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Effects of selected variables on prices received for calves in the Crossville Demonstrational Feeder Calf Sales

Rodney Hugh Smith

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To the Graduate Council:

I am submitting herewith a thesis written by Rodney Hugh Smith entitled "Effects of selected variables on prices received for calves in the Crossville Demonstrational Feeder Calf Sales." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Husbandry.

Haley M. Jamison, Major Professor

We have read this thesis and recommend its acceptance:

J. B. McLaren, Robert S. Dotson

Accepted for the Council:

Carolyn R. Hodges

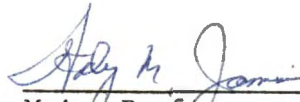
Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)



February 15, 1971

To the Graduate Council:

I am submitting herewith a thesis written by Rodney Hugh Smith entitled "Effects of Selected Variables on Prices Received for Calves in the Crossville 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 CROSSVILLE 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
Rodney Hugh Smith

March 1971

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ABSTRACT

Records of 1,221 lots of Angus and Hereford steers and heifers sold in the Crossville Demonstrational Feeder Calf Sales held each fall from 1952 through 1969, inclusive, were studied to determine the effects of grade, sex, pen size and the average weight per pen on the price received per hundredweight and on the price received per head for feeder calves.

Choice calves sold for an average of \$2.68 per hundredweight more than calves of the medium grade. The choice calves also sold for an average of \$0.73 per hundredweight more than calves in the good grade. Medium calves sold for an average of \$1.95 less per hundredweight than good calves.

Choice calves sold for \$12.14 more per head than the medium grade calves. The choice calves sold also for \$3.75 more per head than those calves grading good. Medium calves sold for an average of \$8.39 less per head than calves grading good.

Steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. Steer calves, on the average, sold for \$3.55 more per hundredweight and \$15.49 more per head than did heifers of a comparable grade.

These data indicate that calves in pen sizes of 91 or more sold for more per head than did calves in any other pen size group.

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 increased, the price per hundredweight decreased. When the price received per head was regressed on the average weight per pen, within the range of the 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 Crossville Demonstrational Feeder Calf Sale are similar to those described in other studies involving feeder calf sale data in the Southeast.

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION.	1
II. REVIEW OF LITERATURE.	3
Grade	4
Sex	6
Pen Size.	7
Weight.	8
Average Weight Per Pen.	9
III. EXPERIMENTAL PROCEDURE.	11
Source of Data.	11
Rules and Regulations of the Crossville Feeder Calf Sales .	11
Inspection of Calves.	14
Grades and Grading of Calves.	14
Weighing of Calves.	15
Penning of Calves	15
Selling of Calves	16
Classification of Data and Method of Analysis	16
IV. RESULTS AND DISCUSSION.	21
Grade Effects	28
Sex Effects	29
Pen Size Effects.	30
Average Weight Per Pen Effects.	33

CHAPTER	PAGE
V. SUMMARY	34
LITERATURE CITED.	36
VITA.	39

LIST OF TABLES

TABLE	PAGE
I. Format Used for IBM Cards	17
II. Unadjusted Means and Standard Deviations of Selected Variables	22
III. Least-Squares Estimates of Prices Received (Analysis I) . . .	24
IV. Analysis of Variance of Prices Received (Analysis I).	25
V. Least-Squares Estimates of Prices Received (Analysis II). . .	26
VI. Analysis of Variance of Prices Received (Analysis II)	27

LIST OF FIGURES

FIGURE	PAGE
1. Location of Crossville, Tennessee, Feeder Calf Sale and Area Serviced	12
2. Effects of Pen Size on Price Per Hundredweight.	31
3. Effects of Pen Size on Price Per Head	32

CHAPTER I

INTRODUCTION

The feeder calf sale in Crossville, Tennessee, was established in 1952 and is one of the older feeder calf sales in the state. At the time of its establishment it was patterned after a feeder sale operating in Upper East Tennessee and several sales which were operating in Virginia.

Many of the early consignors were hesitant about having their cattle mixed with other people's cattle. This was especially true with some of the larger producers. Therefore, several calf sales were held prior to 1952 at which each consignor's calves were penned together and sold separately.

This sale was developed to provide groups of farmers with small cow herds an opportunity to offer uniform lots of feeder calves, in large enough groups, to attract buyers and compete with the larger producers of the West. Since its establishment, the Crossville Sale has enjoyed considerable growth in both income and numbers consigned. For example, farm income, from feeder calves sold in the fall sales, has risen from \$29,658.86 in 1952 to \$305,820.89 in 1969. During this 18-year period the number of calves sold annually increased from 279 in 1952 to 2,134 calves in 1969.

On the basis of a survey and other records, it is estimated that approximately 20 percent of the calves produced in Cumberland County are marketed through the Crossville Feeder Calf Sales. However, virtually all the calves are marketed at prices established by these sales.

Since the beginning of these sales, no organized statistical analysis has been made of the effects of various factors on the price for which feeder calves have sold. The objective of this study was to evaluate the effects of grade, sex, pen size (number of calves per pen), and average pen weight on price per hundredweight and price per head of feeder calves sold for 1952 through 1969.

CHAPTER II

REVIEW OF LITERATURE

Marketing feeder calves is a relatively old practice in this section of the United States. Interest in this particular method has increased since special feeder calf sales were held in West Virginia in 1931. The first feeder calf sale recorded in Tennessee was held in Shouns in 1935. In 1938 in Virginia the first demonstrational feeder calf sale was held in Tazewell. However, it was not until 1945 that significant interest was shown and the marketing of feeder calves through organized sales began to increase. Randell and Wheeler (1955) reported that the Mountain Breeders Association was organized with the assistance of the University of Tennessee Marketing Specialist in 1953. At this time the sale was moved from Shouns to Johnson City.

Next to organize and start feeder calf sales were producers at Crossville and Morristown in 1952. In 1953 sales were started in Cookeville and Nashville. During 1954 and 1955 sales were organized at Rogersville and Brownsville, respectively.

Randell and Wheeler (1955) reported that 351 calves were sold in organized sales. In the fall of 1969 a total of 28,221 calves sold for \$3,962,879.50 in 34 graded sales according to the Tennessee Feeder Calf Sale Report.

Only recently has this method of marketing calves attained its present popularity. Therefore, relatively few studies to evaluate the effect of selected variables on the price of calves have been made.

The literature will be summarized from the standpoint of what has been reported on grade, sex, pen size, weight and average weight per pen.

I. GRADE

In a study of the Jamestown Feeder Calf Sale, involving 708 lots of steers and heifers, Smith (1970) found that choice calves sold for an average of \$3.19 per hundredweight more than medium calves and \$0.96 more than the good grade calves. He found also that medium calves sold for an average of \$2.23 less per hundredweight than good calves. Choice calves sold for \$16.02 more per head than the medium calves and \$5.01 more than those grading good. The medium grade calves sold for an average of \$11.01 less per head than calves grading good.

In a similar study of a series of sales held at Cookeville; Cole (1969) reported that choice calves sold for an average of \$2.24 per hundredweight more than medium calves. In this same study choice calves averaged \$0.60 per hundredweight more than good calves of the same weight. The medium calves sold for an average of \$1.64 per hundredweight less than good calves. Choice calves sold for \$11.45 more per head than medium calves and \$3.31 more per head than calves grading good. Medium calves sold for an average of \$8.14 less per head than calves grading good.

In 1968 Jamison and Sellers affirmed that grade had a highly significant effect on the price received per hundredweight for feeder calves. For example, they found choice calves averaged \$3.27 per hundredweight more than medium calves and \$1.20 more than good. Medium calves averaged \$2.07 per hundredweight less than good calves.

Choice steer calves averaged \$1.58 per hundredweight more than good steers in a study made by Walker (1961). He found also that steers grading medium averaged \$1.91 per hundredweight less than good steers. Choice heifers averaged \$1.79 more than good heifers, and medium heifers averaged \$1.97 per hundredweight less than good heifers.

Greathouse, Cole and Magee (1968) found that significant difference in the prices paid for choice cattle and most other grades. Differences were observed in all cases; however, the difference between choice and prime grades in 1966 sales and the good and choice grades in 1967 sales were not significant.

Williamson (1958) found that fancy and choice steers averaged \$2.11 per hundredweight more than good steers, and medium steers averaged \$1.44 per hundredweight less than heifers grading good.

It was found by Riley (1952) that the average annual price of good stocker steers at Kansas City was more closely related to the average annual price of medium slaughter steers than to the feed supply per animal unit in the United States. However, he did find that the feed supply per animal unit was highly significant in explaining the average annual price of good stocker steers at Kansas City, when other factors were held constant.

During the period 1938 to 1950, the average price of choice steers weighing 500-800 pounds varied from \$6.00 to \$12.00 per hundredweight above the price of good 500- to 800-pound feeder steers as reported by Cox et al. (1953).

Over a four-and-one-half-year period, Purcell (1956) found that good feeder steers averaged \$3.20 more per hundredweight than medium

steers on five Georgia markets and \$3.42 more on two midwest terminal markets.

Harper (1957) found that average price per hundredweight was closely related to grade. Choice calves averaged \$22.00; good, \$20.53 and medium, \$18.73. However, there was a wide variation between the high and low price received per hundredweight for calves within the same grade. For choice steers the range was \$9.00 per hundredweight, \$10.70 for good steers and \$12.50 for medium steers. For heifers the range was \$5.90, \$8.60, and \$6.10 per hundredweight for the choice, good and medium grades, respectively.

II. SEX

Smith (1970) reported that steer calves sold for significantly higher prices than did heifer calves in the fall sales at Jamestown from 1955 through 1969. Steer calves, on the average, sold for \$3.22 more per hundredweight and \$14.35 more per head than did heifers of a comparable grade.

Cole (1969) found that steer calves, on the average, sold for \$3.64 and \$15.14 more per hundredweight and per head, respectively, than did heifers of a comparable grade. This was significant ($P < .01$).

Jamison and Sellers (1968) found that, on the average, steer calves sold for \$2.64 more per hundredweight than did heifer calves. Harper (1957) reported that the average price received for all grades, was \$20.85 per hundredweight for steers and \$17.81 for heifers.

Greathouse, Cole and Magee (1968) reported that heifers sold for a significantly lower price per hundredweight than steers in 1966 and 1967. The differences were \$4.27 and \$4.40 per hundredweight for the two years, respectively.

III. PEN SIZE

Smith (1970) found that calves in pen sizes of 81 to 90 sold for more per hundredweight than calves in other pen sizes. Calves in pen sizes 21 to 30 sold for more per head than did calves in any other pen-size.

When calves were sold in pens of 91 head or more the price per hundredweight and price per head increased, according to data presented by Cole (1969). However, the differences in price per head were not significant. Greathouse, Cole and Magee (1968) reported that cattle selling in lots of one to five head averaged 75 cents less per hundredweight than those sold in lots of 16 to 25 head. They reported also that no significant differences were found between sale groups of various sizes until lot sizes reached 46 to 50 head in 1966 and 55 to 65 head in 1967. These data show no price advantage for sale groups of more than 65 head. This was substantiated by Jamison and Sellers (1968) who concluded that as pen size increased above 26 head, the price per hundredweight decreased.

Williamson (1958) in a study of 21 Virginia feeder calf sales from 1951 through 1956 found definite price advantage for both steer and heifer calves sold in larger lots. Sales with 901 to 1,100 head averaged 46 cents per hundredweight higher than those with 701 to

900 head (base group); sales with 1,101 to 1,300 head, 26 cents higher; 1,301 to 1,500 head, 95 cents higher and sales with 1,500 head, \$1.72 per hundredweight higher than the base. The average price for sales with less than 700 head was lower than the base. The size of sale did not have the same consistent effect on the average price of heifer calves as on the price of steer calves.

In a study by St. Clergy, Goodwin and Modin (1956) in which they compared feeder calves sold as a singles versus groups, they found that the groups outsold singles grade for grade, at the Delhi, Louisiana, feeder calf sale held in November, 1956. Choice animals sold in groups averaged \$16.87 per hundredweight as compared with \$15.48 for similar animals sold singly. Similar results were reported for other grades. They found also that the price advantage as a result of grouping was more evident for steer calves than for heifers.

Walker (1961) found a definite price advantage for selling steer calves in larger lots. Steer calves sold for more when grouped in lots of 81 head or more than those selling in smaller lots. For example, they sold for \$1.81 per hundredweight more than those in lots of one to ten head. Heifers in groups of 51 to 60 head sold for \$1.57 per hundredweight more than those in lots of one to ten. These two lot-size classifications represented the extremes with respect to selling price per hundredweight.

IV. WEIGHT

A variation of \$5.55 per hundredweight was attributed to weight difference in steers by Walker (1961). The highest prices were paid

for steers in the 301- to 350-pound classification, and the lowest prices were paid for those in the 651- to 700-pound classification. He found in a similar analysis that the difference in price for heifers was \$3.65, with those in the 301- to 350-pound class bringing the highest and those in the 601- to 650-pound class bringing the lowest price.

Williamson (1958) found that steer calves weighing between 401 and 500 pounds sold for significantly higher prices than heavier or lighter steers. The 301- to 400-pound lots averaged 21 cents per hundredweight less than the 301- to 500-pound group, and those weighing 501- to 600-pounds and 601- to 700 pounds sold for 50 cents and \$1.30 less than the 401- to 500-pound group, respectively. This trend was noted also for heifers, but it was not statistically significant.

Lighter steers tend to be more expensive than heavier steers as reported by Cox, Eisenbach and Mitchell (1953). They further stated that April, May and June were the months in which the highest prices were paid for stocker and feeder steers while the lowest prices occur during the late fall and early winter months of October, November, December and January.

Nervik (1951) noted that prices were generally higher during the spring than in the fall, but the gains made during the summer months ordinarily more than offset the seasonally higher prices in the spring.

V. AVERAGE WEIGHT PER PEN

Smith (1970) reported that when the price received per hundredweight was regressed on the average weight per pen with all other sources of variation held constant, the price received per hundredweight

decreased as the average weight per pen increased. He found also that as the average weight per pen increased so did the average price received per head.

Very similar results were reported by Cole (1969). He found that when the price received per hundredweight was regressed on the average weight per pen and all other sources of variation were held constant, the price received per hundredweight decreased as average weight per pen increased. When the price received per head was regressed on the average weight per pen, within the range of the data, as average weight per pen increased, so did the average price received per head.

Williamson (1958) used pens averaging 401- to 500-pounds per head as a base group for comparison and observed that the pens weighing 300- to 400-pounds averaged 21 cents per hundredweight less than the base group. Those weighing 501 to 600-pounds and 601 to 700-pounds sold for \$0.50 and \$1.30 per hundredweight less than the base group, respectively. This observation was substantiated by Jamison and Sellers (1968) who reported that as average weight per pen increased beyond 481 pounds, the price received per hundredweight decreased. Cox, Eisenach and Mitchell (1953) also presented data indicating that light steers tend to be more expensive than heavy steers.

Robertson and Mitchell (1940) and Mitchell (1941) reported the following as factors which affect the price of feeder cattle: (1) the general price level of feeder cattle, (2) grazing conditions in the range country, (3) the position of the cattle cycle, (4) anticipated fat cattle prices for the near future, (5) size of feed crop in the corn belt, and (6) recent profits from cattle feeding operations.

CHAPTER III

EXPERIMENTAL PROCEDURE

I. SOURCE OF DATA

The data used in this study were collected over an 18-year period (1952-1969) from the Crossville, Tennessee, Demonstrational Feeder Calf Sales. Although sales were held in the spring some years, only the fall sales were found suitable for this study. The location of this sale and the area it serves are shown in Figure 1.

A total of 1,221 pens of Angus and Hereford calves (19,964) of varying size, weight, and grade were found suitable for this study to determine the effect 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 of feeder calves in the Crossville sales. In some years as many as two sales were held each fall during a 30-day period.

II. RULES AND REGULATIONS OF THE CROSSVILLE FEEDER CALF SALES

The following regulations and procedures are applicable to all sales that are held:

1. The minimum weight for all calves being entered in this sale will be 300 pounds and the maximum weight will be 800 pounds for steers and 650 pounds for heifers.

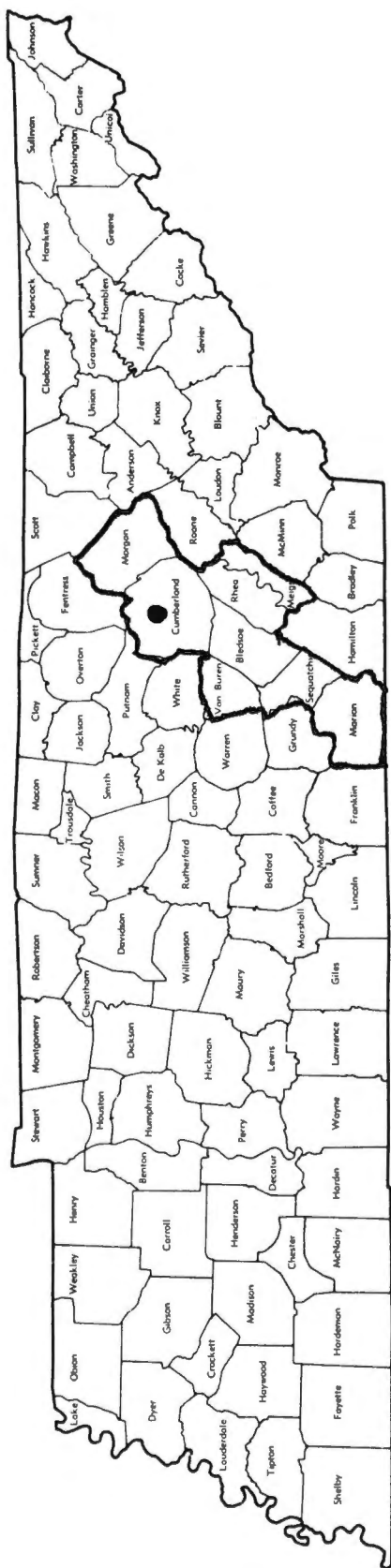


Figure 1. Location of Crossville, Tennessee, Feeder Calf Sale and area serviced.

2. All calves must be produced on the farm of the member consignors or be calves purchased out of the Crossville Feeder Sale.

3. All Consignors entering calves in the Crossville Feeder Calf Sale are required to be bona fide members of a County Livestock Association which is affiliated with the Tennessee Livestock Association. Membership dues for the Bledsoe and Cumberland County Livestock Association are \$5.00.

4. All male calves must be castrated with a knife elastrator and clear by the time of field inspection.

5. All calves entering the sale must be naturally polled or properly dehorned and healed by sale day.

6. Only calves officially accepted by the field inspection committee will be allowed to be sold in the Crossville Feeder Calf Sale. The field inspection committee will visit each farm to inspect the calves, their dams and sires.

7. All calves entered in this sale must be out of beef type cows (may be either purebred or grade). Calves will not be accepted which are out of cows with dairy breeding or questionable background. All calves must be sired by a purebred registered beef bull.

8. All calves entering this sale will be required to be vaccinated with the three-in-one shot for Blackleg, Malignant Edema, and Hemorrhagic Septicemia. Vaccination will be done at least two weeks before and not more than six weeks before sale time.

9. A fee of \$1.00 per calf will be charged for calves accepted for the sale to help defray the cost of advertising the sale. This will not include the cost of selling, or commission charge, to be collected at the sale.

10. 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.

11. All calves which do not grade either medium, good, or choice will not 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 Agricultural Extension Leader and a member of the staff and a member of the Board of Directors of the Crossville Feeder Calf Association. They were again inspected before or immediately after unloading at the sale. As the calves were inspected on the farm, the inspector 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. At the second inspection, 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, 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 800 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, average price per hundredweight and the average price per head were available for all of the calves used in this study. The data were taken directly from these sheets, ordered and punched into IBM cards according to the format presented in Table I.

TABLE I
 FORMAT USED FOR IBM CARDS

Data	Code	IBM Card Column Numbers
Location		
Crossville	3	1
Grade		
Choice	13	2-3
Good	10	
Medium	07	
Sex		
Heifers	01	4-5
Steers	02	
Breed		
Angus	01	6-7
Hereford	02	
Year		
1952	52	8-9
1953	53	
1954	54	
1955	55	
1956	56	
1957	57	
1958	58	
1959	59	
1960	60	
1961	61	
1962	62	
1963	63	
1964	64	
1965	65	
1966	66	
1967	67	
1968	68	
1969	69	
Sale number		
First	01	28-29
Second		

TABLE I (continued)

Date	Code	IBM Card Column Numbers
Pen size (no. of 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+	10	
Price/head	Actual Price	32-36

Pen size in these data ranged from 1 to 110 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 sizes in increments of ten animals.

An estimate of breed effects could not be obtained due to the fact that each sale within a year had only one breed represented. Therefore, the analysis was done on a within-year-sale-basis.

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

It was believed that two analyses, one with number of head per pen as a discrete variable and pen weight (average) as a continuous variable and another analysis with number of head per pen as well as pen weight as continuous variables would be helpful in gaining insight into the way in which pen size and pen weight affect price.

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

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

The assumed models considered appropriate for the analyses were:

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

$$Y_{ijk1} = \mu + g_i + s_j + P_k + b_{2ijk} + e_{ijk1}$$

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

Y_{ijk1} = the average price per hundredweight k^{th} pen size of the j^{th} sex of the i^{th} grade.

μ = 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 twelve classifications

1 = pen size 1-10 6 = pen size 51-60

2 = pen size 11-20 7 = pen size 61-70

3 = pen size 21-30 8 = pen size 71-80

4 = pen size 31-40 9 = pen size 81-90

5 = pen size 41-50 10 = pen size 91- +

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_{ijk1} = random error.

CHAPTER IV

RESULTS AND DISCUSSION

For ease 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 dependent variable in both analyses were price per hundredweight and price received per head. No attempt was made to separate means within sub-class 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 are 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 are 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.

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		19,964	1,221	16.4 ± 18.32	462.8 ± 102.58	24.42 ± 5.14	112.34 ± 31.58
1952	1	215	40	5.4 ± 3.62	431.6 ± 77.02	25.86 ± 2.25	111.04 ± 18.04
1953	1	356	59	6.0 ± 5.54	441.9 ± 84.32	16.43 ± 1.65	72.54 ± 15.31
1954	1	186	41	4.5 ± 3.82	437.4 ± 87.87	16.78 ± 2.03	73.43 ± 17.69
1955	1	475	58	8.2 ± 15.74	431.3 ± 83.35	17.83 ± 2.53	76.83 ± 18.38
1956	1	323	62	5.2 ± 3.52	464.2 ± 102.03	17.51 ± 2.13	80.94 ± 18.70
1957	1	377	61	6.2 ± 4.93	450.3 ± 115.29	22.47 ± 2.42	100.04 ± 23.01
1958	1	535	67	8.0 ± 6.74	460.6 ± 105.93	29.92 ± 3.31	136.26 ± 27.25
1959	1	725	74	9.8 ± 9.07	471.8 ± 109.41	28.60 ± 4.37	132.03 ± 22.98
1960	1	860	67	12.8 ± 13.57	451.2 ± 99.89	23.40 ± 2.29	104.84 ± 22.50
1961	1	422	37	11.4 ± 9.11	461.1 ± 99.32	23.99 ± 2.29	109.91 ± 22.05
1961	2	469	34	13.8 ± 12.69	474.7 ± 108.69	27.32 ± 2.81	127.69 ± 21.83
1962	1	609	36	16.9 ± 18.87	470.7 ± 108.96	28.04 ± 3.30	130.64 ± 27.36
1962	2	467	36	13.0 ± 9.81	470.9 ± 103.01	26.74 ± 3.02	124.94 ± 26.02
1963	1	598	36	16.6 ± 13.34	457.9 ± 94.66	24.06 ± 2.29	109.46 ± 21.35
1963	2	777	33	23.5 ± 20.10	482.7 ± 111.55	24.80 ± 2.64	118.54 ± 24.72
1964	1	726	37	19.6 ± 20.29	468.1 ± 109.61	20.45 ± 2.48	95.17 ± 22.52

TABLE II (continued)

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
1964	2	509	39	13.1 + 9.42	473.9 + 105.87	19.56 + 1.97	91.86 + 18.56
1965	1	903	38	23.8 + 19.51	474.3 + 108.51	23.82 + 2.90	112.26 + 26.01
1965	2	995	38	26.2 + 23.45	470.5 + 109.10	24.14 + 2.87	112.99 + 26.98
1966	1	1,282	42	30.5 + 23.60	483.2 + 108.61	26.89 + 2.96	128.37 + 24.77
1966	2	1,171	39	30.0 + 21.60	474.3 + 104.58	26.36 + 2.70	123.84 + 24.39
1967	1	1,129	39	28.9 + 20.79	472.7 + 105.32	26.22 + 2.70	122.54 + 22.76
1967	2	1,733	39	44.4 + 32.48	471.5 + 109.42	26.29 + 2.71	122.57 + 23.94
1968	1	1,183	50	23.7 + 14.97	466.5 + 94.92	27.54 + 2.91	127.61 + 24.49
1968	2	805	38	21.2 + 15.48	462.7 + 94.33	27.66 + 3.53	126.65 + 24.39
1969	1	896	41	21.9 + 17.64	479.4 + 110.34	30.91 + 3.70	146.56 + 30.57
1969	2	1,238	40	31.0 + 25.75	479.1 + 115.05	30.79 + 3.40	146.07 + 31.52

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

Variable	No. of Pens	Avg. Price Received Per Cwt.	Avg. Price Received Per Head
Grade			
Medium	369	-1.545	-6.844
Good	453	0.406	1.546
Choice	399	1.139	5.298
Sex			
Male	672	1.774	7.744
Female	549	-1.774	-7.744
Pen Size			
1-10	646	- .706	-3.569
11-20	248	- .081	-0.263
21-30	126	0.038	-0.303
31-40	83	- .168	-0.470
41-50	46	- .175	-0.504
51-60	24	0.277	-0.529
61-70	20	0.248	1.442
71-80	15	- .050	-0.310
81-90	6	0.074	2.146
91+	7	0.543	2.360
Regression of Y on:			
Average weight/pen		- .012	0.188

^aEstimates are deviations from the overall adjusted means when equal numbers exist per subclass. The overall arithmetic mean of average price per hundredweight and average price per head are \$24.42 and \$112.34, 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	666.522**	13480.655**
Sex of calf	1	3338.788**	63650.211**
Pen size	9	9.077**	223.545**
Regression of Y on:			
Average wt./pen	1	1556.802**	360396.730**
Residual	1181	2.241**	45.705**
R^2		.73	.92

**P < .01.

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

Variable	No. of Pens	Avg. Price Received Per Cwt.	Avg. Price Received Per Head
Grade			
Medium	369	-1.565	-6.921
Good	453	0.441	1.700
Choice	399	1.124	5.221
Sex			
Male	672	1.794	7.837
Female	549	-1.794	-7.837
Regression of Y on:			
Average number/pen		0.013	0.067
Average wt./pen		- .013	0.186

^aEstimates are deviations from the overall adjusted means when equal numbers exist per subclass. The overall arithmetic mean of average price per hundredweight and average price per head are \$24.42 and \$112.34, respectively.

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

Source	Degrees of Freedom	Mean Squares	
		Avg. Price Per/pen	Avg. Price Per head
Grade	2	677.100**	13604.261**
Sex	1	3467.295**	66193.144
Regression of Y on:			
Average number/pen	1	26.274**	962.377**
Average wt./pen	1	1751.924**	372870.250**
Residual	1189	2.264	46.280
R ²		.72	.92

**P < .01.

I. GRADE EFFECTS

The estimates as shown in Tables III and V, pages 24 and 26, indicate that grade of calf had a highly significant effect ($P < .01$) on the price received per hundredweight and on the price received per head of feeder calves.

In Analysis I choice calves sold for an average of \$2.68 per hundredweight more than calves of the medium grade. The choice calves also sold for an average of \$0.73 per hundredweight more than calves in the good grade. Medium calves sold for an average of \$1.95 less per hundredweight than good calves.

Also, the data in Analysis I indicates that choice calves sold for \$12.14 more per head than the medium grade calves. The choice calves also sold for \$3.75 more per head than those calves grading good. Medium calves sold for an average of \$8.39 less per head than calves grading good.

In Analysis II choice calves sold for an average of \$2.69 per hundredweight and \$12.14 per head more than calves of the medium grade. The choice calves sold also for an average of \$0.68 per hundredweight and \$3.52 per head more than the calves in the good grade. Medium calves sold for an average of \$2.01 less per hundredweight and \$8.62 less per head than good calves.

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 the medium grade. Smith (1970) working with similar data reported that choice calves averaged \$3.19

per hundredweight and \$16.02 more than calves of the medium grade. Jamison and Sellers (1968) reported that choice calves averaged \$2.37 per hundredweight more than calves of the medium grade. Williamson (1958) in a study involving Virginia calves, reported that choice steer calves averaged \$2.11 per hundredweight more than good steers.

II. SEX EFFECTS

Sex of calf in both analyses had a highly significant effect ($P < .01$) on the price received per hundredweight and on the price received per head of feeder calves. Steer calves in Analysis I, on the average, sold for \$3.55 more per hundredweight and \$15.49 per head more than did heifers of a comparable grade.

In Analysis II steer calves sold for \$3.59 more per hundredweight and \$15.67 more per head than heifers of the same grade.

These findings are in general agreement with those of Smith (1970) who reported that steer calves on the average sold for \$3.22 per hundredweight and \$14.35 per head more than did heifers of a comparable grade. Jamison and Sellers (1968) reported that steer calves on the average sold for \$2.64 more per hundredweight than did heifer calves. Cole (1969) in his study involving Tennessee calves, reported that steer calves sold for \$3.64 more per hundredweight and \$15.14 more per head than did heifers of comparable grades. Williamson (1958) reported similar results.

III. PEN SIZE EFFECTS

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 highly significant ($P < .01$) in these data. These data indicate that for an increase in pen size by one animal the price per hundredweight increased \$0.013 and the price per head increased \$0.067 per pound. In Analysis I when pen size was included as a discrete variable in the model, the effects were significant for price received per hundredweight and price received per head. The data indicates that calves in pen sizes of 91 or more sold for more per hundredweight than those in other groups. Calves in pen sizes 91 or more sold for more per head than did calves in any other pen size group.

The capacity of a 32-foot, double deck cattle van for 463-pound calves is approximately 58 head. As can be seen from Figure 2 buyers were willing to pay more per hundredweight for a trailer load or two trailer loads than they were for any number of partial loads. However, these data suggest also that local feeders or individuals desiring 21-30 calves were willing to pay a premium.

Figure 3 suggests that when calves were sold by the head individuals desiring 81-90 and 91 or more were also willing to pay a premium.

These findings are in general agreement with those of Cole (1969) who reported that calves in pen sizes of greater than 91 sold for more per hundredweight than calves in any other pen size group. Jamison and

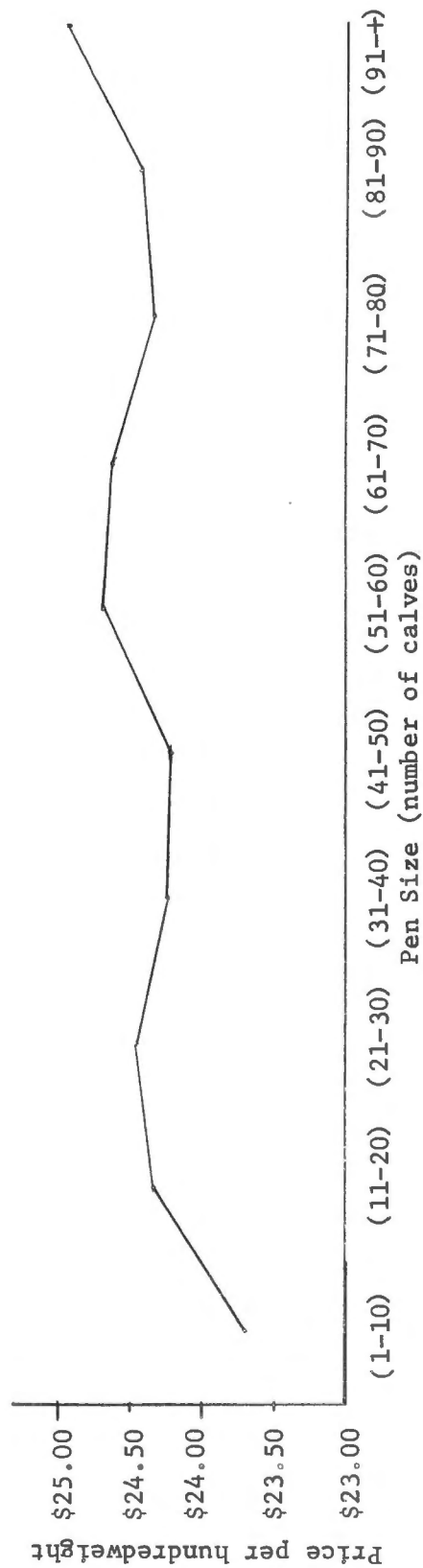


Figure 2. Effects of pen size on price per hundredweight.

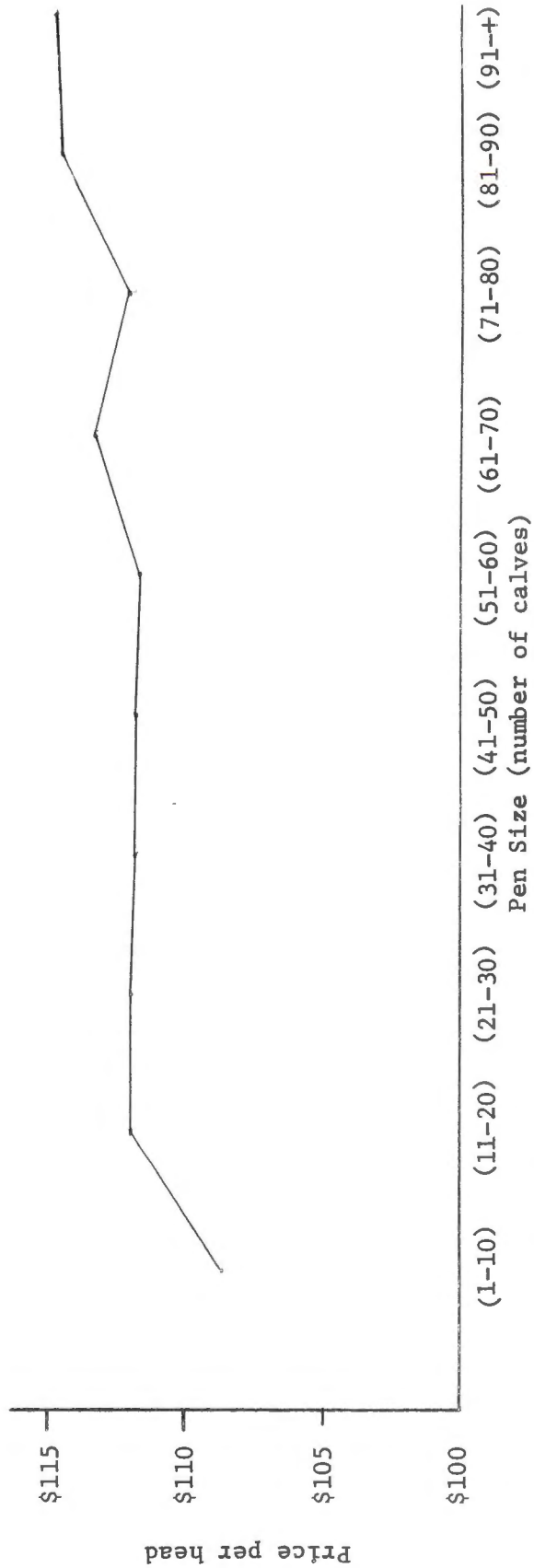


Figure 3. Effects of pen size on price per head.

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

IV. AVERAGE WEIGHT PER PEN EFFECTS

The average weight per pen was a highly significant ($P < .01$) source of variation in Analyses I and II. 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 increased the price received per hundredweight decreased \$0.012 per pound. This indicates that the buyers were willing to pay more for light weight calves per hundredweight than those having heavier weight. When 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. These data indicates also that although lighter calves sell for more per hundredweight, for every pound increase in average weight the price per head increases \$0.19. From these data one could conclude, that selling light weight calves was undesirable if the cost of producing the extra gain was less than \$0.19.

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

CHAPTER V

SUMMARY

Records of 1,221 lots of Angus and Hereford steers and heifers sold in the Crossville Demonstrational Feeder Calf Sales held each fall from 1952 through 1969, inclusive, were studied to determine the effects of grade, sex, pen size and the average weight per pen on the price received per hundredweight and on the price received per head for feeder calves.

Choice calves sold for an average of \$2.68 per hundredweight more than calves of the medium grade. The choice calves also sold for an average of \$0.73 per hundredweight more than calves in the good grade. Medium calves sold for an average of \$1.95 less per hundredweight than good calves.

Choice calves sold for \$12.14 more per head than the medium grade calves. The choice calves sold also for \$3.75 more per head than those calves grading good. Medium calves sold for an average of \$8.39 less per head than calves grading good.

Steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. Steer calves, on the average, sold for \$3.55 more per hundredweight and \$15.49 more per head than did heifers of a comparable grade.

These data indicate that calves in pen sizes of 91 or more sold for more per head than did calves in any other pen size group.

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 increased, the price per hundredweight decreased. When the price received per head was regressed on the average weight per pen, within the range of the 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 Crossville Demonstrational Feeder Calf Sale are similar to those described in other studies involving feeder calf sale data in the Southeast.

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VITA

Rodney Hugh Smith was born February 9, 1938 in Fentress County, Tennessee. He was reared on a beef cattle and swine farm. He graduated from Clarkrange High School in 1957.

He received his first two years of college work at Martin Junior College, Pulaski, Tennessee. Then he enrolled at The University of Tennessee, Knoxville, Tennessee, in the fall of 1959, to study Agriculture. He was graduated with a B.S. degree in Animal Science and Agricultural Education in December, 1961.

He was employed as Assistant County Agricultural Agent in Cumberland County and is currently serving as Associate Extension Agent in youth work.

Mr. Smith 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. Smith was married in 1962 to the former Flodena Harmon of Fountain City, Tennessee. They have three daughters, Rhonda, age 5, Cathy, age 3, and Pamela, age 6 months.