SCALE ECONOMIES AND RETURNS IN COMMERCIAL CATTLE FEEDLOTS

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CHAPTER I

INTRODUCTION

The growth of commercial dry-lot cattle feeding in the United States is having a substantial impact upon each phase of beef production and marketing. Established patterns and production practices are changing. Location of slaughter cattle production, location and nature of processing facilities, feeder cattle movement patterns, seasonality of feedlot placements and marketings, financial and feed requirements, types and qualities of feeder cattle produced, and management practices have been affected in many areas. Impacts of these adjustments have also been evident at the retail and consumer levels. These effects, among others, have led to widespread interest in cattle feeding.

Problem Statement

Oklahoma has been a leading national source of feeder cattle. More than 900,000 head were produced in 1962 of which most were shipped to the Corn Belt and other leading cattle feeding areas for fattening.[1] At the same time, a relatively high percentage of the fed beef consumption

[1]Marketings of cattle and calves (1,729,000) minus inshipments to farms and ranches (453,000) minus total slaughter (437,000) equal estimated feeder marketings (909,000).

in Oklahoma was imported in carcass form from the North Central Region.[2] This fact, together with evidence of abundance with respect to both feeder cattle and feed grain in Oklahoma, has stimulated inquiries concerning possibilities and potentials of the cattle-feeding industry in Oklahoma. It has been suggested that markets for fed beef produced in Oklahoma could be successfully expanded to include areas south and east of the state.[3]

This study is directed toward estimates of costs and revenues associated with feedlot production and marketing under prevailing Oklahoma conditions. Interest is focused primarily upon cost savings associated with feedlot size, referred to as "economies of scale." Other factors examined for their influence upon cost and revenue include variations in volume or extent to which fixed facilities are utilized, length of feeding period, sex and weight of feeder animals, types of feeding systems, feed cost, feeder cattle cost, and others. The cost of feeding cattle in a custom feedlot is contrasted with the cost of feeding in a lot under control of the cattle owner.

Within specified limitations, the study provides Oklahoma feedlot producers with guides to least cost, and in some cases, most profitable sizes and types of cattle feeding operations. Costs and efficiency in

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[2]Willard F. Williams, Marketing Potentials for Feedlot Cattle in Oklahoma and Texas, Oklahoma State University Experiment Station, Processed Series P-426 (Stillwater, 1962), p. 20.

[3]John W. Malone, "A Spatial Equilibrium Analysis of the Fed Beef Economy" (unpublished Ph.D. dissertation, Oklahoma State University, 1963), p. 106.

feedlot production and marketing are critical factors which to a large extent will determine Oklahoma's future role in the nation's cattle-feeding industry. Although earlier studies have indicated that Oklahoma is favorably located with respect to deficit markets in the South and Southeast, locational advantages could be offset by differentially higher costs of production or marketing. On the other hand, significantly lower costs of production or marketing in Oklahoma relative to other surplus regions could offset locational disadvantages in deficit markets such as California.[4]

Objectives

Specific objectives of the study are to: (1) describe the historical development of the Oklahoma cattle feeding industry relative to other cattle feeding regions; (2) determine and describe systems, patterns, and practices currently employed by Oklahoma feedlot operations in procuring feeder cattle and feed, operating feedlots, and in marketing fed cattle; (3) synthesize models of relatively efficient commercial feedlot operations and determine both short-run cost relationships and long-run planning curves with emphasis upon economies of scale;[5] (4) estimate breakeven prices as influenced by volume, scale, feeding systems, length of feeding period, feeder cattle cost, and other factors; and (5) estimate revenue functions and cost-revenue

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[4]Ibid., p. 115.

[5]Commercial feedlots and other terms are defined in a later section.

relationships as influenced by these variables. The first two objectives of this study were completed and published as Oklahoma Agricultural Experiment Station publications.[6]

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[6]Willard F. Williams and James McDowell, Characteristics and Growth of Cattle Feedlot Operations In Oklahoma, Oklahoma Agricultural Experiment Station Processed Series P-418 (Stillwater, 1962); and James McDowell and Willard F. Williams, Feed Use In Oklahoma Commercial Feedlots, Oklahoma Agricultural Experiment Station Processed Series P-433 (Stillwater, 1962).

CHAPTER II

THEORETICAL CONSIDERATIONS AND REVIEW OF LITERATURE

Costs usually are considered in terms of a money outlay for productive resources or services used to produce and market a product. Leftwich points out that such a concept of cost is not complete--that alternative costs and implicit costs also must be considered.[1] Alternative costs of productive resources are their values in alternative uses whereas implicit costs are costs of self-employed resources such as a return on fixed investment or a return to farm labor or management. In many cases, such implicit costs are not considered as cost outlays and frequently are overlooked entirely.

The appropriate or applicable theoretical structure necessary to an analysis such as this study of cattle-feeding costs and returns is accepted production economics and corresponding cost theory as presented by Carlson,[2] Heady,[3] and Liebhafsky,[4] among others. At least seven cost concepts are outlined for use in economic analysis by these authors.

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[1] Richard H. Leftwich, The Price System and Resource Allocation (New York, 1958), p. 132.

[2] Sune Carlson, A Study on the Pure Theory of Production (London, 1939).

[3] Earl O. Heady, Economics of Agricultural Production and Resource Use (Englewood Cliffs, 1952).

[4] H. H. Liebhafsky, The Nature of Price Theory (Homewood, 1963).

These are: total cost, total variable cost, total fixed cost, average total cost, average variable cost, average fixed cost, and marginal cost. The length of the planning period, or "length of run," is important in differentiating these categories. In the long-run all costs involve money outlays varying with the level of output; whereas fixed costs have meaning only in the short-run period in which fixed resource components are committed to the production process.

Mathematical Interpretations

Table I summarizes the mathematical forms of these cost and revenue functions under the simplifying assumption of two resources used to produce a given product. The table is general and shows the form these concepts take under any competitive situation, and for short and long-run situations.

Total cost in the short-run with one resource, (Y), fixed is designated $f(x)X + P_yY$. In this case, the price of the resource, $f(x)$, may vary with the quantity of resource used, X. In a purely competitive situation, the price of resource X would be fixed at P_x for any quantity of the resource the firm prefers to use. Thus, total variable cost is designated $f(x)X$ or P_xX, depending upon the level of competition prevailing in the resource market, and $f(x)X$ equals P_xX under purely competitive conditions. Total fixed cost is the price of the fixed resource, P_y, multiplied by the quantity employed, Y. If Q is output, then $\frac{f(x)X}{Q}$ is average variable cost, and $\frac{P_yY}{Q}$ is average fixed cost. The sum of these two, $\frac{f(x)X + P_yY}{Q}$, is average total cost. Marginal cost

TABLE I

MATHEMATICAL INTERPRETATION OF COST AND REVENUE CONCEPTS UNDER SIMPLIFYING ASSUMPTIONS[a]

Concept	Length of Run: Short-Run	Long-Run
Total cost	$f(x)X + P_yY$	$f(x)X + f(y)Y$
Total fixed cost	P_yY	None
Total variable cost	$f(x)X$	$f(x)X + f(y)Y$
Average total unit cost	$\frac{f(x)X + P_yY}{Q}$	$\frac{f(x)X + f(y)Y}{Q}$
Average fixed unit cost	$\frac{P_yY}{Q}$	None
Average variable unit cost	$\frac{f(x)X}{Q}$	$\frac{f(x)X + f(y)Y}{Q}$
Marginal cost	$\frac{df(x)X + P_yY}{dQ} = f(x)\frac{dX}{dQ} + X\frac{df(x)}{dQ} + 0$	$\frac{df(x)X + f(y)Y}{dQ} = f(x)\frac{dX}{dQ} + X\frac{df(x)}{dQ} + f(y)\frac{dY}{dQ} + Y\frac{df(y)}{dQ}$
Total revenue	$f(q)Q$	$f(q)Q$
Average revenue	$\frac{f(q)Q}{Q} = f(q)$	$\frac{f(q)Q}{Q} = f(q)$
Marginal revenue	$\frac{df(q)Q}{dQ} = f(q)\frac{dQ}{dQ} + Q\frac{df(q)}{dQ}$	$\frac{df(q)Q}{dQ} = f(q)\frac{dQ}{dQ} + Q\frac{df(q)}{dQ}$
Profit maximization condition	$f(q) + Q\frac{df(q)}{dQ} = f(x)\frac{dX}{dQ} + X\frac{df(x)}{dQ}$	$f(q) + Q\frac{df(Q)}{dQ} = f(x)\frac{dX}{dQ} + X\frac{df(x)}{dQ} + f(y)\frac{dY}{dQ} + Y\frac{df(y)}{dQ}$

[a]The assumptions are: (1) $Q = f(X/Y)$ is the short-run production function, (2) $Q = f(X,Y)$ is the long-run production function, (3) $P_x = f(x)$ is the factor demand for X, (4) $P_y = f(y)$ is the factor demand for Y, (5) $P_q = f(Q)$ is the product demand, and (6) $\frac{\partial Y}{\partial X} = 0$, or the factors are independent.

is the first derivative of total cost or total variable cost.[5] Under imperfect competition this becomes $f(x)\frac{dX}{dQ} + X\,\frac{df(x)}{dQ}$ with the latter half of the formula reducing to zero under perfect competition since f(x) is a constant, P_x.

Mathematical interpretations of long-run cost concepts are similar to short-run interpretations except that quantity and price of the second rexource, Y, are allowed to vary. Thus, total cost and total variable cost are identical, and designated f(x)X + f(y)Y.

The revenue concepts are identical in both long and short-run time periods. Total revenue is designated f(q)Q, while average revenue reduces to product price, f(q). In the purely competitive market, product price is constant at P_q for any quantity the firm desires to sell. Marginal revenue is the first derivative of total revenue with respect to output. This is designated $f(q) = Q\,\frac{df(q)}{dQ}$, with this latter half reducing to zero under perfectly competitive competition since product price is a constant P_q.

Relationship of Cost and Revenue to Production Function

Outlays for productive resources or services, and revenues accruing from the sale of the resulting product are directly related to the laws of production if factor costs and product prices are given. In Table I, for instance, the short-run production function is designated Q = f(X/Y). Assuming a purely competitive situation the price of the

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[5] The derivative of total cost equals the derivative of total variable cost because the derivative of a constant (total fixed cost) equals zero.

variable resource would be given as P_x. If the production function is of the traditional textbook form, it could be written specifically as $Q = a + bX + cX^2 - dX^3$.[6] In this case, average product, $\frac{Q}{X}$, would be $\frac{a}{X} + b + cX - dX^2$, and marginal product would be $b + 2cX - 3dX^2$. Total variable cost equals P_xX, which divided by output, Q, equals average variable unit cost. Thus, average variable cost may be written as

$$\frac{P_xX}{a + bX + cX^2\ 2\ dX^3},$$

which may be restated as

$$\frac{X}{a + bX + cX^2 - dX^3}\, P_x.$$

But

$$\frac{X}{a + bX + cX^2 - dX^3}$$

may be written as

$$\frac{1}{\frac{a + bX + cX^2 - dX^3}{X}},$$

or

$$\frac{1}{\frac{a}{x} + b + c - dX^2},$$

which is the reciprocal of average product. Thus, the relationship between the production function and the cost function is that the reciprocal of average product multiplied by variable factor price equals average variable unit cost. Similarly, marginal cost equals the reciprocal of marginal product multiplied by variable factor price.

Total value product or total revenue takes the exact form of the production function when shown as a function of the level of inputs if

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[6]There is no reason to assume this type of production function. Any type of production function can be used to demonstrate the basic principles.

product price is given. Total revenue is a straight line function if taken as a function of output and if product price is not influenced by the firm's output. In purely competitive conditions, marginal revenue equals product price for all levels of output.

Short-Run and Long-Run Considerations

It is important to differentiate between cost savings associated with more efficient use of fixed short-run facilities and cost savings associated with changing scale. The former may be referred to as "utilization economies" and the latter as "economies of scale."

In the short-run, the firm has established a fixed plant capable of producing a range of output when combined with various levels of the variable input factors. The equilibrium quantity of output forthcoming from the fixed plant depends upon product and resource prices prevailing.

Capacity of a plant is a confusing and sometimes meaningless concept.[7] Absolute capacity, in physical terms, is the maximum quantity of product the plant could produce under any circumstances. Beyond this point, additional units of variable factors add nothing to total product while costs continue to rise. According to Liebhafsky, economic capacity has a different meaning from absolute capacity and refers to "...the least cost point, the point at which the marginal cost curve cuts the average cost curve from below."[8] Eitman argues that if plants

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[7]In July, 1962, the Subcommittee on Economic Statistics of the Joint Committee of the Congress recommended that the Bureau of the Budget fromulate acceptable standards and definitions of capacity.

[8]Liebhafsky, p. 164.

were designed according to specific engineering requirements, the absolute capacity of the plant should be near the minimum average total unit cost position.[9] If such is the case, a cost saving may be associated with using a small plant at capacity output rather than a larger plant utilized to obtain the same output. Eitman's definition of capacity is used in this study although allowances are made for variations in feeding patterns.[10]

In the long-run time period, all resources are considered variable and the firm can build and operate a plant of any feasible size. Thus, the long-run situation may be shown as a series of short-run situations confronting the firm, each of which involves a fixed set of facilities or plant capable of producing a given range of output. As these situations become more numerous the planning curve or long-run average unit cost curve is formed and takes on a scalloped shape. When the number of short-run alternatives becomes infinite, a smooth curve develops. The point of long-run economic capacity is defined by Liebhafsky as "the point at which the 'optimum' amounts of the inputs are being used in the 'optimum' proportions."[11] This, of course, refers to the low point on the planning curves.

Figure 1 shows a typical long-run average unit cost curve, showing both economies and diseconomies of scale. The long-run planning curve

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[9]Wilford J. Eitman, "Factors Determining the Location of the Least Cost Point," <u>American Economic Review</u>, XXXVII (1947), p. 913.

[10]For greater detail on the definition of capacity used in this study, refer to Chapter IV and the section dealing with selection and definition of model feedlots.

[11]Liebhafsky, p. 184.

is formed by tangencies with short-run cost curves at minimum cost points for particular quantities of output and takes on a scalloped shape when only a few short-run situations are considered. When the number of short-run situations is infinite, the planning function forms a smooth curve.

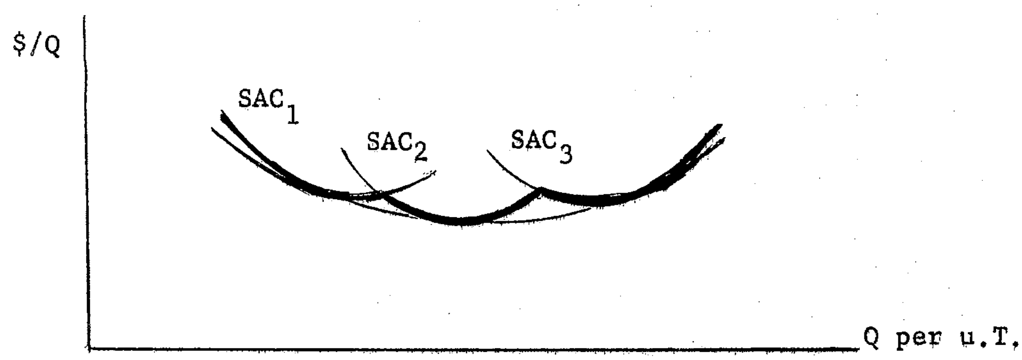

Figure 1. Typical Long-Run Average Cost Curve.

A declining long-run average cost function is associated with economies of scale. Internal economies of scale come about internally within the firm as a result of action taken by the firm. Division of labor and specialization are common internal economies made possible by the use of larger machines. Pecuniary internal economies also occur as the firm becomes large enough to obtain price discounts on resources. Other factors over which the firm has no control result in external economies of scale. Such items as improved transportation facilities, commercial bookkeeping firms, and other cost reductions result from the combined effect of a number of firms, each of which by itself could not have brought about these developments.

An increasing long-run planning curve reflects diseconomies of scale. Internal diseconomies, for which the firm alone is responsible, refer to such items as limited management efficiency, factor interactions, or in some cases, resource price increases. This latter would occur when a firm needed large quantities of a resource and would bid up the resource price to procure the quantities required. External diseconomies, over which the firm has no control, are largely pecuniary and brought about through increased demand for a resource by many firms.

Review of Literature

Pioneering research dealing with economies of scale was conducted by R. G. Bressler, Jr. in the New England milk industry.[12] Since then, similar studies have been made of almost all agricultural products and of several other major industries.[13] However, early researchers failed to apply production theory correctly to cost analysis. These failures have been listed as (1) neglect of the fact that total output could be varied by varying the time period as well as the production rate; (2) adoption of a single stage plant model, whereas operations at most plants consist of a series of stages each having different cost components; (3) nonrecognition of indivisibility of certain variable factors; and (4) failure to take account of the durable nature of fixed

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[12] R. G. Bressler, Jr., <u>Economies of Scale in the Operations of Country Milk Plants</u>, New England Research Council on Marketing and Food Supply in cooperation with the New England Agricultural Experiment Stations and the U. S. Department of Agriculture (Storrs, 1942).

[13] John Johnston, Statistical Cost Analysis (New York, 1960), pp. 12 and 139-141.

factors.[14] Adjustments to these failures included the division of a plant into individual production elements, the recognition of discontinuous cost functions, and allowing the output to vary by increasing the number of eight hour work days rather than the scale of plant.

Economies of scale studies of cattle feedlot operations have been conducted by several state experiment stations, and by the U. S. Department of Agriculture as well as other organizations. One of the first studies to be devoted to such operations was prepared by the Bank of America to measure the contribution of cattle feeding to the growth of the California economy.[15] In this study, daily nonfeed costs were found to vary inversely with the number of head fed, averaging 13.02 cents per head per day for lots feeding an average 866 head per year to 8.02 cents per head per day for lots feeding an average 26,866 head per year. The importance of utilization was also pointed out. Lots feeding throughout the year averaged 8.52 cents daily nonfeed cost per head whereas those feeding only one lot per year averaged 11.13 cents.

A similar study by the Arizona Experiment Station measured average nonfeed costs in terms of tons of feed utilized.[16] Conclusions were much the same as those cited in the Bank of America study. However, it was noted that, excluding small feedlots, unit costs were affected more

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[14] Ben C. French, "Economic Efficiency in California Pear Packing Plants" (unpublished Ph.D. dissertation, University of California, 1954), pp. 20-21.

[15] John A. Hopkin, Cattle Feeding in California, Bank of America Economics Department (San Francisco, 1957).

[16] Leo J. Moran, Nonfeed Costs of Arizona Cattle Feeding, University of Arizona Agricultural Experiment Station Technical Bulletin 138 (Tucson, 1959).

by utilization of fixed facilities than by size or scale of feedlot. In this study, average nonfeed expenses per ton of feed fed varied from $18.30 for smaller lots feeding less than 500 tons of feed to $5.56 for larger lots feeding 12,500 tons or more feed. Costs associated with an increased investment use ratio varied from $20.13 per ton of feed fed for 14 lots with an investment use ratio of under 25 to $4.26 for eight lots with an investment use ratio of 100 and up.[17]

A cost study of commercial feedlots by the U. S. Department of Agriculture was conducted in 1962 for purposes of designing improved feedlot layouts.[18] Although confined to silage feeding operations, this study provides useful input coefficients for cattle feeding in terms of man and machine hours necessary for production. In this study it was determined that the cost of performing feedlot operations in an improved layout decreased from $4.17 per head in a 1,000 head lot to $2.29 per head in a 10,000 head lot. This report indicated that some operations, such as loading cattle and cleaning pens, actually required more man and machine hours per head as a feedlot size increased, but that economies in other operations more than offset these diseconomies.

A more recent California Experiment Station study dealt primarily with economies associated with size or scale of commercial feedlots.[19]

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[17] In this study, the investment use ratio was specifically defined as tons of feed fed per $1,000 nonland investment.

[18] Tarvin F. Webb, Improved Methods and Facilities for Commercial Cattle Feedlots, U. S. Department of Agriculture Marketing Research Report Number 517 (Washington, 1962).

[19] Gordon A. King, Economies of Scale in Large Commercial Feedlots, Californai Agricultural Experiment Station Giannini Foundation of Agricultural Economics Research Report Number 251 (Berkeley, 1962).

A variety of models were synthesized in this study using economic-engineering techniques. Specific cost functions were developed for items such as labor, electricity, water, equipment repair, and telephone. Costs at maximum output in this study declined from 7.19 cents per head per day for a feedlot capacity of 3,760 head to 5.57 cents per head per day for a feedlot capacity of 22,560 head. The data indicated that few economies of scale were achieved beyond a feedlot capacity of about 7,520 head.

Economies of scale among small farmer-feeding operations have also been conducted. One such study by the Oklahoma Experiment Station covered economies accruing to different methods of feed handling for as many as 2,000 head of cattle annually.[20] This study indicated that feedlots with volumes greater than 200 head per year or feeding more than 112 tons of feed with custom processing rates at $3.00 per ton, could profitably invest in small mixer feed mill facilities. Also, larger feedlots feeding more than 450 head annually or utilizing more than 316 tons of feed, could obtain least-cost processing with grinder-blender equipment. Indications were that costs of gain associated with feed processing and handling were reduced from four cents per pound when 100 head of cattle were fed to one and one-half cents per pound when 2,000 head were finished to a slaughter weight.

Another study of small-volume feedlots conducted by the Montana Experiment Station concluded that sources of minor economies were

[20] Reece Edward Brown, Jr., "Economics of Mechanization in Feeding Beef Cattle" (unpublished M.S. thesis, Oklahoma State University, 1962).

available to farm feedlots of that state.[21] These economies appeared with increased utilization of existing facilities and when minor equipment additions, such as dry-roller processing facilities, were introduced.

A limited survey of the Oklahoma cattle-feeding industry was conducted by the Statistical Reporting Service of USDA and Oklahoma State Board of Agriculture cooperatively in 1957.[22] This study pointed out the important cattle feeding areas of the state, the source of the cattle on feed, where the cattle were sold, the slaughter grades, and the relative sizes of the different operations as they existed in Oklahoma during 1957. Indications were that slightly more than 2,500 Oklahoma farmers and ranchers produced grain-fed cattle for slaughter, and that a large part of this volume was concentrated in the few large lots within the state.

Numerous other descriptive studies and reports budgeting costs and returns for various feedlot sizes have been published. Two Texas Agricultural Experiment Station studies include findings applicable to Oklahoma cattle-feeding conditions. One of these contained costs and

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[21]Robert G. Mueller, "The Effects of Costs and Returns of Varying Size and Organization of Farm Feedlots in Montana" (unpublished M.S. thesis, Montana State College, 1962).

[22]Ronald J. Sharp, The Cattle Feeding Industry in Oklahoma, U. S. Department of Agriculture--Agricultural Marketing Service and Oklahoma State Board of Agriculture cooperating (Oklahoma City, 1958).

returns information for feedlots of 100 and 500 head capacity.[23] The other also provided costs and returns information, but in addition, included data on labor-management income as related to marketing margins and feed prices.[24] Objectives of both publications were to determine opportunities for, and farm income effects of marketing grain sorghum through feeder cattle. A major conclusion derived from the models studied was that at prices which prevailed during the fall of 1956 and spring of 1957, and as a way to market grain sorghum, cattle feeding was profitable. It was determined profitable to feed a high concentrate ration with a positive two cent-per-pound differential between the price of slaughter cattle and feeder cattle where a $2.00 price per hundredweight was placed on grain sorghum. A lower price margin was profitable when grain sorghum was valued at $1.25 per hundredweight. It was noted that a 25 cent-per-hundredweight increase in grain sorghum price increased the cost per pound of gain by 1.57 cents, and necessitated an increase in slaughter price of 0.7 cents to breakeven. Labor-management returns were greater for a 150 day feeding program than for a 180 day feeding program.

A Kansas Experiment Station study presented basic characteristics of large scale custom feedlots in that state.[25] Such factors as

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[23] A. C. Magee, et al., Economics of Cattle Feeding Systems for West Texas, Texas Agricultural Experiment Station Bulletin 880 (College Station, 1957).

[24] William F. Hughes, et al., Economic Returns from Grain Sorghum Fed to Steer Calves on Dryland Farms of the High Plains, Texas Agricultural Experiment Station MP-295 (College Station, 1958).

[25] John H. McCoy and Robert H. Wuhrman, Some Economic Aspects of Commercial Cattle Feeding in Kansas, Kansas State University Agricultural Experiment Station Bulletin 424 (Manhattan, 1960).

ownership status, procurement of cattle, operational practices, operating costs, disposition of fat cattle, and probable future development of the industry were described. The study noted that feed costs averaged about 90 percent of total variable operating costs at large feedlots.

Other descriptive and cost studies of some aspects of the cattle-feeding business are cited in the Selected Bibliography.

Theoretical Assumptions and Hypotheses

Several specific hypotheses are tested in this study. These are enumerated as follows:

(1) Significant economies of scale exist in the cattle-feeding industry with corresponding higher profits or smaller losses per head fed for large-volume versus small-volume feedlots.

(2) Many of these economies are achieved by a 2,000 head feedlot.

(3) The planning curve, within the range of scale considered, does not increase or show diseconomies of scale.

(4) A sizeable cost reduction is obtained by utilizing feedlot facilities to the fullest extent.

(5) The practice of "upgrading," raising slaughter grade above the equivalent feeder grade, increases feedlot profits or reduces losses.

(6) Operation of a feedlot by the entrepreneur feeding cattle is less costly than placing cattle in a custom feedlot for fattening.

Hypotheses tested in this study were derived from the theoretical framework described in the preceeding section and from conclusions drawn from other studies. The following theoretical assumptions were applied to this analysis:

(1) A purely competitive situation exists in the selling market.

(2) Pecuniary advantages accrue to larger operations with respect to purchases of some inputs.

(3) Each equivalent unit of a resource is of equal potential productivity although some units are utilized more efficiently in large-volume operations.

(4) Indivisibility with respect to some inputs, particularly labor, is present. It is realistically assumed that additional men and machines required are purchased in whole units although such units may remain idle a portion of the time, thereby increasing variable cost per unit of product.

(5) All feedlots are subject to the same production function with respect to feed inputs and operate in Stage II of production.

(6) The principal objective of the feedlot operator is to maximize net revenue or minimize loss annually.

Nutritional and economic logic suggest cattle feedlot production functions of the Cobb-Douglas or quadratic forms when only the feed input is considered.[26] This implies a per-head total cost function

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[26] James S. Plaxico, Paul Andrilenas and L. S. Pope, Economic Analysis of a Concentrate--Roughage Ratio Experiment, Oklahoma State University Agricultural Experiment Station Processed Series P-310 (Stillwater, 1959), p. 26.

increasing at an increasing rate or at a constant percentage rate for an individual animal as the per head liveweight gain is increased. If significant economies of scale exist, as hypothesized, the total per-head cost functions decline as scale is increased. This is shown in Figure 2 where TC_1 represents the hypothetical per head cost of feeding animals in a small lot and TC_2 the per head cost associated with a larger lot.

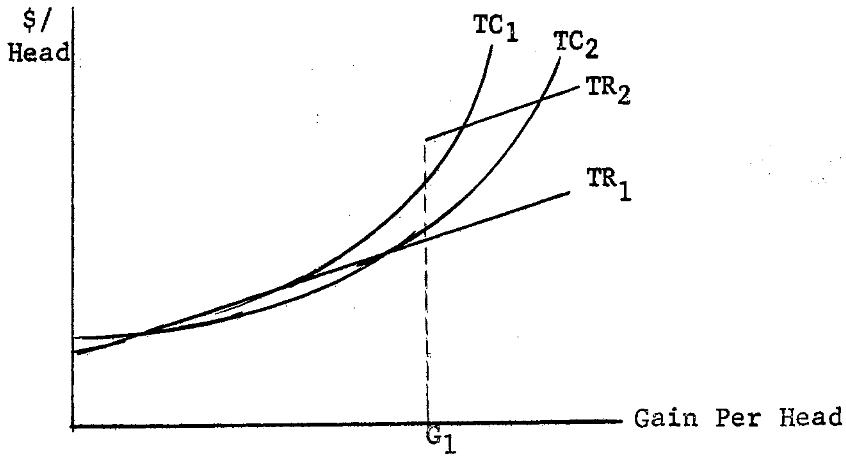

Figure 2. Hypothetical Per Head Revenue and Costs.

The revenue function per pound of gain increases at a constant rate per unit of production if the slaughter prices remain constant for all weights and grades. If, however, the animal changes slaughter grade during the production process, and a higher grade sells at a higher price, the revenue function is discontinuous at this point of upgrading and shifts upward to a higher level. In Figure 2, upgrading, it is assumed, takes place at weight gain G_1.

If a linear increase in total annual feedlot costs with scale is postulated, the equivalent planning curve shows no diseconomies. In this case, long-run marginal cost is constant with the planning curve approaching marginal cost from above as output increases with increasing scale.

Annual total feedlot revenue, net of all costs, is maximized under continuous feeding when the average net revenue per head fed is at a maximum.[27] Faris presents this mathematically as follows:

> Let NR(n) be the net revenue as a function of the length of feeding period. The average net revenue over time, ANR = $\frac{NR}{n}$. This will be maximized at time n_m such that
>
> $$\frac{dANR}{dN} = \frac{1}{n}\frac{dNR}{d_n} - \frac{NR}{n^2} = 0$$
>
> or
>
> $$\frac{dNR}{dn} = \frac{NR}{n} = ANR$$
>
> i.e., when marginal net revenue $\frac{dNR}{dn}$ equals average net revenue.[28]

As feeding is continued beyond this point, the declining additions to net revenue pull down the average net revenue. This reduces annual net revenue, since an increase in the feeding period decreases the number of head it is possible to feed on an annual basis.

When only one batch per year is fed, maximum annual net revenue is reached by feeding for maximum net revenue per head. This is illustrated in Figure 3 where t_1 represents the length of feeding period required for maximum average net revenue and t_2 the time period for maximum net revenue per head, assuming identical per head net revenue functions for all cattle fed during the year.

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[27] Edwin J. Faris, "Analytical Techniques Used in Determining the Optimum Replacement Pattern," Journal of Farm Economics, XLII (1960), p. 755.

[28] Ibid., p. 757.

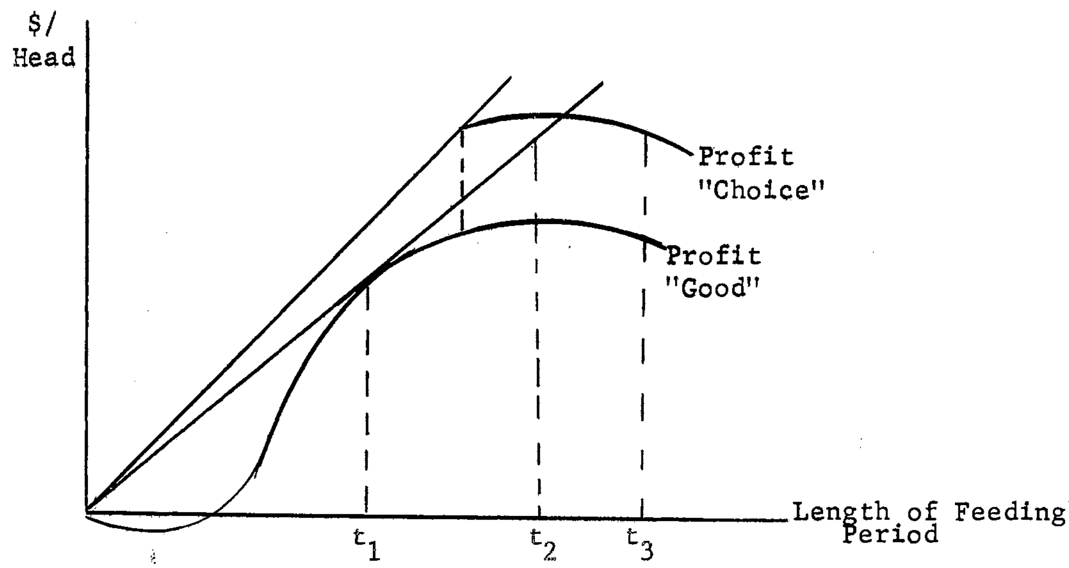

Figure 3. Hypothetical Profit Functions For A Cattle Feeding Situation.

Upgrading is profitable for a continuous operation if maximum average net revenue is increased during the upgrading process. This is assumed to be the case in Figure 3 where upgrading is introduced between t_1 and t_2 days. If, however, the cattle are not upgraded until t_3 days, the upgrading process does not result in a greater average net revenue, although operators feeding only one batch per year increase net revenue by feeding t_3 days.

The turnover rate is implicit in Figure 3 for continuous operations. Because the turnover rate is greater for t_1 length of feeding period than for t_2, more cattle are fed annually. As a result, annual profits are greater for the shorter length of feeding period, t_1.

CHAPTER III

CHARACTERISTICS OF THE OKLAHOMA CATTLE FEEDING INDUSTRY

This chapter presents a brief description of basic characteristics of the Oklahoma cattle feeding industry and some implications of these characteristics to the economies of scale and revenue analysis which follows in later chapters. Emphasis is placed upon information and implications pertaining to industry structure, feeding systems and practices, sources of feed and feeder cattle, and marketing practices employed as criteria and guides for decisions required in the cost study. Facts cited in this description are obtained largely from two published Oklahoma Agricultural Experiment Station reports concerning the Oklahoma cattle feeding industry.[1] These publications were the result of a 1961 survey of the Oklahoma cattle feeding industry conducted by the Oklahoma State University Department of Agricultural Economics. This survey was conducted from a list of 119 feedlots developed with the aid of the Oklahoma Extension Service, the Statistical Reporting Service, feed dealers, and owners of feedlots. Operators of all 10 large lots with capacity for 2,000 head or more were interviewed. In addition, managers of 25 of 31 medium-volume lots and 30 of 65 small-volume lots were queried about feeding facilities and operations.

[1]Williams and McDowell, and McDowell and Williams.

Industry Structure

In the summer of 1961, there were 119 commercial feedlots in Oklahoma (Table II). This compared with 187 operations feeding 94 or more head per operation between August 1956 and July 1957.[2] The decrease in number of feedlots during this period was accounted for by a decrease in the number of small-volume producers. Numbers of large and medium-volume lots increased during this four-year period with approximately 30 percent of the state's feedlots in 1961 being established within the previous year. At least 13 new feedlots have been built since 1961 (Figure 4). Large and medium-volume lots accounted for more than 80 percent of the feedlot capacity in 1961. Although feedlots were widely distributed around the state, the largest concentration in numbers and capacity was in the West, where 51 lots were located. Especially important counties, in terms of volumes marketed, were Texas, Jackson, Canadian, Custer, Alfalfa, Craig, Caddo, and Pontotoc.

Indications were that custom feeding, the practice of feeding cattle for other owners, was becoming more important as 19 of the feedlots followed this practice. These lots charged rates varying from five cents per head per day plus a 15 cent markup on feed over cost per hundredweight to 10 cents per head per day with the identical markup on feed. Many of the newer lots were established as custom operations. The increase in custom operations indicated that many Oklahoma cattle feeders were finding it profitable to have cattle fed on a custom basis rather than owning facilities.

[2] Sharp, p. 12.

TABLE II

COMMERCIAL FEEDLOTS,[a] BY CAPACITY AND LENGTH OF TIME IN OPERATION, OKLAHOMA, SUMMER, 1961

Size	Capacity[b]	Older Operations[c]		New Operations[c]		Total All Operations	
	Head	Number	Percent	Number	Percent	Number	Percent
Small	100-500	55	66.3	23	63.9	78	65.5
Medium	501-2000	20	24.1	11	30.6	31	26.1
Large	2001 and up	8	9.6	2[d]	5.5	10	8.4
Total		83	100.0	36	100.0	119[e]	100.0
Percent Distribution			69.7		30.3		100.0

[a]A commercial feedlot was defined as a confined dry-lot facility with capacity and equipment to feed a minimum of 100 head through a complete feeding period.

[b]Capacity referred to the number of head a feedlot could handle with normal space and facilities requirements through a feeding period.

[c]Length of time in operation referred to how long the feedlot had been operating as a business. Older operations were those in operation prior to April 1, 1960. Newer operations entered the cattle feeding business after April 1, 1960.

[d]One of these marketed no cattle during 1960.

[e]Nineteen of these 119 feedlots specialized in feeding cattle for other owners and were classed as custom operations. Seven of the custom lots were large, ten were medium, and two were small.

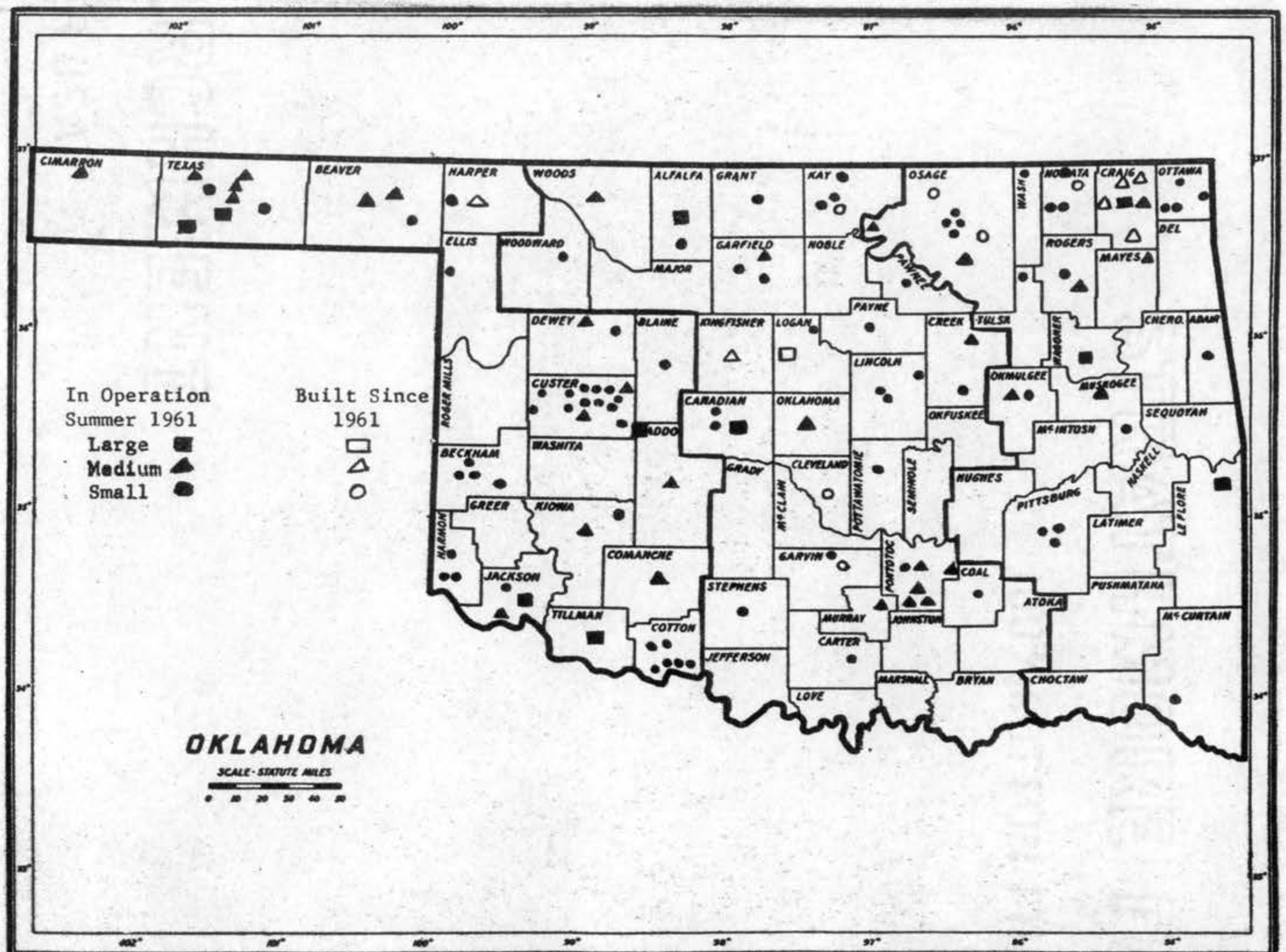

Figure 4. Location of Oklahoma Commercial Feedlots by Size, Summer 1961, and New Additions.

Oklahoma commercial feedlots marketed an estimated 140,551 head of fed cattle in 1960.[3] Large feedlots accounted for nearly 65 percent of these sales, while medium lots fed more than one-fifth, and small lots less than 13 percent. New lots provided only a small portion of the 1960 sales, indicating that a considerable expansion in numbers fed probably would be forthcoming in the future. About 47 percent of the estimated sales were fed in feedlots specializing in custom feeding. Western Oklahoma feedlots accounted for nearly 55 percent of the marketings.

Some feedlots were vertically integrated with the feed industry or the meat packing industry. Seventeen feedlots were either owned or managed by local commercial feed mills and feed dealers with the feed being delivered and distributed at the lot by the commercial mill.[4] Such arrangements eliminated the need for processing and distribution equipment at the lot and increased the use of the existing commercial feed mill facilities. In several cases, commercial feed mills established small feedlots as demonstrations to sell feed and continued these operations on a larger basis when cattle feeding was found to be profitable.

Three Oklahoma feedlots were owned by meat packing concerns, and several packers had cattle fed for them on a custom basis. Such action by meat packers generally was taken to assure a steady supply of the type of cattle desired by the packer when it was needed.

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[3] Williams and McDowell, p. 43.

[4] A commercial feed mill is defined as a feed mill selling processed feed or processing feed for a fee.

Feedlot investment costs in Oklahoma varied widely with the size and type of feedlot, feeding system, amount of equipment, extent of feed mill and storage facilities, and other factors (Table III). These costs serve as a rough guide for synthesization of the various feedlot models presented in Chapter IV. It was apparent that although total investment per head of capacity was greater in the larger feedlots, investment per head of capacity was smaller. Investment costs were considerably smaller for those feedlots having no feed mill, feed storage, and distribution equipment.

Cattle in Oklahoma commercial feedlots consumed nearly 400 million pounds of feed (dry-weight basis) during 1960.[5] This was more than 2,800 pounds per head. Considering all areas and feedlot sizes, the average daily ration per head contained more than 17 pounds of feed grain, nearly four pounds of dry-weight roughage, and two and a half pounds of supplement. However, this consumption of feed represented a relatively small proportion of Oklahoma feed production.[6] Milo, corn, and barley were the most commonly used feed grains, although some oats were used early in the feeding period. Cottonseed hulls and silage were more important roughages than prairie or alfalfa hay. A 32 percent protein supplement containing stilbestrol and other additives was more commonly used than cottonseed oilmeal or other supplements.

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[5]McDowell and Williams, p. 3.

[6]Ibid., p. 5.

TABLE III

AVERAGE INVESTMENT BY SIZE OF FEEDLOT AND TYPE OF FEED MILL AND GRAIN STORAGE CAPACITY, OKLAHOMA, 1960

Feed Mill Situation[a]	Large	Medium	Small	All Feed-lots	Average Capa-city	Invest-ment Per Head
		- Dollars -			Head	Dollars
A. Pushbutton Mill with Full Storage	225,800	83,333	80,000[b]	162,111	3,344	48.48
B. Small Pushbutton with Little Storage	--	38,000[b]	65,000[b]	47,000	700	67.14
C. Grinder-Blender, Some Storage	24,000[b]	17,438	8,933	12,396	496	24.99
Average of Situation A, B, and C	192,167	35,808	16,411	52,708	1,554	33.92
Average of Lots with No Feed Mill or Storage	50,000	23,050	5,864	17,541	1,181	14.85
Average of All Types	144,777	29,683	11,648	37,018	1,206	30.69

[a]A. - This includes output capacity of at least 10 tons of processed feed per hour and adjoining storage capacity of at least 25,000 bushels.

B. - This includes output capacity of less than 10 tons of processed feed per hour and adjoining storage capacity of less than 25,000 bushels.

C. - These feedlots contained small grinder-blender feed mills and some storage capacity.

[b]Less than three feedlots are included in these categories.

Feeding Systems and Facilities

Variety was a distinctive feature of Oklahoma cattle feeding operations. Wide variation in types of feed fed already has been suggested. Differences also were evident in basic types of feeding systems and facilities utilized.

Two general types of commercial feeding systems were found in Oklahoma. The distinguishing characteristic of these systems was the type of roughage utilized--one using silage and the other a dry roughage such as cottonseed hulls, prairie hay, or alfalfa hay. These systems were further distinguished by types of feeding facilities as: (1) completely automated; (2) fenceline bunk or trough; and (3) self-feeders. In terms of number of feedlots, the dry-roughage system prevailed by nearly two to one. The dry-roughage system was even more important in terms of number of head fed, quantity of feed used, and feedlot capacity. Indications were that self-feeding dry-roughage systems were becoming more important, as several of the new feedlots employed this method of feeding. Silage systems were largely confined to irrigated areas.

Feed mill facilities at Oklahoma commercial feedlots ranged from large automatic pushbutton systems with potentials for producing more than 10 tons of processed feed per hour to smaller grinder and roller mills with limited processing capacities (Table III). It was estimated that in 1960 more than two-thirds of the feed grain used by Oklahoma feedlots was processed in facilities located at the feedlot.[7] This was

[7]Ibid., p. 8.

an indication that total feed costs were less if processing facilities were included in the feedlot layout, even though investment was considerably greater.

Large and medium lots tended to utilize feed storage facilities to a greater degree than small lots. Feed storage facilities at these large and medium lots was equivalent to a 60-day supply.[8] In addition, the larger lots utilized considerable quantities of commercial grain storage facilities, indicating that it was profitable to purchase feed grain seasonally and store for future use.

Both trucks and tractor-pulled wagons commonly were used in distributing feed in Oklahoma feedlots. Tractors prevailed where mud was a problem, while trucks generally were used in drier areas. Distribution to self-feeders involved moving the feed via overhead augers or blowers from the truck box, whereas distribution to bunks involved a gravity flow auger system from the truck box. Manure was usually loaded onto dump trucks with a track tractor, although a few lots used small carryalls for this purpose.

Geographic and Market Sources of Feed and Cattle

Geographic and market sources refer to geographic areas and type of market used to obtain feed and feeder cattle. Oklahoma feedlots tended to purchase feed grain locally because it was usually less expensive (Table IV). Large quantities of supplement also were purchased locally, although probably more for convenience than cost. Purchases

[8] Ibid., pp. 9-11.

TABLE IV

GEOGRAPHIC SOURCES[a] OF FEED INPUTS, OKLAHOMA COMMERCIAL FEEDLOTS, 1960 FEEDLOT MARKETING YEAR

Feedstuff	Locally Purchased		Purchased Nonlocally in Oklahoma		Bought Out-of-State	
	1,000 Lbs.	Pct. of Total Use	1,000 Lbs.	Pct. of Total Use	1,000 Lbs.	Pct. of Total Use
Feed grain	170,805.0	59.4	18,456.2	6.4	80,179.0	27.9
Hay	12,508.5	72.3	--	--	200.1	1.2
Cottonseed hulls	8,442.0[b]	34.4	8,772.7	35.8	7,294.7	29.8
Supplement	25,536.3[c]	59.8	9,535.4[d]	22.3	7,646.1[e]	17.9

[a]Local was purchased in Oklahoma within 25 miles of the feedlot and nonlocal was purchased in Oklahoma more than 25 miles from the feedlot.

[b]It was estimated one-fourth of these were obtained at the retail level and three-fourths directly from oil mills.

[c]This includes 22,416.3 thousand pounds purchased from local dealers and 3,120 thousand pounds purchased directly from local commercial feed mills.

[d]This is purchased direct from commercial feed mills in Oklahoma.

[e]This included 7,474.2 thousand pounds obtained directly from commercial feed mills in other states and 171.9 thousand pounds obtained from local dealers in other states.

of cottonseed hulls were largely in bulk form from commercial cottonseed oil mills.

Nearly 30 percent of the feeder cattle placed in Oklahoma feedlots were procured from out-of-state sources.[9] This was a sharp increase over the 1957 level when only 11 percent was obtained from other states.[10] Market sources were about equally divided among other farms and ranches, terminal markets, and auctions, with auctions being slightly more popular. The importance of feedlot operators' own herds as supply sources decreased from 42 percent of the total placements in 1957 to less than five percent in 1960.[11] Large feedlots purchased out-of-state and directly from farmers and ranchers to a greater degree than did other size groupings. Medium lots preferred auctions and terminal markets as a supply source of feeder cattle.

Seasonal purchasing, the practice of buying feed during harvest when prices are traditionally lowest, was common among Oklahoma feedlot operators. The purchase of feed by contract, whereby price and delivery agreements were determined in advance on a written or verbal basis, also was practiced frequently. Contracts for feed grain and cottonseed hulls were usually in terms of a specified price and delivery date. Supplement contracts were similar but the feedlot operator often had the priviledge of paying market price at delivery date if

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[9] Williams and McDowell, p. 25.

[10] Sharp, p. 6.

[11] Williams and McDowell, p. 25.

market price was less than the contract price. In general, large lots, and those in the western portion of the state, purchased relatively greater precentages of feeds seasonally and by contract than did other lots. It was apparent also, that the percentage of seasonal purchases was greatest for feed grains and least for cottonseed hulls, while the percentage of contract purchasing was greatest for supplement and least for feed grains (Table V).

Average feed prices paid by Oklahoma feedlot operators during the 1960 feeding season were similar to those reported by the Statistical Reporting Service.[12] Differences in average procurement price for feed were apparent by size and location of lot. These price differences were significant only for milo, where larger lots paid higher prices than small lots.[13] This was probably related to the fact that large feedlots fed continuously throughout the year, and therefore purchased some feed grain when prices were seasonally high.

Feeding Patterns and Practices

Feeder cattle placements in Oklahoma during 1959-61 were seasonally high in the fourth quarter of the year. However, placement percentages for the first and third quarters were higher for Oklahoma than for most other areas, or the nation generally (Table VI). Oklahoma placements were seasonally low in the second quarter, but the extent in variation

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[12]McDowell and Williams, p. 31.

[13]The average grain sorghum price paid by Oklahoma feedlots during 1960 was \$1.68, \$1.65, and \$1.55 per hundredweight for large, medium, and small lots, respectively.

TABLE V

VOLUME AND PERCENT OF FEED INPUTS PURCHASED SEASONALLY AND BY CONTRACT, OKLAHOMA COMMERCIAL FEEDLOTS, 1960

Feedstuff	Time of Purchase: Seasonal Volume 1,000 Lbs.	Seasonal Volume Pct. of Total	Nonseasonal Volume 1,000 Lbs.	Nonseasonal Volume Pct. of Total
Feed grain	129,025.2	44.8	159,705.8	55.2
Cottonseed hulls	4,863.8	19.8	19,645.6	80.2
Supplement	11,266.0	26.4	31,415.8	73.6
	Basis of Purchase: Contract Volume 1,000 Lbs.	**Contract Volume Pct. of Total**	**Cash Volume 1,000 Lbs.**	**Cash Volume Pct. of Total**
Feed grain	102,806.0	35.7	184,925.1	64.3
Cottonseed hulls	14,696.0	60.0	9,813.4	40.0
Supplement	30,480.0	70.4	12,237.8	28.6

TABLE VI

PERCENTAGE DISTRIBUTIONS OF FEEDER CATTLE PLACEMENTS IN FEEDLOTS BY QUARTERS AND REGION, AVERAGE FOR 1959-61, PRINCIPAL FEEDING AREAS

	Quarter of Year[a]					
	Jan-Mar.	Apr-June	July-Sept.	Oct-Dec.	Total	Highest Quarter Placements Divided by Lowest Quarter
	- Percent -					
Southern						
Plains	18.8	19.1	26.7	35.4	100.0	1.9
Oklahoma	21.3	15.3	25.7	37.7	100.0	2.5
Texas	18.1	20.2	27.0	34.7	100.0	1.9
Northeast	17.5	13.6	22.7	46.2	100.0	3.4
North Central						
Lake States	19.5	10.7	15.6	54.2	100.0	5.1
Central Corn Belt	21.9	13.2	18.6	46.3	100.0	3.5
Northern Plains	23.0	13.7	21.9	41.4	100.0	3.0
Kansas-Missouri	19.3	10.0	28.6	42.1	100.0	4.2
Intermountain West						
Colorado	19.2	22.6	25.3	32.9	100.0	1.7
Arizona and N. Mexico[b]	16.4	22.2	21.9	39.5	100.0	2.4
Other	15.6	11.3	23.3	49.8	100.0	4.4
Pacific						
California	16.5	32.9	25.3	25.3	100.0	2.0
Northwest	20.2	17.3	30.7	31.8	100.0	1.8
United States (26 states)	20.1	16.6	21.8	41.5	100.0	2.5

[a]Underlining indicates the highest percentage in each row.

[b]Average for 1960-61.

Source: Derived from Statistical Reporting Service, U. S. Department of Agriculture, Cattle and Calves on Feed, Quarterly Issues.

from quarter-to-quarter was less than in such areas as the Corn Belt, where farmer-feeders predominated.

Heifers comprised a relatively high percentage of the cattle on feed in Oklahoma during this period. The Statistical Reporting Service indicated that about 42 percent of the cattle fed in Oklahoma during the 1959-61 period were heifers. This was considerably higher than the 25 percent in the Corn Belt and 16 percent in California, but was not as great as the 50 percent reported for Colorado. Heifers were fed in large numbers in the Oklahoma area because they were less expensive than steers of corresponding weights and grades,[14] and because heifers were ready for market at lighter weights more preferable to local meat packers.

Lower quality feeder animals were preferred by Oklahoma feedlot operators for price reasons, although it was estimated by these operators that "Good" and "Choice" feeders accounted for more than 60 percent of the placements in 1960.[15] Cattle placements into these feedlots were relatively light, but suggested several weight groups were being fed. Indications were that the weight distribution for heifers upon arrival at feedlots was bimodal at 500 and 650 pounds, and that the average steer placement weight was 710 pounds.

The two general types of feeding systems were associated with distinctive rations and feeding practices. In both systems, however, it

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[14] This is expounded upon in more detail in Chapter VI.

[15] Williams and McDowell, p. 37.

was a common practice to initiate the feeding period with a "starter" ration containing considerably more roughage than concentrate. Commonly also, the concentrate was gradually increased and the roughage reduced over a period of ten days to several weeks, until the animal was receiving a "finishing" ration relatively high in concentrate and low in roughage. The quantity of supplement usually remained near two pounds throughout the feeding period. Length of time on the "finishing" ration ranged from 90 to 150 days.

Commercial feedlots in Oklahoma used considerably more feed grain than roughage. The average grain-to-roughage ratio in these lots during 1960 was 4.43:1. Large lots averaged nearly five pounds of feed grain per pound of roughage; whereas smaller lots, utilizing roughage produced by the feedlot operator, fed at a ratio of less than three pounds of grain per pound of roughage.

Cattle in Oklahoma feedlots were fed a relatively short period of time. The survey data indicated that in 1960 the average feeding period was 110 days for heifers and 134 days for steers.[16] This contrasted sharply with the Corn Belt and Colorado where cattle frequently were fed in excess of six months.

Despite the relatively large number of lower grading feeder cattle utilized, Oklahoma commercial feedlots reported satisfactory daily gains. Feedlot operators estimated average daily gains usually exceeded two pounds, but a few operators indicated gains in excess of three pounds daily. Averages for steers were consistently greater than for heifers.

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[16] Ibid., p. 53.

Average slaughter weights near 1,070 pounds for steers and 810 pounds for heifers were estimated, with average daily gains of two and two-thirds pounds for steers and slightly more than two and one half pounds for heifers. However, wide variation in selling weights, and a bimodal weight distribution for both sexes, was reported.

Nearly 60 percent of the cattle marketed from Oklahoma feedlots in 1960 were estimated as U. S. Good in slaughter quality, while more than a third were classed as U. S. Choice. The remaining seven percent were sold as "Standard."[17]

Comparison of estimated feeder grades purchased and estimated slaughter grades marketed provided insight into the extent of upgrading achieved during the 1960 season. It was estimated that approximately 81 percent of the low quality "Common and Medium" were upgraded at least one grade. If none of these were further upgraded, about 38 percent of the U. S. Good quality feeders were upgraded to a "Choice" slaughter grade if all "Choice" feeders were sold as "Choice" slaughter animals.[18] Upgrading based on these estimations, provided the basis for hypothesizing a total revenue function as shown in Figure 2.

Substantial changes in market outlets used by Oklahoma cattle feeders have occurred since 1957. In 1960, about two-thirds of the marketings from these lots went directly to meat packers whereas in 1957

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[17] Ibid., p. 55.

[18] These percentages were obtained as follows: 50,124 "Common to Medium" feeders minus 9,439 "Standard" slaughtered yields 40,685 cattle upgraded to "Good" and 40,685 ÷ 50,124 = 81.2 percent. 47,177 "Choice" slaughter animals minus 20,137 "Choice" feeders indicates that 27,040 head of "Good" feeders were upgraded to "Choice" slaughter grade. Since 70,290 head of "Good" feeders were placed, the percentage of upgrading for "Good" feeders was near 38 percent.

only about one-fourth of the state's feedlot production was sold in this manner.[19] Terminal markets received less than 30 percent of the 1960 sales; whereas in 1957 such markets received nearly two-thirds of the feedlot production. Auctions appear to have become less important outlets during this time period. Direct sales were characteristic of the larger, specialized operations, while smaller feedlots patronized the terminal markets to a greater extent.

Almost 44 percent of the marketings from Oklahoma feedlots in 1960 were sold to out-of-state markets, primarily on a direct-to-packer basis.[20] The fat cattle auction at Dodge City, Kansas, was an important market outlet in the Panhandle area, while Wichita and Fort Worth terminal markets were important. Direct shipments to packing plants in Pueblo, Wichita, Arkansas City, Kansas City, St. Louis, Fort Smith, Little Rock, Memphis, and many points in Texas were important out-of-state markets.

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[19] Williams and McDowell, p. 45.

[20] Ibid.

CHAPTER IV

RESEARCH PROCEDURES AND DATA GENERATION

Selection of Research Technique

At least three research techniques have been used in studies of scale economies. These are: (1) estimation of scale functions directly from firm cost data by regression techniques; (2) synthesization of cost curves using the budgeting procedure; and (3) linear programming, which can be used in combination with regression or budgeting. The first two methods have been utilized more extensively than the latter.

Use of regression in economies of scale studies has been confined largely to survey data. Average regression lines, net regression lines, and lines representing lowest cost firms have been derived.[1] The method of fitting an average regression line to the data obtained from all firms in the sample was criticized by Bressler and others for combining and confusing short-run cost changes associated with use of a fixed plant and long-run cost changes associated with scale. This technique was further criticized because the locus of points defined by a least squares regression line lies above the true economies of scale function or least cost curve.[2]

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[1] R. G. Bressler, Jr., "Research Determination of Economies of Scale," Journal of Farm Economics, XXVII (1945), pp. 528-531.

[2] H. O. Carter and G. W. Dean, "Cost Size Relationships for Cash Crop Farms in a Highly Commercialized Agriculture," Journal of Farm Economics, XLIII (1961), p. 273.

Net regression lines, derived by adjusting least squares regression lines downward to approximate true economies of scale curves, also have been employed. Such an adjustment was attempted in an Iowa Experiment Station study of commercial feed mills. Data on capacity and percentage utilization were employed in making the adjustment.[3]

Linear programming has not been used extensively in economies of scale studies. A procedure for using this technique in such an analysis was presented by Barker.[4] The basic method used in this analysis was variable resource programming where a single resource was allowed to vary continuously throughout a specified range. To develop average cost curves, an optimum plan giving maximum net revenue was derived through the simplex method. The firm then was made to move to sub-optimum positions, so as to lose the minimum amount of money per unit increase or decrease in output. Firm cost curves provided by this procedure represent a series of sub-optimum plans with respect to the maximum profit situation. The average cost curves are formed by line segments, with the length and slope of these segments determined by the available quantity and cost of the variable resource.

In recent years, budgeted estimates have been used most frequently in determining cost changes associated with changes in scale of operations. Model plants, supposedly most efficient for a given size, are synthesized

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[3] Richard Phillips, "Empirical Estimates of Cost Functions for Mixed Feed Mills in the Midwest," Agricultural Economics Research, VIII (1956), pp. 1-8.

[4] Randolf Barker, "A Derivation of Average Cost Curves by Linear Programming," Agricultural Economics Research, XII (1960), pp. 6-12.

to meet specific economic and engineering requirements. Input-output studies of particular portions of existing plants and engineering standards contribute to the building of "synthetic" operations. Costs are applied to the engineering data on the basis of the job analyses, input coefficients, and other standards. An advantage of budgeting and synthesis is that it facilitates the determination of short-run as well as long-run average cost curves, whereas regression analysis yields a cross section of survey averages and includes both short-run and long-run considerations. Also budgets can be compared in several forms including tables, smooth curves connecting the plotted points, and regression lines fitted to the budgeted points.

Inherent dangers in the budgeting approach, according to Bressler, are tendencies to overlook the fact and effects of increasing variable costs and to forget some costs.[5] However, these criticisms seem to reflect upon individual use of the technique rather than upon the technique itself. Another important shortcoming of the budgeting technique is that the method provides no adequate means of testing for extent or degree of error involved in the estimating procedure. That is, statistical tests of budgeted data are of no value since the budgeting procedure is not on a random basis.

For several reasons, the budgeting procedure was used in this study to determine cost relationships associated with increasing feedlot size. As explained earlier, the method yields superior and more

[5]Bressler, p. 536.

detailed estimates of possible cost relationships. Moreover, data limitations would have restricted the use of the regression procedure. The number of reasonably homogeneous feedlots representing particular size groups are scarce in Oklahoma. Also, many of the existing facilities maintained records inadequate for a regression analysis. Another factor is that effects of small changes are easily determined in partial budgets; whereas the regression technique does not allow flexibility of this nature.

Data Requirements and Sources

Certain basic data were required to synthesize feedlot plants and costs and to construct budgets of alternative cattle-feeding situations. These included input coefficients, output coefficients, and factor and product prices. A part of this information was obtained from a survey of Oklahoma cattle feeders during the spring and summer of 1961. Other data were obtained from studies cited earlier and from consultation with agricultural engineers, equipment dealers, and feedlot operators themselves. Since the cost of conducting detailed time-and-motion or ratio-delay studies of various elements or operations at particular feedlots was judged high relative to improvements in input-output coefficients that might have been achieved, considerable reliance was placed upon data reported in other studies. Engineering specifications of equipment capacity were followed closely. Prices of inputs were obtained from interviews with feedlot operators and agricultural engineers, from equipment catalogs, and from other published sources. In general, the

Oklahoma City terminal market was the source for prices of feeder cattle and fed slaughter cattle.

Selection of Model Feedlots

Seven primary models for as many different feedlot sizes were developed for each of two basic feeding systems. Additional models, representing variations in the basic models, were developed and designed to accomodate differences in particular characteristics. In all, 672 models were synthesized.

The two basic systems of feeding selected for study were (1) the "fenceline bunk system" involving daily distribution of feed to troughs along outside fences of each pen and (2) the "self-feeder" system in which feed is distributed on a weekly or "as needed" basis to gravity-flow feed units ordinarily located near the center of each lot. Both systems, it was assumed, involved a relatively high concentrate ration. In addition, feed waste or loss was the same in each system. Essential differences, if any, in the two systems, therefore, are found in construction or investment cost and in cost of feed distribution. The fenceline bunk system required distribution of relatively small quantities of feed at frequent intervals, The self-feeder system, in contrast, permits larger quantities of feed to be distributed at less frequent intervals. Both systems are common in Oklahoma.

"Feedlot size," defined in terms of specified physical space requirements, was allowed to vary from 300 to 15,000 head.[6] Specific

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[6]The physical space requirements were 200 square feet of pen space and 18 inches of fenceline bunk or equivalent self-feeder space.

size models of 300, 600, 1,000, 2,000, 5,000, 10,000, and 15,000 head were chosen as typical of sizes and the size range for Oklahoma at present and in the near future.

Two definitions of "capacity" were employed in this study. One was used for models in which it was assumed feeding was practiced on a continuous basis throughout the year. Capacity for these models was defined as the maximum number of head which could be fed annually, given the fixed physical space requirement, if immediate replacement followed the sale of finished animals. Thus, capacity, according to this definition, varied with assumptions regarding length of time cattle were held on feed.

The second definition centered around the common practice of feeding a single lot or "batch" of cattle per year. For models with this characteristic, capacity was defined as equivalent to size. Thus, a feedlot operated at the minimum physical space requirement for one feeding period and then left vacant was defined arbitrarily as a full capacity operation. Both definitions, therefore, employed the same physical space requirement and both referred to the maximum number of cattle fed annually. They differed with respect to assumptions regarding rate of turnover. This difference also could be considered a difference in use level or utilization rate. The alternative of varying the definition of capacity offered two principal advantages. Both short-run and long-run cost functions logically could be constructed for "single batch" and "continuous" operations. In addition, the term "utilization rate" was reserved for use as defined below.

Utilization rate was defined as the ratio of the numbers of cattle fed at one time or continuously to the maximum number defined as full capacity. Models were synthesized for each feedlot size in each system at three different utilization rates. These were "one-third," "two-thirds," and "full" capacity. These models provided the basis for calculation of short-run cost functions and relationships.[7]

The method of comparative statics was employed to examine separate effects of variations in class of feeder animal fed and length of feeding period upon short-run and long-run cost functions. Models incorporating each of the features described earlier were constructed for each of two weight classes of feeder heifers and one weight class of feeder steers. These classes, where weight refers to initial, on-feed weight, were 500 pound and 650 pound heifers and 700 pound steers. Additional models were developed to accomodate variations in length of feeding period. Feeding periods of 60, 90, 120, and 150 days were chosen as representative of the range of feeding period alternatives in Oklahoma.

In a continuous operation, rate of turnover varies with length of feeding period. The annual rates are 6, 4, 3, and 2.4 for feeding periods of 60, 90, 120, and 150 days, respectively. Together, size and rate of turnover--or length of feeding period--determine capacity.

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[7]It should be recognized at this point that utilization at less than full capacity, as defined, sometimes is determined by factors which define or establish limits upon "economic capacity." These factors may include capital rationing, alternative uses for labor and management, and exceptionally large seasonal increases in feeder cattle prices.

Feedlot Layout, Construction and Investment Cost

Synthetic construction of model feedlots was based upon requirements and operating standards considered necessary and sufficient to care for the animals throughout a feeding period. Detailed specifications are found in Appendix Tables A.1, A.2, and B.1. Only general requirements and principal variations in these requirements are considered here.

Layout and Construction

The following types of physical facilities were considered in connection with each of the seven feedlot sizes for each of the two basic feeding systems: land, feeding pens, work pens and infirmary pens, feed mill and storage facilities, water equipment and facilities, feeding equipment, office and scale house, and transportation. The three smallest feedlot sizes, it was assumed, did not have office and scale house facilities. Others had appropriate sizes and types of each of these facilities.

Land

Land requirements varied from three acres for the 300 head lot to 120 acres for the 15,000 head lot. This land, it was assumed, had an alternative value only as pasture.

Feeding Pens

Feeding pens were built to a standard size of 150 feet by 140 feet which provided 200 square feet of pen space per head for 100 animals.

animals.[8] Since 18 inches of feed bunk space per head fed was considered necessary, specifications of bunk feeding models required a layout such that at least one 150 foot side was provided with bunks and made available to feed trucks.[9] Materials used in construction of feeding pens were creosote posts, used oil field cable, and stainless steel gates.

Feeding Pen Facilities

Fenceline feed bunks were built upon a concrete slab one foot deep and two and one-half feet wide which served as the bottom of the bunk.[10] Bunk sides were built of rough lumber bolted to posts. A concrete apron was extended from the bunks for a distance of six feet into the feeding pens. The alley between pens was gravelled.

"Self-feeders" were metal, gravity flow feed dispensers in the dimensions of 12 by 16 feet. When filled, feed dispensers of this type contain approximately eight tons of feed.[11] Self-feeders were placed upon concrete aprons. Feeding pens in all models were supplied with certain additonal facilities such as "back scratchers" used mainly for grub and fly control.

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[8] Magee, p. 4.

[9] James R. Gray, So You Want to Feed Cattle, New Mexico Agricultural Experiment Station Report 30 (Los Cruces, 1959), p. 8.

[10] Gray, p. 9.

[11] Advertising brochure from Baker-Built Feeders (Rhome, Texas).

Work Pens and Infirmary Pens

Construction of working pens and infirmary pens differed in the models from the feeding pens. Rough lumber served as fencing and pens were separated into compartments containing shelter and facilities for feeding hay. Essential equipment for use in connection with working pens consisted of a loading chute, a squeeze chute, and livestock scales.

Feed Mill and Storage Facilities

Although varying widely in capacity and other respects, feed mill and storage facilities were similar with respect to type for all models other than the smallest. The 300 head size model was supplied with two portable elevators or loaders to move feed to and from storage facilities and a portable roller-mixer for processing feed.[12] No feed mill building, however, was provided for the 300 head model.

The other six size models were designed with permanent feed mill facilities including building, legs, rollers, mixers, molasses tanks, suspension hopper scales, distributor outlets, augers and screw lifts or load-out augers and truck lifts for unloading. Included also were sufficient feed storage facilities for a 90 day supply of feed. A central push button panel electrically controlled the movement of feed within the mill. These facilities varied by size of feedlot with respect to number and design as well as capacity.

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[12] Brown, p. 12., indicates such systems are adequate for a feedlot of this type.

Water Facilities and Equipment

Feedlot water requirements were met from a well located near the feeding layout.[13] An 80 foot well with diameter depending upon number of head fed was assumed adequate to supply the 10 gallons of water needed per head per day.[14] A submergible pump system was considered satisfactory for smaller feedlot sizes. A concrete water storage facility was supplied to the models.

Water dispensers of two sizes were used in model feedlots. Tanks of 250 gallon capacity were placed upon concrete aprons in the feeding pens. These tanks contained floats for automatic filling and electric heating units to keep ice from forming during the winter months. Smaller 50 gallon watering units were similarly constructed for use in infirmary and holding pens.

Feed Distribution Equipment

Two-ton feed trucks equipped for augering feed from the cargo box into fenceline bunks were employed in all bunk models. Self-feeder systems used cargo boxes, also mounted on two-ton trucks, which augered feed upward into self-feeder units. Truck numbers varied with size of feedlot but for a given size, larger numbers were required for fenceline bunk models.

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[13] Other systems common to Oklahoma which could have been assumed were a gravity flow pump with water piped from a nearby pond or reservoir, or alternatively, connection to a municipal water system.

[14] This system is common in Oklahoma according to Elmer Daniel, Oklahoma Agricultural Experiment Station Agricultural Engineer.

Manure Handling Equipment

In the smaller feedlots, manure handling equipment consisted of a tractor with loader and a used dump truck. Optimum requirements for larger feedlots included caterpillar tractors with heavy duty loaders and dump trucks.

Other Facilities

Only the four larger size models were assumed to have a separate office and a truck scale. The smaller feedlots, it was assumed, would have incoming feed weighed elsewhere and would use a portion of the feed mill as an office. Separate offices for other models were equipped with heat, water, electricity, and furniture, in addition to weighing facilities. All feedlots, it was assumed, used pickup trucks as transportation within the feedlot and on feedlot business.

Investment Costs

For feedlots of comparable size, investment cost was about the same in fenceline bunk models as in self-feeder systems (Tables VII and VIII). Total investment ranged in bunk feeding models from $22,839 to $411,169. For small feedlots, the 1,000 head size and smaller units, self-feeder systems involved a larger total investment cost. The reverse was true of feedlots in the 2,000-15,000 head size range. The total increased more rapidly with size in bunk systems rising an average of about $2,750 per 100 head increase in size, compared with a comparable average increase of $2,642 for self-feeder systems.

Principal differences in component investment costs of the two systems are found in feeding pens, feed dispensing units and feeding

TABLE VII

INVESTMENT COST FOR SYNTHESIZED FEEDLOTS--SELF-FEEDING SYSTEMS[a]

Item	Feedlot Size in Number of Head						
	300	600	1,000	2,000	5,000	10,000	15,000
				- Dollars -			
Feeding pens	1,379	2,707	4,404	7,915	20,238	33,924	53,625
Work pens and equipment	3,340	3,794	4,403	5,573	8,536	16,343	20,916
Self-feeders	1,652	3,328	5,545	11,088	27,719	55,438	83,156
Water system	1,527	2,076	3,325	7,676	12,424	19,478	27,244
Manure equipment	3,477	3,477	4,500	4,500	6,500	13,000	19,500
Feeding equipment	2,600	2,600	2,600	2,600	5,200	7,800	10,400
Feed mill with storage	6,364	22,640	32,817	51,464	94,282	134,773	174,860
Transportation	2,200	2,200	2,200	2,200	4,400	4,400	4,400
Land	300	600	1,000	1,600	4,000	8,000	12,000
Office and scale hours	--	--	--	8,148	10,684	12,904	15,868
Total investment	22,839	45,422	60,794	102,764	193,983	306,060	411,169

59.79 37.99 29.80 26.66

[a]A complete breakdown of these costs for 300 and 5,000 head feedlots is shown in Appendix A.

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TABLE VIII

INVESTMENT COSTS FOR SYNTHESIZED FEEDLOTS--FENCELINE BUNK SYSTEMS BY FEEDLOT SIZE[a]

Item	Feedlot Size in Number of Head						
	300	600	1,000	2,000	5,000	10,000	15,000
				- Dollars -			
Feeding pens	1,288	2,519	4,165	7,325	18,740	31,226	49,354
Work pens and equipment	3,340	3,794	4,403	5,573	8,536	16,343	20,916
Bunks	1,685	3,264	5,615	11,230	28,075	56,148	84,222
Water system	1,527	2,076	3,325	7,676	12,424	19,478	27,244
Manure equipment	3,477	3,477	4,500	4,500	6,500	13,000	19,500
Feeding equipment	2,300	2,300	2,300	4,600	9,200	13,800	18,400
	Substituted		[illegible],308		84,475	149,995	
Feed mill with storage	6,364	24,640	32,817	51,464	94,282	134,773	174,860
Transportation	2,200	2,200	2,200	2,200	4,400	4,400	4,400
Land	300	600	1,000	1,600	4,000	8,000	12,000
Office and scale house	--	--	--	8,148	10,684	12,904	15,868
Total investment	22,481	44,870	60,335	104,316	196,841	310,072	426,764
	72,23						

[a]A complete breakdown of these costs for 300 and 5,000 head feedlots is shown in Appendix A.

equipment. The self-feeder models had a slightly higher investment in feeding pens since fencing was required in lieu of bunk space. For most feedlot sizes, investment cost of bunks, aprons, and related facilities exceeded investment cost of self-feeders and related facilities. Differences, however, were small. Feed trucks and other feeding equipment provide the principal difference. For small feedlots less feeding equipment was required by fenceline bunk models. Beyond the 1,000 head size model, however, feeding equipment costs of bunk systems rose rapidly.

Feeding and Weight Gain Assumptions

Selection of rations and corresponding gains was based upon results of the 1961 sample survey and a 1956-57 feeding trial conducted by the Oklahoma State Experiment Station. Basic feeds were grain sorghum, a 32 percent protein supplement containing stilbestrol and other additives such as Vitamin A and aureomycin, and cottonseed hulls. This combination of feed was selected as typical of the high concentrate to roughage feed mixes currently employed in Oklahoma and Texas. Specific feeding and weight gain specifications for three classes of feeder animals and varying lengths of time on feed are shown in Table IX.

Net marketable weight gains for 60, 90, 120, and 150 day feeding periods were based on production functions similar to ones estimated from a feeding trial conducted by the Oklahoma Agricultural Experiment Station during 1956 and 1957. The Cobb-Douglas functions based on the 1956-57 feeding trials were $Y = .97X_1^{.440836} X_2^{.333355}$ for steers and $Y = .95X_1^{.425795} X_2^{.331286}$ for heifers with Y defined as liveweight gain,

TABLE IX

FEEDING AND WEIGHT GAIN SPECIFICATIONS FOR STEERS AND HEIFERS AT DIFFERENT LENGTHS OF FEEDING PERIOD

Time On Feed	Net Weight Sold	Total Gain	Average Daily Gain	Concentrate Consumed	Roughage Consumed	Total Feed Consumed	Concentrate To Roughage Ratio	Feed Per Pound Gain
Days					- Pounds -			
				500 Pound Feeder Heifers				
30	589	89	2.98	255	150	405	1.70:1	4.55
60	661	161	2.68	660	255	915	2.59:1	5.68
90	720	220	2.44	1,155	345	1,500	3.35:1	6.82
120	760	260	2.17	1,710	435	2,145	3.93:1	8.25
150	798	298	1.99	2,310	529	2,835	4.40:1	9.51
				650 Pound Heifer Feeders				
30	740	90	3.02	315	165	480	1.91:1	5.33
60	812	162	2.70	810	285	1,095	2.84:1	6.76
90	870	220	2.44	1,365	375	1,740	3.64:1	7.91
120	908	258	2.15	1,965	465	2,430	4.23:1	9.42
150	943	293	1.95	2,605	555	3,160	4.69:1	10.78
				700 Pound Feeder Steers				
30	796	96	3.22	375	180	555	2.08:1	5.78
60	871	171	2.85	930	300	1,230	3.10:1	7.19
90	937	237	2.63	1,605	390	1,995	4.12:1	8.42
120	986	286	2.38	2,340	480	2,820	4.88:1	9.86
150	1,033	333	2.22	3,135	570	3,705	5.50:1	11.13

X_1 as pounds of grain, and X_2 as pounds of roughage.[15] These functions reflected average daily gains substantially lower than those estimated by Oklahoma feedlot operations. The equations, therefore, were adjusted to yield 120 day average gains of 2.4, 2.3, and 2.5 pounds, respectively for 500 pound heifers, 650 pound heifers, and 700 pound steers. This process of adjustment involved redefining the value of the predicting equations such that these equations took the forms $Y = 1.253X_1^{.440836} X_2^{.333355}$, $Y = 1.617X_1^{.425795}X_2^{.331286}$, and $Y = 1.439X_1^{.425795}X_2^{.331286}$, respectively, for 700 pound steers and 500 and 650 pound heifers.

It was observed that the original functions and the adjusted functions increased in a near linear rate as feed intake was increased beyond the 60 day period and tended to diverge as required by the adjustment procedure. Therefore, a further adjustment seemed necessary since nutritional logic suggested a function with more curvature as feed inputs were increased beyond 90 days. This involved modifying the adjusted functions by limiting the difference between the original and the adjusted functions beyond 90 days to the 90 day difference.[16] The initial forms, first adjustments, and final forms of these production functions are shown in Table X for the three classes of feeder animals and the

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[15] Plaxico, Andrilenas, and Pope, pp. 9 and 11.

[16] Part of the problem centered in the widening divergence, a necessary result of the adjustment process, between the original and adjusted functions. Beyond the 90 day point this divergence was considered excessive. The additional adjustment, of course, could not be handled simply by adjusting the Cobb-Douglas coefficients. In effect, limits were placed upon the adjusted forms of the equations. The same results was obtained by using the adjusted equations to the 90 day point and employing the original functions plus appropriate constants beyond this point.

TABLE X

PREDICTING EQUATIONS AND ADJUSTMENTS UTILIZED IN ARRIVING AT ASSUMED WEIGHT GAINS

Length of Feeding Period	1956-57 Feeding Trial (Predicting Equation)[a]	Adjustment to Yield Specified 120 Day Gain[b] (Predicting Equation)	Adjustment on Basis of 90 day Difference[c] (Predicting Equation)
		500 Pound Heifers	
60 and 90 days	$.95X_1^{.425795}X_2^{.331286}$	$1.617X_1^{.425795}X_2^{.331286}$	$1.617X_1^{.425795}X_2^{.331286}$
120 and 150 days	$.95X_1^{.425795}X_2^{.331286}$	$1.617X_1^{.425795}X_2^{.331286}$	$.95X_1^{.425795}X_2^{.331286} + 93$
		650 Pound Heifers	
60 and 90 days	$.95X_1^{.425795}X_2^{.331286}$	$1.439X_1^{.425795}X_2^{.331286}$	$1.439X_1^{.425795}X_2^{.331286}$
120 and 150 days	$.95X_1^{.425795}X_2^{.331286}$	$1.439X_1^{.425795}X_2^{.331286}$	$.95X_1^{.425795}X_2^{.331286} + 74$
		700 Pound Steers	
60 and 90 days	$.97X_1^{.440836}X_2^{.333355}$	$1.253X_1^{.440836}X_2^{.333355}$	$1.253X_1^{.440836}X_2^{.333355}$
120 and 150 days	$.97X_1^{.440836}X_2^{.333355}$	$1.253X_1^{.440836}X_2^{.333355}$	$.97X_1^{.440836}X_2^{.333355} + 54$

[a]Plaxico, Andrilenas, and Pope, pp. 9 and 11.

[b]Approximate average 120 day gain estimated from 1961 survey of Oklahoma feedlot operations.

[c]Computed by restricting the differences between the original and the adjusted functions beyond 90 days to the 90 day difference.

four feeding periods considered.[17] The final production functions, utilized in this study are shown graphically in Figure 5.

Generation of Fixed Cost

Fixed costs for commercial feedlots include depreciation, interest on fixed investment, taxes, insurance, license fees, repair on facilities due to the elements, management, and office salary. The following is a discussion of the methods used in computing fixed costs in this study.

The straight line method was used to compute depreciation. The computation of depreciation was based on the formula $\frac{NC - SV}{EL}$, where NC is new cost, SV is salvage value, and EL is the expected lifetime of the machine. Used equipment was treated as if it were new equipment. Salvage values and expected lifetimes for feedlot equipment are shown in Appendix Table B.1.

Interest on investment was computed at five percent of average investment.[18] Average investment was found by the formula $\frac{NC + SV}{2}$, where NC is new cost and SV is salvage value. Annual interest charges were obtained by multiplying the average investment by the rate of interest.

Taxes and insurance were estimated at two percent of total investment in the feeding facilities.[19] License fees on pickups were assumed to average $40 per year.

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[17] To obtain a smooth curve for 500 pound heifers, the 90 day weight, as predicted by the adjusted equation, was lowered six pounds.

[18] A rate of three percent on average investment was used by King, p. 14. However, long-term interest rates have risen considerably since then.

[19] King, p. 21.

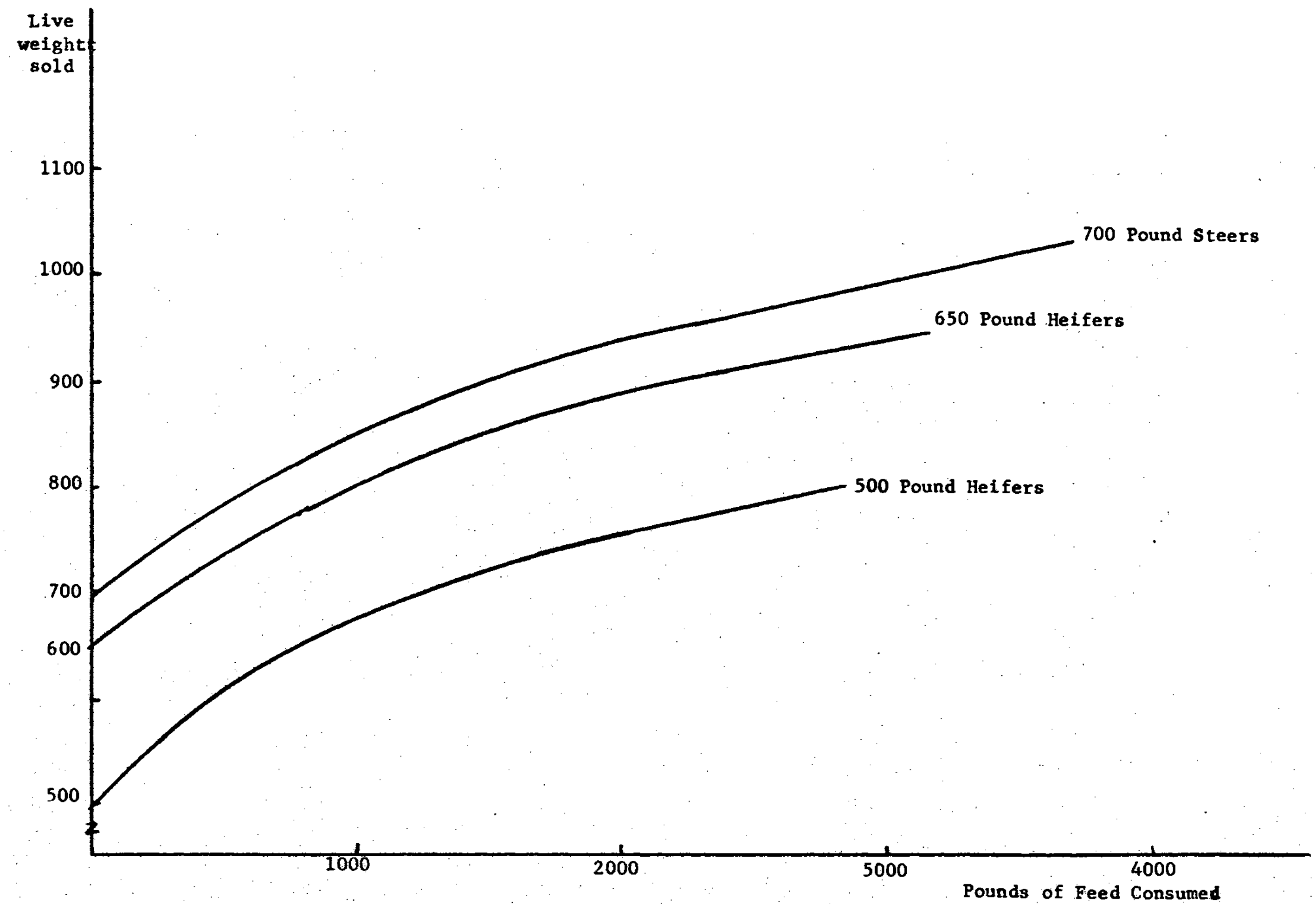

Figure 5. Specified Production Functions for Three Classes of Feeder Animals.

An annual charge of two percent of new cost was utilized to account for repair associated with exposure to the elements.[20] This cost was placed on buildings, feeding pens, and other feedlot equipment which would face such exposure.

Management and office salaries were considered fixed costs for all model feedlots synthesized.[21] The minimum salary for a part-time manager was assumed to be $2,000, regardless of the number of hours the manager devoted to the feeding enterprise. Salary of managers above this minimum was based on $1.50 per head of feedlot capacity for all seven feedlot size groups.

Other cost items, sometimes considered fixed, that were not included in this analysis were bonuses to feedlot personnel, business promotion expenses, contributions, and life insurance on managers.

Total annual fixed costs for each model feedlot synthesized are shown in Tables XI and XII for fenceline bunk techniques and self-feeding techniques, respectively. These costs were obtained by a summation of the values of each fixed cost component associated with a particular feedlot size and feeding technique.

Generation of Nonfeed Variable Costs

Nonfeed variable costs refer to expenditures other than feed cost which vary with output. Included in this category are expenses such as

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[20] King, p. 16.

[21] Managerial cost would be associated with returns to labor and management if the feedlot owner conducted the management functions.

[22] King, in the California study, used a rate equivalent to $1.33 per head of capacity.

TABLE XI

ANNUAL FIXED COSTS FOR SYNTHESIZED FEEDLOTS--FENCELINE BUNK SYSTEMS BY FEEDLOT SIZE

Item	Feedlot Size in Number of Head						
	300	600	1,000	2,000	5,000	10,000	15,000
	- Dollars -						
Repair on improvements	126	272	374	663	1,427	2,474	3,623
Management and office	2,225	2,450	2,750	4,500	11,250	22,500	33,750
Taxes, insurance and license	490	937	1,247	2,126	4,017	6,281	8,615
Interest	603	1,182	1,597	2,747	5,141	7,547	11,255
Depreciation	1,911	3,392	4,409	6,863	12,511	20,182	28,188
Total	5,355	8,233	10,377	16,899	34,346	58,984	85,431
Fixed cost per head of capacity	17.85	13.72	10.38	8.45	6.87	5.90	5.70

TABLE XII

ANNUAL FIXED COSTS FOR SYNTHESIZED FEEDLOTS--SELF-FEEDING SYSTEMS BY FEEDLOT SIZE

Item	Feedlot Size in Number of Head						
	300	600	1,000	2,000	5,000	10,000	15,000
	- Dollars -						
Repair on improvements	127	277	377	672	1,450	2,514	3,687
Management and office	2,225	2,450	2,750	4,500	11,250	22,500	33,750
Taxes, insurance and license	497	948	1,256	2,095	3,960	6,201	8,303
Interest	607	1,193	1,610	2,717	5,092	7,496	11,160
Depreciation	1,926	3,389	4,381	6,548	11,837	19,035	25,965
Total	5,382	8,257	10,374	16,532	33,589	57,746	82,865
Fixed cost per head of capacity	17.94	13.76	10.37	8.27	6.72	5.77	5.53

repair, fuel and oil, electricity, telephone, death loss, marketing, veterinary and medical needs, labor, and interest on operating capital.

Marketing costs frequently are omitted in cattle feeding cost studies by assuming sales of finished cattle on a direct-to-packer basis at the feedlot. In practice, however, this usually involve a hidden "pencil shrinkage" cost which often is not mentioned. Under Oklahoma conditions, a pencil shrink equivalent to four or five percent of the gross weight at the feedlot is common practice. In addition, prices offered by packer-buyers at the feedlot often ranged below equivalent terminal market prices.

The alternative to a pencil shrink was the assumption of marketing at a terminal market. Since Oklahoma has a centrally located terminal market, a marketing cost of selling at the Oklahoma City Public Stockyards was included in the cost analysis. Included in this charge was yardage, feed and bedding, commission, delivery within the yard, a promotion checkoff, and transportation to the market (Appendix Table B.2). It was assumed the livestock were transported by truck for $45 per load. Marketing costs, under these assumptions ranged from $3.86 per steer in large lots to $3.89 per steer in small lots and from $3.70 per heifer in large lots to $3.73 per heifer in small lots.[23] Marketing costs were less for heifers than steers because larger numbers were transported and sold at one time.

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[23] The "pencil shrink" alternative for determining marketing cost was rejected because market value costs of these losses exceeded costs associated with terminal marketing and efficient feedlot operators were assumed to be both knowledgeable and rational.

Interest on operating capital also was omitted as a cost in some studies of commercial cattle feedlots. In this study, interest on short-term operating capital was charged to the model feedlots at six percent per annum for purchases of feed, nonfeed variable factors, and feeder cattle. Capital borrowed to finance monthly nonfeed operating expenses was assumed used for one month only when a continuous feeding program, selling on a weekly or monthly basis, was followed. Otherwise, money was borrowed for the duration of the feeding period.

Death loss was estimated at one percent of the number of cattle fed. This cost was computed by assuming death at about the midpoint of the feeding period where weight loss was valued at $24 per hundredweight for steers and $23 per hundredweight for heifers. Feed costs associated with dead animals were assumed at 40 percent of feed cost per animal sold.[24]

Telephone expense was assumed to vary with the number of head fed at one time (Appendix Table B.3). A rate of 0.1 cents per animal unit day fed was charged for repairs to pens, bunks, self-feeders, and buildings associated with use of these facilities.[25]

Repair cost per hour of use for feed mill equipment and gasoline equipment was charged as a percentage of new cost or used cost (Appendix Table B.4). Repair to submergible and turbine pumps was estimated

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[24]Approximately 40 percent of the total feed consumed by one animal during a feeding period would have been consumed at the halfway point of that period.

[25]King, p. 24.

at three cents per day for the former and 14 cents per day for the latter.[26] The repair rate on sprayers used to spray livestock was taken as nine dollars per year.[27]

Electricity cost was based on the number of machine hours necessary to process the average daily feed requirements needed during the feeding period. Estimates of the average number of hours the machines needed to operate were obtained by dividing average quantity of feed handled by the equipment capacity, as designated by engineering data. This average was then multiplied by the horsepower of the electrical motor and used as an estimate of the kilowatt hours of electrical power needed per day. These daily electrical requirements were summed for all machines and multiplied by 30 to obtain a monthly kilowatt total. Monthly cost of this was computed according to local REA rates given in Table XIII. Gas and oil charges per hour for gasoline equipment were estimated as one dollar for heavy duty trucks and tractors and 55 cents for pickups and 3-plow tractors.[28]

Medical expenses were based upon the animals receiving medication or preventative vaccinations for blackleg-edema, rednose, worms, grub and fly control, and a combiotic injection for prevention of shipping fever and other miscellaneous maladies. These charges were assumed constant as the number of head fed increased. In addition, it was assumed that the services of a licensed veterinarian would be necessary for serious illnesses or injuries, and that larger lots obtained veterinary

[26]Elmer Daniels, Oklahoma State University Agricultural Engineer.

[27]Dale A. Knight and C. F. Bortfield, Annual Costs for Beef Cattle Equipment, Kansas State University Agricultural Economics Report Number 92 (Manhattan, 1960), p. 5.

[28]Ibid.

TABLE XIII

STATEMENT OF RATES--CENTRAL RURAL ELECTRIC COOPERATIVE, STILLWATER, OKLAHOMA

Number of KW Hours	Cost per KWH in Cents
	Cents
1st 30 hours	10
Next 30 hours	6
Next 30 hours	5
Next 110 hours	3
Next 200 hours	2
All over 400 hours	1 3/4

care at lower rates than the smaller lots.[29] Under these conditions, the per head cost of veterinary and medical care varied from $1.50 when 700 head or less were fed at one time in a feedlot to $1.00 in lots feeding 5,000 or more head at one time (Appendix Table B.3).

Labor requirements were the most difficult inputs to estimate for the feedlot models considered. This was because some labor operations varied with the pounds of feed handled while others depended upon the number of head fed or the animal unit days fed. Some of the job elements required more labor per unit of output as feedlot size increased while others required less.

In the large commercial feedlot models synthesized in this study, labor operations within the feedlot were placed in five categories. It

[29]In the survey of Oklahoma feedlot operations, this expenditure ranged from five dollars to twenty-five cents per head.

was assumed one man was sufficient to operate the feed mill. Several men were needed for driving trucks and feeding the livestock. Another operation involving mounding, loading, and hauling manure required several men in the larger feedlots. Handling incoming and outgoing livestock involved considerable quantities of labor. A small repair crew was also a necessity. These crews, it was assumed, were flexible and able to perform different jobs as needed.

Labor requirements in the model feedlots of this analysis were found by summing the individual operation requirements and adjusting for repair work, unloading feed at the feed mill, and other unaccounted jobs. An adjustment factor of 1.5 was used for this purpose since a factor of this size yields estimated total labor requirements similar to those noted in other studies.

Labor requirements determined by the number of head fed included receiving cattle, loading cattle and care of sick animals (Appendix Table B.5). Feedlots of similar size with greater turnover rates per year required more labor for handling livestock than those with low turnover rates. Increased labor requirements were noted for receiving and loading cattle as feedlot size increased because the loading pens were located farther from the feeding pens, thereby requiring more driving time.

Some labor requirements depended only on the number of cattle in feedlot at any one time (Appendix Table B.5). Among these were manure loader and dump truck operations, daily checking of the cattle, and the preparation of daily feed orders. The diseconomies associated with the manure operations were due to the increased distance which the manure was hauled. The economies in use of labor for checking cattle and preparing feed orders were present since little more time is required to view several thousand animals than to inspect several hundred.

Other labor requirements varied with the pounds of feed fed per head (Appendix Table B.5). Among these were feed mill operations, loading feed onto feed trucks, and unloading feed trucks in fenceline bunks or self-feeders. Man hours needed to operate the feed mill were determined by the operating time of feed mill equipment. Loading labor requirements, in terms of man hours, were much greater per pound of feed handled for the 300 head lot because this model, it was realistically assumed, did not contain an automatic pushbutton mill with a gravity load-out system. Considerably more labor time was required by the self-feeder systems than by the bunk systems for unloading from the feed truck. Augers moving feed up into the self-feeder required nearly three times as much man and machine hours as augers distributing feed down into bunks from trucks.

It was assumed that labor could not be hired in less than four hour units even though a lesser quantity was needed per day. This assumption was made to account for the difficulty in hiring part-time labor for an hour or two of work per day.

Wage rates in this study varied from one dollar to a dollar and fifty cents per hour. Specifically, part-time labor was valued at one dollar per hour while workers employed a full eight hours were postulated to be receiving one dollar and twenty-five cents per hour. Foremen received one and a half dollars per hour for an eight hour shift, but were employed only in lots larger than 1,000 head.[30]

Miscellaneous cost items such as horse expense, feed analysis and testing, and workmen's compensation were assumed to be offset by a manure credit and were not included in the cost analysis.

Total annual nonfeed variable costs associated with continuous feeding were computed by summing all the individual costs for each model feedlot and feeding situation. A summary of these costs is shown in Appendix C. Costs for one batch only operations may be derived from these totals by dividing by the rate of turnover.

Generation of Feed Cost

Three basic feeds, cottonseed hulls, grain sorghum, and a 32 percent protein supplement containing additives, formed the rations used in this cost analysis. The assumed price of cottonseed hulls delivered to feedlots in bulk was twenty dollars per ton.[31] This price, it was assumed, did not vary seasonally or with the quantity purchased. The protein and additive supplement was assumed to cost seventy-five dollars per ton delivered to the feedlots.

A lower delivered grain sorghum price was assumed for those operations feeding only one batch per year than for those feeding continuously.

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[30] These rates are equivalent to those noted in Oklahoma where wages for common feedlot labor ranged from \$100 a month and room and board to \$55 per week for a 40 hour week. Foremen or supervisors were generally paid a monthly wage varying from \$200 and living facilities to \$400 and living facilities depending upon length of service, hours, and other factors.

[31] This is greater than was indicated in the survey of Oklahoma feedlots in 1961 but is less than the average hull price in Oklahoma City during the 1962-63 season.

Logic suggests facilities feeding only one batch of cattle per year would purchase feed grain at harvest prices and utilize their feedlot storage facilities until the grain was fed; whereas those operators following a continuous program likely would purchase some feed grain during periods of higher seasonal prices. A grain sorghum price of \$1.80 per hundredweight was selected for the continuous operations. This price was reduced five cents per hundredweight for models feeding only one batch per year.[32] In addition to these prices, an interest charge of six percent per annum was assessed on capital required for feed purchases.

Per head feed costs under these price assumptions and the assumed production relationships are shown in Table XIV, along with feed costs per pound of gain. These feed costs were based on the number of cattle sold and included the value of feed fed to animals assumed to die during the feeding period. Total annual feed costs for each situation synthesized in this study were obtained by multiplying the number of head by the number of animals sold (Appendix D).

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[32]These prices are equivalent to the long-run farm price of \$1.70 assumed in Regional Project S-42 and Oklahoma Agricultural Experiment Station 1040 on agricultural adjustment.

TABLE XIV

ESTIMATED FEED COSTS PER HEAD AND PER POUND GAIN FOR VARIOUS CLASSES OF FEEDER CATTLE, LENGTHS OF FEEDING PERIOD, AND TURNOVER

Length of Feeding Period	Class of Feeder Animals					
	500 Pound Heifers		650 Pound Heifers		700 Pound Steers	
	Cost Per Head	Cost Per lb. Gain	Cost Per Head	Cost Per lb. Gain	Cost Per Head	Cost Per lb. Gain
	Dollars	Cents	Dollars	Cents	Dollars	Cents
	Continuous Operation					
60 Days	17.60	10.93	20.64	12.74	22.99	13.44
90 Days	29.18	13.26	33.33	15.15	37.89	15.99
120 Days	42.05	16.17	46.97	18.21	54.05	18.53
150 Days	55.71	18.69	61.49	20.99	71.47	21.46
	One Lot Only Operation					
60 Days	17.35	10.78	20.31	12.54	22.59	13.21
90 Days	28.71	13.05	32.76	14.89	37.18	15.69
120 Days	41.26	15.87	46.13	17.88	53.00	18.53
150 Days	54.72	18.26	60.35	20.60	70.04	21.03

CHAPTER V

ECONOMIES OF UTILIZATION AND SCALE IN CATTLE FEEDING

Economies of utilization, as employed in this analysis, are short-run effects of variations in the use of fixed facilities, whereas scale economies are a long-run phenomenon. While short-run variable and total unit cost functions theoretically are U-shaped, definitions and capacity limitations in this analysis require all short-run cost functions to be negatively sloped. Some, however, are discontinuous.

Economies of scale in the analysis refer invariably to costs or cost differences at full capacity levels.[1] Theoretically, scale economies arise primarily from savings associated with management, technology and changes in the composition of costs and certain pecuniary effects. Here, no explicit account is taken of diffferences in managerial abilities or capacities but these may be reflected to some extent in the coefficients and factors selected for use in computing variable costs. A few pecuniary advantages of scale were built into the various models. Cost rates of veterinary care and telephone services, for instance, drop with scale. Principal potential sources of scale economies, however, are found in the changing technology and organization of the feedlot with changes in size and associated changes in the composition of costs.

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[1]As explained previously, however, two different definitions of capacity were adopted. See p. 47.

In the long-run, all factors of production are variable and can be purchased in any quantities. While quantities of fixed factors vary with scale in this analysis, recognition is given to the fact that at each level of scale fixed costs do exist. Realistically, recognition also is given to the discrete or discontinuous nature of certain variable inputs.

In view of the preceding discussion, emphasis is placed in this chapter upon (1) the size and nature of economies associated with utilization and scale and (2) sources of these economies or, alternatively, contributions of utilization and scale to cost savings.

Particular attention is given to effects of the changing composition of costs. Effects of utilization rate and scale on fixed costs and nonfeed variable costs are examined separately. In these analyses, effects of all other factors are held constant or varied systematically. Costs of feed and feeder cattle are excluded. While these costs usually exceed the combined total of other costs, it was assumed, logically, that they were not significantly affected by variations in utilization rate or scale.[2]

In the manner specified in comparative statics, several factors or conditions were examined systematically for their effects on short-run cost functions and long-run planning curves. These included (1) the class of feeder animal fed, i.e., 500 pound heifers, 650 pound heifers,

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[2]This assumption would not be valid for areas where feed supplies were restricted or where feeder cattle density was low. For Oklahoma, however, it appeared logical to assume that available supplies of feed and feeder animals were infinitely elastic within the range of scale considered.

and 700 pound steers, (2) feeding system in which length of the feeding period was the distinguishing characteristic, and (3) differences in the concept of capacity, i.e., single batch versus continuous feeding operations. With output measured in terms of liveweight gain, comparative cost differences arise in connection with class of feeder animal as a result of differences in production functions adopted. Varying rates of gain with feed input, level of output (gain) and time are largely responsible for cost differences among the alternative lengths of feeding periods.

The following considerations also should be borne in mind during the course of the discussion on effects of utilization and scale:

1. For continuous feeding operations, total annual gains are greater for shorter than for longer feeding periods (Appendix E). Continuous, short-period feeding involves a larger annual total number of animals fed and a higher average rate of gain than continuous, long-term feeding.
2. For single batch operations, total annual gains rise as the feeding period lengthens. A constant number of animals are involved and positive rates of gain throughout each alternative feeding period are postulated but the average daily rate of gain drops as the feeding period lengthens.
3. Although feed cost itself is excluded from the analysis, fixed and variable inputs related to the processing, transportation and handling of feed are included. While feed costs logically are not affected by scale, they are influenced by variations in length of feeding period. Average feed

consumption per head and per pound of gain increases as the feeding period lengthens. These effects, excluded here, are considered in the following chapter.

4. Cost differences for fenceline bunk systems versus comparable self-feeder systems were small and, in general, insignificant. Accordingly, economies of utilization and scale are examined here only for fenceline bunk systems. The nature of cost differences associated with these two feeding techniques, however, is considered briefly toward the end of this chapter where comparative costs of custom feeding operations also are analyzed.

Changes in the Component Distribution of Total Cost With Scale and Other Factors

Percentage distributions of total feedlot cost, including feed cost but excluding feeder cattle costs, are shown in Table XV by size of feedlot and length of feeding period. These are confined to models characterized by fenceline bunk and continuous feeding at full utilization.

In these models feed cost was the most important component varying from 59 percent of the total cost of feeding 300 head in the 60 day program to 83 percent in feeding 15,000 head on a 150 day basis. Both scale and length of feeding period contributed significantly to changes in the relative importance of feed cost with the latter having a relatively larger effect. Effects of scale rose progressively with increases in length of feeding period. Similarly, effects of feeding period length rose progressively with scale.

TABLE XV

PERCENTAGE DISTRIBUTION OF TOTAL COSTS BY TYPE FOR 500 POUND HEIFERS, ALTERNATIVE FEEDING PERIODS, CONTINUOUS FULL UTILIZATION, AND FENCELINE BUNK SYSTEMS

Cost Item	Feedlot Size 300	600	1,000	2,000	5,000	10,000	15,000
	- Percent -						
				60 Day Feeding Period			
Fixed cost	10.0	8.1	6.4	5.2	4.4	3.8	3.7
Nonfeed variable	31.3	30.3	29.2	29.9	28.7	28.6	28.7
Feed[a]	58.7	61.6	64.4	64.9	66.9	67.6	67.6
Total Dollars	53,454	101,908	162,304	322,085	781,747	1,547,600	2,318,875
				90 Day Feeding Period			
Fixed cost	10.1	8.3	6.4	5.3	4.4	3.8	3.7
Nonfeed variable	24.3	21.8	21.6	22.0	21.6	20.8	20.8
Feed[a]	65.7	69.9	72.0	72.7	74.0	75.4	75.5
Total Dollars	52,786	99,183	160,503	317,813	781,208	1,532,702	2,295,347
				120 Day Feeding Period			
Fixed cost	10.0	8.2	6.3	5.2	4.3	3.8	3.7
Nonfeed variable	20.1	17.6	17.3	17.7	16.6	16.4	16.2
Feed[a]	69.9	74.2	76.4	77.1	79.1	79.8	80.1
Total Dollars	53,609	100,870	163,451	324,020	789,751	1,564,492	2,339,845
				150 Day Feeding Period			
Fixed cost	9.8	7.8	6.2	5.1	4.2	3.7	3.6
Nonfeed variable	17.7	16.2	14.6	14.5	13.9	13.6	13.5
Feed[a]	72.5	76.0	79.2	80.4	81.9	82.7	82.9
Total Dollars	54,797	104,504	167,113	329,084	807,766	1,600,903	2,395,793

[a]Feed prices included grain sorghum at $1.80 per hundredweight, cottonseed hulls at $20 per ton, and supplement at $75 per ton.

Fixed costs relative to total costs dropped sharply with increases in feedlot size but were not affected appreciably by length of feeding period. While nonfeed variable cost percentages, in contrast, dropped modestly with increases in scale, they were markedly affected by length of feeding period.

Several factors are responsible for these patterns of the changing composition of feedlot costs. The relevant product functions require greater feed consumption as the length of feeding progresses. Larger feedlots use bigger, more flexible or adaptable facilities. And labor and other nonfeed variable factors are more efficiently utilized in the larger feedlots.

The exclusion of feed costs from these calculations changes the nature of these findings to some extent. The principal change is an increase rather than a small decline in relative importance of fixed cost with increases in length of feeding period. Accordingly, nonfeed variable costs drop relative to total nonfeed costs more sharply than indicated. In addition, these nonfeed variable costs rise relatively rather than fall with increases in scale. These points, highly relevant in the following analysis, are illustrated in Table XVI.

Scale and Utilization Economies Associated With Fixed Costs

The spreading of fixed cost over a larger output is the principal source of short-run cost savings. This is a well known principle and is the primary explanation of cost savings associated with increases in "utilization rate" as defined for use in this study. Fixed costs,

TABLE XVI

PERCENTAGE DISTRIBUTION OF NONFEED VARIABLE AND FIXED COST BY FEEDLOT SIZE FOR 500 POUND HEIFERS FED AT ALTERNATIVE FEEDING PERIODS ON A CONTINUOUS FULL UTILIZATION BASIS IN FENCELINE BUNK SYSTEMS

Cost Item	Feedlot Size 300	600	1,000	2,000	5,000	10,000	15,000
				- Percent -			
				60 Day Feeding Period			
Fixed cost	24.6	21.0	18.0	15.0	13.3	11.8	11.4
Nonfeed variable	75.4	79.0	82.0	85.0	86.7	88.2	88.6
Total Dollars	22,202	39,179	57,160	112,997	259,003	502,160	750,715
				90 Day Feeding Period			
Fixed cost	29.6	27.6	23.1	19.5	16.9	15.6	15.2
Nonfeed variable	70.4	72.4	76.9	80.5	83.1	84.4	84.8
Total Dollars	18,120	28,858	44,950	86,707	203,496	377,174	562,055
				120 Day Feeding Period			
Fixed cost	33.2	31.7	26.9	22.8	20.8	18.7	18.3
Nonfeed variable	66.8	68.3	73.1	77.2	79.2	81.3	81.7
Total Dollars	16,142	25,938	38,562	74,243	165,320	315,607	466,517
				150 Day Feeding Period			
Fixed cost	35.5	32.8	29.9	26.3	23.5	21.3	20.8
Nonfeed variable	64.5	67.2	70.1	73.7	76.5	78.7	79.2
Total Dollars	15,076	25,117	34,746	64,350	145,932	277,233	410,289

however, frequently are the source of additional economies if proportions of fixed to nonfixed costs are allowed to vary. In the models synthesized for this study, reductions in fixed cost per pound of gain with increases in feedlot size represented a substantial portion of the total economies associated with scale.

Effects of Scale on Fixed Costs

Average fixed cost per pound of gain, the unit of measurement considered here, dropped continuously and significantly throughout the range of scale considered. For continuous feeding operations, these costs fell about two cents over the scale range of 300 head to 15,000 head (Figure 6). Approximately three-fourths of this total saving was achieved with a 2,000 head feedlot. Figure 6 also shows that long-run average fixed cost functions rose progressively to new higher levels as the feeding period lengthened. While effects are illustrated in this instance only for 500 pound heifers, similar cost functions and relationships were indicated for other feeder classes.

Differences by type of feeder animal, nevertheless, were apparent (Tables XVII and XVIII). Although long-run average fixed costs were smaller at equivalent levels of gain for steers than for heifers, larger savings with respect to the association of per unit fixed cost and scale were indicated for heifers. That is, larger fixed cost reductions with scale were achieved in feeding heifers.

Effects of single batch versus continuous feeding on fixed cost-scale functions are illustrated in Figure 7. The function representing single batch operations lies at a significantly higher level than the

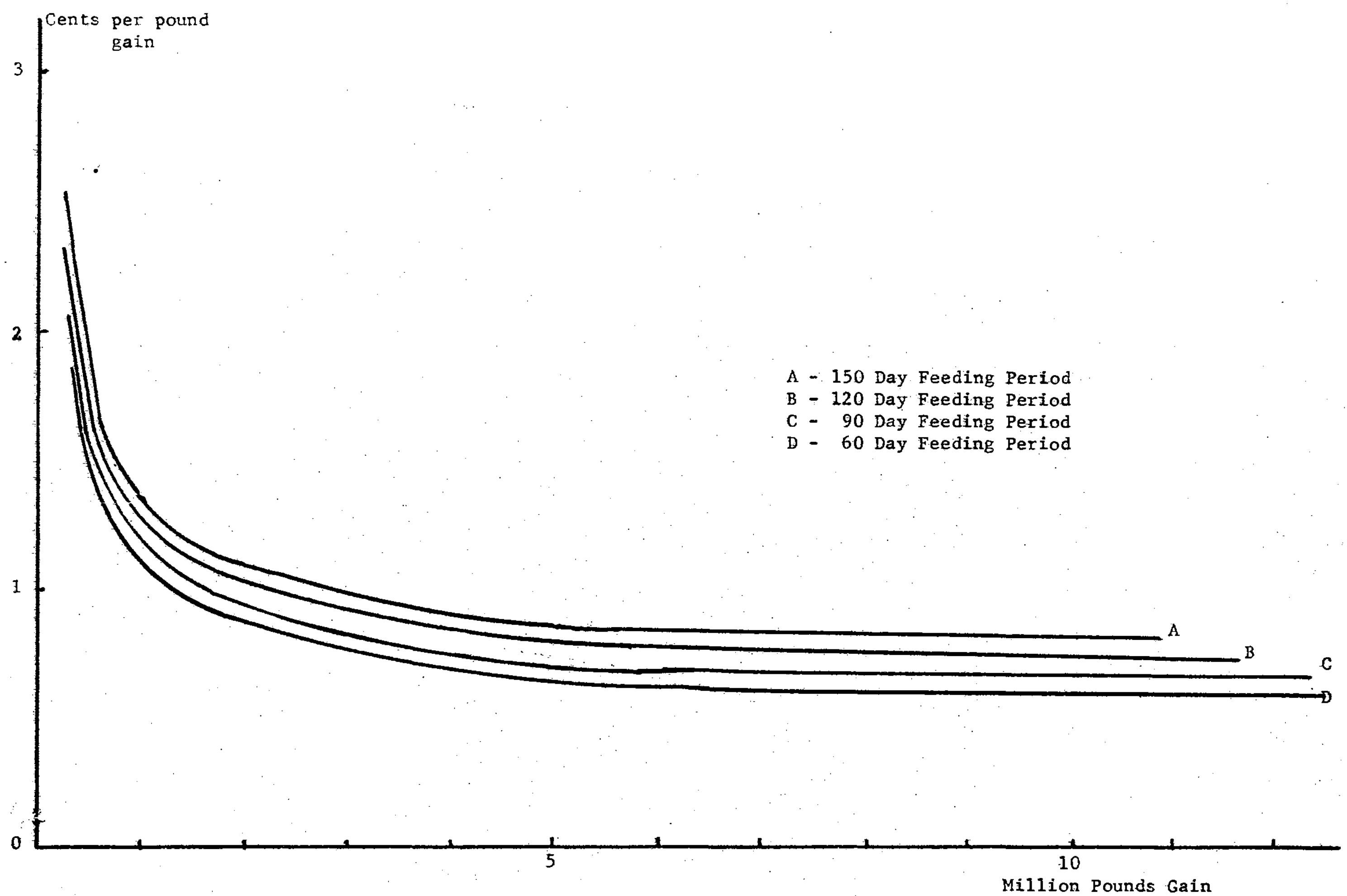

Figure 6. Reductions in Fixed Cost per Pound of Gain Associated with Increases in Feedlot Size and Changes in the Length of Feeding Period--500 Pound Heifers Fed Continuously.

TABLE XVII

LEVELS AND DIFFERENCES IN AVERAGE FIXED COSTS PER POUND OF GAIN BY SCALE OF FEEDLOT FOR THREE TYPES OF FEEDER ANIMALS, VARYING LENGTHS OF FEEDING PERIODS, AND CONTINUOUS OPERATIONS--FENCELINE BUNK SYSTEMS

Feedlot Size and Cost Comparison	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
	- Cents Per Pound of Gain -			
		500 Pound Heifers		
300 head lot	1.86	2.05	2.31	2.52
2,000 head lot	.88	.97	1.10	1.20
15,000 head lot	.60	.65	.74	.81
Saving - 300 to 15,000	1.26	1.40	1.57	1.71
Saving - 300 to 2,000	.98	1.08	1.21	1.32
Saving - 2,000 to 15,000	.28	.32	.36	.39
		650 Pound Heifers		
300 head lot	1.85	2.05	2.23	2.56
2,000 head lot	.87	.97	1.10	1.21
15,000 head lot	.59	.65	.74	.82
Saving - 300 to 15,000	1.26	1.40	1.59	1.74
Saving - 300 to 2,000	.98	1.08	1.13	1.35
Saving - 2,000 to 15,000	.28	.32	.46	.39
		700 Pound Steers		
300 head lot	1.76	1.90	2.10	2.25
2,000 head lot	.83	.90	1.00	1.07
15,000 head lot	.56	.60	.67	.72
Saving - 300 to 15,000	1.20	1.30	1.43	1.53
Saving - 300 to 2,000	.93	1.00	1.10	1.18
Saving - 2,000 to 15,000	.27	.30	.33	.35

TABLE XVIII

LEVELS AND DIFFERENCES IN AVERAGE FIXED COST PER POUND OF GAIN BY SCALE OF FEEDLOT FOR THREE TYPES OF FEEDER ANIMALS, VARYING LENGTHS OF FEEDING PERIOD, ONE TURNOVER ANNUALLY, AND FENCELINE BUNK SYSTEMS

Feedlot Size and Cost Comparison	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
	- Cents Per Pound of Gain -			
	500 Pound Heifers			
300 head lot	11.20	8.20	6.94	6.06
2,000 head lot	5.30	3.89	3.29	2.87
15,000 head lot	3.58	2.62	2.21	1.94
Saving - 300 to 15,000	7.62	5.58	4.73	4.12
Saving - 300 to 2,000	5.90	4.31	3.65	3.19
Saving - 2,000 to 15,000	1.72	1.27	1.08	.93
	650 Pound Heifers			
300 head lot	11.12	8.20	6.98	6.15
2,000 head lot	5.27	3.89	3.30	2.91
15,000 head lot	3.55	2.62	2.23	1.96
Saving - 300 to 15,000	7.57	5.58	4.75	4.19
Saving - 300 to 2,000	5.85	4.31	3.68	3.24
Saving - 2,000 to 15,000	1.72	1.27	1.07	.95
	700 Pound Steers			
300 head lot	10.55	7.61	6.31	5.41
2,000 head lot	5.00	3.60	2.99	2.56
15,000 head lot	3.37	2.43	2.02	1.73
Saving - 300 to 15,000	7.18	5.18	4.29	3.68
Saving - 300 to 2,000	5.55	4.01	3.32	2.85
Saving - 2,000 to 15,000	1.63	1.17	.97	.83

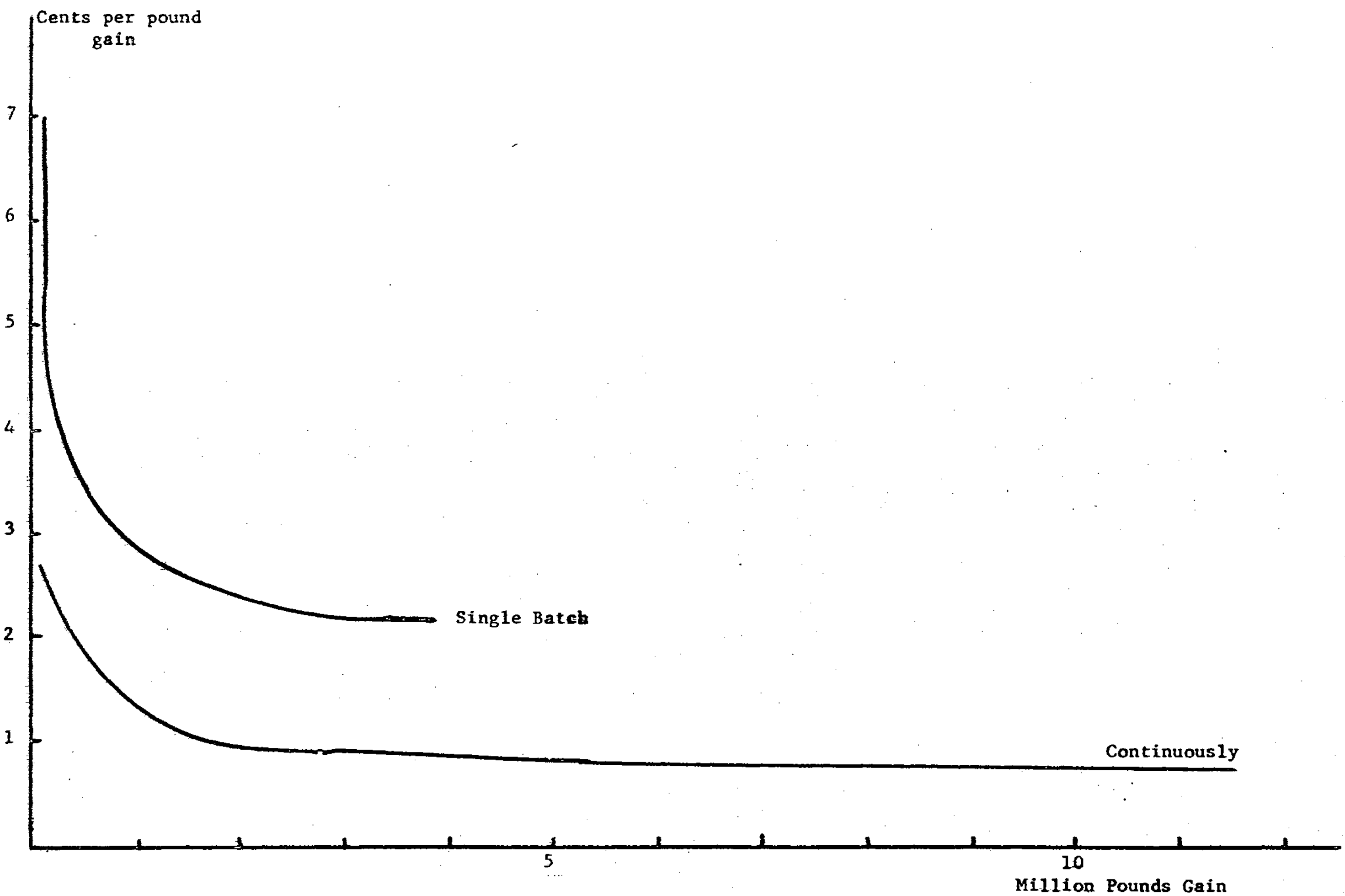

Figure 7. Effects of Single Batch Versus Continuous Feeding on Fixed Cost-Scale Functions--500 Pound Heifers Fed 120 Days.

one for continuous systems. The difference averages about one and one-half cents. However, cost savings with increases in scale are greater for single batch systems than for continuous operations. The reason is that the single batch system more completely utilizes fixed facilities at higher levels of production and feedlot size than at lower levels. Tables XVII and XVIII provide detailed comparisons.

Effects of Utilization on Fixed Costs

Short-run average fixed cost curves dropped sharply with increases in utilization rate. These reductions were greater for systems involving longer feeding periods, smaller feedlot sizes, and for heifers relative to steers. Approximately three-fourths of the cost reduction associated with spreading fixed cost over a larger volume was reached at two-thirds of total capacity.

Typical negatively sloped average fixed cost functions were derived for each feedlot size (Figure 8). The slopes were much steeper for smaller feedlots than for larger-volume models. This indicated that over the range of utilization studied, a larger cost reduction per additional unit of output was achieved in small lots than in large ones. More detailed data on cost savings associated with a fuller use of fixed feeding facilities are shown in Table XIX.

Scale and Utilization Economies Associated With Nonfeed Variable Costs

Nonfeed variable costs also are affected by variations in scale and utilization rate. In general, however, these effects are much smaller than the effects on fixed costs described earlier. The changing

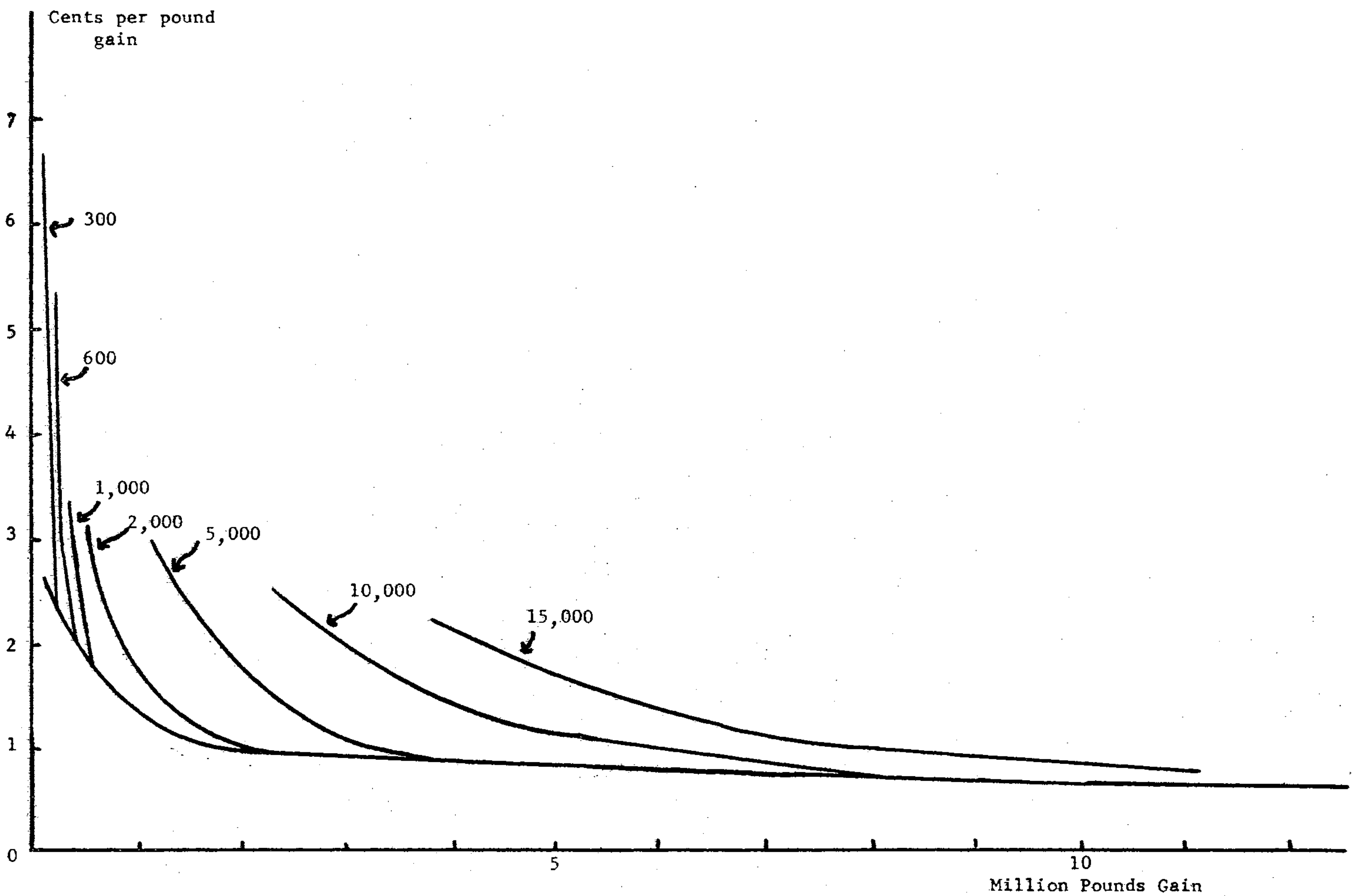

Figure 8. Short-Run Average Fixed Cost Curves for Seven Feedlot Sizes--650 Pound Heifers Fed Continuously for 120 Days.

TABLE XIX

SAVINGS IN FIXED COST PER POUND OF GAIN ASSOCIATED WITH CHANGES IN UTILIZATION RATES FOR VARYING FEEDLOT FACILITIES AND CONTINUOUS FEEDING OF 650 POUND HEIFERS IN FENCELINE BUNK SYSTEMS

Feedlot Size	Change in Utilization Rate (Continuous Feeding)	Cost Savings Associated With Utilization Increase — Length of Feeding Period: 60 Days	90 Days	120 Days	150 Days
	-Percent-	- Cents Per Pound of Gain -			
300	33 to 67	2.78	3.07	3.49	3.85
	67 to 100	.93	1.03	1.16	1.28
600	33 to 67	2.15	2.35	2.68	2.96
	67 to 100	.74	.80	.89	.98
1,000	40 to 70	1.15	1.27	1.45	1.59
	70 to 100	.46	.52	.58	.64
2,000	35 to 75	1.33	1.48	1.68	1.84
	75 to 100	.30	.33	.37	.41
5,000	30 to 60	1.19	1.32	1.49	1.65
	60 to 100	.48	.52	.60	.65
10,000	30 to 70	1.17	1.29	1.46	1.61
	70 to 100	.26	.30	.33	.36
15,000	33 to 67	.89	.98	1.12	1.22
	67 to 100	.28	.33	.37	.41

internal composition of nonfeed variable costs was largely responsible for many observed relationships between these costs and utilization rate or scale.

Effects of Scale on Nonfeed Variable Costs

Long-run nonfeed variable cost curves dropped on the average about three-fourths of one cent per pound of gain as the range of scale increased from 300 to 15,000. Significantly lower cost levels were achieved with increases in length of feeding period. This is illustrated for 500 pound heifer feeders in Figure 9. As shown, however, cost differences become progressively smaller with each additional 30 day increase in the feeding period.

Long-run nonfeed variable cost curves are shown in Figure 10 for each of the three feeder animal classes in a continuous 120 day feeding system. For these functions approximately half of the overall cost reduction was attained with a size model of 2,000 head. Differences in levels of these functions were so small that for practical operating purposes they could be neglected.

At equivalent levels of production, nonfeed variable costs were smaller for single batch operations than for models of continuous feeding (Figure 11). Differences, however, were insignificantly small. For the models illustrated in Figure 11 and other similar comparisons based upon budgeted data, the difference was approximately one-tenth of one cent throughout most of the scale range.

More complete data on nonfeed variable costs and cost savings associated with scale are shown in Table XX. Nonfeed cost savings

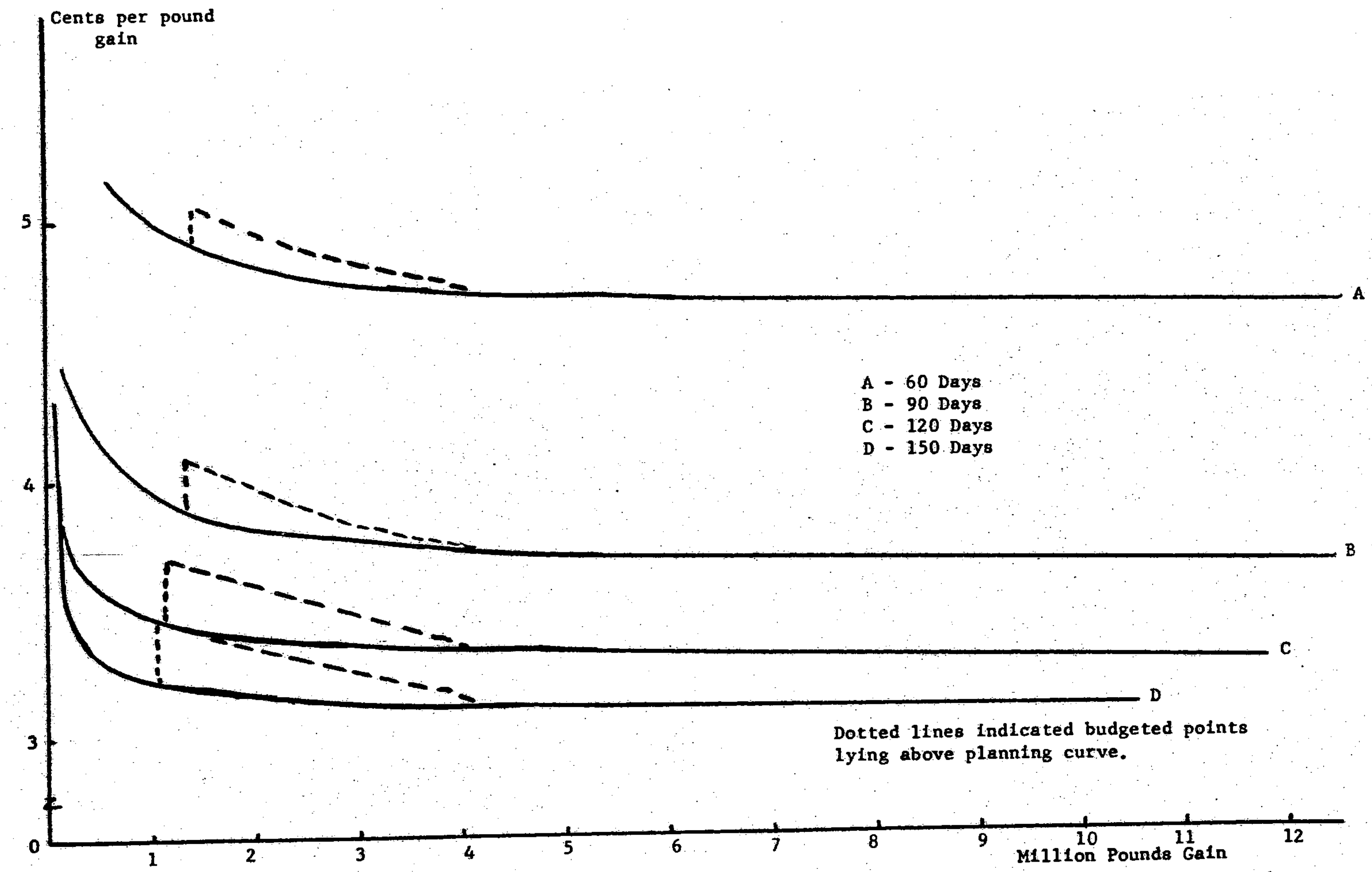

Figure 9. Long-Run Nonfeed Variable Cost Curves Associated with Different Lengths of Feeding Periods--150 Pound Heifers Fed Continuously.

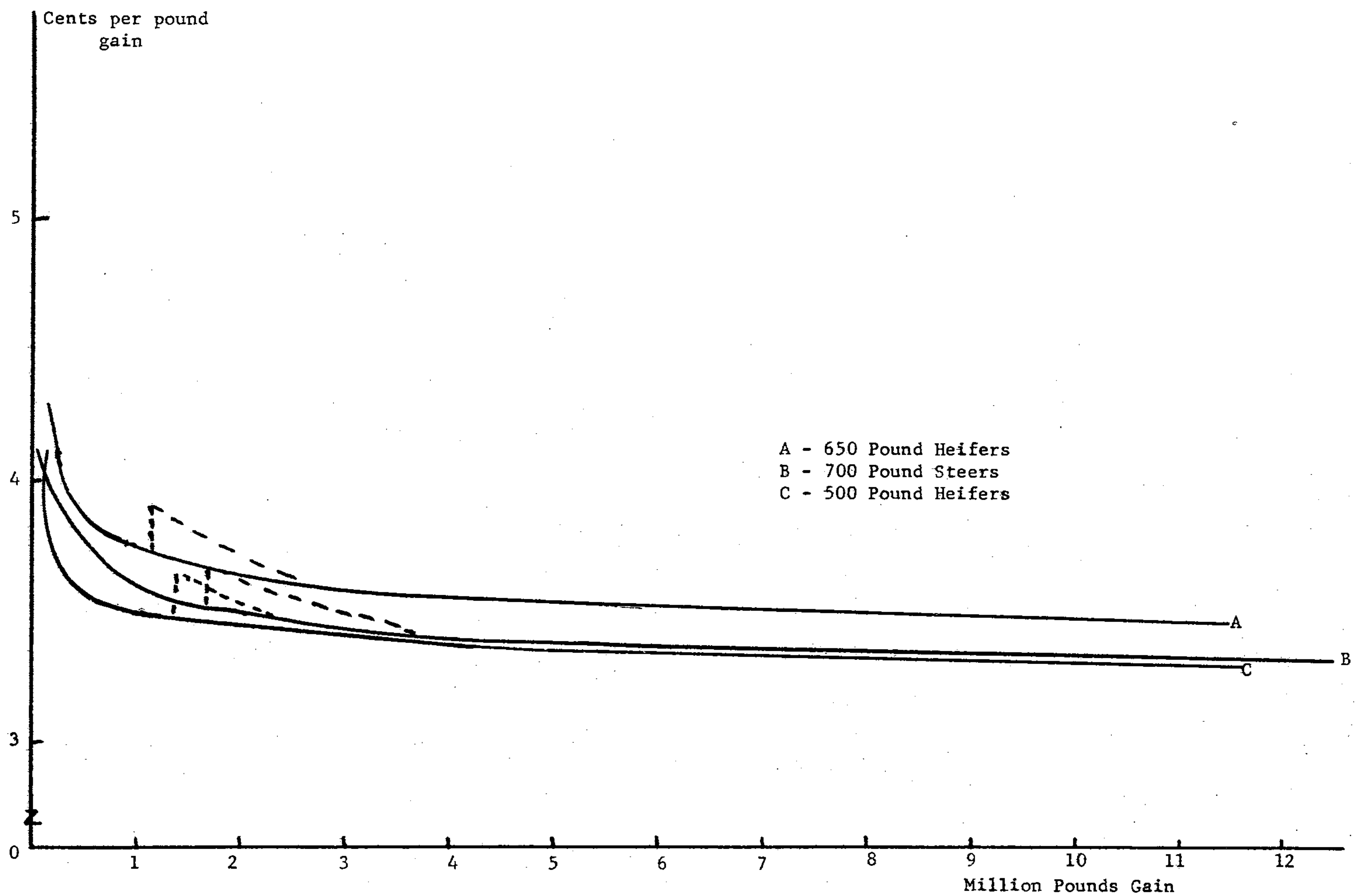

Figure 10. Long-Run Nonfeed Variable Cost Curves Associated with Three Classes of Feeder Animals--120 Day Continuous Feeding.

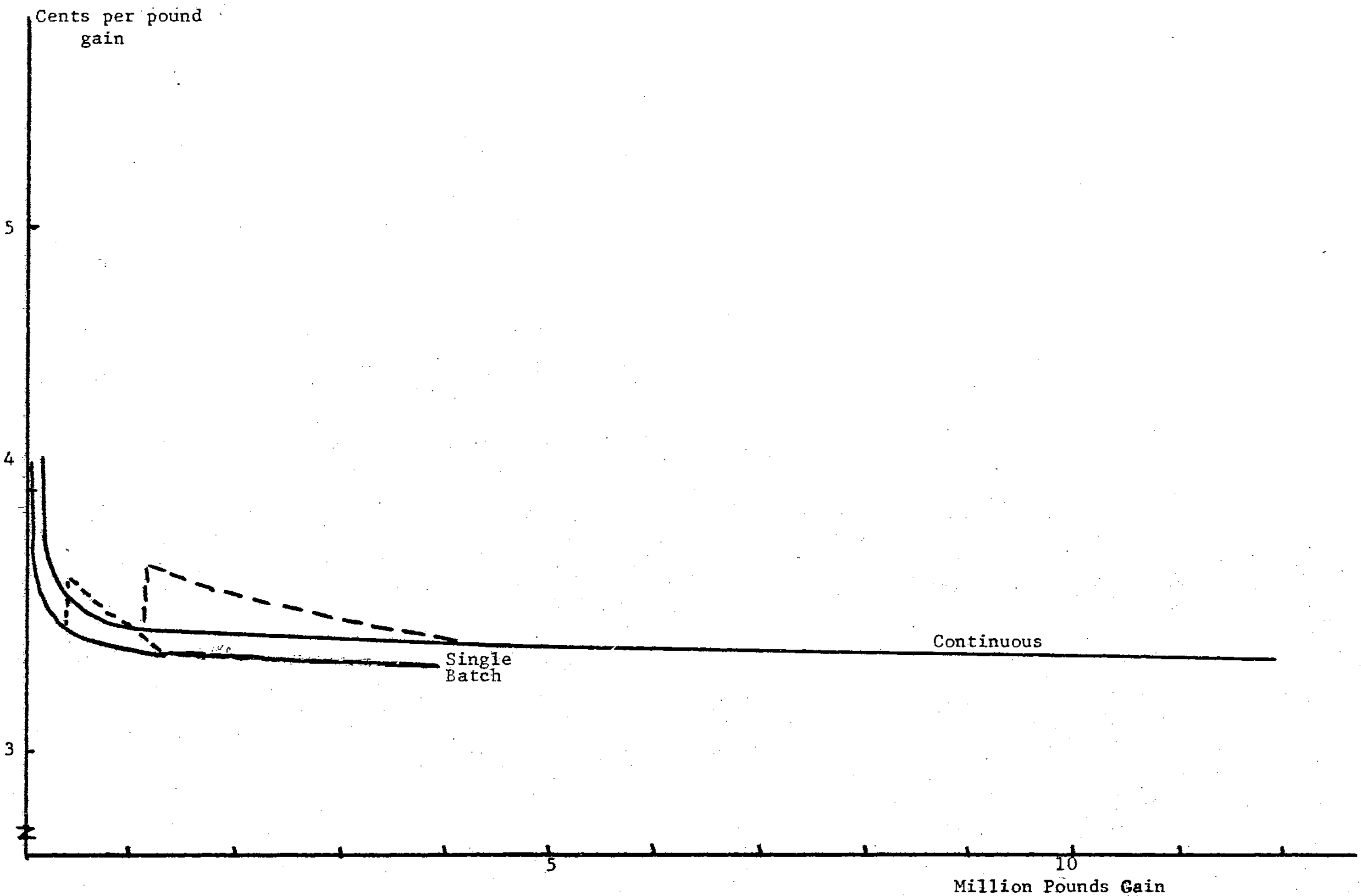

Figure 11. Long-Run Nonfeed Variable Cost Curves Associated with Continuous and Single Batch Operations--500 Pound Heifers Fed 120 Days.

TABLE XX

COSTS AND COST SAVINGS IN AVERAGE NONFEED VARIABLE COSTS PER POUND OF GAIN BY SCALE OF FEEDLOT FOR THREE TYPES OF FEEDER ANIMALS AND VARYING LENGTHS OF FEEDING PERIOD IN FENCELINE BUNK SYSTEMS

Feedlot Size and Cost Comparison	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
	- Cents per Pound of Gain -			
	500 Pound Heifers			
300 head lot	5.39	4.39	4.10	3.91
2,000 head lot	5.03	4.01	3.69	3.49
15,000 head lot	4.63	3.65	3.29	3.06
Saving - 300 to 15,000	.76	.74	.81	.85
Saving - 300 to 2,000	.36	.38	.41	.42
Saving - 2,000 to 15,000	.40	.36	.40	.43
	650 Pound Heifers			
300 head lot	5.58	4.51	4.25	4.11
2,000 head lot	5.26	4.19	3.86	3.67
15,000 head lot	4.85	3.82	3.47	3.24
Saving - 300 to 15,000	.73	.69	.78	.87
Saving - 300 to 2,000	.32	.32	.39	.44
Saving - 2,000 to 15,000	.41	.37	.39	.43
	700 Pound Steers			
300 head lot	5.53	4.41	4.00	3.76
2,000 head lot	5.21	4.07	3.68	3.42
15,000 head lot	4.83	3.76	3.31	2.99
Saving - 300 to 15,000	.70	.65	.69	.77
Saving - 300 to 2,000	.32	.34	.32	.34
Saving - 2,000 to 15,000	.38	.31	.37	.43

associated with scale in the range of 300 to 15,000 head varied from 0.85 cents for 650 pound heifers fed 150 days to 0.70 cents for 700 pound steers fed 60 days. Slightly larger savings usually were achieved with the 500 pound heifer class of feeder animal.

Discontinuities in planning functions, illustrated in each of the figures, are not uncommon and as suggested in an earlier section are associated with the discrete nature of inputs such as labor. Labor requirements adopted for use in this study call for the addition of a skilled feed mill operator at a point between the 1,000 and the 2,000 head feedlot sizes. The effect, as illustrated by the dashed lines in Figure 9 and other scale diagrams is an upward shift in cost per pound of gain and discontinuity in the planning function. Since only one such skilled operator is required for the full range of scale considered no further large discontinuities appear. However, additional small discontinuities associated with adding labor as output increases are present but not shown.

Effect of Use Upon Nonfeed Variable Costs

Short-run average nonfeed variable costs per pound of gain were found to exhibit two characteristics as the level of output forthcoming at a specific feedlot size was increased from one-third to full utilization. First, these functions were negatively sloped. Secondly, the utilization functions were discontinuous as changes were required in the composition and number of laborers. The discontinuities resulting from the addition of one more man were more apparent in smaller feedlots than in large lots because the addition to cost was spread over a much greater volume in the large operations, and in effect was nearly proportional to increased output. The problem is further complicated by the fact that, for any given feedlot model, only three levels of use were budgeted, thereby making it difficult to trace out effects accurately.

Short-run average nonfeed variable cost functions are shown in Figure 12 for the four smaller-volume feedlots. The composition and number of laborers required also is shown, with part-time employees designated P, full-time employees F, and a mill foreman M. The situation is illustrative only, since it is virtually impossible to show discontinuous functions when only three points are examined for each situation. The discontinuities shown are pecuniary as well as physical since the three types of employees each receive a different wage rate.

The slopes of the short-run average nonfeed variable cost functions were considerably steeper for small-volume feedlots than for larger-volume lots. This indicated that cost savings associated with increasing the level of utilization were greater per unit of output for the smaller feedlots than for the larger ones.

Table XXI shows the savings associated with increasing the use level for the 650 pound feeder class with variation in length of feeding period and feedlot size. A longer feeding period, ceteris paribus, was associated with a greater saving in nonfeed variable cost as feedlot utilization was increased. Effects of variations in utilization rate were much the same for comparable models involving other feeder cattle classes.

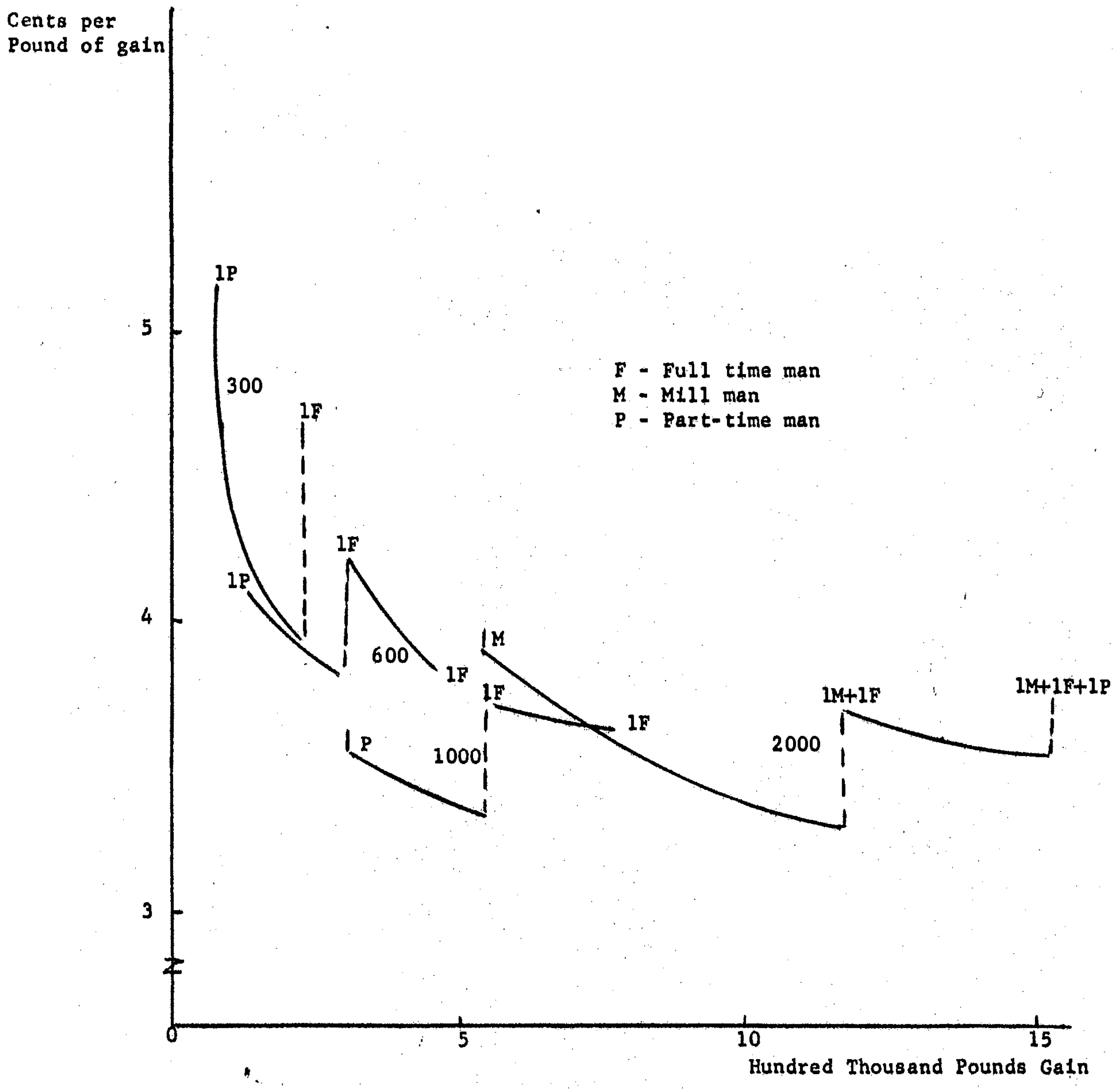

Figure 12. Short-Run Average Nonfeed Variable Cost Curves for Four Feedlot Sizes--500 Pound Heifers Fed Continuously for 120 Days.

TABLE XXI

NONFEED VARIABLE COST SAVINGS ASSOCIATED WITH CHANGES IN UTILIZATION RATES OF FIXED FEEDLOT FACILITIES, 650 POUND HEIFER FEEDER CLASS, AND CONTINUOUS FEEDING IN FENCELINE BUNK SYSTEMS

Feedlot Size	Change in Utilization Rate (Continuous Feeding)	Cost Savings Associated With Utilization Increase — Length of Feeding Period			
		60 Days	90 Days	120 Days	150 Days
	-Percent-	- Cents Per Pound of Gain -			
300	33 to 67	.89	1.00	1.07	1.28
	67 to 100	-.45	-.55	-.58	-.68
600	33 to 67	-.11	-.13	-.16	-.19
	67 to 100	.09	.09	.10	.13
1,000	40 to 70	.23	.83	.54	.52
	70 to 100	.31	.08	.07	.15
2,000	35 to 75	.36	.10	.21	.24
	75 to 100	-.05	.09	-.03	-.04
5,000	30 to 60	.23	.16	.24	.31
	60 to 100	.16	.15	.09	.01
10,000	30 to 70	.17	.16	.14	.16
	70 to 100	.03	.04	.00	.00
15,000	33 to 67	.05	.02	.02	.05
	67 to 100	.00	.01	.01	.02

Total Economies of Scale and Utilization

Short-run nonfeed cost functions and nonfeed cost planning functions are the summation of effects described earlier. Since scale and utilization economies arose primarily from reductions in fixed costs, the patterns and relationships described are, in general, similar to those outlined in the discussion of fixed costs.

Scale Economies

Findings regarding effects of scale in the feedlot industry were in general accordance with theoretical expectations. It was found that in continuous feeding operations, cost reductions over the range of scale considered varied from 2.32 cents to 3.29 cents per pound of gain depending upon length of feeding period and class of feeder animal fed (Table XXII). In comparison, scale-based cost reductions for single batch feeding operations were considerably larger ranging from 8.82 cents to 4.72 cents (Table XXIII).

Planning functions reflecting economies of scale, generally speaking, were only slightly lower for 700 pound steers than for 500 pound heifers, despite higher daily rates of gain for steers, and were highest for 650 pound heifers (Tables XXII and XXIII). Scale economies differed widely among systems distinguished by differences in length of feeding period. These functions dropped to progressively lower levels as the feeding period lengthened largely because lower nonfeed variable costs

TABLE XXII

AVERAGE TOTAL COSTS AND COST SAVINGS PER POUND OF GAIN BY SCALE OF FEEDLOT FOR THREE TYPES OF FEEDER ANIMALS, VARYING LENGTHS OF FEEDING PERIOD, CONTINUOUS OPERATIONS, AND FENCE-LINE BUNK SYSTEMS[a]

Feedlot Size and Cost Comparison	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
	- Cents Per Pound of Gain -			
	500 Pound Heifers			
300 head lot	7.69	6.94	6.97	7.10
2,000 head lot	5.91	4.98	4.82	4.58
15,000 head lot	5.23	4.30	4.03	3.87
Saving - 300 to 15,000	2.46	2.64	2.94	3.23
Saving - 300 to 2,000	1.78	1.96	2.15	2.52
Saving - 2,000 to 15,000	.68	.68	.79	.71
	650 Pound Heifers			
300 head lot	7.88	7.11	7.16	7.35
2,000 head lot	6.18	5.16	4.99	4.92
15,000 head lot	5.45	4.47	4.21	4.06
Saving - 300 to 15,000	2.43	2.64	2.95	3.29
Saving - 300 to 2,000	1.70	1.95	2.17	2.43
Saving - 2,000 to 15,000	.73	.69	.78	.86
	700 Pound Steers			
300 head lot	7.71	6.78	6.63	6.53
2,000 head lot	6.10	4.97	4.68	4.49
15,000 head lot	5.39	4.36	3.98	3.71
Saving - 300 to 15,000	2.32	2.42	2.65	2.82
Saving - 300 to 2,000	1.61	1.81	1.95	2.04
Saving - 2,000 to 15,000	.71	.61	.70	.78

[a]Feed and feeder cattle costs are excluded.

TABLE XXIII

AVERAGE TOTAL COSTS AND COST SAVINGS PER POUND OF GAIN BY SCALE OF FEEDLOT FOR THREE TYPES OF FEEDER ANIMALS, VARYING LENGTHS OF FEEDING PERIOD, ONE TURNOVER ANNUALLY, AND FENCELINE BUNK SYSTEMS[a]

Feedlot Size and Cost Comparison	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
	- Cents Per Pound of Gain -			
	500 Pound Heifers			
300 head lot	17.03	13.09	11.60	10.64
2,000 head lot	10.33	7.90	7.01	6.25
15,000 head lot	8.21	6.27	5.50	5.00
Saving - 300 to 15,000	8.82	6.82	6.10	5.64
Saving - 300 to 2,000	6.30	5.19	4.59	4.39
Saving - 2,000 to 15,000	2.52	1.63	1.51	1.25
	650 Pound Heifers			
300 head lot	17.15	13.26	11.81	10.94
2,000 head lot	10.58	8.08	7.19	6.62
15,000 head lot	8.41	6.44	5.70	5.20
Saving - 300 to 15,000	8.74	6.82	6.11	5.74
Saving - 300 to 2,000	6.57	5.18	4.62	4.32
Saving - 2,000 to 15,000	2.17	1.64	1.49	1.42
	700 Pound Steers			
300 head lot	16.50	12.49	10.84	9.69
2,000 head lot	10.27	7.67	6.67	5.98
15,000 head lot	8.20	6.19	5.33	4.72
Saving - 300 to 15,000	8.30	6.30	5.51	4.97
Saving - 300 to 2,000	6.23	4.82	4.17	3.71
Saving - 2,000 to 15,000	2.07	1.48	1.34	1.28

per pound of gain were generated by the longer feeding periods.[13] Total nonfeed cost planning functions were greater for single batch operations than for continuous feeding systems as a result, primarily, of higher fixed costs per pound of gain.

These effects and relationships, excluding feed costs, are selectively illustrated in Figures 13, 14, and 15. Figure 13 indicates that class of feeder animal fed has relatively little effect upon either the level or shape of functions reflecting nonfeed economies of scale. In these and related models, approximately three-fourths of the per unit cost reduction associated with scale over the size range of models studied was reached with a 2,000 head feedlot.

Figure 14 suggests that for 500 pound heifers fed in lots operating continuously, costs at equivalent levels of scale were about one and one-half cents lower in a 150 day feeding plan than for the 60 day feeding period. Clearly, potential savings beyond the one million pound level of gain, a scale size of approximately 1,500 head, offered by increases in length of feeding period greatly exceed those that might be achieved through further increases in scale.

Long-run cost differences for single batch versus continuous feeding systems are illustrated in Figure 15 for synthesized operations involving 500 pound heifers and a 120 day feeding period. Here, economies

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[13] It is important to remember, at this point, that the costs considered in the economies of scale analysis do not include feed costs. Increasing feed costs associated with longer feeding periods raises the total cost for longer feeding periods above similar total costs for shorter feeding periods when feeder cattle are not included as costs. When feeder cattle are included as costs, the total cost of feeding is greater in short feeding periods because more animals are purchased (See Figure 20).

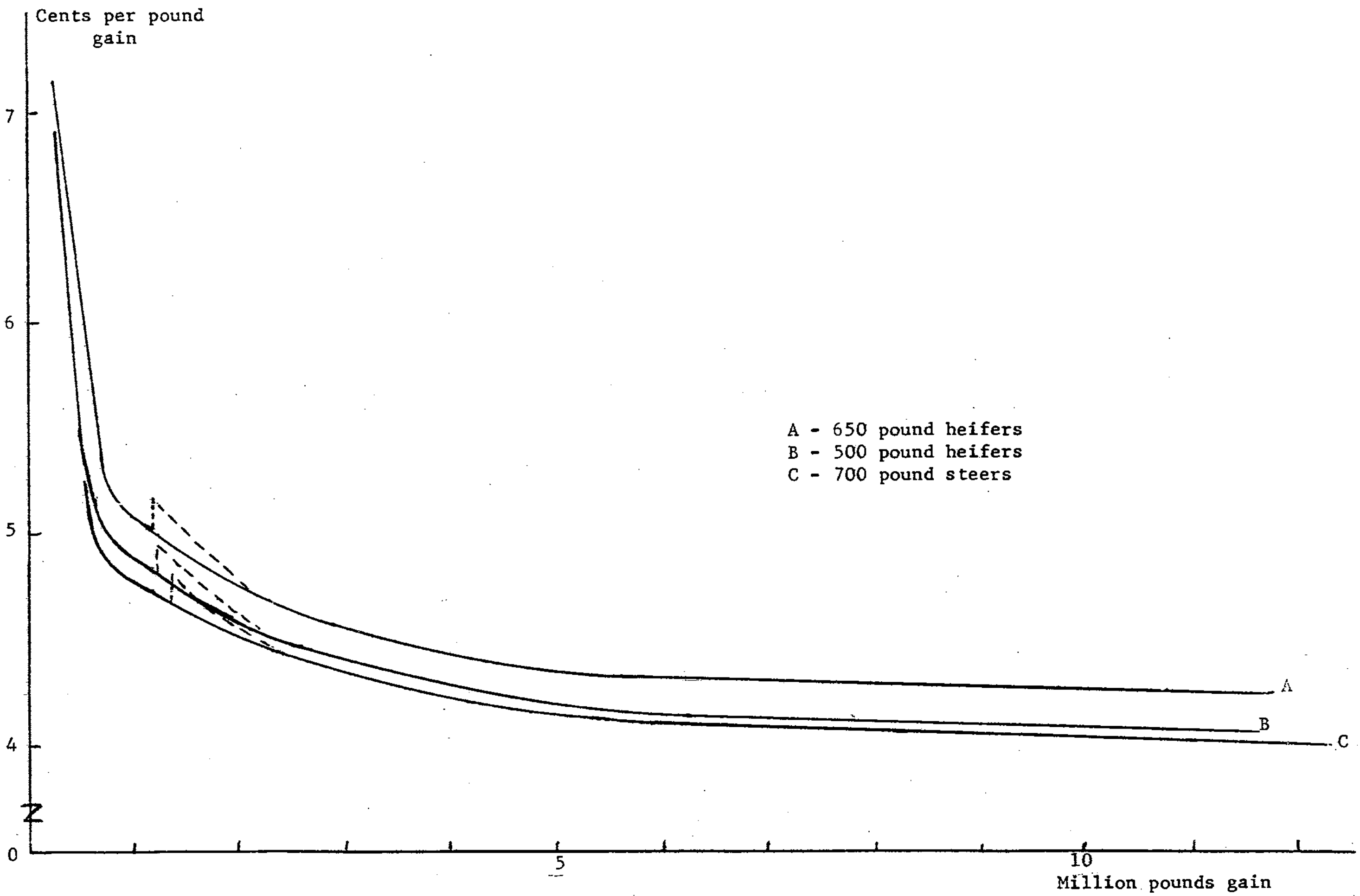

Figure 13. Long-Run Average Total Costs Excluding Feed and Feeder Cattle Associated with Three Classes of Feeder Cattle--Continuous 120 Day Feeding Plans.

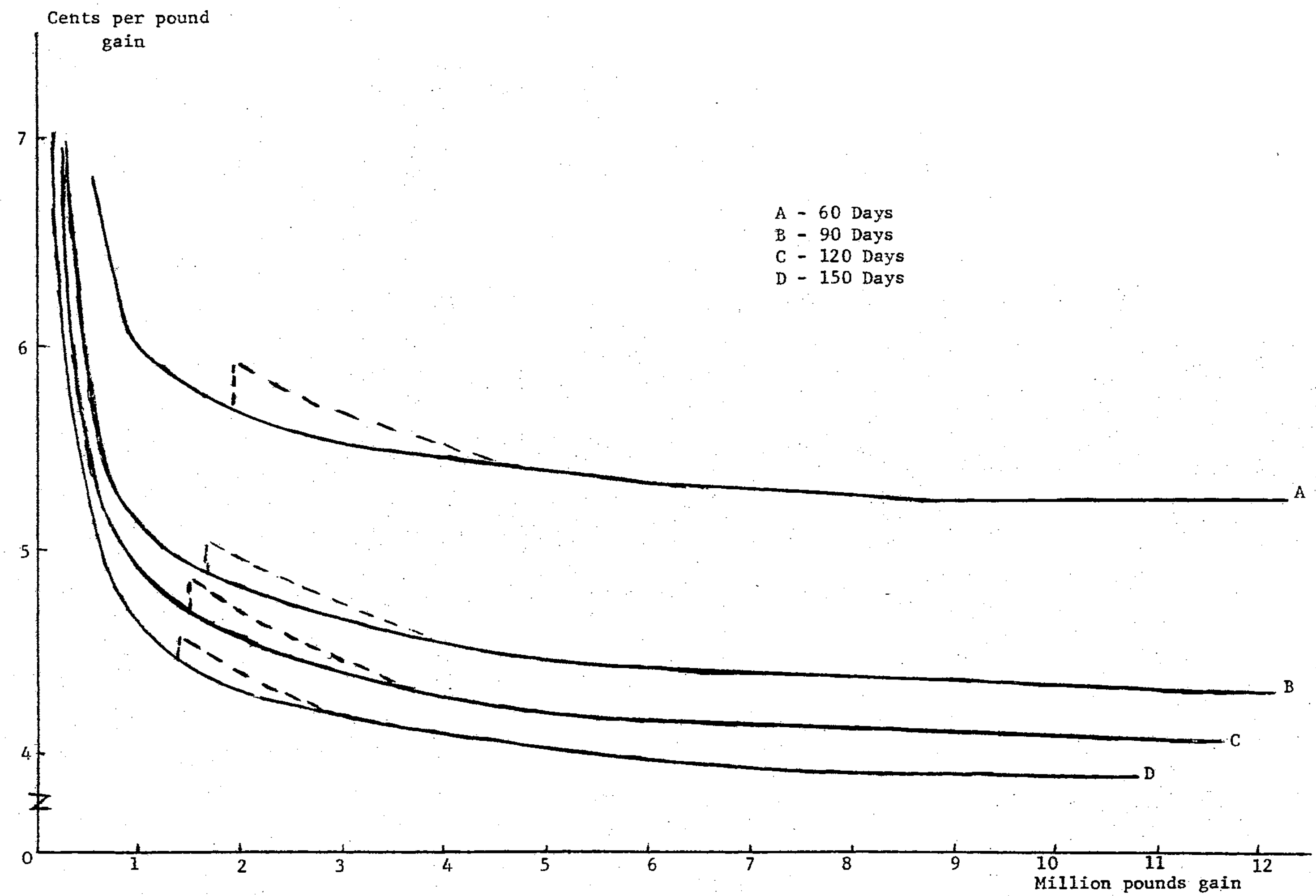

Figure 14. Long-Run Average Total Costs Other than Feed and Cattle Associated with Different Lengths of Feeding Periods--500 Pound Heifers Fed Continuously.

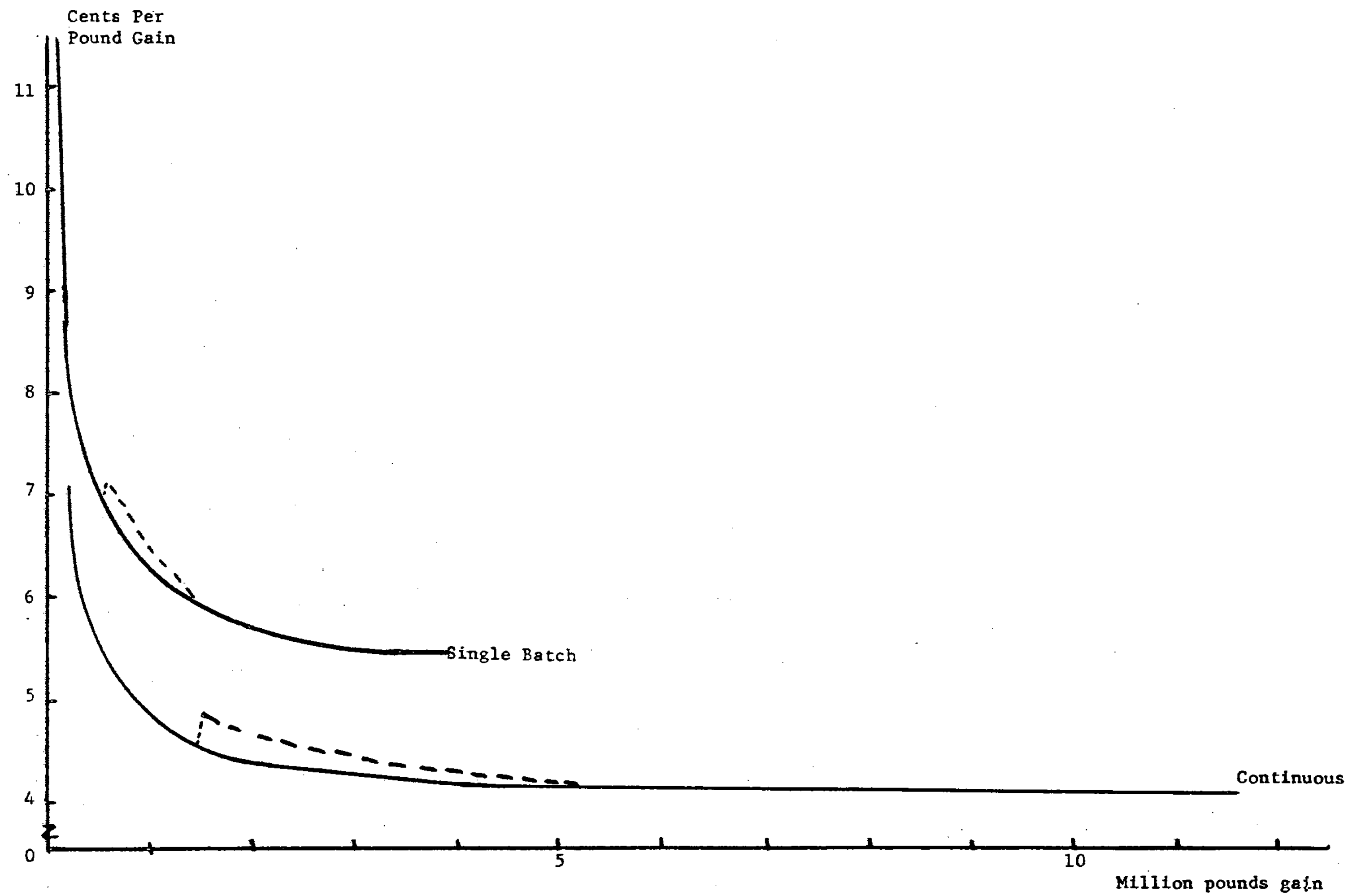

Figure 15. Long-Run Average Total Costs Other than Feed and Cattle Associated with Continuous and Single Batch Feeding--500 Pound Heifers Fed 120 Days.

of scale differences for equivalent levels of production were approximately one and one-half cents per pound of gain. Again, potential savings offered by the shift to continuous operation greatly exceed potential savings associated with scale beyond the one million pound level of production. As indicated earlier, however, scale economies (cost savings) within the lower range of production were considerably larger for single batch than for continuous systems.

Scale economies of the magnitude indicated are substantial. They are sufficiently large that under highly competitive conditions and an industry structure including many efficiently operated and large-volume feedlots, small-scale feedlots of less than 2,000 head likely would experience substantial and recurrent short-run losses. However, findings also suggest that scale advantages of the larger operations can be and, perhaps, frequently are largely offset and, in effect, destroyed by adoption of short period feeding operations or single batch programs. But as shown in the following chapter, the lower cost operations are not necessarily the most profitable.

Economies Associated with Utilization Rate

Average total nonfeed costs per pound of gain dropped with increased levels of utilization as anticipated. Short-run cost functions and associated cost savings, like the long-run planning functions, shifted with variations in scale, length of feeding period, continuity of feeding operations, and class of feeder animal.

Generally, savings per pound of gain associated with increased use of fixed feedlot facilities were greater, ceteris paribus, for heifers than for steers. This was true also for longer feeding periods relative to shorter periods, and for smaller lots in comparison with larger ones. A substantial portion of possible savings were achieved at a use level of approximately two-thirds.

Savings associated with increasing the level of utilization in model feedlots feeding 650 pound feeder heifers continuously are shown in Table XXIV. In this case, increasing the use level from one-third to full resulted in savings ranging from a high of 5.63 cents per pound of gain in the 300 head feedlot with a 150 day feeding period to 1.22 cents in the 15,000 head feedlot following a 60 day feeding plan. Another situation illustrating the effect of increasing the use level for 500 pound heifers and a 120 day feeding period is shown in Figure 16. Here, the cost saving associated with increasing use from one-third to full varied from about five cents in small lots to less than a cent and a half in large-volume lots. Short-run average cost curves, excluding costs of feed and feeder cattle, sloped downward and to the right in this and all other models considered. Findings revealed that models involving steers displayed patterns similar to those illustrated for heifers with respect to cost savings associated with use levels.

Several basic factors, briefly mentioned in the preceding paragraph, are shown more clearly in Table XXIV. First, a large share of the potential savings were achieved by increasing the use level from one-third to two-thirds; and, second, increases in capacity utilization above two-thirds were significantly and proportionately less important. Furthermore, effects per unit of gain associated with changes in utilization rates were relatively smaller for large lots than for small-volume lots because fixed cost represented a larger share of total cost in the small

TABLE XXIV

AVERAGE TOTAL COST AND COST SAVINGS PER POUND OF GAIN ASSOCIATED WITH USING FACILITIES AT FULL UTILIZATION LEVELS[a]

Feedlot Size	Change in Utilization Rate (Continuous Feeding)	Cost Savings Associated With Utilization Increase			
		Length of Feeding Period			
		60 Days	90 Days	120 Days	150 Days
	-Percent-	- Cents Per Pound of Gain -			
300	33 to 67	3.67	4.07	4.56	5.13
	67 to 100	.48	.48	.58	.60
600	33 to 67	2.04	2.22	2.52	2.77
	67 to 100	.81	.89	.99	1.11
1,000	40 to 70	1.38	2.10	1.99	2.11
	70 to 100	.77	.60	.65	.79
2,000	30 to 75	1.69	1.58	1.89	2.08
	75 to 100	.25	.42	.34	.37
5,000	30 to 60	1.42	1.48	1.73	1.96
	75 to 100	.64	.67	.69	.66
10,000	30 to 70	1.34	1.45	1.60	1.77
	70 to 100	.29	.34	.33	.36
15,000	33 to 67	.94	1.00	1.14	1.27
	67 to 100	.28	.34	.38	.43

[a]Assuming bunk systems, continuous feeding, 650 pound feeder heifers, and excluding costs of feed and feeder cattle.

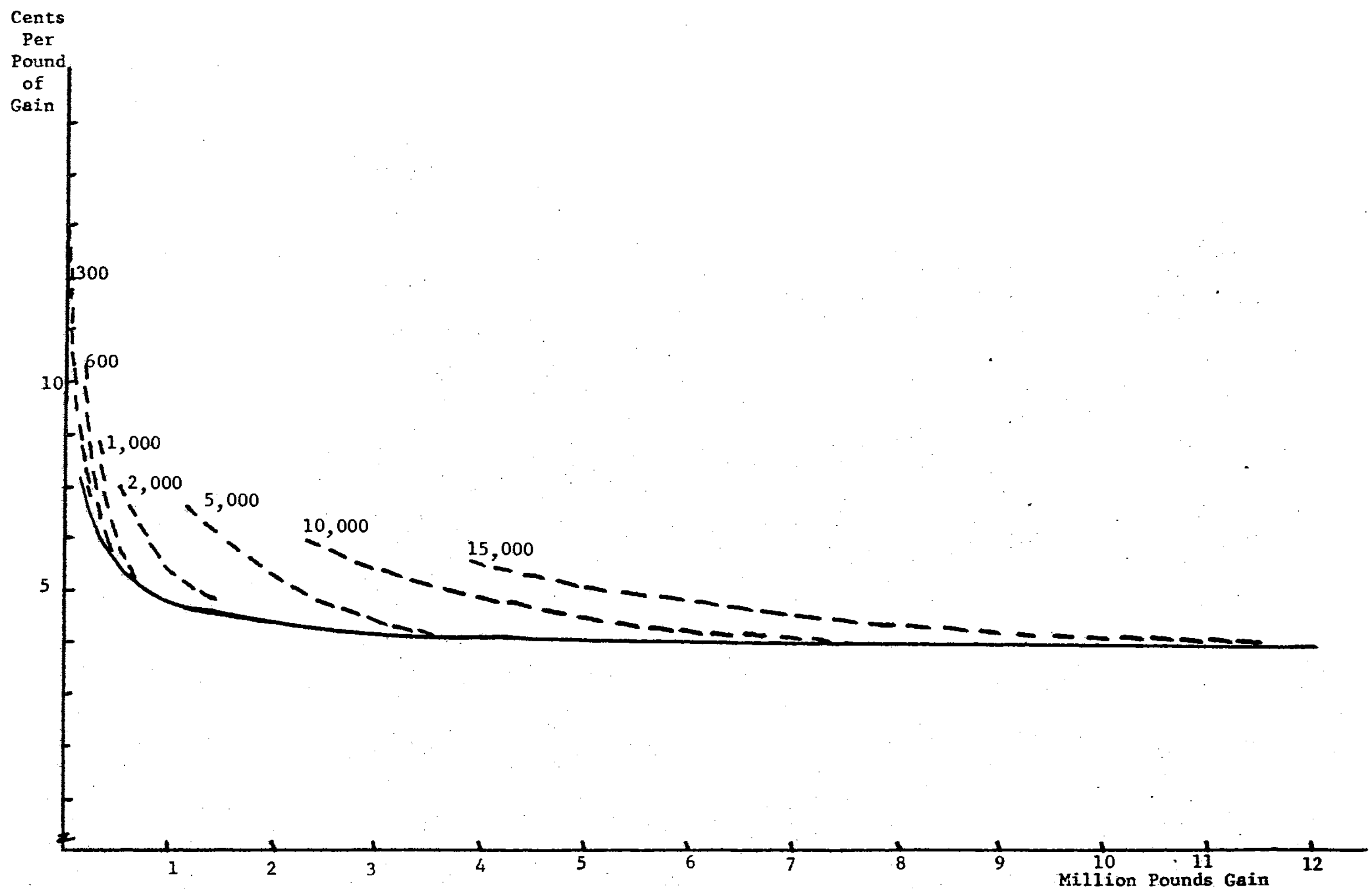

Figure 16. Short-Run Average Total Costs Other than Feed and Cattle for Seven Feedlot Sizes--500 Pound Heifers Fed 120 Days.

lots. In general, cost savings associated with the use level increased as the feeding period lengthened because fixed costs became relatively more important in longer feeding periods. In the 1,000 head feedlot size for instance, cost reductions per pound of gain associated with increasing the use level from one-third to full ranged from 2.90 cents for the 150 day feeding period to 2.15 cents for the 60 day period.

Fenceline Bunk Operations Versus Self-Feeder Systems

Combined annual nonfeed variable, fixed, and feed costs usually were slightly greater for self-feeder systems, ceteris paribus, than for fenceline bunk systems, although this was not always the case. Generally, the fenceline bunk systems were associated with lower nonfeed variable costs and the self-feeding systems were associated with lower fixed costs. Exceptions were found in some models such as the 5,000 head feedlot feeding 60 days.

Nonfeed variable costs were slightly lower, ceteris paribus, for fenceline bunk techniques than for self-feeder systems. This was attributable primarily to increased labor, repair, and fuel and oil associated with greater man and machine-hour requirements for unloading feed into self-feeders. Specific nonfeed variable cost items are shown in Table XXV for 10,000 head fenceline bunk and self-feeder feedlots operating at three levels of utilization on a continuous 120 day basis and feeding 500 pound heifers. In this case, annual nonfeed variable

TABLE XXV

NONFEED VARIABLE COSTS FOR 10,000 HEAD SELF-FEEDING AND FENCELINE BUNK FEEDING TECHNIQUES AT VARYING LEVELS OF UTILIZATION UNDER CONTINUOUS FEEDING WITH 500 POUND FEEDER HEIFERS AND 120 DAY FEEDING PERIOD

Cost Component	Self-Feeding Technique Utilization Level			Fenceline Bunk Technique Utilization Level		
	10,000	7,000	3,000	10,000	7,000	3,000
	- Dollars -					
Fuel and oil	12,018	8,410	3,653	10,261	7,183	3,128
Electricity	5,411	3,811	1,679	5,411	3,811	1,679
Electrical repair	4,327	3,049	1,350	4,327	3,049	1,350
Gasoline equipment repair	5,643	3,469	1,497	4,940	2,978	1,286
Pens and building repair	3,600	2,520	1,080	3,600	2,520	1,080
Labor	44,640	31,680	15,840	41,040	30,240	13,680
Veterinary and medical	30,000	21,000	10,800	30,000	21,000	10,800
Death loss	44,436	31,105	13,331	44,436	31,105	13,331
Marketing	109,890	76,923	32,967	109,890	76,923	32,967
Telephone	1,440	902	402	1,440	1,260	864
Interest on operating capital	1,308	910	416	1,278	902	402
Total	262,713	184,137	83,477	256,623	180,971	80,567

costs at full capacity utilization were more than $6,000 greater for the self-feeder technique. Relative differences in nonfeed variable costs associated with feeding techniques were similar for other feedlot sizes and classes of feeder animals.

Fixed costs were slightly smaller for 300 and 600 head fenceline bunk systems than for corresponding self-feeder systems. For sizes of 1,000 head or more, fixed costs were lower for self-feeder systems because of lower depreciation. Depreciation was less in the larger self-feeder models than in equivalent fenceline bunk models primarily because the large-volume bunk systems required more feed trucks and these depreciate rapidly.

Minimum Scale Requirements for Feedlot Ownership

One of the questions arising out of the increase in custom cattle feeding in Oklahoma and elsewhere is the minimum scale or volume required for feedlot ownership when custom feeding facilities and services are available. As noted earlier, custom feeding rates in Oklahoma commonly ranged from five to ten cents lot fee per animal unit day plus a markup of fifteen cents per hundredweight over "raw" feed price. Both the five and ten cent charge were considered in the following analysis to determine the minimum feedlot size at which it becomes less costly to own a feedlot rather than have cattle fed in a custom operation.

Certain costs of feeding cattle have no influence upon the break-even size associated with ownership of a feedlot versus custom feeding. These include costs of feeder cattle, marketing, death loss, and veterinary and medical expenses. Feedlot owners doing their own feeding must account for all remaining costs from revenue associated with the sale of fed cattle. The owner of a custom operation hopes to pay these costs from lot fees and the price "markup" on feed sales.

Over the range of scale considered and with specified custom feeding rates, costs per pound of gain associated with feedlot ownership, assuming continuous feeding at full capacity, usually were smaller than custom costs. On the other hand, with a single batch operation, it often was less expensive to place cattle in a custom lot. The breakeven feedlot size required to approximate costs in custom operations decreased, ceteris paribus, as the custom lot fee increased. As the feeding period lengthened, other things constant, the feedlot size needed to approximate custom costs decreased. Very little difference was noted in the breakeven feedlot size required for the three classes of feeder animals under continuous feeding.

Approximate feedlot sizes where feedlot ownership costs were equivalent to custom costs are shown in Table XXVI. These sizes were approximated to the nearest 25 head by assuming linear cost functions between the budgeted costs presented in Appendix F. A cattle feeder contemplating continuous feeding of 300 head or more would face lower costs with his own feedlot for all situations considered if the custom lot fee were ten cents. If the custom lot fee were five cents, the cattle feeder would require from 425 to 600 head, depending upon class of feeder cattle and length of feeding period, to justify feedlot ownership.

When only one batch per year feeding was synthesized, cattle feeders needed a considerably larger volume to justify ownership of facilities if the custom lot fee was five cents per day. This required

TABLE XXVI

APPROXIMATE FEEDLOT SIZE AT WHICH COSTS ASSOCIATED WITH OWNING A FEEDLOT ARE EQUIVALENT TO COSTS OF FEEDING IN CUSTOM FEEDLOTS WITH VARIATION IN FEEDING PERIOD, UTILIZATION, CLASS OF FEEDER ANIMALS, AND CUSTOM RATES--FENCELINE BUNK SYSTEMS

Class of Feeder Animals	Length of Feeding Period and Daily Lot Fee							
	60 Days		90 Days		120 Days		150 Days	
	5¢	10¢	5¢	10¢	5¢	10¢	5¢	10¢
	- Feedlot Size -							
	Continuous Feeding							
500 pound heifers	600	<300	500	<300	475	<300	500	<300
650 pound heifers	550	<300	525	<300	500	<300	475	<300
700 pound steers	500	<300	475	<300	450	<300	425	<300
	One Batch Feeding							
500 pound heifers	>15,000	8,800	>15,000	1,550	4,375	725	1,500	525
650 pound heifers	>15,000	7,500	11,150	1,325	3,875	725	1,300	475
700 pound steers	>15,000	6,450	9,775	1,100	2,850	675	875	400

volume ranged from approximately 875 in 150 day plans involving steers to more than 15,000 for all 60 day plans, and for 500 pound heifers fed 90 days. When the custom fee increased to ten cents per head per day plus the feed price markup, breakeven feedlot size varied from 8,800 head to 400 head. The former was associated with 500 pound heifers and 60 day plans, whereas the latter pertained to 700 pound steers and a 150 day feeding period.

Effects of changing the lot fee from five cents to ten cents per head per day and the difference between one batch and continuous feeding are shown in Figure 17. In these situations, the breakeven feedlot size is represented by the intersection of cost lines associated with feedlot ownership and custom operations.

Similar illustrations were developed to show relationships pertaining to changing feeding periods and class of feeder animals. In Figure 18, costs associated with feeding 500 pound heifers continuously in owned and custom operations for varying lengths of feeding period are shown for a custom rate of five cents per head per day. This figure illustrates that the breakeven feedlot size falls, ceteris paribus, as the feeding period increases in length.

Costs associated with feeding three classes of feeder animals continuously for 120 days when the custom rate is five cents per head per day plus feed costs are shown in Figure 19. The fact that the class of feeder animal has little effect on the breakeven feedlot size is illustrated in this figure.

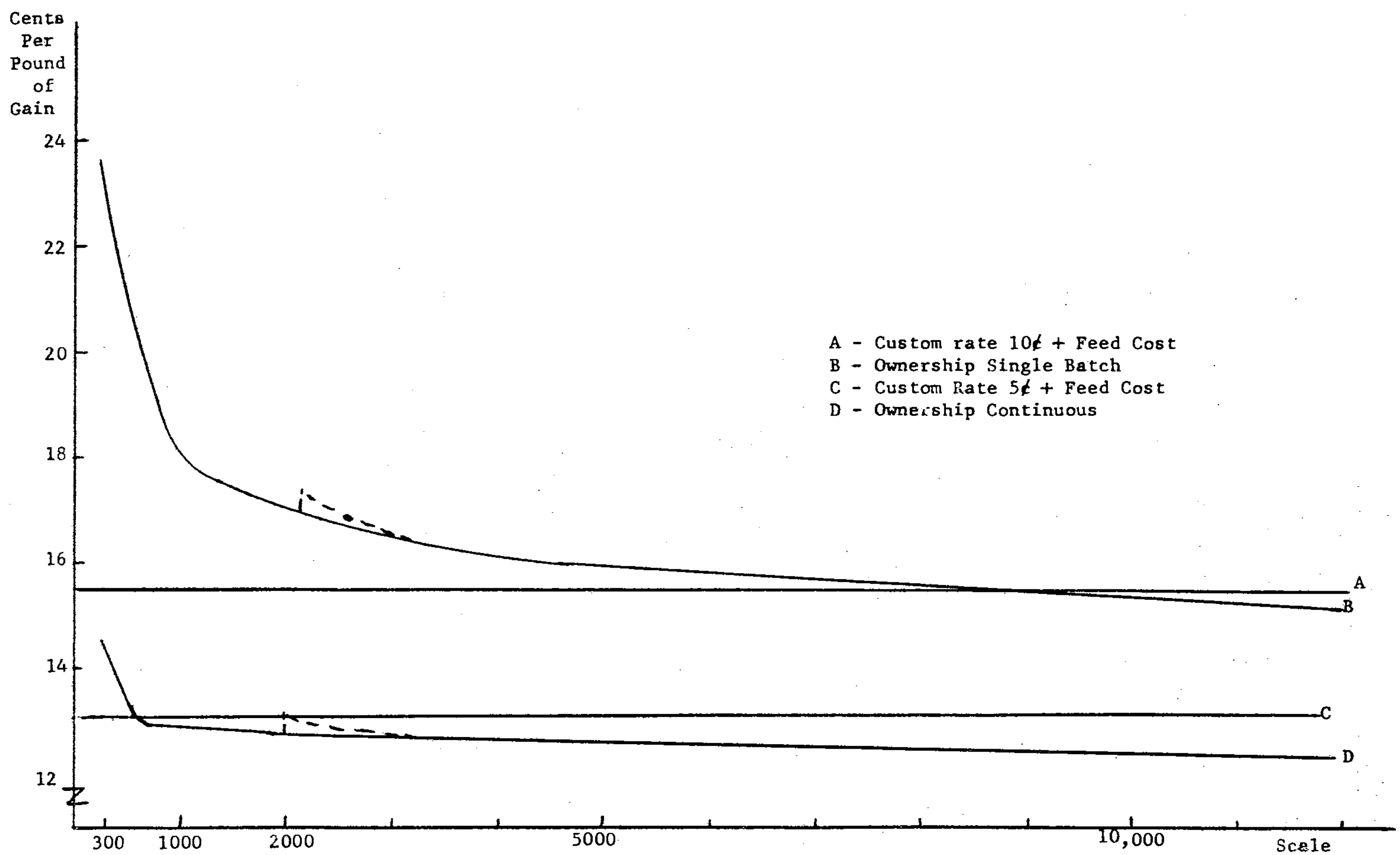

Figure 17. Cost of Feeding Cattle in Custom and Owned Facilities for Single Batch and Continuous Feeding at Two Custom Rates--500 Pound Heifers Fed 60 Days.

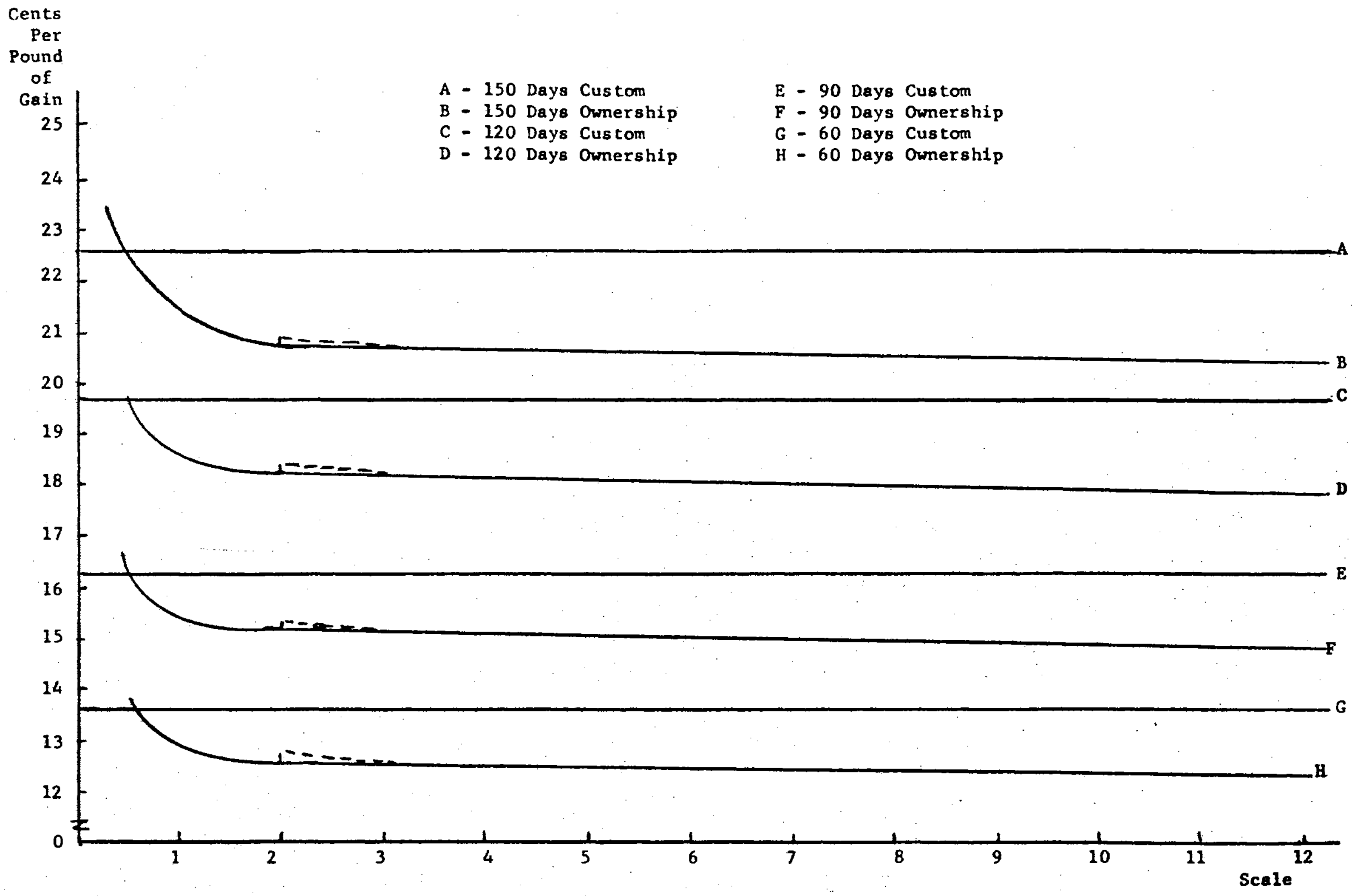

Figure 18. Cost of Continuously Feeding Cattle in Custom and Owned Facilities at Two Custom Rates and Variation in the Length of Feeding Period--500 Pound Heifers.

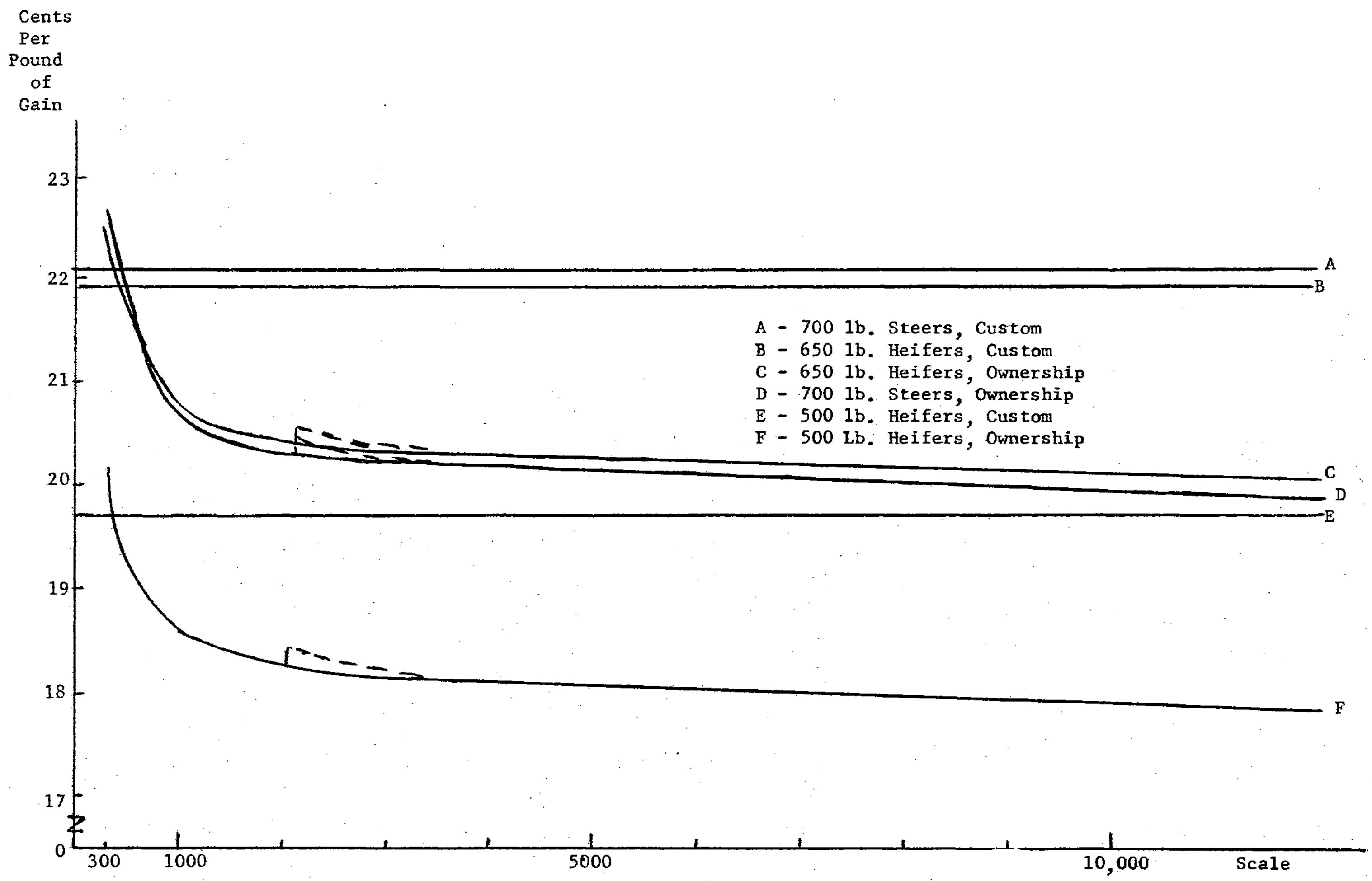

Figure 19. Cost of Continuously Feeding Cattle in Custom and Owned Facilities at Two Custom Rates with Variation in the Class of Feeder Animal--120 Day Feeding Period.

Major Findings Regarding Scale and Utilization

Findings regarding effects of scale and utilization in the feedlot industry generally agreed with theoretical expectations. That is, cost savings per pound of gain were noted with increases in feedlot size and with increases in the utilization rate. Changes in fixed cost per pound of gain were largely responsible for these phenomena although nonfeed variable costs also were important. From all appearances the utilization effect was greater than the scale effect, especially in the smaller feedlot sizes and longer feeding periods which fixed costs were relatively more important. Approximately three-fourths of the cost savings associated with increasing scale were reached with a 2,000 head feedlot. The savings associated with increasing the use level from one-third to two-thirds were considerably more important than the savings associated with increasing the capacity utilization from two-thirds to full. A more detailed summarization and implications of findings regarding scale and utilization are presented in a later chapter.

CHAPTER VI

COST AND COST-PRICE RELATIONSHIPS

Preceding material has dealt primarily with costs as related to scale of feedlot operations and to utilization. Revenue, profits, and other aspects of cost also are of interest to cattle feeders. Emphasis is placed in this chapter upon coefficients, relationships and analytical methods that provide bases for evaluations and decisions relevant to many feeding situations encountered frequently in the Southern Plains. This emphasis is largely confined to cost relationships other than those related primarily to utilization rate and scale. Particular attention is given to the influence of varying cost and price factors upon cattle feeding margins, breakeven prices, costs per pound of gain, revenues and profits. Some of the tables and charts are more illustrative than otherwise. Tables and text provide bases necessary for broader generalizations, and in addition, offer details applicable to a wide variety of specific situations. Models for both 500 pound heifers and 700 pound steers are used extensively in the analysis. The fenceline bunk system is employed throughout.

"Feeding margin" or "price margin" in this analysis, is defined as the difference between feeder cattle prices when purchased and slaughter cattle prices when sold. "Profit," in contrast, refers to the difference, positive or negative, between total cost and total revenue.

It was hypothesized that profits are affected significantly by all factors considered. These include price changes, length of feeding period, class of feeder animal, changes in slaughter grade, "upgrading," and other factors as well as variations in utilization rate and scale.

Total Cost Components and Their Relative Importance

Feed cost and feeder cattle cost are included in the analysis of this section as integral parts of the total cost structure. Interest on feeder cattle cost was charged at six percent per annum. However, cost associated with death loss was omitted in this analysis from non-feed variable costs. These costs were taken into account on the revenue side through adjustments in sale weight and in pounds added during the feeding period.

Total feedlot costs varied both by size and within size classes (Appendix Table G). Large quantities of operating capital were required. For example, the total annual operating capital required for a 1,000 head feedlot operated continuously on the basis of a short 60 day steer feeding program was slightly in excess of one million dollars. As the feeding period was extended to 150 days, this requirement fell to about $580,000.

Feed and feeder cattle, according to Table XXVII, are by far, the largest variable cost items encountered in feedlot feeding. At $ .20 per pound feeder cattle costs alone ranged from 80.5 to 57.9 percent of the total cost of feeding 500 pound heifers continuously. For steers at $ .22 per pound this range was from 83.8 percent to 63.6 percent.

These percentages increased with scale, reflecting effects of scale of economies with respect to "other" or nonfeed costs, and fell with increases in length of feeding period.

TABLE XXVII

PERCENTAGE OF TOTAL FEEDLOT COST ACCOUNTED FOR BY PURCHASE PRICE AND INTEREST CHARGE ON FEEDER CATTLE BY FEEDLOT SIZE AND LENGTH OF FEEDING PERIOD[a]

Feedlot	60 Days		90 Days		120 Days		150 Days	
Size	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers
				- Percent -				
300	78.1	82.1	70.4	75.2	63.7	69.1	57.9	63.6
600	78.9	82.7	71.8	76.0	65.2	69.9	59.1	64.5
1,000	79.7	83.0	72.4	76.7	65.8	70.7	60.0	65.1
2,000	79.8	83.3	72.6	76.8	66.0	70.8	60.5	65.4
5,000	80.3	83.7	72.9	77.2	66.7	71.2	60.9	65.9
10,000	80.5	83.8	73.3	77.3	66.8	71.4	61.1	66.0
15,000	80.5	83.8	73.4	77.4	66.9	71.5	61.2	66.1

[a]Assuming 20 cent feeder heifers and 22 cent feeder steers with continuous fenceline bunk operations at full utilization.

Breakeven Prices, Costs Per Pound of Gain and Price Margin Required

"Breakeven price" is the slaughter price required to defray the total cost of feeding. It, therefore, is total cost per pound sold. Breakeven price minus the appropriate feeder cattle price is "price margin required" to break even. "Cost per pound of gain" refers to the total cost of feeding minus the initial feeder cattle cost but including interest on feeder cattle cost per pound of weight added at time of sale.

Computational procedure may be expressed as follows:

(1) $BEP_i = TC_i/X_i$,

where

TC_i = Total cost of feedlot operation for situation i;

BEP_i = Breakeven price for the i^{th} situation; and

X_i = Total pounds of fed animal sold in the i^{th} situation.

(2) $PMR_i = BEP_i - pi$

where

PMR_i = Price margin required in i^{th} situation;

pi = Feeder price per pound;

BEP_i is defined above.

(3) $$CPPG_i = \frac{TC_i - p_i x_i}{X_i - .99x_i}$$

where

$CPPG_i$ = Cost per pound gain in the i^{th} situation,

x_i = Pounds of feeder animals purchased;

.99 adjusts initial weight and weight gain for death loss, and other terms are defined above.

Breakeven prices required to cover all feedlot costs dropped with increases in scale and rose with increases in length of feeding period (Table XXVIII). Scale economies and increased feed costs and other costs with length of feeding period were largely responsible for these

TABLE XXVIII

BREAKEVEN SALES PRICE BY SIZE OF FEEDLOT, CLASS OF FEEDER ANIMAL, AND LENGTH OF FEEDING PERIOD[a]

	500 Pound Heifers				700 Pound Steers			
Feedlot Size	60 Days	90 Days	120 Days	150 Days	60 Days	90 Days	120 Days	150 Days
	- Dollars Per Hundredweight -							
300	19.77	20.21	21.28	22.38	20.33	20.86	21.82	22.85
600	19.56	19.84	20.81	21.97	20.18	20.64	21.55	22.53
1,000	19.36	19.67	20.60	21.59	20.10	20.45	21.30	22.24
2,000	19.33	19.62	20.54	21.47	20.02	20.41	21.26	22.19
5,000	19.21	19.52	20.37	21.30	19.91	20.29	21.24	22.03
10,000	19.17	19.42	20.29	21.22	19.89	20.26	21.07	21.97
15,000	19.17	19.41	20.27	21.20	19.88	20.25	21.05	21.94

[a]Assuming bunk systems in continuous operation at full capacity utilization, 20 cent feeder animals, and other costs as shown in Appendix G.1 and G.2.

relationships. The reduction in BEP associated with scale accelerated as the feeding period was lengthened. As might have been expected from the earlier discussion, BEP also was affected significantly by utilization rate.

Price margins required to break even (PMR) at a \$ .20 feeder heifer cost per pound may be computed for the models represented in Table XXVIII by deducting \$20.00 from each figure appearing in this table. These logically fall with scale and rise with length of feeding period. For 500 pound heifers breakeven prices are achieved with negative price margins in all 60 day models and in all 90 day models except the one for 300 head. This means that in these models feedlot operators could break even at slaughter prices somewhat lower than prices paid for feeders. For instance, a 15,000 head feedlot with a 500 pound heifer feeding program could break even by selling $20 feeder cattle after 60 days of feeding at $19.17. If the cattle feeder held them for 150 days, he would need $21.22 to break even.

Cost per pound of gain (CPPG), like BEP, falls with increases in scale and rises with length of feeding period (Table XXIX). On the average, CPPG dropped $ .19 per hundredweight of heifer gain with each increase of 1,000 head in feedlot size and rose $2.38 with each 30 day increase in feeding period length. Cost reductions for heifers with 1,000 head increases in scale varied from an average of $ .17 per hundredweight gain for the 60 day feeding period to $ .21 for the 150 day period. In feeding 700 pound steers, reductions in CPPG per 1,000 head increase in scale varied from $ .16 to $ .19 and averaged about $ .17. The average increase for steers in CPPG per 30 day increase in length of feeding period was $2.39.

Effects of Changes in Prices of Feeders and of Slaughter Cattle

While cost relationships at fixed prices are of interest, price changes and their effects in a dynamic economy are of constant and continuing concern. Changes in prices of feeder cattle and of finished slaughter animals are of particular interest to feedlot operators. Feeder cattle, as indicated earlier, are the principal cost items in feedlot operation and slaughter cattle prices govern gross revenues. Effects of changes in cattle prices on costs, revenues and profits as indicated by the synthesized data, therefore, are dealt with in this section. All computations involved fenceline bunk models operating continuous feeding programs.

TABLE XXIX

COST PER POUND OF GAIN BY SIZE OF FEEDLOT, CLASS OF FEEDER ANIMAL, AND LENGTH OF FEEDING PERIOD[a]

Feedlot Size	500 Pound Heifers 60 Days	90 Days	120 Days	150 Days	700 Pound Steers 60 Days	90 Days	120 Days	150 Days
	- Dollars Per Hundredweight of Gain -							
300	18.42	20.24	23.24	26.05	20.87	22.82	25.79	28.44
600	17.55	19.02	21.97	24.91	20.09	21.94	24.83	27.42
1,000	16.76	18.46	21.37	23.92	19.66	21.17	24.00	26.54
2,000	16.63	18.28	21.18	23.56	19.26	21.01	23.84	26.38
5,000	16.14	17.98	20.66	23.14	18.72	20.57	23.38	25.88
10,000	15.97	15.34	20.46	22.93	18.60	20.44	23.21	25.70
15,000	15.96	17.61	20.40	22.88	18.55	20.40	23.14	25.60

[a]Includes interest cost on purchase of feeder animals but excludes original feeder cattle cost. Milo cost included at $1.80 per hundredweight, continuous fenceline bunk system.

Effects on Costs of Changes in Feeder Cattle Prices

In general, effects of changes in feeder cattle prices upon costs and profits per unit of production or sale weight were less than proportional. The reason is, of course, that any given change in feeder cattle cost associated with a price change is spread over sale weights that exceed initial weights.

Nature of these and other effects may be expressed through simple equations of the following forms:

(4) $TC_i = a_i \pm b_i p^*$, and (5) $\Delta TC_i = \pm b_i p^*$

where

TC_i = total annual cost for situation i where "situation" refers to specifications of a particular model

a_i = total annual cost at a "specified" feeder price for situation i

p^* = change in cents per pound above (+) or below (-) the specified price

b_i = change in total annual cost associated with a one-cent per pound change in feeder price for situation i

ΔTC_i = total annual change in total cost for situation i.

Values for "b_i" are not affected by changes in the "specified" price but they drop with increases in length of feeding period, rise linearly with scale and are affected by changes in utilization rate (Appendix H.1 and H.2). Assuming fixed sales prices and revenues for each situation, these coefficients also represent changes in total annual profits associated with a one-cent change in feeder cattle price.

Dividing equation 4 by X_i, sales weight, yields costs and cost changes per unit of sales weight. But $TC_i/X_i = BEP_i$ and, therefore, the modified equation can be written:

(6) $BEP_i = a_i^o \pm b_i^o p^*$

where

$a_i^o = a_i/X_i$ = total cost per pound of weight sold assuming a "specified" feeder price for situation i, and

$b_i^o = b_i/X_i$ = average change in total cost per pound of sale weight associated with a one-cent change in feeder price for situation i.

Similar equations were developed for PMR AND CPPG. Resulting coefficients, shown in Table XXX, represent average changes in cents per pound associated with a one-cent change in feeder price per pound. These coefficients do not change with feedlot size, utilization rate, or the "specified" price under consideration but, as indicated, they do vary with length of feeding period. The corresponding "a_i" values, which are annual costs associated with the specified price, also vary with length of feeding period, but in addition, change with scale and utilization rate.

A specific equation for BEP in the 600 head model with a 90 day continuous steer feeding program is as follows:

(7) $BEP = 21.94 \pm .7659\ p_i^*$

where p_i^* = change in feeder price in cents per pound above or below 20 cents.

This equation could be used to describe a line on a conventional breakeven chart where feeder prices are represented on the horizontal scale and breakeven sales prices are shown on the other. In this event, the coefficient .7659 would be the slope of the breakeven line and would state that with each change of one cent in feeder price, BEP changes in the same direction by .7659 cents--less than proportional. Other coefficients provide the basis for other breakeven lines and those for PMR and CPPG suggest various other educational charts and devices.

TABLE XXX

CHANGE IN BREAKEVEN PRICE, PRICE MARGIN REQUIRED, AND COST PER POUND OF GAIN ASSOCIATED WITH A ONE-CENT CHANGE IN FEEDER CATTLE PRICE FOR STEERS AND HEIFERS, AND FOUR FEEDING PERIODS IN FENCELINE BUNK SYSTEMS

Length of Feeding Period	Change in Cents Associated with a One-Cent Change in Feeder Cattle Price (b_i^o)					
	Heifers			Steers		
	BEP[a]	PMR[b]	CPPG[c]	BEP[a]	PMR[b]	CPPG[c]
	- Cents Per (Appropriate) Pound -					
60 Days	.7717	-.2283	.0314	.8199	-.1801	.0401
90 Days	.7120	-.2883	.0344	.7659	-.2341	.0434
120 Days	.6778	-.3225	.0389	.7315	-.2685	.0480
150 Days	.6487	-.3508	.0424	.7016	-.2986	.0515

[a]The breakeven price is the slaughter price needed to defray the total cost of feeding.

[b]The price margin required is the breakeven price minus the feeder price.

[c]Cost per pound of gain refers to the total cost of feeding minus initial feeder cattle cost but including interest on feeder cattle cost divided by the number of pounds of gain.

With increases in length of feeding period, a given change in feeder price is distributed over increasingly large quantities of selling weight. This is the reason why coefficients representing changes in BEP with unit increases in feeder price drop as length of feeding period increases. Since $PMR_i = BEP_i - p_i$, the relationship also explains why PMR falls (increases negatively) with increases in length of feeding period.

Feeder price and changes in this price affect CPPG only through interest on feeder cost. Effects, therefore, are small. Increases in the CPPG coefficient with length of feeding period are the result, primarily of increases in the relative importance of this interest cost with increases in length of feeding period.

Effects of Changes in Slaughter Cattle Sales Prices

Sales price-revenue coefficients can be computed in a manner parallel to that explained for feeder price-cost coefficients:

(8) $TR_j = a_j \pm b_j P^*$, and (9) $\Delta TR_j = b_j P^*$

where

TR_j = total annual revenue for the j^{th} situation

a_j = total annual revenue associated with a specified sales price for situation j

P^* = change in sales price above (+) or below, (-), the specified price, and

b_j = change in total annual revenue associated with a unit change in sales price for situation j

ΔTR_j = total change in annual revenue associated with the change in sales price for the j^{th} situation.

Resulting coefficients are found in Appendix Tables H.1 and H.2. Total revenue and the revenue coefficients, of course, rise in a linear fashion with scale. Dividing equation 8 by sales weight would yield "a" values equivalent to the "specified sales price and "b" values of unity--the per pound effect of a one-cent change in sales price. Dividing, instead, by scale size places the coefficients on a basis of dollars per head of feedlot size as follows:

(10) $TR'_j = a'_j \pm b'_j P^*$

where

$TR'_j = TR_j/s_j$; $a'_j = a_j/s_j$ and $b'_j = b_j/s_j$

and s_j = feedlot size in number of head for situation j.

The value a'_j is revenue per head of feedlot size at the specified price and b'_j is the increase or decrease in revenue per head with a unit increase or decrease in sales price. Values of b'_j shown in Table XXXI do not change with scale. Assuming no changes in feeder price, they also represent changes in profits per head.

For purposes of comparison, coefficients representing changes in total cost per head of feedlot size also are shown in Table XXXI. These were computed by dividing equation 4 by feedlot size to obtain:

(11) $TC'_i = a'_i \pm b'_i P^*$ where:

$TC'_i = TC_i/s_i$; $a'_i = a_i/s_i$; $b'_i = b_i/s_i$, and

$s_i = s_j$ as defined above.

Both revenue and cost coefficients, and, therefore, profit coefficients, drop with increases in length of feeding period because with these increases feedlot size remains constant but progressive reductions take place in numbers of animals fed (Table XXXI). Clearly, effects on profits, or above normal returns to labor and management, are more severely affected by a given change in sales price than by an equivalent change in feeder cattle price.

Illustration of Price Effects

Figure 20 illustrates the effect of scale upon total revenue, total cost, and profit when 500 pound heifers are valued at 20 cents per pound, a zero price margin exists and the feedlots are following a continuous

TABLE XXXI

VALUES FOR REVENUE COEFFICIENTS AND COST COEFFICIENTS[a] ASSOCIATED WITH ONE-CENT CHANGES IN SALES OR FEEDER PRICE AND VARIOUS LENGTHS OF FEEDING PERIODS FOR 500 POUND HEIFERS AND 700 POUND STEERS[b]

Length of Feeding Period	500 Pound Heifers		700 Pound Steers	
	b_j' Change in Revenue	b_i' Change in Cost[c]	b_j' Change in Revenue	b_i' Change in Cost[c]
Days	- Dollars Per Head of Feedlot Size -			
60	39.2634	30.30	51.7344	42.42
90	28.5120	20.30	37.1052	28.42
120	22.5720	15.30	29.2842	21.42
150	18.9605	12.30	24.5440	17.22

[a]These coefficients are also profit coefficients since a given change in either feeder cattle or slaughter price, ceteris paribus, has an equal effect on profits. The b_i''s, however, have a negative sign as profit coefficients whenever cost coefficients are positive and vice versa.

[b]These coefficients are based on the assumption of fenceline bunk systems fully utilizing capacity in a continuous program.

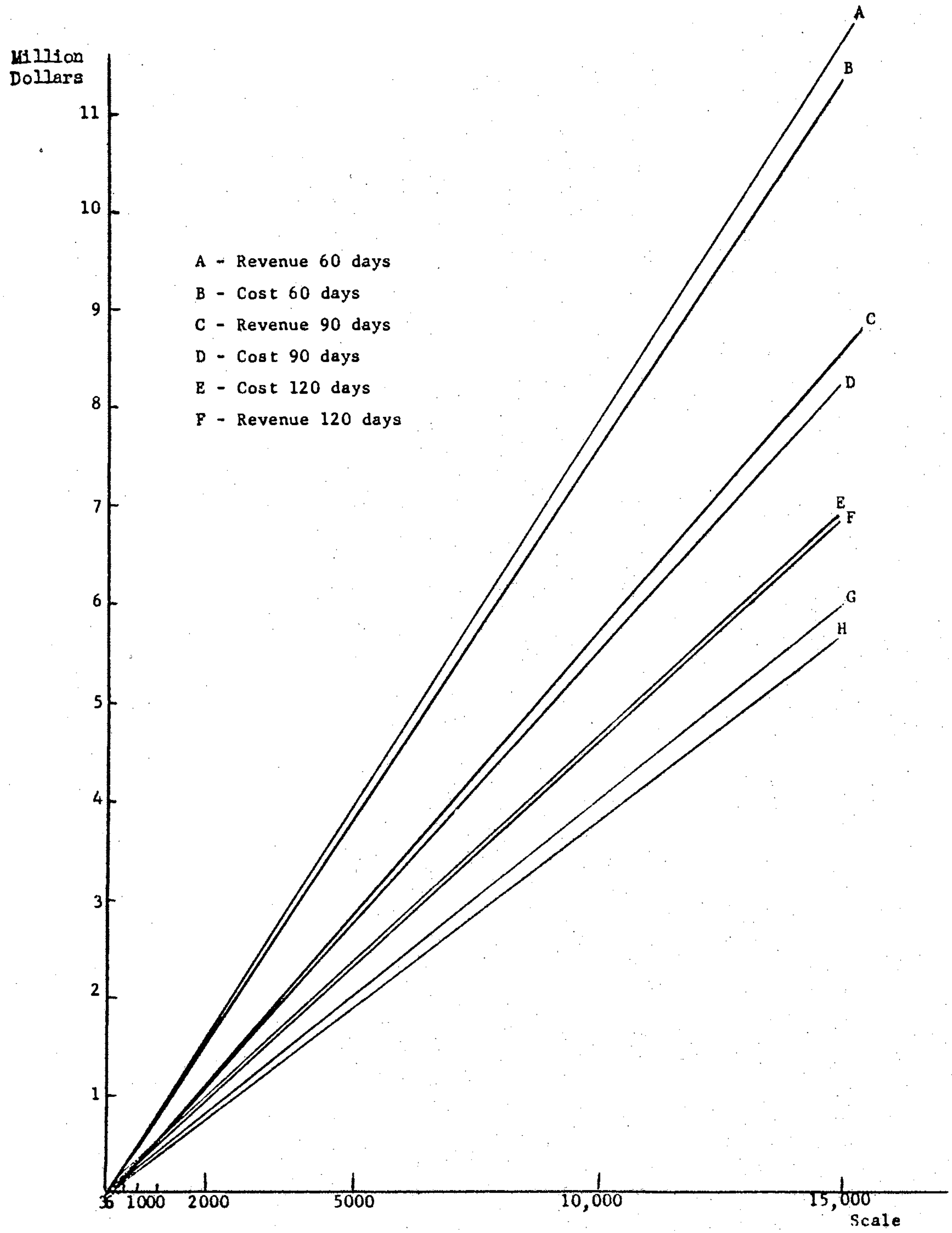

Figure 20. Annual Total Costs and Total Revenue for Various Lengths of Feeding and Feedlot Scale When Feeder Cattle and Slaughter Cattle are Valued at 20 Cents per pound--500 Pound Heifers Fed Continuously at Full Utilization.

full utilization feeding plan. Under these assumptions, the 60 day feeding plan is the only one in which all feedlot scales considered show a profit. Similar diagrams utilizing the cost and revenue coefficients shown in Table XXXI could be developed for a variety of situations.

In Figure 21, the revenue situation in Figure 20 for the 120 day feeding period is employed and used to show effects of varying feeder-cattle cost above and below 20 cents per pound. This chart illustrates the critical nature of a small change in feeder cattle cost upon total cost and profit. It appears that a one-cent reduction in feeder cost below 20 cents would have the effect of changing the 120 day profit situation from negative to slightly positive. Losses were increased further when the feeder cost was increased above 20 cents and the sale price remained at 20 cents. The cost-profit situation for the 120 day feeding plan in Figure 20 is adjusted in Figure 22 for varying slaughter prices. Increases in slaughter price above 20 cents had the effect of changing the loss situation to a profit situation when feeder-cattle prices remained at 20 cents. A comparison between Figures 21 and 22 illustrates the principle that variations in slaughter price have a greater effect upon profit or loss than similar variations in feeder price. The principal reason for this phenomenon is that more weight is affected with a change in sales price than with a similar change in feeder cost.

Figure 23 illustrates the effect on profit of changes in sales price by one-cent intervals. At X, the same situation exists as is shown in Figure 20 for the 5,000 head feedlot. The 20-cent feeder

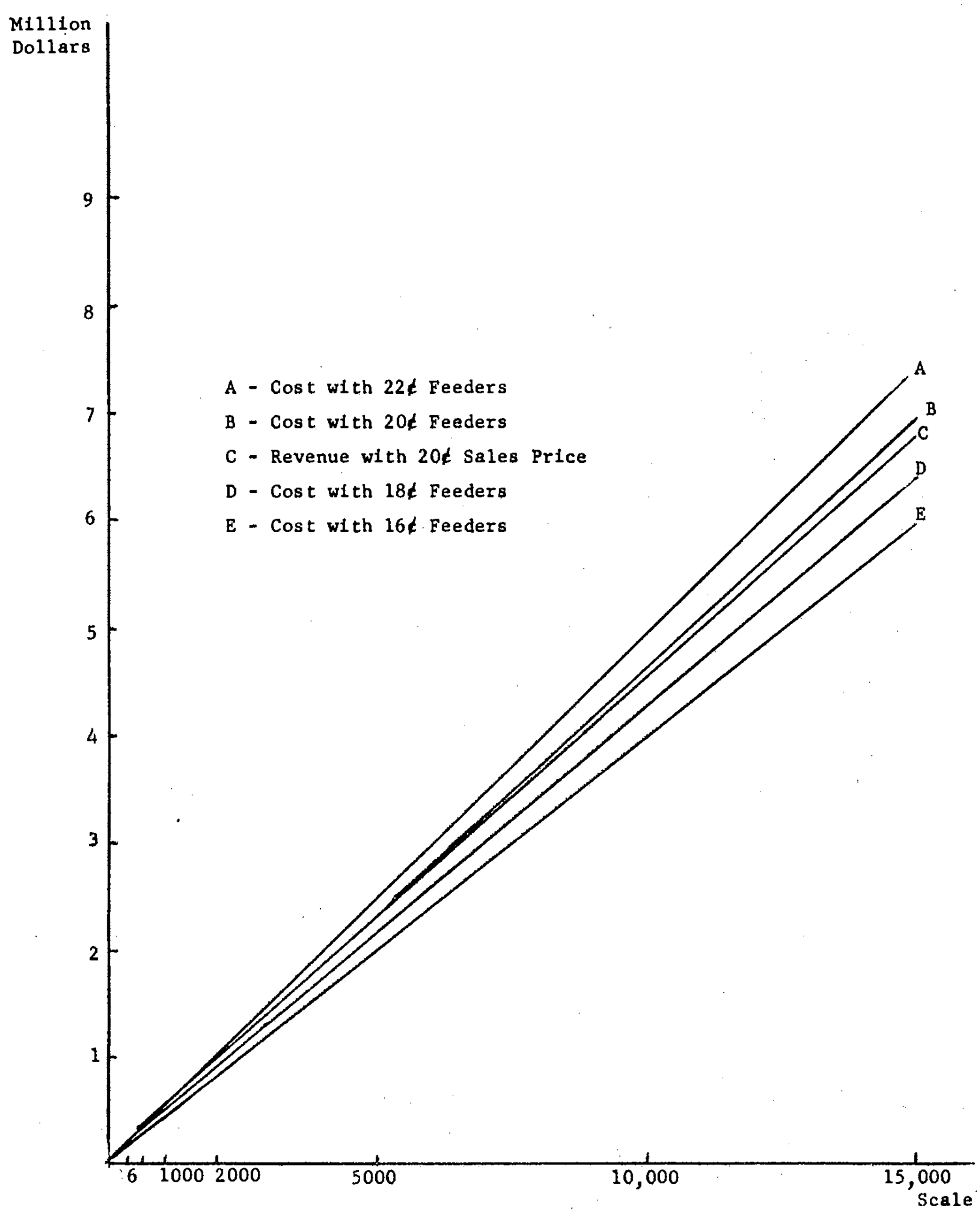

Figure 21. Annual Total Costs and Revenue with a 20 Cents per pound Slaughter Price and Variation in Feeder Cattle Prices and Scale--500 Pound Heifers Fed Continuously at Full Capacity Utilization for 120 Days.

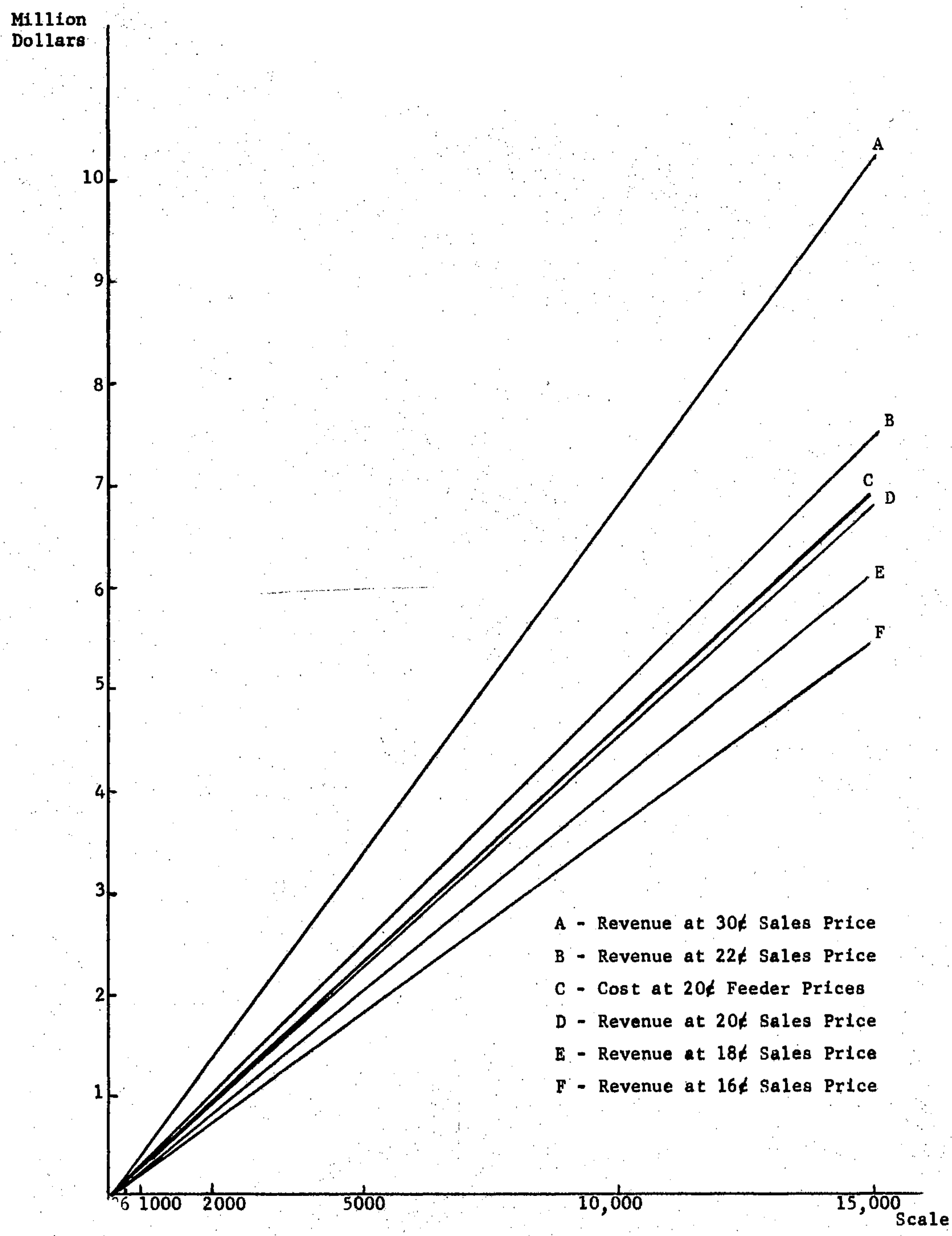

Figure 22. Annual Total Cost and Revenues with a 20 Cents per pound Feeder Price and Variation in Slaughter Price and Feedlot Scale--500 Pound Heifers Fed Continuously at Full Use Levels for 120 Days.

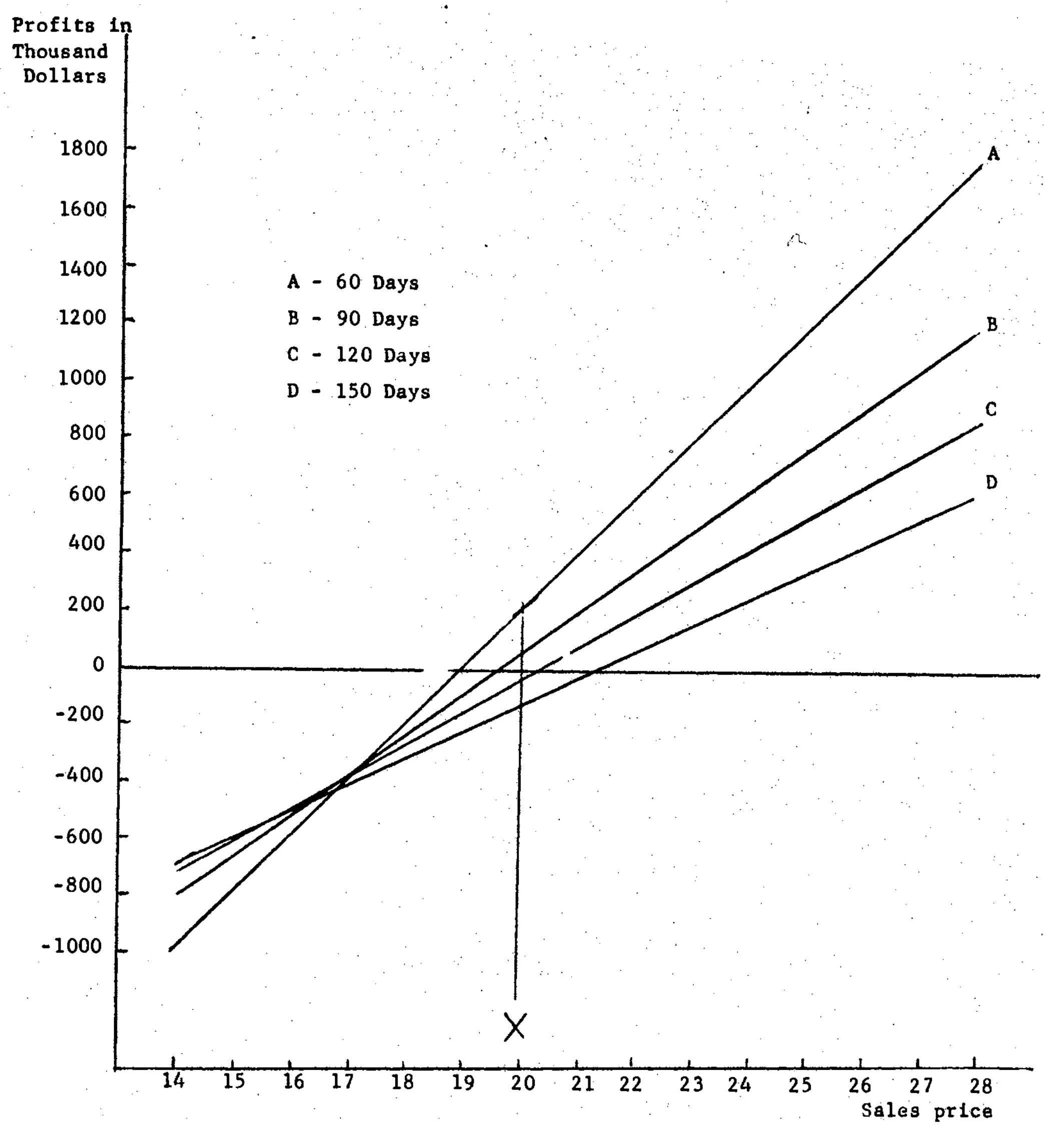

Figure 23. Annual Profits or Losses with Variation in Sales Price and Length of Feeding When Feeder Price is 20 Cents per pound--5,000 Head Feedlot at Continuous Full Utilization.

price, minus the price at which the profit line is zero, equals the price margin required to cover all costs. This diagram (Figure 23) shows that, assuming a 20-cent feeder cost, the rate of increase in either profits or losses with changes in sales price is smaller for feeding systems involving long-term feeding practices. That is, while profits of feedlots with short-term feeding programs rise more sharply with increases in sales price, they also fall more sharply with reductions in sales price. The reason is that the shorter feeding periods involve a larger total number of animals, a higher average rate of gain, and a larger total sales volume.

Figure 24 illustrates effects on profit for alternative lengths of feeding period of changes in feeder price, assuming a 20-cent slaughter price for a 5,000 head feedlot with a continuous feeding program at full utilization. With the exception of the horizontal scale which represents feeder cost and falls rather than rises from left to right, this diagram is similar to Figure 23. Similarly, also, profits associated with short feeding periods rise and fall more sharply with changes in feeder cost. According to these data, a higher feeder cattle cost, assuming a fixed sales price, can be offset to some extent by adoption of a shorter feeding period.

In Figure 25 and 26, total revenue and total costs are shown in a specific example as functions of the length of feeding period. It is clear that in continuous feeding situations, both types of functions are negatively sloped, i.e., fall with increases in length of feeding period. Possible effects of upgrading or a shift in sales value of the cattle at the end of a feeding period are represented by the

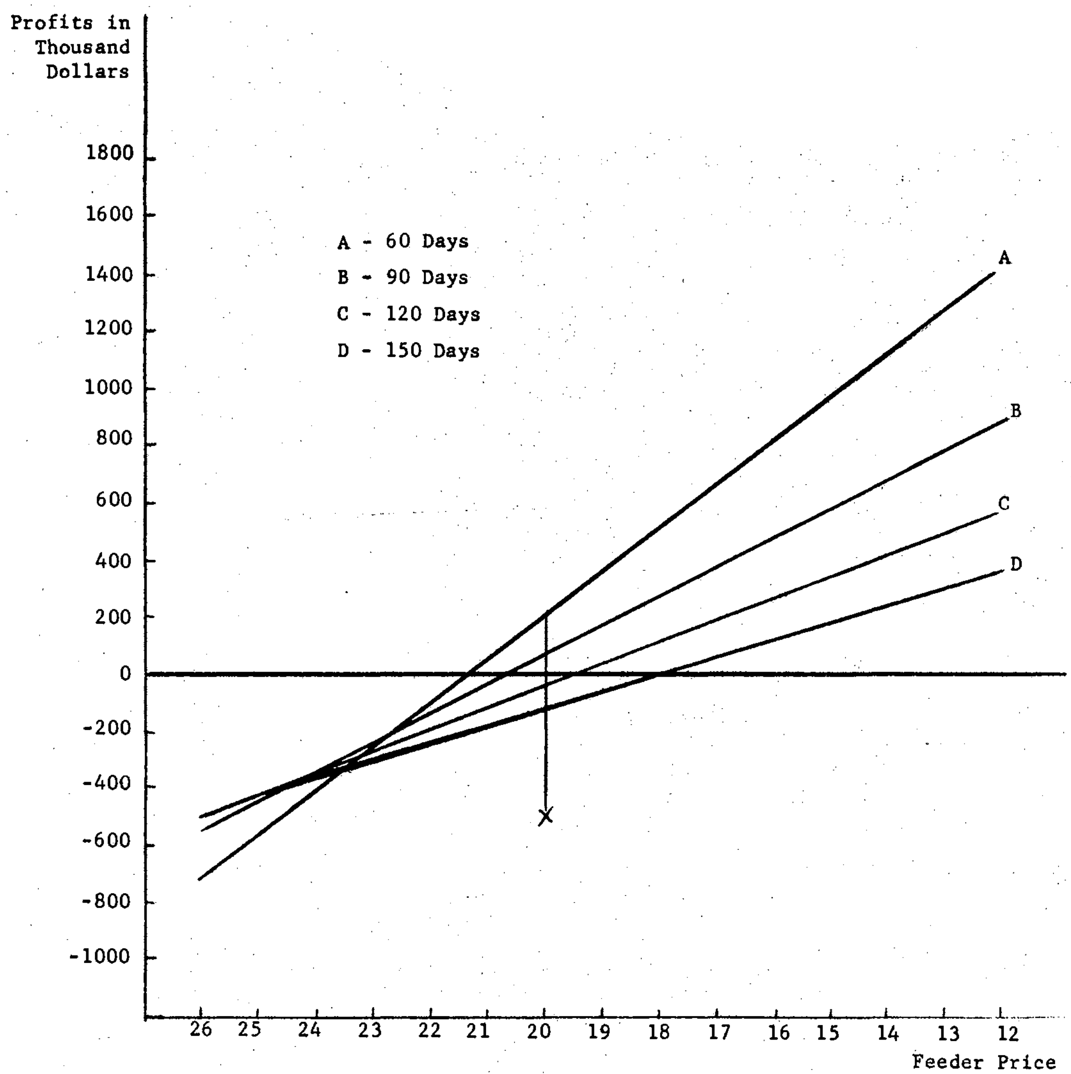

Figure 24. Annual Profits or Losses with Variation in Feeder Price and Length of Feeding When Sales Price is 20 cents per pound--5,000 Head Feedlot at Continuous Full Utilization.

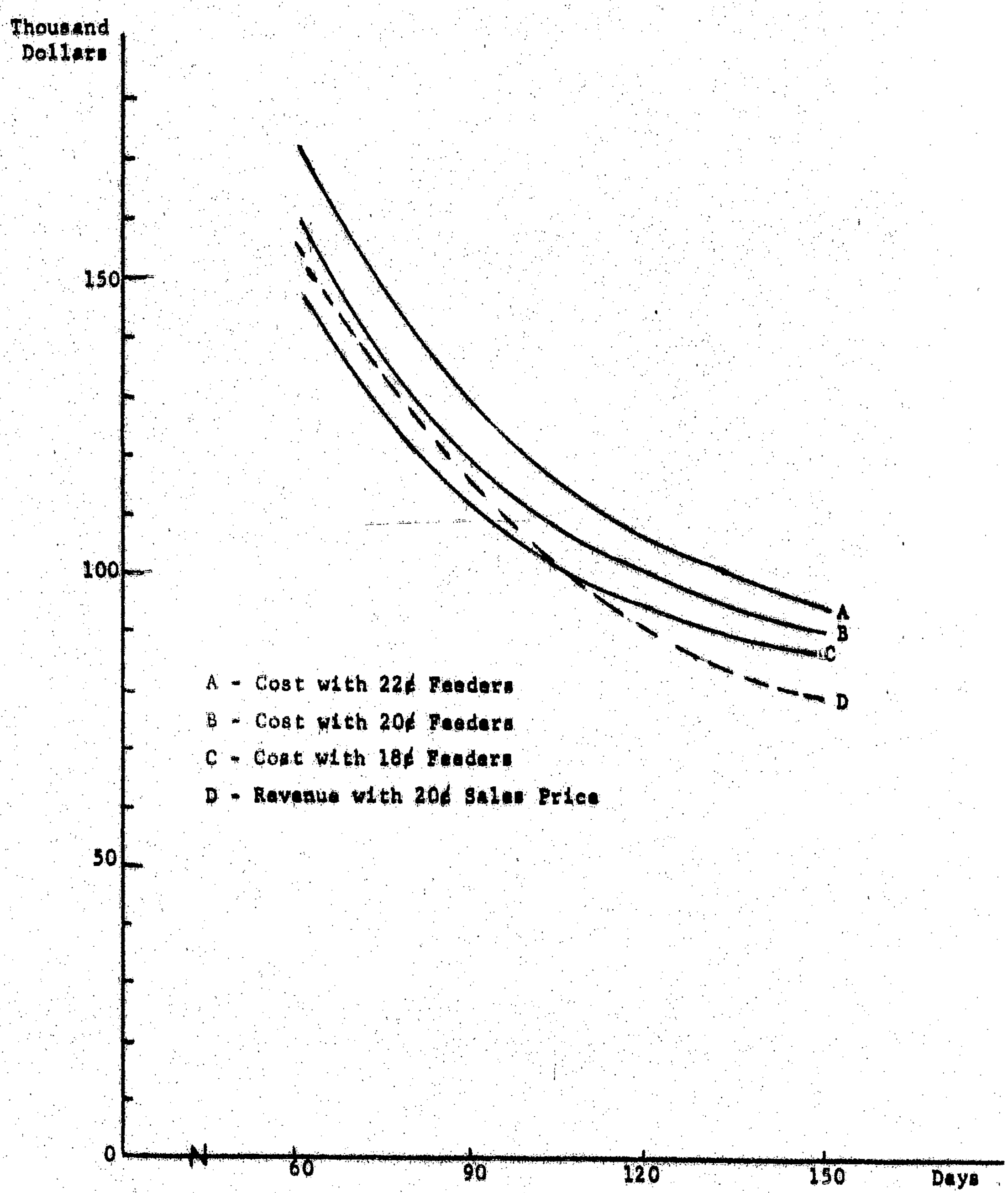

Figure 25. Annual Total Costs and Revenue as Functions of the Length of Feeding with Variation in Feeder Cost and a Sales Price of 20 cents per Pound--500 Pound Heifers Fed Continuously in a 600 Head Feedlot at One-Third of Capacity Utilization.

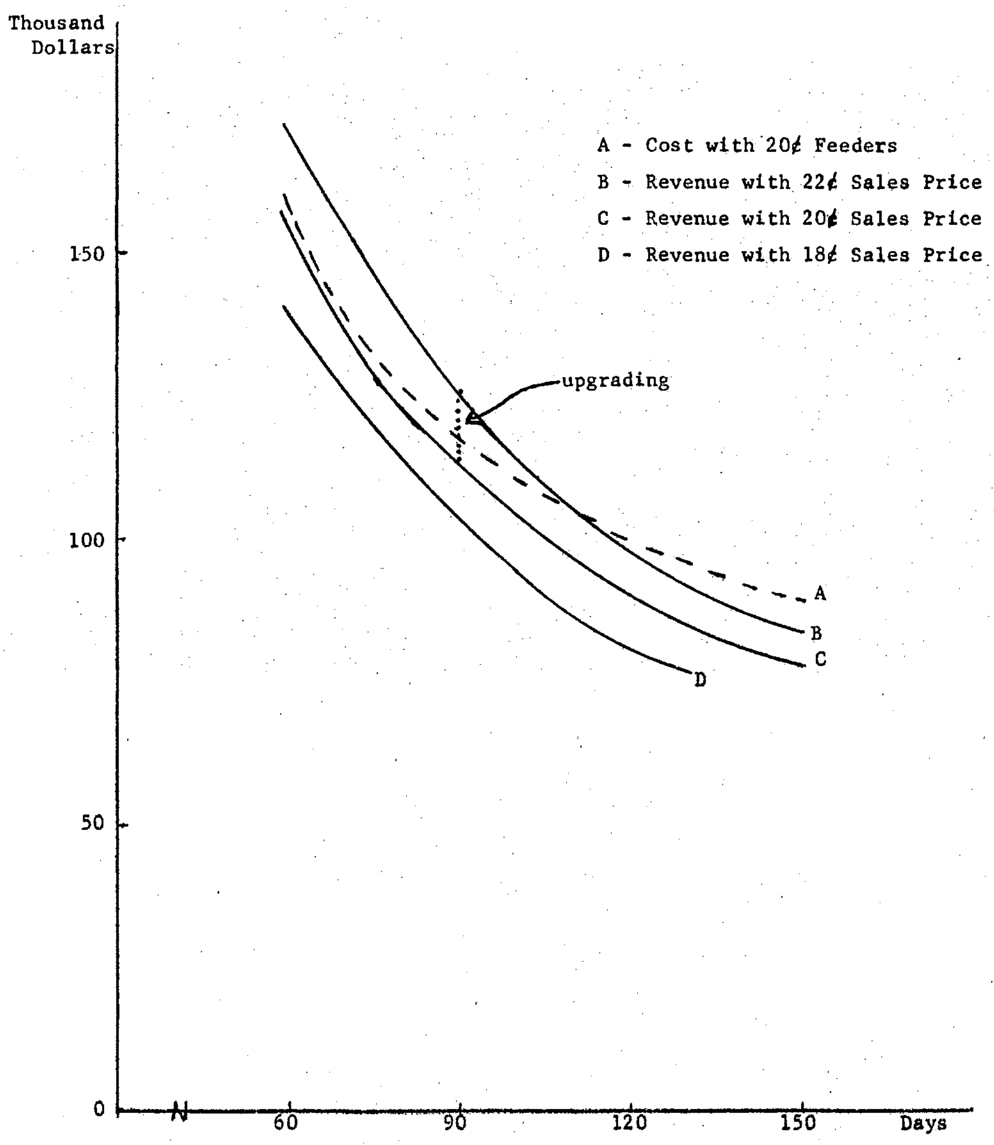

Figure 26. Annual Total Cost and Revenues as Functions of the Length of Feeding Period with Variation in Sales Price and a Feeder Price of 20 Cents Per Pound--500 Pound Heifers Fed Continuously in a 600 Head Feedlot at One-third of Capacity Utilization.

indicated shifts from one total revenue function to another. For instance, a shift in sales price at 90 days from 20 cents to 22 cents results in profits which drop as the 120 day point is approached. While "feeding period" refers to one of several alternative feeding plans, it would be possible at any time for a feedlot owner to shift from one length of feeding plan to another.

Total annual costs drop as the feeding period lengthens because with capacity fixed, smaller numbers of feeder animals are purchased in the longer-term feeding plans. Feeder animal cost is the largest variable expense item (see Table XXVII). Increases in per head feed cost associated with longer feeding periods do not offset the annual reduction in feeder cattle costs. Annual total revenue, of course, falls as the feeding period increases because a smaller number of animals are sold.

Per Head Profit or Loss

Given basic cost-price assumptions, profits and/or losses per head of cattle sold vary with scale, utilization, time on feed, and class of feeder animal. Generally speaking, profits per head were larger or losses were smaller as feedlot size increased, for the short 60 day feeding period, at highest levels of utilization, and for heifers relative to steers. These generalizations, of course, are affected by upgrading, changes in sale price during the feeding period, or any other departure from postulated, ceteris paribus, conditions.

Profit situations for 500 pound feeder heifers and 700 pound steers when feeder and sales prices approximate average 1960 and early 1963 conditions for Oklahoma are shown in Appendix I, and Table XXXII. Other costs of feed, nonfeed variable inputs, and fixed inputs remain at levels as determined earlier. Several diagrams drawn from data in these tables are useful in explaining differences or variations in per head profit or loss associated with variation in feeding systems and practices.

TABLE XXXII

PROFIT PER HEAD FOR 500 POUND MEDIUM-GOOD FEEDER HEIFERS AND 700 POUND GOOD FEEDER STEERS WITH PRICES APPROXIMATING 1960 OKLAHOMA CONDITIONS AND VARIATION IN LENGTH OF FEEDING PERIOD AND SLAUGHTER GRADE[a]

Length of Feeding Period	500 Pound Heifers "Good Slaughter	500 Pound Heifers "Choice" Slaughter	700 Pound Steers "Good" Slaughter	700 Pound Steers "Choice" Slaughter
	- Dollars Per Head -			
60 Days	21	--	3	-
90 Days	20	--	0	-
120 Days	13	24	-8	6
150 Days	5	16	-18	-4

[a]Assuming a 300 head fenceline bunk feedlot and continuous operation at full capacity.

The first of these illustrations, another specific situation, shows per head total cost and total revenue for heifers as a function of the feed input (Figure 27). In this case, the per head revenue curve is of the same shape as the production function with its position being determined by product price. Upgrading, it is assumed, takes place at

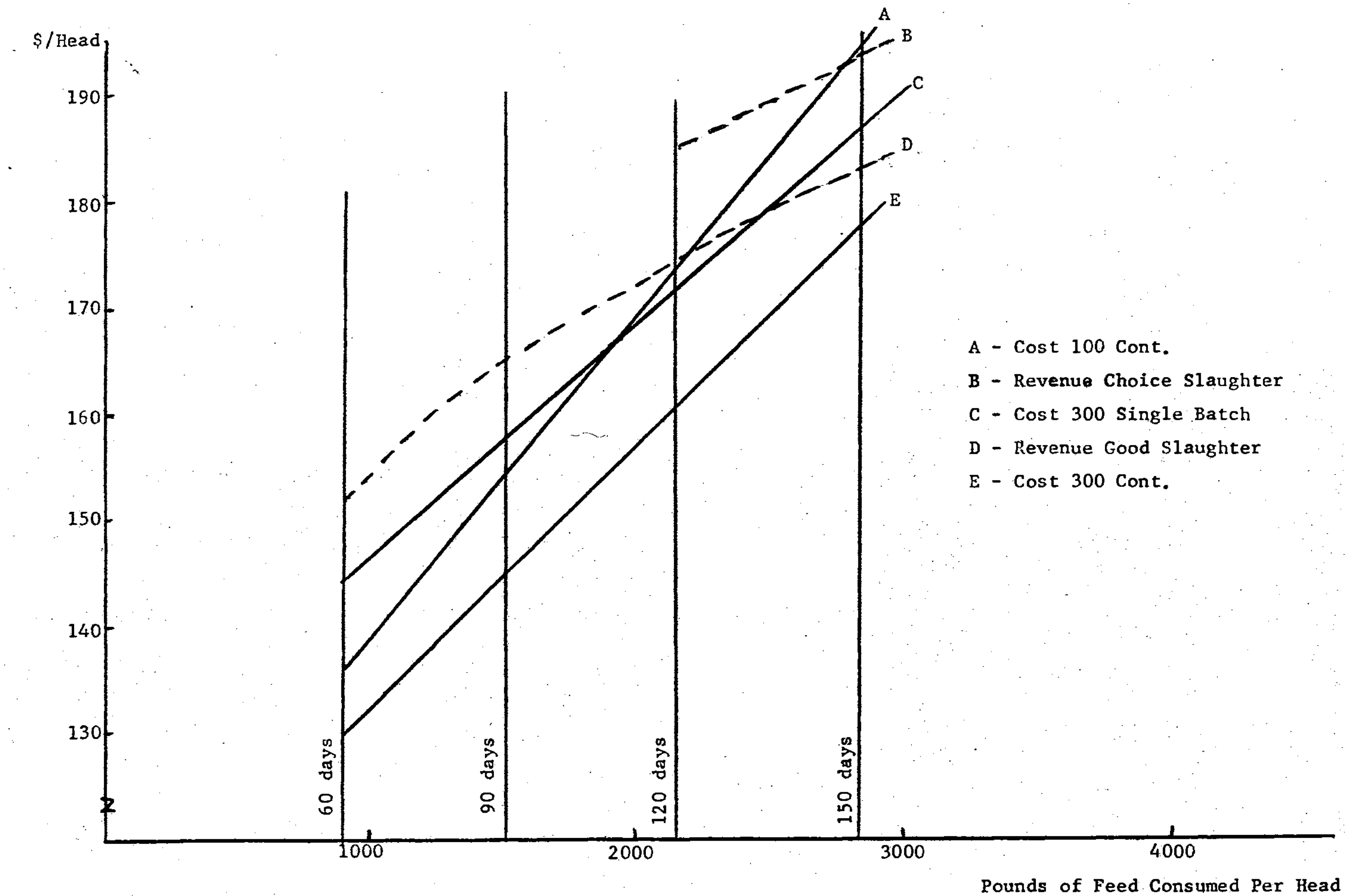

Figure 27. Per Head Total Cost and Total Revenue with Feeder and Sales Prices Approximating 1960 Oklahoma Conditions--500 Pound Medium-Good Heifers Fed in a 300 Head Feedlot with Two Levels of Continuous Feeding and Single Batch Feeding.

120 days, thereby raising the revenue function. Total cost per head sold rises linearly with the increasing use of feed. Profit or loss is the vertical difference between total revenue and total cost. Effects of increasing the level of utilization and the difference between the two definitions of capacity also are emphasized.

More commonly, cost and revenue are shown as functions of output (Figure 28). Here, the per head revenue function increases in a linear fashion while cost rises at an increasing rate. The feeding situation shown in this illustration is similar to the one in Figure 27 except that the feedlot scale at full utilization differs.

Several important findings are illustrated in these two diagrams. First, the lowest cost per head sold always was associated with feeding continuously at full utilization. More significant, however, are differences between the per head cost functions for single batch and those for continuous operations at one-third capacity utilization. Specifically, the cost functions associated with these two systems exhibited a crossover effect. For longer feeding periods of 120 and 150 days, the single batch operations, if operated at full capacity, showed lower total costs per head than did operations involving one-third use levels on a continuous basis; the reverse was true for 60 and 90 day feeding periods. Differences in numbers fed annually and in feed prices largely were responsible for these effects. The number of head fed annually in this illustration was 300 for the single batch operation. Continuous operations utilizing one-third of the 300 available capacity fed 600, 400, 300, and 240 for feeding periods of 60, 90, 120, and 150 days. Feed grain prices were slightly lower for

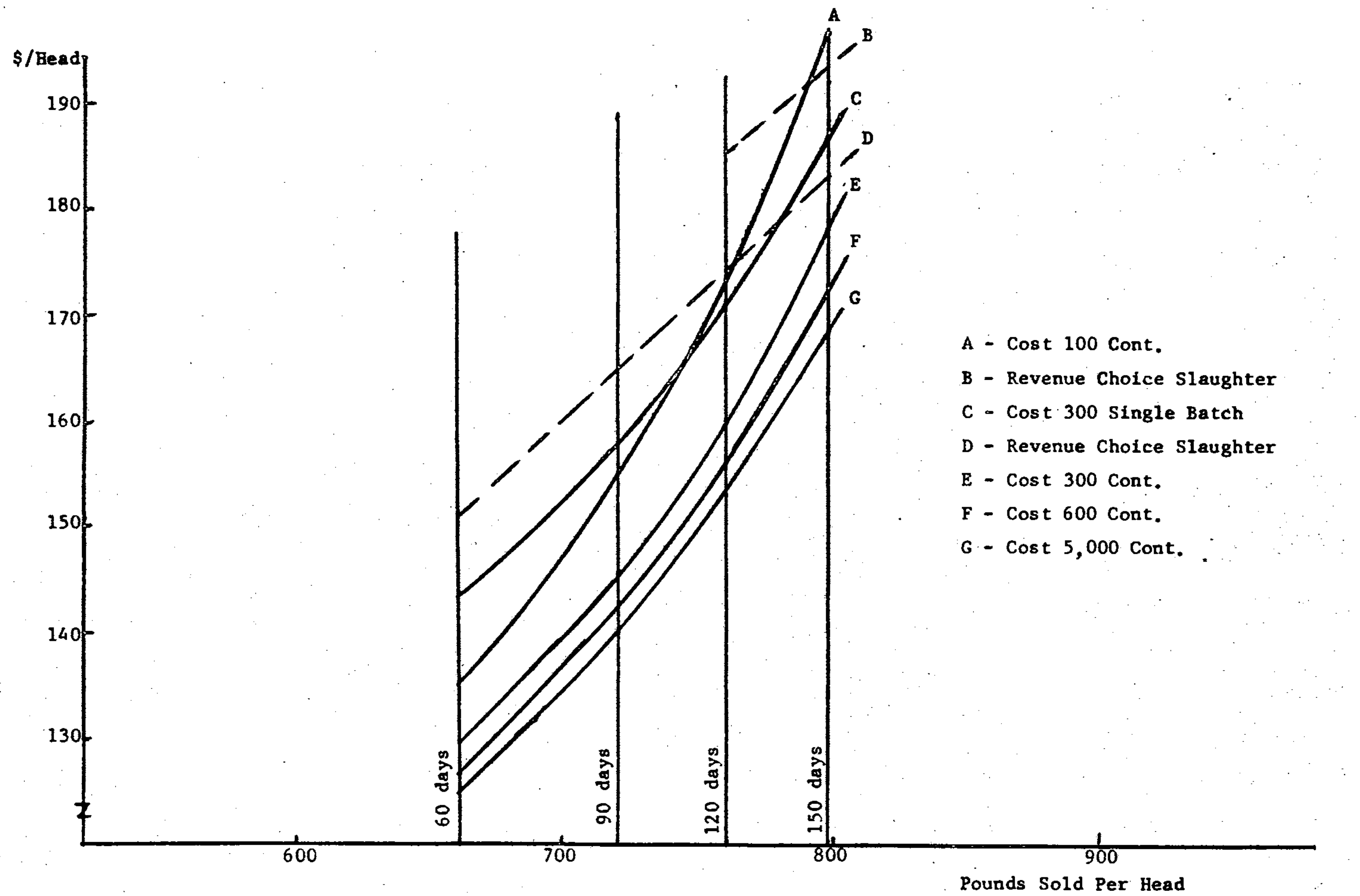

Figure 28. Per Head Total Cost and Total Revenue with Feeder and Sales Prices Approximating 1960 Oklahoma Conditions--500 Pound Medium-Good Heifers Fed in a 300 Head Feedlot with Two Levels of Continuous Feeding and Single Batch Feeding.

single batch operations than for continuous operations. The principal effect of increases in scale upon per-head cost functions, as shown in Figure 28, was to shift cost function slightly downward and to the right. Profits were apparent throughout most of the ranges of scale and utilization considered.

The per-head cost and revenue situation for 700 pound steers fed in a 300 head lot at varying use levels and definitions of capacity is shown in Figure 29. In this case, findings were similar to those for heifers except that profit levels were considerably lower, and negative under certain indicated conditions.

A profit function also can be developed from data in Appendix I. This is illustrated in Figure 30 for the single batch and continuous operations at full capacity shown in Figures 27 and 28. Functions C and D in Figure 30 show changes in net revenue per head as the feeding period increases. Slaughter grade, it is assumed, does not change. Clearly, per head profits in these situations are greatest in the 60 day feeding period program.

Functions A and B illustrate effects upon per-head profit functions when upgrading takes place at the 120th day of feeding. Under these

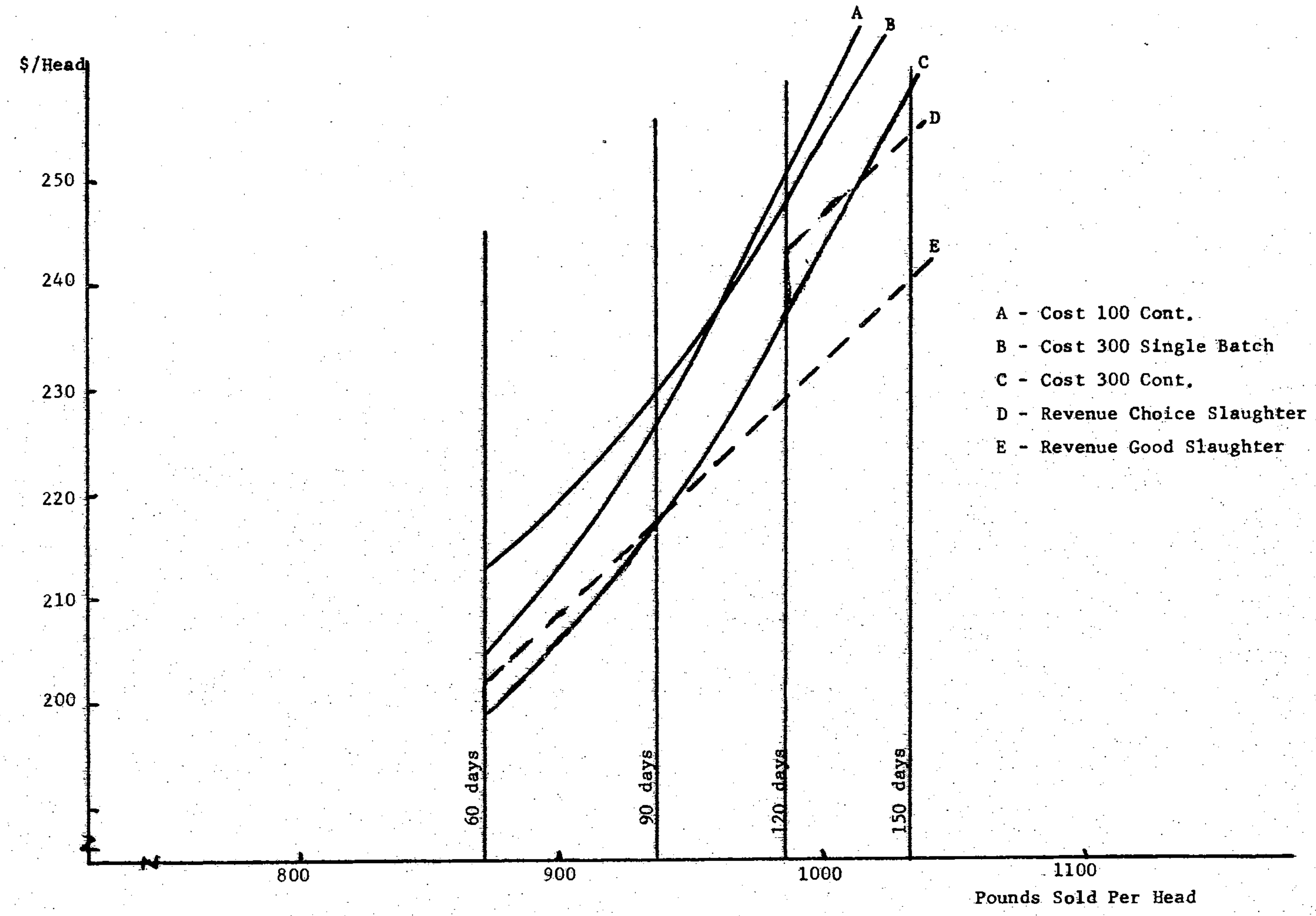

Figure 29. Per Head Total Cost and Revenue for 700 Pound Good Steers with Feeder and Sales Prices Approximating 1960 Oklahoma Conditions--300 Head Feedlot with Two Levels of Continuous Feeding and Single Batch Feeding.

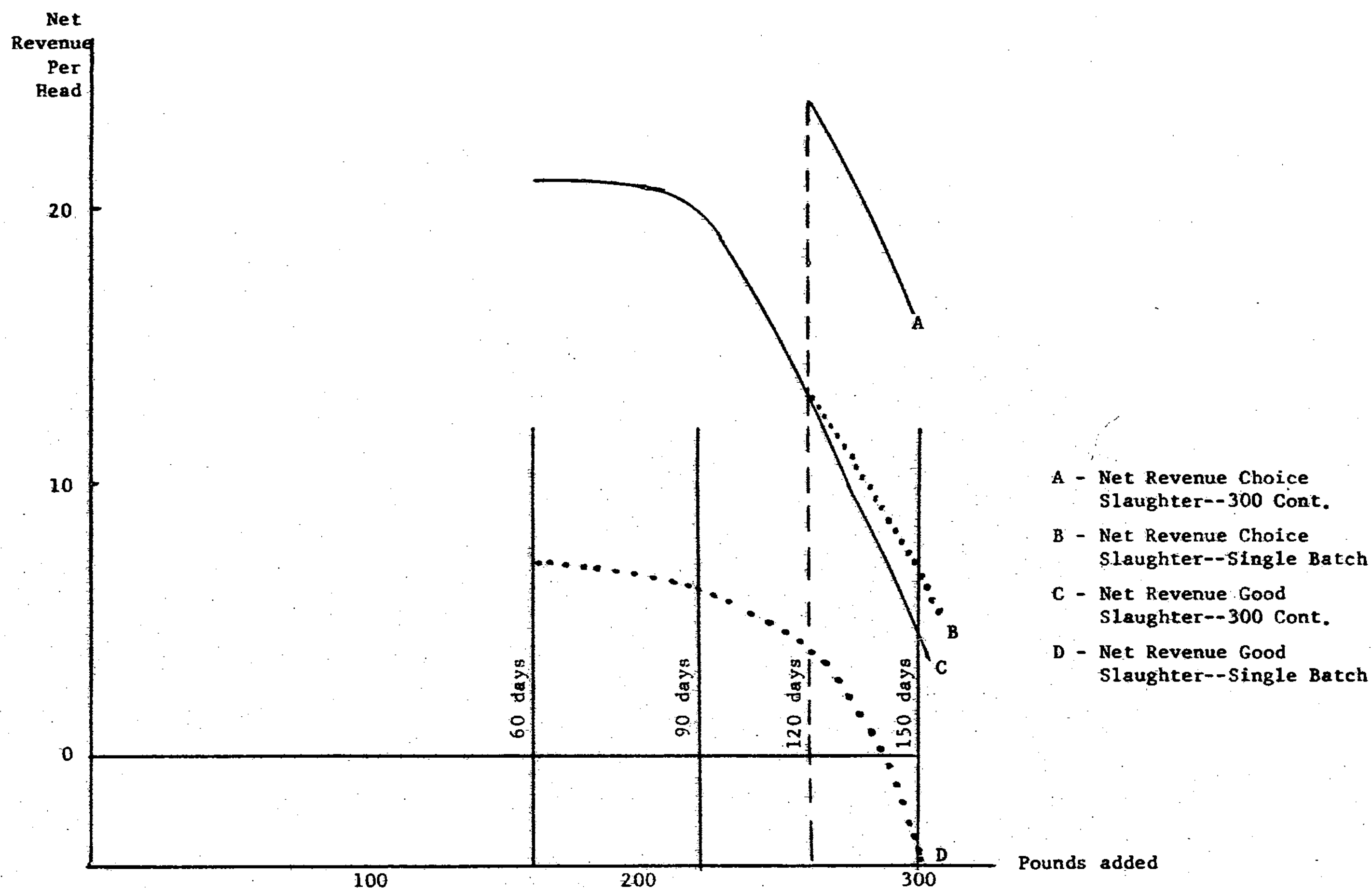

Figure 30. Per Head Profit Functions for Single Batch and Continuous Full Utilization When Feeder and Sales Prices Approximate 1960 Oklahoma Conditions--500 Pound Heifers Fed in a 300 Head Feedlot.

cost-price assumptions, as indicated, the effect of upgrading, ceteris paribus, is to increase profit per head sold.[1]

Both continuous and single batch operators attempt to maximize annual profits. In doing this, the single batch operator rationally maximizes profit per head. Under upgrading conditions assumed for Figure 30, the single batch operator will adopt the 120 day feeding program. If upgrading is not assumed, this operator will maximize profits with a 60 day plan. In contrast, the feedlot operator following a continuous plan maximizes annual profits by maximizing profit per pound of gain for each lot fed during the year. Profits per pound of gain are maximized where linear functions drawn from the origin are tangent to the profit functions. These functions would show that profit per pound is greater in the 60 day feeding program than in any longer term feeding period. Under conditions assumed, therefore, the rational manager of a continuous operation would select the 60 day program. These typical 1960 data suggest that a much larger price differential between "Good" and "Choice" would be required

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[1]Prices at the Oklahoma City terminal market are not reported within grades so that only the contrast between "Good" and "Choice" is presented in Figure 30. Previous research has indicated that prices within the "Good" slaughter grade continue to increase as quality and weight of the animal increases within the grade. For "Choice," however higher quality, heavier carcasses were often discounted in price. Price differentials within grades of this type would increase the profit function between 60 and 120 days but would have an opposite effect beyond 120 days. These results, among others, were apparent in a study of beef pricing in the Los Angeles area by Willard F. Williams and Edward Uvacek, Pricing and Competition On Beef In Los Angeles, USDA-AMS Marketing Research Report 413 (Washington, 1960).

before managers of continuous operation rationally could attempt to achieve upgrading to "Choice" through adoption of a longer feeding program.

Effect of Changing Grain Sorghum Price

Feed prices were held constant throughout the preceding analysis while selected other factors were varied systematically. At this point, the influence of changing feed prices, specifically grain sorghum prices, is examined and all other factors are impounded. Effects of changes in prices of cottonseed hulls and supplement were not examined because these feeds comprise a relatively small portion of the ration.

Effects of a ten-cent increase in grain sorghum price upon breakeven price and cost per pound of gain for 500 pound heifers and 700 pound steers and various feeding periods are shown in Appendix J and summarized in Table XXXIII. As indicated, the coefficients rise as feed consumption per head increases with length of feeding period. Differences in rates of feed consumption explain differences in the coefficients for steers and heifers. Effects on cost per pound of gain exceed those on breakeven prices because the latter are associated with more animal weight. If it is assumed that grain sorghum prices are identical for all buyers, these coefficients do not vary with utilization or scale.

Changes in grain sorghum price logically affect total per head cost and net revenue or profit. These effects also are shown in Table XXXIII. Profit reductions with increases in grain sorghum prices

TABLE XXXIII

EFFECT OF A TEN-CENT CHANGE IN GRAIN SORGHUM PRICE PER HUNDREDWEIGHT UPON BREAKEVEN PRICE, COST PER POUND OF GAIN, AND PER HEAD PROFIT, FOR SEVERAL DIFFERENT LENGTHS OF FEEDING PERIOD AND TWO CLASSES OF LIVESTOCK[a]

Length of Feeding Period	500 Pound Heifers			700 Pound Steers		
	BEP	CPPG	Per Head Profit[b]	BEP	CPPG	Per Head Profit[b]
	Dollars per Hundredweight		Dollars Per Head	Dollars Per Hundredweight		Dollars Per Head
60 Days	.08	.55	.51	.09	.77	.77
90 Days	.13	.67	.94	.15	.91	1.37
120 Days	.19	.82	1.42	.21	1.08	2.03
150 Days	.25	.96	1.96	.27	1.21	2.75

[a]Assuming 20 cent feeder cattle and all other costs computed as shown in Appendix G.

[b]This could also be labeled per head cost.

apparently are affected significantly by length of feeding period and class of feeder animal. However, these cost-profit coefficients associated with changing feed grain price are considerably smaller than similar coefficients relating to changes in feeder cattle prices shown in Table XXX because feed cost is less important than feeder cost.

Historical Price Margins and Profits

Traditionally, cattle feeders have anticipated profits from feeding margins based on producing gains and upon price margins, defined as differences between prices paid for feeder cattle and prices received for fed cattle. It normally is considered profitable to feed cattle when prices received for fed animals are expected to exceed comparable feeder-cattle prices. In Oklahoma, this condition was prevalent for light feeder heifers during most of the period, 1958-1962. Average price margins for comparable grades of feeder and slaughter steers during this period, however, generally were negative. Even lower price margins were apparent for higher grades of cattle than for the lower grades.

Price margins for steers and heifers under assumptions regarding feeder class, length of feeding, and slaughter class are shown in Figure 31 and Figure 32. Prices used in this analysis were obtained from USDA-AMS market quotations of the Oklahoma City terminal livestock market. Average monthly slaughter prices were matched with feeder cattle prices representative of the average monthly price when the feeders were placed on feed. Prices of "Medium-Good" feeder heifers and "Good" feeder steers were compared with prices of "Good" and "Choice" slaughter animals. The "Choice" slaughter grade, it was assumed, was reached only in a 150 day feeding plan.

On the basis of the price margins shown in these charts, it appeared that in Oklahoma the feeding of heifers was relatively more profitable than steer feeding during the five year period considered.[2] Negative price margins for heifers were apparent only during the latter part of 1960 and early 1961, whereas negative margins for steers appeared frequently.

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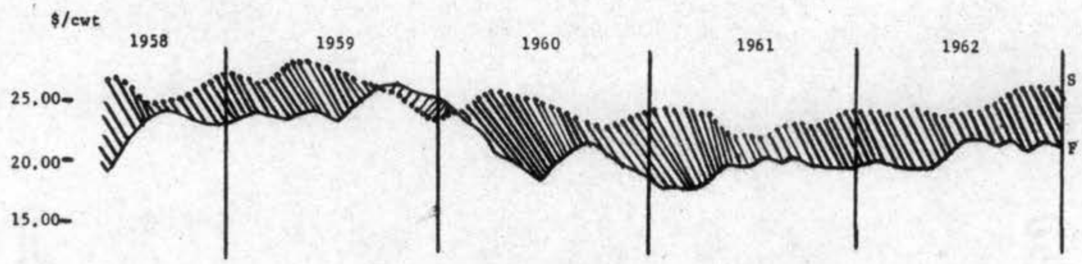
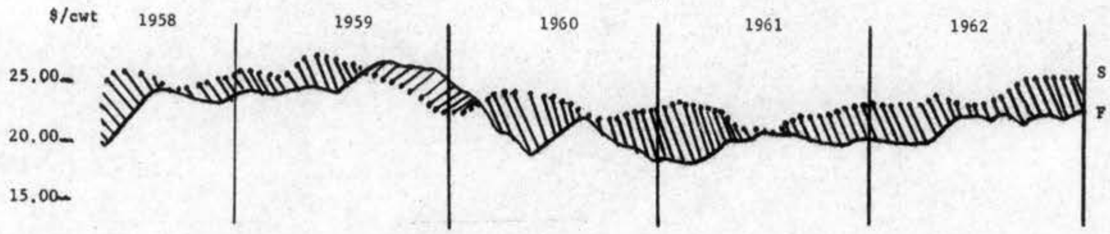
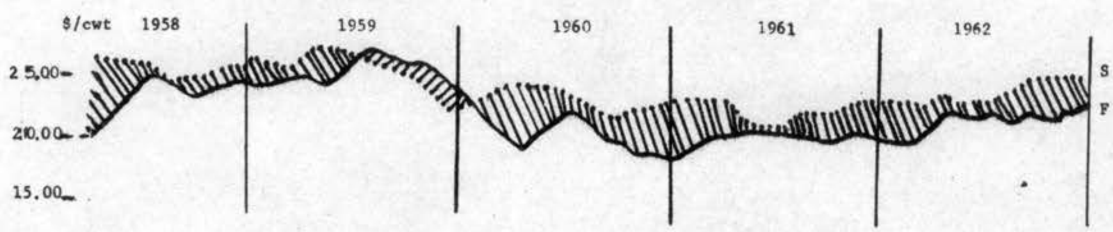
[2]This also is demonstrated by comparing Figures 28 and 29.



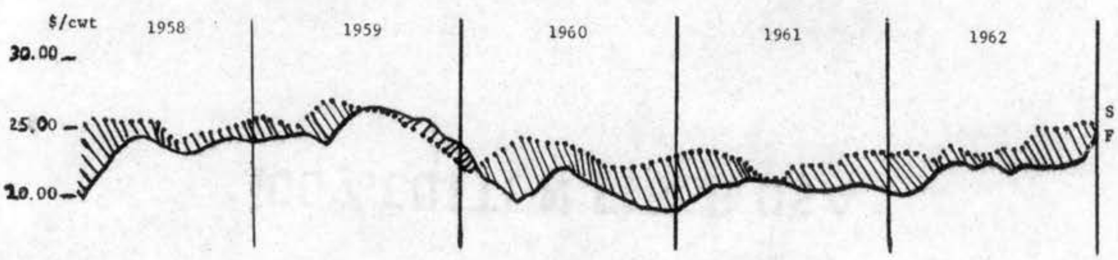
Medium-Good Feeders to Choice Slaughter in 150 Days--Average Price Margin $3.41.



Medium-Good Feeders to Good Slaughter in 120 Days--Average Price Margin $1.77.

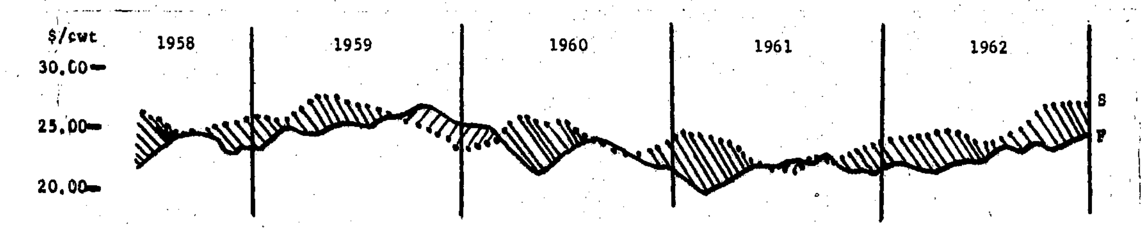


Medium-Good Feeders to Good Slaughter in 90 Days--Average Price Margin $1.80.

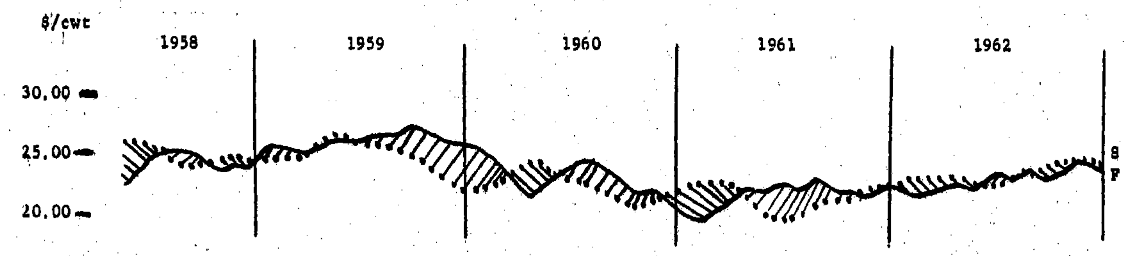


Medium-Good Feeders to Good Slaughter in 60 Days--Average Price Margin $1.70.

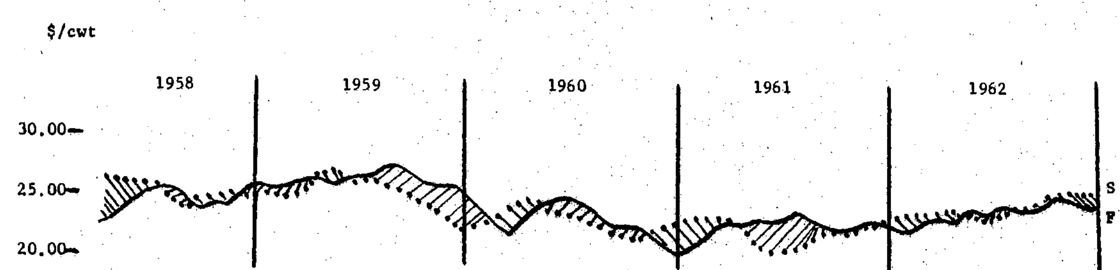
Figure 31. Price Margins for Heifers with Variations in Lengths of Feeding Period and Slaughter Grades--Oklahoma, 1958-1963.



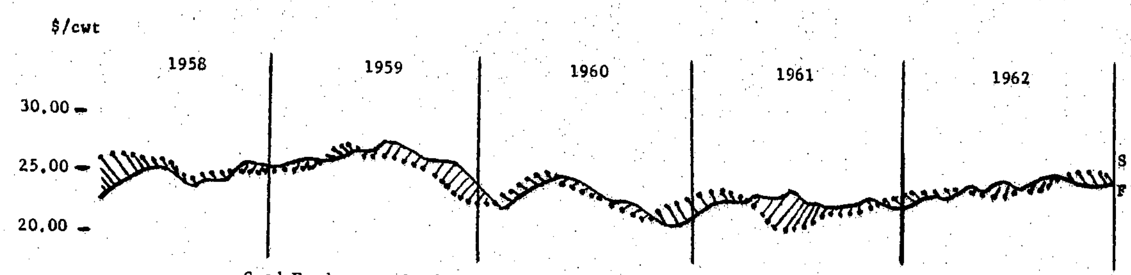
Good Feeders to Choice Slaughter in 150 Days--Average Price Margin $1.41.



Good Feeders to Good Slaughter in 120 Days--Average Price Margin $-.24.



Good Feeders to Good Slaughter in 90 Days--Average Price Margin $-.19



Good Feeders to Good Slaughter in 60 Days--Average Price Margin $-.16.

Figure 32. Price Margins for Steers with Variations in Lengths of Feeding Period and Slaughter Grades--Oklahoma, 1958-1963.

The average price margin for heifers varied between $1.70 and $1.80 when it was assumed the cattle were sold as U. S. Good. The margin nearly doubled when upgrading was introduced. Average price margins for steers were slightly negative when the sales price was based on the "Good" grade. The assumption of upgrading had the effects of increasing the average price margin for steers from negative to positive. One factor which probably made the profit margins of heifers appear more favorable relative to steers was that feeder heifers were reported as "Medium to Good" and were sold as "Good" in 60, 90, and 120 day feeding periods. Some upgrading probably was present for this combination of feeder and slaughter grades.

Price margins, however, are only general indications of profitability in cattle feeding. Other factors such as feed costs, nonfeed variable costs and fixed costs also must be accounted for. The combination of price margins and these other costs are shown in Appendix K for steers and heifers under simplifying assumptions. In this case, the price of grain sorghum and feeder and slaughter cattle was allowed to vary according to monthly price reports and all other costs were constant at levels computed earlier. Data are presented on a monthly basis from January, 1960 through June, 1963. The sale price per pound of gain minus the total cost per pound of gain represents the synthesized profit per pound of gain for the period under consideration.

It was apparent that changes in feeder cattle or slaughter prices had much more effect than changes in grain sorghum price upon variations through time in profits from cattle feeding. This is clearly demonstrated in Figure 33 where cost-revenue relationships are shown

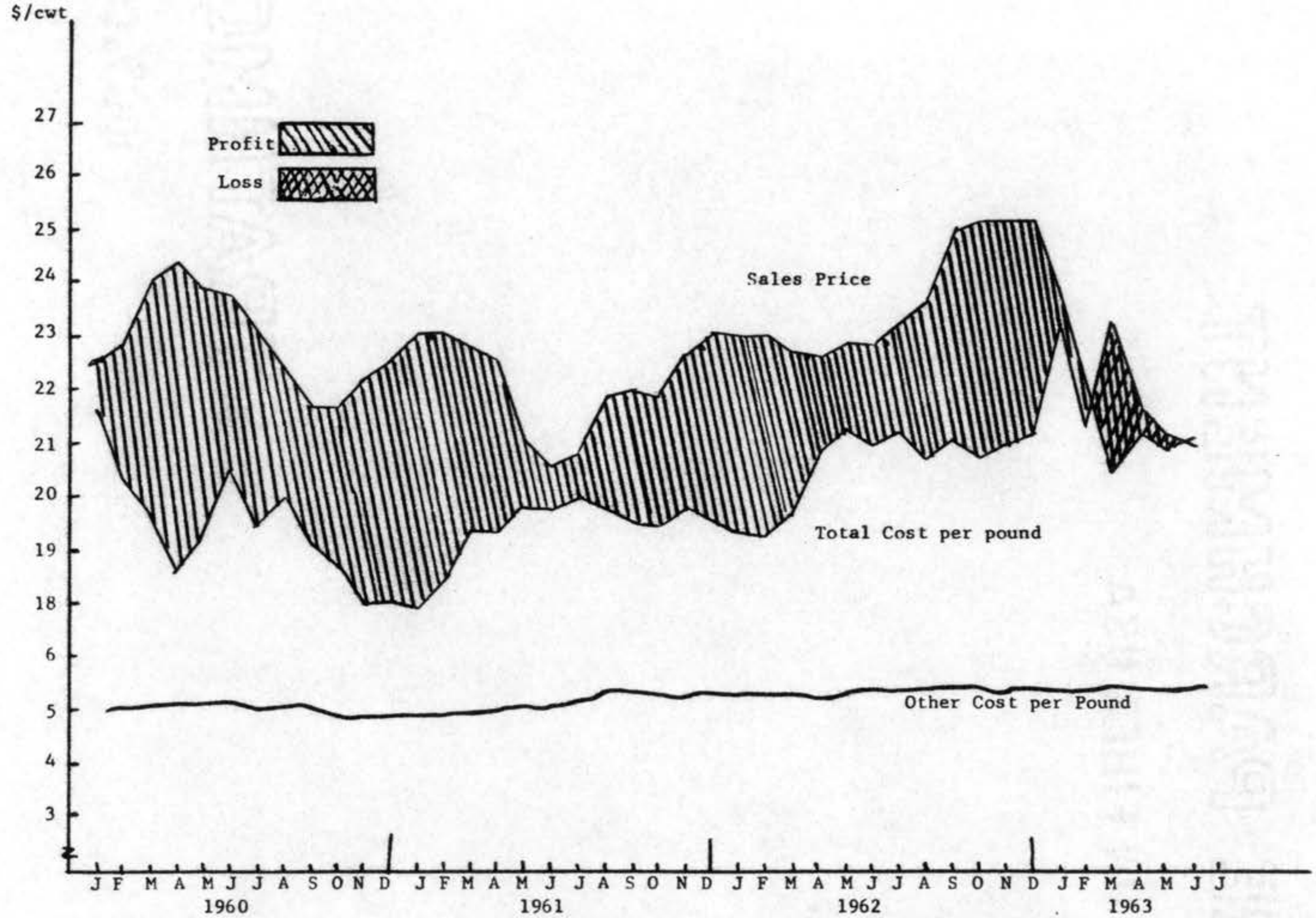


Figure 33. Cost-Revenue Relationships, Oklahoma, 1960-63--500 Pound Heifers Fed Continuous in a 2,000 Feedlot for 90 Days at Full Utilization.

for 500 pound heifers fed continuously for 90 days in a 2,000 head lot at full capacity utilization. Variation in "other cost," reflecting effects of variation in grain sorghum price, was small in comparison to variation in feeder cattle cost and slaughter price. Except for the period February-May, 1963, positive profits are indicated for the period under consideration. Negative profits for Spring, 1963, of as much as two cents are suggested. High profits of as much as five cents per pound of gain were estimated for April, 1960 and in January, 1961 for 500 pound heifers.

Differences in per head consumption of feed grain were responsible for two other relationships observed in Appendix K. Variations in grain price were more important in longer feeding periods and for steers relative to heifers because these situations involved a greater feed grain consumption.

Major Findings With Respect to Cost-Price Relationships

Prinicpal findings presented in this chapter were largely in accord with specified hypotheses. Increases in scale and utilization, it was found, were associated with increases in profit via reduced costs. However, the feeding systems presenting greatest opportunities for reduction of per unit costs were not necessarily those with the greatest profit potentials when costs of feed and cattle were taken into consideration. The process of upgrading did not necessarily increase profit as hypothesized, since feedlot operators following continuous feeding maximize profits per pound of gain rather than per head. Heifers were relatively more profitable than steers under 1960 cost-price relationships.

Other findings with respect to influences of changes in prices of feeder cattle, slaughter cattle, and feed grain upon profit were important. Effects of changes in feeder cattle prices on breakeven prices and costs per pound of gain, ceteris paribus, were less than proportional. It was noted that feed grain price changes had smaller effects upon profits than did changes in either feeder or sales prices. Changes in sales price, ceteris paribus, were more influential upon profit than either feed grain or feeder cattle price changes.

More detailed summarizations and implications of cost-price relationships are presented in the following chapter in combination with findings and implications of scale and utilization effects.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The growth of commercial dry-lot feeding of cattle is one of the more dramatic of the many changes taking place in Oklahoma's beef industry. Changes such as the construction of a new feedlot or the enlargement and renovation of an old one require entrepreneurial decisions. In planning a new feedlot the question of location arises immediately. This is followed by decisions regarding (1) a basic system of feeding, (2) equipment, facilities, and layout consistent with the system selected, (3) the size or scale of feedlot to build, (4) rations and technical aspects of the feeding program, (5) length of the feeding period, (6) type, class, and sex of feeder animals to buy and time of purchase, (7) quantities of feed required and procurement programs for feed and other resources, (8) types and quantities of labor required, and (9) place and timing of sales, and type of marketing program. In addition, information often is needed with respect to effects of variations in prices of feeder cattle, feed grain, or other variable resources; changes or variations in use of fixed facilities; changes in length of the feeding period; alterations in slaughter cattle prices, price differentials, or price margins; and variations in other factors affecting costs, prices, or both.

After construction, decisions regarding many aspects of feedlot operation must be reviewed and revised. Others must be made periodically. Basically, decisions regarding three major aspects of feedlot operation are required. These are (1) procurement of feeder cattle, feed, and other variable resources, (2) feedlot operation, and (3) marketing. Intelligent and informed decision-making in each aspect of feedlot operation is required if the operator is to realize, fully, his goals and objectives.

The generally accepted objective of feedlot operators, as of other entrepreneurs, is to maximize profits or minimize losses. In highly competitive industries such as cattle feeding where individual operators cannot significantly influence market prices either of resources, including raw materials, or of the product sold, this, i.e. profit maximization, requires cost minimization. To the individual firm in a highly competitive environment, profit maximization, while perhaps not equivalent to cost minimization, is related closely to it and to operational efficiency.

In view of these considerations, this study was designed primarily to provide bases and criteria for decisions of feedlot operators regarding costs and operational efficiency. While illustrative cost-revenue relationships were developed, major emphasis was placed upon measurement of cost savings associated with scale and utilization. Specific stages of the study envolved determining current and historical cattle feeding conditions, systems, and practices in Oklahoma; using resulting findings and other data in constructing specific and highly detailed economic-engineering models; examining these models for effects of changes in scale, utilization rate and other cost-affecting factors; and developing and presenting illustrative cost-revenue functions and relationships.

Cost functions and relationships developed in the study are not averages for the state of Oklahoma, for any other area, or for any specified group of cattle feeders. Cost averages presented are not intended to represent any "typical" situations. Instead, the models were designed or synthesized according to sound economic and engineering principles to represent the least-cost or most efficient operations that, under conditions imposed, might reasonably have been developed in Oklahoma (during the 1960-1963 period). Accordingly, findings provide feedlot operators with opportunity to compare their costs not with industry averages, but with costs they might reasonably expect to approach through superior organization and management. In developing various cost relationships and in examining effects of various factors on costs, avenues toward cost reductions are suggested. In short, findings might be considered goals toward which typical entrepreneurs might strive and clues regarding pathways toward these goals.

Analytical Procedures

Information pertaining to the current and historical status of the Oklahoma cattle feeding industry was developed largely from data obtained from a survey of the industry in 1961. Additional information was derived from previous publications and from quarterly estimates of numbers of animals on feed published by United States Department of Agriculture.

The budgeting technique was used in this study to determine cost relationships with increasing feedlot size and levels of utilization. Input-output coefficients required for this process were developed from earlier studies, from engineering specifications, and from observations of Oklahoma feedlot conditions.

Specific factors allowed to vary in the budgets to show scale and utilization effects were feeding techniques, length of feeding period, class of feeder animals, feedlot size, utilization rate, and the definition of capacity. Combination of these factors resulted in the synthesization of 672 specific cattle feeding models. Two feeding techniques, self-feeders and fenceline bunks, were contrasted. Three classes of feeder animals, 500 and 650 pound heifers and 700 pound steers were considered. Seven feedlot sizes ranging from 300 head to 15,000 head were analyzed. Variations in each size model representing use of fixed facilities at one-third, two-thirds and full capacity were developed. Thus, both short-run and long-run models were constructed. Feeding periods of 60, 90, 120, and 150 days were budgeted and two definitions of capacity involving continuous and single batch feeding operations were considered. In examining effects of each of these factors, effects of others, in each case were impounded.

An entire chapter was devoted to cost effects of scale and utilization rate. Findings provide bases for decisions regarding feedlot size and costs that could be incurred to achieve cost savings associated with maintenance of near-full capacity. Only fixed costs and nonfeed variable costs were considered in scale analysis. Prices of feed and feeder cattle, it was assumed, were not affected by scale or utilization rate.

In the following chapter effects on costs of additional factors were examined in a comparative static framework. Costs of both feed and feeder cattle were introduced. Breakeven prices were developed and effects of various factors upon these prices, costs per pound of gain, and price margins required to cover costs were examined. Illustrative revenue functions were selected and compared with cost functions to provide indications of effects upon profits. Finally profit relationships pertaining to 1960 Oklahoma conditions were developed for specific feeding situations.

Major Findings

Findings of the study were conditioned and largely determined by specifications and assumptions inherent in the models. Since the methodology precluded statistical tests of significance, reliability of the findings depend primarily upon adequacy of the models and the care exercised in their construction. As a constant check upon adequacy of the models and accuracy in computations, however, all data and findings were tested against the criteria of "reasonableness" and internal consistency."

Among the principle findings are those following:

1. Substantial economies of scale are available in feedlot feeding to the capacity level of about 2,000 head; beyond this point only minor further reductions in cost are achieved through increases in scale.
   (a) Cost reductions associated with increasing scale from 300 to 15,000 ranged from 2.32 cents to 3.29 cents per

pound of gain depending upon feeding program with respect to length of feeding period and class of feeder animal fed.

(b) Fixed costs are more significantly affected by scale than nonfeed variable costs. Fixed costs fell about two cents per pound of gain as scale was increased from 300 head to 15,000 head in continuous feeding operations. Approximately three-fourths of the potential reduction in fixed cost associated with scale was achieved with a 2,000 head feedlot.

(c) Average nonfeed variable costs dropped about three-fourths of a cent per pound of gain over the range of scale considered in continuous feeding operations. Slightly more than half the potential reductions in nonfeed variable costs were achieved with a 2,000 head feedlot.

(d) Cost savings associated with increases in scale were greater for single batch operations than for continuous operations although scale functions for continuous operations were at lower cost levels than scale functions associated with single batch operations.

(e) Other factors such as length of feeding period and class of feeder animal affected the relative position of the scale function. Generally speaking, scale functions were at lower cost levels for steers than for heifers. This was true also for longer feeding periods in comparison with shorter ones. Usually, fenceline bunk systems were associated with slightly lower scale functions than self-feeder systems.

2. Substantial savings in costs are available through increasing the utilization rate within a given feedlot size from one-third to two-thirds; beyond this point further reductions in costs were relatively smaller.
   (a) Fixed costs are more significantly affected by utilization than nonfeed variable costs. Approximately three-fourths of the savings in fixed costs associated with increasing the use level was reached at two-thirds of capacity utilization.
   (b) Short-run average nonfeed variable costs were negatively sloped and discontinuous. Discontinuities in these functions were associated with labor input.
   (c) Savings attributable to the utilization effect were greater in smaller lots than in larger lots, and in longer feeding periods relative to shorter periods.
3. The minimum feedlot size required to justify ownership decreases substantially as the custom feeding rate increases. This breakeven size decreases with increases in the custom rate and as the length of feeding increases and is smaller for continuous than for single batch operations.
4. In general, cost-price relationships, and effects of changing prices of feeder cattle, feed grain, and slaughter cattle were in accordance with theoretical expectations.
   (a) A change in the price of feeder cattle, ceteris paribus,

was associated with a less than proportionate change in the same direction in breakeven price and cost per pound of gain.

(b) A positive 10 cent change in feed grain price per hundredweight was associated with changes in breakeven price of one-tenth to one-fourth of a cent per pound of gain depending upon length of feeding period and class of feeder animal. Cost per pound of gain rose approximately three-fourths of one cent per pound of gain with each ten cent increase in grain sorghum price.

(c) Effects on revenue and profits of changes in slaughter cattle prices exceeded effects on costs and profits of equivalent changes in feeder cattle prices.

(d) Length of feeding period and class of feeder animal influenced the magnitude of cost-price relationships. Coefficients of change were smaller for shorter feeding periods and for heifers relative to steers. Correspondingly, breakeven prices and costs per pound of gain were larger for longer feeding periods and for steers. Profits were higher for programs involving heifers and shorter feeding periods.

(e) Breakeven prices and costs per pound of gain were lower in large scale models than in small-volume models. Similar effects were noted when the use level was increased.

5. Cattle feeders attempt to maximize profits annually. Continuous and single batch operators maximize different criteria to attain this goal.
   (a) The single batch operator rationally maximizes profit per head. In the synthetic models, per head profits were maximized in the absence of upgrading, the process of raising the slaughter grade above the equivalent feeder grade, in a 60 day feeding program. With upgrading at 120 days, profits were highest for the 120 day feeding program.
   (b) The goal in a continuous operation is to maximize profits per pound of gain. Profits per pound of gain were greatest in models involving 60 day feeding periods even though upgrading was assumed possible at 120 days.

Selected Implications

Among the multitude of implications suggested by this study, several deserve emphasis. Among these are inferences regarding effects of scale economies upon market structure and nature of industry competition. While findings revealed substantial and significant economies of scale between 300 and 2,000 head, cost reductions beyond this scale were small and, in general, insignificant. Thus, feedlots of 2,000-3,000 head operating at or near capacity on a continuous basis may enjoy critically significant cost advantages over smaller-volume operations. This suggests that small, casual, seasonal, and farmer-feeding programs may decline in relative importance. The findings, however, do not support the contention that exceptionally large feedlots of 10-15 thousand head or more are required for success and survival in the commercial cattle feedlot industry.

It is possible that not all economies of large-scale organization are reflected, or reflected accurately, in the findings. For instance, ownership of livestock trucking facilities was not considered, and it is likely that a volume in excess of that forthcoming from a 2,000 head feedlot is necessary to justify ownership of a semi-truck-trailer designed for cattle. In addition, smaller-volume lots usually are more acutely affected by costs associated with under-utilization of fixed facilities. Single batch feeding programs or continuous feeding at rates below full capacity utilization are more common among small than among larger-volume feedlots. In practice, therefore, cost disadvantages of smaller feedlots to the scale of 5,000 head or more may be significantly larger than those indicated by long-run planning functions. Also pecuniary advantages in purchases of feeder cattle and other resources and in sales of cattle may be available at times or under particular circumstances, to large-scale feedlots.

Implications with respect to Oklahoma's present and potential competitive situation in the fed cattle economy also may be drawn from findings of this study. With several outstanding exceptions, feedlots in Oklahoma must be characterized as small. In 1961, two-thirds had capacity for 500 head or fewer and another one-fourth had capacity for no more than 2,000 head. In a highly competitive industry, regional price differences tend to reflect cost differences. The critical effect of small one or two cent differences (per pound) in regional prices upon optimum interregional flows of fed beef was demonstrated in another study. Accordingly, findings of this study suggest that for most effective competition with other fed cattle supply areas, some increase for Oklahoma in average size of feedlot may be necessary. In addition, some increase and more consistent maintenance of utilization rate and exploitation of other suggested avenues toward cost reductions may be required. But, as indicated, these changes may take place as natural processes of inter-feedlot competition within the state.

Findings with respect to profitability of relatively short-period feeding programs relative to others suggest implications worthy of additional study. Another study has indicated a predominant demand in Oklahoma and Texas for fed beef carcasses within the weight range of 450 to 650 pounds qualifying for "Top Good" or "Low Choice." This demand probably has contributed to the profitability of short-period feeding programs in Oklahoma. Potential growth in this demand, or shifts or changes in it, therefore, are factors that could significantly affect relative profitability of the various feeding programs considered.

The study also suggests the need for study of potentials and demand for "warm up" feeding operations in Oklahoma. A warm up feeding system would involve a short-feeding period and sale for further feeding elsewhere. This system currently is practiced to a limited extent in Oklahoma and Texas. Use of low cost, high roughage rations in warm up feeding systems might further increase relative profitability of of short-period feeding. Many of the cattle placed on feed in Oklahoma, according to survey findings, are thin, plain animals from East Texas or Louisiana. After having been fed for 60 days or more, these animals might be considered fully acceptable feeder cattle by corn belt farmers or others. If not, a demand for them possibly could be developed.

Additional questions or problems for further study are suggested. Methodology required in this analysis precluded the detailed study of interactions among factors affecting costs or among effects. Joint or interrelated effects of two or more of the factors may not be the same as the summation of their separate effects, as assumed in this study. Cost analyses of additional feeding systems, including silage feeding operations, and additional comparative analyses of alternative feeding systems and programs are needed. Finally, little attention was given in this study to effects of seasonal variations in feeder cattle prices, slaughter cattle prices, placements on feed, feed purchases, or sales of finished cattle.

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APPENDICES

APPENDIX TABLE A.1

SPECIFICATIONS AND ASSOCIATED INVESTMENT COSTS FOR 300 HEAD FENCELINE BUNK AND SELF-FEEDER FEEDLOTS

Component Part and Item by Type of Feedlot[a]	Number and Description	Total Cost
		Dollars
Fenceline bunk pens		
7" posts	14 corner and brace	47
5" posts	152 cable posts	372
12' gates	3 stainless steel, 5' high	72
Cable and clamps	5,000 feet, 5/8"	175
Labor	Labor valued at 20 percent of above material cost	133
Alley gravel	112 tons	384
Back scratchers	3, automatic cattle oilers for grub control	105
Total		1,288
Self-feeding pens		
7" posts	14 corner and brace	47
5" posts	164 cable	402
12' gates	3 stainless steel, 5' high	72
Cable and clamps	6,340', 5/8"	222
Labor	20 percent of above material cost	147
Alley gravel	112 tons	384
Back scratchers	3 automatic cattle oilers	105
Total		1,379
Self-feeders		
12'x16' feeders	3 metal with capacity for 8 tons of feed	1,350
Concrete aprons	5.86 cu. yard per feeder	252
Labor	25 percent of concrete cost	50
Total		1,652
Land	3 acres	300
Pickup	1/2 ton, 3-speed	2,200
Fenceline bunks		
Concrete slab	2 1/2'x1'x450' - bottom of bunk	586
2"x12" boards	1800 board feet - sides of bunk	216
2"x6" boards	450 board feet - sides of bunk	54
Bolts, 1/2"x8"	135 - used to hold boards to posts	34
Concrete feeding apron	6'x4"x450'	470
Labor	25 percent of concrete cost, 20 percent of materials cost	325
Total		1,685

APPENDIX TABLE A.1 (Continued)

Component Part and Item by Type of Feedlot[a]	Number and Description	Total Cost
		Dollars
Work and infirmary pens		
7" posts	21 corner and brace	70
5" posts	20 cable	49
4" posts	50 for boards	75
Cable and clamps	704'	25
2"6" boards	992 feet	119
1/2"x8" bolts	165	41
10' gates	6 - used in work pens	120
12" gates	3 - entering feeding pens from back side	72
Labor	20 percent of material cost	114
Hay rack	10' metal	60
Cattle scales	10T 12'x8' including installation	1,408
Shelter		220
Squeeze chute	7 1/2 foot metal	177
Sprayers	1 - 50 gallon tank on wheels	350
Miscellaneous equipment	Veterinary equipment such as vaccine guns, etc.	200
Loading chute	10' metal and movable	240
Total		3,340
Manure equipment		
Used tractor	1 3-plow	1,000
Front end loader	1 - 41"	477
Used dump truck	1 2-ton	2,000
Total		3,477
Water system		
80' well	1 1/4" pipe and digging	271
Pump and wiring	3/4 HP submergible	278
Waterline and connections	315' 1", 325" 1 1/4"	110
Hole for water line	Dug by backhoe at $7.00/hr.	90
Storage tank	9,000 gallons including labor	484
Waterers	2 - 250 gallon	196
Waterer	1 - 50 gallon	35
Concrete aprons for waterers	1 3/4 cu. yds. concrete each and including labor	63
Total		1,527
Self-feeding distribution equipment		
Feed box with long auger	3 ton	1,600
Used truck	2 ton	1,000
Total		2,600

APPENDIX TABLE A.1 (Continued)

Component Part and Item by Type of Feedlot[a]	Number and Description	Total Cost
		Dollars
Bunk feeding distribution equipment		
Feed box	3 ton	1,300
Used truck	2 ton	1,000
Total		2,300
Feed mill and storage facilities		
16' grain elevator	2 for moving feed	275
Portable roller-mixer	12"x12" 82 bu./hr. - 25 HP	1,805
Feed scale	1 - 2,500 pound capacity	684
Bulk tanks	3 - 10 ton stainless steel	1,575
1,000 bu. storage bin	3 - stainless steel	1,590
500 bu. storage bin	1 - stainless steel	435
Total		6,364

[a]Where feedlot type not indicated, components and items indicated are common to both techniques.

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APPENDIX TABLE A.2

SPECIFICATIONS AND ASSOCIATED INVESTMENT COSTS FOR 5,000 HEAD FENCELINE BUNK AND SELF-FEEDER FEEDLOTS

Component Part and Item by Type of Feedlot	Number and Description	Total Cost
		Dollars
Fenceline bunk pens		
7" posts	162 corner and brace	543
5" posts	2,104 cable	5,155
12' gates	55 - 5' stainless steel	1,320
Cable and clamps	85,950'	3,008
Labor	20 percent of materials	2,005
Alley gravel	1,417 tons	4,959
Back scratchers	50 - automatic cattle oilers for grub control	1,750
Total		18,740
Self feeder pens		
7" posts	162 corner and brace	543
5" posts	2,292 cable	5,615
12' gates	55 - stainless steel 5'	1,320
Cable and clamps	108,450'	3,796
Labor	20 percent of material	2,255
Alley gravel	1,417 tons	4,959
Back scratchers	50 - automatic cattle oilers for grub control	1,750
Total		20,238
Self-feeders		
12'x16' feeders	50 - metal	22,500
Concrete aprons	50x5.86 cu. yds./feeder	4,175
Labor	25 percent of concrete work	1,044
Total		27,719
Land	40 acres	4,000
Pickup	2 - 1/2 ton, 3-speed	4,400
Fenceline bunks		
Concrete slab	2 1/2'x1'x7,500' - base for trough	9,761
2"x10" boards	30,000 board feet - side of bunk	3,600
2"x6" boards	7,500 board feet - side of bunk	900
Bolts 1/2"x8"	2,250	563
Concrete feeding apron	6'x4'x7,500'	7,838
Labor	25 percent of concrete work and 20 percent of materials	5,413
Total		28,075

APPENDIX TABLE A.2 (Continued)

Component Part and Item by Type of Feedlot[a]	Number and Description	Total Cost
		Dollars
Work and infirmary pens		
7" posts	60 - for corners and braces	201
4" posts	312 - for boards	468
2"x6" boards	8,080' for fencing	970
Bolts 1/2"x8"	1,347 for holding boards to posts	337
10' gates	28	560
12' gates	2	48
Load chute	2 - homemade, nonmoveable	200
Cattle scales	1 - 10 ton, 14'x9', including installation	1,471
Hay rack	15 - metal	900
Shelter	Small windbreak	1,500
Labor	20 percent of materials	557
Squeeze chute	7 1/2' metal	354
Sprayer	1 - 100 gallon	450
Miscellaneous equipment	Veterinary equipment	200
Total		8,536
Manure equipment		
Used track tractor	Diesel	2,000
Scoup	1 cubic yard	500
Used dump truck	2 - 2-ton	4,000
Total		6,500
Water system		
80' well	3" pipe and digging	960
Pumphouse	Rough lumber	50
Turbine pump and wiring	100 gallon per minute	2,320
Water line	4,200' 1", 3,375' 1 1/4"	1,572
Storage tank	150,000 gallons	2,052
Waterers	25 - 250 gallon automatic	2,450
Waterers	8 - 50 gallon automatic	280
Hole for water line	Dug by backhoe	1,089
Apron for waterers	1 3/4 cubic yards	625
Labor	20 percent of materials and 25 percent of concrete	1,026
Total		12,424
Self-feeding distribution equipment		
Feed box with long auger	2 - 3-ton	3,200
Used truck	2 - 2-ton	2,000
Total		5,200

APPENDIX TABLE A.2 (Continued)

Component Part and Item by Type of Feedlot[a]	Number and Description	Total Cost
		Dollars
Bunk feeding distribution equipment		
Feed box	4 - 3-ton	5,200
Used truck	4 - 2-ton	4,000
Total		9,200
Office and truck scale		
Office building and equipment	Block building with heat and furniture	4,000
Truck scale	34'x10' 30-ton installed	6,684
Feed mill and storage facilities		
Building 40'x80'	1 steel building	12,000
Concrete work	Pits, foundations, etc.	4,300
Excavation	Pits	1,600
Wiring and plumbing		5,400
General labor and supplies		14,000
Upright storage bins	1 - 20,000 bushel installed	6,028
Upright storage bins	2 - 15,000 bushel installed	9,642
Upright storage bins	1 - 2,500 bushel installed	1,092
Overhead bulk bins	4 - 100-tons	4,704
Overhead bulk bins	2 - 50-tons	1,250
Overhead bulk bins	5 - 20-tons	1,825
70' 2,500 bushels leg	1 - 2,500 bu/hr. 7 1/2 HP	2,498
Leg ladder and platform		978
Grain roller-dry	1 - 12"x36"	3,090
Molasses tank	1 - 500 gallon	950
Vertical mixer	1 - 2-ton unit with molasses adder	4,011
Suspension hopper scale	2 - 10,000 pound	4,346
Distributor outlet	1 - 9" 16 holes	2,486
Truck hoist	1 - 20-tons	1,290
12"x60' augers	2 - main augers from storage to leg	2,374
12"x10' augers	2 - augers to leg from dump pits	918
9"x10' augers	20 - distribution augers	5,900
Chain drag	1 - 40'x10' - move feed from mixer	3,600
Total		94,282

[a]Where feedlot type not indicated, components and items indicated are common to both techniques.

APPENDIX TABLE B.1

ESTIMATED LIFE AND SALVAGE VALUE OF EQUIPMENT USED IN COMMERCIAL FEEDLOTS WITH NORMAL REPAIRS[a]

Equipment or Feedlot Component	Estimated Life	Salvage Value in Percent of New Cost
	Years	Percent
Feeding pens	20	0
Work pens excluding board fences	20	0
Board fences in work pens	10	0
Hay racks	20	5
Gates	20	5
Loading chute	10	0
Scales	20	5
Self feeders	20	5
Concrete work	20	0
Board feed bunks	10	0
Water well	12	0
Pump house	20	0
Pumps	12	5
Water line	20	0
Waterers	16	0
Squeeze chute	20	5
Scratchers	17	0
Sprayers	15	5
Vet equipment	20	0
Used trucks and tractors	5	5
Feed boxes on trucks	10	5

APPENDIX TABLE B.1 (Continued)

Equipment or Feedlot Component	Estimated Life	Salvage Value in Percent of New Cost
	Years	Percent
Pickup	10	5
Manure loader	10	5
Feed mill electrical equipment except hoists, scale, and distributor	10	5
Hoist, scale, and distributor	20	5
Molasses tank and leg ladder to platform	20	5
Feed mill building and feed storage	20	5
Office, scale house and equipment	20	0

[a]The estimated life and salvage values came from various references listed in the Selected Bibliography.

APPENDIX TABLE B.2

ASSUMED MARKETING CHARGES CORRESPONDING TO OKLAHOMA CITY TERMINAL MARKET[a]

Item	Rate and Unit
	(dollars)
Yardage - cattle and calves	
400 pounds or greater	1.00 per head
Feed and bedding	
Prairie hay	1.95 per cwt.
Alfalfa hay	2.35 per cwt.
Corn	1.80 per cwt.
Bedding	1.00 per bale
Commission	
One head only	1.40 per head
First 15 head	1.25 per head
Each additional head	1.15 per head
Delivery charge	.10 per head
Livestock and meat board checkoff	.50 per carload

[a]Oklahoma City Public Stockyards rates as published by Packers and Stockyards Division, U. S. Department of Agriculture.

APPENDIX TABLE B.3

ESTIMATED PER HEAD TELEPHONE AND MEDICAL CHARGES ASSOCIATED WITH ALTERNATIVE NUMBERS OF CATTLE ON FEED

Number of Cattle On Feed	Telephone Cost Per Head Per Day	Medical Charge Per Head[a]
(Number)	(cents)	(dollars)
100	.35	1.50
200	.25	1.50
300	.20	1.50
400	.185	1.50
600	.16	1.50
700	.15	1.50
1,000	.13	1.40
1,500	.11	1.35
2,000	.09	1.30
3,000	.08	1.20
5,000	.06[b]	1.00
7,000	.05[b]	1.00
10,000	.04[b]	1.00
15,000	.04[b]	1.00

[a]A 70-cents charge per head for blackleg-edema vaccination, red-nose vaccination, worming pill, combiotic injection, and spray is included. The remainder is accounted for by veterinary service. These charges are based on the 1961 survey of Oklahoma feedlots.

[b]Gordon A. King, Economies of Scale In Large Commercial Feedlots (Berkeley, 1962), p. 24.

APPENDIX TABLE B.4

FEEDLOT EQUIPMENT REPAIR RATES PER HOUR OF USE AS PERCENTAGES OF NEW OR USED MACHINE COSTS

Equipment Type and Item	Repair Rate per Hour Of Use as a Percent Of New or Used Cost
	(Percent of New Cost)
Electrical equipment	
Rollers and mixers	.012[a]
Augers, lifts, and drags	.010[a]
Legs and hoists	.005[a]
Gasoline equipment	
Side auger feed box	.010[a]
Overhead auger feed box	.010[a]
Manure loader	.007[a]
Pickup	.015[b]
	(Percent of Used Cost)
Feed or dump truck	.020[b]
Wheel or track tractor	.020[b]

[a] Reece Edward Brown, Jr., Economics of Mechanization in Feeding Beef Cattle (Stillwater, 1962), pp. 64-66.

[b] Dale A. Knight, Annual Costs for Beef Cattle Equipment (Manhattan, 1958), p. 4.

APPENDIX TABLE B.5

LABOR REQUIREMENTS BY SPECIFIC OPERATIONS FOR MODEL FEEDLOTS OF VARYING SIZES[a]

	Operations with Labor Requirements Varying only with the Number of Head Fed per Year			Operations with Labor Requirements Depending Upon the Number of Head on Feed at one Time			Operation with Labor Requirements Depending Upon the Pounds of Feed Fed		
Feedlot Size	Receiving Cattle[a]	Loading Cattle[b]	Care of Sick[c]	Manure Operations[d]	Checking Cattle[e]	Preparing of Feed Orders[f]	Loading Feed	Unloading to Bunks	Unloading to Feeders
	(man hours per head fed)			(man hours per head on feed)			(man hours per pound fed)		
300	.09	.03	.05	.11	.10	.10	.000092	.00001773	.00004533
600	.09	.03	.05	.11	.10	.10	.00001064	.00001773	.00004533
1,000	.09	.03	.05	.11	.09	.09	.00001064	.00001773	.00004533
2,000	.10	.04	.05	.12	.09	.08	.00001064	.00001773	.00004533
5,000	.11	.05	.05	.15	.09	.06	.00001064	.00001773	.00004533
10,000	.12	.06	.05	.15	.08	.05	.00001064	.00001773	.00004533
15,000	.13	.07	.05	.15	.08	.04	.00001064	.00001773	.00004533

APPENDIX TABLE B.5 (Continued)

[a]Receiving involves removing cattle from trucks, administering preventative medication, sorting, and moving cattle to the feeding pens.

[b]Loading involves driving cattle to the scales from feeding pens, sorting, weighing, and driving the cattle onto trucks for shipment to market.

[c]Care of sick involves moving cattle from feeding pens to infirmary and administering treatment, then moving cattle back to feeding pens as the disease or injury is cured.

[d]Manure operations involves periodically mounding manure into piles within the pens and then removing this manure as time allows.

[e]Inspecting cattle involves a worker visually checking the pens on a daily basis for signs of illness or injury.

[f]Preparation of feed orders involves a worker visually checking bunks or self-feeders on a daily basis to determine the quantity of feed required.

Source: Tarvin F. Webb, Improved Methods and Facilities for Commercial Feedlots (Washington, 1962), p. 23.

James A. Seagraves, Bulk Handling Reduces Labor Costs (Raleigh, 1958), p. 27.

APPENDIX TABLE C.1

TOTAL ANNUAL NONFEED VARIABLE COSTS WITH VARIATION IN FEEDLOT SIZE, LEVEL OF UTILIZATION, FEEDING TECHNIQUE, AND LENGTH OF FEEDING PERIOD, ASSUMING 500 POUND HEIFERS AND CONTINUOUS FEEDING[a]

Feedlot Size	Use Level	Length of Feeding Period: 60 Days Bunks	60 Days Feeders	90 Days Bunks	90 Days Feeders	120 Days Bunks	120 Days Feeders	150 Days Bunks	150 Days Feeders
		(dollars)							
300	300	16,736	16,801	12,765	12,838	10,787	10,860	9,721	9,802
	200	10,311	10,352	7,632	7,679	6,327	6,373	5,528	5,584
	100	6,005	6,025	4,638	4,646	4,010	4,036	3,647	3,677
600	600	30,946	31,073	21,625	23,209	17,705	17,846	16,884	17,047
	400	20,971	21,051	15,693	15,786	13,510	13,158	11,556	11,657
	200	10,278	10,322	7,612	7,659	6,509	6,365	5,516	5,573
1,000	1,000	47,383	47,595	34,573	34,800	38,185	28,432	24,369	24,632
	700	33,847	35,439	24,686	24,843	20,122	20,293	17,394	17,603
	400	21,058	21,138	16,905	17,066	10,983	13,248	9,475	11,748
2,000	2,000	96,098	97,977	69,808	70,269	57,344	57,841	47,451	50,444
	1,500	72,524	72,837	54,286	54,629	42,673	44,489	37,035	37,424
	700	36,209	36,355	25,625	25,774	21,040	22,211	18,366	18,548

APPENDIX TABLE C.1 (Continued

Feedlot Size	Use Level	Length of Feeding Period: 60 Days		90 Days		120 Days		150 Days	
		Bunks	Feeders	Bunks	Feeders	Bunks	Feeders	Bunks	Feeders
		(dollars)							
5,000	5,000	224,657	225,714	169,150	170,306	130,974	133,662	111,586	115,013
	3,000	139,334	139,971	101,066	101,756	80,533	83,443	69,576	72,499
	1,500	72,968	73,281	52,519	52,961	43,039	43,407	37,387	37,762
10,000	10,000	443,176	448,908	318,190	324,111	256,623	262,713	218,249	224,832
	7,000	311,844	314,762	223,605	227,383	180,971	184,137	154,190	158,183
	3,000	140,422	141,053	101,096	101,787	80,567	83,477	69,553	70,332
15,000	15,000	665,284	672,066	476,624	483,275	381,086	389,855	324,858	333,831
	10,000	443,100	448,832	318,132	321,880	253,630	259,721	217,081	223,312
	5,000	223,802	224,865	160,476	168,071	128,754	132,165	109,688	112,440

[a]The cost of feeding only one batch per year is found by dividing the respective totals by the rate of turnover.

APPENDIX TABLE C.2

TOTAL ANNUAL NONFEED VARIABLE COSTS WITH VARIATION IN FEEDLOT SIZE, LEVEL OF USE, FEEDING TECHNIQUE, AND LENGTH OF FEEDING PERIOD, ASSUMING 650 POUND HEIFERS AND CONTINUOUS FEEDING[a]

		Length of Feeding Period							
Feedlot	Use	60 Days		90 Days		120 Days		150 Days	
Size	Level	Bunks	Feeders	Bunks	Feeders	Bunks	Feeders	Bunks	Feeders
		(dollars)							
300	300	17,420	17,496	13,218	13,301	11,123	11,208	10,020	10,109
	200	10,749	10,804	7,937	7,984	6,525	6,580	5,718	5,779
	100	6,234	6,260	4,792	4,817	4,080	4,105	3,764	3,795
600	600	32,286	32,442	23,973	24,136	19,818	19,984	17,334	17,612
	400	21,865	21,966	16,289	16,395	13,510	13,626	11,918	12,034
	200	10,724	10,779	7,915	7,970	6,509	6,564	5,703	5,764
1,000	1,000	49,633	52,062	36,071	36,345	29,318	29,568	25,377	25,675
	700	36,868	37,044	25,748	27,382	20,893	21,091	18,484	18,693
	400	21,950	22,050	17,596	17,750	13,602	13,720	12,016	12,132
2,000	2,000	102,114	102,624	72,910	73,445	59,655	60,221	51,758	50,817
	1,500	75,953	76,327	55,882	56,287	44,405	46,279	38,391	39,126
	700	38,080	38,256	26,693	28,327	21,873	22,069	19,052	18,717

APPENDIX TABLE C.2 (Continued)

Feedlot Size	Use Level	Length of Feeding Period							
		60 Days		90 Days		120 Days		150 Days	
		Bunks	Feeders	Bunks	Feeders	Bunks	Feeders	Bunks	Feeders
		(dollars)							
5,000	5,000	235,877	239,319	169,261	172,974	136,643	139,503	117,774	120,694
	3,000	146,071	149,004	105,595	107,853	83,893	86,909	70,757	75,258
	1,500	76,336	76,714	54,618	56,471	44,738	45,064	38,646	39,084
10,000	10,000	467,222	473,386	334,743	341,067	268,549	274,958	229,611	236,167
	7,000	329,249	333,200	236,354	239,694	188,185	194,417	166,414	166,093
	3,000	146,101	149,034	105,587	106,397	83,883	86,899	72,207	75,262
15,000	15,000	701,019	708,585	499,076	506,745	399,388	409,414	338,215	349,862
	10,000	467,006	471,724	333,171	339,495	267,028	273,472	227,467	234,020
	5,000	235,777	239,225	167,736	170,725	134,377	137,959	115,516	119,158

[a]The cost of feeding only one batch per year is found by dividing the respective totals by the rate of turnover.

APPENDIX TABLE C.3

TOTAL ANNUAL NONFEED VARIABLE COSTS WITH VARIATION IN FEEDLOT SIZE, LEVEL OF USE, FEEDING TECHNIQUE, AND LENGTH OF FEEDING PERIOD, ASSUMING 700 POUND STEERS AND CONTINUOUS FEEDING[a]

		Length of Feeding Period							
Feedlot	Use	60 Days		90 Days		120 Days		150 Days	
Size	Level	Bunks	Feeders	Bunks	Feeders	Bunks	Feeders	Bunks	Feeders
		(dollars)							
300	300	18,125	18,164	13,743	13,834	11,529	11,624	10,174	10,275
	200	11,228	11,250	8,282	8,391	6,794	6,896	5,952	6,018
	100	6,462	6,479	4,966	4,997	4,308	4,281	3,675	3,715
600	600	33,965	34,036	25,011	25,186	20,645	20,836	17,935	18,138
	400	22,978	23,025	16,985	17,105	14,059	14,186	12,387	12,520
	200	11,309	11,333	8,256	8,317	6,784	6,852	5,994	5,964
1,000	1,000	55,629	57,750	37,822	40,306	30,685	31,009	26,424	26,762
	700	38,483	38,680	26,993	28,612	21,872	23,546	18,876	20,566
	400	22,850	22,899	18,293	18,413	14,352	14,279	12,489	12,619
2,000	2,000	106,910	107,157	76,421	78,413	62,470	64,608	54,173	56,286
	1,500	79,294	81,892	58,524	58,984	48,041	48,527	41,659	42,181
	700	39,829	39,916	29,400	29,616	22,796	24,470	19,128	20,823

APPENDIX TABLE C.3 (Continued)

Feedlot Size	Use Level	Length of Feeding Period: 60 Days Bunks	60 Days Feeders	90 Days Bunks	90 Days Feeders	120 Days Bunks	120 Days Feeders	150 Days Bunks	150 Days Feeders
		(dollars)							
5,000	5,000	247,674	250,456	178,033	183,182	144,774	148,564	123,496	126,623
	3,000	153,149	155,685	110,741	113,104	90,103	92,519	75,609	78,799
	1,500	79,874	80,060	57,356	59,264	46,742	48,674	40,402	40,912
10,000	10,000	493,061	497,892	354,116	360,790	284,214	291,069	242,337	249,386
	7,000	345,816	348,836	248,369	254,143	199,745	205,625	170,714	176,565
	3,000	153,118	155,655	110,799	111,713	88,258	91,217	75,627	78,816
15,000	15,000	735,884	744,948	528,520	538,166	421,000	432,636	355,313	367,645
	10,000	492,845	497,684	351,927	358,602	282,056	288,709	241,069	248,127
	5,000	247,620	250,370	177,986	181,687	144,081	147,150	121,442	125,311

[a]The cost of feeding only one batch per year is found by dividing the respective totals by the rate of turnover.

APPENDIX TABLE D.1

TOTAL ANNUAL FEED COSTS WITH VARIATION IN FEEDLOT SIZE, LEVEL OF USE, AND LENGTH OF FEEDING PERIOD FOR 500 POUND HEIFERS, CONTINUOUS FEEDING, AS COMPARED WITH ONE BATCH PER YEAR

		Length of Feeding Period							
		60 Days		90 Days		120 Days		150 Days	
Feedlot Size	Use Level	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch
		(dollars)							
300	300	31,363	5,205	34,666	8,613	37,467	12,378	39,721	16,416
	200	20,909	3,470	23,111	5,742	24,978	8,252	26,463	10,944
	100	10,455	1,735	11,555	2,871	12,489	4,126	13,203	5,472
600	600	62,729	10,410	69,332	17,226	74,933	24,756	79,387	32,832
	400	41,818	6,940	46,221	11,484	49,955	16,504	52,925	21,888
	200	20,909	3,470	23,111	5,742	24,978	8,252	26,463	10,944
1,000	1,000	104,544	17,350	115,553	28,710	124,889	41,260	132,367	54,720
	700	73,181	12,145	80,887	20,097	87,422	28,882	92,646	38,304
	400	41,818	6,940	46,221	11,484	49,955	16,504	52,925	21,888
2,000	2,000	209,088	34,700	231,106	57,420	249,777	82,520	264,734	109,440
	1,500	156,816	26,025	173,329	43,065	187,333	61,890	198,550	82,080
	700	73,181	12,145	80,887	20,097	87,422	28,882	92,646	38,304

APPENDIX TABLE D.1

		Length of Feeding Period							
		60 Days		90 Days		120 Days		150 Days	
Feedlot Size	Use Level	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch
		(dollars)							
5,000	5,000	522,720	86,750	577,764	143,550	624,443	206,300	661,835	273,600
	3,000	313,632	52,050	364,658	86,130	374,666	123,780	397,101	164,160
	1,500	156,816	26,025	173,314	43,065	187,333	61,890	198,550	82,080
10,000	10,000	1,045,440	170,350	1,155,528	287,100	1,248,885	412,600	1,323,670	547,200
	7,000	731,808	121,450	808,870	200,970	874,220	288,820	926,569	383,040
	3,000	313,632	52,050	346,658	86,130	374,666	123,780	397,101	164,160
15,000	15,000	1,568,160	260,250	1,733,292	430,650	1,873,328	618,900	1,985,504	820,800
	10,000	1,045,440	170,350	1,155,528	287,100	1,248,885	412,600	1,323,670	547,200
	5,000	522,720	86,750	577,764	143,550	624,443	206,300	661,835	273,600

APPENDIX TABLE D.2

TOTAL ANNUAL FEED COSTS WITH VARIATION IN FEEDLOT SIZE, LEVEL OF USE, AND LENGTH OF FEEDING PERIOD FOR 650 POUND HEIFERS, CONTINUOUS FEEDING, AS COMPARED WITH ONE BATCH PER YEAR

		Length of Feeding Period							
		60 Days		90 Days		120 Days		150 Days	
Feedlot Size	Use Level	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch
		(dollars)							
300	300	36,780	6,093	39,596	9,828	41,850	13,839	43,842	18,105
	200	24,520	4,062	26,397	6,552	27,900	9,226	29,208	12,070
	100	12,260	2,031	13,199	3,276	13,950	4,613	14,573	6,035
600	600	73,561	12,186	79,192	19,656	83,701	27,678	87,623	36,210
	400	49,041	8,124	52,795	13,104	55,800	18,452	58,416	24,140
	200	24,520	4,062	26,397	6,552	27,900	9,226	29,208	12,070
1,000	1,000	122,602	20,310	131,987	32,760	139,501	46,130	146,100	60,350
	700	85,821	14,217	92,391	22,932	97,651	32,291	102,258	42,245
	400	49,041	8,124	52,795	13,104	55,800	18,452	58,416	24,140
2,000	2,000	245,203	40,620	263,974	65,520	279,002	92,260	292,200	120,700
	1,500	183,902	30,465	197,980	49,140	209,251	69,195	219,150	90,525
	700	85,821	14,217	92,391	22,932	97,651	32,291	102,258	42,245

APPENDIX TABLE D.2 (Continued)

		Length of Feeding Period							
		60 Days		90 Days		120 Days		150 Days	
Feedlot Size	Use Level	Con-tinuous	One Batch	Con-tinuous	One Batch	Con-tinuous	One Batch	Con-tinuous	One Batch
		(dollars)							
5,000	5,000	613,008	101,550	659,934	163,800	697,505	230,650	730,501	301,750
	3,000	367,805	60,930	395,960	98,280	418,503	138,390	438,301	181,050
	1,500	183,902	30,465	97,980	49,140	209,251	69,195	219,150	90,525
10,000	10,000	1,226,016	203,100	1,319,868	327,600	1,395,009	461,300	1,461,002	603,500
	7,000	858,211	142,170	923,908	229,320	976,506	322,910	1,022,702	422,450
	3,000	367,805	60,930	395,960	98,280	418,503	138,390	438,301	181,050
15,000	15,000	1,839,024	304,650	1,979,802	491,400	2,092,514	691,950	2,191,504	905,250
	10,000	1,226,016	203,100	1,319,868	327,600	1,395,009	461,300	1,461,002	603,500
	5,000	613,008	101,550	659,934	163,800	697,504	230,650	730,501	301,750

APPENDIX TABLE D.3

TOTAL ANNUAL FEED COSTS WITH VARIATION IN FEEDLOT SIZE, LEVEL OF USE, AND LENGTH OF FEEDING PERIOD FOR 700 POUND STEERS, CONTINUOUS FEEDING, AS COMPARED WITH ONE BATCH PER YEAR

		Length of Feeding Period							
		60 Days		90 Days		120 Days		150 Days	
Feedlot Size	Use Level	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch	Continuous	One Batch
		(dollars)							
300	300	40,968	6,777	45,013	11,154	48,159	15,900	50,958	21,012
	200	27,312	4,518	30,009	7,436	32,106	10,600	33,948	14,008
	100	13,656	2,259	15,004	3,718	16,053	5,300	16,938	7,004
600	600	81,936	13,554	90,027	22,308	96,317	31,800	101,845	42,024
	400	54,624	9,036	60,018	14,872	64,211	21,200	67,896	28,016
	200	27,312	4,518	30,009	7,436	32,106	10,600	33,948	14,008
1,000	1,000	136,561	22,590	150,044	37,180	160,528	53,000	169,813	70,040
	700	95,592	15,813	105,031	26,026	112,370	37,100	118,855	49,028
	400	54,624	9,036	60,018	14,872	64,211	21,200	67,896	28,016
2,000	2,000	273,121	45,180	300,089	74,360	321,057	106,000	339,625	140,080
	1,500	204,841	33,885	225,067	55,770	240,793	79,500	254,719	105,060
	700	95,592	15,813	105,031	26,026	112,370	37,100	118,855	49,028

APPENDIX TABLE D.3 (Continued)

Feedlot Size	Use Level	60 Days Continuous	60 Days One Batch	90 Days Continuous	90 Days One Batch	120 Days Continuous	120 Days One Batch	150 Days Continuous	150 Days One Batch
		(dollars)							
5,000	5,000	682,803	112,950	750,222	185,900	802,643	265,000	849,064	350,200
	3,000	409,682	67,770	450,133	111,540	481,586	159,000	509,438	210,120
	1,500	204,841	33,885	225,067	55,770	240,793	79,500	254,719	105,060
10,000	10,000	1,365,606	225,900	1,500,444	371,800	1,605,285	530,000	1,698,127	700,400
	7,000	955,924	158,130	1,050,311	260,260	1,123,700	371,000	1,188,689	490,280
	3,000	409,682	67,770	450,133	111,540	481,586	159,000	509,438	210,120
15,000	15,000	2,048,409	338,650	2,250,666	557,700	2,407,928	795,000	2,547,191	1,050,600
	10,000	1,365,606	225,900	1,500,444	371,800	1,605,285	530,000	1,698,127	700,400
	5,000	682,803	112,950	750,222	185,900	802,643	265,000	849,064	350,200

APPENDIX TABLE E.1

TOTAL ANNUAL FEEDLOT PRODUCTION FOR CONTINUOUS OPERATIONS, WITH VARIATION IN LENGTH OF FEEDING PERIOD AND NUMBERS ON FEED, 500 POUND HEIFERS[a]

On Feed	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
Number Head	-Pounds of Gain-			
300	286,902	261,360	231,660	212,474
200	191,268	174,240	154,440	141,550
100	95,634	87,120	77,220	70,626
600	573,804	522,720	463,320	424,650
400	282,536	348,480	308,880	283,100
200	191,268	174,240	154,440	141,550
1,000	956,340	871,200	772,200	708,048
700	669,438	609,840	540,540	495,574
400	382,536	348,480	308,880	283,100
2,000	1,912,680	1,742,400	1,544,400	1,416,096
1,500	1,434,510	1,306,800	1,158,300	1,062,072
700	669,438	609,840	540,540	495,574
5,000	4,481,700	4,356,000	3,861,000	3,540,240
3,000	2,869,020	2,613,600	2,316,600	2,124,144
1,500	1,434,510	1,306,800	1,158,300	1,062,072
10,000	9,563,400	8,712,000	7,722,000	7,080,480
7,000	6,694,380	6,098,400	5,405,400	4,956,336
3,000	2,869,020	2,613,600	2,316,800	2,124,144
15,000	14,345,100	13,068,000	11,583,000	10,620,720
10,000	9,563,400	8,712,000	7,722,000	7,080,480
5,000	4,781,700	4,356,000	3,861,000	3,540,240

[a]Production for one batch only is obtained by dividing the total production for the continuous basis by the turnover rate.

APPENDIX TABLE E.2

TOTAL ANNUAL FEEDLOT PRODUCTION FOR CONTINUOUS OPERATIONS, WITH VARIATION IN LENGTH OF FEEDING PERIOD AND NUMBERS ON FEED, 650 POUND HEIFERS[a]

On Feed	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
Number Head	-Pounds of Gain-			
300	288,684	261,360	229,878	208,909
200	192,456	174,240	153,252	139,175
100	96,228	87,120	76,626	69,441
600	577,368	522,720	459,498	417,522
400	384,912	348,480	306,504	278,350
200	192,456	174,240	153,252	139,175
1,000	962,280	871,200	766,260	696,168
700	673,596	609,840	536,382	487,259
400	384,912	348,480	306,504	278,350
2,000	1,924,560	1,742,400	1,532,520	1,392,336
1,500	1,443,420	1,306,800	1,149,390	1,044,252
700	673,596	609,840	536,382	487,259
5,000	4,811,400	4,356,000	3,831,300	3,480,840
3,000	2,886,840	2,613,600	2,298,780	2,088,504
1,500	1,443,420	1,306,800	1,149,390	1,044,252
10,000	9,655,200	8,712,000	7,662,600	6,961,680
7,000	6,735,960	6,098,400	5,363,820	4,873,176
3,000	2,886,840	2,613,600	2,298,780	2,088,504
15,000	14,434,200	13,068,000	11,493,900	10,442,520
10,000	9,655,200	8,712,000	7,662,600	6,961,680
5,000	4,811,400	4,356,000	3,831,300	3,480,840

[a]Production for one batch only is obtained by dividing the total production for the continuous basis by the turnover rate.

APPENDIX TABLE E.3

TOTAL ANNUAL FEEDLOT PRODUCTION FOR CONTINUOUS OPERATIONS, WITH VARIATION IN LENGTH OF FEEDING PERIOD AND NUMBERS ON FEED, 700 POUND STEERS[a]

On Feed	Length of Feeding Period			
	60 Days	90 Days	120 Days	150 Days
Number Head	-Pounds of Gain-			
300	304,722	281,556	254,826	237,429
200	203,148	187,467	169,884	158,175
100	101,574	93,852	84,942	78,921
600	609,444	563,112	509,652	474,525
400	406,296	375,408	339,768	316,350
200	203,148	187,467	169,884	158,175
1,000	1,015,740	938,520	849,420	791,208
700	711,018	656,964	594,594	553,779
400	406,296	375,408	339,768	316,350
2,000	2,031,480	1,877,040	1,698,840	1,582,416
1,500	1,523,610	1,407,780	1,274,130	1,186,812
700	711,018	656,964	596,673	553,779
5,000	5,078,700	4,692,600	4,247,100	3,956,040
3,000	3,047,220	2,815,560	2,548,260	2,373,624
1,500	1,523,610	1,407,780	1,274,730	1,186,812
10,000	10,157,400	9,385,200	8,494,200	7,912,080
7,000	7,110,180	6,569,640	5,945,940	5,538,456
3,000	3,047,220	2,815,560	2,548,260	2,373,624
15,000	15,236,100	14,077,800	12,741,300	11,868,120
10,000	10,157,400	9,385,200	8,494,200	7,912,080
5,000	5,078,700	4,692,600	4,247,100	3,956,040

[a]Production for one batch only is obtained by dividing the total production for the continuous basis by the turnover rate.

APPENDIX TABLE F.1

COST OF FEEDING 500 POUND FEEDER HEIFERS FOR OWNERSHIP AS COMPARED TO CUSTOM FEEDING WITH ALTERNATIVE FEEDING PERIODS AND SCALE, TWO LEVELS OF UTILIZATION, AND AT TWO CUSTOM RATES IN FENCELINE BUNK SYSTEMS[a]

Feedlot	60 Day Period				90 Day Period				120 Day Period				150 Day Period			
	Ownership		Custom		Ownership		Custom		Ownership		Custom		Ownership		Custom	
Size	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢
	- Cents Per Pound of Gain -															
300	14.53	23.72	13.65	15.51	17.16	23.10	16.29	18.38	20.54	24.87	19.72	22.03	23.44	26.55	22.64	25.15
600	13.65	20.68	13.65	15.51	15.94	20.46	16.29	18.38	19.18	22.44	19.72	22.03	22.30	24.58	22.64	25.15
1,000	12.96	18.17	13.65	15.51	15.44	18.81	16.29	18.38	18.61	21.00	19.72	22.03	21.36	22.98	22.64	25.15
2,000	12.80	17.07	13.65	15.51	15.31	18.02	16.29	18.38	18.48	20.37	19.72	22.03	21.05	22.29	22.64	25.15
5,000	12.57	16.02	13.65	15.51	15.14	17.30	16.29	18.38	18.07	19.55	19.72	22.03	20.71	21.64	22.64	25.15
10,000	12.41	15.35	13.65	15.51	14.79	16.62	16.29	18.38	17.88	19.10	19.72	22.03	20.50	21.24	22.64	25.15
15,000	12.40	15.23	13.65	15.51	14.77	16.60	16.29	18.38	17.82	18.99	19.72	22.03	20.45	21.15	22.64	25.15

[a]Costs associated with marketing, death loss, and veterinary and medical expense are not included.

APPENDIX TABLE F.2

COST OF FEEDING 650 POUND FEEDER HEIFERS FOR OWNERSHIP AS COMPARED TO CUSTOM FEEDING WITH ALTERNATIVE FEEDING PERIODS AND SCALE, TWO LEVELS OF UTILIZATION, AND AT TWO CUSTOM RATES IN FENCELINE BUNK SYSTEMS[a]

Feedlot Size	60 Day Period				90 Day Period				120 Day Period				150 Day Period			
	Ownership		Custom		Ownership		Custom		Ownership		Custom		Ownership		Custom	
	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢
	- Cents Per Pound of Gain -															
300	16.34	25.43	15.60	17.46	19.07	24.98	18.38	20.43	22.64	26.95	21.95	24.27	25.84	28.95	25.16	27.72
600	15.48	22.42	15.60	17.46	18.12	22.69	18.38	20.43	21.57	24.80	21.95	24.27	24.65	26.93	25.16	27.72
1,000	14.77	19.98	15.60	17.46	17.35	20.69	18.38	20.43	20.69	23.06	21.95	24.27	23.73	25.33	25.16	27.72
2,000	14.70	18.92	16.60	17.46	17.22	19.90	18.38	20.43	20.55	22.41	21.95	24.27	23.56	24.78	25.16	27.72
5,000	14.40	17.79	15.60	17.46	16.88	19.01	18.38	20.43	20.21	21.67	21.95	24.27	23.11	24.01	25.16	27.72
10,000	14.25	17.14	15.60	17.46	16.72	18.43	18.38	20.43	19.95	21.33	21.95	24.27	22.89	23.59	25.16	27.72
15,000	14.23	17.01	15.60	17.46	16.68	18.21	18.38	20.43	19.89	21.04	21.95	24.27	22.80	23.46	25.16	27.72

[a]Costs associated with marketing, death loss, and veterinary and medical expenses are not included.

APPENDIX TABLE F.3

COST OF FEEDING 700 POUND STEERS FOR OWNERSHIP AS COMPARED TO CUSTOM FEEDING WITH ALTERNATIVE FEEDING PERIODS AND SCALE, TWO LEVELS OF UTILIZATION, AND AT TWO CUSTOM RATES IN FENCELINE BUNK SYSTEMS[a]

Feedlot	60 Day Period				90 Day Period				120 Day Period				150 Day Period			
	Ownership		Custom		Ownership		Custom		Ownership		Custom		Owhership		Custom	
Size	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢	Cont.	One	5¢	10¢
	- Cents Per Pound of Gain -															
300	16.88	25.48	16.28	18.04	19.65	25.11	19.15	21.05	22.54	26.40	22.11	24.21	25.32	28.00	24.95	27.21
600	16.00	22.67	16.28	18.04	18.80	22.95	19.15	21.05	21.58	24.47	22.11	24.21	24.30	25.23	24.95	27.21
1,000	15.74	20.66	16.28	18.04	18.06	21.12	19.15	21.05	20.79	22.89	22.11	24.21	23.46	24.81	24.95	27.21
2,000	15.33	19.31	16.28	18.04	17.93	20.38	19.15	21.05	20.67	22.31	22.11	24.21	23.33	24.34	24.95	27.21
5,000	15.03	18.23	16.28	18.04	17.62	19.57	19.15	21.05	20.33	21.60	22.11	24.21	22.92	23.65	24.95	27.21
10,000	14.92	17.64	16.28	18.04	17.48	19.13	19.15	21.05	20.15	21.19	22.11	24.21	22.73	23.24	24.95	27.21
15,000	14.87	17.49	16.28	18.04	17.45	19.03	19.15	21.05	20.08	21.08	22.11	24.21	22.64	23.17	24.95	27.21

[a]Costs associated with marketing, death loss, and veterinary and medical expenses are not included.

APPENDIX TABLE G.1

COSTS, BREAKEVEN PRICE,[a] PRICE MARGIN REQUIRED,[b] AND COST PER POUND GAIN[c] AT 20 CENTS FEEDER COST; AND CHANGE (b VALUE) WITH EACH ONE CENT CHANGE IN PER POUND FEEDER COST, 500 POUND HEIFERS, AND FENCELINE BUNK SYSTEMS

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value[f]	CPPG a Value	CPPG b Value
	-Dollars-					-Cents-					
300 Head Lot											
One Lot-300											
60 Days	30,000	1,500	43,197	1,515	12,897	22.00	.7717	2.00	.2283	27.60	.0314
90 Days	30,000	1,500	47,239	1,522	16,789	22.09	.7120	2.09	.2883	26.79	.0344
120 Days	30,000	1,500	51,359	1,530	20,759	22.75	.6778	2.75	.3225	27.65	.0389
150 Days	30,000	1,500	55,891	1,538	25,141	23.58	.6487	3.58	.3508	29.25	.0424
Continuous-300											
60 Days	180,000	9,000	232,856	9,090	51,056	19.77	.7717	-.23	.2283	18.42	.0314
90 Days	120,000	6,000	172,891	6,090	51,091	20.21	.7120	.21	.2883	20.24	.0344
120 Days	90,000	4,500	144,075	4,590	52,275	21.28	.6778	1.28	.3225	23.34	.0389
150 Days	72,000	3,600	127,357	3,690	53,557	22.38	.6487	2.38	.3517	26.05	.0424
Continuous-100											
60 Days	60,000	3,000	81,615	3,030	21,015	20.79	.7717	.79	.2283	22.60	.0314
90 Days	40,000	2,000	61,583	2,030	20,983	21.60	.7120	1.60	.2883	24.77	.0344
120 Days	30,000	1,500	52,010	1,530	21,410	23.04	.6778	3.04	.3225	27.21	.0389
150 Days	24,000	1,200	46,396	1,230	21,796	24.53	.6508	4.53	.3492	31.67	.0424

APPENDIX TABLE G.1 (Continued)

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value[f]	CPPG a Value	CPPG b Value
			-Dollars-					-Cents-			
600 Head Lot											
One Lot-600											
60 Days	60,000	3,000	83,496	3,030	22,896	21.27	.7717	1.27	.2283	24.57	.0314
90 Days	60,000	3,000	91,024	3,045	30,124	21.28	.7117	1.28	.2883	23.74	.0344
120 Days	60,000	3,000	98,952	3,060	37,752	21.92	.6783	1.92	.3217	25.22	.0389
150 Days	60,000	3,000	108,303	3,075	46,803	22.85	.6492	2.85	.3508	27.30	.0424
Continuous-200											
60 Days	120,000	6,000	159,020	6,060	37,820	20.25	.7717	.25	.2283	20.40	.0314
90 Days	80,000	4,000	119,025	4,060	37,825	20.87	.7117	.87	.2883	22.40	.0344
120 Days	60,000	3,000	99,804	3,060	38,604	22.11	.6783	2.11	.3217	25.77	.0389
150 Days	48,000	2,400	88,636	2,460	39,436	23.38	.6483	3.38	.3517	28.71	.0424
Continuous-600											
60 Days	360,000	18,000	460,706	18,180	97,106	19.56	.7717	-.44	.2283	17.55	.0314
90 Days	240,000	12,000	339,399	12,180	95,799	19.84	.7117	-.16	.2883	19.02	.0344
120 Days	180,000	9,000	281,804	9,180	98,204	20.81	.6783	.81	.3217	21.97	.0389
150 Days	144,000	7,200	249,779	7,380	102,179	21.97	.6492	1.97	.3508	24.91	.0424
5,000 Head Lot											
One Lot-5,000											
60 Days	500,000	25,000	656,001	25,250	151,001	20.05	.7717	.05	.2283	19.57	.0314
90 Days	500,000	25,000	719,177	25,375	211,677	20.18	.7125	.18	.2875	20.13	.0344
120 Days	500,000	25,000	784,816	25,500	274,816	20.86	.6775	.86	.3225	22.13	.0389
150 Days	500,000	25,000	856,455	25,625	343,955	21.68	.6492	1.68	.3508	24.16	.0424

APPENDIX TABLE G.1 (Continued)

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value[f]	CPPG a Value	CPPG b Value
	-Dollars-					-Cents-					
Continuous-5,000											
60 Days	3,000,000	150,000	3,771,727	151,500	741,727	19.21	.7717	-.79	.2283	16.14	.0314
90 Days	2,000,000	100,000	2,783,010	101,500	753,010	19.52	.7117	-.48	.2883	17.98	.0344
120 Days	1,500,000	75,000	2,297,533	76,500	767,533	20.36	.6783	.36	.3217	20.66	.0389
150 Days	1,200,000	60,000	2,019,166	61,500	789,166	21.30	.6492	1.30	.3508	23.14	.0424
Continuous-1,500											
60 Days	900,000	45,000	1,161,131	45,450	252,131	19.72	.7717	-.28	.2283	18.20	.0314
90 Days	600,000	30,000	860,720	30,450	251,720	20.13	.7125	.13	.2875	19.95	.0344
120 Days	450,000	22,500	717,049	22,950	258,049	21.18	.6783	1.18	.3217	23.06	.0389
150 Days	360,000	18,000	633,703	18,450	264,703	22.28	.6492	2.28	.3508	25.77	.0424
1,000 Head Lot Continuous											
60 Days	600,000	30,000	760,300	30,300	154,300	19.36	.7717	-.64	.2283	16.76	.0314
90 Days	400,000	20,000	560,863	20,300	154,863	19.67	.7120	-.33	.2880	18.46	.0344
120 Days	300,000	15,000	465,007	15,300	159,007	20.60	.6778	.60	.3222	21.37	.0389
150 Days	240,000	12,000	409,393	12,300	163,393	21.59	.6487	1.59	.3513	23.92	.0424
2,000 Head Lot Continuous											
60 Days	1,200,000	60,000	1,518,077	60,600	306,077	19.33	.7717	-.67	.2283	16.63	.0314
90 Days	800,000	40,000	1,118,534	40,600	306,534	19.62	.7120	-.38	.2880	18.46	.0344
120 Days	600,000	30,000	927,133	30,600	315,133	20.54	.6778	.54	.3222	21.18	.0389
150 Days	480,000	24,000	813,644	24,600	321,644	21.46	.6487	1.46	.3513	23.56	.0424

APPENDIX TABLE G.1 (Continued)

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value[f]	CPPG a Value	CPPG b Value
	-Dollars-					-Cents-					
5,000 Head Lot											
Continuous											
60 Days	3,000,000	150,000	3,771,727	151,500	741,727	19.21	.7717	-.79	.2283	16.14	.0314
90 Days	2,000,000	100,000	2,783,010	101,500	753,010	19.52	.7117	-.48	.2883	17.98	.0344
120 Days	1,500,000	75,000	2,293,533	76,500	767,533	20.36	.6783	.36	.3217	20.66	.0389
150 Days	1,200,000	60,000	2,019,166	61,500	789,166	21.30	.6492	1.30	.3508	23.14	.0424
10,000 Head Lot											
Continuous											
60 Days	6,000,000	300,000	7,527,560	303,000	1,467,560	19.17	.7717	-.83	.2283	15.97	.0314
90 Days	4,000,000	200,000	5,336,306	203,000	1,476,306	19.42	.7120	-.58	.2880	15.34	.0344
120 Days	3,000,000	150,000	4,580,056	153,000	1,520,056	20.29	.6778	.29	.3222	20.46	.0389
150 Days	2,400,000	120,000	4,023,703	123,000	1,563,703	21.22	.6487	1.22	.3513	22.93	.0424
15,000 Head Lot											
Continuous											
60 Days	9,000,000	450,000	11,288,815	454,500	2,198,815	19.17	.7717	-.83	.2283	15.96	.0314
90 Days	6,000,000	300,000	8,300,753	304,500	2,210,753	19.41	.7120	-.59	.2280	17.61	.0344
120 Days	4,500,000	225,000	6,863,191	229,500	2,273,191	20.27	.6778	.27	.3222	20.40	.0389
150 Days	3,600,000	180,000	6,029,993	184,500	2,339,993	21.20	.6487	1.20	.3513	22.88	.0424

[a]The breakeven price is defined as the slaughter price required to exactly cover the total cost of feeding.

[b]The price margin required is the feeder cattle price minus the slaughter price necessary to cover all costs.

[c]Cost per pound of gain is the total cost of feeding, excluding the purchase price of feeder animals but including interest on the purchase of feeder animals, divided by the pound gained during the feeding process.

[d]Total cost includes interest on feeders, feeder cost, and other cost.

[e]Other cost includes feed cost, fixed cost, and nonfed variable costs.

[f]The b value for price margin required (PMR) is negative in every case.

APPENDIX TABLE G.2

COSTS, BREAKEVEN PRICE,[a] PRICE MARGINS REQUIRED,[b] AND COST PER POUND GAIN[c] AT 20 CENTS FEEDER COST; AND CHANGE (b VALUE) WITH EACH ONE CENT CHANGE PER POUND FEEDER COST, 700 POUND STEERS, AND FENCELINE BUNK SYSTEMS

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value[f]	CPPG a Value	CPPG b Value
	-Dollars-					-Cents-					
300 Head Lot											
One Lot-300											
60 Days	42,000	2,100	56,942	2,121	14,522	22.01	.8199	2.01	.1801	29.42	.0401
90 Days	42,000	2,100	61,870	2,132	19,240	22.23	.7659	2.23	.2341	25.08	.0434
120 Days	42,000	2,100	67,168	2,142	24,328	22.94	.7315	2.94	.2685	29.63	.0480
150 Days	42,000	2,100	72,835	2,153	29,785	23.74	.7016	3.74	.2984	31.18	.0515
Continuous-300											
60 Days	252,000	12,600	315,589	12,726	61,069	20.33	.8199	.33	.1801	20.87	.0401
90 Days	168,000	8,400	232,259	8,526	61,739	20.86	.7659	.86	.2341	22.82	.0434
120 Days	126,000	6,300	191,725	6,426	63,205	21.82	.7315	1.82	.2685	25.79	.0480
150 Days	100,800	5,040	168,323	5,166	65,003	22.85	.7016	2.85	.2986	28.44	.0515
Continuous-100											
60 Days	84,000	4,200	109,187	4,242	24,347	21.10	.8199	1.10	.1801	24.80	.0401
90 Days	56,000	2,800	81,375	2,842	24,535	21.93	.7659	1.93	.2341	27.04	.0434
120 Days	42,000	2,100	67,943	2,142	25,103	23.20	.7315	3.20	.2685	30.54	.0480
150 Days	33,600	1,680	60,031	1,722	25,591	24.52	.7033	4.52	.2967	33.49	.0515

APPENDIX TABLE G.2 (Continued)

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value[f]	CPPG a Value	CPPG b Value
	-Dollars-					-Cents-					
600 Head Lot											
One Lot-600											
60 Days	84,000	4,200	111,025	4,242	26,185	21.46	.8199	1.46	.1801	26.61	.0401
90 Days	84,000	4,200	120,643	4,263	35,383	21.68	.7659	1.68	.2341	25.74	.0434
120 Days	84,000	4,200	131,055	4,284	45,375	22.38	.7315	2.38	.2685	27.70	.0480
150 Days	84,000	4,200	142,184	4,305	56,084	23.17	.7016	3.17	.2984	29.43	.0515
Continuous-200											
60 Days	168,000	8,400	214,281	8,484	44,601	20.71	.8199	.71	.1801	22.78	.0401
90 Days	112,000	5,600	158,596	5,684	44,916	21.37	.7659	1.37	.2341	24.86	.0434
120 Days	84,000	4,200	131,577	4,284	45,897	22.47	.7315	2.47	.2685	28.59	.0480
150 Days	67,200	3,360	116,005	3,444	47,125	23.64	.7019	3.64	.2981	30.86	.0515
Continuous-600											
60 Days	504,000	25,200	626,415	25,452	117,375	20.18	.8199	.18	.1801	20.09	.0414
90 Days	336,000	16,800	459,565	17,052	118,525	20.64	.7659	.64	.2341	21.94	.0434
120 Days	252,000	12,600	378,559	12,852	121,519	21.55	.7315	1.55	.2685	24.83	.0480
150 Days	201,600	10,080	201,600	10,332	125,073	22.53	.7019	2.53	.2981	27.42	.0515
5,000 Head Lot											
One Lot-5,000											
60 Days	700,000	35,000	885,050	35,350	178,050	20.53	.8199	.53	.1801	21.86	.0401
90 Days	700,000	35,000	963,493	35,525	252,993	20.77	.7659	.77	.2341	22.46	.0434
120 Days	700,000	35,000	1,048,771	35,700	334,771	21.49	.7315	1.49	.2685	24.64	.0480
150 Days	700,000	35,000	1,139,306	35,875	421,806	22.28	.7016	2.28	.2981	26.65	.0515

APPENDIX TABLE G.2 (Continued)

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value	CPPG a Value	CPPG b Value
	-Dollars-					-Cents-					
Continuous-5,000											
60 Days	4,200,000	210,000	5,150,498	212,100	908,498	19.91	.8199	-.09	.1801	18.72	.0401
90 Days	3,360,000	168,000	3,765,051	170,100	923,051	20.29	.7659	.29	.2341	20.57	.0434
120 Days	2,100,000	105,000	3,093,125	107,100	951,125	21.24	.7315	1.24	.2685	23.38	.0480
150 Days	1,680,000	84,000	2,703,706	86,100	981,706	22.03	.7016	2.03	.2984	25.88	.0515
Continuous-1,500											
60 Days	1,260,000	63,000	1,574,763	63,630	302,163	20.29	.8199	.29	.1801	20.66	.0401
90 Days	840,000	42,000	1,157,504	42,630	304,904	20.80	.7659	.80	.2341	22.55	.0434
120 Days	630,000	31,500	955,290	32,130	312,690	21.75	.7315	1.75	.2685	25.52	.0480
150 Days	504,000	25,200	838,507	25,830	321,907	22.78	.7016	2.78	.2984	28.19	.0515
1,000 Head Lot Continuous											
60 Days	840,000	42,000	1,039,687	42,420	191,287	20.10	.8199	.10	.1801	19.66	.0401
90 Days	560,000	28,000	758,723	28,420	190,323	20.45	.7659	.45	.2341	21.17	.0434
120 Days	420,000	21,000	623,870	21,420	195,470	21.30	.7315	1.30	.2685	24.00	.0480
150 Days	336,000	16,800	545,974	17,220	201,574	22.24	.7016	2.24	.2984	26.54	.0515
2,000 Head Lot Continuous											
60 Days	1,680,000	84,000	2,071,170	84,840	374,370	20.02	.8199	.02	.1801	19.26	.0401
90 Days	1,120,000	56,000	1,514,369	56,840	377,569	20.41	.7659	.41	.2341	21.01	.0434
120 Days	840,000	42,000	1,244,986	42,840	388,186	21.26	.7315	1.26	.2685	23.84	.0480
150 Days	672,000	33,600	1,089,417	34,440	400,617	22.19	.7016	2.19	.2984	26.38	.0515

APPENDIX TABLE G.2 (Continued)

Lot Size and Situation	Feeder Cost a Value	Feeder Cost b Value	Total Cost[d] a Value	Total Cost[d] b Value	Other Cost[e]	BEP a Value	BEP b Value	PMR a Value	PMR b Value[f]	CPPG a Value	CPPG b Value
	-Dollars					-Cents-					
10,000 Head Lot											
Continuous											
60 Days	8,400,000	420,000	10,288,851	424,200	1,804,851	19.89	.8199	.11	.1801	18.60	.0401
90 Days	5,600,000	280,000	7,518,344	284,200	1,834,344	20.26	.7659	.26	.2341	20.44	.0434
120 Days	4,200,000	210,000	6,171,283	214,200	1,887,283	21.07	.7315	1.07	.2685	23.21	.0480
150 Days	3,360,000	168,000	5,393,048	172,200	1,949,048	21.97	.7016	1.97	.2984	25.70	.0515
15,000 Head Lot											
Continuous											
60 Days	12,600,000	630,000	15,426,524	636,300	2,700,524	19.88	.8199	.12	.1801	18.55	.0401
90 Days	8,400,000	420,000	11,271,817	426,300	2,745,817	20.25	.7659	.25	.2341	20.40	.0434
120 Days	6,300,000	315,000	9,248,559	321,300	2,822,559	21.05	.7315	1.05	.2685	23.14	.0480
150 Days	5,040,000	252,000	8,078,337	258,300	2,912,337	21.94	.7016	1.94	.2984	25.60	.0515

[a]The breakeven price is defined as the slaughter price required to exactly cover the total cost of feeding.

[b]The price margin required is the feeder cattle price minus the slaughter price necessary to cover all costs.

[c]Cost per pound of gain is the total cost of feeding, excluding the purchase price of feeder animals but including interest on the purchase of feeder animals, divided by the pound gained during the feeding process.

[d]Total cost includes interest on feeders, feeder cost, and other cost.

[e]Other cost includes feed cost, fixed cost, and nonfed variable costs.

[f]The b value for price margin required (PMR) is negative in every case.

APPENDIX TABLE H.1

TOTAL COST, TOTAL REVENUE, AND PROFIT AT 20 CENTS FEEDER COST AND TWO SLAUGHTER PRICES; AND CHARGE WITH EACH ONE CENT CHANGE PER POUND OF FEEDER COST AND SLAUGHTER PRICE, 500 POUND HEIFERS IN CONTINUOUSLY OPERATING FENCELINE BUNK SYSTEMS AT FULL UTILIZATION

Feedlot Size and Length of Feeding Period	Sales Volume	Total Cost Feeder Price	Total Revenue Slaughter Price		Profit Slaughter Price		ΔTR and Profit with One Cent Change in Sales or Feeder Price	
		20¢	20¢	30¢	20¢	30¢	Sales	Feeder[a]
	Pounds				-Dollars-			
300								
60 Days	1,177,902	232,856	235,580	353,370	2,724	120,514	11,779	9,090
90 Days	855,360	172,891	171,072	256,608	-1,819	83,717	8,553	6,090
120 Days	677,160	144,075	135,432	203,148	-8,643	59,073	6,771	4,590
150 Days	568,974	127,357	113,794	170,692	13,562	43,335	5,689	3,690
600								
60 Days	2,355,804	460,706	471,160	706,741	10,454	246,035	23,558	18,180
90 Days	1,710,720	339,399	342,144	513,216	2,745	173,817	17,107	12,180
120 Days	1,354,320	281,804	270,864	406,296	-10,940	124,492	13,543	9,180
150 Days	1,137,150	249,779	227,430	341,145	-22,349	91,366	11,371	7,380
1,000								
60 Days	3,926,340	760,300	785,268	1,177,902	24,968	417,602	39,263	30,300
90 Days	2,851,200	560,863	570,240	855,360	9,377	294,497	28,512	20,300
120 Days	2,257,200	465,007	451,440	677,160	-13,567	212,153	22,572	15,300
150 Days	1,896,048	409,393	379,209	568,814	-30,183	159,421	18,960	12,300
2,000								
60 Days	7,852,680	1,518,077	1,570,536	2,355,804	52,459	837,727	78,526	60,600
90 Days	5,702,400	1,118,534	1,140,480	1,710,720	21,946	592,186	57,024	40,600
120 Days	4,514,400	927,133	902,880	1,354,320	-24,253	427,187	45,144	30,600
150 Days	3,792,096	813,644	758,419	1,137,629	-55,224	323,985	37,920	24,600

APPENDIX TABLE H.1 (Continued)

Feedlot Size and Length of Feeding Period	Volume	Total Cost Feeder Price 20¢	Total Revenue Slaughter Price 20¢	Total Revenue Slaughter Price 30¢	Profit Slaughter Price 20¢	Profit Slaughter Price 30¢	ΔTR and Profit with One Cent Change in Sales or Feeder Price: Sales	ΔTR and Profit with One Cent Change in Sales or Feeder Price: Feeder[a]
	Pounds				-Dollars-			
5,000								
60 Days	19,631,700	3,771,727	3,926,340	5,889,510	154,613	2,117,783	196,317	151,500
90 Days	14,256,000	2,783,010	2,851,200	4,276,800	68,190	1,493,790	142,560	101,500
120 Days	11,286,000	2,297,533	2,257,200	3,385,800	-40,333	1,088,267	112,860	76,500
150 Days	9,480,240	2,019,166	1,896,048	2,844,072	-123,118	824,906	94,802	61,500
10,000								
60 Days	39,263,400	7,527,560	7,852,680	11,779,020	325,120	4,251,460	392,634	303,000
90 Days	28,512,000	5,536,306	5,702,400	8,553,600	166,094	3,017,294	285,120	203,000
120 Days	22,572,000	4,580,056	4,514,400	6,771,600	-65,656	2,191,544	225,720	153,000
150 Days	18,960,480	4,023,703	3,792,096	5,688,144	-231,607	1,644,441	189,604	123,000
15,000								
60 Days	58,895,100	11,288,815	11,779,020	17,668,530	490,205	6,379,715	588,951	454,500
90 Days	42,768,000	8,300,753	8,300,753	12,830,400	252,847	4,529,647	427,680	304,500
120 Days	33,858,000	6,863,191	6,771,600	10,157,400	-91,591	3,294,209	338,580	229,500
150 Days	28,440,720	6,029,993	5,688,144	8,532,216	-341,849	2,502,223	284,407	184,500

[a]This is equivalent to the change in total cost for each situation shown in Appendix G.

APPENDIX TABLE H.2

TOTAL COST, TOTAL REVENUE, AND PROFIT AT 20 CENTS FEEDER COST AND TWO SLAUGHTER PRICES; AND CHARGE WITH EACH ONE CENT CHANGE PER POUND OF FEEDER COST AND SLAUGHTER PRICE, 700 POUND STEERS IN CONTINUOUSLY OPERATING FENCELINE BUNK SYSTEMS AT FULL UTILIZATION

Feedlot Size and Length of Feeding Period	Sales Volume	Total Cost Feeder Price	Total Revenue Slaughter Price		Profit Slaughter Price		ΔTR and Profit with One Cent Change in Sales or Feeder Price	
		22¢	20¢	30¢	20¢	30¢	Sales	Feeder[a]
	Pounds				-Dollars-			
300								
60 Days	1,552,122	341,041	310,424	465,637	-30,617	124,596	15,521	12,726
90 Days	1,113,156	249,311	222,631	333,947	-26,680	84,636	11,131	8,526
120 Days	878,526	204,577	175,705	263,558	-28,872	58,981	8,785	6,426
150 Days	736,529	178,655	147,306	220,959	-31,349	42,304	7,365	5,166
600								
60 Days	3,104,244	677,319	620,849	931,273	-56,470	253,954	31,042	25,452
90 Days	2,266,312	493,669	445,262	667,894	-48,407	174,225	22,263	17,052
120 Days	1,757,052	404,263	351,410	527,116	-52,853	122,953	17,570	12,852
150 Days	1,472,025	352,377	294,405	441,608	-57,972	89,231	14,720	10,332
1,000								
60 Days	5,173,740	1,124,527	1,034,748	1,552,122	-89,779	427,595	51,737	42,420
90 Days	3,710,520	815,563	742,104	1,113,156	-73,459	297,593	37,105	28,420
120 Days	2,928,420	666,710	585,684	878,526	-81,026	211,816	29,282	21,420
150 Days	2,454,408	580,414	490,882	736,322	-89,532	155,908	24,544	17,220
2,000								
60 Days	10,347,480	2,240,850	2,069,496	3,104,244	-171,354	863,394	103,474	84,840
90 Days	7,421,040	1,628,049	1,484,208	2,226,312	-143,841	598,263	74,210	56,840
120 Days	5,856,840	1,330,666	1,171,368	1,757,052	-159,298	426,386	585,684	42,840
150 Days	4,908,816	1,158,297	981,763	1,472,645	-176,534	314,348	490,882	34,440

APPENDIX TABLE H.2 (Continued)

Feedlot Size and Length of Feeding Period	Sales Volume	Total Cost Feeder Price 22¢	Total Revenue Slaughter Price 20¢		Profit Slaughter Price 20¢		ΔTR and Profit with One Cent Change in Sales or Feeder Price: Sales	
			20¢	30¢	20¢	30¢	Sales	Feeder[a]
	Pounds				-Dollars-			
5,000								
60 Days	25,868,700	5,574,698	5,173,740	7,760,610	-400,958	2,185,912	258,687	212,100
90 Days	18,552,600	4,049,251	3,710,520	5,565,780	-338,731	1,516,529	185,526	142,100
120 Days	14,642,100	3,307,325	2,928,420	4,392,630	-378,905	1,085,305	146,421	107,100
150 Days	12,272,040	2,875,906	2,454,408	3,681,612	-421,498	805,706	122,720	86,100
10,000								
60 Days	51,737,400	11,137,251	10,347,480	15,521,220	-489,771	4,383,969	517,374	424,200
90 Days	37,105,200	8,086,774	7,421,040	11,131,560	-665,704	3,044,816	371,052	284,200
120 Days	29,284,200	6,599,683	5,856,840	8,785,260	-742,843	2,185,577	292,842	214,200
150 Days	24,544,080	5,737,448	4,908,816	7,363,224	-828,632	1,625,776	245,440	172,200
15,000								
60 Days	77,606,100	16,699,124	15,521,220	23,281,830	-1,177,904	6,582,706	776,061	636,300
90 Days	55,657,800	12,124,417	11,131,560	16,697,340	-992,857	4,572,923	556,578	426,300
120 Days	43,926,300	9,891,159	8,891,159	13,177,890	-1,105,899	3,286,731	439,263	321,300
150 Days	36,816,120	8,594,937	7,363,224	11,044,836	-1,231,713	2,449,899	368,161	258,300

[a]This is equivalent to the change in total cost for each situation shown in Appendix G.

APPENDIX TABLE I.1

TOTAL COST, TOTAL REVENUE AND PROFIT FOR 500 POUND HEIFERS FED CONTINUOUSLY IN FENCELINE BUNK SYSTEMS, AT ALTERNATIVE SCALES AND USE LEVELS, AND WITH FEEDER AND SLAUGHTER CATTLE PRICES APPROXIMATING 1960 OKLAHOMA CONDITIONS

Situation	Total Other Cost[a]	Feeder Cost $19.80 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b]			
						Total Revenue		Profit	
						$22.90	$24.30	$22.90	$24.30
				- Dollars -					
300 Head Lot									
One Lot-300									
60 Days	12,897	29,700	297	42,894	144	151	--	7	--
90 Days	16,789	29,700	446	46,935	158	165	--	7	--
120 Days	20,759	29,700	594	51,053	172	174	185	2	13
150 Days	25,141	29,700	743	55,584	187	183	194	-4	7
Continuously-300									
60 Days	51,056	178,200	1,782	231,038	130	151	--	21	--
90 Days	51,091	118,800	1,782	171,673	145	165	--	20	--
120 Days	52,275	89,100	1,782	143,157	161	174	185	13	24
150 Days	53,557	71,280	1,782	126,619	178	183	194	5	16
Continuously-100									
60 Days	21,015	59,400	594	81,009	136	151	--	15	--
90 Days	20,983	39,600	594	61,177	154	165	--	11	--
120 Days	21,410	29,700	594	51,704	174	174	185	0	11
150 Days	21,796	23,760	594	46,150	195	183	194	-12	-1
600 Head Lot									
One Lot-600									
60 Days	22,896	59,400	594	82,800	140	151	--	11	--
90 Days	30,124	59,400	891	90,415	152	165	--	13	--
120 Days	37,752	59,400	1,188	98,340	166	174	185	8	19
150 Days	46,803	59,400	1,485	107,688	181	183	194	2	13

APPENDIX TABLE I.1 (Continued)

Situation	Total Other Cost[a]	Feeder Cost $19.80 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b] Total Revenue $22.90	$24.30	Profit $22.90	$24.30
				-Dollars					
Continuously-600									
60 Days	97,106	356,400	3,564	457,070	128	151	--	23	--
90 Days	95,799	237,600	3,564	336,963	142	165	--	23	--
120 Days	98,204	178,200	3,564	279,968	157	174	185	17	28
150 Days	102,179	142,500	3,564	248,303	174	183	194	9	20
Continuously-200									
60 Days	37,820	118,800	1,188	157,808	133	151	--	18	--
90 Days	37,825	79,200	1,188	118,213	149	165	--	16	--
120 Days	38,604	59,400	1,188	99,192	167	174	185	7	18
150 Days	39,436	47,520	1,188	88,144	186	183	194	-3	8
5,000 Head Lot									
One Lot-5,000									
60 Days	151,001	495,000	4,950	650,951	132	151	--	19	--
90 Days	211,677	495,000	7,425	714,102	144	165	--	21	--
120 Days	274,816	495,000	9,900	779,716	158	174	185	16	27
150 Days	343,955	495,000	12,375	851,330	172	183	194	11	22
Continuously-5,000									
60 Days	741,727	2,970,000	29,700	3,741,427	126	151	--	25	--
90 Days	753,010	1,980,000	29,700	2,762,710	140	165	--	25	--
120 Days	767,533	1,485,000	29,700	2,282,233	154	174	185	20	31
150 Days	789,166	1,188,000	29,700	2,006,866	169	183	194	14	25

APPENDIX TABLE I.1 (Continued)

Situation	Total Other Cost[a]	Feeder Cost $19.80 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b]			
						Total Revenue		Profit	
						$22.90	$24.30	$22.90	$24.30
				- Dollars -					
Continuously-1,500									
60 Days	252,131	891,000	8,910	1,152,041	129	151	--	22	--
90 Days	251,720	594,000	8,910	854,630	144	165	--	21	--
120 Days	258,049	445,500	8,910	712,459	160	174	185	14	25
150 Days	264,703	356,400	8,910	630,013	177	183	194	6	17

[a]Total other costs include feed, nonfeed variable cost excluding death loss, and fixed cost.

[b]These prices represent the average 1960 "Good" and "Choice" slaughter prices at the Oklahoma City Public Stockyards as reported by USDA Market News Service.

APPENDIX TABLE I.2

TOTAL COST, TOTAL REVENUE, AND PROFIT FOR 700 POUND STEERS FED CONTINUOUSLY IN FENCELINE BUNK SYSTEMS AT ALTERNATIVE SCALES AND USE LEVELS AND WITH FEEDER AND SLAUGHTER CATTLE PRICES APPROXIMATING 1960 OKLAHOMA CONDITIONS

Situation	Total Other Cost[a]	Feeder Cost $23.00 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b] — Total Revenue $23.20	Total Revenue $24.60	Profit $23.20	Profit $24.60
					- Dollars -				
300 Head Lot									
One Lot-300									
60 Days	14,522	48,300	483	63,305	213	202	--	-11	--
90 Days	19,240	48,300	725	68,265	230	217	--	-13	--
120 Days	24,328	48,300	966	73,594	248	229	243	-19	-5
150 Days	29,785	48,300	1,208	79,293	267	240	254	-27	-13
Continuously-300									
60 Days	61,069	289,800	2,898	353,767	199	202	--	3	--
90 Days	61,739	193,200	2,898	257,837	217	217	--	0	--
120 Days	63,205	144,900	2,898	211,003	237	229	243	-8	6
150 Days	65,003	115,920	2,898	183,821	258	240	254	-18	-4
Continuously-100									
60 Days	24,347	96,600	966	121,913	205	202	--	-3	--
90 Days	24,535	64,400	966	89,901	227	217	--	-10	--
120 Days	25,103	48,300	966	74,369	250	229	243	-21	-7
150 Days	25,591	38,640	966	65,197	275	240	254	-35	-21
600 Head Lot									
One Lot-600									
60 Days	26,185	96,600	966	123,751	208	202	--	-6	--
90 Days	35,383	96,600	1,449	133,432	225	217	--	-8	--
120 Days	45,375	96,600	1,932	143,907	242	229	243	-13	1
150 Days	56,084	96,600	2,415	155,099	261	240	254	-21	-7

APPENDIX TABLE I.2 (Continued)

Situation	Total Other Cost[a]	Feeder Cost $23.00 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b] Total Revenue $23.20	$24.60	Profit $23.20	$24.60
				- Dollars -					
Continuously-600									
60 Days	117,375	579,600	5,796	702,771	197	202	--	5	--
90 Days	118,525	386,400	5,796	510,721	215	217	--	2	--
120 Days	212,519	289,800	5,796	417,115	234	229	243	-5	9
150 Days	125,073	231,840	5,796	362,709	255	240	254	-15	-1
Continuously-200									
60 Days	44,601	193,200	1,932	239,733	202	202	--	0	--
90 Days	44,916	128,800	1,932	175,648	222	217	--	-5	--
120 Days	45,897	96,600	1,932	144,429	243	229	243	-14	0
150 Days	47,125	77,280	1,932	126,337	266	240	254	-26	-12
5,000 Head Lot									
One Lot-5,000									
60 Days	178,050	805,000	8,050	991,100	200	202	--	2	--
90 Days	252,993	805,000	12,075	1,070,068	216	217	--	1	--
120 Days	334,771	805,000	16,100	1,155,871	234	229	243	-5	9
150 Days	421,806	805,000	20,125	1,246,931	252	240	254	-12	2
Continuously-5,000									
60 Days	908,498	4,830,000	48,300	5,786,798	195	202	--	7	--
90 Days	923,051	3,220,000	48,300	4,191,351	212	217	--	5	--
120 Days	951,125	2,415,000	48,300	3,414,425	230	229	243	-1	13
150 Days	981,706	1,932,000	48,300	2,962,006	249	240	254	-9	5

APPENDIX TABLE I.2 (Continued)

Situation	Total Other Cost[a]	Feeder Cost $23.00 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b]: Total Revenue $23.20	Total Revenue $24.60	Profit $23.20	Profit $24.60
				- Dollars -					
Continuously-1,500									
60 Days	302,163	1,449,000	14,490	1,765,653	198	202	--	4	--
90 Days	304,904	966,000	14,490	1,285,394	216	217	--	1	--
120 Days	312,690	724,500	14,490	1,051,680	236	229	243	-7	7
150 Days	321,907	579,600	14,490	915,997	257	240	254	-17	-3

[a]Total other costs include feed, nonfeed variable cost excluding death loss, and fixed cost.

[b]These prices represent the average 1960 "Good" and "Choice" slaughter prices at the Oklahoma City Public Stockyards as reported by USDA Market News Service.

APPENDIX TABLE I.3

TOTAL COST, TOTAL REVENUE, AND PROFIT FOR 500 POUND HEIFERS FED CONTINUOUSLY IN FENCELINE BUNK SYSTEMS AT ALTERNATIVE SCALES AND USE LEVELS AND WITH FEEDER AND SLAUGHTER CATTLE PRICES APPROXIMATING JANUARY THROUGH JUNE 1963 OKLAHOMA CONDITIONS

Situation	Total Other Cost[a]	Feeder Cost $23.00 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b]			
						Total Revenue		Profit	
						$21.00	$22.25	$21.00	$22.25
				- Dollars -					
300 Head Lot									
One Lot-300									
60 Days	12,987	34,500	345	47,742	161	139	--	-22	--
90 Days	16,789	34,500	518	51,807	174	151	--	-23	--
120 Days	20,759	34,500	690	55,949	188	160	169	-28	-19
150 Days	25,141	34,500	863	60,504	204	168	178	-36	-26
Continuously-300									
60 Days	51,056	207,000	2,070	260,126	146	139	--	-7	--
90 Days	51,091	138,000	2,070	191,161	161	151	---	-10	--
120 Days	52,275	103,500	2,070	157,845	177	160	169	-17	-8
150 Days	53,557	82,800	2,070	138,427	194	168	178	-26	-16
Continuously-100									
60 Days	21,015	69,000	690	90,705	153	139	--	-14	--
90 Days	20,983	46,000	690	67,673	171	151	--	-20	--
120 Days	21,410	34,500	690	56,600	191	160	169	-31	-22
150 Days	21,796	27,600	690	50,086	211	168	178	-43	-33

[a]Total other costs include feed, nonfeed variable cost excluding death loss, and fixed cost.

[b]These prices represent the average 1960 "Good" and "Choice" slaughter prices at the Oklahoma City Public Stockyards as reported by USDA Market News Service.

APPENDIX TABLE I.4

TOTAL COST, TOTAL REVENUE, AND PROFIT FOR 700 POUND STEERS FED CONTINUOUSLY IN FENCELINE BUNK SYSTEMS AT ALTERNATIVE SCALES AND USE LEVELS AND WITH FEEDER AND SLAUGHTER CATTLE PRICES APPROXIMATING JANUARY THROUGH JUNE 1963 OKLAHOMA CONDITIONS

Situation	Total Other Cost[a]	Feeder Cost $24.33 Per Cwt	Interest on Feeders	Total Cost	Total Cost Per Head Sold	Total Revenue and Profit at Two Slaughter Prices Per Cwt[b]: Total Revenue $21.25	Total Revenue $22.75	Profit $21.25	Profit $22.75
				- Dollars -					
300 Head Lot									
One Lot-300									
60 Days	14,522	51,093	511	66,126	223	185	--	-38	--
90 Days	19,240	51,093	766	71,099	239	199	--	-40	--
120 Days	24,328	51,093	1,022	76,443	257	210	224	-47	-33
150 Days	29,785	51,093	1,277	82,155	277	220	235	-57	-42
Continuously-300									
60 Days	61,069	306,558	3,066	370,693	208	185	--	-23	--
90 Days	61,739	204,372	3,066	269,177	227	199	--	-28	--
120 Days	63,205	153,279	3,066	219,550	246	210	224	-36	-22
150 Days	65,003	122,623	3,066	190,692	268	220	235	-48	-33
Continuously-100									
60 Days	24,347	102,186	1,022	127,555	215	185	--	-30	--
90 Days	24,535	68,124	1,022	93,681	237	199	--	-38	--
120 Days	25,103	51,093	1,022	77,218	260	210	224	-50	-36
150 Days	25,591	40,874	1,022	67,487	285	220	235	-65	-50

[a]Total other costs include feed, nonfeed variable cost excluding death loss, and fixed cost.

[b]These prices represent the average 1960 "Good" and "Choice" slaughter prices at the Oklahoma City Public Stockyards as reported by USDA Market News Service.

APPENDIX TABLE J.1

TOTAL OTHER COST, BREAKEVEN PRICE, AND COST PER POUND OF GAIN AT TWO ALTERNATIVE GRAIN SORGHUM PRICES; AND CHANGES IN BREAKEVEN PRICES AND COST PER POUND OF GAIN ASSOCIATED WITH INCREASING PRICE OF GRAIN SORGHUM BY TEN CENTS[a]

Scale	Total Feeder Cost at 20¢ Per Pound	Grain Sorghum at $1.80/cwt Total Other Cost	BEP	CPPG	Grain Sorghum at $1.50/cwt Total Other Cost	BEP	CPPG	ΔBEP With 10¢ Δ in milo	ΔCPPG With 10¢ Δ in milo
	- Dollars -		Cents per Pound		-Dollars-	-Cents per Pound-			
				500 Pound Heifers					
60 Days	181,800	51,056	19.77	19.02	48,312	19.53	17.38	.08	.55
90 Days	121,800	51,091	20.21	20.71	47,717	19.82	18.69	.13	.67
120 Days	91,800	52,275	21.28	23.80	48,453	20.71	21.33	.19	.82
150 Days	73,800	53,557	22.38	26.49	49,321	21.64	23.60	.25	.96
				700 Pound Steers					
60 Days	254,520	61,069	20.33	21.77	56,881	20.06	19.47	.09	.77
90 Days	170,520	61,739	20.86	23.52	56,797	20.42	20.79	.15	.91
120 Days	128,520	63,205	21.82	26.45	57,716	21.20	23.22	.21	1.08
150 Days	103,320	65,003	22.85	29.04	59,072	22.05	25.40	.27	1.21

[a]Assuming a 300 head fenceline bunk feeding system, continuous feeding, and full utilization.

APPENDIX TABLE K.1

TOTAL AND PER POUND COST AND REVENUE WITH FEEDER CATTLE PRICE, SLAUGHTER CATTLE PRICE, AND GRAIN SORGHUM PRICE AT REPORTED AVERAGE MONTHLY PRICE FROM 1960-1963,[a] 500 POUND HEIFERS, 90 DAY FEEDING PERIOD, 2,000 HEAD BUNK FEEDLOT AND CONTINUOUS FEEDING

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Heifer Good 600-800
	Cents Per Pound		- Dollars -			- Cents Per Pound -		
1960								
Jan.	23.49	953,694	285,790	1,239,484	21.74	16.72	5.01	22.49
Feb.	21.38	868,028	288,777	1,156,805	20.29	15.22	5.06	22.90
Mar.	20.50	832,300	290,229	1,122,529	19.69	14.60	5.09	23.98
Apr.	19.00	771,400	290,956	1,062,356	18.63	13.53	5.10	24.38
May	19.81	804,286	292,489	1,096,775	19.23	14.10	5.13	23.88
June	21.58	876,148	290,229	1,166,377	20.45	15.36	5.09	23.75
July	22.18	900,508	288,777	1,189,285	20.86	15.79	5.06	23.12
Aug.	20.95	850,570	289,503	1,140,073	19.99	14.92	5.08	22.38
Sept.	19.90	807,940	283,531	1,091,471	19.14	14.17	4.97	21.74
Oct.	19.44	789,264	276,831	1,066,095	18.70	13.84	4.85	21.69
Nov.	18.50	751,100	275,378	1,026,478	18.00	13.17	4.83	22.25
Dec.	18.50	751,100	275,378	1,026,478	18.00	13.17	4.83	22.55
1961								
Jan.	18.31	743,386	276,831	1,020,217	17.89	13.04	4.85	23.09
Feb.	18.94	768,964	279,818	1,048,782	18.39	13.48	4.91	23.12
Mar.	20.18	819,308	285,063	1,104,371	19.37	14.37	5.00	22.84
Apr.	20.12	816,872	287,243	1,104,115	19.36	14.33	5.04	22.55
May	20.72	841,232	286,516	1,127,748	19.78	14.75	5.02	21.08
June	20.74	842,044	289,503	1,131,547	19.84	14.77	5.08	20.62

APPENDIX TABLE K.1 (Continued)

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Heifer Good 600-800
	Cents Per Pound		- Dollars -			- Cents Per Pound -		
1961								
July	20.80	844,480	293,943	1,138,423	19.96	14.81	5.15	20.77
Aug.	20.35	826,210	302,821	1,129,031	19.80	14.49	5.31	21.94
Sept.	19.99	811,594	303,628	1,115,222	19.56	14.23	5.32	22.00
Oct.	19.99	811,594	298,381	1,109,975	19.47	14.23	5.23	21.89
Nov.	20.51	832,706	297,656	1,130,362	19.82	14.60	5.22	22.68
Dec.	20.12	816,872	298,381	1,115,253	19.56	14.33	5.23	23.11
1962								
Jan.	19.86	806,316	299,107	1,105,423	19.39	14.14	5.25	23.05
Feb.	19.76	802,256	299,915	1,102,171	19.33	14.07	5.26	23.12
Mar.	20.30	824,180	300,641	1,124,821	19.73	14.45	5.27	22.74
Apr.	21.98	892,388	301,367	1,193,755	20.93	15.65	5.28	23.69
May	22.36	907,816	305,080	1,212,896	21.27	15.92	5.35	22.95
June	22.02	894,012	305,807	1,199,819	21.04	15.68	5.36	22.95
July	22.40	909,440	306,534	1,215,974	21.32	15.95	5.38	23.25
Aug.	21.55	874,930	307,341	1,182,271	20.73	15.34	5.39	23.73
Sept.	22.15	899,290	305,080	1,204,370	21.12	15.77	5.35	25.04
Oct.	21.82	885,892	302,094	1,187,986	20.83	15.54	5.30	25.25
Nov.	22.14	898,884	299,915	1,198,799	21.02	15.76	5.26	25.25
Dec.	22.40	909,440	300,641	1,210,081	21.22	15.95	5.27	25.21

APPENDIX TABLE K.1 (Continued)

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Heifer Good 600-800
	Cents Per Pound		- Dollars -			- Cents Per Pound -		
1963								
Jan.	25.37	1,030,022	301,367	1,331,389	23.35	18.06	5.28	23.95
Feb.	22.50	913,500	302,094	1,215,594	21.32	16.02	5.30	22.12
Mar.	25.25	1,025,150	304,354	1,329,504	23.31	17.98	5.34	20.50
Apr.	23.00	933,800	305,807	1,239,607	21.74	16.38	5.36	21.25
May	22.25	903,350	306,534	1,209,884	21.22	15.84	5.38	21.00
June	22.00	893,200	306,534	1,199,734	21.04	15.66	5.38	21.25

[a]Feed prices are as reported by Statistical Reporting Service and cattle prices by USDA-AMS Market News Service.

[b]The feeder price represents the price paid by the feedlot operator when the animal was purchased rather than the feeder price at the selling date. Total feeder cost includes an interest charge.

[c]Total other cost includes feed, nonfeed variable cost except death loss, and fixed cost.

[d]Sum of total other cost and feeder cost.

APPENDIX TABLE K.2

TOTAL AND PER POUND COST AND REVENUE WITH FEEDER CATTLE PRICE, SLAUGHTER CATTLE PRICE, AND GRAIN SORGHUM PRICE AT REPORTED AVERAGE MONTHLY PRICE FROM 1960-1963,[a] 500 POUND HEIFERS, 150 DAY FEEDING PERIOD, 2,000 HEAD BUNK FEEDLOT AND CONTINUOUS FEEDING

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Heifers Good	Sale Price Heifers Choice
	Cents Per Pound	- Dollars -			- Cents Per Pound -			-Dollars-	
1960									
Jan.	25.65	630,990	299,295	930,285	24.53	16.64	7.89	23.72	24.50
Feb.	24.33	598,518	301,204	899,722	23.73	15.78	7.94	22.10	24.71
Mar.	23.49	577,854	304,969	882,823	23.28	15.24	8.04	22.49	25.96
Apr.	21.38	525,948	306,876	832,824	21.96	13.87	8.09	22.90	26.51
May	20.50	504,300	307,806	812,106	21.42	13.30	8.12	23.98	26.12
June	19.00	467,400	309,713	777,113	20.49	12.33	8.17	24.38	25.76
July	19.81	487,326	306,876	794,202	20.94	12.85	8.09	23.88	25.12
Aug.	21.58	530,868	304,969	835,837	22.04	14.00	8.04	23.75	24.33
Sept.	22.18	545,628	305,947	851,575	22.46	14.39	8.07	23.12	23.68
Oct.	20.95	515,370	298,366	813,736	21.46	13.59	7.87	22.38	23.44
Nov.	19.90	489,540	289,858	779,398	20.55	12.91	7.64	21.74	23.87
Dec.	19.44	478,224	287,950	766,174	20.20	12.61	7.59	21.69	24.30
1961									
Jan.	18.50	455,100	287,950	743,050	19.59	12.00	7.59	22.25	25.03
Feb.	18.50	455,100	289,858	744,958	19.65	12.00	7.64	22.55	24.86
Mar.	18.31	450,426	293,623	744,049	19.62	11.88	7.74	23.09	24.69
Apr.	18.94	465,924	300,274	766,198	20.21	12.29	7.92	23.12	24.55
May	20.18	496,428	303,111	799,539	21.08	13.09	7.99	22.84	22.83
June	20.12	494,952	302,132	797,084	21.02	13.05	7.97	22.55	22.62

APPENDIX TABLE K.2 (Continued)

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Heifers Good	Sale Price Heifers Choice
	Cents Per Pound	- Dollars -			- Cents Per Pound -			-Dollars-	
1961									
July	20.72	509,712	305,947	815,659	21.51	13.44	8.07	21.08	22.42
Aug.	20.74	510,204	311,620	821,824	21.67	13.45	8.22	20.62	23.23
Sept.	20.80	511,680	322,966	834,646	22.01	13.49	8.52	20.77	23.50
Oct.	20.35	500,610	323,895	824,505	21.74	13.20	8.54	21.94	23.39
Nov.	19.99	491,754	317,294	809,048	21.34	12.97	8.37	22.00	24.00
Dec.	19.99	491,754	316,364	808,118	21.31	12.97	8.34	21.89	24.62
1962									
Jan.	20.51	504,546	317,294	821,840	21.67	13.31	8.37	22.68	24.70
Feb.	20.12	494,952	318,223	813,175	21.44	13.05	8.39	23.11	24.50
Mar.	19.86	488,556	319,201	807,757	21.30	12.88	8.42	23.05	24.48
Apr.	19.76	486,096	320,130	806,226	21.26	12.82	8.44	23.12	25.12
May	20.30	499,380	321,059	820,439	21.64	13.17	8.47	22.74	24.48
June	21.98	540,708	325,803	866,511	22.85	14.26	8.59	23.69	24.22
July	22.36	550,056	326,731	876,787	23.12	14.51	8.62	22.95	24.54
Aug.	22.02	541,692	327,709	869,401	22.93	14.28	8.64	22.95	25.29
Sept.	22.40	551,040	328,639	879,679	23.20	14.53	8.67	23.25	26.76
Oct.	21.55	530,130	325,803	855,933	22.57	13.98	8.59	23.73	26.88
Nov.	21.82	536,772	322,037	858,809	22.65	14.16	8.49	25.04	26.84
Dec.	22.14	544,644	319,201	863,845	22.78	14.36	8.42	25.25	26.88

APPENDIX TABLE K.2 (Continued)

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Heifers Good	Sale Price Heifers Choice
	Cents Per Pound	- Dollars -			- Cents Per Pound -			-Dollars-	
1963									
Jan.	22.40	551,040	320,130	871,170	22.97	14.53	8.44	23.95	25.55
Feb.	25.37	624,102	321,059	945,161	24.92	16.46	8.47	22.12	23.75
Mar.	22.50	553,500	322,037	875,537	23.09	14.60	8.49	20.50	22.12
Apr.	25.25	621,150	324,873	946,023	24.95	16.38	8.57	21.25	21.00
May	23.00	565,800	326,731	892,531	23.54	14.92	8.62	21.00	22.25
June	22.25	547,350	327,709	875,059	23.08	14.43	8.64	21.25	22.25

[a]Feed prices are as reported by Statistical Reporting Service and cattle prices by USDA-AMS Market News Service.

[b]The feeder price represents the price paid by the feedlot operator when the animal was purchased rather than the feeder price at the selling date. Total feeder cost includes an interest charge.

[c]Total other cost includes feed, nonfeed variable cost except death loss, and fixed cost.

[d]Sum of total other cost and feeder cost.

APPENDIX TABLE K.3

TOTAL AND PER POUND COST AND REVENUE WITH FEEDER CATTLE PRICE, SLAUGHTER CATTLE PRICE, AND GRAIN SORGHUM PRICE AT REPORTED AVERAGE MONTHLY PRICE FROM 1960-1963,[a] 700 POUND STEERS, 150 DAY FEEDING PERIOD, 2,000 HEAD BUNK FEEDLOT AND CONTINUOUS FEEDING

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Steers Choice
	Cents Per Pound		- Dollars -			- Cents Per Pound -		-Dollars-
1960								
Jan.	26.36	907,838	365,748	1,273,586	25.94	18.49	7.45	25.67
Feb.	26.09	898,540	368,438	1,266,978	25.81	18.30	7.51	25.25
Mar.	24.54	845,158	373,867	1,219,025	24.83	17.22	7.62	24.96
Apr.	22.69	781,444	376,556	1,158,000	23.59	15.92	7.67	24.18
May	22.40	771,456	377,926	1,149,382	23.41	15.72	7.70	23.59
June	23.99	826,216	380,615	1,206,831	24.59	16.83	7.75	24.07
July	24.69	850,324	376,556	1,226,880	24.99	17.32	7.67	24.76
Aug.	25.10	864,444	373,867	1,238,311	25.23	17.61	7.62	25.46
Sept.	24.89	857,212	375,187	1,232,399	25.11	17.46	7.64	25.20
Oct.	23.50	809,340	364,428	1,173,768	23.91	16.49	7.42	25.00
Nov.	22.85	786,954	352,252	1,139,206	23.21	16.03	7.18	24.60
Dec.	22.69	781,444	349,561	1,131,005	23.04	15.92	7.12	22.64
1961								
Jan.	21.69	747,004	349,561	1,096,565	22.34	15.22	7.12	22.58
Feb.	20.75	714,630	352,252	1,066,882	21.73	14.56	7.18	22.26
Mar.	20.94	721,174	357,680	1,078,854	21.98	14.69	7.29	23.30
Apr.	22.26	766,634	367,118	1,133,752	23.10	15.62	7.48	23.68
May	22.92	789,365	371,177	1,160,542	23.64	16.08	7.56	23.55
June	23.06	794,186	369,808	1,163,994	23.71	16.18	7.53	24.30

APPENDIX TABLE K.3 (Continued)

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Steers Choice
	Cents Per Pound		- Dollars -			- Cents Per Pound -		-Dollars-
1961								
July	23.40	805,896	375,187	1,181,083	24.06	16.42	7.64	24.72
Aug.	23.16	797,630	383,306	1,180,936	24.06	16.25	7.81	25.10
Sept.	23.99	826,216	399,493	1,225,709	24.97	16.83	8.14	25.25
Oct.	23.00	792,120	400,862	1,192,982	24.30	16.14	8.17	25.50
Nov.	22.86	787,298	391,423	1,178,721	24.01	16.04	7.97	25.71
Dec.	22.48	774,211	390,055	1,164,266	23.72	15.77	7.95	25.18
1962								
Jan.	23.27	801,419	391,423	1,192,842	24.30	16.33	7.97	24.75
Feb.	22.98	791,431	392,744	1,184,175	24.12	16.12	8.00	25.19
Mar.	22.50	774,900	394,114	1,169,014	23.81	15.79	8.03	26.01
Apr.	22.92	789,365	395,434	1,184,799	24.14	16.08	8.06	27.66
May	23.36	804,518	396,803	1,201,321	24.47	16.39	8.08	28.02
June	23.25	800,730	403,552	1,204,282	24.53	16.31	8.22	28.16
July	24.48	843,091	404,921	1,248,012	25.42	17.18	8.25	28.09
Aug.	24.14	831,382	406,241	1,237,623	25.21	16.94	8.28	26.02
Sept.	24.86	856,178	407,612	1,263,790	25.75	17.44	8.30	27.69
Oct.	24.15	831,726	403,552	1,235,278	25.16	16.94	8.22	28.00
Nov.	24.82	854,801	398,173	1,252,974	25.53	17.41	8.11	28.17
Dec.	25.45	876,498	394,114	1,270,612	25.88	17.86	8.03	28.13

APPENDIX TABLE K.3 (Continued)

Sale Date	Feeder Cost[b]	Total Feeder Cost	Total Other Cost[c]	Total Cost[d]	Total Cost Per Pound Sold	Feeder Cost Per Pound Sold	Other Cost Per Pound Sold	Sale Price Steers Choice
	Cents Per Pound		- Dollars -			- Cents Per Pound -		-Dollars-
1963								
Jan.	24.98	860,311	395,434	1,255,745	25.58	17.53	8.06	26.43
Feb.	24.49	843,436	396,803	1,240,239	25.27	17.18	8.08	24.50
Mar.	24.75	852,390	398,173	1,250,563	25.48	17.36	8.11	22.88
Apr.	25.06	863,066	402,182	1,265,248	25.78	17.58	8.19	23.46
May	25.19	867,544	404,921	1,272,465	25.92	17.67	8.25	22.75
June	24.33	837,925	406,241	1,244,166	25.35	17.07	8.28	22.62

[a]Feed prices are as reported by Statistical Reporting Service and cattle prices by USDA-AMS Market News Service.

[b]The feeder price represents the price paid by the feedlot operator when the animal was purchased rather than the feeder price at the selling date. Total feeder cost includes an interest charge.

[c]Total other cost includes feed, nonfeed variable cost except death loss, and fixed cost.

[d]Sum of total other cost and feeder cost.

VITA

James I. McDowell

Candidate for the Degree of

DOCTOR OF PHILOSOPHY

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Education: Attended high school in Bridger, Montana; graduated from Bridger High School in May, 1954. Received the Bachelor of Science Degree from Colorado State University, Fort Collins, Colorado in June, 1958, with a major in Animal Husbandry. Received the Master of Science Degree from Oregon State University, Corvallis, Oregon in June, 1961, with a major in Agricultural Economics. Engaged in post graduate study toward the Doctor of Philosophy Degree at Oklahoma State University, Stillwater, Oklahoma, from September, 1960, to March, 1963. Completed the requirements for the Doctor of Philosophy Degree in August, 1963.

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