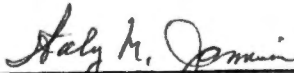


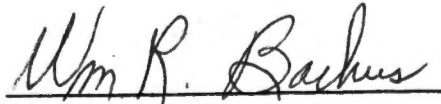
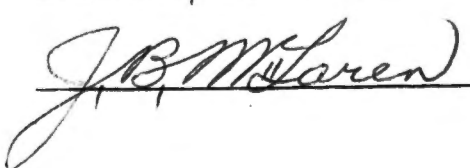
March 8, 1974

To the Graduate Council:

I am submitting herewith a thesis written by A. Hayden Brown, Jr. entitled "Effects of Selected Variables on the Price Received for Calves in Tennessee Feeder Calf Sales." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Science.


Haley M. Jamison, Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:


Vice Chancellor
Graduate Studies and Research

EFFECTS OF SELECTED VARIABLES ON THE PRICE
RECEIVED FOR CALVES IN TENNESSEE
FEEDER CALF SALES

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee

A. Hayden Brown, Jr.

June 1974

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ABSTRACT

Records of 10,710 pens of calves sold in Tennessee feeder calf sales held in the spring and fall of 1965 through 1969 were studied to calculate estimates of the effects of sex, grade, average weight per pen, and pen size on the price received per hundredweight and per head for feeder calves. The following results were obtained in this study.

These data indicated that sex had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves. Steers sold for \$2.15 per hundredweight and \$9.40 per head more than heifers of identical grade.

These data revealed that grade had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves. Choice calves sold for an average of \$1.91 per hundredweight more than medium calves. Choice calves also sold for an average of \$0.71 per hundredweight more than good calves. Calves in the medium grade sold for an average of \$1.20 per hundredweight less than good calves. Choice calves sold for \$9.00 and \$3.58 per head more than medium and good calves, respectively.

The average weight per pen was a significant ($P < .01$) source of variation in this study. When the price received per hundredweight was regressed on the average weight per pen, with all other sources of variation held constant, these data indicated that as average weight per pen increased the price received per hundredweight decreased. When the price received per head was regressed on the

average weight per pen, within the range of this data, as the average weight per pen increased, so did the average price received per head. Although lighter weight calves sold for more per hundredweight, for each pound increase in average weight the price per head increased \$0.21.

The regression of the price received per hundredweight and per head on pen size was significant ($P < .01$). These data indicated that for an increase in pen size by one unit the price per hundredweight increased \$0.04 and the price per head increased \$4.82.

The estimates of these parameters indicated that factors affecting the price received for feeder calves in Tennessee feeder calf sales were similar to those described in other studies involving feeder calf sale data.

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CHAPTER I

INTRODUCTION

Due to the efforts in 1935 of two young innovative educators, Vernon Darter and John Ewing, Assistant County Agents in Carter and Johnson Counties, respectively, Tennessee has been considered by some authorities to be the birthplace of the feeder calf sale industry in the Southeast. When these two young educators saw the size of their clientele's herds, they realized the need for a competitive market for small beef cattle producers. In order to fulfill this need, Darter and Ewing talked with leading farmers in each of these counties. This action led to an endeavor to bring these cattle to a central sale facility, co-mingle ownership and place them in pens of comparable breed, grade, sex and weight. From the efforts of these two young men, the first sale of this type was held at Shouns, Tennessee, in 1935.

The marketing of beef cattle through organized sales has been a relatively old practice in Tennessee. However, it was not until 1945 that significant interest began to develop in the marketing of Tennessee feeder calves on a large scale through these organized sales. In 1953 producers in the Johnson City area reorganized the cattleman's organization known as the Mountain Breeders' Association and established it as a cooperative.

The development of this cooperative led to the organization of similar sales in other sections of Tennessee. By 1955 there were

eight organized feeder calf sales across the state. These sales were conducted and promoted by area feeder calf associations in cooperation with The University of Tennessee Agricultural Extension Service and The Tennessee Department of Agriculture.

The chief objective of this type of cooperative marketing program has been to provide Tennessee farmers with an opportunity to put together large pens of cattle that are more uniform in size and quality, thus attracting more buyers and permitting them to compete with the larger producers of the West. Teaching has been another objective associated with this type of marketing system. Consignors are provided an opportunity to observe their cattle in comparison to those of differing quality when they transport them to a central sale facility.

Since the beginning of these sales at different locations in Tennessee, no statistical analysis has been made to compare the effects of different variables on the price of feeder calves on a statewide basis. The objective of this study was to calculate estimates of the effects of sex, grade, average weight per pen, and pen size on the price received per hundredweight and per head for calves sold from 1965 through 1969 in Tennessee feeder calf sales.

The effects of breed, geographical location of the sale, season of the year, size of the sale and time of the sale on the price received for calves in Tennessee feeder calf sales were not included in this study. The variations due to these effects were considered fixed. Thus, they were considered only of academic interest.

The data used for this study were assembled over a five year period, 1965 through 1969. During this period, sales were held at 24 locations which represented all the geographic areas of Tennessee. Several of these sales had increased in volume to the extent that it was necessary to divide them by breed and sex with a series of sales being held on consecutive days.

It is hoped that the findings from this study will prove beneficial to farmers in Tennessee in planning their beef production and marketing programs, and that the conclusions drawn will be helpful to the sponsors and sale managers in the continued effort to improve the feeder calf sales throughout Tennessee.

CHAPTER II

REVIEW OF LITERATURE

Few studies have been made to determine the effects of selected variables on the price received for cattle sold in organized feeder calf sales within specific states. Most of the studies have been directed toward specific sales within certain states. Consequently, much of the literature cited herein pertains to these studies. The literature which is available will be presented from the standpoint of what has been reported on each of the following variables: sex, grade, average weight per pen, and pen size. The effects of each of these variables will be reviewed.

I. SEX

Smith's (1971) study involving feeder calves showed that steers sold for a significantly ($P < .01$) higher price than heifers. Steers sold for \$3.55 per hundredweight and \$15.49 per head more than heifers of a comparable grade.

In a similar study conducted by Willhite (1971), steers were found to have sold for a significantly ($P < .01$) higher price than heifers. Steers sold for \$4.05 per hundredweight and \$17.54 per head more than heifers of the same grade.

Smith's (1970) study concluded that steers sold for a significantly ($P < .01$) higher price than heifers. Steers sold for \$3.22

per hundredweight and \$14.35 per head more than heifers of identical grade.

Cole (1969) found that steers sold for \$3.64 and \$15.14 per hundredweight and per head more, respectively, than heifers of comparable grade. This difference was significant ($P < .01$).

Jamison and Sellers (1968) resolved that steers sold for a significantly ($P < .01$) higher price per hundredweight than heifers. Steers in their study sold for \$2.64 per hundredweight more than heifers of the same quality.

A study conducted by Greathouse, Cole and Magee (1968) revealed that heifers sold for a significantly ($P < .01$) lower price per hundredweight than steers in 1966 and 1967. The differences were \$4.27 and \$4.40 per hundredweight for the two years.

The average price received for all grades as reported by Harper (1957) was \$20.85 per hundredweight for steers and \$17.81 for heifers.

II. GRADE

Smith (1971) reported that choice calves sold for an average of \$2.68 per hundredweight more than medium calves. Choice calves also sold for an average of \$0.73 per hundredweight more than good calves. Medium calves sold for an average of \$1.95 per hundredweight less than good calves. In the same study, Smith concluded that choice calves sold for \$12.14 per head more than medium calves. Choice calves also sold for \$3.75 per head more than good calves. Medium calves sold for an average of \$8.39 per head less than good

calves. The above data indicated that grade had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves.

In a study involving 988 pens of steers and heifers, Willhite (1971) found that grade had a significant ($P < .01$) effect on the price received for feeder calves per hundredweight and per head. Choice calves sold for an average of \$2.51 per hundredweight more than medium calves. Choice calves also sold for an average of \$1.21 per hundredweight more than good calves. Calves in the medium grade sold for an average of \$1.39 per hundredweight less than good calves. Choice calves sold for \$12.06 and \$5.40 per head more than medium and good calves, respectively.

In a similar study involving 708 pens of feeder calves, Smith (1970) disclosed that choice calves sold for an average of \$3.19 per hundredweight more than medium calves and \$0.96 per hundredweight more than good calves. He revealed also that medium calves sold for an average of \$2.23 per hundredweight less than good calves. Choice calves sold for \$16.02 per head more than medium calves and \$5.01 per head more than good calves. Medium calves sold for an average of \$11.01 per head less than good calves. These data indicate that grade had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves.

Choice calves were reported selling for an average of \$2.24 per hundredweight more than medium calves in a study conducted by Cole (1969). He also found in the same study that choice calves averaged \$0.60 per hundredweight more than good calves. Medium

calves sold for an average of \$1.64 per hundredweight less than good calves. Choice calves sold for \$11.45 per head more than medium calves and \$3.31 per head more than good calves. Medium calves sold for an average of \$8.14 per head less than good calves. These differences were significant ($P < .01$).

Greathouse, Cole and Magee (1968) stated that a significant ($P < .05$) difference existed in the price paid for choice feeder cattle and cattle of any other grade. In all cases there were differences in price; however, the difference between choice and prime cattle in 1966 and 1967 sales was not significant.

The preceding results were affirmed by Jamison and Sellers (1968). They also found that grade has a significant ($P < .01$) effect on the price received per hundredweight for feeder calves. They found that choice calves averaged \$3.27 per hundredweight more than medium calves and \$1.20 per hundredweight more than good calves. Medium calves averaged \$2.07 per hundredweight less than good calves.

Walker (1961) observed that a difference in price paid for cattle grading choice, good and medium was statistically significant ($P < .05$). Good steers averaged \$1.58 per hundredweight less than choice steers and \$1.91 per hundredweight more than medium steers. Choice heifers averaged \$1.79 per hundredweight more and medium heifers \$1.97 per hundredweight less than good heifers.

In a study conducted in seven Southern states by Stout and Freund (1958), grade was found to have a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves. For example, a change of one full grade indicated a price change of \$1.02 and \$1.44 per hundredweight for steers and heifers, respectively.

Fancy and choice steers averaged \$2.11 per hundredweight more than good steers, and medium steers averaged \$2.45 per hundredweight less than good steers. Fancy and choice heifers averaged \$1.45 per hundredweight more than good heifers, and medium heifers averaged \$1.44 per hundredweight less than heifers grading good, according to a study conducted by Williamson (1958). This study revealed that grade had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves.

The average price per hundredweight in a study conducted by Harper (1957) was found to be significantly ($P < .01$) affected by grade. Choice calves averaged \$22.00; good, \$20.53 and medium, \$18.73. However, for calves within the same grade, there was a wide variation between the high and low price received per hundredweight. For steers the range per hundredweight was \$9.00 for choice, \$10.70 for good and \$12.50 for medium. The range for heifers was \$5.90, \$8.60 and \$6.10 per hundredweight for the choice, good and medium grade, respectively.

Badenhop (1956) reported that the price differential for grade was statistically significant ($P < .05$) and tended to be less pronounced for feeders than for the other market classes. For steer and heifer calves, the price differential per hundredweight averaged \$1.65 and ranged from a low of \$0.10 to \$3.25.

Purcell (1956) determined that good steer calves averaged \$3.20 per hundredweight more than medium steer calves on five Georgia markets and \$3.42 per hundredweight more on two Midwest terminal markets. This study was conducted over a four year period.

III. AVERAGE WEIGHT PER PEN

Smith's (1971) data indicated that the effects of average weight per pen on the price received for calves per hundredweight and per head were significant ($P < .01$). This study showed that as average weight per pen increased, the price received per hundredweight decreased. In this same study as average weight per pen increased, so did the average price received per head.

Willhite (1971) affirmed an earlier study and stated that as average weight per pen increased, the price received per hundredweight decreased. He also affirmed that as average weight per pen increased, so did the average price received per head. This difference was significant ($P < .01$).

Similar results were reported by Smith (1970) in a study conducted on 708 pens of feeder cattle. He discovered that the price per hundredweight decreased significantly ($P < .01$) as the average weight per pen increased. He also found that as average weight per pen increased the average price received per head increased significantly ($P < .01$).

Cole (1969) also found that the price received per hundredweight decreased as average weight per pen increased. He resolved that as average weight per pen increased so did the average price received per head. The effects of average weight per pen on the price received per hundredweight and per head were significant ($P < .01$).

Jamison and Sellers (1968) observed that as average weight per pen increased beyond 481 pounds, the price received per hundredweight decreased significantly ($P < .01$).

Walker's (1961) data indicated that with all other variables held constant as the average weight per pen increased, the price received per hundredweight decreased significantly ($P < .05$). This indicated that buyers were willing to pay more per hundredweight for lighter weight calves.

IV. PEN SIZE

Smith's (1971) data indicated that the effects of pen size on the price received for calves per hundredweight and per head were significant ($P < .01$). For an increase in pen size of one unit the price per hundredweight increased \$0.013 and the price per head increased \$0.067. His data further showed that calves in an average pen size of 91 or more sold for a definite price advantage.

Willhite (1971) declared that the effects of pen size on the price received per hundredweight for feeder calves were not statistically significant. However, his study revealed that calves in an average pen size of 81 to 90 sold for a higher price per hundredweight and per head than calves in any other pen size.

In a study conducted by Smith (1970), the effects of pen size were not significantly related to the price received per hundredweight and per head for feeder calves. The calves in an average pen size of 81 to 90 were also reported to have sold for more per hundredweight. Nevertheless, calves in an average pen size of 21 to 30 sold for more per head.

Data presented by Cole (1969) determined that when calves were sold in a pen containing 91 head or more, the price per head increased.

The differences in price per head, however, were not statistically significant.

Jamison and Sellers (1968) reported a significant ($P < .05$) negative relationship when price received per hundredweight was regressed on the average number of head per pen.

Walker (1961) found that as pen size increased, the price of steers increased. However, the differences were not significant. Steers sold in a pen size of 81 head or more averaged higher in price per hundredweight than all others. The 51 to 60 head pen size was the highest priced pen for heifers.

CHAPTER III

EXPERIMENTAL PROCEDURE

I. SOURCE OF DATA

The data used in this study were collected over a five year period (1965-1969) from Tennessee feeder calf sales which were held in the spring and fall of each year. At 24 locations these sales represented all the geographic areas of the state. These geographic locations are shown in Figure 1.

A total of 10,710 pens of calves (183,527 head) of different breed, sex, grade and weight were found appropriate for this study. Of the locations included in this study, the largest sales, in total number of calves sold, were at Cookeville from January 1, 1965, through December 31, 1965, with 10,209 calves being marketed. The smallest sales, in total number of calves sold, were at Trenton covering the twelve months period from January 1, 1968, to December 31, 1968, where 182 calves were exchanged on the market.

II. GENERAL RULES AND REGULATIONS THAT GOVERN

TENNESSEE FEEDER CALF SALES

Tennessee feeder calf sales are open and available to all beef cattle producers within the state. However, all consignors that sell calves in these sales are required to be a bona fide member of a county or an area livestock association which is affiliated with the Tennessee Livestock Association.

All calves entered in these sales must be of beef breeding, either purebred or grade, and must be sired by a purebred registered bull. Calves of dairy or questionable breeding are not accepted at these sales.

The management practices of castration (with a knife) and dehorning, where applicable, are required on calves sold in Tennessee feeder calf sales. Inspection for these practices is made by the sale management and recorded at unloading docks.

Certain regulatory requirements are of utmost importance in Tennessee's feeder calf sale industry. The state requires that all cattle sold in these sales be permanently identified by an ear-tag. A vaccination is required on all calves consigned for blackleg, malignant edema, and hemorrhagic septcemia (3-in-1 shot) not less than two weeks and not more than six prior to the sale.

All calves entering the sales are graded by personnel of The Tennessee Department of Agriculture Marketing Service. Calves consigned receive one of the feeder quality grades of choice, good, medium, or odd lots.

Following grading, all calves are weighed individually by a certified weighmaster. The minimum weight for all calves sold in these sales is 300 pounds and the maximum weight is 800 pounds for steers and 650 pounds for heifers.

Within breed, sex, grade and weight, calves are placed in pens with 50 pound increments in weight. If the number of calves in a particular pen becomes extremely large, the pen is closed and a new one opened.

The management of most sales in establishing sale order takes into consideration the pen or pens with large numbers weighing from 500 to 550. Normally, these calves are in the greatest demand, thus setting the tempo of the sales.

III. CLASSIFICATION OF DATA AND METHOD OF ANALYSIS

In this study the data obtained from pen summary sheets included the following: year, season, division, sale location, sale sequence, breed, sex, grade, average weight per pen, pen size, price per hundredweight and price per head. The data were taken directly from these summary sheets, coded and punched into IBM cards according to the format presented in Table I.

Pen summary sheets showed that there was no weight obtained on individual calves in Tennessee feeder calf sales. Calves were penned in groups of varying size (number), depending on grade and average weight; therefore, weight was not included in the analyses. Thus, the pen was used as the experimental unit in the analyses of data.

Because of the disproportionate subclass frequencies, least-square methods as described by Harvey (1960) were used in the analyses to obtain estimates of the various effects on the price received per hundredweight and per head for feeder calves.

The fixed environmental effects such as year, season, division, sale location, sale sequence and breed have no significance in this study and describe only an economic trend; therefore, these effects were absorbed. Calculating sum of squares and cross products on a

TABLE I
FORMAT USED FOR IBM CARDS

Data	Code	IBM Cards Column Numbers
Year		1-2
1965	65	
1966	66	
1967	67	
1968	68	
1969	69	
Season		3
Spring	1	
Fall	2	
Division		4
East	1	
Plateau	2	
Middle	3	
West	4	
Location		5-6
Carthage	01	
Columbia	02	
Cookeville	03	
Crossville	04	
Brownsville	05	
Greeneville	06	
Hartsville	07	
Huntingdon	08	
Jamestown	09	
Johnson City	10	
Lafayette	11	
McMinnville	12	
Morristown	13	
Nashville	14	
Newborn	15	
Obion County	16	
Rogersville	17	
Sevierville	18	
Sparta	19	
Sweetwater	20	
New Tazewell	21	
Trenton	22	
Woodbury	23	
Pulaski	24	

TABLE I (continued)

Data	Code	IBM Cards Column Numbers
Sale Sequence		7
First	1	
Second	2	
Third	3	
Fourth	4	
Fifth	5	
Breed		9
Angus	1	
Hereford	2	
White-face-black	3	
Shorthorn	4	
Sex		11
Steers	1	
Heifers	2	
Grade		12-13
Choice	13	
Good	10	
Medium	07	
Average Weight	Actual Weight	14-17
Number Head Per Pen	Actual Number	18-20
Price Per Head	Actual Price	21-25
Pen Number	Actual Number	26-28
Price Per Head	Actual Price	30-34
Pen Size		37-38
1-10	01	
11-20	02	
21-30	03	
31-40	04	
41-50	05	
51-60	06	
61-70	07	
71-80	08	
81-90	09	
91-100	10	
101-110	11	
111-120	12	

within-subclass basis and summing over all subclasses accomplished this absorption.

In order to fit a model including sex and grade, it was necessary to assume that they were independent of each other and that they would be combined in an additive manner.

In a preliminary analysis when average weight per pen and average pen size was adjusted to a constant sex and grade basis, correlations between other elements of the model were recorded. No significant ($P < .05$) increase in R^2 was observed when the quadratic and cubic terms of average weight per pen and average pen size polynomials were included in the model. Therefore, these elements were assumed to be negligible with respect to adjustments for fixed environmental effects and were deleted from subsequent analysis.

The two dependent variables were price per hundredweight and price per pound. An individual observation was assumed to be composed of six components in the final analysis. The model was as follows:

1. A constant (μ) common to all observations
2. Sex expressed as two discrete levels
3. Grade expressed as three discrete levels
4. The partial regression of y /on average pen weight (linear)
5. The partial regression of y /on average pen size (linear)
6. Random variation

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to obtain an estimate of the value of the selling price of feeder calves, measured by price received per hundredweight as well as price per head, whereas many sources of environmental variation as possible were removed.

The least-squares estimates for the independent effects on price per hundredweight and per head are presented in Table II. The corresponding analysis of variance is presented in Table III.

No attempt was made to separate means within a subclass when three or more levels of effects were included.

In several preliminary analyses, after various sources of environmental variation were removed, a model containing sex, grade, and the continuous variables of average weight and pen size, linear, quadratic, and cubic were investigated. The percent of variation removed as a result of the inclusion of the quadratic and cubic terms was negligible. This model explained 75 and 95 percent of the variation in price per hundredweight and per head, respectively, when the quadratic and cubic term of the weight and pen size polynomials were deleted from the statistical model. The linear, linear and quadratic, and the linear, quadratic and cubic regressions are presented in Figures 2 and 3 for average price per hundredweight and per head, respectively.

TABLE II
LEAST-SQUARES ESTIMATES^a OF THE PRICE RECEIVED

Variable	Avg. Price Rec'd Per cwt.	Avg. Price Rec'd Per Head
Sex		
Steers	2.15	9.41
Heifers	-2.15	-9.41
Grade		
Medium	-1.01	-4.82
Good	0.19	0.62
Choice	0.90	4.20
Regression of Y on:		
Avg. wt./pen	-1.20	20.62
Avg. no./pen	0.40	4.82

^aEstimates are deviations from the overall adjusted means when equal numbers exist per subclass. The overall arithmetic mean of price per hundredweight and price per head was \$26.38 and \$126.04, respectively.

TABLE III
ANALYSIS OF VARIANCE OF THE PRICE RECEIVED

Source	Degrees of Freedom	Mean Squares	
		Avg. Price/cwt.	Avg. Price/Head
Sex of calf	1	4.0498**	771844.02**
Grade of calf	2	0.2746**	64454.375**
Regression of Y on:			
Avg. wt./pen		1.5140**	4435668.4**
Avg. no./pen		0.00282**	5212.5141**
Residual	10323	0.0002	38.4464
R ²		0.75	0.95

** P < .01

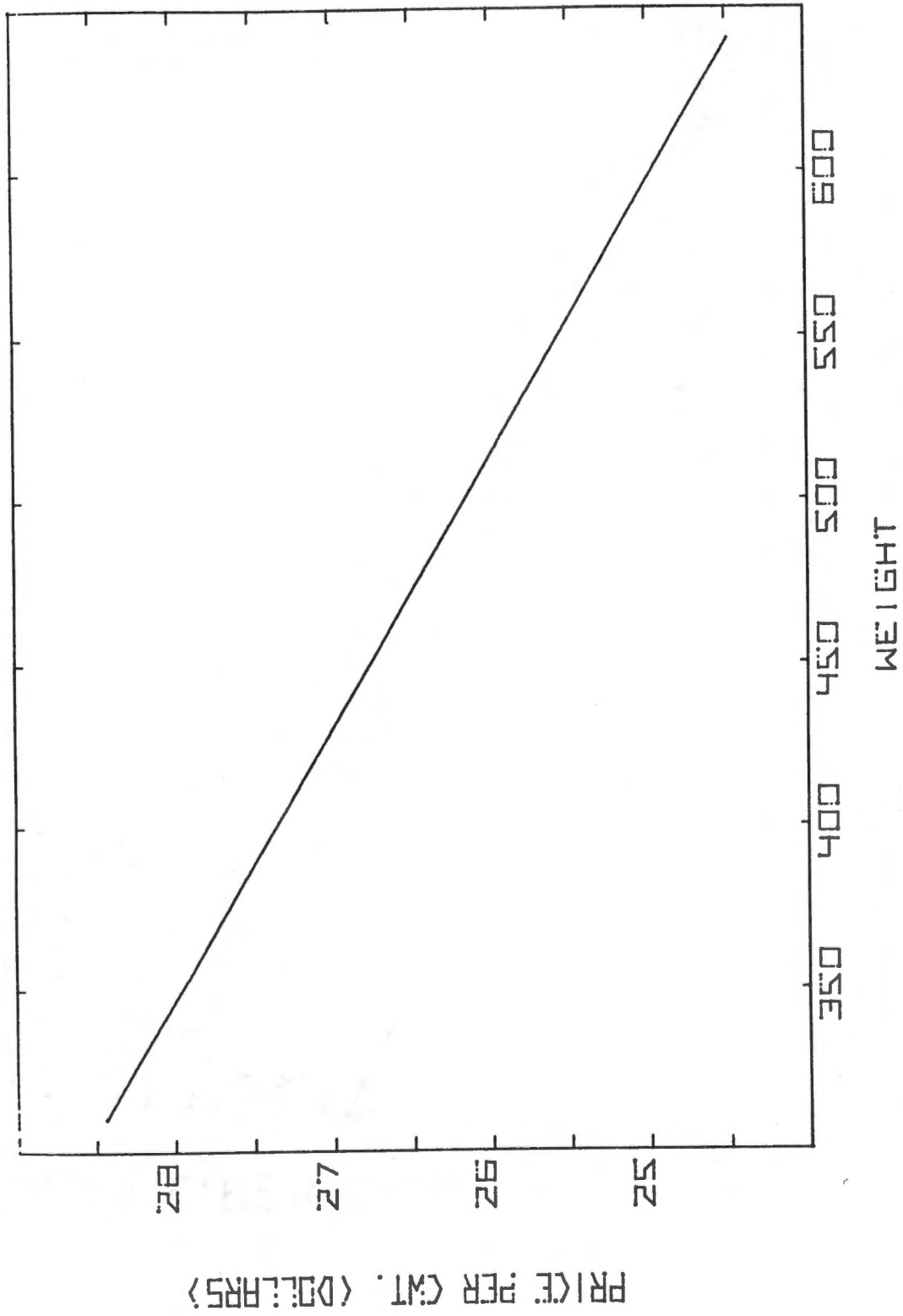


Figure 2. The linear relationship of average weight per pen on the price received per hundredweight for feeder calves.

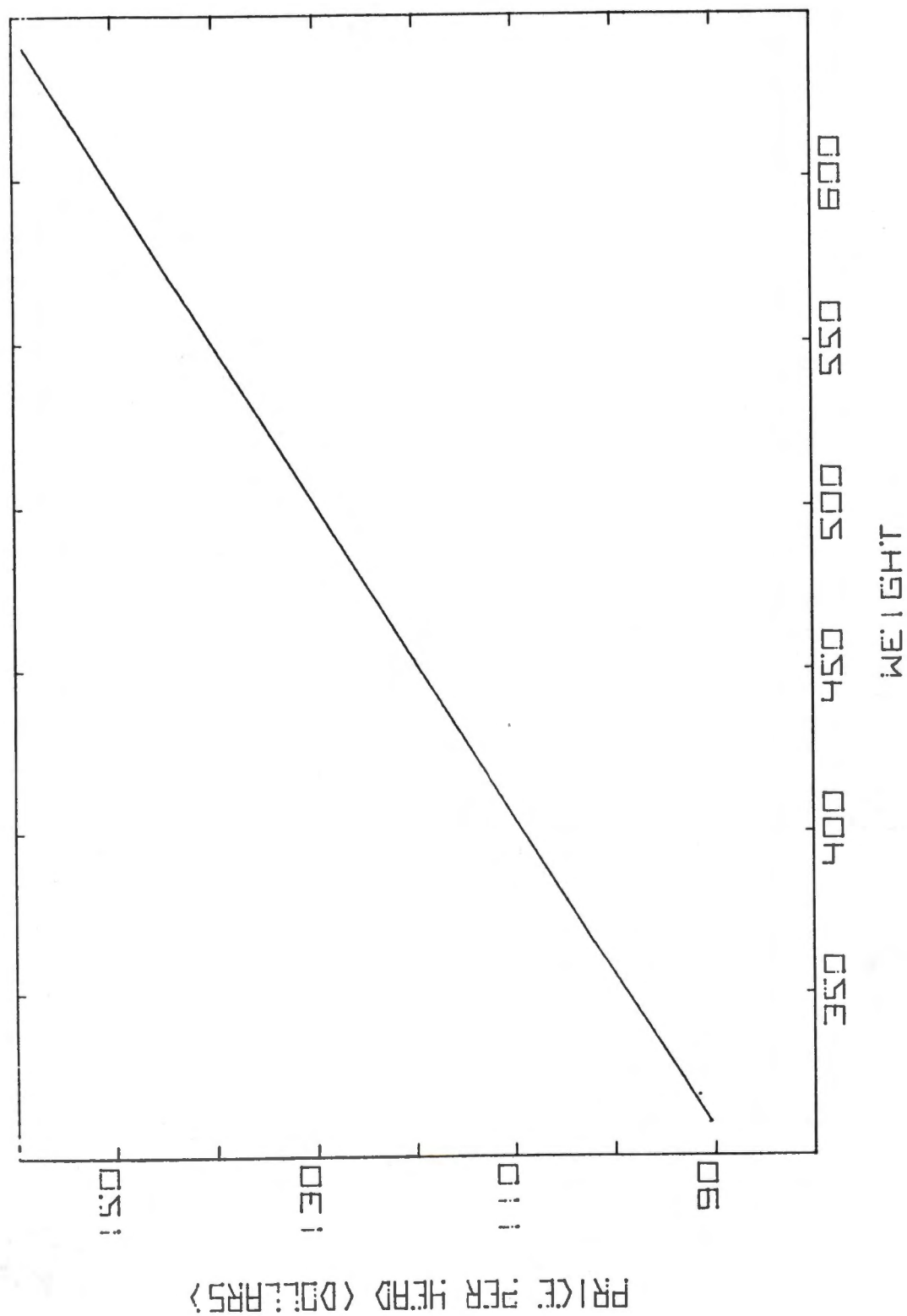


Figure 3. The linear relationship of average weight per pen on the price received per head for feeder calves.

The quadratic and cubic terms of average weight per pen and average pen size polynomials explained only .002 and .004 percent, respectively, of the variation in price received per hundredweight and price per head. The R^2 values as shown in Table III represent the fraction of the variation attributable to the independent variables after variation due to previously included fixed environmental effects had been considered.

I. SEX EFFECTS

These data indicated that sex had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves. Steers sold for \$2.15 per hundredweight and \$9.40 per head more than heifers of identical grade.

The results stated above were in agreement with those of previous authors. Smith (1971) reported that steers sold for \$3.55 per hundredweight and \$15.49 per head more than heifers of the same grade. Willhite (1971) proclaimed that steers sold for \$4.05 per hundredweight and \$17.54 per head more than heifers of similar grade. Smith (1970) concluded that steers sold for \$3.22 per hundredweight and \$14.35 per head more than heifers of identical grade. Cole (1969) also found that steers sold for \$3.64 and \$15.14 per hundredweight and per head more, respectively, than heifers of comparable grade. Jamison and Sellers (1968) resolved that steers sold for \$2.64 per hundredweight more than heifers of the same grade. Greathouse, Cole and Magee (1968), and Harper (1957) also concluded that steers sold for more per hundredweight and per head than heifers of a comparable grade.

II. GRADE EFFECTS

These data revealed that grade had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves. Choice calves sold for an average of \$1.91 per hundredweight more than medium calves. Choice calves also sold for an average of \$0.71 per hundredweight more than good calves. Calves in the medium grade sold for an average of \$1.20 per hundredweight less than good calves. Choice calves sold for \$9.00 and \$3.58 per head more than medium and good calves, respectively.

Authors reported in previous studies that grade had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves.

Smith (1971) reported that choice calves sold for an average of \$2.68 per hundredweight more than medium calves. Choice calves also sold for an average of \$0.73 per hundredweight more than good calves. Medium calves sold for an average of \$1.95 per hundredweight less than good calves. In the same study, Smith concluded that choice calves also sold for \$3.75 per head more than the good calves. Medium calves sold for an average of \$8.39 per head less than good calves.

Willhite (1971) found that choice calves sold for an average of \$2.51 per hundredweight more than medium calves. Choice calves also sold for an average of \$1.21 per hundredweight more than good calves. Calves in the medium grade sold for an average of \$1.39 per hundredweight less than good calves. Choice calves sold for \$12.06 and \$5.40 per head more than medium and good calves, respectively.

Smith (1970) disclosed that choice calves sold for an average of \$3.19 per hundredweight more than medium calves and \$0.96 per hundredweight more than good calves. He revealed also that medium calves sold for an average of \$2.23 less per hundredweight than good calves. Choice calves sold for \$16.02 per head more than medium calves and \$5.01 per head more than good calves. Medium calves sold for an average of \$11.01 per head less than good calves.

Choice calves were reported selling for an average of \$2.24 per hundredweight more than medium calves in a study conducted by Cole (1969). He also found in the same study that choice calves averaged \$0.60 per hundredweight more than good calves. Medium calves sold for an average of \$1.64 per hundredweight less than good calves. Choice calves sold for \$11.45 per head more than medium calves and \$3.31 per head more than good calves. Medium calves sold for an average of \$8.14 per head less than good calves.

Greathouse, Cole and Magee (1968) stated that a significant ($P < .05$) difference existed in the price paid for choice cattle and cattle of any other grade. In all cases there were differences in price; however, the difference between choice and prime cattle in 1966 and 1967 sales was not significant.

Results similar to those above were reported by Jamison and Sellers (1968), Walker (1961), Stout and Freund (1958), Williamson (1958), Harper (1957), Badenhop (1956), and Purcell (1956).

III. AVERAGE WEIGHT PER PEN EFFECTS

The overall average weight per pen in these data was 481 pounds. The average weight per pen was a significant ($P < .01$) source of variation in this study. When the price received per hundredweight was regressed on the average weight per pen, with all other sources of variation held constant, these data indicated that as average weight per pen increased the price received per hundredweight decreased. This indicated that buyers generally were willing to pay more for lighter weight calves than those that weighed heavier. When the price received per head was regressed on the average weight per pen, within the range of this data, as the average weight per pen increased, so did the average price received per head. Although lighter weight calves sold for more per hundredweight, for each pound increase in average weight the price per head increased \$0.21. This indicated that selling lighter weight calves was undesirable provided that cost of gain was less than \$0.21 per pound.

The results stated above were in agreement with those of preceding authors. They also found that average weight per pen had a significant ($P < .01$) effect on the price received per hundredweight and per head.

Smith (1971), Willhite (1971), Smith (1970), Cole (1969), Jamison and Sellers (1968), and Walker (1961) reported that as average weight per pen increased, the price received per hundredweight decreased. In their studies they also found that as average weight per pen increased, so did the average price received per head.

IV. PEN SIZE EFFECTS

The overall average pen size in these data was 17.36 calves per pen. The regression of the price received per hundredweight and per head on pen size was significant ($P < .01$) in this study. These data indicated that for an increase in pen size by one unit the price per hundredweight increased \$0.004 and the price per head increased \$0.048.

It was observed that buyers paid more for lighter weight calves in a larger pen size. A possible explanation for this was that calves in a larger pen size were purchased by order buyers rather than feeders. Usually, order buyers pay a premium for calves in a pen size that approaches a truck load.

The results stated above were in agreement with those of Smith (1971). He reported that for an increase in pen size of one unit the price per hundredweight increased \$0.013 and the price per head increased \$0.067. His data further showed that calves in an average pen size of 91 or more sold for a definite price advantage.

The results stated above were not in agreement with those of Willhite (1971), Smith (1970), Cole (1969), Jamison and Sellers (1968), and Walker (1961). They declared that the effects of pen size on the price received per hundredweight and per head were not statistically significant. However, their studies revealed that calves in a larger pen size sold for a definite price advantage.

CHAPTER V

SUMMARY

Records of 10,710 pens of calves sold in Tennessee feeder calf sales held in the spring and fall of 1965 through 1969 were studied to calculate estimates of the effects of sex, grade, average weight per pen, and pen size on the price received per hundredweight and per head for feeder calves. The following results were obtained in this study.

These data indicated that sex had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves. Steers sold for \$2.15 per hundredweight and \$9.40 per head more than heifers of identical grade.

These data revealed that grade had a significant ($P < .01$) effect on the price received per hundredweight and per head for feeder calves. Choice calves sold for an average of \$1.91 per hundredweight more than medium calves. Choice calves also sold for an average of \$0.71 per hundredweight more than good calves. Calves in the medium grade sold for an average of \$1.20 per hundredweight less than good calves. Choice calves sold for \$9.00 and \$3.58 per head more than medium and good calves, respectively.

The average weight per pen was a significant ($P < .01$) source of variation in this study. When the price received per hundredweight was regressed on the average weight per pen, with all other sources of variation held constant, these data indicated that as

average weight per pen increased the price received per hundredweight decreased. When the price received per head was regressed on the average weight per pen, within the range of this data, as the average weight per pen increased, so did the average price received per head. Although lighter weight calves sold for more per hundredweight, for each pound increase in average weight the price per head increased \$0.21.

The regression of the price received per hundredweight and per head on pen size was significant ($P < .01$). These data indicated that for an increase in pen size by one unit the price per hundredweight increased \$0.04 and the price per head increased \$4.82.

The estimates of these parameters indicated that factors affecting the price received for feeder calves in Tennessee feeder calf sales were similar to those described in other studies involving feeder calf sale data.

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VITA

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In June of 1964 he entered Tennessee Technological University, Cookeville, to study agriculture and was awarded his Bachelor of Science degree in Animal Husbandry in 1968. While attending Tennessee Tech, Mr. Brown was a member of the Honor Society of Delta Tau Alpha, and in 1968 he received the American Society of Animal Science Scholarship Award. He also received the college merit trophy award for his work with the Block and Bridle Club.

In July 1968 he joined The University of Tennessee Agricultural Extension Service staff. His first assignment was in Fentress County, Tennessee, where he served as Assistant County Agent. He is now serving as an Assistant Extension Agent in the same location.

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