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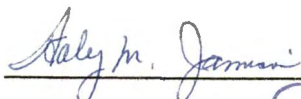
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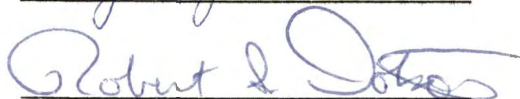
I am submitting herewith a thesis written by James Edwin Willhite entitled "Effects of Selected Variables on Prices Received for Calves in the Nashville Demonstrational Feeder Calf Sales." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Husbandry.



Major Professor

We have read this thesis and
recommend its acceptance:





Accepted for the Council:



Vice Chancellor for
Graduate Studies and Research

EFFECTS OF SELECTED VARIABLES ON PRICES RECEIVED FOR CALVES
IN THE NASHVILLE DEMONSTRATIONAL FEEDER CALF SALES

A Thesis
Presented to
the Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
James Edwin Willhite

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ABSTRACT

Records of 988 lots of steers and heifers sold in the Nashville Area Demonstrational Feeder Calf Sales held each fall from 1961 through 1969 were studied to determine the effects of grade, sex, pen size, and the average weight per pen on the prices received per hundredweight and per head for feeder calves sold.

Choice calves sold for an average of \$2.51 per hundredweight more than the medium grade calves. The choice calves sold also for an average of \$1.12 per hundredweight more than the calves grading good. Calves in the medium grade sold for an average of \$1.39 less per hundredweight than good calves.

Choice calves sold for \$12.06 more per head than the medium grade calves. The choice calves sold also for \$5.40 more per head than calves grading good.

Steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. On the average, steer calves sold for \$4.05 and \$17.54 more per hundredweight and per head, respectively, than did heifers of a comparable grade.

These data indicate that calves in pen sizes 81-90 sold for more per hundredweight and more per head than calves in any other pen size group. However, the differences were not significant.

When the price received per hundredweight was regressed on the average weight per pen, all other sources of variation held constant; 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 these data, as average weight per pen increased, so did the average price received per head.

The estimates of these parameters indicate that factors affecting the price received for feeder calves in the Nashville Area Demonstrational Feeder Calf Sale were similar to those described in other studies involving feeder calf sale data in the Southeast.

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CHAPTER I

INTRODUCTION

The demonstrational feeder calf sales in Nashville, Tennessee, were organized in 1953. Beef producers in Middle Tennessee surrounding the Nashville area made up the organization named the Tennessee Valley Beef Producers Association. The feeder calves were brought from farms, graded, weighed, and penned in uniform lots and sold at auction in the consignors' names. The sales were organized in cooperation with The University of Tennessee Agriculture Extension Service, the State Department of Agriculture, and area beef producers for the purpose of providing a market for feeder calves.

The sales were developed from an Agricultural Extension Service sponsored demonstration into an independent organization operated by the membership with Extension personnel acting in an advisory capacity. Consignments have been predominately Angus and Hereford calves selling in late September and early October.

No organized statistical analysis has been made to assess the effects of various factors on the price of feeder calves since the beginning of these sales. The objective of this study was to evaluate the effects of grade, sex, pen size (number of calves per pen), and pen weight (average) on the price per hundredweight and the price per head of feeder calves sold from 1960 through 1969.

Conclusions from this study should be helpful to breeders and feeders in planning their respective beef production programs. Too, it

is hoped that this study will be of help to sponsors and managers of sales in the continued effort to improve the beef industry in the Nashville-Middle Tennessee area and other locations.

CHAPTER II

REVIEW OF LITERATURE

The practice of marketing feeder calves through organized feeder calf sales is not new in this section of the United States. The first recorded special feeder calf sale in the East was held in West Virginia in 1931. The first recorded sale in Tennessee was held in 1935 at Shouns. Randell and Wheeler (1955) reported that farmers in the Johnson City area, with assistance from a University of Tennessee Marketing specialist, reorganized the cattlemens' organization known as the Mountain Breeder's Association and established it a cooperative in 1953.

Crossville and Morristown were next to organize feeder calf sales in 1952. Sales in Nashville and Cookeville began in 1953, and in 1954 and 1955 sales were held in Rogersville and Brownsville, respectively.

Randell and Wheeler (1955) reported a total of 351 calves sold in organized sales in 1953. According to the Tennessee Feeder Calf Sale report, 34 organized sales were held in Tennessee in the fall of 1969 with a total of 28,221 calves selling for \$3,962,879.50. 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.

There have been relatively few studies to evaluate the effects of selected variables on the price of feeder calves because this method of selling feeder calves has attained its present popularity in recent years.

The literature for this review will be summarized from the standpoint of what has been reported on each of the following factors: grade, sex, average weight per pen, and pen size. These factors will be considered in the order given above.

I. GRADE EFFECTS

In a study of records of 708 lots of Angus steers and heifers sold in the Jamestown sale, Smith (1970) reported that choice calves sold for an average of \$2.19 per hundredweight more than calves of the medium grade. Choice calves sold for an average of \$0.96 per hundredweight more than calves in the good grade. Medium calves sold for an average of \$1.23 less per hundredweight than good calves. Choice calves sold for \$16.02 more per head than the medium calves, \$5.01 more than good calves and medium calves sold for an average of \$11.01 less than calves grading good.

Cole (1969) reported in a study of 1049 lots of steers and heifers that choice calves sold for an average of \$2.24 per hundredweight more than calves of the medium grade. Choice calves averaged \$0.60 per hundredweight more than good calves, and medium calves sold for \$11.45 more per head than calves in the medium grade and \$3.31 more per head than calves grading good. Medium calves sold for \$8.14 less per head than calves grading good.

Jamison and Sellers (1968) found that choice calves sold for an average of \$3.27 per hundredweight more than calves of the medium grade and \$1.20 more than good calves. Medium calves sold for \$2.07 less per hundredweight than good calves.

Walker (1961) stated that choice steer calves averaged \$1.58 per hundredweight more than good grades. Steers grading medium averaged \$1.91 per hundredweight less than good grades. Choice heifers averaged \$1.79 more than good heifers and medium heifers averaged \$1.97 less than good grades.

Greathouse, Cole, and Magee (1968) found that there were significant differences between the price paid for choice cattle and most other grades. In all cases, differences were observed; however, the differences between the choice and prime grade in the 1966 sales and the good and choice classification in 1967 sales were not significant.

It was found by Williamson (1958) that 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. The fancy and choice heifers averaged \$1.45 more than good heifers, and medium heifers averaged \$1.44 less than heifers grading good.

Cox et al. (1953) found that good steers averaging to 500-800 pounds in weight sold from 6 to 12 dollars less than choice steers of the same weight during a period from 1938 to 1950.

According to a study by Riley (1952), the average annual price of good stocker steers at Kansas City was more closely related to the average annual price of medium slaughter steers at the market than to the feed supply per animal unit in the United States.

Over a four-and-one-half-year period on Georgia markets, Purcell (1956) found that good grade steers averaged \$3.20 more per hundredweight, and \$3.42 more than medium steers on two midwest terminal markets.

Harper (1957) found that choice calves averaged \$3.27 per hundredweight more than medium calves. Choice calves averaged \$1.47 per hundredweight more than good calves, and medium calves sold for \$1.80 per hundredweight less than calves in the good grade.

Badenhop (1956) reported that the effect of grade on price was significant in all classes of slaughter cattle and calves. In general, the price increased with grade, but not in the same proportion, suggesting that animals in the higher grades did not sell for as much as expected.

II. SEX EFFECTS

Smith (1970) reported that steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. Steer calves sold, on the average, for \$3.22 more per hundredweight than did heifers. Jamison and Sellers (1968) found that steers sold for \$2.64 per hundredweight more than heifer calves. Harper (1957) reported the average price received for steers to be \$3.04 per hundredweight more than that received for heifer calves.

In a study by Cole (1969), steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. Steer calves, on the average, sold for \$3.64 per hundredweight more than did heifers of a comparable grade.

Greathouse, Cole, and Magee (1968) reported that steers sold for \$4.27 and \$4.40 per hundredweight more than did heifers in 1966 and 1967, respectively.

III. PEN SIZE EFFECTS

Smith (1970) found that the regressions of price received per hundredweight and price per head on average number of calves per pen were not significant. However, least-squares effects of pen size as a discrete variable on price received per hundredweight and price received per head were highly significant ($P < .01$). Calves in pen sizes 21 to 30 sold for more per head than did calves in any other pen size group; however, calves in pen sizes 81 to 90 sold for more per hundredweight than calves in any other pen size group.

Cole (1969) reported that calves in pen sizes of greater than 91 sold for more per hundredweight and more per head than did calves in any other pen size group.

Walker (1961) reported a definite price advantage for selling steer calves in larger lots. Steer calves in lots of 81 or more head averaged higher in price than those selling in smaller lots and sold for \$1.81 per hundredweight more than those in lots of 1 to 10 head. Heifers in lots of 1 to 10 head sold for \$1.57 per hundredweight less than those in lots of 51 to 60 head. Williamson (1958) reported a definite price advantage for selling steer calves in larger lots and an indications that the average price of the optimum size of sale lot for steer calves in the special calf sales is between 21 and 30 head. Jamison and Sellers (1968) found that as pen size became larger than 26, the price per hundredweight decreases. Greathouse, Cole, and Magee (1968) reported that cattle selling in lots of 1 to 5 head averaged \$0.75 less per hundredweight than those sold in lots of 16 to 25 head. No additional significant

differences were found between classifications until pen size reached the 46 to 55 head grouping in 1966 and the 55 to 65 head groupings in 1967.

St. Clergy, Goodwin, and Woodin (1956) found that groups outsold singles, grade for grade, in a study comparing feeder calves sold as singles to those sold in groups. The price advantage due to grouping was more evident for steers than heifers.

IV. AVERAGE WEIGHT PER PEN

Smith (1970) reported that when price received per hundredweight was regressed on the average weight per pen, all other sources of variation held constant as average weight per pen increased, price received per hundredweight decreased. These data indicate that buyers were willing to pay more per hundredweight for light calves than for heavier calves. These data indicate also that lighter calves sell for more per hundredweight, but for every pound increase in average weight, the price per head increases \$0.19. It would be highly undesirable to sell light calves when the loss in gain is more than \$0.19. Cole (1969) reported similar results.

Walker (1961) found a range of \$5.55 per hundredweight among weight classes. Steers in the 301- to 350-pound classification brought the highest prices while the lowest prices were received for steers in the 651- to 700-pound classification. The trend was the same for heifers, with a range of \$3.65 with heifers in the 301- to 350-pound class bringing the highest and those in the 601- to 650-pound class bringing the lowest.

Williamson (1958) reported that steer calves weighing 401 to 500 pounds sold for \$0.40 per hundredweight more than calves in the 301- to 400-pound group. The 601- to 700-pound calves sold for \$1.17 less than the 401- to 500-pound group, and the 501- to 600-pound group sold for \$0.39 less per hundredweight than the 401- to 500-pound group.

Cox, Eisenach, and Mitchell (1953) reported that lighter steers tend to be more expensive than the heavier steers.

Jamison and Sellers (1968) found that when the price received per hundredweight was regressed on the average weight per pen, their data indicated that as the average weight per pen increased beyond 481 pounds, the price received per hundredweight decreased significantly ($P < .05$).

CHAPTER III

EXPERIMENTAL PROCEDURE

I. SOURCE OF DATA

The data used in this study were collected over a nine-year period (1961-1969) from the Nashville, Tennessee, Demonstrational Feeder Calf Sales. The location of this sale and the area that it serves are shown in Figure 1. Only data collected at the fall sales were found suitable for this study.

A total of 988 pens of Angus and Hereford calves (22,663 animals) of varying size, weight, and grade were found suitable for this study to determine the effects of grade, sex, number of calves per pen, and average weight of pen on the price received per hundredweight and the prices received per head for feeder calves in the Nashville sales. In most years as many as two sales were held each fall during a 15-day period.

II. RULES AND REGULATIONS OF THE NASHVILLE FEEDER CALF SALES

The following regulations and procedures of the Tennessee Valley Beef Producers Association to all sales that are held:

1. The minimum weight of a calf or calves consigned must be 300 pounds and maximum weight for heifer calves 600 pounds and steer calves 750 pounds.

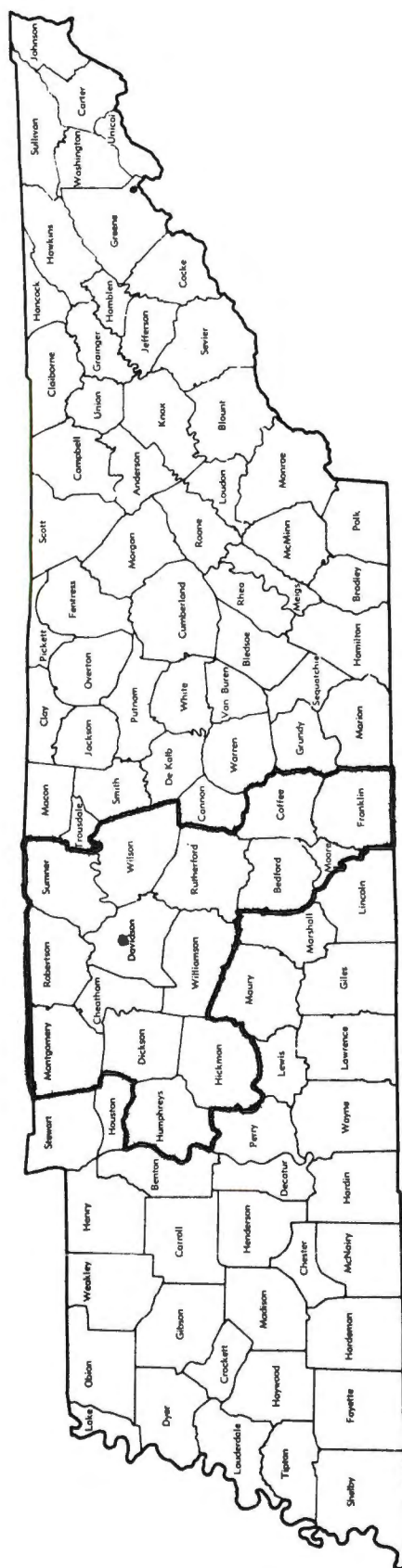


Figure 1. Location of Nashville, Tennessee, feeder calf sale and area serviced.

2. All calves must be out of good beef type cows (may be either grade or purebred). Calves will not be accepted that are out of cows having any dairy blood as well as those with questionable backgrounds.
3. All calves must be sired by a registered beef bull of good quality and acceptable to the inspection committee.
4. All calves must be owned by the breeder consigning the calves, and meet the feeder calf standards for the association.
5. All bull calves must be castrated by use of a knife or rubber band by the time of summer field inspection. All calves found to be a stag or have a stag appearance, even if they have been castrated with a knife, or rubber band, will be rejected and returned to the farmer or delivered to a commission firm.
6. All calves must be inoculated against Blackleg and Malignant Edema at least two weeks prior to the sale.
7. All calves will be field inspected and a fee of \$1.00 per head collected by the inspection committee for each calf accepted for the sale. This covers costs of advertising, stationery and other expenses of the association and will not be refunded or credited to a later sale.
8. No calf will be sold for anyone who is not a member of the association.
9. All calves must be dehorned by the time the inspection committee visits the farm. Horned or nub horned cattle will be rejected and returned to the farmer or delivered to a commission firm.

10. All calves for sale must be listed at time of inspection by the inspection committee.
11. All calves will be identified by number and grade markings, weighed separately, graded, and placed in a pen with other calves of same breed, grade, and weight the day of the sale, to be sold in pen lots, not as individual animals consigned by any particular breeder.
12. All calves which do not grade either medium, good, or choice will be accepted and sold. And these will be loaded back on trucks.

III. INSPECTION OF CALVES

Each consignment of calves was inspected on the farm several days prior to a given sale by a committee, usually made up of the County Extension Agent and a member of the Board of Directors of the Tennessee Valley Beef Producers Association. They were again inspected before or immediately after unloading at the sale. As the calves were inspected on the farm, the inspectors checked for any indication of dairy breeding in both calves and their dams, or any other condition or abnormality in the calves consigned to the sale that would have prevented them from being accepted at the sale. The committee at the sale barn checked for sickness and other conditions or abnormalities that might have been overlooked on the farm or that might have developed after the farm inspection.

IV. GRADES AND GRADING OF CALVES

The calves were brought to the sale in the morning of a given sale day and a hip tag was attached to each calf with a special cement before the calves were unloaded. These hip tag numbers were recorded on a receiving slip with the producer's name and address on it. Before the calves reach the scales, a grader from the State Department of Agriculture marked each calf with its proper feeder grade. The calves were graded and classified as choice, good, or medium in the sales. Consequently, the same grade classifications were used in this study. Animals grading below medium were classified as "odd lots" and were not accepted at the sales.

V. WEIGHING OF CALVES

As each calf was weighed there was an individual weight ticket made which included the sex, grade, weight, hip tag number, and pen number. The minimum and maximum weight limitations for graded lots, were 300 and 750 pounds, respectively. In all of the sales the calves were allotted on a 50-pound weight interval. For the purpose of this study, the 50-pound weight intervals were used, and the calves were classified in the following groups: 301-350 pounds, 351-400 pounds, 401-450 pounds, 451-500 pounds, 501-550 pounds, 551-600 pounds, 601-650 pounds, and 651-700 pounds. The only exception to this weight classification was that heifers weighing more than 650 pounds were not accepted.

VI. PENNING OF CALVES

As each calf was weighed, it was penned according to sex, grade, and weight classification. The number of calves penned and sold in a particular lot at a sale was determined by the number of calves of a certain sex, grade, and weight delivered to the sale. Occasionally, an attempt was made to pen them into predetermined size groups, such as semi-trailer lots.

VII. SELLING OF CALVES

The sale order was determined by the association officers with the help of employees of the State Department of Agriculture and Agricultural Extension Service, Animal Husbandry Department. However, the first few pens sold were some of the higher grading, more uniform calves. It was assumed that this tends to set a price pattern for the sale and generally helps the overall price of the sale. The pen sheets containing all necessary information about each pen of calves was thoroughly checked before the pen was sold. The pen sheets were arranged according to the sale order and were in the sale ring when each pen was sold. The price and buyer's name was recorded on the pen sheet and the sheet was returned to the sale office for necessary calculations and payment to consignors. All calves were sold by the pound rather than by the head.

VIII. CLASSIFICATION OF DATA AND METHOD OF ANALYSIS

Pen summary sheets, which included the number of calves sold, sex, grade, average weight, selling price per hundredweight, and selling price per head were available for all of the calves used in this study. These

data were taken directly from the summary sheets, coded and punched into IBM cards according to the format presented in Table I.

Pen size in these data ranged from 1 to 100 calves per pen. In order to obtain a more realistic estimate of pen size effects, pen size was divided into ten discrete classes. The discrete classes represented pen size in increments of ten animals.

Because of the disproportionate subclass frequencies, least-squares methods as described by Harvey (1960) were used in the analyses to obtain estimates of the effects of grade, sex, year, pen size, the continuous variables of average number of head per pen, and average weight per pen on the price received per hundredweight and price received per head for feeder calves.

A study of the unadjusted means indicated no significant interaction between the various classes of effects.

It was thought that an estimate of year effects would be uninformative; therefore, the analyses were done on a within sale-year basis.

It also was thought that an analysis to include number of head per pen as a continuous variable, and an analysis to include number of head per pen as a discrete variable would yield some useful information.

The assumed models considered appropriate for the analyses were:

$$Y_{ijl} = u + g_i + s_j + b_{1ij} + b_{2ij} + e_{ijl}$$

$$Y_{ijkl} = u + g_i + s_j + P_k + b_{2ijk} + e_{ijkl}$$

as:

Y_{ijl} = the average price per hundredweight and the average price per head of the j^{th} sex of the i^{th} grade

TABLE I
FORMAT USED FOR IBM CARDS

Data	Code	IBM Column Number
Location		
Nashville	4	1
Grade		
Medium	07	2-3
Good	10	
Choice	13	
Sex		
Heifer	01	4-5
Steer	02	
Breed		
Angus	01	6-7
Hereford	02	
Year		
1961	61	8-9
1962	62	
1963	63	
1964	64	
1965	65	
1966	66	
1967	67	
1968	68	
1969	69	
Pen size (no. of calves/pen)	Actual number	13-15
Pen weight (avg. wt. of calves/pen)	Actual number	16-18
Price/cwt./pen	Actual number	19-22

TABLE I (continued)

Data	Code	IBM Column Number
Sale Number		
First	01	28-29
Second	02	
Pen Size (No. calves/pen)		
1-10	01	30-31
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	
Price/head	Actual price	32-36

Y_{ijkl} = the average price per hundredweight k^{th} pen size of the j^{th} sex of the i^{th} grade.

u = population mean price per hundredweight and per head where equal subclass numbers exist.

g = the effect of grade with three classifications

1 = medium

2 = good

3 = choice

s = the effect of sex with two classifications

1 = heifers

2 = steers

P = the effect of pen size with ten classifications

1 = pen size 1-10 7 = pen size 61-70

2 = pen size 11-20 8 = pen size 71-80

3 = pen size 21-30 9 = pen size 81-90

4 = pen size 31-40 10 = pen size 91-100

5 = pen size 41-50

6 = pen size 51-60

b_1 = partial regression of Y on number of calves per pen.

b_2 = partial regression of Y on average weight of calves per pen.

e_{ijkl} = random error.

CHAPTER IV

RESULTS AND DISCUSSION

For convenience of discussion the analysis of the three independent variables, namely, grade of calves, sex of calves, and pen sizes with average weight per pen as a continuous independent variable will henceforth be referred to as Analysis I. The analysis containing two independent variables, grade of calves, and sex of calves with average weight per pen and average number of calves per pen as continuous independent variables will henceforth be referred to as Analysis II. The independent variable in both analyses were price per hundredweight and price received per head. No attempt was made to separate means within a subclass when three or more effects were included. The arithmetic means and standard deviations of the selected variables studied are presented in Table II.

The least-squares estimates of the environmental effects on price per hundredweight and per head from Analysis I are presented in Table III. The corresponding analysis of variance is presented in Table IV. The least-squares estimates of the environmental effects on price per hundredweight and price received per head for Analysis II are presented in Table V. The corresponding analysis of variance is presented in Table VI.

I. GRADE EFFECTS

The least-squares estimates as shown in Table III and V indicate that grade of calf had a highly significant effect ($P < .01$) on the price

TABLE II
UNADJUSTED MEANS AND STANDARD DEVIATIONS OF SELECTED VARIABLES

Year	Sale No.	Total Head	No. of Pens	Avg. Size of Pens Number	Avg. Wt. of Calf Pounds	Avg. Price Per Cwt. Dollars	Avg. Price Per Head Dollars
Overall means		22,663	988	22.9 ± 18.66	483.6 ± 98.74	25.98 ± 3.91	125.19 ± 29.89
1961	1	948	54	17.6 ± 16.21	490.6 ± 103.46	26.21 ± 2.17	127.91 ± 25.38
1961	2	1,460	54	27.0 ± 11.22	495.4 ± 100.05	23.95 ± 1.88	117.21 ± 23.35
1962	1	1,078	39	27.6 ± 18.14	483.6 ± 93.96	27.42 ± 2.33	132.09 ± 25.14
1962	2	1,541	54	28.5 ± 17.96	494.6 ± 103.58	28.35 ± 4.86	104.31 ± 42.96
1963	1	2,027	70	29.0 ± 20.94	487.1 ± 98.55	24.54 ± 2.05	118.50 ± 20.36
1963	2	1,573	68	23.1 ± 20.35	512.1 ± 105.93	24.25 ± 1.73	123.66 ± 24.41
1964	1	636	21	30.3 ± 16.77	442.9 ± 74.17	18.41 ± 1.14	81.33 ± 13.05
1964	2	1,412	51	27.7 ± 17.94	479.7 ± 104.12	21.30 ± 2.29	102.24 ± 24.49
1965	1	2,317	76	30.5 ± 23.57	479.5 ± 99.35	23.51 ± 3.00	113.14 ± 28.56
1965	2	1,292	58	22.3 ± 17.04	495.5 ± 97.78	25.12 ± 4.81	124.42 ± 33.06
1966	2	2,261	119	19.0 ± 15.85	479.6 ± 93.24	26.52 ± 3.02	126.5 ± 24.80
1967	1	1,882	66	28.5 ± 20.88	471.6 ± 93.31	26.22 ± 2.30	122.87 ± 22.29
1967	2	823	41	20.1 ± 16.16	479.8 ± 108.90	25.81 ± 2.10	123.28 ± 27.07
1968	1	743	29	19.1 ± 15.97	481.5 ± 98.59	26.79 ± 2.49	128.74 ± 27.34
1968	2	1,316	79	16.7 ± 19.20	472.2 ± 95.08	27.34 ± 2.64	128.66 ± 26.17
1969	1	1,354	99	13.7 ± 13.60	476.4 ± 99.90	31.63 ± 2.96	149.89 ± 30.50

TABLE III
LEAST-SQUARES ESTIMATES^a OF PRICES RECEIVED
(ANALYSIS I)

Variable	No. of Pens	Avg. Price Rec'd Per cwt.	Avg. Price Rec'd Per Head
Grade			
Medium	310	-1.298	-6.244
Good	365	0.087	0.424
Choice	313	1.211	5.820
Sex			
Male	547	2.023	8.771
Female	441	-2.023	-8.771
Pen Size			
1-10	3	-0.496	-2.428
11-20	326	-0.444	-2.745
21-30	192	-0.175	-1.432
31-40	150	-0.293	-1.558
41-50	155	-0.189	-0.847
51-60	73	-0.087	0.070
61-70	46	0.080	0.475
71-80	30	0.519	2.188
81-90	7	0.921	4.613
91-100	6	0.164	1.664
Regression of Y on Avg. wt./pen		-0.011	0.211

^a Estimates 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 \$25.98 and \$125.19, respectively.

TABLE IV
ANALYSIS OF VARIANCE OF PRICES RECEIVED
(ANALYSIS I)

Source	Degrees of Freedom	Mean Squares	
		Avg. Price Per cwt.	Avg. Price Per Head
Grade of calf	2	449.603**	10393.985**
Sex of calf	1	3096.020**	58178.278**
Pen size	9	3.413	97.034
Regression of Y on:			
Avg. wt./pen		957.905**	378023.470**
Residual	959	3.541**	100.578**
R ²		.57	.87

**P < .01.

TABLE V
LEAST-SQUARES ESTIMATES^a OF PRICES RECEIVED
(ANALYSIS II)

Variable	No. of Pens	Avg. Price Rec'd Per cwt.	Avg. Price Rec'd Per Head
Grade			
Medium	310	-1.305	-6.304
Good	365	0.084	0.389
Choice	313	1.221	5.915
Sex			
Male	547	2.022	8.788
Female	441	-2.022	-8.788
Regression of Y on:			
Avg. no./pen		0.010	0.053
Avg. wt./pen		-0.011	0.211

¹Estimates 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 \$25.98 and \$125.19, respectively.

TABLE VI
ANALYSIS OF VARIANCE OF PRICES RECEIVED**
(ANALYSIS II)

Source	Degrees of Freedom	Mean Squares	
		Avg. Price Per Pen	Avg. Price Per Pen
Grade	2	465.809**	10899.863**
Sex	1	3160.824**	59683.618**
Regression of Y on:			
Avg. no./pen		24.454**	710.865**
Avg. wt./pen		973.685**	318035.720**
Residual	967	3.518	99.914
R ²		.57	.87

**P < .01.

received per hundredweight and on the price received per head of feeder calves.

In Analysis I choice calves sold for an average of \$1.12 per hundredweight more than calves in the good grade. The choice calves also sold for an average of \$1.51 per hundredweight more than calves of the medium grade. Calves grading good sold for an average of \$1.39 more per hundredweight than calves grading medium.

Also, the data in Analysis I indicates that choice calves sold for \$12.06 more per head than the medium grade calves. The choice calves also sold for \$5.40 more per head than those calves grading good. Calves grading good sold for an average of \$6.67 more per head than calves grading medium.

In Analysis II choice calves sold for an average of \$2.53 per hundredweight and \$12.22 per head more than calves of the medium grade. The choice calves sold also for an average of \$1.14 per hundredweight and \$5.53 per head more than the calves in the good grade. Medium calves sold for an average of \$6.69 less per head and \$1.39 less per hundredweight than calves grading good.

These estimates are comparable to the findings of Cole (1969) who reported that choice calves averaged \$2.24 per hundredweight and \$11.45 per head more than calves of medium grade. Williamson (1958) reported that choice steer calves averaged \$2.11 per hundredweight more than good grade steers. Walker (1961), in a study involving Tennessee calves, reported that choice steers averaged significantly higher in price than good or medium calves.

II. SEX EFFECTS

These data indicate that sex of calf had a highly significant effect ($P < .01$) on the price received per hundredweight and the price received per head in Analysis I and II. Steer calves on the average sold for \$4.04 per hundredweight and \$17.54 per head more than did heifers of a comparable grade.

These findings are in general agreement with those of Cole (1969) who reported that steer calves sold for \$3.64 and \$15.14 per head more than did heifers of a comparable grade. Jamison and Sellers, working with Tennessee calves, reported that steer calves on the average sold for \$2.64 more per hundredweight than did heifers. Smith (1970) reported similar results.

III. PEN SIZE EFFECTS

In Analysis I, the average number of calves per pen was considered as a discrete variable in the model, the effects were not significant for price received per hundredweight and the price received per head. However, these data indicate that calves in pen size of 81-90 sold for more per hundredweight and per head than those in other groups. Whereas, in Analysis II the average number of calves per pen was considered as a continuous variable. The regression of the price received per hundredweight and the price per head on the average number of calves per pen was not significant in these data. However, the data indicate that for increase in pen size by one animal the price received per hundredweight increased \$0.010 and the price per head increased \$0.053.

The capacity of a 42-foot, double deck cattle trailer for 484-pound calves is approximately 85 head. As can be seen from Figures 2 and 3, buyers were willing to pay more per hundredweight and more per head for a trailer load than they were for any number of partial load. The Nashville feeder calf sale was held at a terminal market. Thus established commission firms, and order buyers had assembling facilities physically available and perhaps were not concerned about the number of calves per pen.

These findings are in agreement with Smith (1970) who reported no significant differences with reference to pen sizes. However, Jamison and Sellers (1968) found a significant negative relationship when price per hundredweight was regressed on the average number per pen.

IV. AVERAGE WEIGHT PER PEN EFFECTS

The average weight per pen was a highly significant ($P < .01$) source of variation in this study. When the price received per hundredweight was regressed on the average weight per pen, all other sources of variation held constant, these data indicate that as average weight per pen increases the price received per hundredweight decreases. This indicates that the buyers generally were willing to pay more for light-weight calves than those having heavier weights. When the price received per head was regressed on the average weight per pen, within the range of these data, as the average weight per pen increased, so did the average price received per head. Although lighter weight calves sell for more per hundredweight, for every pound increase in average weight the price per head increases \$0.21. One could conclude from these data

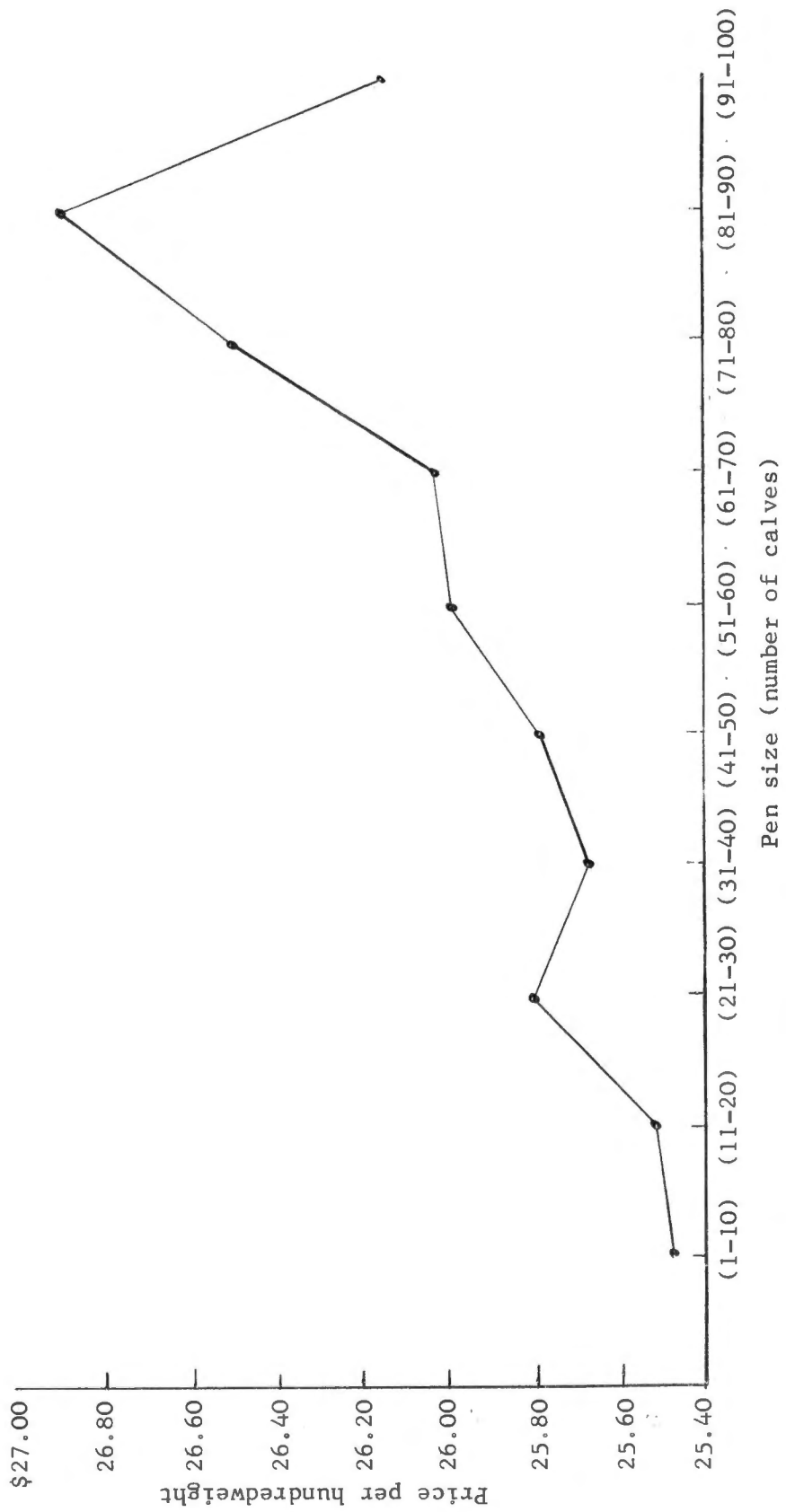


Figure 2. Effects of pen size on price per hundredweight.

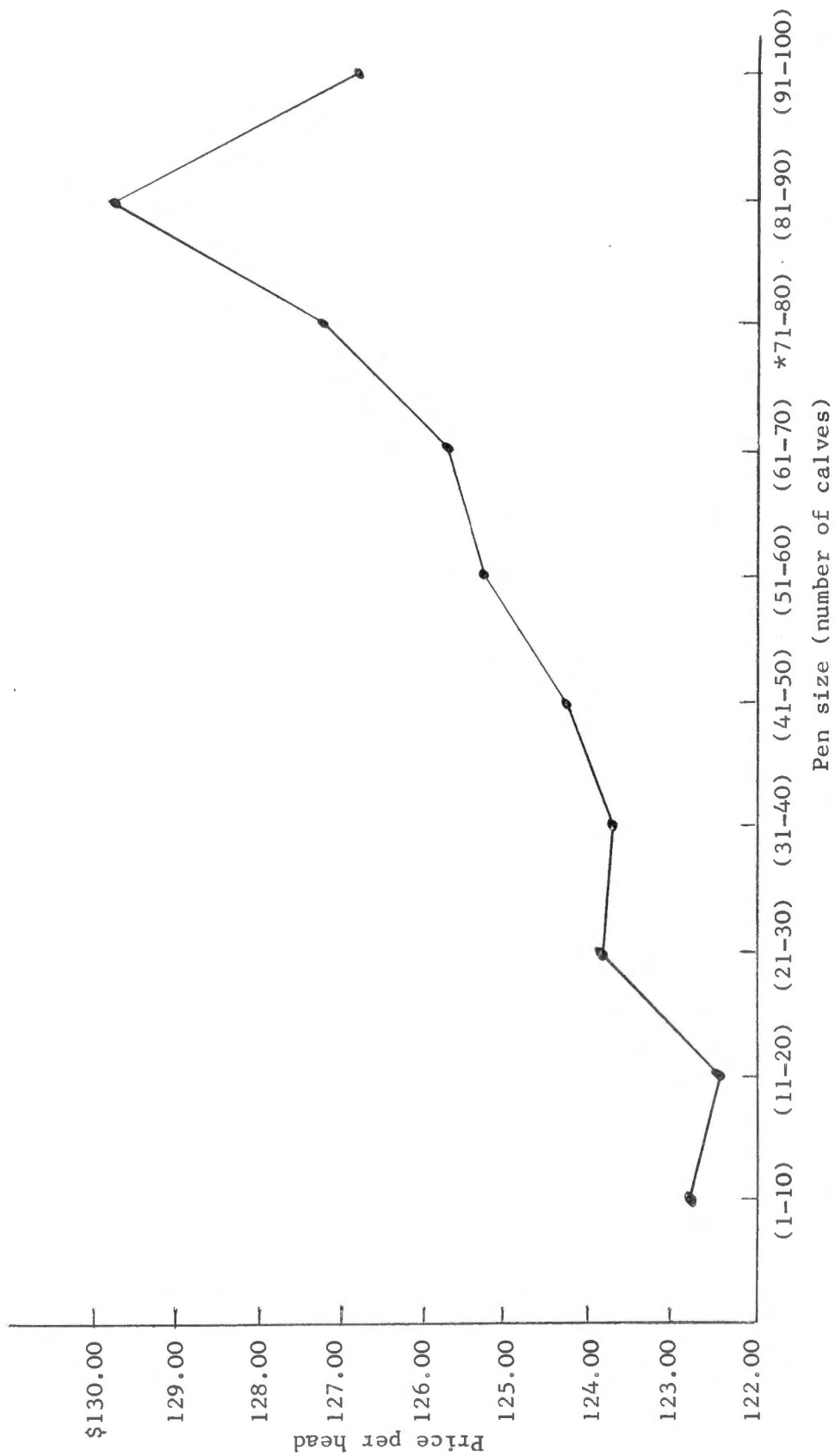


Figure 3. Effects of pen size on price per head.

that selling light weight calves, on the average, was undesirable provided that cost of gain was less than \$0.21 per pound.

These findings are in general agreement with those of Smith (1970), Cole (1969), Jamison and Sellers (1968), and Williamson (1958).

CHAPTER V

SUMMARY

Records of 988 lots of steers and heifers sold in the Nashville Area Demonstrational Feeder Calf Sales held each fall from 1961 through 1969 were studied to determine the effects of grade, sex, pen size, and the average weight per pen on the prices received per hundredweight and per head for feeder calves sold.

Choice calves sold for an average of \$2.51 per hundredweight more than the medium grade calves. The choice calves sold also for an average of \$1.12 per hundredweight more than the calves grading good. Calves in the medium grade sold for an average of \$1.39 less per hundredweight than good calves.

Choice calves sold for \$12.06 more per head than the medium grade calves. The choice calves sold also for \$5.40 more per head than calves grading good.

Steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. On the average, steer calves sold for \$4.05 and \$17.54 more per hundredweight and per head, respectively, than did heifers of a comparable grade.

These data indicate that calves in pen sizes 81-90 sold for more per hundredweight and more per head than calves in any other pen size group. However, the differences were not significant.

When the price received per hundredweight was regressed on the average weight per pen, all other sources of variation held constant;

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 these data, as average weight per pen increased, so did the average price received per head.

The estimates of these parameters indicate that factors affecting the price received for feeder calves in the Nashville Area Demonstrational Feeder Calf Sale were similar to those described in other studies involving feeder calf sale data in the Southeast.

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VITA

James Edwin Willhite was born June 23, 1933, in Humphreys County, Tennessee. He graduated from Waverly Central High School in 1951.

He received his first two years of college work at Middle Tennessee State University, Murfreesboro, Tennessee. He transferred to The University of Tennessee, Knoxville, and graduated with a B.S. in Animal Husbandry in 1962.

Prior to serving two years in the United States Navy, he was engaged in farming with his brother. Upon graduation, he began duties as assistant county agent in Robinson County, Tennessee. Mr. Willhite is now Associate Extension Agent in Robertson County.

Mr. Willhite enrolled in The University of Tennessee Graduate School to attain a Master's degree in Animal Husbandry which he expects to receive in March, 1971.

Mr. Willhite was married in 1957 to the former Ruth Youree of Woodbury, Tennessee. They are the parents of a son, Edwin, age seven, and a daughter, Adelia, age five.