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An Economic Analysis of Feeding Steers Versus Heifers

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AN ECONOMIC ANALYSIS OF FEEDING STEERS VERSUS HEIFERS

by

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ABSTRACT

An Economic Analysis of Feeding Steers

Versus Heifers

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The question of which sex of cattle to feed is a basic economic decision which must be made by feeders. An economic analysis of costs and returns associated with feeding steers in comparison to heifers would give feeders some assistance in making this decision.

The objectives of this study were to make an economic analysis of feeding a pen of steers and a pen of heifers in a feedlot, then determine the break-even prices for feeder cattle which would make the feeder indifferent to whether he fed steers or heifers, and finally to develop a decision model that could be used by feeders to evaluate this decision for their feedlots.

Steers gain faster and more economically than do heifers. Steers, however, must be fed from 40 to 60 days longer in order to reach the quality standards of the choice grade. Steers reach the market at heavier weights both as fat cattle and carcasses. On the other hand heifers sell for less per pound as feeders and finish earlier in the feedlot.

A graphical decision model was derived which will aid any given feedlot manager in making the decision of which sex would return more profit. This model allows one to plot the break-even prices and price spreads of feeder steers and heifers. The current market prices of feeder cattle on any given day can be compared to the model, and a decision made as to which sex is most profitable.

The break-even spread in feeder cattle prices between steers and heifers gets wider as the price of feeder cattle increases. This explains the wide spread when feeder cattle are selling around 38-40 cents per pound.

(73 pages)

INTRODUCTION

Since the end of World War II, demand for red meat in the United States has increased rapidly. This increase is largely due to the rapid increase in average incomes of American families. As consumer disposable income goes up, so does the demand for more expensive and nutritious foods. Increased consumption of beef and beef products has had a positive effect on quality. A large percentage of the cattle killed for beef in the U. S. are fattened on high concentrate rations. This percentage is increasing as fewer and fewer grass fat beef are marketed.

In 1970 approximately 290,000 head of calves were available for sale or feeding from Utah cattle producers. Approximately two-thirds, or 193,000 of these calves were steers, and the remaining one-third, or 97,000, heifers.

There is always a strong demand for steers, as they are preferred by most feedlot operators. The demand for heifers has not been as high. Often feeder heifers sell at prices which range from $2 to $7 per hundred weight less than steers. There is a price spread in the same direction for fattened cattle.

With this type of price spread and feeding preference, why do some feeders insist upon feeding only heifers? Answers to this question are not easily found. Feeders have different reasons for their preference for steers or heifers. Some insist that steers are more efficient in feed conversion, while other feeders hold the opposite view. Farm and ranch magazines have carried articles on the feeding efficiencies of each sex, but without empirical evidence to back up their conclusions.

One feedlot in the midwest follows a "rule of thumb" whereby the operators buy heifers when there is a price spread of $2 or more between steer and heifer prices for animals of comparable weights.

Other feeders believe they cannot feed heifers profitably because of lower gain associated with heat cycles. Yet one of the largest feedlots in Utah feeds only heifers. The operators think feeding heifers is more profitable than feeding steers because of the high prices for steer feeders.

The question of which sex of cattle to feed is a basic economic decision which must be made at the beginning of the feeding period. An economic analysis of costs and returns associated with feeding steers in comparison to heifers would give feeders some aid in making this decision. No individual feeder will have costs exactly like any other feeder. With an analysis of a given feedlot situation, however, any feedlot manager could compile data on his own operation and subject them to the same analytical procedure.

This thesis study was done to help alleviate the uncertainty feeder buyers face in deciding the sex best suited to their own managerial methods and physical plant.

OBJECTIVES OF THE STUDY

1. To make an economic analysis of feeding steers and heifers in the feedlot.

2. To determine the price spread between steer and heifer feeder cattle based on the value of the carcass or live slaughter animal and performance in the feedlot.

3. To develop a decision model which can be used as an aid for cattle feeders.

LITERATURE REVIEW

Several articles and books contribute information to this problem. None, however, addresses itself to the three objectives which are the basis of this study. Many studies have been done which compare cattle of different sexes in the feedlot. Most of these involve a comparison of fattening steers and bulls, rather than steers and heifers. Those comparing steers and heifers were concerned only with gain rates, nutritional requirements, and weights of finished animals. Little has been written comparing the two sexes economically in the feedlot.

The characteristics of yield, grade, and cutability are the factors accounting for the carcass price spread between the sexes.

Because feeder and fed cattle prices fluctuate so much, they are not easily studied and compared over time. Articles in periodicals have expressed opinions and forecasts which have been used as buying guides for feedlot managers. None of the available literature undertakes the task of developing a decision model which can be used by cattle buyers in deciding which sex of cattle is most profitable at varying market prices associated with any given day in the market.

An experiment conducted at Pennsylvania State University by Wilson, et al. (1969) evaluated the influence of sex and sire upon the growth and carcass traits of beef cattle. Data were collected from 80 steers and 94 heifers born from 1963 to 1966. Given identical care except for castration, the cattle were fed to slaughter weights. The cattle were slaughtered with unshrunk weight endpoints of 454 and 424 kilograms (1,001 and 935 pounds) for steers and heifers respectively.

They were taken off feed 24 hours prior to slaughter, and trucked 11 kilometers (6.8 miles). Overall average slaughter ages of the steers and heifers were 447.1 and 448.1 days respectively. All carcasses were chilled at 0 C for 48 hours before cutting. Subjective estimates of various quality indicators (marbling, carcass grade, lean texture and firmness, and color of lean and fat) were obtained. Weight per day of age at slaughter was 0.97 and 0.89 kilograms (2.14 and 1.96 pounds) for steers and heifers respectively, with significant ($P < .01$) differences observed only for individual experiment year and sex. Although the slaughter weights, using a 4 percent shrink, were significantly ($P < .01$) different, averaging 435.1 and 409.8 kilograms (959 and 903 pounds) respectively, the average ages were essentially the same. Dressing percentage of heifers was significantly ($P < .05$) greater than that of steers, which could be the reflection of the increased fatness of the heifers. The heifers also averaged a higher percentage of untrimmed, intact hindquarter (49.4 vs. 48.9 percent). Thickness of the fat cover, expressed in either absolute units or as a ratio to carcass weight, was significantly ($P < .01$) greater for heifers. The heifers also had a significantly ($P < .01$) greater percentage of kidney fat (4.33 vs. 3.81 percent). The 1. dorsi rib-eye muscle areas of the steers were significantly ($P < .05$) larger than that of the heifers at 70.2 vs. 67.9 square centimeters (10.9 vs. 10.5 square inches); however, expression on a carcass weight ratio basis removed the significant sex difference. (Breidenstein, et al. [1963] reported greater fat thickness and larger 1. dorsi areas for heifers than for steers of similar weight.) As

expected from the sex averages of the individual traits used to calculate cutability, steers had a higher cutability than heifers (49.5 vs. 48.4 percent) in the Penn State study.

Thrift, et al. (1969) found the sex of the feeder was a significant source of variation for all performance traits and all carcass traits except marbling score and dressing percentage. Steers had heavier cold carcass weights; larger ribeye area; greater carcass weight per day of age; and larger estimated boneless, trimmed retail cuts; and received higher carcass conformation scores. Heifers had greater fat thickness over the twelfth rib, greater percentage of estimated fat from kidney and pelvic regions, and larger ribeye area when expressed per 100 kilograms of carcass. Marbling scores and dressing percentage were equal for steers and heifers. These results are similar to those reported by Tanner, et al. (1967), Bradley, et al. (1966), and Wyrick, et al. (1966).

A University of Missouri experiment by Hendrick (1968), comparing bulls, steers, and heifers, found steers and heifers nearly identical in feedlot performance and in quantitative and qualitative aspects, while bulls were significantly different. Steers and heifers were similar in rate of gain while bulls gained significantly faster. Bull carcasses were heavier than either steer or heifer carcasses. Carcass weights of steers and heifers were similar. Other studies, done by Field, Schoonover, and Nelms (1964); and Robertson, Wilson, and Morris (1968), had similar results.

The results of trials conducted by Garrett (1970) indicated that heifers and steers were not different in their ability to convert feed energy into body

energy. Heifers, however, reached a carcass composition typical of the low choice grade about 60 days and 200 pounds lighter than steers when fed the same ration, because of the greater quantity of fat stored in each pound of gain made by the females. The marked increase in feed required per pound of gain for both sexes as the feeding period progressed was due to a combination of less feed being consumed in relation to maintenance requirement and the increase in fat content of the gain. The overall results indicated that heifers fed to the same carcass composition as steers have a similar feed efficiency and similar carcass quality with no more backfat. The major problem in feeding heifers appeared to be that of producing heavy carcasses. Figure 1 through 3 show graphical results of Garrett's trial.

Neuman and Snapp (1969) concluded that gains made by heifers while on feed are somewhat smaller and more costly than those made by steers because of the slower rate of growth of heifers. They noted, however, that heifers reach their maximum growth rate earlier than steers. Since steers are usually fed several weeks longer than heifers, the economy of gains at time of slaughter is approximately equal for both classes. Heifers of varying feeder grades tend to feed out to a more homogeneous slaughter grade than do steers. Thus, since the spread between grades of feeder steers is narrower than that for feeder heifers, lower grades of heifers are often more profitable than lower-grade steers. "In a Tennessee Experiment Station study, heifers sold at slaughter prices much nearer the purchase price than did steers. Thus they had much less

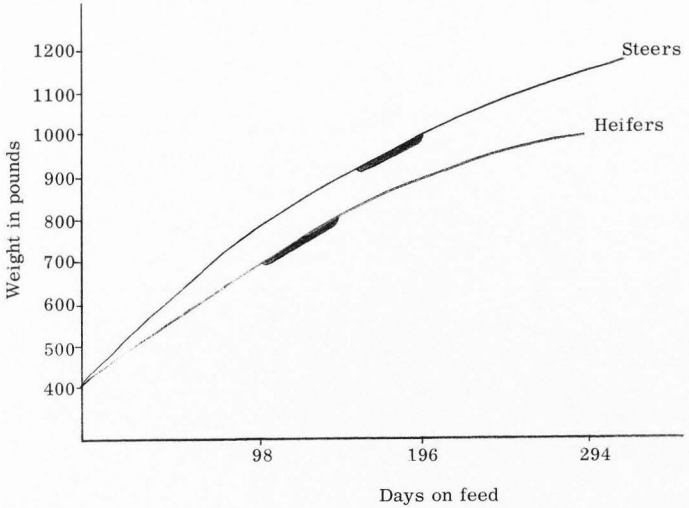


Figure 1. Weight changes associated with days on feed

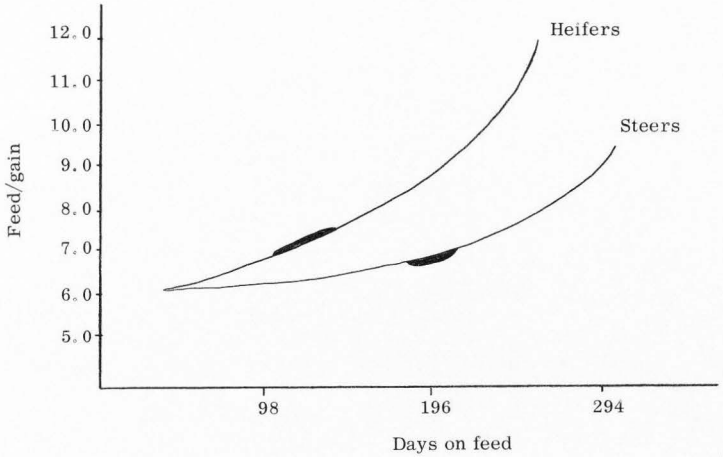


Figure 2. Feed required per pound of gain related to time on feed.

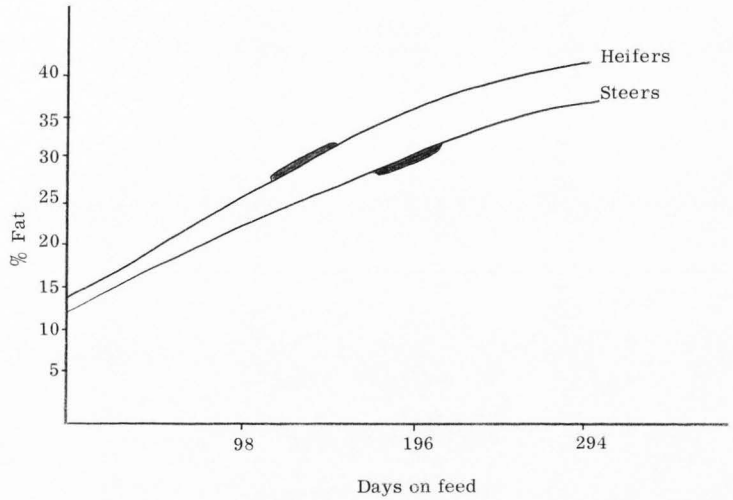


Figure 3. Relationship of fat percentage to days on feed.

negative price spread to overcome in order to show a profit." (Neuman and Snapp, 1965, p. 330) The practice of breeding yearling beef heifers, either accidentally or by intent, is less common today than in the past. This has had much to do with bringing together fat steer and heifer prices. Packers are discriminating less against heifers because the fear of low dressing percentages is reduced. Selling heifers on grade and yield would completely eliminate this fear.

An article in Feedlot Management concluded:

> It is generally understood that there is a difference in purchase price between heifers and steers. Steers perform better than heifers in the feedlot, and therefore the steer commands a higher price.
>
> But what is a "reasonable" price spread in view of the fact that both steers and heifers receive almost identical care?
>
> Some ranchers believe the price differential in recent years has been unduly large. When selling at auction, ranchers have received 1-6¢ more per pound for steers than for heifers. Sold direct to country buyers, the difference has been 2-3¢.
>
> Why buyers pay what they do is explained in a study by the University of Arizona.
>
> Arizona economists conclude that by and large the price differences are justified, after taking these factors into account: slaughter prices of steers vs. heifers, total and daily rate of gain for the two sexes, weight differential when they leave the ranch for the feedlot, and general price levels of cattle. (May, 1971, p. 32)

Dr. Wayne Purcell (1971) made an extensive study of the price differentials between steers and heifers. He concluded that price spreads on feeder cattle were justified because steers are better feed converters, and price spreads on carcass beef were justified because steers have better cutability

scores. Dr. Purcell examined price spreads for feeder cattle, fat cattle, and carcass beef for 1969 Omaha prices (Tables 14-16, Appendix). He concluded that these price differentials are justifiable. On an average basis, the performance of heifers from feeder to dressed carcass falls short of the performance of steers.

EXPERIMENTAL PROCEDURE

The Cattle as a Source of Data

Experimental data which are representative of the total population are very difficult to compile. In order to get true representation, one would have to conduct several experiments like this one at many different feedlots and schedule them during each season of the year, so that the data would reflect seasonal as well as managerial influences upon feeding results.

In this study, 118 heifers and 117 steers were placed in adjoining pens at a local feedlot. The cattle, coming from three ranch sources, all located in the same area of southern Utah, had some bloodline relationship, which helped to alleviate genetic influences upon test results, and received approximately the same management and care from weening to finishing.

The steers went onto full feed at an average weight of 650 pounds and the heifers at 640 pounds. The weight variation between the largest and smallest individual of either sex was estimated at not more than 25 pounds heavier or lighter than these averages.

Both sex groups were made up of approximately the same breed combinations. About half of each group were herefords, one-fourth angus, and one-fourth cross-bred animals (hereford-angus, shorthorn-hereford, hereford-charolais). One steer was a beef-dairy cross-breed.

Every effort was made to keep precise records on each pen without adding variables, not typical to the feeding program at the feedlot, which could effect

feeding performance. Results of this study may be different when compared to data taken from another pen of cattle fed in a different feedlot. In addition, there are significant differences in performance among individual animals. Therefore, all calculations are done on an average per head basis. This evens out the differences between the better and poorer animals in each sex group, making the results easier to interpret on a per head basis. Discrepancies which may exist among feedlots will be discussed in a later section.

Cattle Preparation and Management

The cattle received the same management as any other cattle in the feedlot. First they were placed in a receiving pen to await vaccination and implantation of stillbestrol. All cattle received four shots:

1. Vaccination for I. B. R. (Infectious Bovine Rhinotracheitis), an acute respiratory disease which is very contageous should it get started in a non-vaccinated herd. One vaccination lasts several months.
2. Pneumonia prevention vaccinations (a form of shipping fever).
3. Vaccination against an isolated strain of salmonella, a diarrhea-causing organism which has caused severe problems in the past at this lot.
4. Vaccination to control a sardillie virus strain which caused a number of deaths in 1969. The post mortum showed swelled

necks, with a black or blue colored flesh in the neck area. The swelling causes fatal respiratory complications in many cases.

Steers received 15 milligrams of stillbestrol. Heifers received no implant, but all animals consumed approximately 10 milligrams of stillbestrol daily in the feed.

From here the cattle were placed in adjoining pens, one for steers and one for heifers, where they were kept until finished and ready for slaughter. Each pen of cattle was weighed separately at 21 day intervals, but no other special management was given.

The cattle were watched carefully for sickness, and any sick animals were removed from the herd. None of the steers went into the sick pen. Individual heifers, however, were sick at different times. As the cattle recovered, they were put back into the pen with the remainder of the animals in their sex group.

As the cattle reached the desired degree of finish, they were slaughtered at a nearby packing plant owned by the same firm. This made it possible to follow each animal through both the feeding period and slaughtering.

Feeding Methods and Records System

A bulk feed truck equipped with scales weighed the amount fed to each pen during the once per day feeding, and this weight was recorded each day. Table 1

shows the amounts of feed consumed during each ration feeding period by each group of cattle. As noted in the table, there is an adjustment factor for both steer and heifer totals. This factor is the amount of feed that would have been consumed by the animals not staying on feed for the full period. An 800 pound heifer was killed on June 24. The heifer had a chronic diphtheria problem which caused her to be in the sick pen much of the time. The steer adjustment is for a steer which died from an allergy problem on August 11. The amount of the adjustment was calculated as the average amount of feed consumed by each of the remaining animals in the pen, from removal date until slaughter, multiplied by that number of days.

Table 1. Feed record

Ration	Dates of feeding	Number of days fed	Total lbs. of ration	
			Steers	Heifers
Starter	Apr. 14-May 3	20	79,200	79,950
Medium	May 4-May 23	20	88,900	87,800
Heavy	May 24-July 26 (heifers)	64		217,200
				+ adj. 870
				218,070
	May 24-Aug. 25 (steers)	104	315,000	
			+ adj. 164	
			315,164	

Total figures for each ration can now be divided by the number of cattle in each pen to get the average amount of each ration consumed per animal. Dividing this figure by the number of days each ration was fed yields the average per day consumption of each animal.

Reducing all data to averages per animal is more useful and easier to handle than simply getting pen totals. The usefulness of these averages will be seen later in the comparison of the two sexes and in the development of a pricing model.

Three rations were fed to each group during the feeding period. A starter ration was fed for a 20 day period beginning on April 14. Cattle were put on the medium ration for the next 20 days, beginning on May 4. From May 24 until slaughter, both groups were placed on the heavy finishing ration.

The following feed components made up the different rations. All feed was given ad libum once each day.

Table 2. Feed components making up the different rations

Feed components		Percentage
Starter Ration:		
Alfalfa Hay		43.42
Barley		18.42
Beet Pulp		13.16
Barley Pellets		7.89
Straw		3.95
Wheat Bran		4.26
PMS (Feed Supplement)		6.58
Salt		1.32
	TOTAL	100.00
Medium Ration:		
Alfalfa Hay		6.43
Straw		1.61
Barley		25.00
Beet Pulp		9.68
Wheat Bran		3.23
Barley Pellets		8.87
Salt		.81
Fat		1.61
PMS		4.03
Corn Silage		38.71
	TOTAL	100.00
Heavy Finishing Ration:		
Alfalfa Hay		6.03
Straw		.86
Barley		39.56
Beet Pulp		11.21
Wheat Bran		3.45
Barley Pellets		10.34
Salt		.86
Fat		2.59
PMS		4.31
Corn Silage		29.69
	TOTAL	100.00

The MPS feed supplement contains vitamins A, D, and E, protein, and terramycin.

Ration costs were computed by multiplying the current market price per ton of each individual feed component by its percentage of the ration. The market prices per ton associated with each feed were:

Alfalfa	$ 26.00/T
Barley	50.00/T
Beet Pulp	40.00/T
Barley Pellets	40.00/T
Straw	20.00/T
Wheat Bran	50.00/T
Corn Silage	10.00/T
PMS	80.00/T
Fat	100.00/T
Salt	30.00/T

Adding these component prices gives the cost of each ration per ton. Costs per ton were $38.00, $32.48, and $40,29, respectively, for the starter, medium, and heavy rations. Tables 3, 4 and 5 show the ration formulation sheets. These were prepared by Feed Service, Inc., under the direction of Morris Brock.

Table 3. Ration formulation sheet for Miller Packing, Hyrum, Utah (ration: #1 starter)

Ingredients	Lbs. fed	DFE lbs.	Per lb.	Calories total	Digestible protein		Fiber		Fat		Calcium		Phosphorus		Cost	
					%	Total	%	Total	%	Total	%	Total	%	Total	Unit	Total
Alfalfa	8.25	8.25	400	3,300	10.3	.850	30.0	2.475	1.8	.149	1.22	.1007	.22	.0182	.013	.1073
Barley	3.50	3.50	700	2,450	6.9	.242	5.7	.199	1.9	.067	.06	.0021	.33	.0116	.025	.0875
Beet Pulp	2.50	2.50	675	1,688	5.9	.148	12.0	.300	.5	.013	.69	.0173	.08	.0020	.020	.0500
Pellets	1.50	1.50	653	979	11.8	.177	18.5	.278	3.4	.015	2.05	.0308	1.09	.0164	.020	.0300
Straw	.75	.75	244	168	.7	.005	38.0	.285	1.6	.012	.33	.0025	.10	.0008	.010	.0075
Wheat Bran	1.00	1.00	570	570	12.2	.122	10.5	.105	3.5	.035	.13	.0013	1.10	.0110	.025	.0250
PMS	1.25	1.25	550	688	40.0	.500					.10	.0013	1.50	.0188	.040	.0500
Salt	.25	.25													.015	.0037
Total	19.00	19.00		10.21		2.044		3.642		.291		.1560		.0788		.3110

Energy: 538 Calories per DFE lb.
Protein: 10.75% digestible per DFE lb.
Fiber: 19.17% per DFE lb.
Fat: 1.53% per DFE lb.
Calcium: .82% per DFE lb.
Phosphorus: 41% per DFE lb.

Yardage: .0800
Cost/Day: .3910
1% Digestible protein for each 50 calories
Calories for maintenance: 6440
Calories for gain: 3778
Calories per lb. gain: 2390 Gain: 1.58 lbs./day

Cost of Gain: 75 cents per lb. at 1.58 lbs./day

NOTE: DFE is dry feed equivalent

Table 4. Ration formulation sheet for Miller Packing, Hyrum, Utah (ration: #2 medium)

Ingredients	Lbs. fed	DFE lbs.	Per lb.	Calories total	Digestible protein		Fiber		Fat		Calcium		Phosphorus		Cost	
					%	Total	%	Total	%	Total	%	Total	%	Total	Unit	Total
Alfalfa hay	2.00	2.00	400	800	10.3	.206	30.0	.600	1.8	.036	1.22	.0244	.22	.0044	.013	.0260
Straw	.50	.50	224	112	.7	.003	38.0	.190	1.6	.008	.33	.0016	.10	.0005	.010	.0050
Barley	7.75	7.75	700	5,425	6.9	.535	5.7	.442	1.9	.147	.06	.0046	.33	.0256	.025	.1937
Beet Pulp	3.00	3.00	675	2,025	5.9	.177	12.0	.360	.5	.015	.69	.0207	.08	.0024	.020	.0600
Wheat Bran	1.00	1.00	570	570	12.2	.122	10.5	.105	3.5	.035	.13	.0013	1.10	.0110	.025	.0250
Barley Pel.	2.75	2.75	653	1,795	11.8	.324	18.5	.508	3.4	.093	2.05	.0364	1.09	.0210	.020	.0550
Salt	.25	.25													.015	.0037
Fat	.50	.50	1600	800					100.0	.500					.050	.0250
PMS	1.25	1.25	550	687	40.0	.500					.10	.0012	1.50	.0187	.040	.0500
Corn Silage	12.00	4.00	200	2,400	1.3	.156	8.5	1.020	.6	.072	.12	.0144	.09	.0108	.005	.0600
Total	31.00	23.00		14,614		2.023		3.225		.906		.1246		.0944		.5034

Energy: 635 Calories per DFE lb.
Protein: 8.79% digestible per DFE lb.
Fiber: 14.02% per DFE lb.
Calories per lb. gain: 2650 Gain: 2.87 lbs./day
Fat: 3.94% per DFE lb.
Calcium: .54% per DFE lb.
Phosphorus: 41% per DFE lb.
Cost of gain: 20.33 cents per lb. at 2.87 lbs./day
1% digestible protein for each 72 calories
Calories for maintenance: 7020
Calories for gain: 7594
Yardage: .0800 Cost/Day: .5834

Table 5. Ration formulation sheet for Miller Packing, Hyrum, Utah (ration: #3 heavy)

Ingredients	Lbs. fed	DFE lbs.	Per lb.	Calories total	Digestible protein		Fiber		Fat		Calcium		Phosphorus		Cost	
					%	Total	%	Total	%	Total	%	Total	%	Total	Unit	Total
Alfalfa Hay	1.75	1.75	400	700	10.3	.180	30.0	.525	1.8	.032	1.22	.0214	.22	.0039	.013	.0228
Straw	.25	.25	224	56	.7	.002	38.0	.095	1.6	.004	.33	.0008	.10	.0003	.010	.0025
Barley	11.5	11.5	700	8,050	6.9	.794	5.7	.656	1.9	.219	.06	.0069	.33	.0380	.025	.2875
Beet Pulp	3.25	3.25	675	2,193	5.9	.191	12.0	.390	.5	.016	.69	.0224	.08	.0026	.020	.0650
Wheat Bran	1.00	1.00	570	570	12.2	.122	10.5	.105	3.5	.035	.13	.0013	1.10	.0110	.025	.0250
Barley Pel.	3.00	3.00	653	1,959	11.8	.354	18.5	.555	3.4	.102	2.05	.0615	1.09	.0327	.020	.0600
Salt	.25	.25													.015	.0037
Fat	.75	.75	1600	1,200					100.0	.750					.050	.0375
PMS	1.25	1.25	550	685	40.0	.500					.10	.0012	1.50	.0187	.040	.0500
Corn Silage	6.00	2.00	200	1,200	1.3	.078	8.5	.510	.6	.036	.12	.0072	.09	.0054	.005	.0300
Total	29.00	25.00		16,613		2.221		2.836		1.194		.1227		.1126		.5840

Energy: 664 Calories per DFE lb.
Protein: 8.88% digestible per DFE lb.
Fiber: 11.34% per DFE lb.
Fat: 4.78% per DFE lb.
Calcium: .49% per DFE lb.
Phosphorus: .45% per DFE lb.

Yardage: .0800 Cost/Day: .6640
1% digestible protein for each 75 calories
Calories for Maintenance: 7300
Calories for gain: 9313
Calories per lb. gain: 2770 Gain: 3.36 lbs./day
Cost of gain: 19.76 cents per lb. at 3.36 lbs./day

PRESENTATION AND ANALYSIS OF DATA

Feeding Results (Steers)

The steers consumed 79,200 pounds of started ration for the 117 head in a 20 day interval (see Table 1). This amounts to an average of 33.85 pounds per day for each animal. Average daily gain, 3.53 pounds (Table 6), divided into the daily consumption, shows a conversion rate of 9.6 pounds of feed per pound of gain. This average daily gain is exceptionally good for steers at this body weight, considering the stress factors associated with coming into the feedlot.

Cost of Gain

At a cost of $38.00 per ton, the cost per pound of started ration is $0.019. This cost, multiplied by the average daily consumption of 33.85 pounds, yields a daily feed cost of $0.6432. Dividing the average cost of feed per day by 3.53, the average daily gain (ADG), we get an average cost of $0.1822 per pound of gain.

Feeding results and costs can be calculated for the medium and heavy rations by the same method. The following simplified calculations show the feeding results or conversion:

$$\text{Medium: } \frac{X_1 + (X_2 \cdot X_3)}{X_4} = \frac{88,900 + (117.20)}{4.19} = \frac{38 \text{ lbs.}}{4.19} = 9.1 \text{ conversion}$$

$$\text{Heavy: } \frac{X_1 + (X_2 \cdot X_3)}{X_4} = \frac{315,164 + (117.104)}{2.59} = \frac{25.9 \text{ lbs.}}{2.59} = 10.0 \text{ conversion}$$

where:

X_1 = total pounds ration consumed by the group

X_2 = number of head in sex group

X_3 = number of days cattle are fed each ration

X_4 = average daily gain for the period from Table 6

Table 6. Weighing data

Weigh Date	Average weight (pounds)		ADG for period (pounds)		Ration
	Steers	Heifers	Steers	Heifers	
April 13	652.31	639.41			
May 4	726.50	662.88	3.53	1.12	Starter
May 25	814.44	746.12	4.19	3.96	Medium
June 16	882.05	807.78	3.07	2.80	Heavy
July 7	969.83	879.09	4.18	2.97	
July 21	1,009.83	902.91	2.86	2.34	(Steer ADG = 2.59) [1] (Heifer ADG = 2.75)
July 26		922.09			
Aug. 25	1,083.36		2.10		
AVERAGE DAILY GAIN (lbs.)			2.99	2.72	
DAYS OF FEED			144.00	104.00	
AVERAGE TOTAL GAIN (lbs.)			431.05	282.59	

[1] The total ADG for steers and heifers while on heavy ration was 2.59 and 2.75, respectively.

The costs of gain can be calculated as follows:

Medium: $\frac{Y_1 \cdot Y_2}{Y_3} = \frac{\$0.6171}{4.19} = \$0.1473$ cost of gain per pound

Heavy: $\frac{Y_1 \cdot Y_2}{Y_3} = \frac{\$0.5556}{2.59} = \$0.2145$ cost of gain per pound

where

Y_1 = unit cost of ration per pound. ($0.019, $0.01624, and $0.0245, respectively, for starter, medium, and heavy)

Y_2 = average daily feed consumption per animal $[X_1 + (X_2 \cdot X_3)]$ from above

Y_3 = average daily gain for the period, from Table 6

The total cost of feed for the steers can be found by adding the costs of feed during each period ($12.86 + $12.34 + $57.78 = $82.98 per head).

Heifers

By using Tables 1 and 6 and the equations presented earlier, we get the following as averages for the 118 heifers.

Table 7. Averages for the 118 heifers

Heifer data	Ration fed		
	Starter	Medium	Heavy
Pounds of ration consumed daily	33.85	37.2	28.9
Average daily gain (pounds)	1.12	3.96	2.75
Conversion rate for feed	30.2	9.4	10.5
Cost per day for feed for each heifer	$ 0.6432	$ 0.6041	$ 0.6199
Cost per pound of gain	$ 0.5749	$ 0.1526	$ 0.2254
Cost of feed per head for period	$12.86	$12.08	$39.67
TOTAL FEED COST PER HEAD =	$64.61		

A major factor accounting for poor gains during the first 20 days of feeding for the heifers was their wilder nature in comparison to the steers. It took longer for the heifers to settle down.

Comparative Analysis of Feedlot Results

The steers gained much more rapidly during the first 20 days than did the heifers, 3.53 and 1.12 pounds ADG respectively. This was in spite of the fact that each group consumed exactly the same amount of feed per head daily. (This situation may be unique to this study, and should be considered when comparing other studies of this nature.) The medium and heavy rations produced gains

which were much more typical of results of studies cited in the literature review.

The study conducted by W. N. Garrett (1970), cited previously, indicated that heifers reach a carcass composition typical of the low choice grade about 60 days and 200 pounds lighter than steers. This study showed similar results, with a 40 day difference in feeding time, and an average unshrunk liveweight difference of 161 pounds. Body composition of the animal has much to do with the gain rates, which explains much of the difference in feed consumption and rates of gain shown on Tables 1 and 6 (Note Figure 2).

Average daily gain for each group was 2.99 and 2.72 pounds for steers and heifers, respectively. One must remember that this is associated with 144 and 104 day feeding periods.

In every case, the steers had a conversion rate which indicated a more efficient use of feed than that of heifers. Thus, steers convert feed into gain somewhat more cheaply than do heifers. This explains, in part at least, why steers command a higher feeder price than do heifers.

The steers averaged 1083.36 pounds (unshrunk) and the heifers 922.09 pounds when weighed at time of slaughter. These weights are typical for slaughter cattle leaving the feedlot.

Feed is by no means the only cost which must be considered in arriving at a profit or loss figure in the feeding business. The fixed facility, labor, transportation, medical expenses, and interest are important. These costs have been calculated on a cost per day basis for each animal in this particular feedlot.

The figure used by the feedlot, as calculated by Feed Services, Inc., is eight cents per head for each day in the lot, and this figure will be used in this study also. A later section will deal with the derivation of this figure for any other feeding situation. With the cost of vaccinations at $0.80 per head, the average cost of finishing a steer or heifer at this lot can be calculated as follows:

Table 8. Average cost of finishing a steer or heifer

Expense	Steers	Heifers
Cost of Feed	$ 82.98	$ 64.61
Yardage @ 8¢ daily	11.52	8.32
Vaccination	.80	.80
TOTAL AVERAGE COST	$ 95.30	$ 73.73

Slaughter Data and Comparative Analysis

Records were kept on each animal as it was slaughtered. In total, 116 steers and 117 heifers were slaughtered at the end of the finishing period. Average carcass weights were 659.26 and 541.96 pounds, respectively, for steers and heifers.

A shrink of 4 percent was used on live animal weights before dressing percentage was figures. The steers dressed 63.39 percent and the heifers

61.22 percent. This is within the ranges of other studies cited in the literature review. The steers were somewhat higher in dressing percentage than what has been typical at the packing plant, however.

This packing plant uses United States Department of Agriculture (U.S.D.A.) grades on these animals which will grade choice or better. Other carcasses go to the market under their own brand label. The percentage of the cattle involved in this study that graded was about average for all cattle fed in this feedlot, with 73 of the steers and 76 of the heifers grading U.S.D.A. choice.

Cost of Slaughter

According to the plant owner-manager, it costs $30,00 per head to kill and process the animals. This includes everything involved before shipping to retail outlets. To help offset this processing cost, $20.00 is received for the hide, internal organs, and by-products. The net cost is $10.00 per head when the value of these by-products is subtracted from processing costs.

DEVELOPMENT OF A DECISION MODEL

In this section a decision model is developed to aid cattle buyers facing the decision of buying steers or heifers for feeding. As stated earlier, no two feedlots will have exactly the same management techniques or cost figures. The model developed will pertain to any feedlot if data are compiled for that particular lot.

Explanation of the Model

One of the basic questions a feeder faces at the beginning of the feeding period is which sex of cattle will make the most money in his feedlot. The answer to this question is not easily found, and will not remain the same over time.

For many years, buyers have purchased cattle at the going market price. Each buyer usually follows his own ideas of the appropriate price spread which makes one sex a better buy than the other. The market price spread for steers and heifers can vary anywhere from two to eight cents per pound. If buyers had some way of determining which sex would make the most profit from feeding, the price spread would probably stabilize at a price where most buyers would be indifferent between steers and heifers.

Costs and returns from feeding the two sexes of cattle must be analyzed to develop a buyer decision model. The model can be shown graphically by plotting the price of feeder steers on the horizontal axis, and the spread in price between steers and heifers of approximately the same weight on the vertical axis

(Figures 4-10). Prices at the end of the feeding period are the unknown in the model. Market prices for feeder cattle are known at the beginning of the feeding period. Use of the model necessitates the prediction of the expected price spread between finished steers and heifers. Also, the buyer must decide whether he plans to sell the animals live-weight or as carcass beef.

In predicting the price spread on both live-weight cattle and carcass beef, the buyer can utilize several sources as aids. These include livestock price forecasts, futures market quotations, livestock specialists' reports, or livestock prices of previous years. The market price quotations in the Appendix show the weekly market prices from January 16, 1970 to September 17, 1971. Fat cattle price spread ranges are quite regular over a long period. The average price spread was $1.32 per cwt. during all of 1970 and the first nine months of 1971, with steers selling for more than heifers. Appendix Table 13 shows only one week where the spread was more than $2.00 per cwt., and only one where the spread was less than $0.75 per cwt. These quotations are for choice cattle at weights approximately the same as the study cattle. Most feeders make projections as to what the expected price must be in order to make a profit. It is easier to predict a price spread than the actual price itself. Use of this model does not guarantee that the cattle fed will return a profit. However, use of the model can put the feeder in the position where cattle feeding will make more or less if he chooses the sex which offers the highest return.

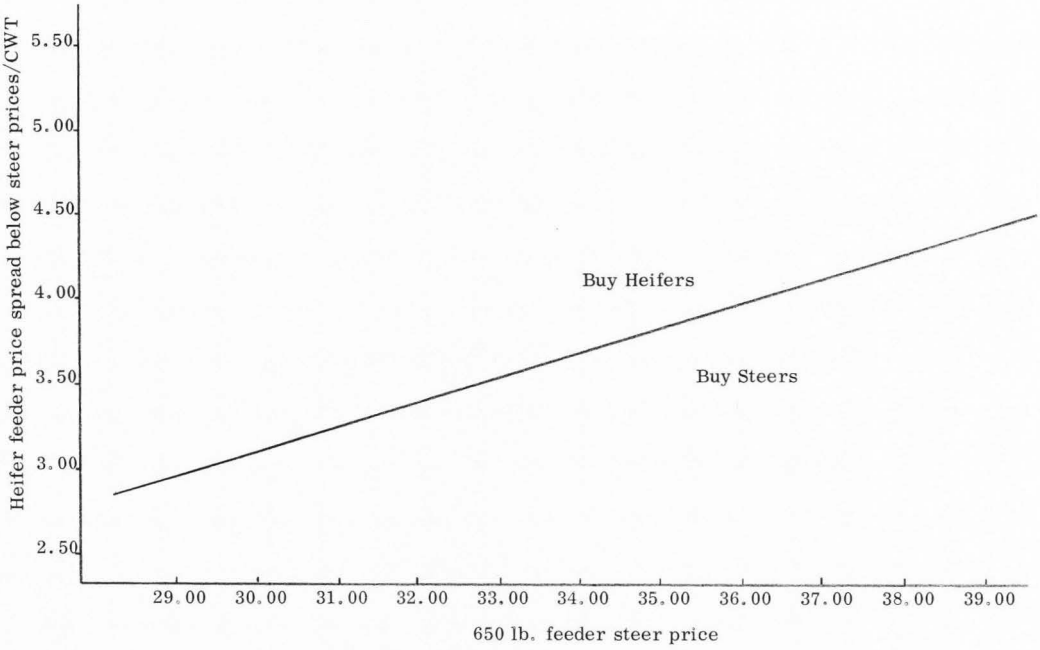


Figure 4. Break-even prices when fat steer and fat heifer prices are the same per CWT.

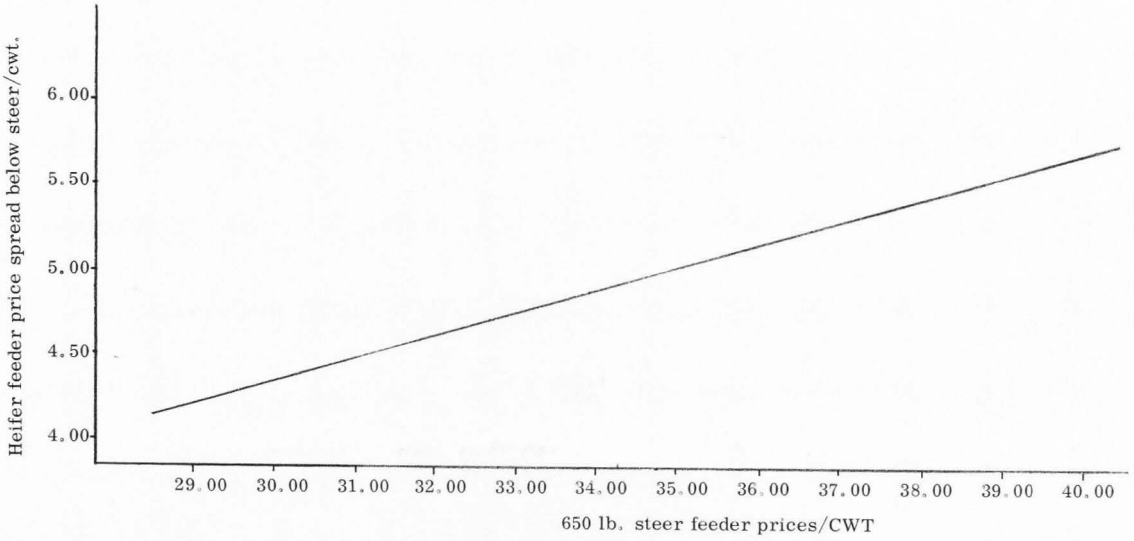


Figure 5. Break-even prices when fat steers sell at $1.00/cwt. above heifers

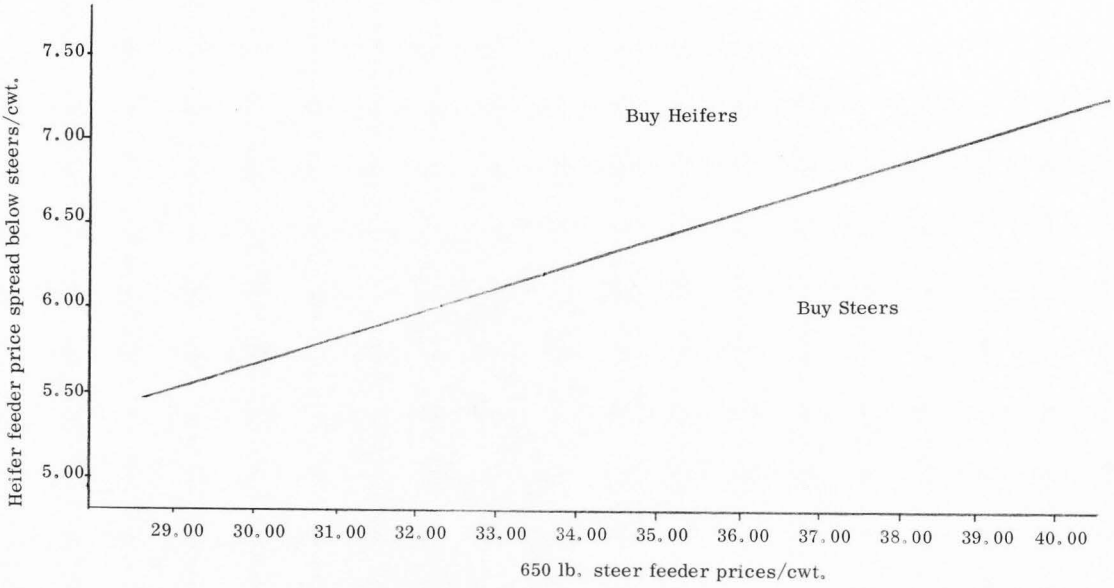


Figure 6. Break-even prices when fat steers sell for $2.00/cwt. above heifers.

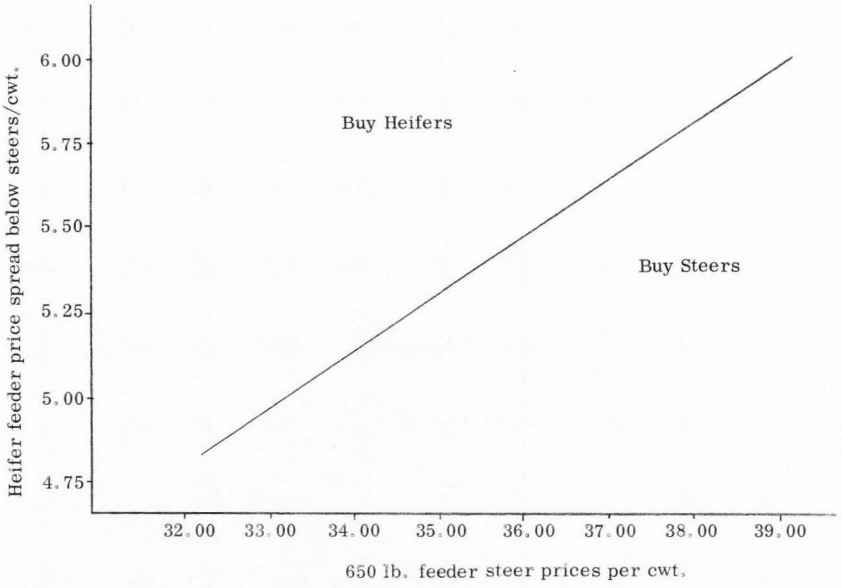


Figure 7. Break-even prices when steer and heifer carcasses sell for the same price.

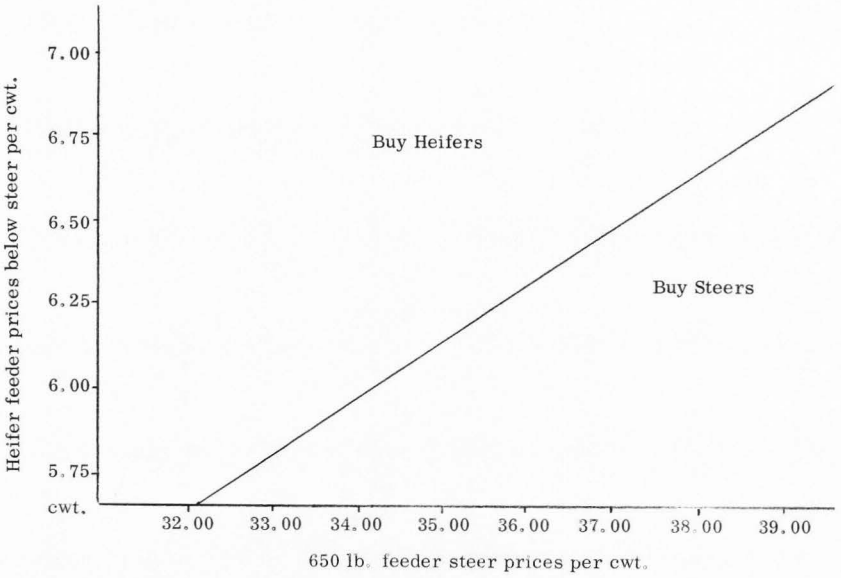


Figure 8. Break-even feeder prices when steer carcasses sell 1¢/lb. above heifer carcasses.

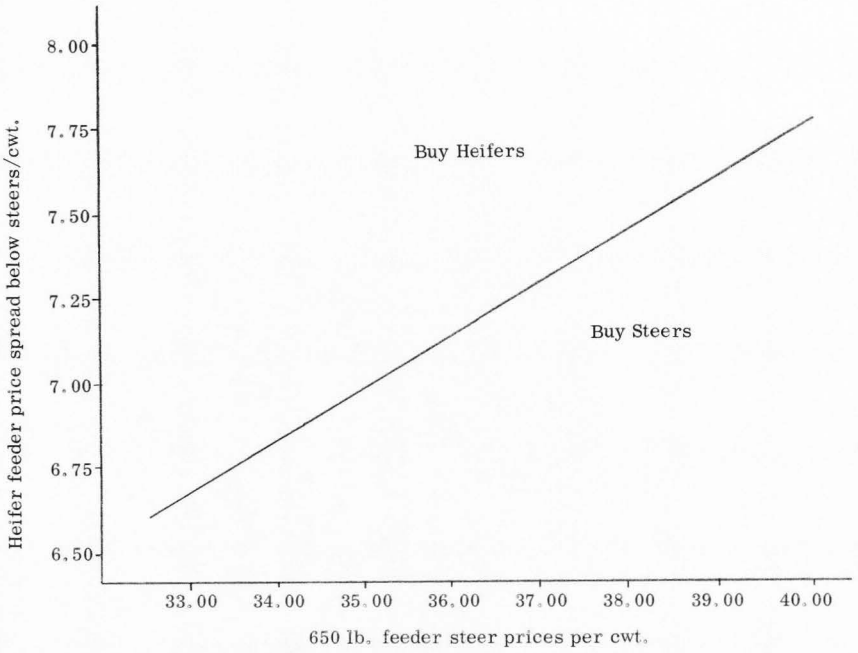
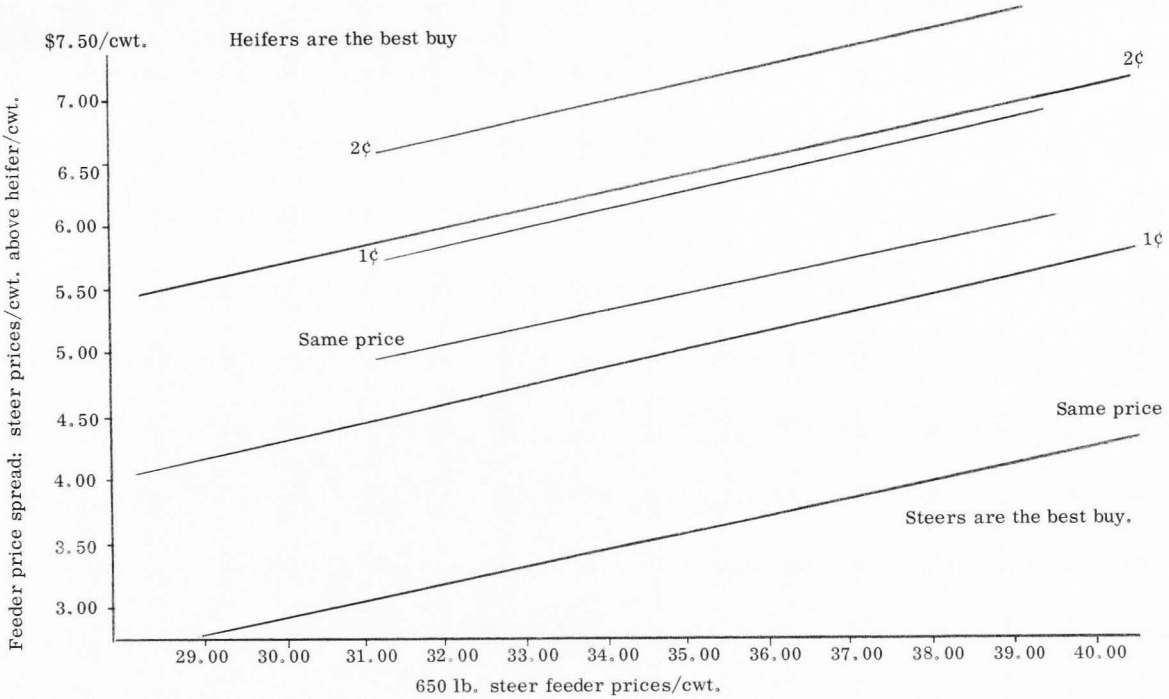


Figure 9. Break-even prices when steer carcasses sell for 2¢/lb. above heifers.



Note: Short break-even lines depict decision model for carcasses--selling spreads noted.
Long break-even lines depict model for fat cattle--selling spreads noted.

Figure 10. Feeder price spread for steers and heifers.

The fat-lean ratio is the main reason for a price spread in carcass beef. Heifer carcasses have a composition which is slightly higher in percentage of fat as compared to lean. This is evident in Appendix Table 16, which shows the price differentials of choice carcasses in a 1969 Omaha study. Any assumed price spread for either live-weight fat cattle or carcass beef yields a linear break-even line on a graph. This break-even line represents the price spread, steer above heifer, at which it makes no difference which sex of cattle is purchased.

Figures 4 through 10 show these relationships graphically. The derivation of the break-even lines is explained in the next section. The market price of 650 pound feeder steers is plotted against the amount per cwt. the steers sell above heifers. Steer prices are plotted on the horizontal axis, the price spread on the vertical axis. On any given market day, a point can be plotted on the graph plane. Should this point fall directly upon the break-even line, the buyer would be indifferent as to which sex he should purchase, but if the intersection point falls above the line, it would be more profitable to feed heifers, and if below the line, steers. When the interesection is very near to the line, the difference in feeding profit of one sex over the other is small. The importance of feeding one sex as opposed to the other is more pronounced as the distance widens.

Derivation of Break-Even Lines

Separate break-even lines must be derived for each price spread associated with the selling prices of fat cattle or carcasses. The calculations and plotting of the break-even line in Figure 4 are presented as an example.

As noted, Figure 4 is associated with fat cattle sold live-weight. The underlying prediction assumes that fat steers and heifers sell for the same price per cwt.

The cost data from the experimental cattle are used to calculate the price which could have been paid for feeder steers and heifers in order to break even. This means that all costs of feeding, plus the purchase price of the feeder animal, will be equal to the value of the finished animal, ready for slaughter.

The following equation is used to estimate the break-even price for feeder animals:

$$\frac{(Z_1 \cdot Z_2) - Z_3}{Z_4} = \text{value per pound of the feeder animal}$$

where

Z_1 = value per pound of fat animal

Z_2 = shrunk weight of live fat animal (in this case assuming 4 percent shrink - 1040 pounds and 885 pounds for steers and heifers, respectively)

Z_3 = total costs of feeding as shown earlier ($95.30 and $73.73 per head)

Z_4 = weight of feeder cattle

These calculations were done for prices of Z_1 which covered a range encompassing any fat cattle price which is apt to prevail on the date of sale, assuming steers and heifers sell for the same price per cwt. Example equations for steers and heifers selling at $27.00/cwt. would be:

$$\frac{(.27 \cdot 1040) - \$95.30}{650} = \$.2854/\text{lb. or } \$28.54 \text{ cwt. for steers}$$

$$\frac{(.27 \cdot 885) - 73.73}{640} = \$.2582/\text{lb. or } \$25.82/\text{cwt. for heifers}$$

Both steer and heifer data must be plugged into the equation.

For clarity Table 9 shows the actual calculated break-even values for each sex of cattle associated with the array of fat cattle prices in columns 1 and 2. In actuality, the two columns are the same because we assume fat cattle prices are the same. The figures would be different if we assumed a spread for fat cattle.

Table 9 shows that with selling prices even for steers and heifers as slaughter cattle, a spread in value per cwt. of feeder cattle can be derived. The values in column 5 are the difference between the values in columns 3 and 4. By plotting the various values in column 3 on the horizontal axis, and the spread in column 5 on the vertical axis, the graphical scheme in Figure 4 is derived. All values in column 5 have a linear relationship. Thus, only two points on the line must be calculated, and a straight line drawn between them. The chance of error is lessened, however, by plotting several extra points. Figures 5 and 6 have the same derivation as Figure 4. The difference is the spread

Table 9. Calculated break-even values for each sex of cattle associated with the array of fat cattle prices

Fat cattle prices/cwt.		Break-even price of feeder cattle/cwt.		Break-even spread of steer feeder price above heifer/cwt.
(1) Steers	(2) Heifers	(3) Steers	(4) Heifers	(5)
$27.00	$27.00	$28.54	$25.82	$2.72
28.00	28.00	30.14	27.20	2.94
29.00	29.00	31.74	28.58	3.16
30.00	30.00	33.34	29.96	3.38
31.00	31.00	34.94	31.35	3.59
32.00	32.00	36.54	32.73	3.81
33.00	33.00	38.14	34.11	4.03
34.00	34.00	39.74	35.50	4.24
35.00	35.00	41.34	36.88	4.46

calculated in column 5, because of a difference in fat cattle prices in columns 1 and 2.

The break-even lines for cattle which are sold as carcass beef can be derived by the same method. The equation for carcass beef is very similar to that for fat cattle. The equation used to calculate the break-even value for feeder cattle at various carcass selling prices is as follows.

$$\frac{(V_1 \cdot V_2) - V_3}{V_4} = \text{value per pound of feeder animal}$$

where

V_1 = value per pound of carcass beef

V_2 = weight of carcass (659 pounds and 542 pounds)

V_3 = total costs of feeding plus \$10 slaughter costs (\$105.30 and \$83.73)

V_4 = weight of feeder cattle

Equation examples:

steer $\frac{(.50 \cdot 659) - \$105.30}{650} = \$34.49/\text{cwt.}$

heifer $\frac{(.50 \cdot 542) - \$83.73}{642} = \$29.26/\text{cwt.}$

The same procedure is used to arrive at a price spread which makes steer and heifer feeder cattle equal in profitability. Figures 7 through 9 depict the break-even decision models for carcass beef.

These carcass models, as with fat cattle models, require prediction of the expected spread in price between steer and heifer carcasses. The main reason for the carcass price spread between sexes is the cutability score. Steer carcasses average a higher percentage of salable cuts when compared to a like grade of heifer carcasses. This cutability difference does not vary much over time. A livestock feeder can predict the carcass price spread with a high degree of accuracy.

Most livestock feeders sell their fed cattle as live slaughter cattle. They would be more inclined to use the live cattle decision model. Those feeders with an integrated business which includes a slaughtering operation may profit more by using the carcass model.

Figure 10 has the break-even lines from Figures 4 through 9 plotted on the same set of axes. Both fat cattle and carcass break-even lines have approximately the same slope. However, no such conclusion can be made for other groups of cattle used as data sources at other feedlots. Such factors as dressing percentages and slaughter costs will affect the position and slope of the lines.

Market prices during November, 1971 show a price spread of approximately $2.00 per cwt. for fat cattle. During this same period, the packing plant associated with this study sold steer carcasses for one cent more per pound than heifer carcasses. The break-even lines for a two cent per pound spread in fat cattle prices and the line for a one cent spread in carcass selling prices are nearly identical. One might conclude that the firm cooperating in this study could use either decision model to arrive at the price spread which would make the operator indifferent as to which sex of feeder cattle he would buy.

ADAPTATION OF THE DECISION MODEL TO ANY FEEDLOT SITUATION

The decision models developed earlier apply directly only to the feedlot where the study cattle were fed. Every feedlot will have a different set of data which pertains to cattle feeding. With the many variables associated with cattle feeding, this is understandable. This section contains some aids which any feeder can follow to develop his own models.

A feedlot manager makes many decisions throughout the feeding period. Deciding which sex of cattle to feed is one of the most important. Given the many differences in feeding steers and feeding heifers, such as feed conversion, gain rate, and cutability, he must decide upon the most profitable sex relative to the price spreads of feeder cattle and fattened cattle. A rational feedlot manager will seek a method of deciding which sex best meets his management capabilities, cattle, and rations. With these variables evident in feeding, each feedlot manager will have to collect and utilize his own data.

The individual feedlot can place several groups of cattle on feed and keep records on gain and feed consumed with little if any extra cost. To do this, steer and heifer groups should be weighed at the beginning of the feeding period. Average weights of gain and feed consumed are easiest to use. The average total cost of feeding a steer and a heifer from the time placed in the lot until slaughter should then be calculated. The weight when placed on feed is usually the same year after year for each sex. This weight is the divisor for each group in the

equation sample in the previous section. The feeder then finds the average shrunk weight of fat cattle for each group of cattle used as a data source.

An estimation of the spread in selling prices for steers and heifers, whether by live-weight or by carcass beef, must be made. This can be done by studying the livestock price forecasts, futures market quotations, livestock specialists' reports, or a list of past fat cattle prices (see Appendix Table 13).

Using an array of possible prices which might prevail on the selling date, the break-even price spread of steer feeder cattle above heifer feeder cattle can be calculated, as done in the previous section.

The results of these calculations can be plotted in the manner shown in Figures 4 through 9. With the price of feeder cattle plotted on the horizontal axis, and the feeder price spread on the vertical axis, any intersection of prices which falls above the break-even line will indicate that it will be more profitable to feed heifers, while intersections below the line indicate that steers will be the best purchase. As a cattle buyer finds out what prices he must pay on a given day for feeder steers or heifers at the weight he usually feeds, he can decide at a glance which sex he will purchase.

The decision model will change if a feedlot alters rations, management practices, or cattle types fed. A new model can be developed in a short time, however.

Fixed Cost Analysis and Yardage Charges

This study used a yardage charge of eight cents per day for the days an animal was in the feedlot. There is a reason for calculating the yardage charge on a "per day" basis, instead of a "per pound of gain" basis. It was pointed out earlier that heifers are in the feedlot a shorter period of time; thus, the turnover ratio is higher for heifer feeding. In other words, more heifers can be fed out in a feedlot of a given capacity, than if the same feedlot were used for steers. If the fixed costs are spread over a larger number of animals, the charge per animal is less.

This daily yardage cost includes both fixed and variable costs associated with the feedlot, except feed costs. This section will describe the costs that fall in each category and how a feedlot manager can arrive at a daily yardage cost which can be used in developing a decision model.

Investment Costs Inverse to Size of Feedlot

Data from a study conducted in 1970 at Utah State University, by Taylor, et al., , showed that there is an inverse relationship between investment per head of capacity and capacity of the feedlot. As feedlot capacity increased, the investment per head of capacity decreased. These data are shown in Table 10.

Feedlots feeding more than 2,000 head turned their cattle an average of 2 1/2 times during the year, while the smaller lots tended to feed only one group of cattle. Hence, larger lots spread their fixed investments over more cattle.

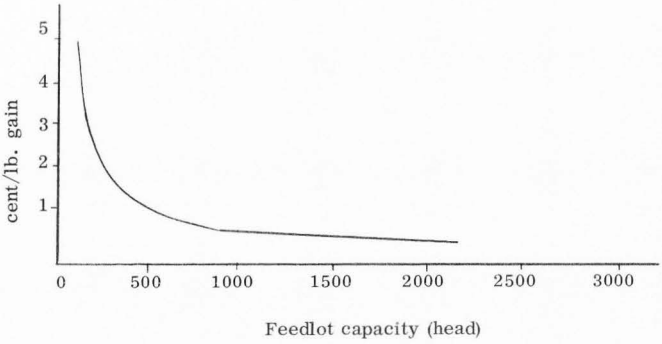
Table 10. Feedlot investment costs, total and per head by size of feedlots, Utah, 1968

Feedlot capacity	No. of feedlots	Total capacity (head)	Total investment (dollars)	Investment per head capacity (dollars)
50 - 99	7	450	44,920	99.82
100 - 199	13	1,710	160,320	93.75
200 - 299	14	2,995	202,488	67.61
300 - 499	11	3,970	216,826	43.62
500 - 999	20	12,450	647,282	51.99
1000 - 1999	15	17,700	813,315	45.95
2000 - over	7	22,100	900.044	40.73
TOTAL	87	61,375	2,985,195	48.64

Source: Taylor et al., 1970.

Fixed investment costs of the large feedlots were only one-sixth as much per head of cattle fed as for the small feedlots. (Note Figure 11 and Table 11.)

Examples of fixed costs are the costs of investment in pens and equipment, water system, feed storage and equipment, feed distribution equipment, tractors, manure disposal equipment, transportation equipment, land, scales, office equipment, etc.



Source: Taylor et al. (1970).

Figure 11. Fixed costs for cattle finishing, as related to feedlot size, Utah, 1968.

Table 11. Fixed costs per pound of gain, yearling steers and heifers, Utah, 1968

Item	Number of head fed						
	50-99	100-199	200-299	300-499	500-999	1000-1999	2000 & over
Fixed Costs							
Depreciation	2.40	.86	.75	.72	.54	.54	.22
Taxes, interest insurance	2.03	1.00	1.08	.72	.53	.72	.34
Total fixed costs	4.43	1.86	1.82	1.44	1.07	1.26	.56

Source: Taylor et al., 1970.

Non-Feed Variable Costs

Economics of size are not restricted to fixed costs. They also extend to most variable costs, such as labor, utilities, fuel, veterinary fees, repairs, death loss, and interest on operating capital. The results of the Utah State University study cited above are shown in Table 12.

Daily Yardage Costs Per Head

In order for a feedlot to arrive at an amount which must be charged against an animal for each day in the lot, several figures must be calculated. Every lot has a different utilization percentage. A 100 percent utilization of a lot would, of course, mean that a new animal would be put into the lot on the same day one is removed for slaughter. The larger lots usually have a higher

Table 12. Non-feed variable cost per pound of gain for yearling steers and heifers, Utah, 1968

Item	Size of feedlot (head)						
	50-99	100-199	200-299	300-499	500-999	1000-1999	2000 & over
	Cents per pound of gain						
Variable costs							
Labor	3.25	2.21	1.30	1.17	.99	.99	.77
Utilities	.11	.08	.05	.08	.10	.11	.11
Fuel	.35	.09	.26	.37	.16	.20	.13
Veterinary	.29	.29	.17	.10	.15	.28	.20
Repair	.89	.35	.38	.26	.20	.25	.17
Other	.01	.01	.01	.01	.01	.01	.01
Death loss[1]	.96	.96	.95	.67	.79	.60	.52
Interest and on feed and cattle[2]	1.42	1.41	1.40	1.40	1.44	1.40	1.39
Total non-feed variable costs	7.28	5.40	4.52	4.06	3.84	3.85	3.30

[1] 830 pound animal multiplied by percent of death loss, times $26.00/cwt. and divided by average gain of 428 pounds.

[2] Seven percent per year interest on investment in feeders, at $26.00/cwt. on cost of feed.

Source: Taylor et al., 1970.

percentage utilization, and thus a lower charge against each animal for each day fed. The utilization percentage can be calculated as follows:

$$\frac{\text{(Turnover Ratio)(Average days on Feed)}}{365 \text{ days}} = \%$$

The turnover ratio is found by dividing the total number of head fed over a year's time by the one-time capacity. To find total number of feeding days, the total number of cattle passing through the lot is multiplied by the average number of days an animal is on feed.

The following major costs must be estimated:

1. Fixed investment costs per year necessitates an estimation of total feedlot investment. Such items as pens and equipment, water system, feed storage and equipment, transportation equipment, land, scales, and office equipment fall into this category. By estimating a useful lifetime for these items and using the straight-line method of depreciation, a yearly use charge can be found.
2. The cost of labor for a year, including management, must be found.
3. An estimation of yearly variable costs, not including feed and labor, can be found by adding such items as property taxes, death loss, fuel and oil, utilities, veterinarian costs, repairs and maintenance, and insurance.

Adding these three yearly costs and dividing by the total number of feeding days for the year gives the daily yardage cost.

The following hypothetical example may help clarify this section:

Assumptions: 5,000 head capacity

10,000 head fed yearly

140 days is average length of feeding period

Total fixed investment is $325,000, with a useful life of fifteen years. (Assume salvage value of $25,000.)

$$\frac{\$300,000}{15} = \$20,000 \text{ yearly}^{1}$$

Labor costs for three men @ $7,000, plus manager @ $10,000 yearly = $31,000

Yearly variable costs excluding labor and feed = $45,000.

Addition of these three figures yields the applicable total yearly costs, $96,000.

$$\frac{\$96,000}{140 \text{ days} \cdot 10,000 \text{ head}} = 6.86 \text{ cents per day}$$

This method gives a close approximation of yardage costs on a per day basis. A small error in calculating the daily cost will not affect the decision model for a feedlot a great deal. Figure 12 in the Appendix has this difference plotted for three different per day yardage costs.

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[1] The straight-line method is the best for calculation because the cost per day on feed figure will remain constant over time. Other methods would necessitate recalculation each year.

SUMMARY AND CONCLUSION

A feedlot owner makes many decisions in his business. One of the most important comes at the very beginning of the feeding period. This is the question of which sex of cattle should be fed in his lot. A rational manager in the cattle feeding business must stress minimization. A major cost in a feeding program is the feeder stock. Steers sell at a higher price per cwt. than do heifers, both as feeders and as finished animals. The spread in price is higher per cwt. for feeder cattle, however. Steer carcasses also sell for a higher price per pound than heifer carcasses.

Steers gain faster and more economically than heifers do. Steers, however, must be fed from 40 to 60 days longer in order to reach the quality standards of the choice grade. The steers, then, will reach the market at a heavier weight both as fat cattle and carcasses. This study was concerned with the prices and price spreads of the two sexes. A graphical decision model was derived which will aid any given feedlot operation in making the decision of which sex would return more profit. This model plots the break-even prices and price spreads of feeder steers and feeder heifers. The prevalent market prices of feeder cattle on any given day can be read into the model, and a decision made as to which sex is most profitable to that feeding operation.

Each individual feedlot will have to invest a few hours toward record keeping and simple calculations in order to make the decision model fit that lot. No two lots have exactly the same set of variables affecting the decision of whether

steers or heifers are the most profitable sex. Differences in management, cattle types, rations, facilities, and climate affect the slope and position of the break-even line on the graphical model.

A decision model concerned with the pricing of feeder cattle will help maximize profits for a feedlot owner and give him a more realistic insight of livestock prices.

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APPENDIX

Table 13. Weekly averages for selling prices of finished steers and heifers from Ogden Market News, January 4, 1968 - September 27, 1971

Week ending	Direct	
	Choice steer	Choice heifer
Jan. 4, 1968	$24.75	$25.00
11	25.50	25.00
18	25.75	25.25
25	25.75	25.25
Feb. 1	25.75	25.25
8	25.50	25.25
15	25.25	25.25
21	25.25	25.50
29	26.25	25.50
Mar. 7	26.50	25.50
14	26.50	25.50
21	26.50	25.75
28	26.50	25.75
Apr. 4	26.25	26.00
11	26.25	26.00
18	26.50	25.75
25	26.50	26.25
May 2	26.50	26.25
9	26.25	26.00
16	26.75	25.75
23	26.75	25.75
31	26.75	25.75
June 6	26.75	25.76
13	27.00	25.50
20	27.25	25.75
27	27.75	26.75
July 3	27.75	25.50
11	27.75	25.25
18	27.75	25.25
25	27.50	25.25
Aug. 1	27.25	25.25
8	27.25	25.25
15	27.00	25.25
22	26.75	25.25
29	26.75	25.25

Table 13. (Continued)

Week ending	Direct	
	Choice steer	Choice heifer
Sept. 5	$26.75	$25.50
12	26.75	25.75
19	26.75	25.75
26	26.75	26.25
Oct. 3	26.50	26.00
10	26.25	26.25
17	26.25	26.00
24	26.25	25.75
31	26.25	25.75
Nov. 7	26.25	25.25
14	26.25	25.25
21	26.50	25.25
27	27.25	25.50
Dec. 5	27.00	25.75
12	27.25	25.75
19	27.25	26.25
26	27.25	26.00
Jan. 2, 1969	27.25	26.25
9	27.25	26.00
16	27.25	25.75
23	26.25	25.75
30	27.25	25.75
Feb. 6	27.50	26.00
13	27.75	26.00
20	27.75	26.00
27	28.00	26.25
Mar. 6	28.50	26.50
13	27.75	26.75
20	29.50	27.50
27	30.25	27.50
Apr. 3	30.25	28.00
10	30.50	28.25
17	30.50	28.25
24	29.75	28.50
May 1	30.75	28.50
8	31.50	29.00
15	33.00	30.25
22	33.50	31.25
29	34.50	32.00

Table 13. (Continued)

Week ending	Direct	
	Choice steer	Choice heifer
June 5	$34.75	$32.75
12	34.25	34.25
19	35.00	32.50
26	34.00	32.75
July 2	34.00	31.50
10	32.75	31.75
17	31.50	30.50
24	30.00	29.50
31	29.50	28.50
Aug. 7	29.75	28.50
14	29.50	27.75
21	29.00	27.50
28	28.50	27.00
Sept. 4	28.50	26.75
11	28.25	31.25
18	27.75	36.25
25	27.50	26.25
Oct. 2	27.25	25.50
9	27.00	24.50
16	26.75	25.75
23	26.50	26.00
30	27.00	26.00
Nov. 6	27.00	26.25
13	27.50	26.50
20	27.25	26.50
27	27.00	26.50
Dec. 4	28.25	27.25
11	29.00	27.75
18	28.50	27.75
31	28.50	27.75
Jan. 16, 1970	29.25	27.75
23	28.50	27.75
30	28.00	27.25
Feb. 6	28.00	27.25
13	29.00	27.50
20	29.00	27.75
27	29.50	28.25

Table 13. (Continued)

Week ending	Direct	
	Choice steer	Choice heifer
Mar. 6	$30.25	$29.25
13	31.75	30.00
20	32.00	30.00
27	32.75	30.50
Apr. 3	32.75	not given
10	31.25	30.00
24	29.50	28.75
May 1	29.25	28.50
8	29.00	28.50
15	29.50	28.50
22	30.00	29.00
28	30.25	29.25
June 5	30.75	29.50
19	31.50	30.50
26	31.75	30.50
July 2	32.25	31.00
10	32.00	30.50
17	31.75	30.50
24	32.00	31.00
31	31.75	29.75
Aug. 7	29.50	28.50
14	29.25	28.50
21	29.25	28.25
28	29.00	28.25
Sept. 4	29.25	27.75
11	29.00	27.75
18	29.25	28.00
25	29.00	28.00
Oct. 2	29.25	28.00
9	28.75	27.75
16	28.75	28.00
23	28.75	27.50
30	28.75	27.25
Nov. 6	28.00	27.25
13	27.75	26.50
20	27.50	26.50
27	28.00	26.50
Dec. 4	27.50	26.50
11	27.00	26.50
21	27.50	26.75
31	28.25	26.75

Table 13. (Continued)

Week ending	Direct	
	Choice steer	Choice heifer
Jan. 8, 1971	$28.25	$27.25
15	28.75	27.75
22	29.75	28.50
29	30.50	29.00
Feb. 5	31.00	30.00
12	32.50	30.50
19	32.75	30.75
26	32.00	30.50
Mar. 5	31.25	30.75
12	31.50	30.25
19	31.75	30.25
26	31.75	30.25
Apr. 2	31.50	30.25
9	32.50	30.75
15	33.00	31.50
23	33.00	31.25
30	33.00	32.75
May 7	33.00	32.50
14	33.25	32.50
21	33.25	31.50
28	33.00	32.50
June 4	33.00	31.25
11	33.00	31.25
18	32.50	31.25
25	32.50	31.00
July 2	32.00	30.50
9	32.25	30.50
16	32.25	30.50
23	32.25	30.50
Aug. 6	32.50	30.50
13	32.75	31.00
27	32.75	31.00
Sept. 3	32.25	30.25
10	32.50	30.50
17	32.25	30.25

Table 14. Price differentials for choice feeder steers and heifers, Omaha prices, 1969

Month	Prices of feeder cattle ($ per cwt.)		
	550-750 lb. steers	500-700 heifers	Differences
Jan.	$28.75	$25.60	$3.15
Feb.	29.00	25.62	3.38
Mar.	30.00	26.44	3.56
Apr.	31.65	27.95	3.70
May	34.25	29.31	4.94
June	35.38	30.72	4.66
July	34.50	30.20	4.30
Aug.	33.50	29.25	4.25
Sept.	33.50	29.25	4.25
Oct.	33.20	29.25	3.95
Nov.	32.50	29.25	3.25
Dec.	32.90	29.65	3.25

Source: Livestock and Meat Statistics, USDA, July 1970.

Table 15. Price differentials for choice slaughter steers and heifers, Omaha prices, 1969

Month	Prices of slaughter cattle ($ per cwt.)		
	900-1100 lb. steers	900-1100 lb. heifers	Differences
Jan.	$27.74	$26.97	$ .77
Feb.	27.50	26.52	.98
Mar.	28.81	27.77	1.04
April	30.14	29.14	1.00
May	32.79	31.84	.95
June	33.63	32.80	.83
July	31.29	30.89	.40
Aug.	30.04	28.96	1.08
Sept.	28.66	27.46	1.20
Oct.	27.60	26.54	1.06
Nov.	27.44	26.54	.90
Dec.	27.73	26.97	.76

Source: Livestock and Meat Statistics, USDA, July 1970.

Table 16. Price differentials for choice steer and heifer carcasses, Omaha prices, 1969

Month	Price of beef carcasses ($ per cwt.)		
	600-700 lb. steer	600-700 lb. heifer	Differences
Jan.	$45.28	$44.24	$1.04
Feb.	44.45	43.56	.89
Mar.	46.46	45.26	1.20
Apr.	48.07	47.49	.58
May	52.71	51.58	1.13
June	53.37	52.58	.79
July	50.07	48.99	1.08
Aug.	47.78	46.36	1.42
Sept.	45.76	44.40	1.36
Oct.	43.97	42.44	1.43
Nov.	43.61	42.30	1.31
Dec.	44.41	43.28	1.13

Source: Livestock and Meat Statistics, USDA, July 1970.

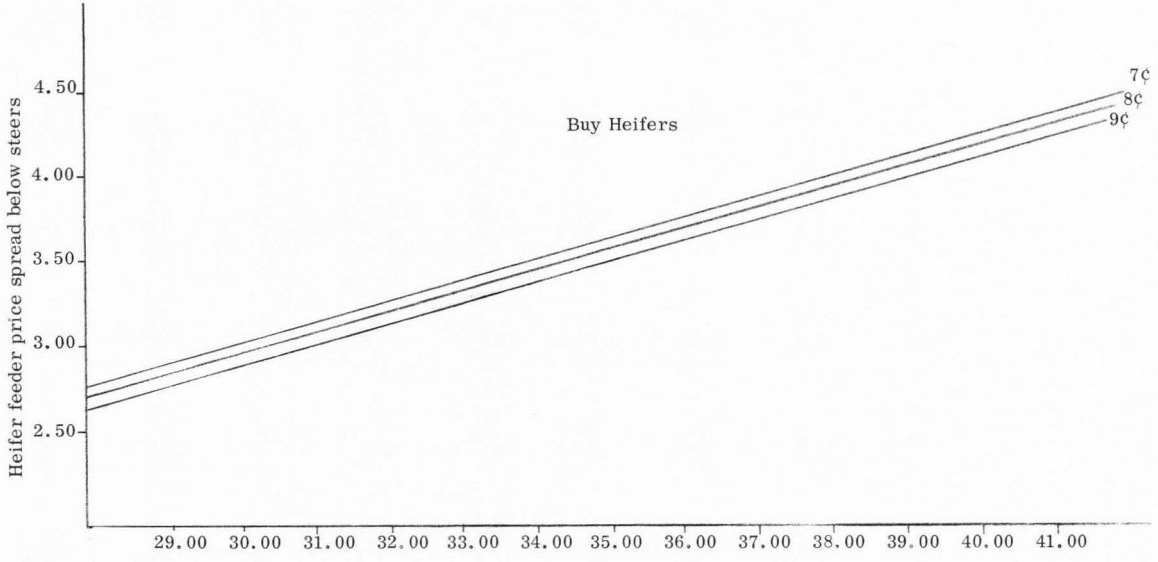

Figure 12. Graphical effect of using different "per day" yardage charges on study cattle.