



An analysis of factors affecting feeder cattle prices at Arizona livestock auctions

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AN ANALYSIS OF FACTORS AFFECTING FEEDER CATTLE
PRICES AT ARIZONA LIVESTOCK AUCTIONS

by

Charles Curtis Howard

A Thesis Submitted to the Faculty of the
DEPARTMENT OF AGRICULTURAL ECONOMICS
In Partial Fulfillment of the Requirements
For the Degree of
MASTER OF SCIENCE
In the Graduate College
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ABSTRACT

The livestock industry accounted for approximately 40 percent of the income from all agricultural commodities produced in the State of Arizona in 1969. An important segment of the Arizona livestock industry is the production of feeder cattle. Producers of feeder cattle have expressed growing interest in country auction sales as outlets for their feeder cattle and calves and factors affecting the prices they received which may be altered by their production management decisions.

The intent of this thesis has been to utilize multiple regression and correlation analysis to test for and study various factors affecting the selling price of feeder cattle at selected Arizona auction markets. Additional information was collected on selling costs and organizational characteristics of auctions to provide market comparisons and data that would serve to qualify the findings of the statistical analysis. Results of the analysis indicated that the following variables significantly affected the selling price of feeder cattle at Arizona auction market sales observed in this study: weight, sex, and grade of animals; the number of animals sold in a lot; and the type of auction market.

A comparison of selling costs indicated that a wide differential existed between selling costs at different auction types. The price differentials were found to be largely the result of the organizational characteristics of the markets analyzed and the services provided by these outlets.

CHAPTER 1

INTRODUCTION

The livestock industry in Arizona is an important source of income. The January 1, 1970 inventory of all cattle and calves in Arizona was estimated at 1,302,000 and was valued at \$214,830,000. The total growth in numbers of cattle during the past decade amounted to about 28 percent or an increase of 283,000 cattle and calves from the 1,019,000 on January 1, 1960. There were 510,000 cattle on feed in Arizona in 1969 while 820,672 fat cattle were shipped out of Arizona in 1969 and 347,566 calves were born and raised in the state (Arizona Agricultural Statistics, 1970, p. 41, 44-46). While detailed statistics were not available, indications are that the greatest part of the calves born in the state were shipped to other states for fattening.

An important facet of the livestock industry in Arizona is the production of feeder cattle. Arizona feeder cattle producers have several alternatives for marketing their cattle and calves. They can ship them to terminal markets in other states or sell directly to a trader, feeder or another rancher for cash or by contract. They can choose to market at one of the central auctions in the state or can join a marketing association which sponsors auction sales.

Additional market related alternatives for the feeder cattle producer's consideration were the breed, sex, grade, and weight of animals

chosen to produce for sale, and to some extent the number of animals marketed in a single group or lot. This study is concerned with analysis of the effects of these various factors on the producer's price.

Central auctions located in the major Arizona cities of Phoenix and Tucson, the special feeder sales held at the central market in Willcox, and the country auctions sponsored by various producer groups, were chosen for analysis. Observations were made on approximately 32,000 head of feeder cattle marketed at 48 sales held at these outlets in 1969.

The selection of marketing outlets was hypothesized to affect returns to feeder cattle producers in Arizona. Two factors that must be considered when choosing among alternative markets are marketing costs and prices received at the alternative outlets. For purposes of this study, costs will not be analyzed in detail but will be presented in order that rough comparisons can be made between the various outlets studied.

The general goal of this study was a detailed analysis of the prices received by producers of feeder cattle in Arizona and the factors affecting these prices. Various markets have been analyzed to determine factors influencing market returns to producers within and between markets. The hypothesis that prices received at alternative markets for Arizona feeder cattle are not equal have been tested for the following sales in 1969: the Navajo Indians (6 sales), Hopi Indians (1 sale), Fort Apache Indians (6 sales), Hualapai Indians (2 sales), San Carlos Apache Indians (3 sales), Willcox special sales (4 sales), Livestock

Association sales (6 sales), Phoenix auction (9 sales), and Tucson auction (10 sales).

The specific objectives of the study are as follows:

1. To record, measure, and compare prices received for feeder cattle at selected auction markets, special feeder cattle sales, and Indian reservation sales.
2. To test the hypothesis that the selling price of feeder cattle, at various markets observed was significantly affected by the following variables:
 - a. the weight, grade, sex, and breed of animals marketed
 - b. the size of lots in which animals were marketed
 - c. the type of auction at which feeder cattle were marketed
3. In those instances where the effect of the above variables were found to be significant with respect to selling price, estimate the magnitude of the difference.
4. To estimate and compare marketing costs to the seller, and try to assess the importance of certain qualitative factors in explaining market price differentials.

The markets studied, the basis for their selection, the sampling procedures, methods of data collection and nature of data collected to accomplish the above objectives are explained in Chapter 2. Multiple regression and correlation techniques were employed to analyze the effects of independent variables on the dependent variable. The model formulated and explained in Chapter 2 attempts to describe the

observations of price called the dependent variable, in terms of the values of other characteristics, called the independent variables. The independent variables hypothesized in this analysis were weight, grade, sex, breed of animals marketed, the size of sale lots, and the type of auction at which feeder cattle were marketed. The remainder of Chapter 2 contains information concerning methods of testing these independent variables for significance and discussion of the results of the regression analysis.

The approach explained in Chapter 3 is qualitative in nature and concerns market organization and costs of selling feeder cattle at the various markets studied. The nature of the data and the method of collection is discussed. A detailed description of selling costs and organizational characteristics including marketing services provided at each auction is presented in Chapter 3 and is followed by a comparison of the costs and associated services provided at the outlets analyzed. This segment of the analysis provides information that serves to explain market price differentials described as a result of the statistical analysis.

CHAPTER 2

ANALYSIS OF FACTORS AFFECTING PRICES RECEIVED BY PRODUCERS OF FEEDER CATTLE IN ARIZONA

Methods of Analysis

Selection of Markets

Auctions were selected for study on the basis of the interest groups which they represented as well as by type and location. Data were collected for sales held in 1969 by four cattlemen's associations, three weekly auction markets and sales held on five of the Indian reservations in Arizona. Phoenix and Tucson auctions were chosen because of their central location and their relative importance as regular weekly auctions.

The Willcox auction was selected because of its location in the southeastern corner of the state and the fact that special feeder cattle sales are held there during the fall months of September, October and November when most of the range cattle are marketed in Arizona.

These markets presented a representative cross section of the types of auction markets in Arizona (see Appendix A for a list of dates and locations of sales).

Sampling Procedures and Collection of Data

The sample consisted of all the sales of steers, heifers, steer calves and heifer calves between the weights of 200 and 799 pounds sold

at the 17 Indian reservation sales, 19 central auction sales, 4 special feeder cattle sales, and 3 sales sponsored by cattlemen's associations during the fall months of September, October and November of 1969. Similar data were collected on one Indian reservation sale and 3 sales sponsored by cattlemen's associations in the spring of 1969. Central auction market sales were sampled weekly for a period of ten weeks.

The cooperation of county extension agents in the areas where sales were held was enlisted to facilitate the collection of data. Two grading schools were held in Phoenix prior to the fall sales to instruct the individual county agents in the grading of animals marketed, and to point out exactly what information was to be collected. This was done to assure that some degree of uniformity in the data collected would be maintained.

Data were obtained at each auction by use of a standardized field schedule. In some cases it was necessary to refer to the auction's copy of the consignor's account to obtain all of the pertinent information.

Nature of the Data Collected at Auctions

The field schedule was constructed to facilitate collection of the following specific data on each consignor with respect to each lot of animals sold: pen number; the number of animals; breed; grade; (including highest, lowest, and average grade in each lot); the total and average weight of animals in the lot and the sale price in dollars and cents per hundredweight.

The collected data for the various marketing outlets were coded and punched onto IBM cards for computation and statistical analysis.

Selection of Specific Grades and Breeds Used for the Study

The basic grades selected for this study were those of the Official United States Standards for Feeder Steers as published by the United States Department of Agriculture, Consumer and Marketing Service, Livestock Division. Preliminary study indicated that the majority of feeder cattle marketed would grade in the range from standard to choice. To present an accurate picture of the effect of grade on selling price, the three grades (standard, good, and choice) were broken down into thirds of each grade. In other words the animals were graded on the basis of nine categories (low standard, average standard, high standard, low good, average good, high good, low choice, average choice, and high choice). This concurred with the opinion of Mr. Ed Ayres, USDA Livestock Market News Reporter in charge of livestock market reporting for the State of Arizona in a personal interview held in September of 1969.

The breeds of feeder cattle used for this study were also selected on the basis of a preliminary check of marketings. The main breeds and breed crosses raised and marketed in Arizona are Hereford, Angus, Hereford-Angus crosses, Brahma and Brahma crosses. Therefore these were the main breeds selected for use in this analysis. Additionally a classification of "other crosses" was included to encompass feeder cattle of non descriptive breeds or so called "oakie cattle".

Analysis of Factors Affecting Price

The statistical method used in this study was multiple regression and correlation analysis. This method was chosen because the primary interest in this study was an estimation or prediction of values of one character from knowledge of several other characters. According to Steel and Torrie in Principles and Procedures of Statistics, "Regression and correlation analysis will give the combined effect of several variables on the one variable of primary concern (Steel and Torrie, 1960, p. 277)". In this particular analysis, for example, the variable of primary concern was price per hundred weight of feeder cattle.

Price was designated as the dependent variable and weight, sex, grade, breed, lot size and type of auction were inserted into the model as independent variables. The analysis attempted to determine the effects of the independent variables on the dependent variable on the basis of the data collected at Arizona auction markets.

The basic model used to test the influence of factors on the prices received for feeder cattle was:

$$P = f(X_i, X_j, X_k, X_l, X_m, X_n, X_o)$$

Where:

P = average price paid per hundred weight

X_i = weight of animals marketed -- a continuous variable

X_j = size of sale lot as a continuous variable

X_k = sex of animals $k=0$ steer, $k=1$ heifer.

X_l = fat cattle price in Phoenix on the day of the sales being considered

X_m = the type of sale, $m = 1$ through 9 (9 sale types)

X_n = the breed of animals marketed, $n = 1$ through 5 (5 breed types)

X_o = the grade of animals, $o = 6$ through 14 (9 grades)

Though the basic assumption was that the relationships expressed here were approximately linear in nature, when studied over a limited range, some may be curvilinear when a broader range is considered. Therefore the independent variables, weight and number of animals in a lot, were added to the model in their squared forms to test for curvilinearity.

Weight and lot size were treated as continuous variables while breed, grade, and type of auction were divided into subclasses and included as dummy variables with one variable in each class taken out as the base for comparison. The sex, whether heifer or steer, was included in the analysis as a discrete variable.

The price of fat cattle in Phoenix for the week of a sale was included in the model to account for the effect of price trends. This was necessary as the auctions observed occurred over a period of time when cattle prices were fluctuating.

The significance of the single factor variables, weight, number of head in a lot, sex, Phoenix fat cattle price, and the squared forms of weight and lot size, were tested by comparing the sample "t" values for each variable to a tabulated "t" as outlined in Steel and Torrie in Principles and Procedures of Statistics (Steel and Torrie, 1960, p. 674-680).

Three of the characteristics, namely breed, grade, and type of auction, had several sub-factors. The combined effect of each was tested by employing a "F"-test which indicated whether or not the addition of a group of variables significantly affected price. According to Goldberger in Econometric Theory, the significance of an additional regression sum of squares attributable to using, for example, x_2 and x_3 along with x_1 may be tested by calculating the sample F statistic (Goldberger, 1964, p. 177).

A related indicator of the significance of these variables was the coefficient of determination, more commonly known as R-squared. This statistic indicated the amount of variation in the dependent variable that was explained by the independent variables under consideration. By removing and adding variables from the regression and comparing the resulting R-squared values, the effects of adding and removing variables was determined.

Results of the Statistical Analysis

The results of the regression analysis including all of the variables considered are presented in Table 1. The computed T values for weight, weight squared, lot size, sex and Phoenix fat cattle price indicated that these were significant variables affecting selling price.

When the variables for breed were removed from the model, the tabulated F value (13.83) was greater than the computed F value (10.23) at the .01 level of significance (see Table 1, Footnote d). The effect of breed was also checked by comparing the coefficients of determination

Table 1. Results of Regression Analysis. All Variables Considered.
Arizona Auction Markets, 1969.

Independent Variable	Computed T Values	Regression Coefficients
Weight	-21.897	-.0357 ^g
Weight Squared	9.796	.00001671 ^g
Lot Size	6.685	.020 ^h
Sex	-57.462	-4.26 ^a
Fat Price (Phoenix)	26.858	.775 ^b
<u>Breed^d</u>		
Hereford	- 2.687	- .260 ^a
Angus	.587 ^c	.093 ^a
Hereford-Angus Cross	.892 ^c	.128 ^a
Brahma	4.160	.622 ^a
Other Crosses	---	---
<u>Grade^e</u>		
Low Standard	-17.674	-9.71 ^a
Average Standard	-25.737	-7.78 ^a
High Standard	-21.286	-5.30 ^a
Low Good	-15.886	-3.72 ^a
Average Good	-11.090	-2.52 ^a
High Good	- 6.499	-1.46 ^a
Low Choice	- 4.306	-1.00 ^a
Average Choice	---	---
High Choice	1.102 ^c	1.21 ^a

Table 1. (Continued)

<u>Auction Type^f</u>		
Navajo Indian Reservation	1.001 ^c	.26 ^a
Hopi Indian Reservation	5.794	2.43 ^a
Fort Apache Indian Reservation	-2.782	-.81 ^a
Hualapai Indian Reservation	-4.752	-1.70 ^a
San Carlos Apache Indian Reservation	-.3585 ^c	-.09 ^a
Cattlemen's Association	-3.010	-.48 ^a
Tucson Auction	-3.152	-.29 ^a
Phoenix Auction	-8.041	-.87 ^a
Willcox	---	---

R - squared		.81714
Standard Error of Estimate		1.869
No. of Observations		2,940

a. Price effects all in terms of dollars per hundred weight.

b. Percent of the price variation of fat cattle over time reflected in feeder cattle price.

c. Not significant at .05 significance level.

d. Breed variables excluded, computed F value 10.23 -- tabulated F value at .01 level of significance 13.83. R-squared value with breed variables deleted -- .8145.

e. Grade variables excluded, computed F value 207.92 -- tabulated F value at .01 level of significance 4.86. R-squared value with grade variables deleted -- .7126.

f. Auction type variables excluded, computed T value -- 16.45 -- tabulated T value at .01 level of significance 4.86. R-squared value with auction type variables deleted .8089.

Table 1. (Continued)

g. Price effects per pound of change in weight in dollars per hundredweight, i. e., approximately 3.6 cents per/cwt/one pound change in weight.

h. Price change in dollars/cwt per additional animal, i. e., approximately 2 cents/cwt/animal.

(R-squared) with breed included and excluded. It was noted that with the breed variables included in the regression, the R-squared (.8171) was only slightly higher than with the breed variables removed (.8145) (Table 1). It was, therefore, concluded that on the basis of information used in this study, breed was not a highly significant factor affecting selling price.

When grade variables were removed from the analysis, the computed F value (207.92) indicated that this group of variables had a highly significant effect on price (Table 1). The tabulated F value at the .01 level of significance was 4.86. Additionally, when grade was not included in the regression selection, the R-squared was lower (.7126) than when the grade variables were included (.81714) (Table 1). Thus including the grade variables increases the amount of variation, in the dependent variable, explained by the independent variables.

The computed F value (16.45), when variables concerning auction type were included in the model, indicated that this group of variables was a highly significant factor affecting selling price. The tabulated F value at the .01 level of significance was 4.86. However, the increase in the R-squared value as type of auction was removed from the regression selection was small (from .8089 to .8174) adding approximately .83 percent to the variance explained by the independent variables (Table 1).

Analysis by Weight

Since breed was estimated to have zero effect on the selling price of feeder cattle, additional analysis was carried out with the

breed variable deleted (Table 2). On this basis weight and weight squared were estimated to be significant variables affecting price. There were two factors that significantly affected selling price as weight increased. An increase in weight of one hundred pounds resulted in a decline in the price per hundredweight of \$3.57 for the range of observations made in this study. However, the square of the weight variable was found to be a significant factor affecting price and had a positive effect of \$0.000017 per hundredweight with a one pound increase in weight. In order to find the net affect, it was necessary to combine the two factors. The coefficient for the price effect of weight squared (\$0.000017 per hundredweight) at first glance was a small amount. However, as weights become large, their squares times the price effect coefficient of \$0.000017 become quite important in ameliorating the decline in price due to increasing weight.

The results of this analysis, therefore, indicated that the relationship between price and weight was negative and curvilinear; in other words, prices declined as the animal weight increased but at a decreasing rate (Table 3 and Figure 1). For example, when an animal's weight increased from 225 pounds to 250 pounds, the price decreased by \$0.0069 per pound. However when an animal's weight increased from 625 pounds to 650 pounds the price decreased by \$0.0037 per pound.

The relationship between increasing weight and total dollars per head was an extremely important consideration. Results of this study indicated that as weight increased, dollars per head increased. For example, a 200 pound animal sold for an average of \$0.3612 per pound

Table 2. Results of Regression Analysis (Breed Variables Deleted).
Arizona Auction Markets.

Independent Variables	Computed T Values	Regression Coefficients
Weight	-21.739	- .0357 ^d
Weight Squared	9.711	.00001666 ^d
Lot Size	6.863	.021 ^e
Sex	-57.348	- 4.26 ^a
Fat Price (Phoenix)	26.586	.769 ^b
<u>Grade</u>		
Low Standard	-17.293	- 9.47 ^a
Average Standard	-25.219	- 7.46 ^a
High Standard	-20.572	- 4.96 ^a
Low Good	-15.142	- 3.52 ^a
Average Good	-10.506	- 2.38 ^a
High Good	- 6.033	- 1.36 ^a
Low Choice	- 3.788	- .88 ^a
Average Choice	----	---
High Choice	1.080 ^c	1.19 ^a
<u>Auction Type</u>		
Navajo Indian Reservation	.29118 ^c	.077 ^a
Hopi Indian Reservation	5.370	2.26 ^a
Willcox	---	---
Fort Apache Indian Reservation	- 3.429	- 1.00 ^a
Hualapai Indian Reservation	- 5.250	- 1.88 ^a
San Carlos Apache Indian Reservation	- 1.195 ^c	- .30 ^a

Table 2. (Continued)

Cattlemen's Associations	- 3.033	- .48 ^a
Tucson Auction	- 3.462	- .32 ^a
Phoenix Auction	- 8.176	- .89 ^a

R-Squared		.81450
Standard Error of Estimate		1.88
No. of Observations		2,940

- a. Price effects in terms of dollars per hundredweight.
- b. Percent of the price variation of fat cattle over time reflected in feeder cattle price.
- c. Not significant at .05 significance level.
- d. Price effects per pound of change in weight in dollars per hundredweight, i. e., approximately 3.6 cents per/cwt/one pound change in weight.
- e. Price change in dollars/cwt/additional animal, i. e., approximately 2 cents/cwt/animal.

Table 3. The Effect of Weight on Selling Price At Arizona Feeder Cattle Markets in 1969.

Average Weight of Animals In A Lot (in pounds)	Expected Average Price ^a (cents per pound)	Price Differential ^b (cents per pound)
200	36.12	.72
225	35.40	.69
250	34.71	.68
275	34.03	.65
300	33.38	.64
325	32.74	.62
350	32.12	.58
375	31.54	.57
400	30.97	.55
425	30.42	.54
450	29.88	.50
475	29.38	.48
500	28.90	.47
525	28.43	.45
550	27.98	.42
575	27.56	.40
600	27.16	.38
625	26.78	.37
650	26.41	.34
675	26.07	.32
700	25.75	

Table 3. (Continued)

a. Expected Average Price -- weight effect negative (-\$.0357 per pound) plus a positive weight squared effect (\$.00001666 per pound) yields a net decrease in price holding other factors constant.

b. Price differential -- the difference in the amount the price declines from one weight to the next.

Dollars/Hundred Weight

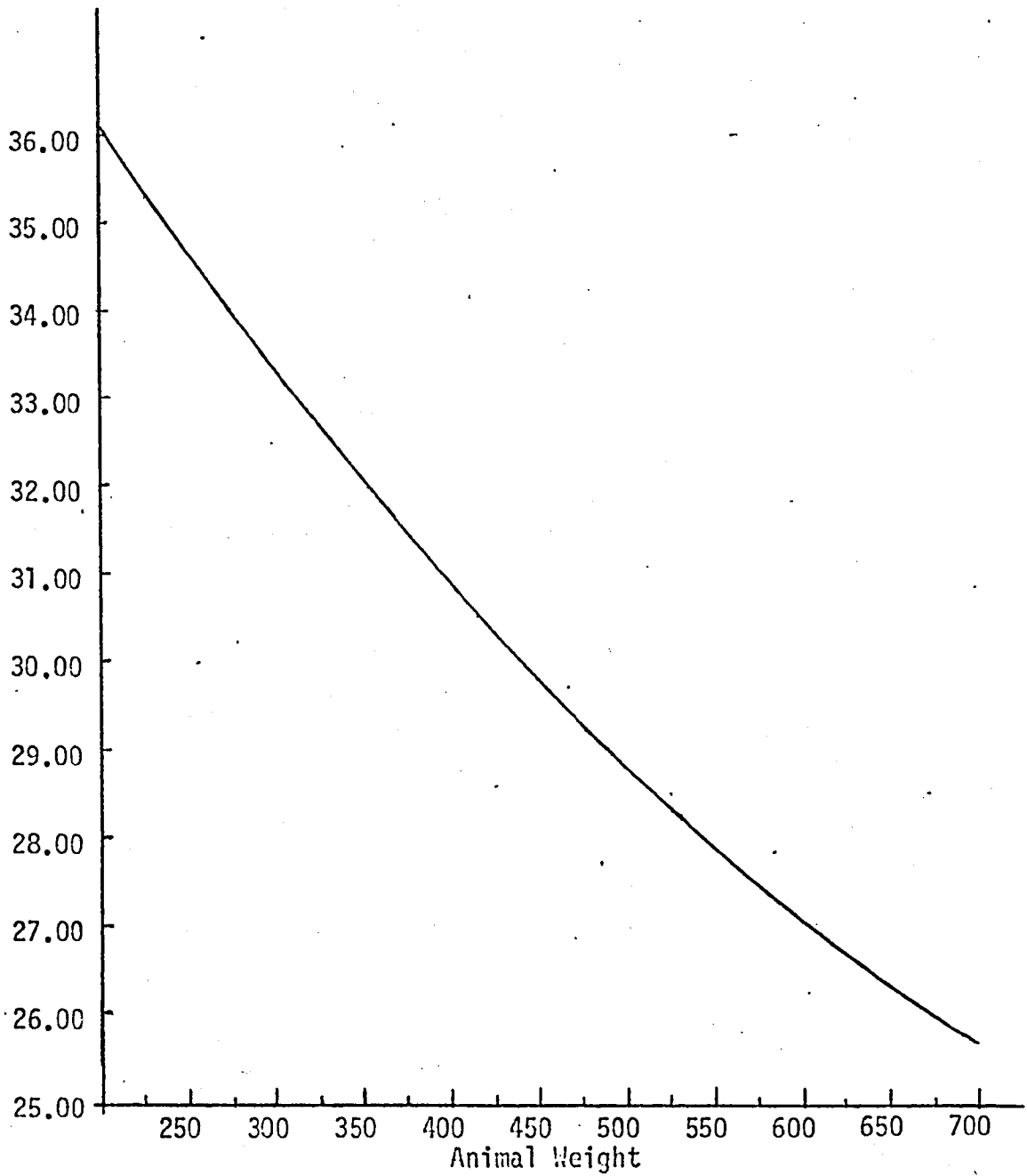


Figure 1. The Effect of Increasing Animal Weight on Selling Price.

holding other factors constant, or approximately \$72.00 per head while a 600 pound animal sold for an average of \$.2716 per pound holding other factors constant or approximately \$163.00 per head (Figure 2).

Analysis of the percentages of cattle sold in each weight group indicated that the largest percentage of cattle observed in this study were marketed at weights ranging from 400 to 500 pounds (Table 4).

Analysis by Size of Sale Lot

The analysis revealed that the number of cattle in a lot was a factor having a significant effect on price. As lot size was increased by one head over the range of observations in this study (1 to approximately 150 head), the price was estimated to increase by an average of \$0.02 per hundred pounds (Table 2). The number of animals in a lot squared was nonsignificant, indicating that the relationship between the number of head or animals in a lot and price closely approximated a linear relationship over the entire range of observations of this variable. In other words, although the effect on price of the number of animals in the lot was significant, it remained constant over the range of observations in this study.

Analysis by Sex

Analysis of steer and heifer prices indicated heifer prices averaged \$4.26 per hundred weight lower than steers (Table 2). However, it must be pointed out that this average price differential was not observed at all price levels. Variation in weight, grade, breed, and resulting price level variation may have a tendency to increase or decrease the price differential between steers and heifers.

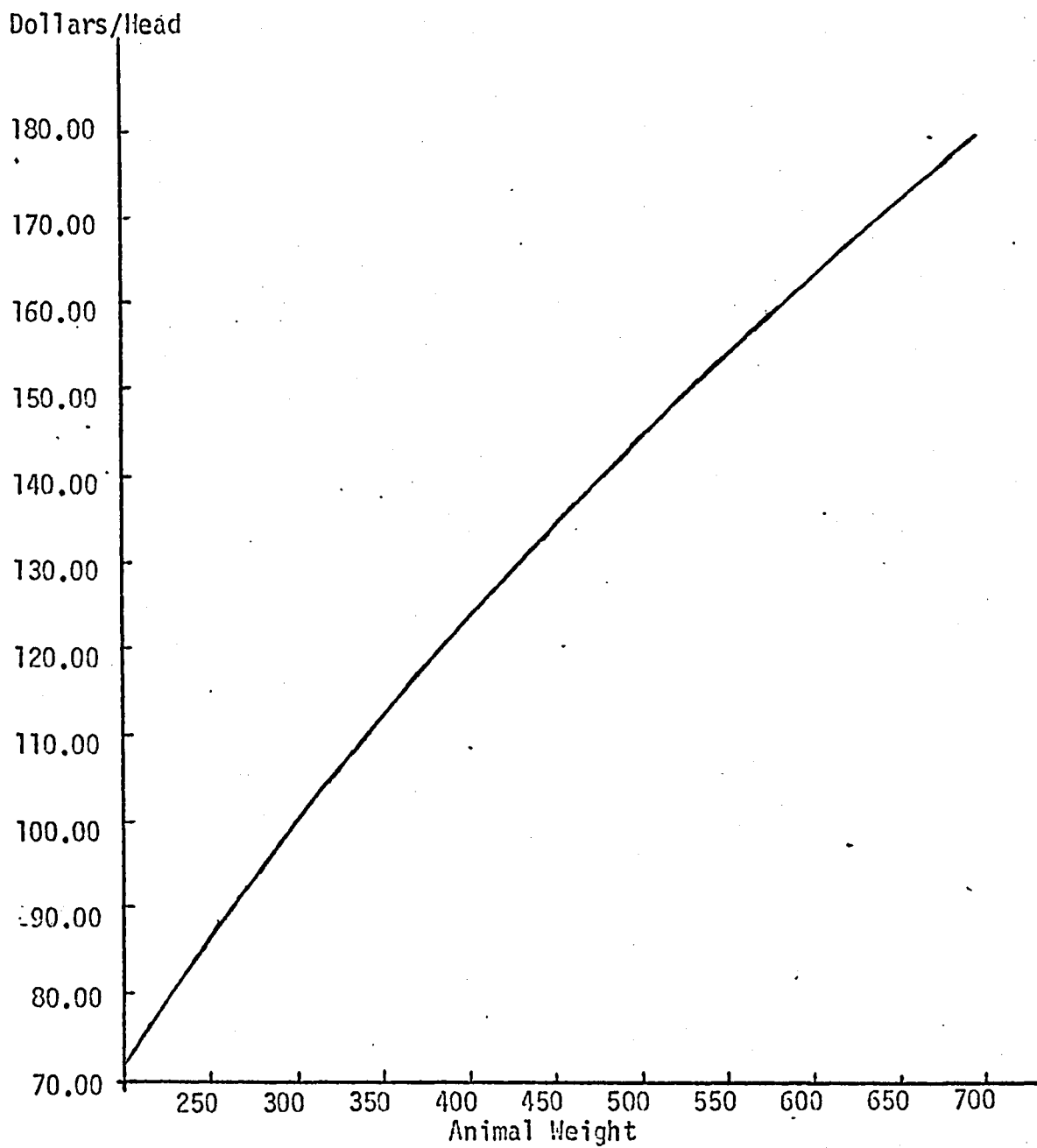


Figure 2. The Effect of Increasing Animal Weight on Total Dollars Received.

Table 4. Percent of Animals Marketed in Each Weight Group At Arizona Feeder Cattle Sales in 1969.

Weight Groups	Percent ^a
200-249	2.6
250-299	6.2
300-349	10.7
350-399	13.0
400-449	15.9
450-499	15.0
500-549	12.2
550-599	12.4
600-649	5.9
650-699	5.7

a. Percent of total number of head marketed within the given weight groups.

The price differential between steers and heifers appeared to be attributable to physiological problems encountered with feeding heifers, yield results of heifer carcasses, and to some extent, ignorance of feeders and consumers.

Analysis by Grade

Grade was included as a dummy variable in this analysis with the average choice grade being the base used. The analysis indicated that there were significant differences between the prices paid for average choice cattle and most other grades recorded. In all cases, differences existed but statistically the difference was not significant for the high choice grade classification. Assuming average choice as the base (average choice = 0) the decline in price (in dollars per hundredweight) for consecutively lower grades was as follows; low choice -- \$0.88, high good -- \$1.36, average good -- \$2.38, high standard -- \$4.96, average standard -- \$7.46, and low standard -- \$9.47. Animals grading high choice sold for an average of \$1.19 more per hundredweight than the base -- average choice (Table 2).

Computations illustrating the effect of grade on selling price are presented in Figure 3. The average price of \$29.87 per hundredweight was assumed to represent the price paid for animals grading average good in the example; other prices were computed based on expected price deviations from the average associated with different grade, while holding other factors constant. It is important to note that the price differentials presented in this analysis were averages and did not remain constant over all price levels. In fact, casual observation

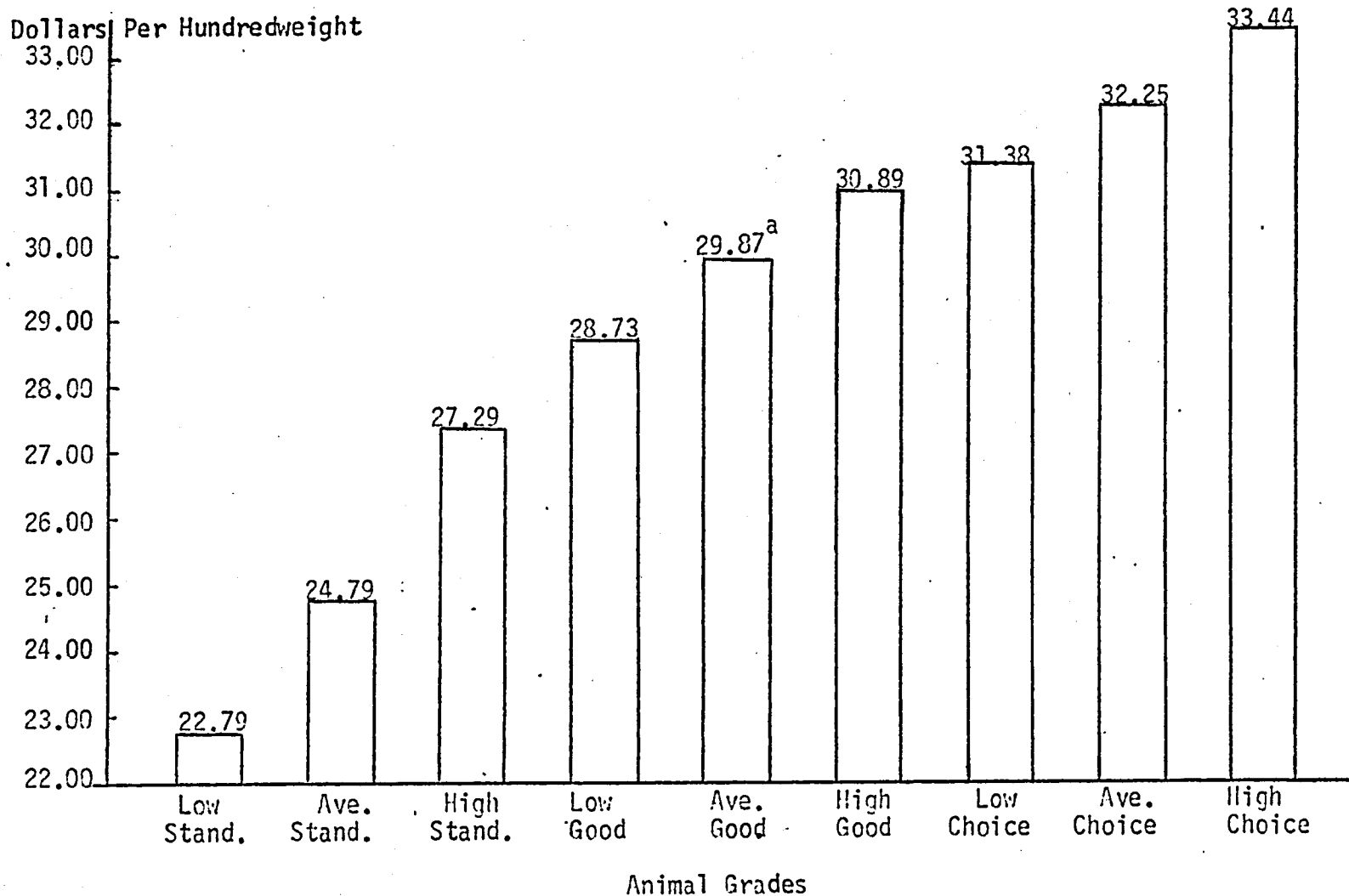


Figure 3. The Effect of Animal Grades on Selling Price

a. Assuming \$29.87/Cwt. represents the price paid for animals grading Average Good.

indicated, as would be expected, that the absolute amounts of the differentials tended to increase as price levels increased.

Analysis by Auction Type

Feeder cattle sales were held on five Indian reservations in Arizona in 1969. Because of the differences in production and marketing organization on each of these Indian reservations, they were included in the model as different auction types. Other marketing organizations singled out for the analysis were the Cattlemen's Association Sales, the special feeder sales held at the Central Auction Market in Willcox, and the central markets in Tucson and Phoenix. Each of the nine market types analyzed in this segment of the study were observed to have organizational characteristics which in some respect made each market unique. Auction type was included in the model as a dummy variable with the Willcox Auction as the base market.

Regression analysis indicated that there were significant differences between selling prices of feeder cattle at the Willcox Auction Market and most other markets. In all cases a difference existed, but statistically, the difference was not significant for the Navajo Indian Reservation Sales and the San Carlos Apache Indian Reservation Sales in 1969. The model indicated the following differences in average selling prices (in dollars per hundredweight) compared to the base market (Willcox); Hopi Indian Reservation Sales (+) \$2.26, Navajo Indian Reservation Sales (+) \$0.07, Tucson Auction (-) \$0.32, Cattlemen's Association Sales (-) \$0.48, Phoenix Auction (-) \$0.89, Fort Apache Indian Reservation Sales (-) \$1.00, Hualapai Indian Reservation Sales

(-) \$1.88 (Table 2). These price differentials, though significant, were explained primarily by organizational characteristics of the markets analyzed. These characteristics will be discussed in detail in the next chapter.

Results Supported by Other Studies

A previous study analyzing the factors affecting selling price of feeder cattle at auction markets was done by David L. Cole in a 1966 University of Wisconsin thesis entitled, Analysis of Economic Factors Influencing Prices, Organization, and Facilities of the Wisconsin Cooperative Graded Beef Feeder Cattle Auction Sales. Cole's methodology was much the same as that used in this study. Regression analysis with price the dependent variable showed that there were significant differences between price paid for cattle sold in varying lot sizes. Significant price differentials were also identified in relation to average weight of the sale lot, grades of feeder cattle and sex of the animals marketed. These results were quite consistent with those obtained in this analysis and supported the findings of this study.

Ehrich, Glandt and St. Clair studied net returns to producers for cattle sold at auction markets in their work entitled, Net Returns To Producers for Cattle Sold at Selected Terminals and Wyoming Auction Markets. Though the statistical method used in this analysis was somewhat different than the one used in the Wyoming study, significant differences in prices received between markets, before and after adjustments for costs, were found when Tukey's procedure for multiple

comparisons among individual pairs of markets was applied to the price data (Ehrich, Glandt, and St. Clair, 1968, p. 5).

A study by Jamison and Sellers entitled, Effects of Selected Variables on Prices Received for Calves in the Brownsville Demonstrational Feeder Calf Sales, utilized the least squares method of estimating the effects of grade, sex, breed, pen size or number of calves per pen and pen weight (average) on the price per hundredweight of feeder calves sold from October, 1955 through 1965 (Jamison and Sellers, 1968, p. 2). Though Jamison and Seller's study was carried out over a much longer period of time, the results support the findings of this analysis, that grade, weight, sale lot size and sex significantly affect the selling price of feeder cattle. Jamison and Sellers found that both Angus and Hereford calves sold for significantly higher prices than did crossbred calves. This does not agree with the findings of this study that the breed of animal does not significantly affect selling price.

Summary

Regression analysis, with price the dependent variable, indicated that weight was a critical factor affecting price. As the average weight of animals in the lots increased from 200 to 700 average pounds, price fell from \$36.12 to \$25.75 per hundredweight respectively. It was also found that as the average weight of animals in a lot increased, prices declined but dollars received per head increased. Observations in the study covered weights ranging from 200 to 700 pounds but over 55 percent of the animals were in the weights ranging from 350 to 550 pounds.

The number of cattle in the sale lot was shown to be a significant factor affecting the price paid by buyers at Arizona feeder cattle auctions. As the sale lot size was increased, price paid for the lot increased on the average, \$0.021 per hundredweight per animal change in lot size. Additionally, steers received, on the average, \$4.26 per hundredweight more than heifers.

There were significant differences between the prices paid for average choice grade cattle and most other grades. Based on animals of average choice quality, these price differentials ranged from a minus \$9.47 per hundredweight for animals grading low standard to a plus \$1.19 per hundredweight for animals grading high choice.

The type of auction market was shown to be a significant factor affecting selling price of feeder cattle in Arizona in 1969. Selling price differences from the base market ranged from a minus \$1.88 per hundredweight to a plus \$2.26 per hundredweight, a spread of approximately \$4.14 per hundredweight for the nine markets analyzed in this study. Explanation for this disparity in selling prices among markets may be found in organizational characteristics of the markets and other qualitative seller and buyer peculiarities.

CHAPTER 3

ANALYSIS OF MARKET ORGANIZATION AND ASSOCIATED COSTS

Each marketing outlet analyzed in this study had characteristics which set it apart from the others. Many differences that may be associated with the market outlet were not inherent characteristics of the market itself, but rather reflected the goals and attitudes of the producers in an area serviced by the particular marketing outlet under study.

Method of Analysis

The data for this section of the study were collected by personal interviews with county agents in charge of collecting data in the various areas studied. Whenever possible other interested parties such as ranchers and livestock managers of Indian reservations were also questioned. To facilitate the collection of data a standardized questionnaire was used to record the information obtained during the interviews (Refer to Appendix B for a copy of the questionnaire used).

The analysis that follows was primarily qualitative due to the nature of the information available. Additionally, it should be pointed out that the purpose of this study was not to provide a detailed analysis of the costs involved in marketing feeder cattle. Rather the goal of the present analysis was to provide information that might prove useful in understanding the organizational characteristics of the

marketing outlets for feeder cattle in Arizona. It also serves to qualify the findings of the preceding chapter regarding significant selling price differences between types of marketing outlets, and factors significantly affecting selling prices for feeder cattle in Arizona.

Organizational Characteristics and Costs or Charges
Associated With Arizona Marketing Outlets

Information concerning organizational characteristics of marketing outlets and associated costs or charges for marketing feeder cattle was collected for sales as listed in Chapter 2 (with the exception of one Indian reservation sale). There were many different ways in which selling charges to the consignor were assessed by the markets studied in this analysis as well as a wide range in actual selling costs between outlets. The main costs studied and discussed in this analysis were the auctioneering fee, hay, labor and other costs including advertising, inspection, utilities and yardage. Because of the organizational characteristics of many of the auctions, cost items were not available in all cases. A complete summary of costs or charges at these various markets can be found in Appendix C. The ensuing discussion will not refer directly to this complete summary but rather to an abbreviated form, Table 5 of the text.

Selling charges to the consignor at the outlets studied were found to vary significantly, ranging in amount from \$2.00 per head to 15 percent of gross sales value depending on services provided and organizational characteristics (Table 5). Selling charges were highest at some of the Indian reservation sales where more services were included.

Table 5. Estimates of Charges for Marketing and Related Services for Feeder Steers and Heifers Sold at Arizona Auctions.^a

Marketing Outlet	Charges Per Head ^a (Dollars)	Number of Head Sold	Number of Sales Recorded
Reservation Sales:			
Navajo	5.84 ^c	904	2
Hopi	3.60 ^c	507	1
Fort Apache	19.51 ^c	4,446	6
San Carlos Apache	24.33 ^c	3,818	4
Hualapai	2.50	1,076	2
Special Sales:			
Willcox	Maximum 3.00	4,943 ^b	4
Cattlemen's Assoc. Sales			
Yavapai Mrkting Assoc.	3.00	2,398	3
Apache Co. Cattlemen's Assoc.	Members 2.00	1,100	1
	Non-members 2.50		
Gila Co. Cattle Growers	3.20	3,050	2
Mohave Lvstk. Mkt. Assoc.	3.22 ^c	2,143	1
Central Auction Markets:			
Phoenix	Maximum 3.25	2,269 ^b	9
Tucson	Maximum 3.25	3,434 ^b	10

a. Charges estimated are not comparable since services involved vary significantly. See text for detailed explanation.

b. These numbers represent only the animals observed at sales under this study.

c. Estimated averages based on number of head sold and charges as a percent of gross revenue.

The Navajo Indian Reservation

There were six feeder cattle sales held on the Navajo Indian Reservation in the fall of 1969. A total of 2,732 head of cattle were marketed at these sales. Information collected on 904 head marketed at two sales indicated that costs were approximately \$5,279. This figure includes the cost of the auctioneer (3 percent of the gross receipts for each of the two sales), all labor for the sale, and maintenance of the sales facilities (\$1.00 per head included in the 3 percent deduction). The selling charges to the consignor were estimated to be \$5.84 per head (Table 5).

The Navajo Indians are relative new-comers in the cattle business. They were not as highly organized as some of the other cattle producers in Arizona that have more or less established themselves as cattlegrowers. Another factor that contributed to an observed lack of unity in the organizational structure of cattle production and marketing on the Navajo Reservation was the economic situation facing the small individual producer. His income has been so limited that his cattle had to be used as his bank account. Whenever a need for cash has arisen regardless of the time of year, a few animals were taken to the nearest trading post and sold to a trader for anywhere from ten to twenty dollars less than the producer could receive by marketing at the scheduled auction sales in the fall.

The economic consequence of the Navajo's plight makes planning of the fall sales difficult. It has made it impossible to estimate the number of cattle to be consigned before the day of the sale.

An additional factor has been the problem of shrinkage. Even under the best conditions some shrinkage is expected during the transport of animals to sale. However, when little or nothing is done to reduce the weight loss of animals from the time of departure from the ranch until sold, a significant amount of shrinkage occurs. In this particular case, the day before the sale the cattle were sorted and delivered in small pick-up trucks, to the sales yard. Generally they were penned outside the sales facilities for up to 24 hours without feed or water. In addition there was little evidence that any attempt was made to fill the cattle before they were brought into the sale area.

The animals were weighed just prior to the sale and a 3 percent pencil shrink was applied to this weight in order to obtain the final selling weight. This method of handling and weighing the cattle has attracted the trader-buyer. Though he may pay a little more per pound for these highly shrunk animals, by transporting them to a feedlot where they gain lost weight and are filled, the trader can market them through a central auction where the final weight is the basis for sale and in most cases realize a substantial profit.

The Hopi Indian Reservation

A feeder cattle sale of 507 head was held on the Hopi Indian Reservation in the fall of 1969 (Table 5). Information collected on this sale indicated that total costs were approximately \$1,828. This figure included the auctioneer's fee (\$0.75 per head), all labor, and any other costs associated with marketing of the cattle. The selling charges to the consignor were estimated to be \$3.60 per head (Table 5).

Prior to the 1969 sale the organizational structure was much the same as the Navajo Indian Reservation sales and in some ways these characteristics remained the same. Some changes have been made, however, to increase returns to ranchers marketing at this sale. The method of sorting was changed to obtain a higher degree of uniformity of animals within a lot. This was accomplished by sorting the animals into lots by weight, sex, and grade the day before the sale. The method of obtaining the sale weights was also changed. The animals were weighed at the completion of the sale, thus giving a more accurate selling weight.

In September of 1969 approximately 150 head of cattle from the Hopi Indian Reservation were trucked to a central market in Phoenix for sale. The trucking costs were approximately \$8.00 per head. A comparison of prices received and costs incurred at the reservation sale with those in Phoenix indicated that producers received a much greater return by marketing at their own sale.

The Fort Apache Indian Reservation

The costs of selling cattle on the Fort Apache Indian Reservation appear quite high when compared with costs assessed by other markets. Included in this high cost, however, are many services which other markets did not provide.

In 1969 six sales were held on the Fort Apache Indian Reservation (Table 5). The number of cattle sold totaled 4,446 head at a total marketing cost of \$87,250 or \$19.51 per head (Table 5). The total cost estimate was obtained by calculating 12 1/2 percent of the

gross receipts from the six sales. This covers all costs of the Association in handling, supervising and marketing the member's cattle.

The operational procedures of the Fort Apache Indian Reservation producers were characterized by a high degree of organization. There were over 400 individual cattle owners located in eight separate livestock districts on the reservation. A stockman was hired for each district and was given responsibility for the care and supervision of the cattle in his area. As the primary decision maker, he cut out cattle that were to be marketed, kept track of how many cattle each rancher had, and determined how many cattle would be sold in advance of the sale date. Basically his budget was the 12 1/2 percent of the gross sales as mentioned previously. His salary was paid out of this as well as all of the other costs associated with marketing.

These marketing costs involved charges for services which began in the spring when the cattle were sorted and trucked to summer pastures that surround the sale facilities. About a month before the sale the cattle were rounded up and driven into pastures closer to the sale yards to await sale. The cost figure of 12 1/2 percent covered all costs associated with such moves prior to the sale, cowboy's salaries, advertising and all sale costs previously outlined.

The producers on the Fort Apache Indian Reservation grossed \$698,000 on their sales in 1969. The 400 individual owners of cattle on the reservation netted \$453,700.

The San Carlos Apache Indian Reservation

The San Carlos Apache Indian Reservation held six sales in 1969. Cost information was collected on four of these sales. The number of cattle sold at the four sales was 3,818 head at a total cost of \$92,902 or \$24.33 per head (Table 5). In the case of the San Carlos sales the total cost estimate was obtained by calculating 15 percent of the gross receipts from the four sales for which data were collected. This covered all costs associated with the sales plus management, supervision, handling and transportation of the cattle prior to the sale including the auctioneer's fee of 1 1/2 percent of the gross receipts.

The San Carlos Indian Reservation was divided into seven cattle producing districts. Each district had a stockman in charge of managing the cattle in that district, much the same as the Fort Apache Indian Reservation. Each district had an association headed by a five man board of directors. The board made decisions concerning the producers in the district and hired the district stockman. The stockman was then responsible for hiring the necessary cowboys to ride fences and assist with the cattle drives. The cowboys, with the stockman in charge, rounded up the cattle and drove them to the sales facility, arriving about seven days prior to the sale, thus providing time to class the cattle into sale lots. The animals were then provided with ample feed and water to enable them to regain some of the weight lost during the drive. This is important since the cattle were sold on the basis of weight recorded immediately after the sale. The costs of the hay used to feed the cattle for this period was charged to the association's funds.

Any costs incurred in transporting and selling the cattle were paid out of the 15 percent of gross sales charge. Salaries of the General Livestock Manager and the district stockmen were also paid from this fund.

The cattle were classed into lots by size, age, and sex. Each association had a state registered brand and in addition, each individual producer had a registered brand. The cattle were co-mingled for classification and sale. After the sale an average of the weights of the animals in each pen was taken. The average became the basis on which the individual producer was paid after marketing costs were deducted.

The Hualapai Indian Reservation

In 1969, two sales were held on the Hualapai Indian Reservation. The total number of animals marketed at these sales was 1,076 at a total cost of \$2,690 or \$2.50 per head (Table 5). This charge covered all sales costs including labor, the auctioneer's fee of \$0.75 per head, and an inspection fee of \$0.15 per head. Any amount left over (from the \$2.50 per head charge) after all other costs were paid, was put into a fund which was used for maintenance of the sales facility.

Producers on the Hualapai Indian Reservation were divided among five associations. Each association sorted the cattle produced by its members into lots according to age and sex prior to the sale. The cattle were driven to the sales facility and each association's cattle were sold separately. Each lot was weighed immediately after sale and this weight was applied to the selling price.

Willcox Livestock Auction -- Special Feeder Cattle Sales

This marketing outlet was a commercial auctioning concern and held weekly sales throughout the year. In addition to these weekly sales, special feeder sales were held during the fall months of October and November when the majority of feeder cattle and calves were marketed.

Data were collected on four special feeder sales held at the Willcox facility. Data on a total of 4,943 head of cattle sold were recorded (Table 5). The selling charges to the consignor were based on preassigned ranges of gross revenue to the producer as follows: \$100.00 and over -- the producer's cost was \$3.00 per head; \$33.00 - \$100.00 -- the cost was 3 percent; \$33.00 and under -- the producer's cost was \$1.00 per head. An additional charge of \$0.25 per head per day was made for feed and \$0.15 per head for brand inspection. Cattle brought to the sale were carefully sorted. Those sold in groups were guaranteed sound.

Yavapai Livestock Marketing Association

This association held three sales in 1969. A total of 2,398 head of cattle were marketed at the three sales. Selling charges to the consignor for selling cattle at the sales were \$3.00 per head (Table 5). This charge covered all costs of operating the sale including inspection, utilities, telephone and supplies. Any monies left over after all other operating costs were paid went back to the original stockholders who financed the building of the sales facility by lending \$5.00 per head (the number of head each stockholder wanted to market at the facility) to the association.

The Yavapai Marketing Association was operated by a board of directors which was responsible for the planning of the sales. One of the stockholders was employed by the association to be the sale manager. The sale manager was in charge of overseeing the entire operation of the sale including loading-in prior to the sale and loading-out upon completion of the sale. All other labor required for sorting, penning, tagging, and clerking was volunteered by association members.

The ranchers that market their cattle through these sales expect to receive a higher return than by contracting the sale of their livestock, primarily because their animals are exposed to more buyers at the association sales. Some of the ranchers estimated that on the average, the producer could expect to receive \$0.01 per pound more by transporting his cattle to the association sale rather than selling at the ranch.

Apache County Cattlemen

The Apache County Cattlemen held one sale in 1969. There were 26 ranchers (approximately 50 percent of the ranchers in the area) who marketed 1,100 head of cattle at this sale. A charge of \$2.00 per head for members of the association and a \$2.50 per head charge for non-members was assessed for selling cattle (Table 5). This charge covered the following services; auctioneering fee (\$200.00), labor costs (\$200.00), weighing and inspection (\$0.30 per head), telephone and meals (\$50.00), and advertising (\$135.00). The amount remaining after the above costs were covered was used to pay back indebtedness incurred in the construction of the sale facility. This facility was financed by an original membership fee of \$100.00 and was not limited strictly to

cattle producers. Most of the labor and some materials for construction of the sale pens and arena were donated. Total costs were estimated at \$13,000.

The ranchers marketing their cattle at this sale estimated that they received approximately \$0.02 to \$0.03 per pound more than if they had contracted the sale of their cattle at the ranch.

Once cattle were consigned to this sale a penalty of \$5.00 per head was assessed if the seller decided to market his cattle through another outlet. With this policy plans can be finalized and advertising mailed to prospective buyers who can be relatively certain that the number of cattle advertised will be the number actually sold.

Gila County Cattle Growers Association

This organization sponsored two sales in the spring of 1969. They were held on consecutive days with a total of 1700 steers and 1350 heifers marketed. The majority of feeder cattle were short to long range yearlings.

The total selling charges to the consignor was \$3.20 per head (Table 5). This cost covered the following: auctioneering fee and payment for clerk, -- \$0.25 per head; yardage -- \$1.75 per head (\$0.50 per head was used to pay labor and \$1.25 per head was assessed each seller for use of the sale yards); advertising, \$0.25 per head; hay charge approximately \$0.95 per head (includes a \$0.25 per bale labor charge). The charge assessed to sellers for use of the sales yards was used to reimburse individual members originally loaning the association \$15.00 per head pen capacity for construction of the facilities. These loans

were made with the provision that they would be paid back in ten years. In addition, the members making the loans had the right to the use of pens which they financed.

The association hired a general manager to oversee all of the operations at the sale facility. Though he may hire one or two others to assist him with loading and unloading of sale cattle most of the labor needed to run the sale was volunteered by members of the association.

Cattle were trucked to the sale facilities three to four days prior to the sale. This enabled them to regain some weight lost in transportation prior to sale. One rancher estimated that his cattle lost approximately 5 percent of their weight from the time they left his ranch to delivery at the sale yards, a distance of 45 miles. Arriving three days prior to the sale, he estimated they regained three fifths of the weight lost. It was important that the cattle regain as much of their lost weight as possible since the sale weight was taken just prior to the time of entry into the sale ring.

The association maintained fairly strict control over the cattle marketed at these sales. Cattle were carefully sorted at the sale facility to cull-out any cattle with cancer eye, lameness or fresh brands. These animals were withheld from association sales. Producers were required to sign an agreement stating the number of cattle they would market. If this number was not marketed, the producer was penalized for the number of head less than that stated in the agreement.

Over a period of years members of the Gila County Cattle Growers estimated that the premium they received for marketing their

cattle at these sales was at least \$1.00 per hundredweight as compared to contracting the sale of animals at the ranch. However, they estimated that this premium was approximately \$3.00 per hundredweight in 1969.

Mohave Livestock Marketing Association

This marketing association held one sale in the spring of 1969. Approximately 2,143 head of cattle were marketed at a total cost of \$6,900 (Table 5). Items covered by this cost included the auctioneer's fee of \$0.25 per head and labor costs amounting to \$110.00. The total selling charge to the consignor was approximately \$3.22 per head (2 percent of the total gross receipts). The amount remaining after the operating costs of the sale were deducted was used to pay back loans made by producers to the association (\$6.00 per head sold) for the construction of the sale facility. Though most of the labor was donated by members of the association, individuals were hired to stay at the sale yard and assist with the unloading of animals prior to the sale and loading the animals upon completion of the sale.

Producers sorted their cattle into lots at the ranch prior to bringing them to the sale. Most of the ranchers hired commercial trucks to transport their cattle, planning to have their livestock there two days before the sale. This was done to allow the cattle time to regain lost weight. The cattle were weighed just before going into the sale ring and this weight was used as the selling weight.

The sales sponsored by this association were well received by producers and buyers. There were 25 ranchers marketing their cattle at

the 1969 sale. There were 55 buyers registered for the sale and 25 of these actually purchased cattle. Ranchers estimated that the average premium which they expected from marketing their cattle through this sale was approximately \$0.015 per pound over other market outlets.

Phoenix Auction

The Phoenix Central Auction held regular weekly sales with all classes of cattle including utility cows, canner and cutter cows, and bulls making up the bulk of the activity. Data were collected on 2,269 head of feeder cattle sold during nine of these weekly sales in the fall (September, October, and November) of 1969.

Selling charges to consignors were as follows; \$1.25 per head minimum charge or 3 percent of the selling price per head not to exceed \$3.25. In other words, the maximum charge was assessed for animals selling for an amount equal to or greater than \$108.00. In addition approximately \$0.225 per head per day was charged for hay and \$0.15 per head for inspection.

Tucson Auction

The Tucson Central Auction also held regular weekly sales. Data were collected on 3,434 head of feeder cattle sold at this auction during ten weekly sales held in the fall (September, October, and November) of 1969. The classes of cattle sold were much the same as those in Phoenix. It was noted, however, that there were more cattle of feeder classification marketed at these sales than at the Phoenix market. This can be partially explained by the fact that the Tucson auction was located in closer proximity to the cattle ranches of

Southern Arizona. Another factor was that there were no country auctions in Southern Arizona. The Tucson auction was the only major market serving this area with the exception of the Willcox market. There were several country auctions in the Phoenix area, namely the Yavapai and Gila County Marketing Association sponsored sales.

Selling charges to consignors at the Tucson auction were as follows: \$3.00 per head minimum charge or 3 percent of the selling price per head not to exceed \$3.25. In addition a straight charge of \$1.50 per bale of hay fed and \$0.15 per head inspection fee was assessed to the consignor.

Market Comparisons

A total of 31,809 head of animals classified as feeder cattle were marketed at 48 sales recorded for this study in the spring and fall of 1969. Results of the cost analysis indicated that there was a wide difference in selling costs and resulting producer marketing charges for sales held on the five Indian reservations studied in this analysis. However, comparisons were difficult to make regarding efficiencies of operation from one reservation to the next because of the wide range of services provided to the producers on the various reservations studied. On the Navajo and Hopi Indian Reservations the producer was provided with little assistance in marketing his animals. He was fully responsible for the care and feeding of his animals up to the time of the sale and was responsible for getting the animals he decided to market to the sale. The producers on the Apache Indian Reservation, in contrast, were provided with a long list of services including managerial

assistance throughout the production and marketing process. Additionally the producer's cattle were trucked to summer pastures in close proximity to sales corrals where they were sold in the fall. The charge made to these producers covered all of the previously mentioned services. Therefore though the marketing costs of the producers on the Navajo and Hopi Indian Reservations were much less than the costs of the producers on the Apache Reservations, the services provided to the producer were comparatively fewer.

Generally the analysis indicated that the costs and accompanying services were similar at the Cattlemen's Association Sales and central auction markets, selling costs ranged from \$3.00 per head to \$3.25 per head with the exception of the Apache County Cattlemen's Sale charges which were \$2.00 per head for members and \$2.50 for nonmembers.

Selling costs at the Cattlemen's Association Sales and central auction markets were in most cases, noticeably different from those charges at the Indian reservation sales. Again this was largely attributable to services provided during the year, particularly managerial assistance throughout the production process including the operation of the Indian reservation auction sales.

The auctioneering fee, a major cost item associated with marketing was found to differ widely between auctions observed in this analysis. This charge was assessed basically in three ways: 1) a percentage of the gross receipts, 2) on a per head basis, and 3) a flat fee for the sale. Producers on the Fort Apache Indian Reservation paid the highest auctioneering fee, amounting to \$1,000 per sale or about

\$1.35 per head. The Apache County Cattlemen paid the lowest fee which was \$200.00 for their sale or approximately \$0.18 per head.

An explanation for this wide variation in auctioneering fees was not clearly evident. The reputation of the auctioneer may offer some explanation, though in degree only, since results of the questionnaire indicated that by and large all producer groups were satisfied with the auctioneers that they had hired.

Perhaps a more important factor to consider than the wide range of fees paid to auctioneers of the various sales was the method in which they were paid. Though the auctioneers who work these sales were well known reputable sellers the auctioneers paid on a percentage of the gross sales basis had an added incentive to get the highest possible price for each lot sold in order to increase the gross revenue from the sale and in turn maximize the fee. When paid on a straight fee for the sale or on a per head basis there was not the same incentive. However, he may have other incentives such as maintaining a good reputation which compels him to seek the highest price for the producer's animals.

Results of the statistical analysis indicated that comparatively the cattle sold at the sale held on the Hopi Indian Reservation received the highest selling price, holding other factors constant. However, the auctioneering fee paid was fixed at \$0.75 per head. Thus it cannot be concluded that the percentage system of paying auctioneers was necessary to provide the incentive to perform well.

Trucking costs and the extent of shrinkage are more difficult to estimate. The cost of hauling cattle to the selling facility varies with the distance, type of road, size and type of truck, number and

pounds of cattle transported, and other factors. Estimates that were available on commercial trucking costs ranged from an average of \$0.50 per head to \$2.00 per head for distances up to 80 miles. Estimates were much higher for private pickup truck transportation which ranged from \$5.00 to \$10.00 per head.

The amount that cattle shrink from ranch to the sales facility also varies considerably depending upon the condition of cattle, length of haul and the truck driver's attitude. Information obtained in this analysis indicated that animals transported in small numbers in pickup trucks shrunk more than those transported in larger numbers via commercial trucks over equal distances and conditions. According to Clive R. Harston in a 1959 Montana Agricultural Experiment Station circular entitled, Shrinkage Depends on Where, When and What You Market, this can be explained by the fact that animals trucked in small numbers must be handled more often. This produces increased nervous disturbances in the animals which causes belly and tissue shrink (1959, p. 3). There is very little that the rancher can do to eliminate losses from shrink. However, by utilizing, when available, the facilities of the auction and taking advantage of the hay-feeding service or supplying his own hay, losses in weight from shrink can be minimized. Most of the ranchers transported their cattle to the auction pens one to seven days prior to the sale. With adequate feed and water the cattle regained a portion of the weight lost during loading, hauling and unloading.

An analysis of characteristics of each of the market outlets investigated in this study indicated with few exceptions, the existence of a high degree of marketing organization. Though each market's

operating procedures differed somewhat, it appears that all have been a success from the standpoint of participating ranchers and buyers. Generally ranchers feel that the auctions returned more money than if they had sold their cattle individually by private treaty.

Buyers benefit from these auctions by having the cattle concentrated at one location which saves time and lowers the buying cost. Also, having the cattle separated into fairly uniform lots makes it easier for buyers to fill their individual needs for cattle.

The central auctions analyzed in this chapter differed from the other auctions primarily in the classes of cattle marketed and therefore attracted different types of buyers. Though this study indicated that the number of feeder cattle marketed through these outlets was fairly large, it must be remembered that the sales were spread out over ten weeks. A large part of the business of these auctions was concentrated on the utility canner, cutter and cull livestock classifications. Additionally some of the buying and selling of feeder cattle was carried on by traders who attempt to profit by buying cattle for later resale in another market.

Many large buyers of feeder cattle were not attracted to the central auction sales primarily because they could not get feeder cattle in a sufficient quantity and of uniform quality in the time required. The special feeder sales, cattlemen's association sales and Indian reservation sales have had an advantage over the central auction in that they have been able to provide the cattle in the time and form desired by the buyers.

CHAPTER 4

CONCLUSIONS

The livestock industry is an important sector of Arizona's agricultural economy. Receipts from the sale of cattle and calves in Arizona during 1969 were approximately \$269,000,000 which was estimated to account for approximately 40 percent of the income from all agricultural commodities produced in the state during this period.

The producer of feeder cattle in Arizona has several alternatives for marketing his livestock. Among the outlets available are the central auction markets in Phoenix, Tucson, and Willcox which are individually owned and operated as commercial marketing outlets; the seasonal auction sales held by the Cattlemen's Associations and those seasonal auctions held on five of the Indian reservations in Arizona. This study has attempted to analyze some of the factors influencing producer prices at these auctions as well as to make some comparisons of characteristics between auctions.

Information on each lot of feeder cattle sold concerning the number of animals, grade, breed, sex, total and average weight of animals in the lot and the sale price was collected for 48 sales held at these outlets in 1969. Approximately 32,000 head of feeder cattle were sold at these sales. Additional information concerning the

organizational characteristics and selling costs of each of the markets analyzed was collected.

Multiple regression and correlation analysis techniques were utilized to statistically analyze the affect of the independent variables (weight, lot size, grade, breed, sex, fat cattle price and type of auction market) on the dependent variable, price. Variables found to have a significant effect on selling price were weight, lot size, sex, Phoenix fat cattle price, grade, and type of auction market outlet. As the average weight of animals in a lot increased, the selling price per hundredweight declined, at a decreasing rate. Total dollars received per animal were noted to increase as the average weight of animals in a lot increased. Thus a major conclusion of this study was that producers should consider the optimum selling weight in terms of net returns, not price per pound. However, when considering alternatives, the costs involved must be carefully weighed. The best selling weight will vary with ranch conditions and producer alternatives, which affect costs in relation to total returns received for the animals at different market weights.

Size of sale lot was also a significant factor affecting selling price. Results of the analysis indicated that selling price increased as number of animals in the lot increased. Most of the feeder cattle marketed at country auction sales observed in this analysis were purchased by large feedlot operators from California and Colorado. These buyers are attracted to sales where large numbers of cattle are sold in relatively large lots, thus enabling the buyers to purchase greater numbers of feeder cattle in a relatively short period of time. This

was a factor which helped to make the Indian reservation sales successful, since the individual producers pool their cattle into larger relatively uniform lots. Other ranchers might give some thought to the possibilities of pooling in order to encourage more competitive bidding among buyers. Optimum size of lot should also be given consideration in determining sales policies within given sales organizations.

The sex of animals had a significant effect on price. Though the price differential may vary for different weight ranges, steers were found to sell at a premium over heifers.

Grade was also determined to be an important factor affecting selling price. Though the price differentials may vary for various breeds and weight classification, on the average, the price differential for the nine grade classes (low standard to high choice) considered in this analysis was approximately \$10.66 per hundredweight. Thus by altering the production management decisions to improve quality, the producer of feeder cattle in Arizona can significantly increase the selling price of his cattle. However, this price increase must be weighed against the costs of such improvements in each individual's situation.

Type of auction market was found to have a significant effect on selling price. For similar animals, with the effects of other factors eliminated, the Hopi Indian Reservation average sales prices were estimated to be the highest. Next in order of rank with respect to selling price were the sales at the Navajo Reservation, Willcox; the San Carlos Apache Indian Reservation, the Tucson Auction, the Cattlemen's Association Sales, the Phoenix Auction and sales held on the Fort Apache and Hualapai Indian Reservations.

The selling price differences estimated above are not easily reconciled. For example, though organizationally the sales held on the Hopi and Navajo Indian Reservations seemed to be the least unified and consistent, the results of the price analysis indicated that on the average, selling prices were the highest at these sales compared to the other seven auction types. In Chapter 3, it was pointed out that shrinkage on the Hopi and Navajo producer's cattle was relatively high at the time of entry into the sales ring and in the case of the Navajo sales, an additional 3 percent pencil shrink was deducted from the pre-sale weight to obtain the final selling weight. This was an attractive aspect of these sales as far as the trader-buyer was concerned. Though buyers may have paid more per hundredweight the difference was balanced off by the relatively high percentage of shrink which could be quickly regained in the feedlot. Therefore it was concluded that the price differential noted was a result of the condition of the sale animals and organizational characteristics peculiar to the markets.

An examination of marketing charges and organizational characteristics indicated that in absolute terms, the Fort Apache and San Carlos Apache Indian Tribes paid the highest amount. However, it was noted that more services were provided to producers in comparison to other marketing groups or organizations. Members of the Apache County Cattlemen's Association paid the least to market their cattle, but this was attributable to the comparatively low auctioneering fee charged to this association. With the exception of the costs paid by producers on the two Apache Reservations analyzed in this study, the main difference

in charges between other marketing groups and organizations was attributable to the wide range of fees paid for auctioneering services.

In making comparisons of results of one market to another, marketing charges and services supplied must be considered, as well as prices received for the cattle sold. A detailed cost study would be necessary to determine which markets are operating with the greatest efficiency. Preliminary results based on the analysis carried out in this study favor the local auctions. When the cost analysis of this study was combined with results of the price analysis by auction type, it was concluded that, if any added trucking costs are considered for shipment of cattle, from the ranch to central markets, the feeder cattle producer generally would net more by using the local auction.

Suggestions for Future Research

One of the findings of this study was that dollars per head received by the producer increased as the weight of the animal increased. However, the cost of putting additional weight on feeder cattle must be carefully weighed with the increased dollars received for added pounds. A detailed production oriented analysis concerning optimal selling weights considering both costs and dollars received would be of benefit in the producer's decision making process. Additionally there are indications that returns vary between markets and marketing methods. A comprehensive study of marketing costs and returns associated with various marketing methods should be of value in assisting producers to make the best decision.

APPENDIX A

DATES AND LOCATIONS OF ARIZONA LIVESTOCK AUCTIONS STUDIED

Spring and Fall 1969

Central Auction Markets

1. Phoenix, Arizona, weekly September 16 to November 25.
2. Tucson, Arizona, weekly September 27 to November 29.

Special Feeder Cattle Sales

1. Willcox, Arizona, 4 special feeder cattle sales: October 9, 21, 30, and November 13.

Cattlemen's Association Sales

1. Yavapai Livestock Marketing Association, Prescott, Arizona, 3 sales, October 24, November 7, and June 2.
2. Gila County Cattle Growers Association, Globe, Arizona, 2 sales May 20 and 21.
3. Mohave Livestock Marketing Association, Kingman, Arizona, May 23.
4. Apache County Cattlemen's Association, St. Johns, Arizona, November 4.

Indian Reservation Sales

1. Western Navajo-3 sales
 - a. Leupp, Arizona -- September 23

- b. Tuba City, Arizona -- September 26
 - c. Bidahochie, Arizona -- September 30
2. Eastern Navajo-3 sales
- a. Mexican Springs, New Mexico -- October 2
 - b. Naschitti, New Mexico -- October 2
 - c. Ganado, Arizona -- October 4
3. Hopi-- Polacca, Arizona, October 3
4. Fort Apache-6 sales
- a. Apache Springs, Arizona, October 7
 - b. McNary, Arizona, October 8
 - c. Apache Springs, Arizona, October 14
 - d. McNary, Arizona, October 15
 - e. Whiteriver, Arizona, October 21
 - f. Whiteriver, Arizona, November 18
5. Hualapai -- Peach Springs, Arizona, October 17
Peach Springs, Arizona, June 18
6. San Carlos Apache-3 sales
- a. Calva, Arizona, October 29
 - b. Calva, Arizona, November 12
 - c. Calva, Arizona, November 13

APPENDIX B

ARIZONA LIVESTOCK AUCTIONS 1969 QUESTIONNAIRE

I. What is the total out-of-pocket cost of selling to the consignor?

A. Auctioneering fee _____

B. Yardage charges

1. Hay _____

a. supplied by consignor _____

b. supplied by association _____

2. Other _____

C. Any other charges

1. Specify _____

Charge _____

2. Specify _____

Charge _____

II. The following is a list of services that are provided by many auction markets. Please check those applicable to the sales in your area and fill in the cost of providing the service.

A. Indicate total charge _____

<u>Check</u>	<u>Service</u>	<u>Cost</u>
1. _____	Auctioneer	_____
2. _____	Hay	_____
3. _____	Water	_____
4. _____	Labor-unloading	_____
5. _____	Labor-loading	_____
6. _____	Penning, tagging, weighing	_____
7. _____	Clerking	_____
8. _____	Other _____	_____
9. What was the associations total cost per head of selling the cattle? _____		

III. Approximate length of time cattle are in the sale yards.

A. Prior to sale

<u>Percent</u>	<u>Length of time</u>
1. _____	less than 3 days
2. _____	more than 3 days

B. After sale

<u>Percent</u>	<u>Length of time</u>
1. _____	less than 24 hours
2. _____	more than 24 hours

IV. How has the cost of sale facilities been financed?

V. How many sales per year are held? _____

A. On the average approximately how many cattle are sold at a sale? _____

VI. What classes of cattle are allowed to be sold? (steers, heifers, bulls, cows, cow-calf pairs, culls). _____

A. How are cattle sorted (by weight, sex, grade, owner)? _____

VII. How are most of the cattle transported to the sale (private truck, commercial truck, driven on foot)? _____

A. If on foot what percentage or number? _____

1. Approximately what distance are they driven? _____

VIII. Length of haul from ranch to sale.

<u>Miles</u>	<u>No. of ranchers</u>	<u>Costs per head or lb.</u>
1 to 10	_____	_____
11 to 25	_____	_____
26 to 50	_____	_____
50 or over	_____	_____

- IX. What do you feel the ranchers can expect on the average, in the way of a premium by marketing through rancher owned auction as compared to on the ranch sales or commercial auction? _____

- X. How many buyers were registered for the sale? _____
- A. Approximately how many or what percentage actually buy cattle at the sale? _____

- B. What percentage of registered buyers actually bid on cattle sold at the sale? _____

- XI. How do the ranchers in general feel about marketing their cattle in this manner? _____

APPENDIX C

ESTIMATES OF CHARGES FOR MARKETING AND RELATED SERVICES.
FOR FEEDER STEERS AND HEIFERS SOLD AT ARIZONA AUCTIONS

Estimates of Charges for Marketing and Related Services for Feeder Steers and Heifers Sold at Arizona Auctions.^a

Marketing Outlets	Head Sold (number)	Sales Recorded (number)	Total Costs (dollars)	Auctioneer	Hay	Labor	Other ^b	Charge Basis	Charges Per Head ^a (dollars)
Navajo ^c	904	2	5,279	3.0% of gross	none	NA	75¢/head-pens, 25¢/hd. other, 15¢/hd brand insp.	3% of gross, \$1.15 per head ^b	5.84
Hopi ^c	507	1	1,828	75¢/head	none	NA	none	3% of gross	3.60
Fort Apache ^c	4,446	6	87,250	\$1,000/sale	none	NA	NA	12.5% of gross	19.51
San Carlos Apache ^c	3,818	4	92,902	1.5% of gross	Association Cost	NA	NA	15% of gross	24.33
Hualapai ^c	1,076	2	2,690	75¢/head	Association Cost	NA	NA	\$2.50/head	2.50
Willcox ^d	4,943	4	NA	NA	25¢/head per day	NA	brand inspec. 15¢/head	\$3.00/head Maximum	3.00 Maximum
Yavapai Mrkting Association ^e	2,398	3	7,194	NA	Purchased from Association	NA	NA	\$3.00/head	3.00
Apache Co. Cattlemen ^e	1,100	1	915	\$200/sale	Owner's Responsibility	\$200 loading-unloading, 15¢/hd. weighing, 15¢/hd inspect.	telephone \$25 meals \$25, advt. \$135	Mbrs \$2/hd. Non-mbrs \$2.50/hd	Mbrs, 2.00 Nonmbrs 2.50
Gila County Cattle Growers ^e	3,050	2	9,760	25¢/head	95¢/head (labor included)	50¢/head	advt. 25¢.hd. yard-age, \$1.25/head	\$3.20/head	3.20
Mohave Livestock Mrkting Assoc. ^e	2,143	1	6,900	25¢/head	Purchased from Association	\$110	none	2% of gross	3.22
Phoenix ^f	2,269	9	NA	NA	22.5¢/head per day	NA	brand inspec. 15¢/head	\$3.25/head Maximum	3.25 Maximum
Tucson ^f	3,434	10	NA	NA	\$1.50/bale	NA	brand inspec. 15¢/head	\$3.25/head Maximum	3.25 Maximum

a. As per Table 5. Charges estimated are not comparable since services involved vary significantly. See text for detailed explanation.

b. Other costs -- includes costs of advertising, inspection, utilities, miscellaneous.

c. Indian Reservation Sales.

d. Special feeder cattle sales.

e. Cattlemen's Association Sales.

f. Central Auction Market.

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