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FACTORS AFFECTING FEEDER CALF PRICES*

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This paper is the result of an extension program designed to assist the beef producers on the Wind River Reservation in assessing the benefits of holding an annual feeder calf sale. The results of each year's sale were summarized using simple averages and presented to the producers. A cursory review of the data indicated the need for additional analysis.

Agricultural economists have traditionally analyzed prices using models based on economic theory, institutional characteristics, etc. These models, however, are not particularly appropriate for aiding ranchers in making managerial decisions. Feeder calf producers are interested in knowing the influence of such factors as weight, sex, and breed on price. It is generally acknowledged that lighter animals receive a higher price/cwt. than heavier animals. Likewise, buyers are willing to pay more for steers than heifers because the former are more efficient in the feedlot. Also, heifers may be discriminated against on the chance that they are pregnant. Breed may influence price due to real or expected differences in dressing percentages and feeding efficiencies. The primary objective of this research endeavor was to determine the importance of breed, weight, and sex in explaining variations in feeder calf prices.

This subject has been studied by Bickel [1], Cole [2], and Kearl [4] using regression analysis with dummy variables. The results generally indicated price variations due to breed, weight, sex and lot size. The purpose of this report is to determine effects of these variables on pricing behavior using analysis of covariance.

Data

Data on 999 lots were obtained for the period 1971-1974 from special feeder sales at Riverton sponsored by the Wind River Reservation Cattleman's Association. The sales each year occurred sometime during the last 2 weeks of October. Specific data items include: price/cwt., average weight/animal (200-700 lb. animals), number of animals/lot, breed (Hereford, Angus, Angus x Hereford, other crossbreds)[1] and sex. For the most part, the same producers were the consigners each year, which should reduce the quality variations of the feeders marketed.

The data were analyzed using analysis of covariance to ascertain if variation in price due to breed, weight class, sex and lot size were statistically significant. If the analysis indicated variation in the above factors, Duncan's Multiple Range test was performed to discover where the variation in each category occurred.

Results of Variance Analysis

The model used for the analysis is of the following form:

$$P_{ijkn} = a + B_i + S_j + W_k + b_1 LS_{ijkn}$$

where:

P_{ijkn} = price/cwt. for the n^{th} observation in the k^{th}W (weight) class, in the j^{th}S (sex) class and in the i^{th}B (breed) class.

a = the population mean when equal frequencies exist in all subclasses and $LS_{ijkn} = 0$.

B_i = effect of the i^{th} breed, i = 1,...,4 (1 = Hereford, 2 = Angus, 3 = Angus x Hereford, 4 = other crossbreds).

S_j = effect of the j^{th} sex, j = 1 or 2 (1 = heifer, 2 = steer).

W_k = effect of the k^{th} weight class, k = 1,...,5 (1 = 200-299, 2 = 300-399, 3 = 400-499, 4 = 500-599, 5 = 600-700).

b_1 = partial regression coefficient for P_{ijkn} on LS_{ijkn}.

LS_{ijkn} = an independent continuous variable for lot size.

One model could have included a year class, however, it was felt that more information would be gained by analyzing the data for each year separately. That is, any peculiarities or changes in buying patterns would be more evident if the latter approach is used. The above model requires analysis of variance with unequal and disproportionate subclass numbers and continuous variables [3]. The data were ana-

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[1] Other crossbreds include: Hereford x Shorthorn, Hereford x Charolais, Angus x Shorthorn, Angus x Charolais, Shorthorn x Charolais.

lyzed using a computer program designed for this type of problem [5].

The results of the covariance analysis presented in table 1 indicate which of the factors outlined in the model explain variation in prices. Evidence is strong ($P \leq .01$) that average prices among weights (with the exception of 1974) and between sexes are not equal. The fact that weight was not a significant factor in 1974 can be partially explained by the prevailing market conditions in that year. High feed prices encouraged buyers to offer more for the higher weight classes relative to lighter animals in 1974 compared to earlier years.

Lot size was also a highly significant ($P \leq .01$) factor contributing to price variation. The regression coefficients for this factor were .086, .125, .148, and .156 for 1971 through 1974 respectively. This indicates that a premium was paid for larger lots. This result is only applicable over the range of the data used in this study which consisted of relatively small lots (range 1 to 42 head and average of 8.0 in 1971, 8.08 in 1972, 6.17 in 1973, and 5.17 in 1974).[2]

[2]Consideration was given to omitting the single animal lots. However, these small lots were typical for members of the Reservation Association.

Table 1. Analysis of covariance for feeder calf prices, 1971-1974

Year and Factor	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio
1971				
Breed	3	54.60	18.20	2.68*
Sex	1	1838.30	1838.30	270.90**
Weight	4	2154.40	538.60	79.37**
Regression LS[1]	1	198.81	198.81	29.30**
Error	293	1988.30	6.79	
1972				
Breed	3	134.90	44.97	1.99
Sex	1	1593.10	1593.10	70.60**
Weight	4	4644.90	1161.20	51.46**
Regression LS[1]	1	331.77	331.77	14.70**
Error	226	5099.60	22.56	
1973				
Breed	3	162.60	54.20	2.66*
Sex	1	3290.30	3290.30	161.41**
Weight	4	2254.10	563.52	27.64**
Regression LS[1]	1	277.06	277.06	13.59**
Error	188	3832.30	20.39	
1974				
Breed	3	23.15	7.72	.67
Sex	1	2144.20	2144.20	186.20**
Weight	4	18.79	4.70	.41
Regression LS[1]	1	357.59	357.59	31.05**
Error	252	2901.90	11.52	

[1] LS = Lot size
* = Significant at the .05 probability level
** = Significant at the .01 probability level

Breed was not a strong factor in explaining price variation in the reservation sale. In 1972 and 1974, breed was not significant and not strongly significant (relative to the other factors) in 1971 and 1973. Therefore, in this particular sale, indications are that there was little discrimination by buyers with respect to breed.

Interactions were not included in the above model because: 1) missing observations which did not permit calculation (B x S and B x W); and, 2) the remaining interaction (S x W) was not significant when incorporated into an initial model.[3]

Duncan's Multiple Range test [3 and 6] was performed to determine which means in each factor were significantly different (table 2). The least square means prices presented in table 2 are the prices which would exist in each factor if there were equal numbers of observations in all categories and if all prices were adjusted for the effects of lot size. These means are thus distinctly different from arithmetic means.

The weight and sex relationship presented in table 2 are statistically different from each other for all years with the exception of weight classes 4 and 5 in 1973. This again can be attributed to the market conditions of that year.

The only significant difference among breeds was for Hereford and Angus x Hereford in 1971 when Herefords commanded the premium; Angus x Hereford and Angus

[3]It is realized that this is not recommended research procedure. However, the particular program used to analyze the data yields better results for the remaining factors if the interactions which are not significant are removed.

Table 2. Least square mean feeder cattle prices adjusted for lot size, 1971-1974[1]

	Price ($/cwt.)			
Factor	1971	1972	1973	1974
Overall mean	36.66	47.88	53.77	26.37
Breed				
Hereford	37.56^{a}	48.59^{a}	54.60^{ab}	26.23^{a}
Angus	37.28^{ab}	45.71^{a}	50.39^{a}	26.67^{a}
Angus x Hereford	35.24^{b}	48.76^{a}	56.13^{b}	26.78^{a}
Other crosses[2]	36.56^{ab}	48.46^{a}	53.95^{ab}	25.80^{a}
Sex				
Heifer	33.89^{a}	44.95^{a}	49.40^{a}	23.35^{a}
Steer	39.43^{b}	50.81^{b}	58.14^{b}	29.39^{b}
Weight (lbs.)				
200-299	41.59^{a}	56.80^{a}	60.42^{a}	26.07^{a}
300-399	38.97^{b}	51.66^{b}	57.40^{b}	26.51^{a}
400-499	36.95^{c}	46.89^{c}	52.42^{c}	25.97^{a}
500-599	33.72^{d}	43.87^{d}	49.79^{d}	26.60^{a}
600-700	32.07^{e}	40.19^{e}	48.82^{d}	26.76^{a}

[1]Within each factor for each year, those prices with the same superscripts are not statistically different ($P \leq .05$); those with different superscripts are statistically different ($P \leq .05$).
[2]Other crosses include: Hereford x Shorthorn, Hereford x Charolais, Angus x Shorthorn, Angus x Charolais and Shorthorn x Charolais.

in 1973 when the crossbreds commanded a premium. This substantiates the previous discussion indicating that breed does not have a strong influence on price at the reservation sale.

Implications

The reader should not generalize from the foregoing discussion that breed is not a significant factor in explaining price variation. The above results only apply to a particular sale. Therefore, implications must be drawn relative to the producers for the aforementioned sale.

The results of this study indicate that the Association members should implement management practice which are directed toward developing high quality herds which gain most efficiently. Producers should strive to produce uniform animals (weight class, quality, sex, and breed to a lesser extent) and to increase lot size. Crossbreeding can be a means of achieving physical production advantages, without any apparent sacrifice in price.

Again, the data used in this study may exhibit peculiarities. Nevertheless, this report should provide the impetus for additional work relating to factors contributing to variation in feeder calf prices.

REFERENCES

1. Bickel, Blaine W., *Analysis of the Impact of Weight, Breed, and Sex on Feeder Cattle Prices in Wyoming,* Unpublished M.S. thesis, Division of Agricultural Economics, University of Wyoming, February 1968.

2. Cole, David L., "Analysis of Factors Affecting the Prices Paid for Feeder Cattle at Northern Michigan Beef Feeder Cattle Sale", Department of Agricultural Economics, Michigan State University, Report No. 60, January 1967.

3. Harvey, Walter R., *Least Squares Analysis of Data with Unequal Subclass Numbers,* USDA-ARS H-4, reprinted February 1975.

4. Kearl, W. Gordon, "Influence of Breeds of Cattle, Weight Number Sold on Feeder Cattle Prices in Wyoming Auctions", Unpublished manuscript, Division of Agricultural Economics, University of Wyoming.

5. Roehrkasse, Glenn P., "Least Squares Program for Heritability and Genetic Correlations", Agricultural Experiment Station, University of Wyoming, March 1, 1968.

6. Steele, Robert G. and James H. Torrie, *Principles and Procedures of Statistics,* McGraw-Hill Book Company, Inc., New York, New York, 1960.