 per hundredweight, respectively.

The analysis of seasonal price patterns indicated that animals in the 150- to 800-pound weight range could be combined into six weight groups. The six weight groups that resulted from significant

Table 1. LINEAR REGRESSION OF WEIGHT ON PRICE FOR ALL ANIMALS, STEERS, AND HEIFERS, FOUR LOUISIANA AUCTION MARKETS, JUNE 28, 1970, THROUGH JUNE 27, 1972

| Sex | Number of observations | Statistical measure | | | |
		a	b	t	R^2
All animals 1/	158,192	49.99	-.036842	-244.31*	.2739*
Heifers	41,655	46.24	-.033131	-143.15*	.3297*
Steers	73,937	54.30	-.042784	-189.50*	.3289*

*Significant at the .0001 probability level.

[1] Includes 42,600 animals for which sex was not determined.

Table 2. ANALYSIS OF CO-VARIANCE OF SELECTED FACTORS AFFECTING PRICE OF STEERS AND HEIFERS FOR SIX WEIGHT GROUPS, FOUR LOUISIANA AUCTION MARKETS, JUNE 28, 1970, THROUGH JUNE 27, 1972

| Source of variance | d.f. | Statistical measure | | | |
		b	S.S.	M.S.	F
Weight	1	-0.043	1,564.03	1,564.03	81.42**
Auction	3		3,566.73	1,188.91	61.89**
Sex	1		8,369.16	8,369.16	435.63**
Weight group	5		2,562.68	512.54	26.68**
A-WG	15		1,587.46	105.83	5.51**
A-Sex	3		693.90	231.30	12.04**
Sex-WG	5		1,175.89	235.18	12.24**
A-Sex-WG	15		567.99	37.87	1.97*
Error	3935		75,597.80	19.21	
Total	3983		189,145.79		

* .014 level of significance
** .0001 level of significance

differences in seasonal price patterns were, in pounds, 150-275, 276-375, 376-500, 501-600, 601-675, and 676-800.

The results of the analysis of co-variance for these weight groups are presented in Table 2. Differences in price attributable to auction location, sex and weight group were each significant after accounting for the linear regression effect of weight on price. All interaction effects were also significant.

Numbers of observations, standard deviations in price, average prices and average animal weights by weight group for all animals, steers, and heifers are presented in Table 3. Standard deviations in price within weight groups were greater for steers than for heifers throughout the 150-800-pound weight range. The standard deviation for heifers declined throughout the weight range; while for steers, it declined from 150-600 pounds, then increased. This may indicate that quality (or grade) has a greater effect on price of steers than heifers. It may also imply that as the final grade of steers becomes more predictable (weights greater than 600 pounds) quality becomes a more influential factor in price determination. Conclusive evidence of these relationships cannot be determined specifically from the sample data. The absence of recorded grade

Table 3.   AVERAGE PRICES AND WEIGHTS FOR SIX WEIGHT GROUPS FOR ALL ANIMALS, STEERS, AND HEIFERS, FOUR LOUISIANA AUCTION MARKETS, JUNE 28, 1970, THROUGH JUNE 27, 1972

Weight interval	Number of observations	Average price	Standard deviation in price	Average weight
Pounds	Number	Dol./cwt.	Dol./cwt.	Pounds
All animals				
150 - 275	32,828	42.94	10.07	229.06
276 - 375	53,022	36.85	6.19	329.99
376 - 500	52,841	33.72	4.91	430.16
501 - 600	13,161	31.17	4.33	542.21
601 - 675	3,177	29.31	4.53	633.03
676 - 800	1,852	26.90	5.08	726.78
Weighted average		36.32		371.27
Steers				
150 - 275	14,942	45.85	10.10	230.84
276 - 375	25,164	38.89	6.07	330.17
376 - 500	25,314	35.40	4.85	430.52
501 - 600	5,714	32.38	4.33	541.63
601 - 675	1,229	30.27	4.59	634.65
676 - 800	809	28.34	5.46	729.76
Weighted average		38.33		370.64
Heifers				
150 - 275	8,632	39.61	7.19	233.64
276 - 375	14,872	34.40	4.95	328.85
376 - 500	13,340	31.69	4.01	428.91
501 - 600	2,947	29.23	3.98	543.70
601 - 675	826	26.65	3.84	636.22
676 - 800	553	24.73	3.36	731.25
Weighted average		33.96		368.24

Table 4. AVERAGE PRICES AND WEIGHTS FOR SIX WEIGHT GROUPS FOR ALL ANIMALS, FOUR LOUISIANA AUCTION MARKETS, JUNE 28, 1970, THROUGH JUNE 27. 1972

| Weight interval	Northeast		Northwest		Central		Southwest	
	Price	Weight	Price	Weight	Price	Weight	Price	Weight
	Dol./cwt.	Pounds	Dol./cwt.	Pounds	Dol./cwt.	Pounds	Dol./cwt.	Pounds
150 - 275	39.33	230.44	40.69	244.82	41.04	240.66	45.79	219.07
276 - 375	36.10	328.52	37.20	333.21	37.11	329.66	36.90	324.53
376 - 500	32.82	431.06	34.27	430.87	33.97	431.53	33.58	425.56
501 - 600	29.94	542.55	32.05	540.00	30.88	544.22	32.02	541.83
601 - 675	27.79	633.78	30.63	633.25	28.58	636.65	31.49	625.53
676 - 800	25.28	726.90	30.92	719.92	26.33	732.85	29.84	710.07
Weighted average	34.46	384.58	35.67	392.78	35.73	383.82	39.07	326.38
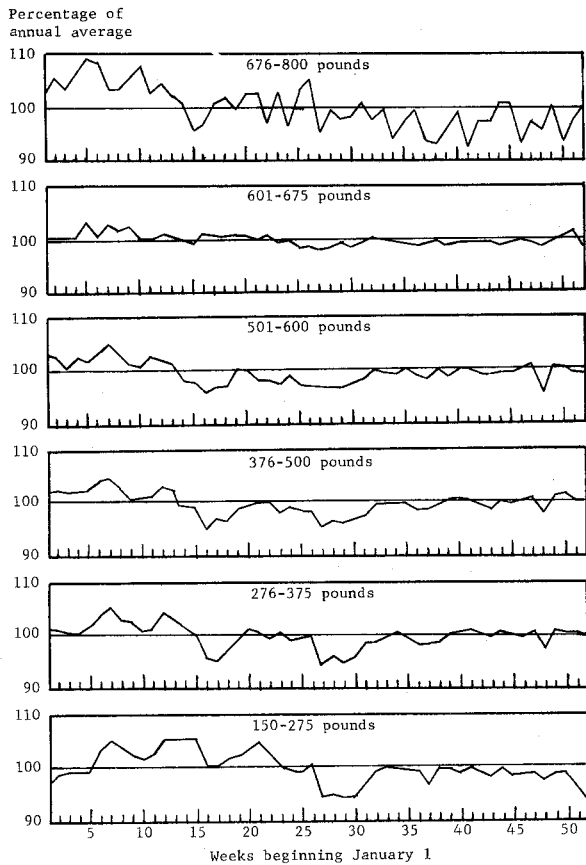
Figure 1. SEASONAL PRICE INDEXES FOR SIX WEIGHT GROUPS, ALL ANIMALS, FOUR LOUISIANA AUCTION MARKETS, JUNE 27, 1970, THROUGH JUNE 28, 1972.

information and the limited number of observations in the heavier weight groups preclude a more detailed analysis.

Average prices and weights by weight group for all animals for each of the four auction market locations are shown in Table 4. While prices among auction locations were significantly different, the differences were generally small. The average weight of animals within the two extreme weight groups varied considerably among auctions. This, in part, accounts for the larger price differences among auction locations in those two weight groups.

The indexes of seasonal prices for the six weight groups are shown in Figure 1. Seasonal price patterns for the lowest and the two highest weight groups were each distinctively different from all others. Price patterns for the other three weight groups, including animals from 275 to 600 pounds, had distinct similarities with differences primarily in magnitude. However, standard deviations in price differed considerably among these three weight groups, ranging from $4.33 to $6.19 per hundredweight (Table 3).

Prices of animals weighing between 676 and 800 pounds were very erratic, while prices for animals between 601 and 675 pounds were very stable throughout the year. Prices within the four lighter weight groups (150-600 pounds) showed considerable seasonal fluctuation during the first 32 weeks, but were relatively stable for the remainder of the year.

The significant differences in price associated with weight, sex, market location, and their allied seasonal patterns (Table 2) indicate that these factors must be accounted for within a price reporting system. Otherwise, the recorded price data may not provide adequate decision information for planning future production.

Revised calf and yearling reporting classifications based on these findings were recommended to the Market News Service of the Louisiana Dept. of Agriculture. The revised classifications include sex distinction for the six weight groups with selective grade reporting. The revised categories were adopted in March, 1974. Subsequent Louisiana cattle price

reports will provide historical data that producers can use in planning future production. They will also reflect the current market situation.

IMPLICATIONS FOR THE SOUTH

Differences in market structure, beef cattle production systems and concentrations of various weights and types of cattle influence cattle pricing. The majority of calves and yearlings sold through auction markets in feeder calf-producing states (such as Louisiana) are purchased by a relatively few order buyers. These buyers purchase animals to fill orders according to specified weight, grade and price specifications. However, due to seasonal patterns of marketing for various types and weights of cattle, these buyers frequently purchase animals outside of these weight and grade specifications. These factors may greatly modify seasonal price patterns among market areas of the South. The pricing disposition of buyers throughout the year, rather than purchase order specifications, should be reflected in the price reporting classifications.

Livestock price reporting systems serve a twofold purpose: (1) they provide prices for current marketing decisions and are an indicator of market activity and, (2) they furnish a historical record of prices and price relationships for decision-making.

Price reporting systems should differentiate among weight groups with unlike seasonal pricing patterns. The use of 100-pound weight intervals represents an improvement in quality of price data available for management decisions. However, this procedure may not adequately reflect seasonal price patterns. For example, this procedure applied to the Louisiana data would misplace, according to seasonal price patterns, three 25-pound interval groups and distort seasonal price pattern estimates for three 100-pound interval groups. This could considerably reduce the reliability of the price data for estimating future prices.

The categories used by a price reporting agency should be based upon the needs of its clientele. The price reporting categories must adequately describe animals of differing value and utility as well as provide for efficiency in collection, distribution and interpretation of information contained therein. While it would be desirable for comparative purposes to have uniform price reporting categories among areas, a uniform set of categories for all areas of the South (or the United States) may not adequately serve the information needs of clientele within the various areas.

A logical compromise may be for each price reporting agency to develop a reporting system that reflects the seasonal patterns of prices among market areas for which it is responsible. The resulting historical price data would permit accounting for both weight and seasonal differences in price, even though animals were purchased and sold in market areas serviced by different price reporting agencies.

REFERENCES

[1] *The Drovers Journal*. The Food and Agricultural Division. Kansas City, Kan.: Vance Publishing Corp.

[2] Louisiana Dept. of Agriculture. *Livestock Market Report*. Livestock Market News Service, Marketing Division. Baton Rouge, La.: Louisiana Dept. of Agriculture.