

THE EFFECTS OF VARIOUS TENURE AND TAX MANAGEMENT
STRATEGIES ON ORGANIZATION OF BEEF CATTLE RANCHES
IN THE GULF COAST AREA OF CENTRAL FLORIDA

By

HENRY DOSS BRODNAX, JR.

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF
THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA
1972



ACKNOWLEDGMENTS

The author wishes to express appreciation to the Department of Food and Resource Economics, University of Florida, and the Economic Research Service, United States Department of Agriculture, for making the joint research effort possible. Indebtedness is acknowledged to Dr. B. R. Eddleman, Chairman of the Supervisory Committee, for his valuable supervision and assistance during the author's graduate program, and to Drs. H. B. Clark, R. E. L. Greene, and C. H. Donovan, who served as committee members.

Grateful acknowledgment is extended to Mr. Gene Harris for his programming assistance, and appreciation is expressed to Dr. K. R. Tefertiller, Chairman, and members of the Department of Food and Resource Economics. A special word of thanks is expressed to Dr. John G. Stovall and to other fellow workers in the United States Department of Agriculture for their help and encouragement.

The author wishes to thank Mrs. Christine Ward for her valuable assistance in typing and checking the dissertation and to Mrs. Carolyn Coker for her clerical help.

The greatest debt is due the author's wife, Martha, for her unselfish devotion and help during his graduate program.

TABLE OF CONTENTS

	<u>Page</u>
ACKNOWLEDGMENTS	ii
LIST OF TABLES	vi
LIST OF FIGURES	xi
ABSTRACT	xii
CHAPTER I	
INTRODUCTION	1
Statement of Problem	2
Scope of the Study	5
Purpose and Specific Objectives	5
Plan of Presentation	7
CHAPTER II	
CONCEPTUAL MODEL	10
Firm Theory	11
Dynamic Nature of the Problem	13
Mathematical Programming Model	14
CHAPTER III	
METHOD OF ANALYSIS	18
Model Assumptions	19
Typical Resource Situation	19
Enterprise Organization	22
Restrictive Production Resources	24
Land	24
Labor	30
Capital	32
Management	33
Planning Horizon	33
Tax Structure	36
Gross income	36
Adjusted gross income	37
Taxable income	37

	<u>Page</u>
Tax Management Strategies	38
Ranch organization	38
Nonranch income levels	42
Programming Matrix	43
Coding.	43
Restrictive Constraints of the Model.	48
Objective Function.	48
Activities of the Model	53
Livestock enterprises.	54
Land activities.	59
Financial components	68
Summary.	74

CHAPTER IV

OPTIMAL PRODUCTION ORGANIZATION FOR ALTERNATIVE TENURE ARRANGEMENTS.	76
Owner-Operator Situation	76
Livestock Enterprises	76
Land Activities	78
Labor Activities.	79
Financial Components.	80
Renter Situations.	82
Livestock Enterprises	82
Land Activities	85
Labor Activities.	85
Financial Components.	86
Tenant-Landlord Situations	89
Livestock Enterprises	89
Land Activities	92
Labor Activities.	92
Financial Components.	93
Summary of the Optimal Tenure Arrangements	95

CHAPTER V

OPTIMAL RANCH ORGANIZATION FOR VARIOUS TAXABLE INCOME SITUATIONS.	97
Owner-Operator Situations.	97
Zero Nonranch Income.	98
Livestock enterprises.	98
Land activities.	98
Financial components	101
Positive Nonranch Income Levels	103
Livestock enterprises.	103
Land activities.	105
Financial components	109
Tenant-Landlord Situations	119
Maximization of Landlord's Income	119
Tenant's Income.	124

	<u>Page</u>
Renter Situations.	127
Summary of Tax Situations.	129
CHAPTER VI	
SUMMARY AND CONCLUSIONS	131
Summary.	131
Conclusions.	139
Need for Further Research.	145
APPENDIX	148
EXPLANATION OF INFORMATION CONTAINED IN TABLES IN APPENDIX . . .	149
LIST OF CITED REFERENCES	174
ADDITIONAL REFERENCES.	176
BIOGRAPHICAL SKETCH.	178

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Initial resources available on the representative ranch used in the programming analysis	21
2	Average (1966-70) cattle prices adjusted for trend by months, 16 Florida livestock auctions	23
3	Animal unit equivalents, annual expenses, and cash receipts per head for each class of livestock.	25
4	Per acre capital requirements for purchasing land, including annual appreciation of 6 percent; machinery and equipment; and building, fencing, and other permanent land improvements for beef herd	26
5	Estimated per acre cost and labor requirements for establishment of improved pasture.	28
6	Annual per acre maintenance costs and grazing produced by specific periods for alternative forage producing systems	29
7	Annual labor requirements by production periods for all alternative livestock and forage systems available to be included in optimal ranch organizations.	31
8	Percentage share of costs, returns, and available resources for various tenure situations.	34
9	Taxable income, tax payments, and marginal tax rates.	39
10	Code key, row types, and right-hand-sides of row elements for one submatrix (one year) of the multiperiod linear programming model	45
11	Code key for column activities for one submatrix (one year) of the multiperiod linear programming model.	49
12	Restrictive bounds used each year for specified column activities of the multiperiod linear programming model.	52

<u>Table</u>		<u>Page</u>
13	Linear programming tableau specifying the brood cow activities of the multiperiod model for year t	55
14	Linear programming tableau specifying the feeder and stocker activities of the multiperiod model for year t	57
15	Linear programming tableau specifying the land activities of the multiperiod model for year t and each tenure situation.	60
16	Linear programming tableau specifying the land purchasing and clearing activities of the multiperiod model for year t.	62
17	Linear programming tableau specifying improved pasture establishment activities of the multiperiod model for year t.	65
18	Linear programming tableau specifying the improved nonirrigated and irrigated permanent pasture activities of the multiperiod model for year t	67
19	Linear programming tableau specifying the hay purchasing, paying overhead, temporary grazing, and unimproved grazing activities of the multiperiod model for year t.	69
20	Linear programming tableau specifying labor purchasing and capital borrowing activities of the multiperiod model for year t.	70
21	Linear programming tableau specifying property tax and certain fixed activities of the multiperiod model for year t.	71
22	Linear programming tableau specifying income tax paying activities of the multiperiod model for year t	73
23	Enterprise combinations, resource allocations, and net returns for a full-equity owner-operator ranch organization	77
24	Enterprise combinations, resource allocations, and net returns for ranch organization for a complete renter (paying \$2.55 annual rent per acre).	83
25	Enterprise combinations, resource allocations, and net returns for ranch organization for a complete renter (paying \$3.15 annual rent per acre). .	84

<u>Table</u>		<u>Page</u>
26	Enterprise combinations, resource allocations, and net returns for the 50-50 tenant-landlord ranch organization, maximizing tenant's income	90
27	Enterprise combinations, resource allocations, and net returns for the 50-50 tenant-landlord ranch organization, maximizing landlord's income . . .	91
28	Livestock numbers for full-equity owner-operator organizations when maximizing before-tax and after-tax incomes with zero nonranch income.	99
29	Improved pasture acreage for full-equity owner-operator organizations when maximizing before-tax and after-tax incomes with zero nonranch income. . . .	100
30	Before-tax and after-tax incomes for full-equity owner-operator when maximizing before-tax and after-tax incomes with zero nonranch income.	102
31	Livestock numbers for full-equity owner-operator ranch organizations with various levels of nonranch income	104
32	Improved pasture acreage for full-equity owner-operator ranch organizations with various levels of annual nonranch income.	107
33	Capital gains and net ranch income for full-equity owner-operator ranch organizations with various levels of annual nonranch income	110
34	Before-tax and after-tax incomes for full-equity ranch owner-operator including various levels of annual nonranch income	114
35	Total income and taxing components for optimal owner-operator ranch organizations and for nonranch income levels without the ranch organization	115
36	Annual depreciation and net worth for full-equity owner-operator ranch organizations with various levels of annual nonranch income	117
37	Livestock numbers for 50-50 tenant-landlord ranch organizations when maximizing landlord's after-tax income with two levels of annual nonranch income	120
38	Improved pasture acreage for 50-50 tenant-landlord ranch organizations when maximizing landlord's income with two levels of annual nonranch income	122

<u>Table</u>	<u>Page</u>	
39	Total net ranch income and landlord's share of ranch income for 50-50 tenant-landlord ranch organizations when maximizing landlord's income with two levels of annual nonranch income.	123
40	Net worth, before-tax income, and after-tax income for landlord in 50-50 tenant-landlord ranch organizations when maximizing landlord's after-tax income with two levels of annual nonranch income.	125
41	Share of ranch income and after-tax income for tenant in 50-50 tenant-landlord ranch organization when maximizing tenant's after-tax income and landlord's after-tax income with two levels of annual nonranch income.	126
42	Comparisons of landowner's and tenant's incomes with high and low rent payments and under a 50-50 tenant-landlord arrangement, landowner with two levels of annual nonranch income.	128
43	Percent of farms under some form of tenant arrangement and average age of farmers by counties in Central Florida.	142
44	Number of beef cattle farms, number of beef cows that have calved, by counties in Central Florida . . .	144
45	Number of farms and acreage of improved pastureland and irrigated pastureland, by counties in Central Florida.	146
46	Optimal ranch organization when maximizing after-tax income for a full-equity owner-operator with zero nonranch income	152
47	Optimal ranch organization when maximizing after-tax income for a complete land renter paying an annual rental rate of \$2.55 per acre	154
48	Optimal ranch organization when maximizing after-tax income for a complete land renter paying an annual rental rate of \$3.15 per acre	156
49	Optimal ranch organization when maximizing tenant's after-tax income (50-50 cost-revenue tenant-landlord share arrangement).	158
50	Optimal ranch organization when maximizing landlord's after-tax income (50-50 cost-revenue tenant-landlord share arrangement) with \$5,000 annual nonranch income	160

<u>Table</u>		<u>Page</u>
51	Optimal ranch organization when maximizing before-tax income for a full-equity owner-operator with zero nonranch income	162
52	Optimal ranch organization when maximizing after-tax income for a full-equity owner-operator with \$5,000 annual nonranch income.	164
53	Optimal ranch organization when maximizing after-tax income for a full-equity owner-operator with \$15,000 annual nonranch income	166
54	Optimal ranch organization when maximizing after-tax income for a full-equity owner-operator with \$25,000 annual nonranch income	168
55	Optimal ranch organization when maximizing after-tax income for a full-equity owner-operator with \$50,000 annual nonranch income	170
56	Optimal ranch organization when maximizing landlord's after-tax income (50-50 cost-revenue tenant-landlord share arrangement) with \$25,000 annual nonranch income	172

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Livestock areas in Florida, shaded area is study area.	6
2	Multiperiod programming matrix configuration.	44
3	Influence of various tax provisions on effective tax rates for optimal full-equity owner-operator ranch organizations	138

Abstract of Dissertation Presented to the
Graduate Council of the University of Florida in Partial
Fulfillment of the Requirements for the Degree of Doctor of Philosophy

THE EFFECTS OF VARIOUS TENURE AND TAX MANAGEMENT
STRATEGIES ON ORGANIZATION OF BEEF CATTLE RANCHES
IN THE GULF COAST AREA OF CENTRAL FLORIDA

By

Henry Doss Brodnax, Jr.

December, 1972

Chairman: Dr. B. R. Eddleman
Major Department: Food and Resource Economics

This study examined the effects that selected institutional factors (tenure arrangements and income tax structure) have on the economic organization of beef cattle firms. The relative advantage to an owner-operator, tenant, or landlord of a tax-sheltered investment in a beef breeding herd was evaluated.

A multiperiod decision model for a beef cow-calf firm was formulated as a dynamic linear programming problem. Decisions made during one production period were binding on alternatives in subsequent production periods. Features of the model included provisions for maximizing after-tax income of the ranch organization for full-equity owner-operator situations, complete renter situations, and 50-50 revenue-cost sharing arrangements between landlord and tenant. Income tax-paying activities were included that required capital for paying taxes in proportion to annual taxable income. The model was designed to maximize after-tax income to owned resources over a 15-year planning horizon. Landowner situations (owner-operator and landlord) were optimized with varying levels of non-ranch income.

A representative ranch firm formed the resource basis of the analysis. The ranch operator could add to the breeding herd with raised

heifers and had the option of selling weaned calves or feeder steers and heifers. Available grazing could be increased by purchasing more land or by establishing improved pasture.

Tax regulations included in the study were paying capital gains income taxes on sales from cull cows (allowing 50 percent deduction on taxable income); capitalizing land-clearing costs over a 10-year period, or charging land clearing-expenses as ordinary business expense up to 25 percent of taxable ranch income (maximum of \$5,000 per year); and charging soils and water conservation expenses as ordinary expenses in the year incurred, up to a maximum of 25 percent of gross ranch income, with any excess expenses carried over to succeeding years. Nonranch income was included as available capital to the firm and was assumed to be completely taxable.

The effects of various tenure arrangements on optimal ranch organization were evaluated for situations without any nonranch income. After-tax income was maximized for each of the three resource ownership situations. The basic solutions for the different tenure situations showed many similarities. No additional land was purchased and approximately one-third of the initial 3,500 acres of rangeland was established in permanent pasture. However, after-tax incomes varied among the three types of tenure situations.

The effects of various tax management strategies on the optimal ranch organization were evaluated for four levels of nonranch income (\$5,000, \$15,000, \$25,000, and \$50,000 annually). The results indicated that present capital gains provisions in the tax law provide an incentive for individuals in the beef cow-calf industry with large nonranch incomes to sell calves and increase the breeding herd. Individuals with little

or no nonranch income would find it more profitable to sell feeders and maintain a smaller cow herd.

CHAPTER I

INTRODUCTION

Beef cattle production is continually becoming relatively more important as a source of farm income in Florida. Total cash farm receipts from the sale of cattle and calves in Florida increased from \$41.3 million (6.5 percent of total cash farm receipts) in 1955 to \$163.9 million (11.5 percent of total cash farm receipts) in 1971. Beef cattle and calves on Florida ranches totaled 1,681 thousand head as of January 1, 1972. This represents an increase of 392,000 head since 1960 [1, pp. 1-2]. According to the 1969 U. S. Census of Agriculture [2, p. 2] there were 14.03 million acres of land in farms in Florida but only 2.23 million acres were used for harvested crops. Thus, Florida has a great potential for growth of the beef industry with large acreages available for cattle production in a mild climate suitable for year-round grazing in parts of Central and Southern Florida.

Even with this ideal climate and abundant water for the production of forages, Florida still has many problems to solve in beef production. Most of these problems are due to variations in soil, terrain, and management practices. Brodnax and Eddleman [3] found that grazing land requirements per mature cow ranged from 3.33 to 8.1 acres and for some ranches this figure was as high as 20 acres per cow on native pasture. Beef produced per acre ranged from 41 pounds to 143 pounds, but some of the top cattle producers and research units have already obtained 400 pounds of beef per acre. In that study five representative

cow-calf organizations were identified which ranged in size from 100 acres to 17,000 acres of grazeable land with a herd size of 43 animal units to 3,131 animal units. Florida is unlike most states in the southeast; a large segment of the beef industry is located on large ranches similar to the western states.

The beef cattle industry in Florida is expected to continue to grow. According to the 1969 DARE Report [4, pp. 123-125], cattle numbers are expected to increase to 1.8 million head by 1975 and 2.1 million head by 1980. The trend is toward increasing ranch size, with an estimated 10,000 ranches in 1980 as compared to over 17,000 in 1969. Most of the increase in beef production is expected to be related to improved pastures and a larger calf crop weaned.

Florida produced 35 percent of the total beef consumed in the state in 1968. It is predicted that Florida can produce only about 42 percent of its beef needs in 1980 due to a rapidly growing population and increasing per capita beef consumption in relation to production capacity [4, p. 124]. However, the Florida beef industry has great potential for growth.

Statement of Problem

The large investment capital requirements of ranch units, as characterized by many of Florida's beef producers, raises many questions with respect to the growth potentials of firms. What are the best alternatives afforded ranchers in expanding their operations? What effect do various decisions related to capital investment and income flows have on organization of the firm?

Beef cattle producers are continually making production decisions that affect their incomes over time. These decisions are usually considered to be based on the ultimate objective of net revenue maximization, but a rancher's goal may be governed by something other than maximum net revenue. Many of the larger ranches in Central Florida are operated by hired managers, with the owner having other sources of income. Thus, the beef cow-calf enterprise may be an alternative for accomplishing some objective other than net revenue maximization. These objectives might include maximization of after-tax income, asset accumulation through land appreciation, or even personal satisfaction derived from owning a ranch.

Adjustments are taking place among beef producers in Florida but these changes are not in terms of new producers. Land ownership is relatively stable even in the face of possible high speculative value of land. Also, large acreages are owned by wood products companies, mining firms, and land speculators. These large land owners can greatly influence the future of beef production (cow-calf system) in the Gulf Coast region of Central Florida. The usual leasing arrangement is short-term (one year) but if longer term leases were offered to cattlemen the rangeland acreage might be made more productive. Under a short-term lease the cattleman grazes the native range with little consideration for the future. Thus, many leases have a stocking rate clause in them that limits the number of animals that can be grazed during the year. Native pastures might be improved and even improved pastures established if the net returns were large enough to meet specified goals for both the landowner and the cattleman.

Another crucial factor that is faced by ranchers, and especially large-scale producers, is their after-tax position. The question of income tax policy as it may affect ranch management decisions is very relevant for the Florida cattleman. Many producers in the study area have nonranch income [3]; thus, beef breeding herds could be a means for a tax-sheltered investment. Carman [5] discusses the after-tax returns for a tax-sheltered investment in beef cattle. His analysis shows how taxpayers in the highest tax brackets benefit from investment in beef cattle operations while incurring apparent large cash losses from their investment.

The problems of financial management are important considerations when analyzing a firm's growth pattern. Ranches in this area of the state seem to be characterized by an internal capital rationing. Relatively low use of intermediate and long-term credit was found with the largest proportion of credit needs being annual operating capital [3]. From a random survey of ranches in the study area, less than 40 percent of the ranchers interviewed admitted using any type of credit for their ranch. On ranches with over 2,000 head, no intermediate or long-term credit was used. Thus, growth opportunities may be available to warrant use of more capital.

Previous firm growth studies have dealt almost entirely with variations in technical production and market structures and not with the institutional structures that this study considers. It is believed that ranches in Central and South Florida are not as responsive to price variations as they are to changes in some institutional structures. This suggests that decisions might be based on such considerations as maximizing after-tax returns to the owner-operator rather than maximizing the gross net returns to the firm per se.

Scope of the Study

The scope of this study includes beef cattle ranches in a nine-county area in the Gulf Coast area of Central Florida (Figure 1). The soils are predominately sandy and imperfectly to poorly drained. These counties are below the normal freeze line and a killing frost is likely in half the years. Average annual normal rainfall is 56 inches and the mean temperature is 73° F.

Climatic factors are important to ranchers in the study area. With the mild climate and high rainfall, year-round grazing is possible throughout the area. Thus, very little forage is produced and stored for use in the winter months. The warm climate and heavy rainfall increase the hazard of diseases, insects, and leaching of soil fertility.

Farming in this area is usually highly specialized in either citrus, vegetable crops, or beef cattle. Beef herds in this area are usually large, with large areas over which to graze. Citrus and vegetable production are usually separate farming operations from the beef enterprise and compete very little with beef for resources. Vegetable and citrus production in some instances have been replaced with cattle. This has occurred when excessively large disease problems emerged in vegetable production or when a large acreage of citrus was lost during a freeze. The analysis of this study deals with representative ranches which are assumed to be completely independent from other farming enterprises.

Purpose and Specific Objectives

The general purpose of this study was to develop an economic decision model that identifies optimal ranch investment and production



Figure 1. Livestock areas in Florida, shaded area is study area.

strategies required to fulfill specified entrepreneurial goals. This study dealt more with growth patterns and organizational change of the ranch firm due to institutional conditions rather than with growth in the sense of increased net worth or acreage.

Specific objectives were (1) to develop a multiperiod production model for a beef cow-calf operation, (2) to analyze the effect of various tenure arrangements on the organizational structure of the firm, and (3) to compare the effects of various tax management situations on the optimal ranch organization.

When ownership and management of ranch firms were assumed to be by the same individual the objective was to maximize after-tax net income, given certain tax regulations and a specified amount of nonranch income. Another aspect was the combining of leasing structure with tax management. The tenant and landlord had the same objective function (maximize after-tax net income), but their optimum organizations were different due to their marginal rates of taxation being different. Under a share-lease arrangement, the landlord with outside income emphasized minimizing income tax payments, with such tax strategies as the capital gains provision.

This study should be helpful in answering questions pertaining to organizational arrangements conducive to firm survival, the aggregate effect of tax-sheltered investment in beef cattle, and the effect of tax incentives on the flow of capital into the beef industry of Florida.

Plan of Presentation

The thesis is presented in six chapters. Chapter II provides a general discussion of previous work in the study of firm growth. This

brief review provides a background for this study and the need for research in the general area of firm growth. In addition, the dynamic nature of the problem is discussed in terms of a planning horizon for firm decisions. The theoretical model is presented emphasizing possible objectives for the decision-maker other than gross net revenue maximization for the firm.

Chapter III provides a detailed description of the multiperiod linear programming model used in the analysis. The representative resource situation is discussed in terms of sources and types of data. The assumptions of the analysis are presented in a discussion of the time period, tenure arrangements, taxing structure, and nonranch income situations. A brief presentation of the programming matrix includes the coding procedure for both activities and constraints. The last part of Chapter III presents detailed information about the specific activities of the decision model. All activities in the model are characterized under one of the following main categories: livestock, land, labor, capital, or tax.

Results from empirical applications of the decision model are presented in Chapters IV and V. In Chapter IV, the optimal ranch organizations are given and discussed for the full-equity owner-operator situations, the complete renter situations, and the 50-50 cost-revenue sharing between landlord and tenant situations. This chapter deals only with the firm when nonranch income is not a factor influencing entrepreneurial decisions. Optimal firm organizations considering various tax situations are discussed in Chapter V. These tax situations are analyzed for the four different nonranch income levels for the landowner in both full ownership and cost-revenue sharing situations.

Chapter VI summarizes the results and the major conclusions of the study. The industry implications of changes in institutional factors with regard to aggregate beef production in the study are discussed.

CHAPTER II

CONCEPTUAL MODEL

Growth might be defined as the gradual development toward maturity. Penrose indicated that growth has two different connotations, "It sometimes denotes merely increase in amount; for example, when one speaks of 'growth' in output, exports, sales. At other times, however, it is used in its primary meaning implying an increase in size or an improvement in quality as a result of a process of development" [6, p. 1].

This study's primary concern is not with total ranch size (e.g., total acres of land or total capital investment) as the growth alternative but more emphasis is placed on the method of obtaining the optimal size of firm consistent with specified goals of the operator. This size was based on the selection of the optimal combinations of alternative activities possible for the ranch organization.

Several factors influence the process of economic growth of the firm. These factors include price and yield variability, managerial ability, resource supply, and institutional factors related to the ranch firm. Most firm studies have dealt primarily with firm factors such as price and yield variability and resource supplies. The conceptual framework of this study may be summarized under three headings: (1) the role of institutional factors in firm theory, (2) the dynamic nature of the problem, and (3) specification of the mathematical programming model used in the analysis and review of some related studies.

Firm Theory

The theory of the firm involves determination of the optimum combination of different forms of output, the optimum combination of variable factors for any given output, and the optimum rate of output. Relevant functions required in the solutions of problems are the production, cost, and revenue functions. These relationships are utilized to obtain an optimum level of production which will maximize an objective, usually assumed to be the highest level of net revenue. This section discusses the problems of compatibility among the goals of the total ranch firm and the goals of the individuals comprising the ranch firm.

Let P_j = the price of product j

Y_j = the output of product j

P_i = the price of resource i

X_i = the input of resource i

F = unallocated fixed costs

TR = total revenue

TC = total cost

$$\text{Net Revenue} = \text{TR} - \text{TC} = \sum P_j Y_j - \sum P_i X_i - F$$

For a specific analysis, inputs are assumed to be either variable inputs or fixed inputs. The technical relationships can then be written as

$$Y_j = f(X_i | X_n) \text{ where } i = 1, 2, \dots, k, \text{ and } n = k+1, k+2, \dots, r$$

In the above expression X_i represents the variable resource inputs, and X_n represents given levels of specified fixed inputs. Carlson [7], Henderson and Quandt [8], and Leftwich [9] state that, by substituting the technical production function [$Y_j = f(X_i | X_n)$] into the net revenue

equation and solving the equation, the optimal levels of the variable resources, X_i , and products, Y_j , can be determined which will maximize net revenue. Thus, variations of product and input prices would affect the optimal arrangement of resources and production for net revenue maximization of a firm.

When considering the individual's aspect of net revenue maximization, not all of the variables are endogenous to the total firm organization. All of the total disposable income of the firm is not available for investment in capital goods for future production. A specified proportion of disposable income must be used to satisfy the family goals of consumption and to pay an individual's federal income tax. Therefore, the amount of disposable income available for obtaining control of additional resources is limited by the consumption level of the family, the amount of income generated through the operation of the ranch firm, the amount of nonranch income available for firm use, and the capital requirement for paying income taxes. The interrelationship between the ranch firm and the family and the relative importance of institutional variables such as tax and tenure structures will have an impact on the growth process of the ranch firm.

The net revenue function of an individual needs to be examined with these institutional factors included. Variable rental rates, share arrangements, and nonranch income levels would affect the individual's optimal economic unit. Rental charges could be included in the price for the land resource, but the tenant-landlord cost and revenue share arrangement is in addition to the firm's resource system. Firm net revenue maximization might not maximize either tenant's or landlord's net income because of the division of income and certain exogenous variables such as the marginal rate of taxation on taxable income.

Let an individual's after-tax net revenue be:

$$Y = TR - TC = S_1 (\sum P_j Y_j - \sum P_i X_i) - S_2 F + NRI - Z(TI)$$

S_1 = share of gross ranch income and variable costs

S_2 = share of unallocated fixed costs

NRI = nonranch income

Z = effective tax rate

TI = taxable income (gross income minus allowable tax deductions)

$$TI = f(\sum P_j Y_j - \sum P_i X_i - F + NRI)$$

$$Z = f(TI)$$

The optimum level of variable resources, X_i , and products, Y_j , for optimizing the individual's net revenue is determined by the technical production function, share of ranch net income received, nonranch income level, and marginal rate of taxation. For a full-equity owner-operator with no nonranch income the individual's net revenue equation would not be affected by the S or NRI variables. However, when the individual's total income is composed of ranch and nonranch income, taxable income is a function of this total income and the allowable tax deductions. It would be expected that products of the firm that were given tax-sheltered advantage would add relatively more to the after-tax net revenue of the optimum organization as the total income level increased (ranch plus non-ranch income). Therefore, individual producers might be more sensitive to their marginal rate of taxation than they would be to the firm's marginal rates of substitution among inputs, and the marginal rates of transformation among products.

Dynamic Nature of the Problem

With static firm theory, the problems associated with capital accumulation and variable institutional factors cannot be solved without

removing the realism. A time span is involved in organizing resources to take maximum advantage of the given situations. In developing a dynamic model, Plaxico states,

By omitting time as a variable, one may greatly simplify conceptual and empirical models. At the same time, one tends to ignore (assume away) certain practical important problems of production timing, capital acquisition and accumulation, transitory resource efficiency, and the impact of a decision in one time period on production, opportunities and choices during subsequent periods.
[10, p. 12]

A ranch firm represents an organization that requires several years to reach optimum resource efficiency. Two years are needed for a heifer to become a producing cow and improved pasture requires at least two years for sustained high levels of forage production. For tenure arrangements to be effective, each party in the firm needs to be able to plan for several years.

The Internal Revenue Code also places the beef firm in a time-wise dynamic situation with requirements such as keeping breeding stock at least two years before the sales can be included as capital gains income. This makes it necessary to employ a framework for the analysis that is dynamic in the sense that time is explicitly included in the production and decision process.

Mathematical Programming Model

Linearity was assumed to describe the production and cost relationships involved in this analysis. The static firm theory described previously can be transformed into a standard linear programming form.

$$\begin{aligned} \text{Maximum net return} &= \sum C_j Y_j && (j = 1, 2, \dots, n) \\ \text{subject to: } \sum a_{ji} Y_j &\leq B_i && (i = 1, 2, \dots, m) \\ &\text{and } Y_j \geq 0 \end{aligned}$$

Where C_j = the net return from producing one unit of product j

Y_j = the number of units of product j produced

a_{ij} = the amount of resource i used to produce one unit of product j

B_i = the total amount of resource i available

Multiperiod linear programming as used in this analysis is an extension of static linear programming where the transformation from the static to the "dynamic" model is produced by the use of submatrices.

The usual one period static model in vector form may be stated as

[10, p. 13]

Maximize $C' X = Z$

Subject to:

$$B \geq AX$$

$$X \geq 0$$

Here, A is a matrix of input-output coefficients; X represents the alternative ways that resources might be transformed into alternative products. The vector C describes the net revenue from each unit of the alternative products which may be produced. The factor B specifies the availability of scarce resources.

The above model can be made "dynamic" if the input-output matrix A represents submatrices corresponding to the time periods of the planning horizons (A_1, A_2, \dots, A_n). Overlapping in rows and columns of the submatrices adds the time dimensions to the analysis. Resources required or produced in one time period affect available resources in some future time period (B_t). Maximum net revenue over time is represented as

$$\text{Net return} = \sum C_{jt} Y_{jt} \quad t = 1, \dots, r$$

C_{jt} = the net return from producing one unit of product j during time period t

Many studies have used the above framework in analyzing the process of firm growth. The early studies dealt with only one period of production. One of the first studies that considered the multiperiod problem was by Martin [11]. His analysis incorporated the longer run investment aspects of firm growth, and various starting equities were determined in relation to specified growth conditions.

Fewer studies have been made of the effects of the progressive income tax system on net income and organization of the farm firm. Martin and Gatz [12] analyzed the possibility of high income nonfarm persons using cattle ranches as a tax-sheltered investment. They concluded that the use of cattle ranches as a tax shelter does not greatly affect cattle prices. In another study by Dean and Carter [13], total revenue and total cost curves were used to determine optimum output under varying conditions. Results showed that when the economic costs are equal to the tax deductible costs, the income tax has no effect on optimum output.

The effects of selected Federal income tax regulations on after-tax net income from farming and ranching were compared in a recursive type analysis by Vieth and Epp [14]. A five-year decision-making horizon was involved, based on specified amounts of tax-sheltered incomes. This study showed that capital gains provisions of the Internal Revenue Code (tax year 1967) provided an incentive for the absentee beef herd investor to replace the breeding herd more often than the owner-operator. Baker [15] presented a method for specifying personal income taxes, consumption, and saving in a decision model. His model specified a progressive tax structure within a linear programming tableau, assuming two situations: no capital gains and capital gains.

The multiperiod model in this study presents several economic aspects not handled by any previous beef cattle firm analysis. These include the partitioning of total income into ordinary and capital gains incomes for tax purposes, inclusion of many alternative forage producing systems, payment of annual income taxes on both ranch and nonranch incomes, and maximization of after-tax incomes of the ranch firm for three different tenure arrangements.

CHAPTER III

METHOD OF ANALYSIS

In this section, three closely associated topics are discussed in detail. First, an explanation of the basic assumptions of the analysis is presented. This includes an identification of the basic resource situation for the typical firm. Second, the model structures are related to the programming matrix. Coding procedures, resource restrictions, objective functions, and economic activities are presented. Third, detailed presentation of all column activities of the model are discussed with emphasis on transfers and tax paying activities.

In general, the framework of the analysis and construction of the model used in this study portrayed characteristics of a typical ranch firm. The ranch operator provided management ability and controlled ranch resources such as capital, land, labor, equipment, and livestock. Types of resources controlled depended on the tenure arrangement: full-equity owner-operator, complete renter, or tenant-landlord cost-revenue share arrangements. The full-equity owner-operator organization is presented as the typical situation and modifications are specified for the other tenure arrangements. These modifications occurred primarily in land and labor resources.

Division of the expenses and returns into categories suitable for the taxpaying activities was a critical factor in specifying the programming model. These tax activities were structured according to existing federal tax regulations. For example, the annual allowable

soil and water conservation expenses were restricted by total gross ranch income. Thus, these conservation expenses required a separate programming activity from the pasture establishment enterprise. The programming matrix was developed to represent the beef production alternatives in terms of existing tax structures for the individual operator. Optimum ranch organizations were based on the objective of maximizing after-tax income.

The multiperiod linear programming model was solved with procedures available in the Mathematical Programming System/360 (MPS/360). MPS/360 procedures deal only with strategy for solving a linear programming problem. Solutions were obtained with the use of an IBM 360/65 computer.

Model Assumptions

The typical ranch in the Gulf Coast area of Central Florida used as the basic resource situation was identified by Brodnax and Eddleman [3]. Data applicable to the area were obtained from agricultural experiment station results at Gainesville, and the Range Cattle Station at Ona; farm surveys; and consultations with scientists of the Florida Agricultural Experiment Stations.

Enterprise budgets based on production coefficients, costs, and returns for above-average management levels were used in the programming analysis. Copies of these enterprise budgets are on file in the Food and Resource Economics Department.

Typical Resource Situation

Usually a large number of farm enterprise alternatives exist in a producing area, but only a relatively small number of alternative

enterprises are relevant to a typical ranch in Central Florida. As pointed out in Chapter 1, beef cattle ranches in this area of Florida are characterized as rather large specialized operations. Approximately 30 percent of total cattle numbers in Central Florida are located on ranches with 500 or more brood cows [1]. Also, previous research results have indicated that most economies to size are achieved with a 500-cow herd size [3]. Net ranch income (returns to investment, operator's labor, management, and risk) for representative ranch budgets, consisting of 480, 900, and 2,100-cow herds, were \$17.73, \$20.31, and \$19.74 per cow, respectively.

The levels of resources available for the initial year of the programming analyses are shown in Table 1. This basic ranch organization was based solely on a cow-calf operation. Calves were sold when weaned and all replacement heifers were selected from the calf crop.

Rangeland required for the cow-calf herd was 3,500 acres. The initial ranch unit was based on full equity in this acreage for either an owner-operator or a landlord. The full-time operator had 2,700 hours of labor available annually, divided equally between three production periods for the year. Additional labor could be purchased in unlimited amounts for each production period.

Land was initially valued at \$150 per acre plus an additional \$7.21 per acre for land improvements. These land improvements included corrals, barns, wells, feed boxes, and fencing needed for 3,500 acres of rangeland. The complement of machinery and equipment required for operating 3,500 acres of rangeland had an average total value of \$22,855 (\$6.53 per acre). Net value of livestock was \$105,700 (based on \$197 per cow unit including proportional value of a bull and \$120 per replacement heifer).

Table 1. Initial resources available on the representative ranch used in the programming analysis

Item	Unit	Total
Brood cows	head	500
Weaned calves ^a	head	400
Replacement heifers ^b	head	60
Bulls	head	20
Rangeland ^c	acres	3,500
Operator labor:		
Period I (November-February)	hours	900
Period II (March-June)	hours	900
Period III (July-October)	hours	900
Total available labor	hours	2,700
Net worth:		
Land ^d	dollars	525,000
Buildings, fences, and improvements ^e	dollars	25,235
Machinery and equipment ^f	dollars	22,855
Livestock	dollars	105,700
Total initial net worth	dollars	678,790
Borrowing capacity (50 percent of net worth)	dollars	339,395

^aEighty percent of the brood cows wean calves.

^bSixty heifers are kept each year for replacement of cows culled and for death loss.

^cThree thousand five hundred acres of rangeland was needed for a 500-cow-calf herd.

^dInitial value of land was \$150 per acre.

^eAverage investment in buildings, fences, and other improvements was \$7.21 per acre.

^fAverage investment in a complement of machinery and equipment needed for 3,500 acres was \$6.53 per acre.

The initial net worth position varied according to the tenure arrangement. For the full-equity owner-operator all the above items were included in the net worth of the firm. Value of land, buildings, fences, and other land improvements was excluded from the net worth of the firm for the complete renter and tenant-landlord cost-revenue share arrangements. These land and improvement values were added to landlord's net worth.

The expense and income of the ranch firm included only those resources that were directly related to production activities of the ranch. With a complete renter situation, the operator paid a fixed sum to the landowner for use of the land and the landlord assumed all expenses directly related to land. The tenant-landlord cost-revenue share arrangement delegated fixed land expenses entirely to the landlord to be deducted from his share of ranch income. Thus, fixed land expenses (real estate taxes and depreciation on improvements) were considered as a direct firm expense for only the full-equity owner-operator situation.

Enterprise Organization

The programming analysis of this study considered four beef cattle production alternatives. In addition to the basic cow-calf system with weaned calves sold in October, the calves could be kept for an additional six months on winter grazing and sold as feeders in April. Also, feeders could be purchased in October and sold in April. Another livestock alternative was buying stocker steers (375 pounds) in April with supplemental feeding on pasture until October. These feeder alternatives allowed flexibility in selling during months when prices are normally high and in utilizing excess forage from pastures. Culled cows were sold in March after the calving season. Prices received for cattle during the 1966-70 period are presented in Table 2.

Table 2. Average (1966-70) cattle prices adjusted for trend by months, 16 Florida livestock auctions

Class	Grade	Weight	Monthly prices		
			March	April	October
		---cwt.---	-----dollars per cwt.-----		
Cows	Commercial	8.75	20.24	20.88	18.34
Calves	Good	4.00	31.50	33.07	27.68
Feeder steers	Choice	6.25	27.21	27.36	26.28

Source: Florida Crop and Livestock Reporting Service, Florida Agricultural Statistics Livestock Summary, 1966-70.

Cattle prices are generally higher during the spring months than during the fall, but a majority of calves produced in Florida are sold during the fall period. Calves purchased as feeders were assumed to weigh the same as calves raised (400 pounds).

The weaning percentage for calves was 80 percent. Thus, 20 percent of the brood cows either did not wean a calf or died during the year. Death loss was equal to 2 percent for brood cows. The average number of years that a mature cow remained in the herd was ten. Thus, to maintain herd size an approximate replacement rate of 12 percent per year was required. An additional 8 percent of the brood cows (without calves) was available for culling to improve the quality of the herd.

Brood cow numbers were maintained and increased only by keeping weaned heifer calves. Fifty percent of the weaned calves were assumed to be heifers and could be kept for herd replacement and expansion. The minimum number of replacement heifers kept each year was 60 head to maintain at least 500 brood cows in the herd. Two years are required for a heifer to mature. Thus, a heifer born in March produced a calf two years later.

The livestock enterprise summary shown in Table 3 reflects the animal unit equivalents, annual expenses, and cash receipts for each class of livestock. Animal unit equivalents were used in determining the grazing requirements for the entire herd. One animal unit month (AUM) of grazing represents the amount of forage or grazing required to maintain one mature cow (approximately 950 pounds in weight) for one month. Yields for each forage enterprise were measured as animal unit months of grazing. The annual cost of production for each enterprise was not included as an annual expense to a specific class of livestock.

The livestock inventory added to the firm's net worth. One brood cow and a twenty-fifth share of a bull was valued at \$197. Replacement heifers increased the beginning year inventory by \$120. Personal property taxes were paid on livestock at a rate of 3.5 mills. Thus, the ranch firm was taxed at an annual rate of \$.70 per brood cow and \$.42 per heifer.

Restrictive Production Resources

The assumptions related to the restrictive resources of the representative ranch firm (land, labor, capital, and management) are presented in this section.

The livestock enterprises (cow-calf system and feeders) were income-producing activities and required varying amounts of resources.

Land.--Since most of the feed requirements for the herd were obtained from grazing, the land base for forage production was a restrictive factor in livestock production. The representative resource situation consisted of 3,500 acres in rangeland that supported the 500-cow herd. Some of this acreage had to be in improved pasture to support

Table 3. Animal unit equivalents, annual expenses, and cash receipts per head for each class of livestock

Class	Animal unit equivalents	Annual expenses	Cash receipts
		-----dollars-----	
Cow, with calf	1.25	18.18	--
Cow, culled	1.0	6.51	170.90
Bull	1.25	49.00 ^a	--
Calf	.50	--	106.84
Feeders (October-April)	.65	134.58	163.36
Stocker steer (April-October)	.65	143.57	156.91
Heifer, coming 1	.50	2.06	--
Heifer, coming 2	.75	10.74	--

^aCash expenses of maintaining a bull were included in the annual expense of a cow. The \$49.00 was annual bull depreciation obtained by subtracting the salvage value adjusted for expected death loss from the purchase value and dividing this total by the years of useful life.

one cow on seven acres. The programming analysis assumed that the initial land resource was unimproved native rangeland. To provide the forage requirements for a 500-cow herd, either forage had to be purchased, additional acreage of rangeland purchased or rented, and/or some of the owned native range put into improved pastures. Growth in the size of the beef herd (more cows, feeders, and stockers) also required additional grazing.

Hay could be purchased to help maintain the herd during the winter months (November-February) at a cost of \$30 per ton. Land was available for purchase during any year of a 15-year planning period. Land values based on annual appreciation of 6 percent are shown in Table 4. For each additional acre of land above the initial 3,500 acres,

Table 4. Per acre capital requirements for purchasing land, including annual appreciation of 6 percent; machinery and equipment; and building, fencing, and other permanent land improvements for beef herd

Year	Value of land ^a	Investment machinery and equipment	Investment building and improvement	Total investment
-----dollars-----				
1	159.00	11.74	14.29	185.03
2	168.54	11.74	14.29	194.57
3	178.65	11.74	14.29	204.68
4	189.38	11.74	14.29	215.41
5	200.73	11.74	14.29	226.76
6	212.77	11.74	14.29	238.80
7	225.54	11.74	14.29	251.57
8	239.07	11.74	14.29	265.10
9	253.42	11.74	14.29	279.45
10	268.62	11.74	14.29	294.65
11	284.74	11.74	14.29	310.77
12	301.83	11.74	14.29	327.86
13	319.93	11.74	14.29	345.96
14	339.13	11.74	14.29	365.16
15	359.49	11.74	14.29	385.52

^aThe value of land initially was \$150 per acre. This does not include \$3 per acre closing cost when purchasing land.

capital requirements for fencing and other improvements were \$14.29 per acre and machinery and equipment required an additional capital investment of \$11.74 per acre.

Two methods of purchasing land were considered. Land could be purchased for cash in any year. The second method of purchasing land was through a 10-year loan which required a one-third down payment at the beginning of the first year and equal annual principal payments at the end of each of the ten years. The annual interest rate on the loan was 7 percent on the unpaid balance. Miscellaneous costs of purchasing land were \$3.00 per acre. For example, land purchased during the fifth year required \$229.76 of capital (\$226.76 plus \$3.00). If the land was bought on loan, the initial down payment per acre equaled

\$66.91 (one-third of \$200.73) plus the additional per acre capital requirements of \$29.03 (equipment \$11.74; fencing and other improvements \$14.29, miscellaneous closing costs \$3.00). Loan payments were \$13.38 per year plus interest on unpaid balance for ten years.

An annual fixed charge of \$2.49 per acre was made for land. The charge included \$.37 for insurance and repair of machinery and equipment; \$.36 for insurance and repair of buildings, fencing, and other beef equipment; \$.93 depreciation on machinery and equipment; and \$.83 depreciation of buildings, fencing, and beef equipment. Real estate taxes were \$1.57 per acre based on a land use value of \$80 per acre plus \$7.21 for land improvements, and a tax rate of 18 mills (\$18 per thousand dollars of evaluation). Personal property tax was \$.02 per acre based on an average investment of \$6.53 per acre in machinery and equipment. Annual insurance costs were .38 percent of average value and annual repair costs were computed as initial cost times 2 percent.

The ranch organization had available the alternatives of grazing land as unimproved native range, cleared land, improved temporary pasture, improved nonirrigated pasture (bahiagrass or Pangola digitgrass) or improved seepage irrigated pasture. Before land could be transferred from native range to improved pasture, land had to be cleared and the improved pasture established. Costs and labor requirements for establishment of improved pastures are presented in Table 5.

Temporary pasture consisted of an annual winter grass (ryegrass) with the acreage planted converted back to cleared land after the grazing season. All other improved pastures were perennials and remained in the farm organization for 15 years, at which time the grass had to be reestablished. As shown in Table 6, several alternatives were

Table 5. Estimated per acre cost and labor requirements for establishment of improved pasture

Item	Expense	Labor required
	---dollars---	----hours-----
Clearing ^a	33.93	2.1
Irrigation system (seepage): ^b		
Capitalized expense ^c	27.14	--
Conservation expense ^d	47.52	--
Establishment of grass ^d	<u>39.75</u>	--
Total	114.41	8.3
Bahiagrass:		
Conservation expense ^d	7.60	--
Establishment of grass ^d	<u>21.53</u>	--
Total	29.13	2.2
Pangola digitgrass:		
Conservation expense ^d	19.47	--
Establishment of grass ^d	<u>21.53</u>	--
Total	41.00	3.3

^aInitial clearing involved removing brush and undesirable growth, leveling, and breaking the land.

^bSeepage irrigated acreage was restricted to 25 percent of total acreage in ranch.

^cCapitalized expenses were for pumps and other equipment that could be depreciated during the years of use.

^dConservation expenses were separated from other establishment costs because of the income tax regulation restricting the total amount of allowable conservation expenses per year.

available for maintaining improved perennial pastureland. These alternatives were based on different levels of fertilization. The cost of maintaining unimproved native range was \$.13 per acre. The acreage of native range remained in the ranch organization unless it was improved at an additional expense to meet increased grazing requirements of the beef herd.

The AUM's of grazing produced per acre was an estimate of the number of animal units that could be grazed for one month, or

Table 6. Annual per acre maintenance costs and grazing produced by specific periods for alternative forage producing systems

Item	Annual maintenance cost	Grazing produced (AUM)			Total
		Period I (Nov.-Feb.)	Period II (Mar.-June)	Period III (July-Oct.)	
Unimproved native range	.13	.28	.38	.32	.98
Cleared land	.13	.36	.46	.40	1.22
Temporary pasture	35.57	4.3	3.9	0	8.2
Bahiagrass pasture:					
Medium fertilization	18.36	.50	3.0	2.5	6.0
High fertilization	27.63	.80	3.6	3.5	7.9
No maintenance (idle)	.13	.48	.48	.48	1.44
Pangola digitgrass:					
Medium fertilization	18.46	.50	2.70	3.10	6.3
High fertilization	27.82	.80	3.50	3.90	8.2
Grass topseeded with ryegrass	45.12	3.7 ^a	3.8	3.0	10.5
Grazing and hay	44.86	6.5 ^a	2.5	2.0	11.0
No maintenance (idle)	.13	.48	.48	.48	1.44
Irrigated perennial grass:					
High fertilization	21.73 ^b	1.6	4.7	4.0	10.3
No maintenance (idle)	3.98 ^c	.48	.48	.48	1.44

^aThis represented 2.5 tons of hay produced in addition to grazing during the other two periods.

^bIncluded depreciation (\$3.48), annual repairs (\$.94), taxes (\$.28), and insurance (\$.09) charges for irrigation system.

^cIncluded depreciation (\$3.48), taxes (\$.28), and insurance (\$.09) for irrigation system.

alternately, the number of months one animal unit could be grazed on one acre. For example, assume that the .32 AUM of grazing produced during Period III by unimproved native range was equally distributed among the four months (July-October). Thus, .08 AUM of grazing was available for each month. The acres required per animal unit can be determined by

$$\text{Acres} = \frac{\text{AU (animal unit)}}{\text{AUM grazing per acre}} = \frac{1}{.08} = 12.5$$

This calculation indicates that 12.5 acres of unimproved native range would be required each month during Period III to support an animal unit (one mature cow). During the same Period III an acre of irrigated perennial pasture (high fertilization) produced 4.0 AUM of grazing which would support one animal unit per month.

Labor.--Labor requirements for livestock and pasture activities were grouped according to the production periods: Period I (November-February), Period II (March-June), and Period III (July-October). These time intervals reflect the seasonal components of production activities for a beef herd. Period I is the winter season requiring supplemental feeding and miscellaneous ranch repairs. The calving season occurs during Period II and the roundup and selling activities are carried out in Period III.

Labor requirements by production periods are presented in Table 7 for the livestock and forage-producing activities. The ranch operator provides 900 hours of labor each period to meet these labor requirements. Hired labor could be obtained during each period at a wage rate of \$1.85 per hour. This wage rate included the base rate (\$1.75 per hour) plus \$.10 (5.2 percent) for the employer's contribution to Social Security taxes. No restrictions were placed on the amount of hired labor that could be purchased in any period.

Table 7. Annual labor requirements by production periods for all alternative livestock and forage systems available to be included in optimal ranch organizations

Item	Unit	Labor requirements (hours)				Total
		Period I (Nov.-Feb.)	Period II (Mar.-June)	Period III (July-Oct.)		
Cow with calf ^a	head	.50	.67	.47	1.64	
Cow, culled	head	.30	.20	0	.50	
Heifer, coming 1	head	.10	0	.05	.15	
Heifer, coming 2	head	.30	.25	.20	.75	
Feeders (Oct.-April)	head	.96	.34	.36	1.66	
Stocker steers (April-Oct.)	head	0	.76	.70	1.46	
Unimproved native range	acre	.08	.02	0	.10	
Cleared land grazed	acre	.08	.02	0	.10	
Temporary pasture	acre	.14	.07	2.15	2.36	
Bahiagrass pasture:						
Medium fertilization	acre	.04	1.22	.04	1.30	
High fertilization	acre	.04	1.22	.13	1.39	
No maintenance (idle)	acre	.08	.02	0	.10	
Pangola digitgrass:						
Medium fertilization	acre	.43	.92	.04	1.39	
High fertilization	acre	.43	.92	.13	1.48	
Grass topseeded with ryegrass	acre	.08	2.01	1.71	3.80	
Grazing and haymaking	acre	3.51	.43	1.01	4.95	
No maintenance (idle)	acre	.08	.02	0	.10	
Irrigated perennial grass:						
High fertilization	acre	.70	1.10	.50	2.30	
No maintenance (idle)	acre	.08	.02	0	.10	

^aLabor requirements for bulls were averaged in the total required for a brood cow.

Capital.--The annual capital requirement consists of operating capital (cash expenses), capital improvements (establishing improved pasture), land investment, principal repayment on borrowed capital, payment of income taxes, and family consumption at a level of \$5,000 per year. Total capital generated within the ranch firm consisted of cash receipts from sale of weaned calves, culled cows, feeders, and stocker steers. Additionally, nonranch income added to the total available capital. Borrowed capital could be used to meet any capital requirements that exceeded total available capital. Unused capital in any given year could be transferred to the next production year. Accumulated capital was the progressive total of the yearly transfers of unused capital.

Three methods of borrowing were available. As previously discussed, land could be bought with a one-third down payment and the balance paid off over 10 years at an annual interest rate of 7 percent. Annual operating capital could be borrowed for one year or on a three-year loan basis. Money borrowed and paid back the beginning of the next year with interest charges constituted the one-year loan. Under a three-year loan only interest charges were paid on the principal during the first and second years, then the total amount borrowed plus annual interest charges for the third year were paid at the end of the third year. The three-year loan extended the capital requirements to later years in the program analysis. The annual interest rate on operating loans was 8 percent and was included as a cash expense for the ranch firm.

Security provided the only restriction on the amount of capital that could be borrowed. Security, or net worth, was the sum of the values of land, livestock and equipment. The amount of capital that could be borrowed was \$1 for each \$2 of security.

Management.--The tenure situations considered in this study were full-equity owner-operator, complete renter, and 50-50 cost-revenue sharing between tenant and landlord. The management level for each situation reflected in the production coefficients for livestock and forage enterprises was assumed to be above the state average.

All resources were controlled and managed by the owner-operator in the full-equity owner-operator situation. Enterprise returns were based entirely on the owner-operator's objectives. The renter controlled all resources except land in the complete renter situation. He paid an annual charge for use of land for a specified number of years through a lease and then made organizational decisions according to his objectives. With the 50-50 cost-revenue sharing tenant-landlord situation, the net returns were equally divided between the tenant and landlord. The landlord (landowner) paid real estate taxes and incurred the depreciation on buildings and fencing. The tenant furnished his labor (2,700 hours per year) for operation of the ranch. Consumption capital and the extra landowner's expense were not included in the firm's annual capital requirement for the tenant-landlord cost-revenue share arrangement.

Percentage shares of costs, returns, and resources for each tenure situation are shown in Table 8. A complete renter contributed 100 percent and a tenant 50 percent of the cost of capital improvements to land, but the landowner reaped the full increase in net worth.

Planning Horizon

The duration of time to be included within a firm's planning horizon is one of the major problems pertaining to multiperiod programming models [16]. A planning horizon is defined as the time span for a plan that is necessary to make a decision for the first period. Uncertainty

Table 8. Percentage share of costs, returns, and available resources for various tenure situations

Item	Full- equity owner- operator	Complete renter situation		Cost-revenue sharing tenant-landlord situation	
		Renter	Landowner	Tenant	Landlord
-----percent-----					
Expenses:					
Real estate taxes	100	0	100	0	100
Capital improve- ments to land ^a	100	100	0	50	50
Land purchased ^b	100	0	100	0	100
Other firm operating expenses	100	100	0	50	50
Depreciation:					
Bull	100	100	0	50	50
Machinery and equipment	100	100	0	50	50
Buildings and fences	100	0	100	0	100
Net ranch returns	100	100	0	50	50
Net worth:					
Livestock	100	100	0	50	50
Complement of equipment	100	100	0	50	50
Land	100	0	100	0	100
Buildings and fences	100	0	100	0	100
Individual's labor available for ranch use	100	100	0	100	0
Management decisions	100	100	0	50	50

^aCapital improvements included land clearing and establishment of nonirrigated or irrigated pasture.

^bIncluded purchase of land plus capital required for buildings and fencing.

complicates decision-making at a specific point in time because as more information becomes available through time, confidence increases.

Ideally, short time periods are preferable for the planning horizon because more detailed information can be used in optimizing the specific objective function. The multiperiod model developed for this study has a planning horizon composed of 15 one-year time periods. Most previous multiperiod studies dealt with more than one year for each planning period primarily because of the limited computer capabilities for solving a large matrix. The size problem comes from the necessity of setting up a submodel for each time period of the planning horizon. If each submatrix was $m \times n$ (number of rows and columns) and the number of time periods within the planning horizon equaled T , then the number of rows and columns for the total matrix would be $T \times m$ and $T \times n$, respectively. The computation requirement grows at the rate of T^3 [16, p. 467].

The shortest time period considered reasonable for this study was one year. This time period is based on the requirement of paying income taxes on an annual basis. Thus, the ranch operated on a January through December basis with yearly transfers of cattle, land, and capital.

A planning horizon of 15 years was chosen for three reasons. First, improved pastureland would have to be reestablished after 15 years in a maintenance program. This would require additional activities for the model which substantially increase the matrix size. Second, according to the 1969 U. S. Census of Agriculture [2, p. 3], the average age of farmers in Florida was approximately 53 years. Assuming that the average age of ranchers in the study area was the same, the additional

15 years in the planning horizon would put the ranch operator at retirement age. The cost of computer services for solving a larger problem was also prohibitive. Approximately one hour of computer time was required for the initial solution of an optimum ranch organization.

Tax Structure

This section discusses federal income tax laws that were incorporated into the analysis. All possible alternative tax regulations could not be included in the analysis, but the major tax laws that affect the ranch organization (individual and firm) were included. The tax rules applicable to the 1971 tax year were assumed effective for this analysis.

The sole proprietorship form of tax regulations was applied as the tax structure for the ranch operator. The rancher (owner-operator, renter, tenant, or landlord) filed a joint return with a wife and two children included as dependents. Each individual taxpayer was allowed a personal exemption deduction from his adjusted gross income of \$650. In addition, another \$650 per dependent was allowed resulting in personal exemptions of \$2,600 per year. The individual is allowed either a standard deduction or an itemized total deduction to be subtracted from his adjusted gross income. This analysis assumed \$1,400 for itemized deductions. Thus, annual total personal exemptions and deductions were \$4,000.

Gross income.--Gross income is defined as all income from whatever source derived such as [17] gross income derived from business; interest, dividends, and royalties; compensation for services (wages); pensions; capital gains; and rents. Two sources of gross income were

included for some aspects of the analysis. First, the ranch firm was a source of income for every optimal organization. This ranch income was derived from two income categories (ordinary income and capital gains income). The ordinary income includes receipts from the sale of weaned calves, feeders, and stockers. Sales of culled brood cows contributed to the capital gains income. A second source of income for an owner-operator or landlord situation was from nonranch activities.

Nonranch income levels for the owner-operator were \$5,000, \$15,000, \$25,000, and \$50,000 per year. The landlord in the tenant-landlord situation was assumed to have two levels of nonranch income (\$5,000 and \$25,000). The renter and tenant received income only from the ranch organization.

Adjusted gross income.--The adjusted gross income for the individual is generally gross income minus business deductions. The allowable deductions as specified by the Revenue Code [17] that were used in the beef analysis were

1. deductions encountered by the business carried on by the taxpayer, if such business does not consist of the performance of services by the taxpayer as an employee;
2. fifty percent of the excess of net long-term capital gain over net short-term capital loss;
3. losses from the sale of property;
4. deductions attributable to rental property; and
5. depreciation allowed on property.

Taxable income.--Taxable income is defined as adjusted gross income minus itemized family deductions and personal exemptions. The taxable income is the amount for which the federal income tax is determined by using the income tax rates. The taxable income levels and tax

rates used in the tax paying activities of the model are shown in Table 9.

A total of 24 marginal tax rates (14 percent to 70 percent) are included in the IRS tax table for a married taxpayer filing a joint return. Only nine tax-paying activities are represented in the programming model because the additional 15 marginal tax rates would have expanded the matrix size by 225 column activities. The procedures used in the programming routine to select the correct income level for tax paying activities are discussed later.

Tax Management Strategies

The terms before-tax incomes and after-tax incomes are used throughout the presentation. Before-tax income is defined as net income (total receipts minus total cash expenses). The objective function used in the analysis was to maximize after-tax income (before-tax income minus tax obligation for the taxable income level). Minimizing taxes does not necessarily give the same result as maximizing after-tax income. If a decision was made strictly to reduce the tax burden, but a larger amount of money is lost by selling at a lower product price, the net after-tax income would be less.

Ranch organization.--Tax management strategies available to a rancher were developed according to regulations specified in the Farmer's Tax Guide [18]. Farmers may file their tax returns using either the cash basis or the accrual basis for accounting. The cash method of accounting was used for this analysis because taxes can be postponed for the farmer who is in a period of year-to-year increases in inventory. The accrual method would have increased the matrix size because of yearly inventory

Table 9. Taxable income, tax payments, and marginal tax rates

Taxable income levels ^a	Tax obligation	Marginal tax obligation ^b
-----dollars-----		-----percent-----
4,000	620	19
12,000	2,260	25
20,000	4,380	32
28,000	7,100	39
36,000	10,340	45
52,000	18,060	53
76,000	31,020	58
100,000	45,180	62
200,000	110,980	70

^aAdjusted gross income minus exemptions and deductions.

^bIncrement of added tax at the specified taxable income levels.

Source: 1971 Instructions from Internal Revenue Service.

accounts. A farmer makes his choice of filing his return on the cash or accrual basis when he files his first return.

Under the cash method of accounting all taxable income, whether received as cash or property, is included as income for the year it is actually received. Income for the beef firm was derived from the sale of culled cows, weaned calves, feeders, and stocker steers. Ranch business expenses were deductible only in the tax year in which they were paid. Allowable expenses included ranch operating expenses paid during the year and depreciation allowances on ranch improvements, machinery, equipment, and bulls.

For income tax purposes, everything the individual owns is either a capital asset or a noncapital (ordinary) asset. Noncapital or

ordinary assets included items held for sale in the normal operation of the farm business, such as livestock, livestock products, and crops. Under certain provisions, gains and losses from sales or other dispositions of ordinary assets used in the farming business and held more than six months (two years for breeding livestock) are often treated as gains and losses from sales of capital assets.

Capital assets for income tax purposes are all the property an individual owns for personal purposes or investment. Capital assets are treated differently from ordinary assets when computing income taxes on the income derived from such assets. Capital assets held for six months or more are classified as long-term assets. Income from short-term assets are taxed at the same rate as noncapital assets. When the net long-term capital gains exceeds the short-term capital loss, an income tax deduction equal to 50 percent of the excess can be subtracted from the gross income.

Income from the sale of weaned calves, feeders, and stocker steers was taxed as ordinary assets (held less than two years). Since gains and losses were computed by the cash accounting method, brood cows raised on the ranch and kept in the herd for two years or more were taxed as capital gains during the year they were sold. For tax purposes the selling price was reduced by any sale costs. Cost of sale included hauling costs, commission charges, and other similar expenses. The costs of raising an animal were deducted as ordinary expenses during the years the animal was being raised.

Farm producers are allowed current deductions (ordinary expenses) of land-clearing expenditures and certain soil and water conservation expenses. Previous tax laws allowed ordinary assets to be converted into capital assets at the time of land sale. The Tax Reform Act of 1969

reduced the advantages of claiming these expenses as current deductions, if the land is sold in less than ten years. If land is sold within any of the nine years after these costs are claimed as ordinary expenses, a specified percentage of the claimed expense must be reported as ordinary income. The allowable percentage reclaimed depends on the year the land was sold.

Land-clearing costs are expenditures for clearing land to make it suitable for farming. These expenditures are for such operations as eradication of trees, stumps and bushes, and the moving of earth. The annual deduction of land-clearing expenses for tax purposes cannot exceed 25 percent of the taxable income from farming up to a maximum of \$5,000. If clearing expenses exceed either of these limitations, the balance must be capitalized, and taxable income would not include the expenditures for clearing land. Both methods of handling land-clearing expenses were included in the programming analysis by imposing the specific limitations of the Internal Revenue Code.

Ranchers were allowed annual deductions for certain soil and water conservation expenses as specified by law. The ranch operator could deduct expenditures up to 25 percent of the gross income from ranching in any one year. Conservation expenses in excess of 25 percent of gross income could be deducted in later years within the general limitation that no deductions in excess of 25 percent of the gross income from ranching in each of these years could be taken. Soil and water conservation activities included leveling, grading, ditching, and restoration of fertility for establishment of nonirrigated and irrigated pasture.

The analysis did not have a land-selling activity. Thus, the capital gains section of the tax regulations on land sales was not

applicable. Capital gains from land appreciation were reflected in the net worth of the landowner.

The straight line method of figuring depreciation was used in the analysis. Depreciation for each year was estimated by dividing the value of the property less salvage value by years of useful life. Depreciation was deducted as an annual expense for purposes of computing taxes and maximizing after-tax income. Sources of annual depreciation in the study were bulls (\$1.96 per mature cow); machinery and equipment (\$.93 per acre operated); buildings, fences, and other capital improvements (\$.83 per acre operated); and seepage irrigation system (\$3.48 per acre irrigated).

Other expenses associated with the operation of the beef herd were deducted for income tax purposes during the year the expense was incurred. An example is expenses associated with feeders bought in October of one year and sold in April of the following year. Expenses from October through December were deducted the first year and expenses for January through March were deducted the second year, even though all income from sales of the feeder animals was reported the second year.

Nonranch income levels.--Nonranch incomes were introduced into the analysis to determine the effects on the optimal ranch organization and tax management strategies. The tax consequences of farm decisions have a greater impact on cash flows and the net income when nonranch income is available. The optimum tax management strategies for the ranch firm with nonranch income were developed for the farm tax regulations discussed in the previous section. Thus, the ranching operation was assumed to be the only tax-sheltered investment available for maximizing after-tax income.

A maximum nonranch income of \$50,000 per year was included in the analysis. The Internal Revenue Code adds restrictions or provisions for offsetting individual income with farm losses when nonfarm adjusted gross income is greater than \$50,000 per year.

Programming Matrix

A prototype of the multiperiod programming matrix used in the analysis is shown in Figure 2. The matrix consisted of column activities, row elements, right-hand-side constraints, restrictive bounds, and objective functions. One submatrix, as represented by either C, E, G, or I in Figure 2, was composed of 40 rows and 62 columns. Therefore, the total matrix (15 submatrices) consisted of 600 rows and 930 columns. The programming model is a composite of submodels. The year t represents any submodel year which is linked to other years by resource transfers for $t + 1$, $t + 2$, . . . , $t + n$ years.

Coding

The size and complexity of the multiperiod linear programming tableau required a very carefully planned coding system to identify constraints and column activities. An eight-digit code was used to specify both rows and columns. The time period (year) occupied two digits and the title (identification) filled the other six spaces.

Table 10 provides a list of all row codes (constraints). The period (year) was coded as the last two digits of the eight digits in the code. For example, INCOWS01 specified the first year and INCOWS15 specified the fifteenth year of the analysis. Column activities were coded with the first two digits of the code as the year designation. The cow-calf activity was coded as 01COWCAL and 15COWCAL for the first and

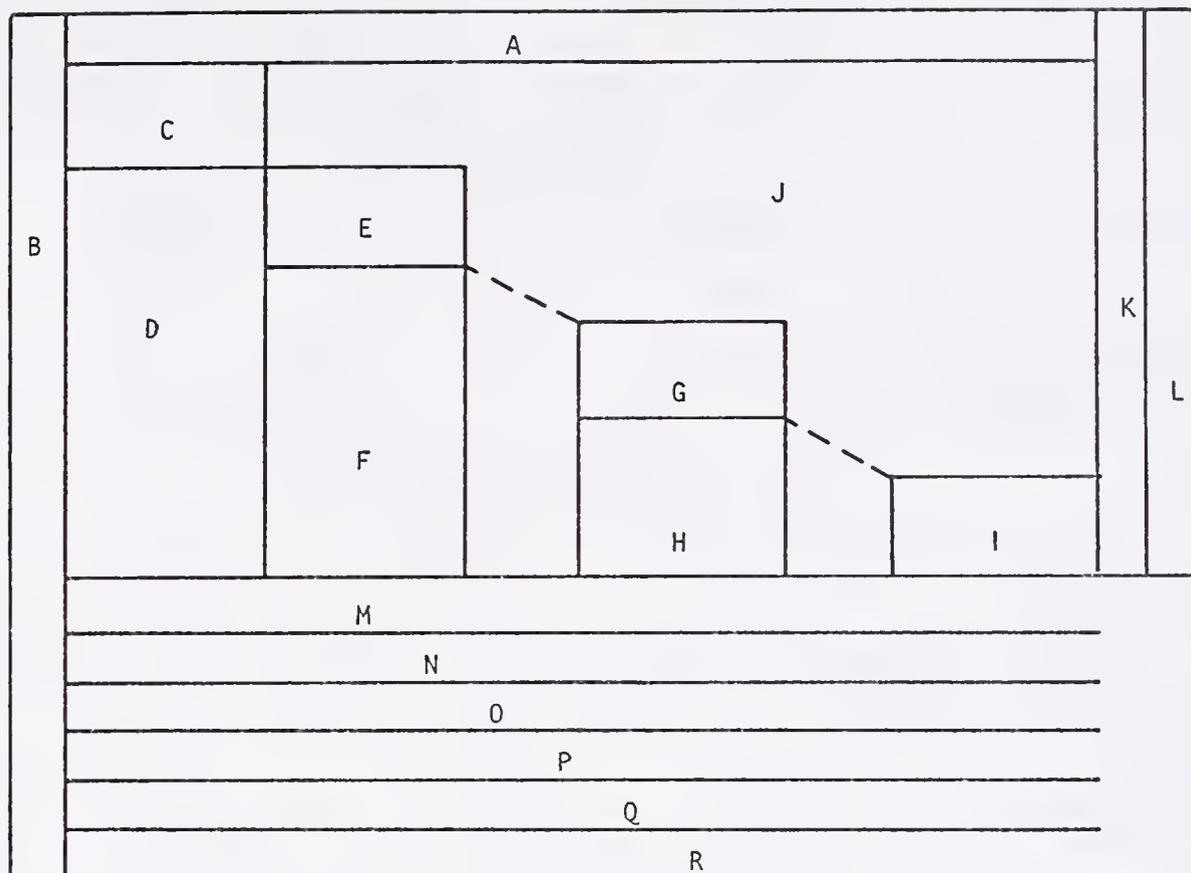


Figure 2. Multiperiod programming matrix configuration.

Legend:

- A. Column identification
- B. Row identification
- C. Input-output submatrix for year 1
- D. Year 1 resource transfer
- E. Input-output submatrix for year 2
- F. Year 2 resource transfer
- G. Input-output submatrix for year t
- H. Year t resource transfer
- I. Input-output submatrix for year 15
- J. All matrix elements right of main diagonal are zero
- K. Type of constraint (equality; less than or equal, greater than or equal, or no constraint)
- L. Right-hand-side restrictive vector
- M. Restrictive bounds
- N. Objective function 1, maximize before-tax income
- O. Objective function 2, maximize after-tax income for full-equity owner-operator situation
- P. Objective function 3, maximize after-tax income for complete renter situation
- Q. Objective function 4, maximize after-tax income for tenant in 50-50 cost-revenue tenant-landlord share arrangement
- R. Objective function 5, maximize after-tax income for landlord in 50-50 cost-revenue tenant-landlord share arrangement

Table 10. Code key, row types, and right-hand-sides of row elements for one submatrix (one year) of the multiperiod linear programming model

Row codes ^a	Explanation	Row type ^b	RHS	Unit
INCOWS	Receives transferred cows from the previous year	E	0 ^c	head
MACOWS	Cows in herd available to calve	E	0	head
CULCOW	Cows that are required to be culled	E	0	head
LIQCOW	Cows that are culled in excess of the requirement	L	0	head
HEIFER	Heifer calves kept for breeding herd	L	0	head
TRCALF	Transfer weaned calf to either breeding herd, sell weaned calf, or raised feeder calf	E	0	head
TRFEED	Transfer feeders from raising activity to selling activity	E	0	head
STOCKS	Transfer stocker steers from raising activity to selling activity	E	0	head
TOLAOW	Total land operated	E	0	acre
RALAOW	Native rangeland	L	0	acre
TRCLLA	Transfer cleared land to improved pasture establishment activity	L	0	acre
IRRLAN	Land available for establishment of irrigated pasture	L	0	acre
IMPNIR	Improved nonirrigated land	L	0	acre
IMPIRR	Improved irrigated land	L	0	acre
TRBAHG	Transfer bahiagrass pasture	E	0	acre
TRPANG	Transfer Pangola digitgrass pasture	E	0	acre
TRPCVI	Transfer grass-clover irrigated pasture	E	0	acre
GZPINF	Grazing available Period I (Nov.-Feb.)	L	0 ^d	AUM

Table 10 (Continued)

Row codes ^a	Explanation	Row type ^b	RHS	Unit
GZP2MJ	Grazing available Period II (Mar.-June)	L	0 ^e	AUM
GZP3JO	Grazing available Period III (July-Oct.)	L	0 ^e	AUM
LBP1NF	Available labor Period I (Nov.-Feb.)	L	900	hour
LBP2MJ	Available labor Period II (Mar.-June)	L	900	hour
LBP3JO	Available labor Period III (July-Oct.)	L	900	hour
CONSER	Transfer all conservation expenses to one column activity	E	0	dollar
RSCSEX	Restrict soil and water conserva- tion expenses	L	0	dollar
RSLACL	Restrict land clearing as direct expense	L	0	dollar
OVERHD	Transfer all overhead expenses to one column activity	E	0	dollar
CAPITA	Available capital for owner-operator and renter situations	L ^f	0	dollar
CAP50L	Available capital for landlord in 50-50 tenant-landlord situation	L ^f	0	dollar
CAP50T	Available capital for tenant in 50-50 tenant-landlord situation	L ^f	0	dollar
SECURI	Security restriction for borrowing capital	L	0	dollar
NETWOR	Net worth accounting row	L	0	dollar
PEPREV	Transfer personal property evalua- tion to column paying activity	E	0	dollar
REESEV	Transfer real estate evaluation to column paying activity	E	0	dollar
ORDINC	Ordinary income accounting row	N		dollar

Table 10 (Continued)

Row codes ^a	Explanation	Row type ^b	RHS	Unit
CAPGAN	Capital gains income accounting row	N		dollar
RANINC	Ranch profit transfer row	L	0	dollar
RANLOS	Ranch loss transfer row	E	0	dollar
TAXINC	Owner-operator or renter's income tax paying row	G ^f	-4,000 ^g	dollar
TXI50L	Landlord's tax paying row	G ^f	-4,000 ^g	dollar
TXI50T	Tenant's tax paying row	G ^f	-4,000 ^g	dollar
ACCEQU	Accounting equality for tax paying activities	E	1	unit
PRETXINC	Objective function 1 (before-tax)	N	max.	dollar
POSTXINC	Objective function 2 (after-tax) for owner-operator or renter	N	max.	dollar
50LANLOR	Objective function 3 (after-tax) for landlord in 50-50 tenant-landlord situation	N	max.	dollar
50TENANT	Objective function 4 (after-tax) for tenant in 50-50 tenant-landlord situation	N	max.	dollar

^aThe period (year) was coded as the last two digits of the eight digits in the code. For example, INCOWS01 signified the first year and INCOWS15 signified the fifteenth year. The objective functions were not coded by years.

^bE, equality; L, less than or equal; G, greater than or equal; and N, no constraint.

^cFirst year RHS equaled 500 because program was assumed to start with 500 brood cows.

^dEqualed 600 first year and 300 second year.

^eEqualed 1,000 first year and 500 second year.

^fRow type was "N" when specified tenure situation was not the objective function.

^gAllowed for personal tax exemptions and deductions of \$4,000 per year.

fifteenth years, respectively. Title codes and explanations for the columns of a submatrix are presented in Table 11. Identification of rows and columns was simplified with the system of placing the year code on opposite ends of the title code.

Restrictive Constraints of the Model

Restrictions were placed on the model with constrained right-hand-sides (rows) and restrictive bounds on column activities. These constraints helped make the model more realistic in terms of a typical beef cattle firm. The type of row constraints and right-hand-side levels are presented in Table 10. Row constraints restrict the factors of production (land, labor, and capital). Bounds were placed on some of the column activities (Table 12) to restrict these activities at equality, upper, or lower levels. Reasons for planning restrictions on certain activities of the model are discussed in following sections of this chapter.

Objective Function

The objective function was to maximize after-tax income for the ranch operator during the planning horizon (15 years). Several other objective functions could have been used. They include maximum net worth, maximum herd size, maximum acreage, maximum before-tax income, and maximum sales. Maximization of after-tax income was chosen for this study because it was considered to be more closely related to the goals of the ranch firm. Ranch operator decisions are usually compatible with the assumption of profit maximization made in studies using static models. But profit maximization in this study includes payment of the individual's income taxes.

The eight-digit code POSTXINC was used in the matrix to identify the objective function row (maximizing after-tax income). When the

Table 11. Code key for column activities for one submatrix (one year) of the multiperiod linear programming model

Code ^a	Explanation	Unit
COWCAL	Cow-calf activity	head
COWCUL	Cull cow activity	head
COWLIQ	Liquidating cow activity in excess of cows culled	head
COWSTR	Transfer remaining cows to next time period	head
HERDEX	Heifer calf activity, kept for breeding herd	head
SWCALF	Sell weaned calf	head
FCALFR	Feeder calf raised	head
FCALFP	Feeder calf purchased in October	head
SFCALF	Sell feeder calf in April	head
BUYSTC	Buy stocker steers in April	head
SELSTC	Sell stocker steers in October	head
PURLAC	Purchase land on cash basis	acre
PURLAL	Purchase land on long-term loan	acre
INITLA ^b	Initial land for owner-operator situation	acre
USOWLA ^b	Total land (initial land plus purchased land) for owner-operator, method of paying ownership land costs	acre
UNIMLR ^c	Land rented for complete renter situation	acre
LEASLA ^c	Total acres leased, used to pay leasing cost (rent), overhead, depreciation, and personal property evaluation	acre
LALOLA ^d	Initial land owned (3,500) by landlord for tenant-landlord situation	acre
SHARLA ^d	Total land in operation (initial land owned plus land purchased by landlord) for tenant-landlord situation used to pay overhead, depreciation, and personal property and real estate evaluation	acre
GZNALA	Grazing native unimproved land	acre
LACLEX	Land-clearing expenses that can be charged in year performed	acre

Table 11 (Continued)

Code ^a	Explanation	Unit
LACLCA	Land-clearing expenses that must be capitalized	acre
BUYFOR	Hay-buying activity	tons
GZCLLA	Graze cleared land	acre
CLLATR	Cleared land transfer for establishment of permanent pasture	acre
IRLATR	Transfer of land suitable for seepage irrigation system	acre
SEEP1R	Investment in seepage irrigation system	acre
RYEGTM	Temporary grazing (ryegrass)	acre
ESTBAH	Establish bahiagrass pasture	acre
MTBAMF	Maintain bahiagrass pasture at medium fertilization level	acre
MTBAHF	Bahiagrass, high fertilization	acre
IDLEBA	Idle bahiagrass pasture, no maintenance	acre
ESTPAN	Establish Pangola digitgrass pasture	acre
MTPAMF	Maintain Pangola digitgrass, medium fertilization	acre
MTPAHF	Pangola digitgrass, high fertilization	acre
PARYEG	Pangola digitgrass topseeded with ryegrass during winter	acre
PANHAY	Pangola digitgrass pasture grazed and cut for hay	acre
IDLEPA	Idle Pangola digitgrass	acre
ESTPCI	Establish perennial grass-clover irrigated pasture	acre
MPCIHF	Maintain perennial grass-clover, high fertilization	acre
IDLPCI	Idle perennial grass-clover irrigated (no maintenance)	acre
CONSEX	Pay soil and water conservation expenses	dollar
LABEP1	Buy labor, Period I	hour
LABEP2	Buy labor, Period II	hour

Table 11 (Continued)

Code ^a	Explanation	Unit
LABEP3	Buy labor, Period III	hour
BORCAP	Borrow capital for one year	dollar
BORCA3	Borrow capital for three years	dollar
CAPTRA	Capital transfer	dollar
PEPRTX	Pay personal property taxes	dollar
REESTX ^e	Pay real estate taxes (owner-operator and landlord)	dollar
PYLEAS ^f	Pay lease (renter)	dollar
FIXCOS	Pay fixed costs	dollar
FAMCON	Family consumption	dollar
OTHINC	Income other than ranch (nonranch income)	dollar
TXRINC	Taxable ranch income	dollar
LOSIT1	Ranch loss	dollar
PYTX00	Pay income tax at zero level (no taxable income)	dollar
PYTX04	Pay income tax at 4,000 level	dollar
PYTX12	Pay income tax at 12,000 level	dollar
PYTX20	Pay income tax at 20,000 level	dollar
PYTX28	Pay income tax at 28,000 level	dollar
PYTX36	Pay income tax at 36,000 level	dollar
PYTX52	Pay income tax at 52,000 level	dollar
PYTX76	Pay income tax at 76,000 level	dollar
PTX100	Pay income tax at 100,000 level	dollar
PTX200	Pay income tax at 200,000 level	dollar

^aThe period (year) was coded as the first two digits of the eight digits in the code. ^bIncluded only for full-equity owner-operator situations. ^cIncluded only for complete renter situations. ^dIncluded only for 50-50 tenant-landlord share situations. ^eIncluded only during owner-operator and tenant-landlord situations. ^fIncluded only during renter situations.

Table 12. Restrictive bounds used each year for specified column activities of the multiperiod linear programming model

Code column ^a	Explanation	Unit	Type bounds ^b	Amount
COWCAL ^c	Cow-calf activity	head	LO	500
HERDEX	Herd expansion	head	LO	60
FCALFP	Feeders purchased	head	UP	250
BUYSTC	Buy stocker steers	head	UP	250
BUYFOR	Buy forage (hay)	tons	UP	500
LACLEX	Land clearing as direct expense	acres	UP	147.25
LACLCA	Land clearing with expense capitalized	acres	UP	500
RYEGTM	Temporary grazing	acres	UP	500
PANHAY	Pangola digitgrass pasture grazed and cut for hay	acres	UP	300
FAMCON	Family consumption	dollar	FX	5,000
OTHINC	Nonranch income level	dollar	FX	d

^aAll columns not listed in this table were unconstrained by the bounds vector.

^bType bounds were LO, lower limit; UP, upper limit; and FX, equality.

^cThis bound did not become effective until the fifth year of the planning horizon.

^dValues were fixed at zero, \$5,000, \$15,000, \$25,000, and \$50,000 depending on objective function.

objective functions for the tenant or landlord situations were imposed, the codes 50TENANT and 50LANLOR were used. With the 50-50 cost-revenue tenant-landlord share situation, the POSTXINC entries were divided equally between the partners.

Activities of the Model

Activities of the multiperiod programming model are discussed by categories: livestock enterprises, land activities, and financial components of the model. The presentation in this section describes the activities included for these categories for one submatrix (one-year period). A submatrix included the input-output coefficients for a specific year (t) with activities for resource transfers to future years. The year t signifies any year of the planning horizon.

The programming matrix is constructed with the column activities across the top and the constraint rows down the side of the page. Coefficients are placed in position (cells) according to the specified column and row. For the row constraints a negative sign with a coefficient indicates an addition to the right-hand-side. The positive or no sign signifies a subtraction. Expenses are indicated as negative in the objective function row and receipts are positive. Thus, sale of a culled cow adds to after-tax income and expenses, such as raising a heifer, subtract from the objective function.

The coefficients in the matrix represent a one-unit segment. For example, the coefficients in the COWCAL column are based on one cow unit of the cow-calf activity. The requirements for purchasing an acre of land with cash are depicted in the land purchase column (PURLAC). If the optimum organization required 100 acres of purchased land, the total requirements of a resource would be 100 times the coefficient in the purchase land column.

The actual coefficients used in the analysis are included in the tables. The discussion of the programming matrix primarily represents the matrix formulation for the owner-operator situation. When the renter and tenant-landlord situations vary from the owner-operator, these differences will be discussed. The expense and receipt coefficients, when maximizing for the tenant or landlord with the 50-50 cost-revenue share arrangement, were usually 50 percent of the owner-operator coefficients. Therefore, the rows pertaining specifically to the tenant or landlord were excluded from the matrix presentation unless the 50-50 cost-revenue share situation did not apply. These rows were capital (CAP50T and CAP50L), taxable income (TXI50T and TXI50L), and objective functions (50TENANT and 50LANLOR).

Livestock enterprises.--The livestock production activities considered in the analysis are presented in Tables 13 and 14. The activities related to the brood cow production system and transfers depict a typical cow-calf system. All mature brood cows are entered in the cow-calf activity (COWCAL) at the beginning of the year. Total annual requirements for a mature cow with a calf and a twenty-fifth of a bull are reflected in the COWCAL coefficients. Cows could either be culled (COWCUL), liquidated (COWLIQ), or transferred (COWSTR) to the cow-calf activity for next year ($t+1$). The COWCUL activity is constrained by an equality row (CULCOW) at the specified culling rate. Additional cows can be culled (COWLIQ) to a rate specified by the less-than row (LIQCOW). Resources are added to the constraint levels by the COWCUL and COWLIQ activities because these cows would not remain in the herd (COWCAL) a full year. Receipts from the culling activities are included in the taxing row (TAXINC) at the capital gains income level (one-half of sales value).

Table 13. Linear programming tableau specifying the brood cow activities of the multiperiod model for year t

Row codes	Coded activities related to breeding herd					
	t COWCAL	t COWCUL	t COWLIQ	t COWSTR	t HERDEX	t SWCALF
INCOWS $_t$	1.0					
MACOWS $_t$	-1.0	1.0	1.0	1.0		
CULCOW $_t$	-.12	1.0				
LIQCOW $_t$	-.06		1.0			
HEIFER $_t$	-.40				1.0	
TRCALF $_t$	-.80				1.0	1.0
GZP1NF $_t$	4.20	-2.10	-2.10		1.0	
GZP2MJ $_t$	5.00	-5.00	-5.00			
GZP3JO $_t$	4.80	-4.80	-4.80		.5	
LBP1NF $_t$	.50	-.20	-.20		.10	
LBP2MJ $_t$	.67	-.47	-.47			
LBP3JO $_t$	.47	-.47	-.47		.05	
RSCSEX $_t$		-44.28	-44.28			-27.68
CAPITA $_t$	18.18	-184.53	-184.53		2.06	-106.84
SECUR I $_t$	-197.00					
NETWOR $_t$	-197.00					
PEPREV $_t$	-197.00					
ORDINC $_t$	20.14	-13.63	-13.63		2.06	-106.84
CAPGAN $_t$		-170.90	-170.90			
TAXINC $_t$	20.14	-99.09	-99.09		2.06	-106.84
INCOWS $_{t+1}$				-.98		
GZP1NF $_{t+1}$					2.55	
GZP2MJ $_{t+1}$					2.55	
GZP3JO $_{t+1}$					2.55	

Table 13 (Continued)

Row codes	Coded activities related to breeding herd					
	${}_t$ COWCAL	${}_t$ COWCUL	${}_t$ COWLIQ	${}_t$ COWSTR	${}_t$ HERDEX	${}_t$ SWCALF
LBP1NF _{t+1}					.30	
LBP2MJ _{t+1}					.25	
LBP3JO _{t+1}					.20	
CAPITA _{t+1}					10.74	
SECURI _{t+1}					-120.00	
NETWOR _{t+1}					-120.00	
PEPREV _{t+1}					-120.00	
ORDINC _{t+1}					10.74	
TAXINC _{t+1}					10.74	
INCOWS _{t+2}					-.96	
PRETXINC	-20.14	184.53	184.53		-12.80	106.84
POSTXINC	-20.14	184.53	184.53		-12.80	106.84

Table 14. Linear programming tableau specifying the feeder and stocker activities of the multiperiod model for year t

Row codes	Coded activities related to feeders and stockers				
	${}_t$ FCALFR	${}_t$ FCALFP	${}_t$ SFCALF	${}_t$ BUYSTC	${}_t$ SELSTC
TRCALF $_t$	1.0				
TRFEED $_t$			1.0		
STOCKS $_t$				-1.0	1.0
GZP1NF $_t$	1.40	1.40			
GZP2MJ $_t$				2.05	
GZP3JO $_t$	.65	.65		2.30	
LBP1NF $_t$	.48	.48			
LBP2MJ $_t$				.76	
LBP3JO $_t$	.36	.36		.70	
RSCSEX $_t$			-42.32		-40.65
CAPITA $_t$	11.93	122.65	-163.36	143.57	-156.91
ORDINC $_t$			-163.36	143.57	-156.91
TAXINC $_t$			-163.36	143.57	-156.91
TRFEED $_{t+1}$	-1.0	-1.0			
GZP1NF $_{t+1}$	1.5	1.5			
GZP2MJ $_{t+1}$	.8	.8			
LBP1NF $_{t+1}$	.48	.48			
LBP2MJ $_{t+1}$	.34	.34			
CAPITA $_{t+1}$	11.93	11.93			
ORDINC $_{t+1}$	23.86	134.58			
TAXINC $_{t+1}$	23.86	134.58			
PRETXINC	-23.86	-134.58	163.36	-143.57	156.91
POSTXINC	-23.86	-134.58	163.36	-143.57	156.91

The COWSTR column transfers cows to the next year (INCOWS_{t+1}) and allows for 2 percent death loss.

A lower bound of 500 brood cows was set on the COWCAL activity for the fifth year through the fifteenth year of the planning horizon. Since each tenure situation started with 500 cows, the possibility of increasing income by selling cows below this level was eliminated with the bound restriction. The bound did not become effective until the fifth year to allow for adjustments in the cow-calf activity. These adjustments were needed because of the two years required for raising a brood cow from a heifer calf.

Calves weaned from the COWCAL activity are made available through the equality row (TRCALF) for herd expansion (HERDEX), selling (SWCALF), or the feeder operation (FCALFR). Heifers kept for the breeding herd are constrained with the HEIFER row to a maximum of 50 percent of weaned calf crop. Requirements for raising a heifer are presented for years t and $t+1$, then the heifer is included in the brood cow herd (INCOWS_{t+2}) in the third year with an adjustment for death loss. Weaned calves sold (SWCALF) add to gross receipts as ordinary income.

Table 14 illustrates the feeder and stocker activities of the matrix. Two sources of feeders were available for the organization: transfer of weaned calves from cow-calf herd (FCALFR) and calves purchased for feeders (FCALFP). Both of these systems had the same grazing and labor requirement for the period October through March. Thus, resource requirements, costs, and returns were included for both year t and year $t+1$ depending on the year involved. The selling activity (SFCALF) occurred in year $t+1$ and was accomplished through the transfer with the equality row (TRFEED). All the gross sales from feeders were taxed as ordinary income in year $t+1$. The other livestock alternative

was grazing of purchased stocker steers (375 pounds) from April to October. Resource levels and costs are shown in the purchase stocker activity (BUYSTC) and the sale activity (SELSTC) reflects the gross sales from a stocker steer.

There were several reasons for separating the livestock selling activities (COWCUL, COWLIQ, SWCALF, SFCALF, and SELSTC). One important reason was the tax regulations pertaining to allowable conservation expenses and capital gains income. Allowable conservation expenses are restricted by total gross sales and capital gains income is taxed at a lower rate than ordinary income. The two alternatives for acquiring feeders were raising them and a cash purchase. Each alternative was considered separately because of different capital requirements.

Land activities.--Fixed charges such as real estate taxes, depreciation, and miscellaneous overhead expenses were based on an acre of land. The proportion of an item charged depended on the type of tenure situation being considered. This required that each tenure arrangement have different land activities (Table 15). Land activities (columns) for a tenure group were deleted from the matrix when the specific tenure arrangement was not being considered.

The activities that specified alternatives for land use were INITLA (for the owner-operator), UNIMLR (for the renter), and LALOLA (for the tenant-landlord). For the owner-operator and tenant-landlord arrangements the initial land owned (INITLA and LALOLA) was fixed at 3,500 acres. The renter's land activity was unrestricted. Any amount of land could be rented during a year but once the land was leased (UNIMLR) it had to remain in the firm for the remaining years in the planning horizon. The equality row (TOLAOW) transferred the total

Table 15. Linear programming tableau specifying the land activities of the multiperiod model for year t and each tenure situation

Row codes	Coded activities related to total land operated					
	Owner-operator ^a		Renter ^b		Tenant-landlord ^c	
	INITLA _t	USOWLA _t	UNIMLR _t	LEASLA _t	LALOLA _t	SHARLA _t
TOLAOW _t	-1.0	1.0	-1.0	1.0	-1.0	1.0
RALAOW _t	-1.0		-1.0		-1.0	
IRRLAN _t	-.25		-.25		-.25	
OVERHD _t		-.73		-.60		-.73
SECURI _t		-x ^d		-6.53		-6.53
NETWOR _t		-x ^d		-6.53		-6.53
PEPREV _t		-6.53		-6.53		-6.53
REESEV _t		-157.21		-157.21		-157.21
ORDINC _t		1.76		.93		1.76
TAXINC _t		1.76		.93		
TX150L _t						1.295
TX150T _t						.465
TOLAOW _{t+1}		-1.0		-1.0		-1.0
PRETXINC		-1.76		-.93		
POSTXINC		-1.76		-.93		
50LANLOR						-1.295
50TENANT						-.465

^aThese columns were deleted from the matrix except when the full-equity owner-operator situation was considered.

^bThese columns were deleted from the matrix except when the complete renter situation was considered.

^cThese columns were deleted from the matrix except when tenant or landlord (50-50 tenant-landlord share) situation was considered.

^dCoefficient equals the appreciated value of land based on the formula $V = \$150 (1+.06)^t$ plus \$6.53; V (appreciated value), \$150 (initial value of land), .06 (appreciation rate), and t (year in the planning horizon).

acreage to an annual expense activity for each tenure group: USOWLA (owner-operator), LEASLA (land leased by renter), and SHARLA (land in tenant-landlord share arrangement). Land available for seepage irrigation was restricted to a maximum of 25 percent of total land (IRRLAN).

Annual land expense activities varied among tenure groups. For the full-equity owner-operator, all fixed costs were charged as a firm expense. The renter firm only paid \$.60 of the per acre overhead charges and \$.93 for depreciation of machinery and equipment. But the renter did pay a rental rate to the landowner based on real estate evaluation (REESEV). Under the tenant-landlord arrangement the firm paid all overhead and depreciation costs per acre except for real estate taxes and buildings and fencing depreciation which were incurred by the landlord. These land activities added to security (SECURI), net worth (NETWOR), personal property tax evaluation (PEPREV), and real estate tax evaluation (REESEV) rows for the firm. With the renter and tenant-landlord situations, land value was not counted in the firm's security or net worth. Increases in land value were fully attributed to the landowner's (owner-operator or landlord) net worth.

The size of the basic ranch acreage could be increased by purchasing land (Table 16). The two methods of purchasing land were PURLAC (cash buy) and PURLAL (loan basis). When land was purchased, it entered the total land activity (TOLAOW) and increased the land available for irrigation. Land purchasing activities were only relevant for the full-equity owner-operator and the landlord in the tenant-landlord arrangement.

The capital requirement for purchasing land with cash depended on the year bought since land increased in value at a rate of 6 percent per year. For tax purposes the only cost that could be charged against

Table 16. Linear programming tableau specifying the land purchasing and clearing activities of the multiperiod model for year t

Row codes	Coded activities related to adding grazing					
	t PURLAC	t PURLAL	t LACLEX	t LACLCA	t CLLATR	t IRLATR
TOLAOW $_t$	-1.0	-1.0				
RALAOW $_t$	-1.0	-1.0	1.0	1.0		
TRCLLA $_t$			-1.0	-1.0	1.0	
IRRLAN $_t$	-.25	-.25				1.0
IMPNIR $_t$					-1.0	
LBPINF $_t$			2.1	2.1		
RSLACL $_t$			33.93			
CAPITA $_t$	x^a	x^b	33.93	33.93		
SECURI $_t$		x^c				
NETWOR $_t$		x^c				
ORDINC $_t$			33.93			
TAXINC $_t$			33.93			
IRRLAN $_{t+1}$						-1.0
CAPITA $_{t+1}$		x^d				
SECURI $_{t+1}$		x^c				
NETWOR $_{t+1}$		x^c				
ORDINC $_{t+1}$	.30	x^e		3.39		
TAXINC $_{t+1}$	.30	x^e		3.39		
.						
.						
.						
CAPITA $_{t+n}$		x^d				
SECURI $_{t+n}$		x^c				
NETWOR $_{t+n}$		x^c				
ORDINC $_{t+n}$	.30	x^e		3.39		

Table 16 (Continued)

Row codes	Coded activities related to adding grazing					
	t PURLAC	t PURLAL	t LACLEX	t LACLCA	t CLLATR	t IRLATR
TAXINC _{t+n}	.30	x^e		3.39		
·						
·						
·						
CAPITA _{t+10}		x^d				
ORDINC _{t+10}	.30	x^e		3.39		
TAXINC _{t+10}	.30	x^e		3.39		
PRETXINC	-3.00	x^f	-33.93	-33.93		
POSTXINC	-3.00	x^f	-33.93	-33.93		

^aTotal cost of purchasing land for year t (Table 4).

^bOne-third of total cost of purchasing land.

^cTotal of unpaid loan.

^dPayment of principal plus interest on loan.

^eAnnual interest expense plus \$.30 for prorated closing cost for tax purposes.

^fTotal interest charge over life of loan plus \$3.00 for closing cost.

the beef firm was a \$3 per acre closing cost (legal fees). This cost was capitalized over 10 tax years. For land purchased under a 10-year loan, both the closing cost and the yearly interest charge were counted as a tax deductible expense. Thus, the total expense included in the objective function was closing cost plus total interest on the loan. Total net worth and available security were reduced each year by the total amount due on the loan. Once land entered the program it was counted in the USOWLA column (Table 15) as being fully owned.

Land was classed either as unimproved native range or improved pasture. Since all land in the initial resource situation was assumed to be unimproved native range, several alternatives were available for improving land. The first alternatives were basic land clearing requirements (Table 16). Two column activities were available for land clearing (LACLEX and LACLCA). Land-clearing costs were charged as a tax deduction on ordinary income (LACLEX) in amounts up to 25 percent of taxable income in a specific year, or a maximum of \$5,000. The row RSLACL constrained the activity to 25 percent of taxable income and the \$5,000 limit was imposed on the column by an upper bound of 147.25 acres ($147.25 \times \$33.39 = \$5,000$). Any land-clearing costs that exceeded the direct expense deduction allowance were handled as capital assets in the LACLCA activity (expense capitalized over 10 tax years).

Cleared land could either be grazed, planted in temporary grazing, or established as improved nonirrigated or irrigated permanent pasture. The CLLATR column and TRCLLA row allowed for transfers of cleared land. The IRLATR column transferred land available for irrigation through time (year t to year $t+1$).

Nonirrigated permanent pasture could be established on cleared land (Table 17). Acreages of irrigated pasture had to be transferred

Table 17. Linear programming tableau specifying improved pasture establishment activities of the multiperiod model for year t

Row codes	Coded activities related to establishing permanent pasture				
	t SEEPIR	t ESTBAH	t ESTPAN	t ESTPCI	t CONSEX
TRCLLA _{t}	1.0				
IRRLAN _{t}	1.0				
IMPNIR _{t}		1.0	1.0		
IMPIRR _{t}	-1.0			1.0	
GZP1NF _{t}		-.30	-.30	-.20	
GZP2MJ _{t}		-1.90			
GZP3JO _{t}					
LBP1NF _{t}		.80			
LBP2MJ _{t}		1.40	1.60	5.80	
LBP3JO _{t}			1.70	2.50	
CONSER _{t}	-20.00	-7.60	-19.47	-27.52	1.0
RSCSEX _{t}					1.0
CAPITA _{t}	47.14	29.13	41.00	67.27	
ORDINC _{t}		21.53	21.53	39.75	1.0
TAXINC _{t}		21.53	21.53	39.75	1.0
TRBAHG _{$t+1$}		-1.0			
TRPANG _{$t+1$}			-1.0		
TRPCVI _{$t+1$}				-1.0	
.					
.					
TRBAHG _{$t+n$}		-1.0			
TRPANG _{$t+n$}			-1.0		
TRPCVI _{$t+n$}				-1.0	
.					
.					
TRBAHG ₁₅		-1.0			
TRPANG ₁₅			-1.0		
TRPCVI ₁₅				-1.0	
PRETXINC		-21.53	-21.53	-39.75	-1.0
POSTXINC		-21.53	-21.53	-39.75	-1.0

through the seepage irrigation activity (SEEPIR) before it could be established as permanent pasture (ESTPCI). The seepage irrigation system consisted of capital improvements such as ditching, wells, pumps, etc. A \$20 per acre cost of leveling and ditching was included as conservation expenses. Part of the expenses for establishing the three types of permanent pasture were charged as conservation expenses. The equality row (CONSER) accumulated the conservation expenses and they were charged to the firm by means of the conservation column (CONSEX). During the year of establishment the improved pasture required labor and furnished some grazing. These establishment requirements were only for one year in the planning horizon. Pasture acreage established in year t was transferred to an annual pasture maintenance activity for each remaining year of the planning period ($t+1, t+2, \dots, t_{15}$).

The annual maintenance activities for improved permanent pasture are presented in Table 18. Once pasture was established, several alternative levels of maintenance (fertilization) were available each year. For example, established bahiagrass pasture (ESTBAH) had maintenance alternatives of medium fertilization (MTBAMF), high fertilization (MTBAHF), or no maintenance (IDLEBA). The established acreage could be allocated in any proportion in any year by the transfer row (TRBAHG). Each maintenance activity increased available grazing (e.g., row GZPINF) and required labor according to the type of pasture and level of fertilization. Improved pasture increased the landowner's capital asset value (SECURI and NETWOR). All expenses related to maintenance were allowed as taxable deductions for the beef firm. The irrigated pasture activities (MPCIHF and IDLPCI) included overhead expenses (OVERHD) for taxes, insurance, and annual repairs on the irrigation system. Overhead was

Table 18. Linear programming tableau specifying the improved nonirrigated and irrigated permanent pasture activities of the multiperiod model for year t

Row codes	Coded activities related to maintenance of permanent pasture										IDLPCI _{t}
	MTBAMF _{t}	MTBAHF _{t}	IDLEBA _{t}	MTPAMF _{t}	MTPAHF _{t}	PARYEG _{t}	PANHAY _{t}	IDLEPA _{t}	MPCIHf _{t}		
TRBAHG _{t}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
TRPANG _{t}											1.0
TRPCVI _{t}									1.0		1.0
GZPINF _{t}	-.50	-.80	-.48	-.50	-.80	-3.70	-6.50	-.48	-1.60		-.48
GZP2MJ _{t}	-3.0	-3.60	-.48	-2.70	-3.50	-3.80	-2.50	-.48	-4.70		-.48
GZP3JO _{t}	-2.5	-3.50	-.48	-3.10	-3.90	-3.00	-2.00	-.48	-4.00		-.48
LBPINF _{t}	.04	.04	.08	.43	.43	.08	3.51	.08	.70		.08
LBP2MJ _{t}	1.22	1.22	.02	.92	.92	2.01	.43	.02	1.10		.02
LBP3JO _{t}	.04	.13		.04	.13	1.71	1.01		.50		
OVERHD _{t}									-1.31		-.37
CAPITA _{t}	18.36	27.63	.13	18.46	27.82	45.12	44.86	.13	16.94		.13
SECURI _{t}	-45.00	-45.00	-45.00	-45.00	-45.00	-45.00	-45.00	-45.00	-55.00		-55.00
NETWOR _{t}	-45.00	-45.00	-45.00	-45.00	-45.00	-45.00	-45.00	-45.00	-55.00		-55.00
ORDINC _{t}	18.36	27.63	.13	18.46	27.82	45.12	44.86	.13	20.42		3.61
TAXINC _{t}	18.36	27.63	.13	18.46	27.82	45.12	44.86	.13	20.42		3.61
PRETXINC	-18.36	-27.63	-.13	-18.46	-27.82	-45.12	-44.86	-.13	-20.42		-3.61
POSTXINC	-18.36	-27.63	-.13	-18.46	-27.82	-45.12	-44.86	-.13	-20.42		-3.61

less for idle irrigated pasture (IDLPCI) because no repair costs were charged. Annual depreciation on the irrigation system (\$3.48 per acre) was included in the objective functions but not in the capital row. An upper bound of 300 acres was set on the Pangola digitgrass pasture grazed and cut for hay (PANHAY).

Cleared land that was not established in permanent pasture was either grazed as cleared land (GZCLLA) or grazed as temporary pasture (RYEGTM). Acreage not cleared remained in the graze native land activity (GZNALA). These three activities, hay buying (BUYFOR), and fixed cost (FIXCOS) activities are shown in Table 19.

Financial components.--The labor purchasing, capital borrowing, and capital transfer activities are given in Table 20. Labor requirements were separated into three periods to correspond to the production periods for beef herds. When labor requirements for any period exceeded 900 hours, labor could be purchased at a cost of \$1.85 per hour. Capital could be borrowed by two methods (BORCAP and BORCA3). The first method was to borrow capital one year (t) and repay it the next year ($t+1$) with the interest charged as a firm expense. The other method (BORCA3) was to assume a three-year loan. Annual interest charges were deducted as taxable expenses each year of the loan and the total loan was repaid the third year ($t+3$). Total capital borrowing was restricted by the security row (SECURI) with \$2 of security backing required for each dollar borrowed. Excess capital could be transferred from year t to year $t+1$ through the capital transfer activity (CAPTRA).

Personal property taxes (PEPRTX) and real estate taxes (REESTX) were considered as separate activities because they were taxed at different rates (Table 21). Personal property taxes on livestock, machinery,

Table 19. Linear programming tableau specifying the hay purchasing, paying overhead, temporary grazing, and unimproved grazing activities of the multiperiod model for year t

Row codes	Coded activities related to forage systems and overhead				
	t BUYFOR	t GZNALA	t GZCLLA	t RYEGTM	t FIXCOS
RALAOW $_t$		1.0			
TRCLLA $_t$			1.0		
IMPNIR $_t$				1.0	
GZPINF $_t$	-7.5	-.28	-.36	-4.3	
GZP2MJ $_t$		-.38	-.46	-3.9	
GZP3JO $_t$		-.32	-.40		
LBPINF $_t$		.08	.08	.14	
LBP2MJ $_t$		.02	.02	.07	
LBP3JO $_t$				2.15	
OVERHD $_t$					1.0
CAPITA $_t$	75.00	.13	.13	35.57	1.0
SECURI $_t$			-30.00	-30.00	
NETWOR $_t$			-30.00	-30.00	
ORDINC $_t$	75.00	.13	.13	35.57	1.00
TAXINC $_t$	75.00	.13	.13	35.57	1.00
RALAOW $_{t+1}$		-1.0			
TRCLLA $_{t+1}$			-1.0	-1.0	
PRETXINC	-75.00	-.13	-.13	-35.57	-1.00
POSTXINC	-75.00	-.13	-.13	-35.57	-1.00

Table 20. Linear programming tableau specifying labor purchasing and capital borrowing activities of the multiperiod model for year t

Row codes	Coded activities related labor and capital					
	t LABEP1	t LABEP2	t LABEP3	t BORCAP	t BORCA3	t CAPTRA
LBPINF $_t$	-1.0					
LBP2MJ $_t$		-1.0				
LBP3JO $_t$			-1.0			
CAPITA $_t$	1.85	1.85	1.85	-1.0	-1.0	1.0
SECURI $_t$				2.0	2.0	
NETWOR $_t$				1.0	1.0	1.0
ORDINC $_t$	1.85	1.85	1.85			
TAXINC $_t$	1.85	1.85	1.85			
CAPITA $_{t+1}$				1.08	.08	-1.0
SECURI $_{t+1}$					2.0	
NETWOR $_{t+1}$					1.0	
ORDINC $_{t+1}$				.08	.08	
TAXINC $_{t+1}$				.08	.08	
CAPITA $_{t+2}$					.08	
SECURI $_{t+2}$					2.0	
NETWOR $_{t+2}$					1.0	
ORDINC $_{t+2}$					.08	
TAXINC $_{t+2}$					.08	
CAPITA $_{t+3}$					1.08	
ORDINC $_{t+3}$					.08	
TAXINC $_{t+3}$					.08	
PRETXINC	-1.85	-1.85	-1.85	-.08	-.24	
POSTXINC	-1.85	-1.85	-1.85	-.08	-.24	

Table 21. Linear programming tableau specifying property tax and certain fixed activities of the multiperiod model for year t

Row codes	Coded activities related to property taxes and fixed nonbranch items							
	t PEPRTX	t REESTX ^a	t PYLEAS ^b	t TXRINC	t LOSITI	t FAMCON	t OTHINC	
RSLACL _{t}								
CAPITA _{t}	.0035	.01	.02			1.0	-1.0	
CAP50L _{t}	.0018	.01				1.0	-1.0	
CAP50T _{t}	.0018					1.0		
PEPREV _{t}	1.0							
REESEV _{t}		1.0	1.0					
ORDINC _{t}	.0035	.01	.02					
RANINC _{t}	.0035	.01	.02	1.0	-1.0			
RANLOS _{t}	.0035	.01	.02	1.0	-1.0			
TAXINC _{t}	.0035	.01	.02				-1.0	
TX150L _{t}	.0018						-1.0	
TX150T _{t}	.0018							
PRETXINC	-.0035	-.01	-.02				1.0	
POSTXINC	-.0035	-.01	-.02				1.0	
50LANLOR	-.0018	-.01					1.0	
50TENANT	-.0018							

^aColumn deleted from matrix when the renter organization was optimized (effective only for landowner in the owner-operator and tenant-landlord situations).

^bColumn deleted from matrix when owner-operator or tenant-landlord organizations were optimized. Rental rate coefficient reduced to .0162 for low rent situation.

and equipment were considered as ordinary firm expenses. Real estate taxes were entirely the landowner's expense. Real estate taxes were a firm expense for the owner-operator, a landlord expense for the tenant-landlord situation, and were not considered in the complete renter situation except that taxes formed part of the charge for the land lease in the objective function. The renter paid an annual lease payment (PYLEAS) based on the landowner's real estate tax evaluation (REESEV).

The taxable ranch income activity (TXRINC) was used with the RSLACL row to restrict the land clearing cost that could be charged as a direct expense to a maximum of 25 percent of taxable ranch income. The ranch loss activity (LOSIT1) and the rows RANINC and RANLOS were required for the TXRINC activity to be feasible. The family consumption (FANCON) and nonranch income (OTHINC) activities were fixed with equality bounds at specified levels. Family consumption represents a withdrawal from the available capital supply and nonranch income added to available capital and taxable income.

The income tax payment row (TAXINC) and the accounting equality row (ACCEQU) shown in Table 22 allow the model to pay income taxes. The income tax paying activities are also shown in Table 22. In considering the capital and tax accounting rows, the following relations are required. Given the notation,

Y = total ordinary income from the ranch

CAGA = capital gains income from the ranch

EX = ranch expenses

$RY = Y + CAGA - EX$ = net ranch income

BC = borrowed capital

TC = capital transferred from previous year

T = income taxes

Table 22. Linear programming tableau specifying income tax paying activities of the multiperiod model for year t

Row codes	Coded activities related to taxable income levels										
	PYTX00 _t	PYTX04 _t	PYTX12 _t	PYTX20 _t	PYTX28 _t	PYTX36 _t	PYTX52 _t	PYTX76 _t	PTX100 _t	PTX200 _t	
CAPITA ^a _t		620	2,260	4,380	7,100	10,340	18,060	31,020	45,180	110,980	
CAP50L ^b _t		620	2,260	4,380	7,100	10,340	18,060	31,020	45,180	110,980	
CAP50T ^c _t		620	2,260	4,380	7,100	10,340	18,060	31,020	45,180	110,980	
TAXINC ^a _t		4,000	12,000	20,000	28,000	36,000	52,000	76,000	100,000	200,000	
TX150L ^b _t		4,000	12,000	20,000	28,000	36,000	52,000	76,000	100,000	200,000	
TX150T ^c _t		4,000	12,000	20,000	28,000	36,000	52,000	76,000	100,000	200,000	
ACCEQU _t	1	1	1	1	1	1	1	1	1	1	
POSTXINC		-620	-2,260	-4,380	-7,100	-10,340	-18,060	-31,020	-45,180	-110,980	
50LANLOR		-620	-2,260	-4,380	-7,100	-10,340	-18,060	-31,020	-45,180	-110,980	
50TENANT		-620	-2,260	-4,380	-7,100	-10,340	-18,060	-31,020	-45,180	-110,980	

^aOnly effective (constrained) for the owner-operator or renter situations.

^bOnly effective (constrained) when maximizing for landlord in the tenant-landlord situations.

^cOnly effective (constrained) when maximizing for tenant in the tenant-landlord situation.

C = family consumption capital

TY = total taxable income

TRY = taxable ranch income

A = personal tax exemptions and deductions

NRY = nonranch income

t = increment in time

f = progressive tax structure (see Table 9)

Then,

$$RY_t = Y_t + CAGA_t - EX_t$$

$$TRY_t = Y_t + 1/2 CAGA_t - EX_t$$

$$TY_t = TRY_t + NRY_t - A_t$$

$$T_t = f(TY)_t$$

Required linear programming specifications:

- (1) $CAPITA_t = - RY_t - NRY_t - BC_t - TC_t + C_t + 620 + \dots + 110,980 \leq 0$
- (2) $TAXINC_t = - TRY_t - NRY_t + {}_tPYTX00 + {}_tPYTX04 + \dots + {}_tPYT200 \geq - A_t$
- (3) $ACCEQU_t = \dots + 1 + 1 + \dots + 1 = 1$
- (4) $POSTXINC = RY_t + NRY_t - 620 - \dots - 110,980 (N) \text{ Max.}$

Equation (1) represents the capital activity of the model. Equation (2) requires the organization to pay income taxes when taxable income exceeds A (allowable personal exemptions and deductions). The ACCEQU equation (3) restricts the tax paying activities to the required amounts. After-tax income (POSTXINC) for year t is represented by equation (4).

Summary

The presentation of this chapter emphasized structuring a beef cattle firm as a workable multiperiod linear programming model.

Assumptions and activities of the model were developed to realistically portray a typical beef cattle firm. A focal interest was to maximize after-tax income considering specified tax regulations pertaining to a farm business and alternative tenure arrangements.

CHAPTER IV
OPTIMAL PRODUCTION ORGANIZATION FOR
ALTERNATIVE TENURE ARRANGEMENTS

This chapter presents the results from applying the decision model with the initial ranch conditions and three tenure situations. These basic situations assumed zero nonranch income for the owner-operator, renter, or tenant-landlord arrangements. The objective function was to maximize after-tax income for each individual. The assumptions of the model were presented in detail in Chapter III. These assumptions must be kept in mind when interpreting the results. Detailed information for each of the optimal ranch organizations is presented in the Appendix. Optimal organizations for the three tenure situations are compared and variations in ranch organizations due to tenure arrangements are emphasized.

Owner-Operator Situation

The optimal solution for the owner-operator situation is presented in Tables 23 and 46. All resources were owned by the operator and he received all of the net ranch income. He furnished 2,700 hours of labor annually to the ranch.

Livestock Enterprises

The number of brood cows in the cow-calf herd ranged from 462 head during the second year to a high of 613 head for the thirteenth year and then decreased to 500 head the last year of the organization.

Table 23. Enterprise combinations, resource allocations, and net returns for a full-equity owner-operator ranch organization

Year	Brood cows		Weaned calves		Pastureland ^a		Labor hired	Operating capital requirement ^b	Net returns ^c
	Total	Culled	Heifers kept	Sold	Feeders	Native				Nonirrigated	Improved
			head			acres	hours	dollars	
1	500	90	125	275	0	3,000	1,147	69,290	-5,058
2	462	83	143	142	85	2,966	806	53,608	-23,841
3	491	85	100	0	293	2,946	913	47,623	-22,736
4	532	96	98	89	238	2,946	1,098	77,523	15,559
5	524	94	125	0	294	2,946	1,088	74,235	919
6	515	93	80	65	267	2,946	1,120	73,367	14,732
7	533	96	136	4	287	2,946	1,117	52,521	5,445
8	505	91	81	44	279	2,946	1,122	68,300	11,774
9	537	96	151	25	253	2,946	1,110	52,595	9,534
10	509	92	60	122	225	2,946	1,032	50,763	15,204
11	554	99	218	138	87	2,946	880	47,412	15,902
12	503	90	60	306	36	2,946	686	44,600	15,114
13	613	111	60	360	71	2,946	685	45,079	16,813
14	551	99	60	323	57	2,946	521	41,756	19,307
15	500	90	60	340	70 ^d	2,946	297	50,743	21,430
							Total		110,098

^aOwned land totaled 3,500 acres. Acreage of grazed cleared land is not shown but equals 176 acres the first year.

^bTotal of cash expenses, repayment of borrowed capital, income taxes, and family consumption.

^cNet ranch income minus Federal income taxes. Minus sign indicates a loss or negative income.

^dThese 70 stocker steers were purchased.

Cows were culled to the maximum allowed (18 percent of mature cows) in most years. The number of bulls required varied from 20 to 27 depending on the number of cows.

The only way to increase herd size or replace culled cows was with heifer calves kept from the weaned calf crop. Thus, in some years a substantial number of heifer calves were kept for the cow herd. This number varied from a high of 218 calves the eleventh year to the minimum of 60 head for several of the latter years. Weaned calves sold varied from zero to a maximum of 360 head in the 13th year. In general, more calves were kept for growth of the herd during the first half of the 15-year planning horizon.

The alternatives for steer calves, and for heifer calves that did not go into the brood cow herd, were sell as weaned calves or sell as feeders after an additional six months on grazing. Feeder numbers reached a peak of 294 head during the fifth year. Feeders gained 225 pounds during the six months on grazing (October through March). Stocker steers were purchased only during the last year of the planning period. Seventy stocker steers were bought to utilize the excess grazing that occurred during the months April through September from the reduction in the brood cow herd.

Land Activities

Initial land owned was 3,500 acres of native range and no additional land was purchased by the rancher during the planning period. Of the total acres operated, 554 acres were cleared and established in improved pasture. Five hundred acres of this land were cleared the first year with the expense capitalized over 10 years. Three hundred acres of improved nonirrigated pasture and 254 acres of seepage

irrigated pastures were established by the third year of the planning period. Thus, 2,946 acres of unimproved native range were also used for grazing the beef herd.

Improved nonirrigated pasture was completely planted in perennial grass with no temporary grazing. The perennial grass was used for grazing, with haymaking in the fall. Some of the nonirrigated pasture was idle during the latter part of the planning period, depending on the grazing requirement for the year. For example, during the fourteenth year 188 acres were maintained for grazing and haymaking and 112 acres were not maintained (idle). The 254 acres of irrigated pasture were maintained at a high fertilization level for the entire planning period. One hundred and fifty tons of hay were purchased only during the first year to meet the feed requirements of the herd. Total feed requirements for the remaining years were supplied by native range and improved pastures.

Labor Activities

Labor requirements were separated into three periods within a production year. The operator had available 900 hours of his labor in each period. Additional labor requirements could be met with hired labor.

Total hours of hired labor are presented in Table 23. Most hired labor was required during Period I (November-February) for haymaking, feeding, repairing fences, etc. Hired labor was needed only during the first two years for the March to June period (approximately 500 hours each year). This extra labor was used mainly for the establishment of improved pasture.

The operator's labor was utilized at the maximum of 900 hours during Period I for every year of the organization. An excess of operator labor occurred for the other two production periods in years three through fifteen. The amount of unutilized operator's labor never exceeded 300 hours during either of these four month production periods.

Financial Components

Soil and water conservation expenses total \$17,904 for the first three years of the organization. Overhead expenses were \$2,888 each year. This fixed expense included insurance premiums and other miscellaneous costs. Personal property taxes on livestock and equipment ranged from \$425 to \$528 per year. Real estate taxes remained constant at \$5,502 per year. This included taxes on the land, fences, and buildings required for the beef enterprises. Four sources of depreciation occurred: depreciation on bulls (\$1.96 per brood cow), equipment (\$.93 per acre of total land), land improvements (\$.83 per acre of total land), and irrigation system (\$3.48 per acre of irrigated land). Total annual depreciation charges ranged from \$7,140 to \$8,245.

Total operating capital requirements included total cash expenses, repayment of borrowed capital, payment of income taxes, and family consumption. Total operating capital requirements reached a peak of \$77,523 during the fourth year. Slightly more than \$23,000 was borrowed for both the first and second years of the ranch operation. This borrowing activity was needed since small amounts of capital were generated from livestock sales. During these years a large number of the heifer calves were kept for the cow herd. After the seventh year no capital was borrowed since internally generated capital met all operating capital requirements. During the tenth year, the ranch firm

began to accumulate operating capital in excess of requirements and depreciation allowances. By the end of the fifteenth year \$29,915 of excess operating capital had been accumulated.

Total net worth of the ranch was \$653,006 in the beginning year. This included 500 brood cows, 3,500 acres of unimproved native rangeland with buildings and fences, and a complement of machinery and livestock equipment. Considering the additional value for each acre of improved pasture and a 6 percent annual appreciation value for all land, the net worth of the ranch organization increased to \$1,439,468 in the fifteenth year. This represented an average annual increase in net worth of \$52,430.

Net ranch income before taxes totaled \$117,478 for the 15 years. Total sales of weaned and feeder calves less production expenses resulted in an income loss of \$123,345 for the 15 years. However, when receipts from culled cows were added to returns, net ranch income was \$117,478. This represented an average before-tax income of \$7,832 per year. The after-tax income for the owner-operator totaled \$110,098, or an average of \$7,340 per year. Annual incomes ranged from a \$23,841 loss for the second year to an after-tax income of \$21,430 for the last year of the planning period (Table 23).

None of the depreciation allowance for buildings and improvements was assumed to be reinvested. Under this assumption the total capital accumulation was \$86,750 and total available cash for the rancher was \$166,933, or an average of \$11,129 per year. The ranch operation provided the rancher and his family with at least \$5,000 each year for personal consumption and an additional \$30,000 during the 15-year period for personal use.

Renter Situations

Two renter situations with different rental rates for land were analyzed. The first situation was based on an annual lease rate of \$2.55 per acre. This lease rate was composed of charges for real estate taxes, depreciation on buildings and fences, and insurance and miscellaneous expenses (Tables 24 and 47). For the second situation (Tables 25 and 48), an additional \$.60 per acre was paid to the landowner for a total lease rate of \$3.15 per acre.

In the following sections comparisons are made for the two optimal ranch organizations when the objective was maximization of after-tax income of the renter. The renter furnished all resources except land and received all of the net returns from the ranching operation. His full-time labor was available for use on the ranch.

Livestock Enterprises

Both renting situations initially started with 500 brood cows. The low land-rent situation resulted in a few more cows being maintained each year of the planning period. For example, the low land-rent organization included 39 more cows in the ninth year and 11 more cows in the thirteenth year. In both situations cows were culled to the maximum number allowed each year.

Heifer calves kept for replacement and expansion of the cow herd varied from a low of 60 head to a high of 190 to 194 head for the renter situations. A major difference occurred in the years that heifer calves were kept. For the first year 122 heifers were kept for the low land-rent situation, but only 60 heifers were kept for the high land rent situation. More of the calves were sold by the high land

Table 24. Enterprise combinations, resource allocations, and net returns for ranch organization for a complete renter (paying \$2.55 annual rent per acre)^a

Year	Brood cows		Weaned calves		Pastureland ^b		Labor hired	Operating capital requirement ^c	Net returns ^d		
	Total	Culled	Heifers kept	Sold	Native	Improved					
						Nonirrigated				Irrigated	
-----head-----acres-----hours-----dollars-----											
1	500	90	122	278	0	3,025	208	139	1,244	75,058	-6,658
2	462	83	139	71	182 ^e	2,974	278	248	876	53,681	-31,448
3	489	88	110	0	281	2,974	295	255	938	67,333	-13,642
4	526	95	90	78	253	2,974	296	255	1,093	72,506	12,091
5	528	95	136	0	287	2,974	296	255	1,101	81,456	2,920
6	511	92	73	77	259	2,974	296	255	1,104	79,835	14,751
7	541	97	139	20	274	2,974	296	255	1,099	54,930	6,371
8	505	91	85	43	276	2,974	296	255	1,105	76,461	9,754
9	539	97	130	55	246	2,974	296	255	1,096	61,882	12,296
10	515	93	103	123	185	2,974	296	255	974	52,452	15,294
11	539	97	194	189	48	2,974	296	255	797	51,867	15,664
12	532	96	60	322	44	2,974	296	255	682	47,224	12,178
13	613	111	60	365	66	2,974	296	255	685	48,330	18,074
14	551	99	60	260	120	2,974	296	255	594	56,660	12,466
15	500	90	60	340	85 ^e	2,084	207	255	379	57,040	27,310
									Total		107,421

^aRenter furnished all resources except land, buildings, and fences. Paid landowner \$2.55 per acre (equal to landowner's expenses).

^bLeased a total of 3,525 acres. Acreages of grazed cleared land are not shown but equal 153 acres the first year, 25 acres the second year, and one acre the third year.

^cTotal of cash expenses, repayment of borrowed capital, income taxes, and family consumption.

^dNet ranch income minus Federal income tax. Minus sign indicates a loss or negative income.

^eSteers were purchased the second (22 head) and fifteenth (85 head) years.

Table 25. Enterprise combinations, resource allocations, and net returns for ranch organization for a complete renter (paying \$3.15 annual rent per acre)^a

Year	Brood cows		Weaned calves			Pastureland ^b			Labor hired	Operating capital requirement ^c	Net returns ^d
	Total	Culled	Heifers kept	Sold	Feeders	Native	Improved				
							Nonirrigated	Irrigated			
-----head-----acres-----hours-----dollars-----											
1	500	90	60	340	0	2,825	134	132	1,064	71,867	3,137
2	462	83	185	91	130 ^e	2,773	229	255	860	63,773	-29,924
3	429	77	100	0	243	2,773	283	264	729	59,532	-24,672
4	522	94	114	82	221	2,773	288	264	1,006	73,693	6,855
5	515	93	82	104	226	2,773	288	264	970	86,698	8,175
6	524	94	139	8	271	2,773	288	264	1,037	84,692	-744
7	500	90	72	85	243	2,773	288	264	1,044	69,960	12,657
8	536	96	125	55	249	2,773	288	264	1,035	76,907	6,823
9	500	90	109	20	271	2,773	288	264	1,047	84,391	2,794
10	522	94	105	109	204	2,773	288	264	1,030	55,100	15,406
11	524	94	190	177	52	2,773	288	264	802	63,948	15,442
12	522	94	69	326	22	2,773	288	264	647	72,973	12,026
13	602	108	60	387	35	2,773	288	264	620	48,344	16,642
14	550	99	60	308	72	2,773	288	264	510	44,747	12,466
15	500	90	60	340	67 ^e	2,773	288	264	330	52,984	21,430
Total											78,513

^aRenter furnished all resources except land, buildings, and fences. Paid landowner \$3.15 per acre (\$.60 per acre above landowner's expenses).

^bLeased a total of 3,325 acres. Acreages of grazed cleared land are not shown but equal 234 acres the first year, 68 acres the second year, and five acres the third year.

^cTotal of cash expenses, repayment of borrowed capital, income taxes, and family consumption.

^dNet ranch income minus Federal income tax. Minus sign indicates a loss or negative income.

^eSteers were purchased the second (37 head) and fifteenth (67 head) years.

rent rancher during the beginning of the planning period since larger operating capital requirements were necessary. Some additional stockers were purchased by both optimal organizations during the second and fifteenth years. Purchased stockers utilized grazing the second year before maximum expansion of the breeding herd and the fifteenth year with the reduction in size of the breeding herd.

Land Activities

In the low land-rent situation 200 more acres of native rangeland was rented than for the high land-rent situation. No restrictions were placed on the acreage of land that could be leased, but once the acreage was brought into the optimal organization it had to remain for the duration of the planning period.

In both situations approximately 550 acres of land were cleared. The low land-rent organization included a maximum of 296 acres of non-irrigated pasture compared to 288 acres for the high land-rent situation. The high land-rent situation included a few more acres of irrigated pasture. The low land-rent organization grazed a total of 2,974 acres of native pasture and 551 acres of improved pasture. For the high land-rent situation 2,773 acres of native range and 552 acres of improved pasture were grazed. Nonirrigated pasture was used for grazing and hay-making. Cattle were grazed on the improved pasture from March to October and then in later months the pasture was cut for hay.

Labor Activities

The high land-rent organization generally required less hired labor than the low land-rent organization. This was primarily due to the smaller acreage operated and fewer cows in the herd. The high land

rent ranch hired 1,064 hours of labor during the first year as compared to 1,244 hours for the other organization (Tables 24 and 25). This difference in hired labor requirements resulted from more improved pasture being established during the first year on the low land-rent organization. Additionally, more heifer calves were kept for inclusion in the herd.

Operator's labor was fully utilized during the November through February production period for both rent situations. The majority of hired labor was needed for this production period.

Financial Components

Soil and water conservation expenses were nearly equal for the two renting situations. The high land-rent firm incurred \$233 more than the \$17,883 paid by the low land-rent firm for soil and water conservation. This difference was due to the high land-rent firm establishing nine more acres for seepage irrigation than the 255 acres established by the low land-rent firm. The total capital outlay for establishing an acre for seepage irrigation was \$114.41 as compared to \$41 for nonirrigated perennial grass pasture. With seepage irrigation, \$47.52 of the capital required was deducted as a conservation expense, \$49.75 as a direct expense, and the remaining \$17.14 was capitalized for yearly depreciation. For one acre of nonirrigated pasture the capital requirement equaled \$41 with \$19.47 included for soil and water conservation and the remaining \$21.53 charged as a direct expense.

Annual overhead expenses were less for the high land-rent organization because of the smaller acreage leased. The overhead or fixed charge included \$.60 per acre for all land in the ranch plus \$1.31 for each acre of irrigated pasture maintained and \$.37 per acre for idle irrigated land.

In most years the personal property tax for the high land-rent ranch was less because of a smaller number of brood cows and replacement heifers in the inventory at the beginning of the year. Personal property was taxed at an annual rate of 3.5 mills. Thus, a cow valued at \$197 contributed \$.70 to the tax bill. Even with a smaller acreage, the high land-rent ranch paid a larger gross sum for rent, (\$10,456 annually as compared with \$8,977 annually for the low land-rent firm).

Allowable sources of depreciation for the renter were bulls, the irrigation system, machinery, and equipment. Depreciation was always greater for the low land-rent organization. The largest amount of depreciation occurred in the thirteenth year for each organization. Irrigated acreage accounted for \$887 of yearly depreciation for the low land-rent organization as compared with \$919 for the high land rent firm.

The high land-rent firm borrowed a larger quantity of capital for more years in the planning horizon. Capital was borrowed through the ninth year as compared with the seventh year for the other organization. The high land-rent firm did not accumulate any capital in excess of family consumption requirements. The low land-rent firm had accumulated \$24,995 over consumption needs by the end of the fifteenth year.

The final net worth of both renters was nearly the same (approximately \$128,000) since both organizations were required to have 500 brood cows in the ending inventory for the fifteenth year. Variations in net worth during the planning period occurred with different amounts of borrowed capital and different livestock inventories. The additional value of improved pastureland contributed to the net worth of the landowner but not to the renter. Improved nonirrigated land

added \$45 to the base value of an acre of unimproved land and irrigated land added \$55 per acre. The value of land to the landowner receiving high rent increased from \$541,965 to \$1,222,784 over the 15-year period. The landowner receiving low rent increased his net worth from \$577,480 to \$1,294,547.

Net ranch income before taxes for the low land-rent firm was \$114,476 as compared to \$82,792 for the high land-rent firm over the 15-year period. This represented a difference of \$31,684 but the high land-rent firm only paid \$22,185 more in lease payments. With the higher rental rate, more yearly operating capital was required for the operation and thus, more money was borrowed with associated interest charges. After-tax incomes are shown in Tables 24 and 25 and averaged \$7,161 annually for the low land-rent firm and \$5,234 annually for the high land rent firm. These were net returns to the renters for their labor, investment capital, risk, and management. The high land-rent firm barely covered family consumption requirements of \$5,000 per year. The only depreciation allowance that might not have been reinvested was for the irrigation system. This would have added \$887 and \$919 annually to the available cash for the low rent firm and the high rent firm, respectively.

The two land rental rates showed definite organizational differences. When the rental rate was equal to the fixed cost of owning land (low rate), the optimal ranch organization was very similar to the owner-operator situation. With an additional \$.60 per acre rental charges for land, the total land leased decreased from 3,525 acres to 3,325. The same number of acres was improved but the high land-rent firm established a larger acreage of irrigated pasture to provide for the forage requirements of the herd.

Tenant-Landlord Situations

Under the tenant-landlord arrangement, the tenant provided his full-time labor and the landlord furnished land, building, and fences for the beef firm. All other costs and returns were shared on a 50-50 basis. The landlord was assumed to own 3,500 acres of rangeland and the ranch organization began with 500 brood cows and was required to maintain 500 brood cows the fifteenth year. Thus, no additional income could be attributed to a liquidation of the brood cow inventory.

This section compared two optimal solutions: maximization of the tenant's after-tax income (Tables 26 and 49) and maximization of the landlord's after-tax income (Tables 27 and 50). The tenant's objective function included 50 percent of the net ranch returns not including the landlord's direct land expense. The landlord received 50 percent of the net returns but he had to incur the annual land expense (\$8,407 per year) due to real estate taxes and depreciation on buildings and fences.

The ranch firm was the tenant's only source of income. Non-ranch income for the landlord was set at \$5,000 per year. Family consumption for the tenant or landlord was not considered in total operating capital requirements of the ranch firm.

Livestock Enterprises

In general, the livestock enterprises were similar over all years of the planning period whether after-tax income was initially maximized for either the tenant or the landlord. The only large difference that occurred was in the thirteenth year. When the tenant's after-tax income was initially maximized, 582 brood cows were in the herd for the thirteenth year as compared to 526 brood cows when the

Table 26. Enterprise combinations, resource allocations, and net returns for the 50-50 tenant-landlord ranch organization, maximizing tenant's income

Year	Brood cows		Weaned calves		Pastureland ^a			Labor hired	Operating capital requirements ^b	Net ranch income ^c	Tenant income ^d																																
	Total	Culled	Heifers kept	Sold	Feeders	Native	Improved																																				
							Nonirrigated					Irrigated																															
-----heads-----											-----acres-----											-----hours-----											-----dollars-----										
1	500	90	130	270	0	3,000	196	122	1,127	58,295	3,189	1,595																															
2	462	83	94	156	120	3,000	234	246	710	53,290	-12,062	-6,031																															
3	496	89	139	37	220	2,947	281	253	878	60,216	-3,820	-1,910																															
4	489	88	102	0	289	2,947	300	253	1,021	62,691	5,199	2,600																															
5	526	95	99	53	269	2,947	300	253	1,118	51,600	21,947	10,536																															
6	521	94	126	0	291	2,947	300	253	1,119	41,040	13,361	6,681																															
7	514	93	81	65	266	2,947	300	253	1,114	41,058	23,154	11,022																															
8	534	96	126	25	276	2,947	300	253	1,097	40,650	16,227	8,114																															
9	507	92	100	14	292	2,947	300	253	1,121	41,123	15,376	7,688																															
10	528	95	115	55	252	2,947	300	253	1,114	40,961	22,654	10,833																															
11	520	93	164	110	143	2,947	300	253	960	37,853	24,016	11,388																															
12	529	95	86	236	100	2,947	300	253	831	36,162	24,144	11,452																															
13	582	105	60	282	123	2,947	300	253	794	35,731	24,962	11,861																															
14	551	99	60	264	117	2,947	300	253	667	32,535	28,712	13,333																															
15	500	90	60	340	79 ^e	2,947	300	253	376	38,225	39,703	17,592																															
										Total	246,762	116,754																															

^aTotal of 3,500 acres. Acreages of grazed cleared land are not shown but equal 182 acres the first year, 20 acres the second year, and 19 acres the third year.

^bTotal of cash expenses and repayment of borrowed capital.

^cNet ranch income to be divided 50-50. Landlord furnished land, buildings, and fences and tenant provided his full-time labor. Minus sign indicates a loss or negative income.

^dTenant's share of net ranch income minus individual Federal income taxes.

^eThese 79 steers were purchased.

Table 27. Enterprise combinations, resource allocations, and net returns for the 50-50 tenant-landlord ranch organization, maximizing landlord's income

Year	Brood cows		Weaned calves			Pastureland ^a			Labor hired	Operating capital requirements ^b	Net ranch income ^c	Landlord income ^d
	Total	Culled	Heifers kept	Sold	Feeders	Native	Improved					
							Nonirrigated	Irrigated				
-----dollars-----												
1	500	90	125	275	10 ^e	3,000	143	123	1,060	57,485	6,145	-5,334
2	462	83	88	170	111	3,000	225	239	706	51,968	-11,096	-13,955
3	491	88	146	43	203	2,948	268	250	826	58,699	-3,736	-10,275
4	479	86	90	24	269	2,948	300	252	953	60,685	5,373	-5,720
5	525	95	129	0	291	2,948	300	252	1,118	50,817	13,611	-1,601
6	509	92	82	50	276	2,948	300	252	1,121	41,126	21,473	2,330
7	533	96	127	19	281	2,948	300	252	1,117	41,020	16,714	-50
8	507	91	95	23	287	2,948	300	252	1,121	41,105	17,191	189
9	528	95	106	47	270	2,948	300	252	1,117	41,028	21,210	2,198
10	516	93	118	0	294	2,948	300	252	1,119	42,537	13,518	-1,648
11	517	93	105	55	253	2,948	300	252	1,113	40,949	22,629	2,908
12	529	95	133	152	137	2,948	300	252	938	37,516	30,961	7,074
13	526	95	60	285	75	2,948	300	252	703	33,404	30,918	7,052
14	550	99	60	335	45	2,948	300	252	512	29,525	31,294	7,240
15	500	90	60	340	66 ^e	2,948	300	252	280	34,497	30,517	6,852
									Total		246,722	-2,740

^aTotal of 3,500 acres. Acreages of grazed cleared land are not shown but equal 234 acres the first year, 36 acres the second year, and 34 acres the third year.

^bTotal of cash expenses and repayment of borrowed capital.

^cNet ranch income to be divided 50-50. Landlord furnished land, buildings, and fences and tenant provided his full-time labor. Minus sign indicates a loss or negative income.

^dLandlord's share of net ranch income minus additional land expense of \$8,407 per year. No Federal income taxes were paid (zero taxable income).

^eSteers were purchased the first (10 head) and fifteenth (66 head) years.

landlord's after-tax income was initially maximized. A higher percentage of weaned calves was sold during the early and latter years of the planning horizon.

Sales from weaned calves generated capital during the year calves were born; whereas, feeder calves added to the available capital the following year. Calves were weaned in October and feeders were sold the next April.

Land Activities

The initial acreage owned by the landlord was operated throughout the entire planning period for both optimal solutions. The landlord had the option of purchasing additional land during any of the fifteen years but no land was purchased. Thus, the tenant situation conformed to the initial 3,500 acres. If the tenant had not been restricted by the landlord's objective, he would have met all grazing requirements with unimproved rangeland. This type land had relatively little cost to the tenant since the landlord incurred all real estate taxes and depreciation on land improvements.

Both optimal organizations cleared approximately the same acreage of rangeland. Three hundred acres of improved nonirrigated perennial grass pasture were included in each solution, and 253 acres of irrigated pasture were established. The perennial grass pastures were used primarily for grazing and haymaking.

Labor Activities

The tenant's labor was available full-time. No labor was furnished by the landlord. Hours of hired labor were similar for both optimal organizations. Labor was hired during the November-February

period of each year. Costs of hired labor were included in the overall ranch expenses and shared equally among the tenant and landlord.

Financial Components

Little difference occurred in the ranch expenses for the tenant and landlord optimal solutions. Because of equal acreage and nearly the same brood cow numbers, overhead and personal property taxes were similar for each solution. Both solutions included an expenditure of approximately \$17,850 for soil and water conservation practices. The landlord in each solution paid \$5,502 yearly for real estate taxes. Annual depreciation charged to the firm or partnership included bulls, (\$1.96 per cow), equipment (\$.93 per acre of land operated), and irrigation system (\$3.48 per acre). Annual depreciation on buildings and fences (\$.83 per acre) was an additional expense for the landlord.

Operating capital requirements for the firm were less for the tenant-landlord arrangement than for the owner-operator situation. Family consumption required \$5,000 per year under the owner-operator arrangement. No capital for family consumption was required for the landlord in the tenant-landlord situation. Operating capital was borrowed during the first four years of the planning period for both the optimal tenant and landlord solutions. Unused operating capital was not transferred to later years in the tenant-landlord situations. Thus, when the annual capital generated by sales exceeded the operating capital requirement, the excess of operating capital was divided equally between the tenant and landlord.

Net worth of the firm at the end of the planning period was \$128,555 for both optimal solutions. This included 500 brood cows, 60 heifers, and a complement of machinery and equipment for 3,500 acres.

The program required that the tenant and landlord share equally in the starting net worth of 500 brood cows and the complement of equipment. The tenant had a very small increase in his share of the net worth, whereas the value of land (landlord's net worth) increased substantially. Based on the annual increase of 6 percent in the value of land and 550 acres of improved pastureland, land appreciated from an initial value of \$569,700 to \$1,285,575 at the end of the planning period. After-tax net ranch incomes for the optimal tenant and landlord solutions were \$246,762 and \$246,722, respectively, for the planning period. Thus, each partner received approximately the same amount of after-tax income (\$123,380) in each optimal solution. Approximately \$10,000 was ordinary income from sales of calves and \$236,000 was capital gains income from sales of culled cows.

The tenant's after-tax income totaled \$116,754 over the planning period, or an annual average of \$7,784. After considering family consumption of \$5,000 yearly, the tenant had accumulated \$41,754 as available cash at the end of the fifteenth year. Thus, with 50 percent of the firm's net worth (\$64,278) and his accumulated capital, the total ending net worth of the tenant was \$106,032.

The landlord's share of after-tax ranch income was \$123,365 for the optimal landlord situation. But with the annual \$8,407 additional expense for land ownership (\$5,502 for taxes and \$2,905 for depreciation), the landlord had a net ranch loss of \$2,740 over the 15 years. If the depreciation allowance had not been reinvested in fences and buildings, the available cash for the landlord's use would have been \$40,835. Ending net worth for the landlord was \$1,349,852, including 50 percent of the firm's net worth. This represented a 116 percent

increase in the value of the landlord's assets over the 15-year planning period.

Summary of the Optimal Tenure Arrangements

The optimal solutions for the basic owner-operator, renter, and tenant-landlord arrangements were consistently similar in terms of livestock numbers, acres of improved pastures, and labor requirements when the objective was maximum after-tax income for the individual. The programming model constrained the brood cow herd to a minimum of 500 head for the fifth through the fifteenth years. The largest number of brood cows (613 head) for any one year was included in the optimal organizations for the owner-operator and for the renter during the thirteenth year. More calves were kept as feeders for an additional six months during the middle part of the 15-year planning period. Increased amounts of grazing became available after initial establishment of improved pasture during the first three years of the planning period.

Basically, the same acreage of land was cleared and established in improved pasture for all tenure arrangements. The landowner did not increase his initial acreage by purchasing additional land in either the owner-operator or tenant-landlord situations. Land could have been purchased by cash or by a long-term loan. Cost of land was increased at an annual rate of 6 percent from the initial year value of \$150 per acre. No land restraints were placed on the renter in terms of acreage requirements, but the optimal solution was very close to the initial size of the owner-operator.

The tenant in the tenant-landlord arrangement received the highest after-tax income over the planning period when compared with

the owner-operator and renter situations. All ranch organizations provided a \$5,000 minimum family consumption income level for each year in the planning period.

CHAPTER V
OPTIMAL RANCH ORGANIZATION FOR VARIOUS
TAXABLE INCOME SITUATIONS

This chapter discusses the optimal ranch organization obtained for four levels of nonranch income. Nonranch income was considered only for the full-equity owner-operator situation and the landlord in the tenant-landlord situation. The complete renter and the tenant in the tenant-landlord situation acquired their income solely from the ranch operation. A landlord generally has a higher probability of some source of nonranch income. Due to federal tax regulations, the after-tax income for a landowner with nonranch income might not be maximum when an objective of maximizing the after-tax income produced by the ranch firm is used.

Comparisons are made between the full-equity owner-operator ranch organizations with varying levels of nonranch incomes. Landlord's returns are discussed when he takes no part in the firm (rents land out at a fixed rate) and when he assumes the role of a partner in the tenant-landlord arrangement.

Owner-Operator Situations

The full-equity owner-operator was considered as the basic ranch organization since this type of ranch firm was predominant in the study area [3]. Therefore, most of the computer runs were for this tenure situation. Six organizations for the owner-operator situation were run

as compared with two for the complete renter situation and three for the tenant-landlord arrangement.

Zero Nonranch Income

Two objective functions were considered for the owner-operator situation with zero nonranch income. These optimal ranch organizations are shown in Appendix Table 51 (maximizing before-tax net ranch income--PRETXINC--) and in Appendix Table 46 (maximizing after-tax income--POSTXINC--). The only difference between these objective functions was that income tax paying activities were deleted from the model when the before-tax income (PRETXINC) was maximized. Thus, no capital was required to pay income taxes for this situation.

Livestock enterprises.--Herd size remained nearly uniform for the PRETXINC situation whereas for the POSTXINC situation, it increased to 23 percent above initial herd size and culled cows were sold to reduce taxable income (Table 28). A larger percentage of the weaned calves were kept as feeders for the optimal PRETXINC situation. Selling of weaned calves dominated the POSTXINC organization during the early and late years of the planning horizon.

Land activities.--The improved pasture activities for the PRETXINC and POSTXINC situations were very similar (Table 29). The optimal before-tax organization cleared eight more acres than the optimal after-tax organization and this additional acreage was established in improved irrigated pasture. Three hundred acres of improved nonirrigated pasture were maintained for hay and grazing (PANHAY) by each situation. Each organization operated the initial 3,500 acres without any purchased land.

Table 28. Livestock numbers for full-equity owner-operator organizations when maximizing before-tax and after-tax incomes with zero nonranch income

Year	Maximizing before-tax income ^a			Maximizing after-tax income ^b		
	Brood cows	Weaned calves sold	Feeders	Brood cows	Weaned calves sold	Feeders
1	500	288	0	500	275	0
2	462	119	133 ^c	462	142	85
3	478	0	291	491	0	293
4	548	116	220	532	89	238
5	528	0	295	524	0	294
6	523	84	256	515	65	267
7	542	11	281	533	4	287
8	511	62	269	505	44	279
9	547	46	264	537	25	253
10	514	22	285	509	122	225
11	536	81	253	554	138	87
12	531	0	289	503	306	36
13	518	87	264	613	360	71
14	547	0	377	551	323	57
15	500	340	135 ^d	500	340	70 ^e

^aObjective function (PRETXINC) includes all activities (expenses and receipts) except income tax-paying activities were deleted from model.

^bObjective function (POSTXINC) includes payment of federal income tax.

^cFifty-three of these steers were purchased.

^dThese 135 steers were purchased.

^eThese 70 steers were purchased.

Table 29. Improved pasture acreage for full-equity owner-operator organizations when maximizing before-tax and after-tax incomes with zero nonranch income^a

Year	Maximizing before-tax income ^b			Maximizing after-tax income ^c		
	Acreage cleared	Improved pasture		Acreage cleared	Improved pasture	
		Nonirrigated	Irrigated		Nonirrigated	Irrigated
-----acres-----						
1	500	186	154	500	199	125
2	35	281	254	34	291	243
3	27	300	262	20	300	254
4	0	300	262	0	300	254
5	0	300	262	0	300	254
6	0	300	262	0	300	254
7	0	300	262	0	300	254
8	0	300	262	0	300	254
9	0	300	262	0	300	254
10	0	300	262	0	300	254
11	0	300	262	0	300	254
12	0	300	262	0	300	254
13	0	300	262	0	300	254
14	0	300	262	0	300	254
15	0	300	262	0	300	254

^aTotal of 3,500 acres operated for each organization. Native unimproved pasture grazed equaled acres operated minus total improved acreage.

^bObjective function (PRETXINC) includes all activities (expenses and receipts), except income tax-paying activities were deleted from model.

^cObjective function (POSTXINC) includes payment of federal income tax.

Financial components.--Since the tax-paying activities were deleted from the model when maximizing before-tax income, taxable income was calculated and income taxes were paid according to the same rate schedule as incorporated in the programming model. When maximizing after-tax income, the linear programming results indicated annual before-tax income, annual income tax payments, and total after-tax income.

When the objective was to maximize before-tax income (PRETXINC), total net ranch income was \$5,796 more than when the objective was to maximize after-tax income; however, total after-tax income was less when the objective was to maximize the before-tax income (\$101,123 compared to \$110,098). The organization paid \$22,151 in total income taxes with the optimal before-tax organization but only \$7,380 income taxes with the optimal after-tax organization (Table 30).

Approximately 72 percent of the total net ranch income for the optimal before-tax organization was added to the objective function during the last three years of the planning horizon. Spreading income to reduce annual taxes was accomplished with the livestock activities. The herd size for the POSTXINC situation fluctuated from year to year emphasizing sales from culled cows rather than a large concentration of feeder sales during the last years of the planning horizon.

The optimal mix of available enterprise alternatives of the ranch organization was affected by taking account of the income taxes owed by the individual operator. Since income taxes are a legitimate expense to the individual rancher, all other organizations included in this study were obtained with an objective of maximizing after-tax income.

Table 30. Before-tax and after-tax incomes for full-equity owner-operator when maximizing before-tax and after-tax incomes with zero nonranch income^a

Year	Maximizing before-tax income ^b			Maximizing after-tax income ^c		
	Before-tax income	Taxes paid	After-tax income	Before-tax income	Taxes paid	After-tax income
-----dollars-----						
1	-5,828	0	-5,828	-5,058	0	-5,058
2	-24,259	0	-24,259	-23,841	0	-23,841
3	-23,985	0	-23,985	-22,736	0	-22,736
4	18,917	1,093	17,824	16,179	620	15,559
5	-1,764	0	-1,764	919	0	919
6	17,079	817	16,262	15,236	504	14,732
7	4,616	0	4,616	5,445	0	5,445
8	12,498	90	12,408	11,774	0	11,774
9	10,289	0	10,289	9,534	0	9,534
10	6,173	0	6,173	15,824	620	15,204
11	15,811	545	15,266	16,522	620	15,902
12	4,438	0	4,438	15,734	620	15,114
13	18,396	1,082	17,314	17,433	620	16,813
14	6,326	0	6,326	20,823	1,516	19,307
15	<u>64,567</u>	<u>18,524</u>	<u>46,043</u>	<u>23,690</u>	<u>2,260</u>	<u>21,430</u>
Total	<u>123,274</u>	<u>22,151</u>	<u>101,123</u>	<u>117,478</u>	<u>7,380</u>	<u>110,098</u>

^aBefore-tax income equaled net ranch income. Taxes paid based on taxable income (before-tax income less personal deductions, exemptions, and 50 percent of capital gains). After-tax income equaled before-tax income minus taxes paid. Minus sign indicates a loss or negative income.

^bObjective function (PRETXINC) includes all activities (expenses and receipts) except income tax-paying activities were deleted from the model. Taxes paid in this organization were calculated with the use of tax tables and not by activities of the model.

^cObjective function (POSTXINC) includes payment of federal income tax.

Positive Nonranch Income Levels

This section discusses and compares ranch organizations for four levels of annual nonranch income (\$5,000, \$15,000, \$25,000, and \$50,000). These optimal ranch organizations are presented in detail in the Appendix (Tables 52-55). The objective function (POSTXINC) was to maximize the owner-operator's total after-tax income.

Livestock enterprises.--Each ranch organization started with 500 brood cows in the herd (Table 31). Herd size decreased to 462 brood cows the second year because of maximum culling in year one and having only 60 replacement heifers as specified in the assumptions for a representative ranch. As the level of nonranch income increased, a larger percentage of heifer calves was kept to increase the breeding herd size. The maximum number of brood cows increased from 551 head to 733 head as the level of annual nonranch income increased from \$5,000 to \$50,000. Greater emphasis was placed on receiving income from culled cows to reduce taxable income through capital gains allowances.

As nonranch income increased, a larger proportion of the weaned calves were sold instead of grazing them for an additional six months as feeders. The \$5,000 nonranch income organization sold a maximum of 97 weaned calves in any year during the third through the twelfth year of the planning horizon, but a maximum of 245 calves were kept as feeders in the ninth year. This is compared to a maximum of 381, 419, and 393 weaned calves sold and a maximum of 94, 51, and 187 calves kept as feeders during the same time interval for the three largest nonranch income situations. Therefore, as greater stress was placed on the organizations for capital gains income to offset taxable income, the programming model utilized a larger proportion of the available firm

Table 31. Livestock numbers for full-equity owner-operator ranch organizations with various levels of nonranch income

Year	\$5,000 nonranch income			\$15,000 nonranch income			\$25,000 nonranch income			\$50,000 nonranch income		
	Brood cows	Weaned calves sold	Feeders	Brood cows	Weaned calves sold	Feeders	Brood cows	Weaned calves sold	Feeders	Brood cows	Weaned calves sold	Feeders
1	500	291	0	500	254	0	500	240	0	500	210	0
2	462	174	98	462	273	0	462	239	0	462	228	0
3	476	3	233	511	240	0	524	202	8	554	248	0
4	476	47	240	503	299	0	547	302	24	581	282	0
5	521	67	227	567	276	48	641	340	40	654	353	18
6	508	97	226	555	234	93	621	321	50	701	320	97
7	527	93	212	571	246	94	627	322	50	709	371	67
8	505	74	233	572	249	92	624	320	51	709	298	98
9	517	51	245	572	245	94	626	325	49	694	371	73
10	508	75	230	571	249	91	627	310	32	721	311	77
11	521	92	213	572	252	46	624	407	0	686	393	97
12	516	95	180	572	375	22	653	419	44	733	340	187
13	522	211	146	613	381	49	613	348	157 ^a	647	198	260
14	551	299	82	550	317	140 ^b	550	335	45	577	245	157
15	500	340	65 ^c	500	340	153 ^d	500	340	231 ^e	522	78	279

^aSeventy-four of these steers were purchased.

^bSeventy-seven of these steers were purchased.

^cThese 65 steers were purchased.

^dThese 153 steers were purchased.

^eThese 231 steers were purchased.

resources for the breeding herd. Instead of providing additional grazing for feeders, the optimal organizations at the higher nonranch income levels sold more weaned calves.

All ranch organizations, except for the \$50,000 level of nonranch income, purchased some stocker steers during the later years of the planning horizon. The structure of a multiperiod linear programming model with the objective function of maximizing after-tax income emphasized income producing activities. Therefore, the minimum 500-cow breeding herd was approached or reached by the fifteenth year to maximize income from culled cows. Stockers were purchased to utilize the grazing established for a larger brood cow herd. The \$50,000 nonranch income organization differed by not buying any stocker steers and reducing the brood cow herd to a minimum of only 522 head. With the maximum 18 percent culling rate and the herd size of 733 head the eleventh year, the \$50,000 organization did not reach the minimum herd size the final year. This organization increased its number of weaned calves kept as feeders from zero the first four years to 279 head the fifteenth year, because available grazing was being used for expanding the breeding herd during the beginning years of the program.

Land activities.--Feed requirements for the livestock activities were met with grazing systems. As the livestock activities varied for each organization, the grazing systems showed different arrangements to give maximum tax advantage for each nonranch income level.

All four ranch organizations initially started with 3,500 acres of unimproved native range and land purchasing activities were available throughout the planning horizon. The only situation that purchased any additional land was the \$50,000 nonranch income organization that

purchased 70 acres the first year of the planning period. Therefore, the \$50,000 nonranch income organization had 3,570 acres in total land operated. This additional land was purchased through the cash land purchasing activity (PURLAC) with nonranch capital made available to the ranch organization.

Land was purchased in the largest nonranch income situation to help meet the increased demand for grazing with the expanding breeding herd in the early years of the planning horizon. Because of the time lag between establishing improved pasture and a high level of sustained grazing (two years), immediate grazing needs could be furnished either by available forage systems, purchasing additional land, or buying forage (BUYFOR). The \$5,000, \$15,000, and \$25,000 ranch organizations purchased 80, 400, and 400 tons of hay, respectively, the first year of the planning period. The \$50,000 optimum ranch organization purchased 412 tons of hay and 70 acres of additional land. Hence, purchasing land for grazing became feasible (least cost) instead of buying more than 412 tons of hay the first year. Also, the purchased land added to the grazing base for the remaining years of the planning period.

Improved pasture acreages varied with different nonranch income levels (Table 32). Acreage cleared from native pasture ranged from 525 acres to 741 acres as the nonranch income level increased from \$5,000 to \$50,000. Land cleared for the two smallest income situations was very similar (525 and 550 acres), but cleared acreage increased from 613 acres to 741 acres as annual nonranch income increased from \$25,000 to \$50,000. Total expenses for clearing land were capitalized over a 10-year period since none of the clearing expenses could be charged as direct expenses. All land was cleared during the first three years of

Table 32. Improved pasture acreage for full-equity owner-operator ranch organizations with various levels of annual nonranch income^a

Year	\$5,000 nonranch income			\$15,000 nonranch income			\$25,000 nonranch income			\$50,000 nonranch income		
	Acreage cleared	Improved pasture		Acreage cleared	Improved pasture		Acreage cleared	Improved pasture		Acreage cleared	Improved pasture	
		Nonirrigated	Irrigated		Nonirrigated	Irrigated		Nonirrigated	Irrigated		Nonirrigated	Irrigated
1	500	137	115	278	129	124	500	144	137	500	143	148
2	0	244	220	148	169	257	0	191	296	241	200	319
3	25	269	239	124	179	288	113	215	351	0	226	374
4	0	277	248	0	202	310	0	245	368	0	254	429
5	0	277	248	0	223	312	0	245	368	0	300	441
6	0	277	248	0	238	312	0	245	368	0	300	441
7	0	277	248	0	238	312	0	245	368	0	300	441
8	0	277	248	0	238	312	0	245	368	0	300	441
9	0	277	248	0	238	312	0	245	368	0	300	441
10	0	277	248	0	238	312	0	245	368	0	300	441
11	0	277	248	0	238	312	0	245	368	0	300	441
12	0	277	248	0	238	312	0	245	368	0	300	441
13	0	277	248	0	238	312	0	245	368	0	300	441
14	0	277	248	0	238	312	0	245	368	0	300	441
15	0	277	248	0	238	312	0	245	368	0	300	441

^aTotal of 3,500 acres operated for each organization except for the \$50,000 nonranch income. This situation purchased 70 additional acres the first year. Native unimproved pasture grazed equaled acres operated minus total improved acreage.

planning horizon when taxable ranch income was negative. The program restricted land-clearing costs that could be charged as an ordinary expense deduction to a maximum of 25 percent of annual taxable income up to a maximum of \$5,000 per year as specified by the Internal Revenue Code.

Improved nonirrigated pasture ranged from 238 acres to 300 acres and this acreage was primarily maintained in the hay and grazing activity (PANHAY). As the grazing requirements were reduced through a reduction in herd size toward the end of the planning horizon, a larger proportion of nonirrigated improved pastureland was left idle. For example, the \$25,000 nonranch income organization had no idle acreage until the thirteenth year but 132 acres of the total 245 acres of nonirrigated pasture were left idle the fifteenth year. Acreages were left idle to reduce variable expenses when grazing needs were low; the expense for maintaining idle land equaled the cost of maintaining unimproved native range.

As the nonranch income levels were increased larger acreages of improved irrigated pasture were established. The largest nonranch income organization established 193 more acres of irrigated pasture than the \$5,000 nonranch income organization. Total soil and water conservation expenses were determined by the acres of improved pasture established. A larger proportion of the cost of irrigated pasture qualified as conservation expenses as ranch incomes increased. The improved acreage for the largest nonranch income situation represented an average conservation expense of \$37 per acre as compared with an average expense of \$32 per acre for the smallest nonranch income organization.

Irrigated pasture required \$85.46 more capital investment per acre for establishment than nonirrigated pasture. Therefore, as the

nonranch income levels increased more capital was available for investment in capital assets such as an irrigation system and annual depreciation of the irrigation system helped to decrease taxable income in future years.

The upper limit on acreage of irrigated pasture was 25 percent of total land operated. This limit did not constrain any of the ranch organizations. The \$50,000 nonranch income organization which had the largest acreage of irrigated pasture, established approximately 13 percent of its total acreage in irrigated pasture. The tax regulation which only allowed 25 percent of gross receipts to be deducted in any year as conservation expenses did not restrict any of the optimal organizations. The largest amount deducted as conservation expenses was \$9,836 the first year of the \$50,000 nonranch income organization which was slightly less than 25 percent of gross sales that year.

Financial components.--Financial components pertain to net returns from the ranch organization and after-tax incomes for the individual operators. Variations occurred in the net ranch income levels when after-tax income was maximized with different levels of non-ranch income.

Ranch income was divided into two categories: ordinary income was defined as receipts from the sale of weaned calves, feeders, and stocker steers minus total allowable tax expenses and capital gains income equaled total receipts from sale of culled cows. The capital gains income and net ranch income are presented for each year of the planning period for the four nonranch income levels in Table 33. Income from the sale of culled cows was approximately 25 percent more for the \$50,000 nonranch income organization than for the \$5,000 nonranch income organization (\$290,710 compared to \$234,090). Total net ranch income (ordinary

Table 33. Capital gains and net ranch income for full-equity owner-operator ranch organizations with various levels of annual nonranch income^a

Year	\$5,000 nonranch income		\$15,000 nonranch income		\$25,000 nonranch income		\$50,000 nonranch income	
	Capital gains	Ranch income	Capital gains	Ranch income	Capital gains	Ranch income	Capital gains	Ranch income
1	15,381	880	15,381	-3,724	15,381	-7,920	15,381	-12,791
2	14,206	-17,817	14,206	-6,037	14,206	-13,898	14,206	-18,905
3	14,639	-18,238	15,731	-3,139	16,126	-12,939	17,033	-9,484
4	14,628	3,936	15,485	742	16,818	-593	17,874	-9,064
5	16,039	9,647	17,443	1,721	19,707	8,852	20,114	56
6	15,641	10,820	17,078	1,538	19,101	8,549	21,564	781
7	16,220	11,109	17,559	9,318	19,279	10,077	21,820	16,909
8	15,526	6,762	17,596	9,797	19,205	9,770	21,799	5,052
9	15,909	6,954	17,585	9,125	19,254	10,504	21,337	16,667
10	15,630	10,814	17,567	9,783	19,242	8,620	22,187	7,548
11	16,022	11,010	17,610	9,804	19,197	16,598	21,130	16,001
12	15,882	10,940	17,602	17,800	20,088	17,043	22,557	17,090
13	16,051	19,025	18,869	18,433	18,869	17,518	19,899	15,948
14	16,935	27,467	16,935	17,727	16,935	23,467	17,763	33,924
15	15,381	26,690	15,381	24,690	15,381	22,690	16,046	38,022
Total	234,090	119,999	252,028	117,578	268,789	118,338	290,710	117,754

^aCapital gains income equaled total sales from culled cows. Net ranch income equaled ordinary income (receipts from calf sales minus total expenses) plus capital gains income.

income plus capital gains) was a reverse situation with \$119,999 for the \$5,000 nonranch income organization and \$117,754 for the \$50,000 nonranch income organization. Since the objective was not to maximize net ranch income, the optimal ranch organization showed less net ranch income but more capital gains income to offset taxable nonranch income as the nonranch income level increased.

The organizations showed a net ranch loss (negative income) the first three to four years of the planning horizon except for the first year for the \$5,000 nonranch income organization. These losses, plus investments in capital assets and family consumption capital, had to be absorbed either with borrowed capital or with capital from nonranch sources. Family consumption was \$5,000 for all organizations in the analysis.

The \$5,000 nonranch income organization consumed all of its nonranch income and borrowed \$34,983 during the first three years of the planning period. This may be contrasted to the \$88,300 of borrowed capital that was required for the operation of the ranch and family consumption when the program was optimized for the owner-operator with zero nonranch income. When the nonranch income exceeded \$5,000, no capital was borrowed except \$2,351 during the first year for the \$25,000 nonranch income organization. The \$25,000 nonranch income organization cleared 500 acres of rangeland and established 144 acres of nonirrigated pasture and 137 acres of irrigated pasture the first year. Whereas, the \$15,000 nonranch income situation borrowed no additional capital but only cleared 278 acres of rangeland and established 129 acres of nonirrigated pasture and 124 acres of irrigated pasture the first year.

Both the large capital borrowing organizations (zero nonranch income and \$5,000 annual nonranch income) borrowed capital through the three-year loan activity (BORCA3). The zero nonranch income organization borrowed \$23,873 of a total capital requirement of \$69,290 the first year with a three-year loan. This first year loan was included in the capital requirement (\$77,523) for the fourth year since the loan matured in three years. The capital generated during the fourth year equaled \$76,522. Thus, only \$1,001 was borrowed the fourth year. Interest on loans was payable annually and was included as an allowable firm expense for tax purposes. Security which equaled net worth less outstanding loans, was never an effective restriction in the model. Even with the maximum amount borrowed (\$68,057) by the zero nonranch income situation, the security still equaled \$304,199.

Individual income taxes were paid on the basis of taxable income which represented adjusted gross income (before-tax income less personal deduction, personal exemptions, and 50 percent of capital gains from ranch and nonranch sources). Personal deductions and exemptions were assumed to equal \$4,000 per year throughout the analysis. Capital gains income was completely based on sales from culled cows and all nonranch income was assumed to be fully taxable.

If the tenth year in the planning horizon is assumed as a typical year for a beef producer, a comparison shows the annual advantage (tax saving) received through capital gains income. The tenth year is reasonable for comparison because it is far enough into the planning period that all pasture systems have been established and the pressure to sell brood cows in latter part of the planning period is minimized. During the tenth year, as nonranch income increased the net ranch income

decreased from \$10,814 to \$7,548 (Table 33). Total before-tax income for the \$5,000 nonranch income level equaled \$15,814 of which only \$4,000 was taxable (Table 34). If income taxes had been paid on \$25,000 gross income without the ranch organization, the taxable income would have been \$21,000 and taxes paid would have equaled \$4,700. With the \$25,000 nonranch income, the optimal ranch organization had a before-tax income of \$33,620 during the tenth year, taxable income was \$20,000, and taxes paid were \$4,380. Thus, with the capital gains deduction from the ranch, an individual would pay \$320 less taxes on \$33,620 of gross income than he would have paid on a \$25,000 income with no capital gains.

The tax advantages received from the capital gains regulation for the total planning period are presented in Table 35. During some years a net ranch loss was incurred. The two smallest nonranch income levels (zero and \$5,000) did not receive full advantage of the capital gains deductions. For example, with an annual nonranch income of \$5,000 plus the net ranch income, the total 15-year before-tax income was \$194,999 and the minimum taxable income should be \$17,954 (before-tax income minus 50 percent of capital gains and \$60,000 personal deductions and exemptions). However, the actual total taxable income was \$74,623. Full advantage was received from allowable capital gains deductions at the \$25,000 and \$50,000 nonranch income levels; the \$15,000 nonranch income organization capitalized on all but \$2,559 of its allowable deductions.

Taxes paid as a percentage of total before-tax income increased as income levels increased but capital gains deductions allowed this taxing percentage to be relatively more favorable for the largest nonranch income levels. With the 50 percent marginal tax rate (\$46,000

Table 34. Before-tax and after-tax incomes for full-equity ranch owner-operator including various levels of annual nonranch income^a

Year	\$5,000 nonranch income		\$15,000 nonranch income		\$25,000 nonranch income		\$50,000 nonranch income						
	Before-tax income	After-tax income	Before-tax income	After-tax income	Before-tax income	After-tax income	Before-tax income	After-tax income					
1	5,880	0	5,880	0	11,276	0	11,276	17,080	909	16,171	37,209	6,262	30,947
2	-12,817	0	-12,817	0	8,963	0	8,963	11,102	0	11,102	31,095	4,380	26,715
3	-13,238	0	-13,238	0	11,861	0	11,861	12,061	0	12,061	40,516	7,100	33,416
4	8,936	0	8,936	0	15,742	620	15,122	24,407	2,260	22,147	40,936	7,100	33,836
5	14,647	390	14,257	390	16,721	620	16,101	33,852	4,380	29,472	50,056	10,340	39,716
6	15,820	620	15,200	620	16,538	620	15,918	33,549	4,380	29,169	50,781	10,340	40,441
7	16,109	620	15,489	620	24,318	2,166	22,152	35,077	4,870	30,207	66,909	18,060	48,849
8	11,762	0	11,762	0	24,797	2,260	22,537	34,770	4,777	29,993	55,052	12,344	42,708
9	11,954	0	11,954	0	24,125	2,124	22,001	35,504	5,019	30,485	66,667	18,060	48,607
10	15,814	620	15,194	620	24,783	2,260	22,523	33,620	4,380	29,240	57,548	13,455	44,093
11	16,010	620	15,390	620	24,804	2,260	22,544	41,598	7,100	34,498	66,001	17,787	48,214
12	15,940	620	15,320	620	32,800	4,380	28,420	42,043	7,100	34,943	67,090	17,970	49,120
13	24,025	2,260	21,765	2,260	33,433	4,380	29,053	42,518	7,541	34,977	65,948	18,060	47,888
14	32,467	4,380	28,087	4,380	32,727	4,469	28,258	48,467	10,340	38,127	83,924	28,344	55,580
15	31,690	4,380	27,310	4,380	39,690	7,100	32,590	47,690	10,340	37,350	88,022	31,020	57,002
Total	194,999	14,510	180,489	14,510	342,578	33,259	309,319	493,338	73,396	419,942	867,754	220,622	647,132

^aBefore-tax income equaled net ranch income plus nonranch income. Taxes paid based on taxable income (before-tax income less personal deductions, exemptions, and 50 percent of capital gains). After-tax income equaled before-tax income minus taxes paid.

Item	Unit	Annual nonranch income levels				
		Zero	\$5,000	\$15,000	\$25,000	
Optimum organization (15 years):^a						
Net ranch income	dollar	117,478	119,999	117,578	118,338	117,754
Total before-tax income	dollar	117,478	194,999	342,578	493,338	867,754
Capital gains income	dollar	240,823	234,090	252,028	268,789	290,710
Total taxable income ^b	dollar	43,666	74,623	159,123	298,944	662,398
Total taxes paid	dollar	7,380	14,510	33,259	73,396	220,622
Total after-tax income	dollar	110,098	180,489	309,319	419,943	647,132
Average after-tax income	dollar	7,340	12,033	20,621	27,996	43,142
Actual effective tax rate ^c	percent	6.3	7.4	9.7	14.9	25.4
Nonranch income (15 years):^d						
Total before-tax income	dollar	0	75,000	225,000	375,000	750,000
Total taxable income	dollar	0	15,000	165,000	315,000	690,000
Total taxes paid ^e	dollar	0	2,100	30,600	70,500	225,900
Marginal tax rate ^f	percent	0	15	22	32	50
Total after-tax income	dollar	0	72,900	194,400	304,500	524,100
Annual after-tax income	dollar	0	4,860	12,960	20,300	34,940
Actual effective tax rate ^c	percent	0	2.8	13.6	18.8	30.1

^aOptimal organizations of multiperiod linear programming model when maximizing after-tax income.

^bBefore-tax income less \$4,000 per year personal deductions and exemptions (\$60,000 for 15 years) and less a maximum deduction of 50 percent of capital gains income.

^cTaxes paid as a percentage of total before-tax income

^dBased on the assumption that taxes were only paid on the annual nonranch income. The ranch organization and capital gains income were not considered.

^eCalculated on an annual basis and then multiplied by 15 years. Taxes were based on the 1971 tax rate schedules for married taxpayers filing joint returns.

^fTax category for income level considered.

taxable income), 30.1 percent of the before-tax income was paid in taxes, but when the ranch organization was included at the \$50,000 nonranch income level, the owner-operator paid 25.4 percent of total gross income in taxes. Thus, the individual paid \$5,278 less in total taxes with an \$867,754 income than would be due on a \$750,000 income taxed as ordinary income.

Total annual depreciation was counted as an allowable tax expense (Table 36). Bull depreciation was based on a cow unit (\$1.96 per cow per year) and equipment and machinery depreciation was prorated on a per acre of total land basis (\$.93 per acre). Fencing, buildings, and other capital assets tied to the land were depreciated at an annual rate of \$.83 per acre, and the irrigated acreage qualified for a depreciation allowance of \$3.48 per acre per year. Therefore, total annual depreciation varied among years because of fluctuation in cow numbers and irrigated acreage.

The total depreciation allowance was also subtracted from after-tax income. Therefore, if capital was not reinvested at the same rate it was depreciated, after-tax income would be greater than shown by optimal organization. If an individual operator was nearing retirement he might not reinvest the depreciation allowance on buildings, fences, and irrigation system which would add a substantial amount to his available cash. For the \$5,000 nonranch income situation, the added cash would equal \$3,768 per year. Because the \$50,000 nonranch income situation purchased more land and established larger irrigated acreage, the added cash would be \$4,498 per year. Therefore, the total after-tax incomes of \$180,489 (\$5,000 annual nonranch income level) and \$524,100 (\$50,000 annual nonranch income level) would increase to \$237,009 and \$591,570 or would average \$15,800 and \$39,438 per year, respectively.

Table 36. Annual depreciation and net worth for full-equity owner-operator ranch organizations with various levels of annual nonranch income^a

Year	\$5,000 nonranch income		\$15,000 nonranch income		\$25,000 nonranch income		\$50,000 nonranch income	
	Depreciation	Net worth	Depreciation	Net worth	Depreciation	Net worth	Depreciation	Net worth
1	7,140	697,864	7,140	703,839	7,140	707,320	7,263	720,724
2	7,464	731,292	7,498	759,115	7,543	762,494	7,704	785,712
3	7,859	767,360	8,057	809,869	8,217	818,565	8,479	881,579
4	7,925	824,922	8,147	855,440	8,454	872,767	8,724	895,360
5	8,044	880,021	8,350	901,340	8,697	921,361	9,058	951,330
6	8,019	933,909	8,334	944,873	8,658	962,322	9,192	1,002,649
7	8,056	977,603	8,365	991,934	8,670	1,007,272	9,208	1,048,958
8	8,013	1,024,337	8,367	1,039,360	8,664	1,054,590	9,208	1,095,318
9	8,036	1,074,632	8,367	1,089,477	8,668	1,104,926	9,178	1,148,549
10	8,019	1,128,552	8,365	1,142,793	8,670	1,157,904	9,231	1,203,182
11	8,044	1,185,634	8,367	1,199,317	8,664	1,217,804	9,163	1,261,215
12	8,034	1,245,694	8,367	1,264,257	8,721	1,275,464	9,255	1,315,905
13	8,046	1,313,167	8,447	1,323,725	8,642	1,327,129	9,086	1,363,498
14	8,103	1,376,825	8,324	1,378,540	8,519	1,381,943	8,949	1,418,363
15	8,003	1,438,133	8,226	1,439,847	8,421	1,443,250	8,841	1,480,052
Total	118,805		122,721		126,348		132,539	

^a Annual depreciation on bulls (\$1.96 per brood cow), equipment (\$.93 per acre operated), fences and improvements (\$.83 per acre), and irrigated system (\$3.48 per acre irrigated). Net worth included \$197 per brood cow, \$120 per heifer, \$45 per acre of nonirrigated land, \$55 per acre of irrigated land, \$6.53 per acre for machinery and equipment, \$7.21 per acre for fences and buildings, and an annual appreciation on land at 6 percent from a base value of \$150 per acre.

With the full-equity owner-operator situation, the net worth of the entire ranch (land, livestock, and equipment) was available to meet the ranch's security requirements. Net worth increased during each year of the planning period with the establishment of improved pasture acreage and the annual percent appreciation in land values (Table 36). Capital accumulation, defined as the annual difference between capital generated and the capital requirement summed over the years, was not included in the firm's net worth. Capital was not available for accumulation until the tenth year of the planning period for the optimal ranch organization with zero nonranch income, but \$29,915 of capital was accumulated by the end of the fifteenth year. For comparison, the \$5,000 nonranch income situation started accumulating capital the fourth year and accumulated \$98,361 by the end of the planning horizon. The \$15,000, \$25,000, and \$50,000 annual nonranch income situations accumulated capital the first year of the planning horizon and the final accumulations equaled \$225,390, \$335,095, and \$521,231, respectively.

As the optimal ranch organization changed with the increased nonranch income, capital requirements were generally larger. The maximum capital requirement for any year of the organization with zero nonranch income was \$77,523 and the minimum was \$41,756 but the capital requirements for the \$50,000 nonranch income organization ranged from \$60,826 to \$89,044. As the breeding herd increased, the per acre capital requirement increased more than with a feeder system and with increased nonranch capital, investments in capital improvements were more readily made.

Tenant-Landlord Situations

Two nonranch income levels (\$5,000 and \$25,000) were used for the landlord when maximizing his after-tax income but the tenant was assumed to have zero nonranch income. The tenant-landlord situations differed from the full-equity owner-operator situations in that the landlord paid the fixed land expenses (real estate taxes and depreciation allowances for fencing and buildings). Ordinary income (excluding fixed land expenses paid by the landlord) and capital gains income were equally divided between the landlord and tenant. Each individual was allowed 25 percent of total capital gains as a tax deduction. The two optimal ranch organizations are presented in detail in Appendix Tables 50 (\$5,000 nonranch income level) and 56 (\$25,000 nonranch income level).

Maximization of Landlord's Income

The trend toward a larger brood cow herd as the landlord's nonranch income increased prevailed in this situation as with the owner-operator organizations. As the annual nonranch income increased from \$5,000 to \$25,000 the maximum herd size increased from 550 head to 639 head (Table 37). Since growth of the herd had to come through the keeping of heifers from the calf crop, the percentage of weaned calves sold or kept as feeders was less when the breeding herd was being expanded than when the herd size was fully established. The \$5,000 nonranch income organization generally fed more feeders than the \$25,000 organization until the last four years of the planning period. Feeders generated capital faster than a brood cow that required two years to mature.

No additional land was purchased by the landlord for either the \$5,000 or \$25,000 nonranch income organizations. The landlord initially

Table 37. Livestock numbers for 50-50 tenant-landlord ranch organizations when maximizing landlord's after-tax income with two levels of annual nonranch income

Year	\$5,000 nonranch income (landlord)			\$25,000 nonranch income (landlord)		
	Brood cows	Weaned calves sold	Feeders	Brood cows	Weaned calves sold	Feeders
	-----head-----					
1	500	275	10 ^a	500	266	0
2	462	170	111	462	213	0
3	491	43	203	500	114	86
4	479	24	269	552	214	150
5	525	0	291	636	134	199
6	509	50	276	586	213	169
7	533	19	281	639	188	176
8	507	23	287	596	163	193
9	528	47	270	619	208	172
10	516	0	294	614	161	188
11	517	55	253	605	189	177
12	529	152	137	623	222	216
13	526	285	75	613	157	274
14	550	335	45	550	194	187
15	500	340	66 ^b	500	340	250 ^c

^aThese 10 steers were purchased.

^bThese 66 steers were purchased.

^cThese 250 steers were purchased.

owned 3,500 acres and capital requirements for purchasing additional land were fully assumed by the landlord.

The optimal \$25,000 nonranch income organization cleared 101 more acres of rangeland than the \$5,000 organization (Table 38). This additional acreage was primarily established in irrigated pasture. Capital requirements for establishing improved pasture were shared equally between the landlord and tenant. The landlord's net worth increased as more improved pasture was established.

Since fixed land costs were not included as firm expenses, the net ranch income was much higher for a 50-50 cost-revenue share arrangement for the tenant-landlord situation than for the full-equity owner-operator arrangement. Total net ranch income was nearly equal for the two organizations but, capital gains income accounted for approximately 12 percent more of the net ranch income in the \$25,000 nonranch income organization than in the \$5,000 nonranch income organization (Table 39).

The net ranch income was divided equally between tenant and landlord for each year of the organization and no capital was transferred to future years. Both of these optimal landlord organizations (\$5,000 and \$25,000 annual nonranch income levels) required borrowed capital for the first four years of the planning period because the landlord's nonranch income was not included as available capital to be used by the ranch firm.

The landlord's share of net ranch income was nearly equal for both organizations (\$123,365 compared to \$123,832), but when the additional land expenses were subtracted from the landlord's share, losses of \$2,740 and \$2,273 incurred over the 15-year period (Table 39). Composition of land expenses included \$5,502 for annual real estate taxes

Table 38. Improved pasture acreage for 50-50 tenant-landlord ranch organizations when maximizing landlord's income with two levels of annual nonranch income^a

Year	\$5,000 nonranch income (landlord)			\$25,000 nonranch income (landlord)		
	Acreage cleared	Improved pasture		Acreage cleared	Improved pasture	
		Nonir- rigated	Irri- gated		Nonir- rigated	Irri- gated
-----head-----						
1	500	143	123	500	191	121
2	0	225	239	0	202	298
3	52	268	250	153	265	348
4	0	300	252	0	305	348
5	0	300	252	0	305	348
6	0	300	252	0	305	348
7	0	300	252	0	305	348
8	0	300	252	0	305	348
9	0	300	252	0	305	348
10	0	300	252	0	305	348
11	0	300	252	0	305	348
12	0	300	252	0	305	348
13	0	300	252	0	305	348
14	0	300	252	0	305	348
15	0	300	252	0	305	348

^aTotal of 3,500 acres operated for each organization. Native unimproved acres grazed equaled total acres operated minus total improved acreage.

Table 39. Total net ranch income and landlord's share of ranch income for 50-50 tenant-landlord ranch organizations when maximizing landlord's income with two levels of annual nonranch income^a

Year	\$5,000 nonranch income (landlord)				\$25,000 nonranch income (landlord)					
	Ranch firm		Landlord's		Ranch firm		Landlord's			
	Capital gains	Net income	Share income	Land expenses	Ranch income	Capital gains	Net income	Share income	Land expenses	Ranch income
1	15,381	6,145	3,073	8,407	-5,334	15,381	2,959	1,480	8,407	-6,927
2	14,206	-11,096	-5,548	8,407	-13,955	14,206	-8,452	-4,226	8,407	-12,633
3	15,102	-3,736	-1,868	8,407	-10,275	15,381	-17,487	-8,743	8,407	-17,150
4	14,737	5,373	2,687	8,407	-5,720	16,983	7,213	3,607	8,407	-4,800
5	16,164	13,611	6,806	8,407	-1,601	19,553	9,996	4,998	8,407	-3,409
6	15,656	21,473	10,737	8,407	2,330	18,013	23,835	11,918	8,407	3,511
7	16,391	16,714	8,357	8,407	-50	19,649	18,434	9,217	8,407	810
8	15,593	17,191	8,596	8,407	189	18,330	15,677	7,839	8,407	-568
9	16,270	21,210	10,605	8,407	2,198	19,054	23,110	11,555	8,407	3,148
10	15,875	13,518	6,759	8,407	-1,648	18,895	15,364	7,682	8,407	-725
11	15,890	22,629	11,315	8,407	2,908	18,600	20,046	10,023	8,407	1,616
12	16,269	30,961	15,481	8,407	7,074	19,152	24,404	12,202	8,407	3,795
13	16,182	30,918	15,459	8,407	7,052	18,869	24,263	12,132	8,407	3,725
14	16,935	31,294	15,647	8,407	7,240	16,935	39,296	19,648	8,407	11,241
15	15,381	30,517	15,259	8,407	6,852	15,381	48,999	24,500	8,407	16,093
Total	236,032	246,722	123,365	126,105	-2,740	264,382	247,657	123,832	126,105	-2,273

^aCapital gains income equaled total sales from culled cows. Firm net ranch income equaled ordinary income (receipts from calf sales minus total expenses) plus capital gains income. Landlord's share of net ranch income equaled 50 percent.

and \$2,905 for annual depreciation on buildings and fences. If capital was not reinvested according to the depreciation schedule, an additional \$43,575 would be available to the landlord.

The same trend prevailed for the landlord's organization as for the owner-operator to convert more income to capital gains as nonranch income level increased. The tax advantage was not as pronounced for the landlord because he was only allowed a 25 percent capital gains deduction and the tenant was allowed the other 25 percent deduction.

Taxes paid by the landlord equaled \$54,650 on \$372,727 of before-tax income which is \$15,850 less than his tax bill would have been on \$375,000 if the ranch organization had not been included (Table 40). The landlord's net worth increased at the same rate as the full-equity owner-operator's but the landlord's net worth only included 50 percent of livestock and equipment value.

Tenant's Income

Nonranch income was not included for the tenant for any of the optimal organizations. A discussion of the tenant's optimal organization was presented in the previous chapter but a summary of his income activities is shown in Table 41. The tenant's share of net ranch income when the two landlord organizations were optimized is also presented. The taxes paid by the tenant in the landlord situations were calculated with the use of the tax table used in the tax paying activities of the programming model. Tenant's total after-tax income did not vary more than \$100 when comparing his share of income from any of the three tenant-landlord organizations. The tenant's after-tax income was slightly less for his optimal organization than with the optimal landlord organizations. Differences appeared between the years and amounts

Table 40. Net worth, before-tax income, and after-tax income for landlord in 50-50 tenant-landlord ranch organizations when maximizing landlord's after-tax income with two levels of annual nonranch income^a

Year	\$5,000 nonranch income (landlord)				\$25,000 nonranch income (landlord)			
	Net worth	Before-tax income	Taxes paid	After-tax income	Net worth	Before-tax income	Taxes paid	After-tax income
1	625,414	-334	0	-445	625,929	18,073	1,870	16,203
2	668,349	-8,955	0	-8,955	674,604	12,367	775	11,592
3	706,289	-5,275	0	-5,275	708,420	7,850	0	7,850
4	753,014	-720	0	-720	763,067	20,200	2,249	17,951
5	798,455	3,399	0	3,399	814,173	21,591	2,435	19,156
6	841,354	7,330	0	7,330	847,208	28,511	4,380	24,130
7	885,582	4,950	0	4,950	901,784	25,810	3,511	22,299
8	933,060	5,189	0	5,189	948,503	24,432	3,222	21,210
9	983,543	7,198	0	7,198	999,494	28,148	4,207	23,941
10	1,036,154	3,352	0	3,352	1,051,901	24,275	3,147	21,128
11	1,093,367	7,908	0	7,908	1,108,995	26,616	3,810	22,806
12	1,153,600	12,074	620	11,454	1,169,143	28,795	4,380	24,415
13	1,218,344	12,052	620	11,432	1,228,028	28,725	4,380	24,345
14	1,283,569	12,240	620	11,620	1,289,022	36,241	7,100	29,141
15	1,349,852	11,852	620	11,232	1,355,357	41,093	9,184	31,909
Total		<u>72,260</u>	<u>2,480</u>	<u>69,780</u>		<u>372,727</u>	<u>54,650</u>	<u>318,077</u>

^aLandlord's net worth included 50 percent of ranch firm's net worth plus \$45 per acre of nonirrigated land, \$55 per acre of irrigated land, \$7.21 per acre for fences and buildings, and an annual appreciation on land at 6 percent from a base value of \$150 per acre. Taxes paid based on taxable income (before-tax income less personal deductions, exemptions, and 25 percent of firm's capital gains).

organizations when maximizing tenant's after-tax income and landlord's after-tax income with two levels of annual nonranch income^a

Year	Maximizing for tenant				Maximizing for landlord						
	Tenant's		After-tax income	\$5,000 nonranch income		Tenant's		Taxes paid ^b	\$25,000 nonranch income		Tenant's after-tax income
	Share ranch income	Taxes paid		Tenant's share ranch income	Taxes paid ^b	Tenant's share ranch income	Taxes paid ^b		Tenant's share ranch income	Taxes paid ^b	
1	1,595	0	1,595	3,072	0	3,072	1,479	0	1,479	0	1,479
2	-6,031	0	-6,031	-5,548	0	-5,548	-4,226	0	-4,226	0	-4,226
3	-1,910	0	-1,910	-1,869	0	-1,869	-8,744	0	-8,744	0	-8,744
4	2,600	0	2,600	2,686	0	2,686	3,606	0	3,606	0	3,606
5	10,974	438	10,536	6,805	0	6,805	4,998	0	4,998	0	4,998
6	6,681	0	6,681	10,736	422	10,314	11,917	520	11,397	520	11,397
7	11,577	555	11,022	8,357	36	8,321	9,217	43	9,174	43	9,174
8	8,114	0	8,114	8,596	96	8,498	7,838	0	7,838	0	7,838
9	7,688	0	7,688	10,605	376	10,229	11,555	303	11,252	303	11,252
10	11,327	494	10,833	6,759	0	6,759	7,682	0	7,682	0	7,682
11	12,008	620	11,388	11,314	508	10,806	10,023	196	9,827	196	9,827
12	12,072	620	11,452	15,480	1,268	14,212	12,202	520	11,682	520	11,682
13	12,481	620	11,861	15,459	1,268	14,191	12,131	520	11,611	520	11,611
14	14,356	1,023	13,333	15,647	1,268	14,379	19,648	1,455	18,193	1,455	18,193
15	19,852	2,260	17,592	15,258	1,268	13,990	24,499	3,443	21,046	3,443	21,046
Total	123,384	6,630	116,754	123,357	6,512	116,845	123,825	7,000	116,825	7,000	116,825

^aTenant's share of net ranch income equaled 50 percent. Taxes paid based on taxable income (share of ranch income less personal deductions, exemptions, and 25 percent of firm's capital gains).

^bTaxes paid in these organizations were calculated with the use of tax tables.

that profits or losses occurred for the tenant. With the optimal \$25,000 nonranch income organization for the landlord, the tenant received less during the beginning years of the planning horizon because the landlord organization established more improved pasture and saved a larger proportion of the weaned calves for inclusion into the breeding herd.

Renter Situations

Because individuals who rented land were assumed to have zero nonranch income, the taxing strategies in this section are considered from the landowner viewpoint. Three land use agreements are included in this section with two levels of nonranch income for the landowner. The low land-rent agreement assumed that the land user paid an annual payment of \$2.55 per acre which covered the landowner's fixed land expenses. The landowner receives \$3.15 per acre with the high land-rent agreement. With the 50-50 cost-revenue share arrangement, the landowner's income depends on the productivity of the beef firm. The low land-rent situation reflects the landowner's income position without the ranch because business expenses equal lease payment. If the landowner had the acreage without any kind of farming operation, the real estate taxes would not be tax deductible as a business expense.

When the landowner received \$5,000 annual nonranch income, the high land-rent agreement was definitely better (\$6,538 annual income compared to \$4,860 for the low rent situation and \$4,652 for 50-50 cost-revenue share arrangement). Those differences narrow as the landowner's annual nonranch income increased to \$25,000 (Table 42). The average after-tax income for the landowner in the larger income bracket with the

Table 42. Comparisons of landowner's and tenant's incomes with high and low rent payments and under a 50-50 tenant-landlord arrangement, landowner with two levels of annual nonranch income

Item	Ranch agreements		
	Low rent ^a	High rent ^b	50-50 share ^c
-----dollars-----			
Landowner (\$5,000 annual nonranch income):			
Nonranch income	75,000	75,000	75,000
Rent payment	134,655	156,840	0
Share ranch income	0	0	123,365
Total income	209,655	231,840	198,365
Real estate taxes	83,115	78,420	82,530
Depreciation allowance	43,890	41,400	43,575
Miscellaneous expenses	7,650	7,230	0
Total land expenses	134,655	127,050	126,105
Before-tax income	75,000	104,790	72,260
Taxes paid	2,100	6,720	2,480
After-tax income	72,900	98,070	69,780
Average annual income	4,860	6,538	4,652
Landowner (\$25,000 annual nonranch income):			
Nonranch income	375,000	375,000	375,000
Rent payment	134,655	156,840	0
Share ranch income	0	0	123,832
Total income	509,655	531,840	498,832
Real estate taxes	83,115	78,420	82,530
Depreciation allowance	43,890	41,400	43,575
Miscellaneous expenses	7,650	7,230	0
Total land expenses	134,655	127,050	126,105
Before-tax income	375,000	404,790	372,727
Taxes paid	70,500	80,040	54,650
After-tax income	304,500	324,750	318,077
Average annual income	20,300	21,650	21,205
Renter (tenant) income:			
Ranch income	114,476	82,792	123,384
Taxes paid	7,055	4,279	6,630
After-tax income	107,421	78,513	116,754
Average annual income	7,161	5,234	7,784

^aAnnual rent payment of \$8,977 equaled land expenses of landowner (3,525 acres).

^bAnnual rent payment of \$10,456 equaled \$1,986 more per year than land expenses of landowner (3,325 acres).

^cOptimal ranch organizations for landlord with specified non-ranch income levels. Tenant income reflects optimal tenant organization for 50-50 tenant-landlord arrangement.

higher rent was \$21,650 compared to \$20,300 for the low rent organization and \$21,205 for the 50-50 cost revenue share arrangements.

The major differences occurred between the renter and tenant's after-tax incomes. Income for the renter averaged \$5,234 when paying the high land-rent, but this is \$1,927 per year less than when paying the low land-rent and \$2,550 per year less than the 50-50 cost-revenue share arrangement. Variations among the landowner's income at the \$25,000 nonranch income level for the three arrangements were less than \$400 per year. Therefore, under these agreements the tenant would benefit most from the 50-50 cost-revenue share arrangement and the landowner's optimal organization would depend on his level of nonranch income.

Summary of Tax Situations

A ranch firm under specified conditions can definitely be used as a tool for taking advantage of certain tax laws. The relative effectiveness of the capital gains regulations on reducing taxable income became more apparent for the larger nonranch income levels. Allowable deductions for capital gains had more effect on the ranch organizations for the full-equity owner-operator organizations because the owner-operator could deduct the entire 50 percent allowable exclusion from his taxable income. As the owner-operator's nonranch income increased, a larger percentage of weaned heifer calves were kept for breeding stock and taxed at the capital gains rate when sold.

The land ownership and management of a ranch firm were separate for the renter and tenant-landlord situations. The landowner gave up land liquidity for a given return on his investment. With the low land-return (\$2.55 per acre) the landowner covered his fixed cost and the

renter had an after-tax income comparable to the owner-operator's income, but when the rental charge was increased \$.60 an acre, the renter's after-tax income was only enough for family consumption. With the 50-50 cost-revenue tenant-landlord share arrangement, the tenant's after-tax income was slightly higher than for either the owner-operator or renter situations. The landlord's relative after-tax income position improved as his nonranch income level increased.

A landowner desiring to either operate a ranch or enter into a leasing agreement would receive more of a tax-shelter from the beef herd at higher nonranch income level. The renter or tenant would be more effective in his bargaining with the landowner depending on the nonranch income of the landlord. Land appreciation might also affect the landowner's bargaining strength because if land values were rapidly increasing he might be willing to give the renter or tenant a better income position. The capital required for establishing improved pasture was paid by the renter and shared by the tenant. But, the landowner receives full net worth value and when the land is sold he would pay income taxes on the increased value at the capital gains rate.

CHAPTER VI
SUMMARY AND CONCLUSIONS

Summary

An economic decision model depicting a beef cattle firm through time in Central Florida was developed in this study. The model placed emphasis on the effect that various tenure arrangements and income tax structures had upon a firm's optimal organization. Since time relationships were involved, the analysis had to be conducted in a multiperiod economic environment. Very little previous work was found to be directly applicable because most studies dealt with either the tenure or tax components in a single year static analysis.

Multiperiod linear programming was used in constructing the firm decision model. This organization incorporated the important aspects of the problem relating to optimal use of resources over time with respect to the objectives to be fulfilled, structural relationships, and constraints. The model was dynamic only in the sense that all time periods were solved simultaneously. Decisions made for one production period were binding on alternatives in subsequent production periods. Thus, the model had no uncertainty components and was static over time.

Features of the model, in addition to being multiperiod, were the provisions for optimizing the ranch organization for either a full-equity owner-operator, a complete renter, or 50-50 cost-revenue tenant-landlord share arrangement. Also, income tax-paying activities

were included that required capital for paying taxes in proportion to an annual taxable income category. The model was designed to maximize after-tax income over a specified planning horizon from a given set of resources. Application of the model was made for a beef cow-calf operation over a 15-year planning horizon. Landowner situations (owner-operator and landlord) were optimized with varying levels of nonranch income.

The tenure situations were analyzed within the same set of assumptions. These major production assumptions were (1) an initial herd of 500 brood cows; (2) a lower limit of 500 brood cows in the final year; (3) all cows for replacement or growth of the herd had to be raised; (4) other livestock alternatives were feeder and stocker activities; (5) 3,500 acres in the basic operation (available land to a renter was not constrained); (6) additional land could be purchased; (7) available grazing could be increased with several alternative forage systems; and (8) a component of equipment available to operate 3,500 acres of grazing land with a 500 cow-calf system was available. With the full-equity owner-operator situation, all resources and management were controlled by the landowner. The complete renter provided everything except land for which he paid a fixed rental rate. Under a 50-50 cost-revenue tenant-landlord share arrangement, the tenant received 50 percent of the net ranch returns and provided his full-time labor. The landlord's income was 50 percent of net ranch return minus fixed land expenses (real estate taxes and depreciation allowance on buildings and fences).

Several financial components were included in the model that were separate from the production activities of the model. These were (1) withdrawal of capital for family consumption (\$5,000 per year); (2)

borrowing of capital at an annual interest rate of 8 percent; (3) capital transfer from one year to the next; (4) various levels of non-ranch income; and (5) graduated income tax paying activities. Capital was generated or made available for the firm through livestock sales and nonranch income. Requirement for capital included capital investments, production expenses, repayment of borrowed capital, family consumption, and payment of income taxes. When the capital requirement exceeded the amount of capital generated, the difference could be transferred from a previous period (if any excess capital existed for the period) or borrowed on a short-term loan.

Tax regulations incorporated into model were (1) two methods of itemizing land-clearing expenses through capitalizing cost over a 10-year period or charging as ordinary expense up to 25 percent of taxable income (maximum of \$5,000) per year; (2) soil and water conservation expenses could be charged as ordinary expense in any year up to a maximum of 25 percent of gross income with any excess being carried over to succeeding years; and (3) sales from culled cows were taxed as capital gains income which allowed 50 percent deduction on taxable income. The nine income tax-paying activities, ranging from zero to \$200,000, allowed taxes to be paid according to annual taxable income.

Income tax rates used were those effective for a head of household filing a joint return during the 1971 tax year. An individual operator claimed \$4,000 per year personal exemption and deductions. Nonranch income was considered to be completely taxable; therefore, before-tax income equaled net ranch income plus nonranch income. Taxable income was based on before-tax income less personal exemptions and capital gains deductions. After-tax income equaled before-tax income minus income taxes paid.

Due to the size of the model and the cost involved in obtaining optimal solutions, the number of computer runs with varying nonranch income levels was limited. The maximum nonranch income level was \$50,000 because at a higher level added restrictions are placed on the amount that can be offset by a business loss and these restrictions would add to the size and complexity of the model.

An objective function of maximizing before-tax income for a full-equity owner-operator with no nonranch income was the first organization solved. Approximately 70 percent of the net ranch income was accounted for during the last three years of the 15-year planning period since no income taxes were charged in the solution. All the remaining optimal organizations were solved with an objective function of maximizing after-tax income during the 15-year planning horizon.

Analysis of the effects of varying tenure arrangements on optimal ranch organization were made by excluding any nonranch income. After-tax incomes were maximized for the full-equity owner-operator, complete renter with two land rental rates, and the tenant and landlord for the 50-50 cost-revenue share situation.

The basic solutions for these tenure groups showed many similarities, each of the situations started with 500 brood cows and also had the minimum (500 head) at the end of the planning horizon. Weaned calves were primarily kept as feeders and grazed for an additional six months. Stocker steers were purchased by the optimal programs during the latter years to use excess grazing created by the reduction in the size of the breeding herd. The maximum size of the breeding herd approached or exceeded 600 head for each of the tenure organizations. Herd size and eventually the number of cows culled varied according to the number of heifer calves kept from the annual calf crop.

Acres operated remained at the minimum 3,500 for the owner-operator and tenant-landlord situations. The landowner purchased no additional acreage for the beef firm. When the renter situations were optimized with no land constraints, the low land rental rate firm required 3,525 acres but the higher land rental rate firm used only 3,325 acres. Instead of buying forage, each tenure organization cleared approximately 550 acres for establishment of improved pasture.

Capital requirements exceeded the amount of capital generated during the early years of the organizations. During these years improved pastures were established and calves were kept to increase the breeding herd. Since no outside income was available, as much as one-third of the capital requirements were met with borrowed funds during the first three years of the planning horizon. The optimal high land rental organization required more borrowed capital than any other tenure situation because of the additional rental charge and the depreciation on buildings and fences which could not be charged as an annual capital expense to reduce taxable income.

The full-equity owner-operator and the complete renter paying a low land rental rate had similar total after-tax incomes but the owner-operator received much more capital value in terms of land appreciation and pasture establishment. When the rental charge was increased to \$3.15 per acre, the renter's net income decreased 27 percent below the low land rental rate situation.

The tenant's and landlord's net returns were compared under a 50-50 cost-revenue share arrangement with a program that was optimized for each individual partner. Total net ranch incomes were very similar for both organizations (\$246,762 for optimal tenant situation and

\$246,722 for optimal landlord situation). Therefore, relatively the same amount was shared by each partner with either optimal organization. The tenant's average annual after-tax income was \$400 more than for the full-equity owner-operator. Fixed land expenses averaged \$8,407 per year and were paid by the landlord. The landlord situation showed a loss (\$2,740 over 15 years) when the land expenses were subtracted from his share of ranch income. It was assumed that the landowner would have paid \$5,502 per year in real estate taxes without the beef firm (real estate taxes are included in the fixed land expenses).

The effects of tax management strategies on optimal tenure organizations were analyzed by varying the level of nonranch income of the individuals. As the annual nonranch income level ranged from zero to \$50,000, the relative importance of capital gains as a source of income was reflected by the increased number of heifers kept and eventually sold as culled cows. The effectiveness of capital gains income (culled cows) as a tax-shelter depended on the type of tenure arrangement. Fifty percent of the capital gains income could be deducted from taxable income with the owner-operator situation, but with the tenant-landlord arrangement the allowable deduction was shared (25 percent for the tenant and 25 percent for the landlord).

Five annual nonranch income levels (zero, \$5,000, \$15,000, \$25,000, and \$50,000) were included in the full-equity owner-operator organization. As the nonranch income level increased, the average size of the breeding herd increased as much as 20 percent. With the added grazing requirements for brood cows, a higher percentage of the weaned calves were sold. Larger grazing requirements were also met with the establishment of increased acreages of improved pasture. The \$50,000

nonranch income organization cleared and established 35 percent more improved pasture acreage than the organization with zero nonranch income. Of the acreage established, 60 percent was put into irrigated pasture on the ranch with the \$50,000 nonranch income as compared with 45 percent at the \$5,000 nonranch income level. Irrigated pasture helped to even out annual income because of allowable depreciation on the irrigation system. An additional 70 acres of native rangeland was purchased by the \$50,000 nonranch income organization.

Capital requirements generally increased with increased nonranch income because of the larger herd size and larger acreage of improved pasture. Average annual net ranch income was slightly less for the \$50,000 nonranch income organization than for the \$5,000 nonranch income level (\$7,850 compared to \$8,000). Capital gains income for the \$50,000 nonranch income organization amounted to 20 percent more than the capital gains income of the ranch organization with zero nonranch income.

The influences of various tax provisions on effective tax rates for the full-equity owner-operator ranch organization are illustrated in Figure 3. The top line (nominal tax rates) illustrates the specified tax rates at given income levels for a married taxpayer filing a joint return. Fourteen percent is the minimum rate and the maximum 70 percent tax category starts at the \$200,000 income level. Average tax rates were determined by dividing the total tax bill by the before-tax income level. Thus, the first dollar is taxed at 14 percent but the average maximum rate only approaches 70 percent. Personal exemptions and deductions were \$4,000 per year for the study; therefore, no taxes were due until the income exceeded \$4,000. Personal deductions represent a smaller proportion of the income as the income level increases.

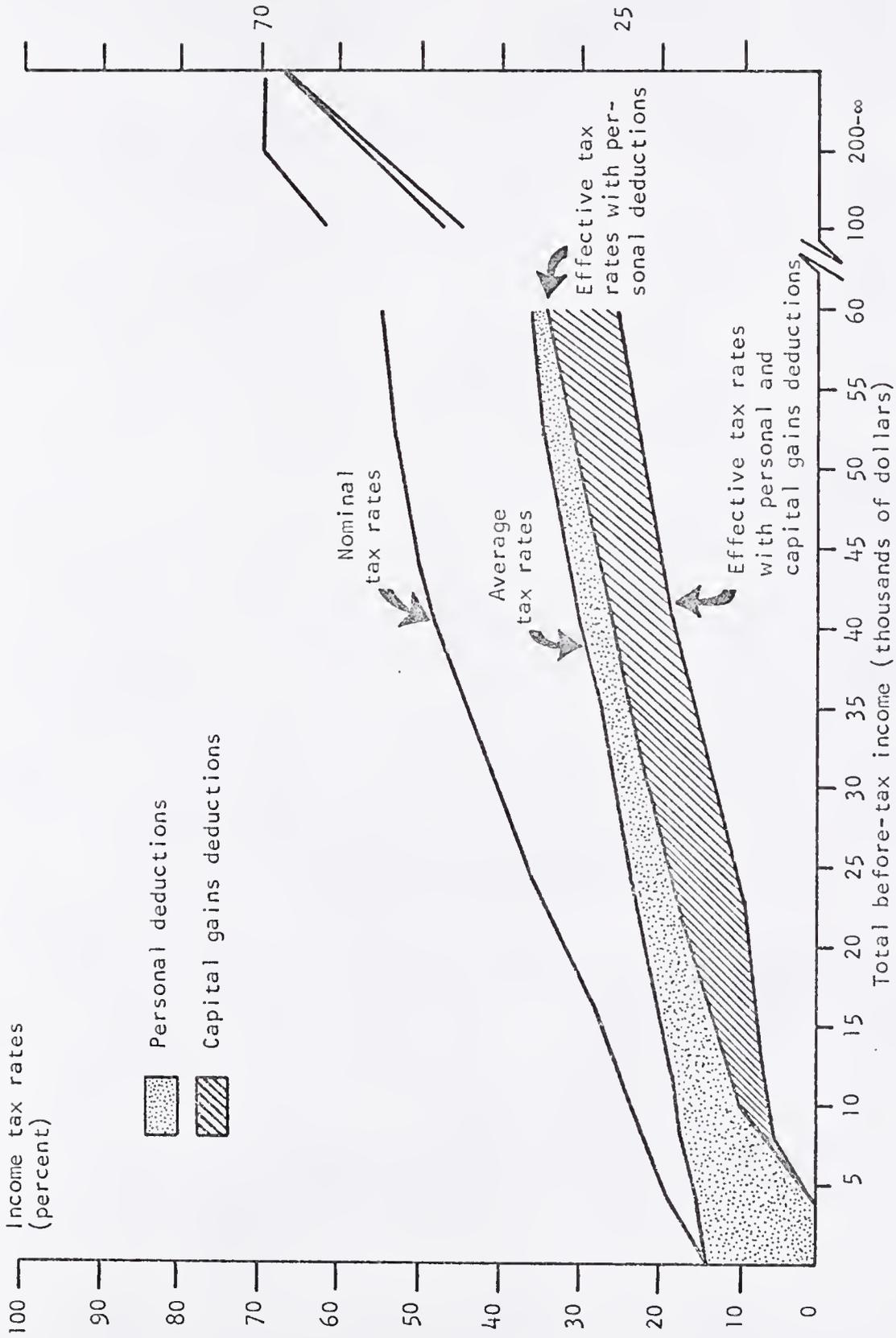


Figure 3. Influence of various tax provisions on effective tax rates for optimal full-equity owner-operator ranch organizations

Actual effective tax rates in this analysis were influenced by personal deductions and capital gains deductions from the sale of culled cows. Capital gains deductions had an increasing effect until income was at an approximate \$23,000 level (\$15,000 nonranch income plus \$8,000 ranch income). Below this income level, full advantage could not be taken of the capital gains allowance. For the \$50,000 annual non-ranch income organization, average annual before-tax income was \$57,850 and the actual effective tax rate was 25 percent. The effective tax rate for \$50,000 with \$4,000 personal deduction and no capital gains would be approximately 30 percent.

Nonranch income was not considered for the complete renter or tenant organizations. The landowner that received rent would pay taxes without the capital gains deduction. However, under the 50-50 cost-revenue tenant-landlord share arrangement, the landowner could claim a deduction of 25 percent of receipts from culled cows. The tenant under the share arrangement, when compared with the complete renter, had a higher income (\$600 per year more than the low rent situation and \$2,400 more than the high rent situation).

Conclusions

This study examined the tenure and taxing structure of representative ranch firms in an important agricultural area of Florida. The analysis established several points with respect to general management strategy and organization structure of ranch firms. A management strategy of maximizing the after-tax income for an individual was quite effective, even when several different tenure structures were considered. Similar results were obtained when the ranch firm operated under an

owner-operator situation, complete renter, or tenant-landlord cost-revenue share arrangement and the ultimate objective was not maximum net ranch income but maximum net income for the individual entrepreneur.

The results of this study showed that present capital gains provision in the tax laws provide an incentive for high nonranch income individuals in the ranching industry to sell calves and increase the cow herd, while for the lower nonranch income individuals it was more profitable to sell feeders and have a smaller cow herd. These taxing regulations also provide an incentive for the higher nonranch income operators to replace the breeding herd more often than normally done.

The effectiveness of the various tenure arrangement, other than the full-equity owner-operator, depended on the tax advantages that can be expected for one arrangement over another. The renter situation was entirely dependent on the rental rate. For the renter to be willing to establish improved pasture and increase carrying capacity, some form of long-term lease should be provided by the landowner. An incentive must be received by the landowner in order for him to enter into a lease or share arrangement. This commitment of the land resource would reduce his land liquidity in terms of selling land during the years of the agreement. Thus, the agreement would be based upon their relative bargaining strength. The range for bargaining as found in this study is relatively small. When the rental rate equals fixed land expenses (no preference to the landowner) the ranch operator's income was similar to the income from the full-equity owner-operator solution. At the higher land rental rate, the operator barely received enough return to cover family consumption requirements, much less get a positive return to capital.

The advantage of the 50-50 cost-revenue tenant-landlord share arrangement over the complete renter was dependent on the landlord's level of nonranch income. As the landowner's income increased, the capital gains provisions on culled cows improved his tax position and the tenant's income position was always better than the complete renter situation. Therefore, the tendency should be toward more cost-revenue tenant-landlord share arrangements.

A higher percentage of tenancy has occurred during recent years in the study area. The percent of farms under some form of tenant arrangement increased from an average of 4.2 percent in 1959 to 10.5 percent in 1969 (Table 43). This same trend extended throughout the other Central Florida counties as well as the state. One reason for the increased number of tenant arrangements might be retirement objectives of individuals. The average age of farmers in the study area was 53.1 years (Table 43). Thus, many farmers are near the retirement age and might desire to retain possession of their land without the duties of management.

No attempt has been made in this study to determine the motives of individuals with nonranch income to invest in beef ranches. The 1969 federal income tax returns showed that approximately 20,000 individuals with adjusted gross incomes over \$50,000 reported \$241 million in farm losses [19, p. 19]. The majority of these losses were generated from activities classified as "livestock farms". It would be very difficult to ascertain the effect of tax-sheltered investment on the total beef supply.

The demand for beef is generally considered to be inelastic. This means that an increase in supply of beef would have an adverse

Table 43. Percent of farms under some form of tenant arrangement and average age of farmers by counties in Central Florida

Counties	Percent of tenancy census years			Average age (years)
	1959	1964	1969	1969
Study area:				
Charlotte	5.4	13.2	17.5	54.0
DeSotoa	1.6	1.0	5.5	52.7
Hardee	1.5	.6	3.6	54.6
Hillsborough	3.4	3.7	7.2	54.1
Lee	9.3	20.5	21.8	51.2
Manatee	8.2	3.9	13.7	52.6
Pasco	1.2	3.0	2.6	53.8
Pinellas	2.4	9.6	7.9	56.0
Sarasota	4.6	8.5	14.4	49.1
Average	4.2	7.1	10.5	53.1
Other Central Florida counties:				
Glades	8.7	0.0	1.9	50.5
Hendry	14.8	12.8	21.6	51.1
Highlands	10.4	4.1	9.4	51.0
Indian River	2.8	.7	2.0	53.4
Martin	16.9	15.2	16.4	47.4
Okeechobee	9.3	11.2	13.8	49.2
Osceola	1.7	2.3	7.4	53.9
Palm Beach	20.3	26.5	32.1	48.9
Polk	1.8	1.4	4.2	55.1
St. Lucie	3.3	3.4	3.2	52.9
Average	9.0	7.8	11.2	51.3
Average Central Florida	6.7	7.5	10.9	52.2
State average	5.7	6.3	7.5	52.4

Source: U. S. Census of Agriculture, 1964 and 1969.

effect on cattle prices. Therefore, if the incentives provided by the present Internal Revenue Code did actually increase the beef supply, cattle prices would be lower. However, the decisions of individuals with high taxable incomes would not be affected as much with lower cattle prices as the decisions of beef producers depending entirely on the beef organization for their source of income.

The results of this analysis indicated a trend toward larger breeding herds, larger capital investment, and increased acreage of improved pasture. These trends were even more emphasized as the organizations were optimized with higher levels of nonranch income. Beef cow numbers have been steadily increasing in recent years in the study area. The total number of brood cows increased by 31 percent from 1959 to 1969 (Table 44). However, the number of farms with mature beef cows remained stable (2,001 farms in 1964 compared to 2,038 farms in 1969). This trend toward larger beef breeding herds prevailed throughout Central Florida. In 1969, 63 percent of all beef brood cows in Florida were located in Central Florida counties as compared with 56 percent in 1959 (Table 44).

According to the projections in the capital and credit section of the 1969 DARE Report [4, p. 161], livestock inventory investment per farm would increase 96 percent from 1964 to 1975 and 140 percent from 1964 to 1980. Total capital investment per farm was projected to increase by 104 percent and 167 percent during the same time periods. Improved pastureland was a large recipient of capital investment in the programming analysis of this study and the availability of nonranch income increased the improved pasture acreage. The number of farms with improved pasture and the total acreage of improved pasture have increased

Table 44. Number of beef cattle farms, number of beef cows that have calved, by counties in Central Florida

Counties	Census years					
	1959		1964		1969	
	Farms	Brood cows	Farms	Brood cows	Farms	Brood cows
Study area:						
Charlotte	24	8,972	25	10,027	46	10,176
DeSoto	159	23,037	173	22,627	193	23,143
Hardee	305	22,261	367	35,804	366	38,608
Hillsborough	556	29,638	683	37,747	650	29,644
Lee	82	7,720	102	7,328	109	7,929
Manatee	193	14,349	222	22,458	222	30,970
Pasco	193	17,505	290	22,107	314	25,735
Pinellas	59	2,902	51	1,979	51	1,701
Sarasota	118	14,705	88	14,244	87	17,309
Total	1,689	141,089	2,001	174,321	2,038	185,215
Other Central Florida counties:						
Glades	80	18,700	75	19,952	87	31,009
Hendry	104	29,855	124	48,052	118	60,901
Highlands	108	24,154	156	33,709	181	46,097
Indian River	39	9,154	40	12,873	39	14,313
Martin	34	7,905	33	8,233	52	17,668
Okeechobee	93	31,537	114	31,036	128	42,613
Osceola	159	37,694	165	60,897	191	90,449
Palm Beach	124	23,537	107	21,973	129	44,962
Polk	558	48,486	614	59,380	535	48,797
St. Lucie	58	18,195	60	22,163	60	25,553
Total	1,357	249,217	1,488	318,268	1,520	422,362
Total Central Florida	3,046	390,306	3,489	492,859	3,558	607,577
State total	10,203	672,403	12,645	870,686	11,197	968,187

Source: Derived from U. S. Census of Agriculture, 1964 and 1969.

in the study area, in Central Florida, and in the state (Table 45).

Acres of improved pastureland in the study area increased by 42 percent from 1964 to 1969. Irrigated pastureland which played an important role in the optimal organizations of this analysis represented approximately 10 percent of the total improved pasture acreage in the study area.

This analysis did not consider the aggregate beef industry in Florida. However, the results obtained from the firm analysis seem to correspond to a high degree with the aggregate data presented for the study area.

Need for Further Research

The model in its present form has many potential uses. One alternative would be to relax the requirement of a minimum brood cow herd. This, along with increasing the allowable culling rate, could simulate the planning horizon for operators going into retirement from the beef activity. Due to the nature of the multiperiod model, the breeding herd would probably be liquidated by the end of the planning horizon.

Another relevant objective function might be to maximize net worth at the end of the planning horizon. Since land appreciation and land purchasing activities are included in the model, this addition would be rather easy to make by adding a net worth objective row. Land-selling activities are not in the model but would be useful in estate planning if the estate taxing regulations were included. No provision was made in the model for risk and uncertainty as the firm moves through time. The effects of variable production rates and prices can be expected to institute more changes in the optimal organization of a ranch firm if taxable income is small.

Table 45. Number of farms and acreage of improved pastureland and irrigated pastureland, by counties in Central Florida

Counties	Improved pastureland				Irrigated pasture	
	Census year 1964		Census year 1969		Census year 1969	
	Farms	Acres	Farms	Acres	Farms	Acres
Study area:						
Charlotte	16	6,531	25	16,711	5	2,556
DeSoto	74	28,461	80	36,146	18	4,390
Hardee	119	40,419	150	57,851	19	6,173
Hillsborough	171	61,127	225	63,582	13	3,482
Lee	30	7,805	41	12,704	11	4,139
Manatee	93	26,739	122	73,498	32	6,794
Pasco	104	44,228	131	59,621	15	1,805
Pinellas	19	4,414	15	2,969	0	0
Sarasota	35	25,921	32	25,249	13	6,559
Total	661	245,645	821	348,331	126	35,898
Other Central Florida counties:						
Glades	32	25,689	53	73,483	18	19,789
Hendry	45	78,197	71	128,323	36	37,394
Highlands	82	52,729	88	88,009	21	22,226
Indian River	18	21,315	26	30,016	10	17,629
Martin	16	40,916	36	60,322	10	13,746
Okeechobee	53	47,988	86	115,988	16	10,318
Osceola	67	204,474	94	225,726	4	20,556
Palm Beach	79	82,656	94	164,022	42	75,992
Polk	202	102,557	192	85,611	20	7,732
St. Lucie	36	49,945	33	45,076	13	22,475
Total	630	706,466	773	1,016,576	190	247,857
Total Central Florida	1,291	952,111	1,594	1,364,907	316	283,755

Source: Derived from U. S. Census of Agriculture, 1969.

The model oversimplifies the family consumption requirement. When incomes are small, the level of consumption would be one of the more important variables in the total capital requirement. Thus, provisions could be made in the model to include a consumption function of the type, $C = a + bY$, where the \$5,000 consumption level is the "a" value plus some constant proportion of annual after-tax income.

Other production alternatives such as purchasing mature cows, were not included in the model because the model became more cumbersome and expensive to operationalize. Purchased cow activity would need separate rows and columns from the raised cows because of different capital gains deductions and depreciation allowances.

Future research efforts should be directed toward studying aspects of the Internal Revenue Code. Closing or reducing the loopholes in the tax laws, such as reducing the allowable capital gains deduction, might reduce income tax rates but the effects of such changes on the decisions of beef investors and the general economy need to be considered before any revisions are made in the tax system. The model developed in this analysis could be used to evaluate specified revisions in Federal Tax Regulations, and some general conclusions reached for the types of firms under consideration.

A P P E N D I X

EXPLANATION OF INFORMATION CONTAINED
IN TABLES IN APPENDIX

Tables in the Appendix give the yearly optimal ranch organization and structure of the different analyses conducted in the study. The following explanations aid in understanding the information presented in each table.

Owner-operator	Owns all resources.
Renter	Provides all resources except land and pays a fee for use of land.
Tenant	Provides labor and divides income with landlord.
Landlord	Provides land and divides income with tenant.
Cows, mature	Number of cows in herd that are of calving age.
Cows, culled	Total mature cows culled for production reasons plus cows liquidated for herd improvement.
Weaned calves	Eighty percent of mature cows wean calves. These calves are either kept to go into the herd (heifers, maximum of 50 percent of calf crop), sold as weaned calves, or kept as feeders on grazing for six months.
Stocker steers	Steers purchased in October and kept on grazing for six months.
Land, owned	Acres in the ranch for an owner-operator.
Land, purchased	Acres purchased in specific years which add to land owned.
Land, leased	Acres of land in the organization for the complete renter situations.
Land, operated	Acres of land in the organization for the tenant-landlord situation; land is owned by landlord.
Native pasture	Acres of unimproved native range available for grazing.

Land, cleared	Unimproved land that is cleared for improved pasture in specific years, but not necessarily the year that improved pasture is established. Acreage of grazed cleared land is not shown, but equals the difference between total land cleared and total land in improved pasture.
Improved pasture	Yearly acreage of maintained nonirrigated perennial grass pasture and seepage irrigated grass-clover pasture.
Labor, hired	Hours of required labor in addition to regular labor supplied by owner, renter, or tenant.
Conservation expenses	Soil and water conservation expenses allowed for tax deductions.
Overhead expenses	Insurance and other miscellaneous expenses.
Property taxes	Includes personal property and real estate taxes for the owner-operator situations but only personal property taxes for the renter and tenant-landlord situations.
Depreciation	Includes bull (\$1.96 per mature cow), machinery and equipment (\$.93 per acre), and building and land improvement (\$.83 per acre) depreciation. Does not include building and land improvement depreciation for renter and tenant-landlord organizations.
Consumption	\$5,000 per year per family.
Capital	Total required capital is capital requirement for beef organization excluding depreciation plus capital for family consumption and capital for paying income taxes. Borrowed capital is amount of capital required in excess of capital generated by sales and nonranch income. Capital accumulation is the summation of generated capital minus required capital.
Net worth, firm	Includes value of livestock, machinery, equipment, and land (landowner only) minus borrowed capital.
Ranch income (excluding cull cows)	Total receipts minus total cash expenses from all sales, except culled cows. Minus sign indicates a loss or negative income.
Receipts, cull cows	Taxed as capital gains income.
Net ranch income	Ranch income plus receipts from culled cows.

Net income shared	Net ranch income for tenant-landlord situations.
Nonranch income	Income from sources other than the ranch firm. Included as part of the available capital.
Land expenses	Includes real estate taxes and depreciation on buildings and improvements paid by the landowner.
Before-tax income	Net ranch income plus nonranch income.
Tax deductions and exemptions	Equal to \$4,000 per year based on a family of four.
Capital gains exclusion	Income that is not subject to income tax (50 percent of sales from culled cows).
Taxable income	Before-tax income minus personal tax deduction and exemptions and the capital gains exclusion.
Taxes paid	Federal income tax on taxable income.
After-tax income	Before-tax income minus income taxes paid.

Table 46. Optimal ranch organization when maximizing after-tax income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	491	532	524	515
Cows, culled	hd.	90	83	85	96	94	93
Weaned calves:							
Heifers, kept	hd.	125	143	100	98	125	80
Calves, sold	hd.	275	142	0	89	0	65
Feeder steers	hd.	0	85	293	238	294	267
Stocker steers	hd.	0	0	0	0	0	0
Land, owned	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,000	2,966	2,946	2,946	2,946	2,946
Land, cleared	acre	500	34	20	0	0	0
Improved pasture:							
Nonirrigated	acre	199	291	300	300	300	300
Irrigated	acre	125	243	254	254	254	254
Labor, hired	hr.	1,147	806	913	1,098	1,088	1,120
Conservation expenses	dol.	9,800	7,403	701	0	0	0
Overhead expenses	dol.	2,555	2,718	2,873	2,888	2,888	2,888
Property taxes	dol.	5,927	5,953	5,981	5,991	5,984	5,989
Depreciation	dol.	7,140	7,501	7,968	8,087	8,071	8,053
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	69,290	53,608	47,623	77,523	74,235	73,367
Borrowed	dol.	23,873	23,092	21,092	1,009	18,009	1,233
Accumulation	dol.	0	0	0	0	0	0
Net worth, firm	dol.	684,506	711,680	744,513	808,851	852,931	916,412
Ranch income (excluding cull cows)	dol.	-20,439	-38,047	-37,845	-180	-15,185	-608
Receipts, cull cows	dol.	15,381	14,206	15,103	16,359	16,104	15,844
Net ranch income	dol.	-5,058	-23,841	-22,736	16,179	919	15,236
Before tax-income	dol.	-5,058	-23,841	-22,736	16,179	919	15,236
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,691	7,103	7,555	8,179	8,052	7,922
Taxable income	dol.	0	0	0	4,000	0	3,314
Taxes paid	dol.	0	0	0	620	0	504
After-tax income	dol.	-5,058	-23,841	-22,736	15,559	919	14,732
Total ranch income - 15 years			\$117,478				
Total after-tax income - 15 years			110,098				
Average after-tax income per year			7,340				

for a full-equity owner-operator with zero nonranch income

Year								
7	8	9	10	11	12	13	14	15
533	505	537	509	554	503	613	551	500
96	91	96	92	99	90	111	99	90
136	81	151	60	218	60	60	60	60
4	44	25	122	138	306	360	323	340
287	279	253	225	87	36	71	57	0
0	0	0	0	0	0	0	0	70
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,946	2,946	2,946	2,946	2,946	2,946	2,946	2,946	2,946
0	0	0	0	0	0	0	0	0
300	300	300	300	300	300	300	300	300
254	254	254	254	254	254	254	254	254
1,117	1,122	1,110	1,032	880	686	685	521	297
0	0	0	0	0	0	0	0	0
2,888	2,888	2,888	2,888	2,888	2,888	2,888	2,888	2,888
5,983	5,987	5,986	5,996	5,989	6,020	6,030	5,987	5,952
8,089	8,034	8,097	8,042	8,130	8,030	8,245	8,124	8,124
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
52,521	68,300	52,595	50,763	47,412	44,600	45,079	41,756	50,743
0	0	0	0	0	0	0	0	0
0	0	0	4,420	10,618	13,372	17,125	23,587	29,915
960,386	1,026,964	1,077,943	1,134,107	1,188,501	1,257,185	1,323,346	1,378,160	1,439,468
-10,964	-3,775	-6,978	174	-523	264	-1,436	3,888	8,309
16,409	15,549	16,512	15,650	17,045	15,470	18,869	16,935	15,381
5,445	11,774	9,534	15,824	16,522	15,734	17,433	20,823	23,690
5,445	11,774	9,534	15,824	16,522	15,734	17,433	20,823	23,690
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
8,205	7,775	8,256	7,825	8,572	7,735	9,434	8,468	7,690
0	0	0	3,999	4,000	3,999	3,999	8,355	12,000
0	0	0	620	620	620	620	1,516	2,260
5,445	11,774	9,534	15,204	15,902	15,114	16,813	19,307	21,430

Table 47. Optimal ranch organization when maximizing after-tax \$2.55 per acre

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	489	526	528	511
Cows, culled	hd.	90	83	88	95	95	92
Weaned calves:							
Helpers, kept	hd.	122	139	110	90	136	73
Calves, sold	hd.	278	71	0	78	0	77
Feeder steers	hd.	0	160	281	253	287	259
Stocker steers	hd.	0	22	0	0	0	0
Land, leased	acre	3,525	3,525	3,525	3,525	3,525	3,525
Native pasture	acre	3,025	2,974	2,974	2,974	2,974	2,974
Land, cleared	acre	500	51	0	0	0	0
Improved pasture:							
Nonirrigated	acre	208	278	295	296	296	296
Irrigated	acre	139	248	255	255	255	255
Labor, hired	hr.	1,244	876	938	1,093	1,101	1,104
Conservation expenses	dol.	10,661	6,541	652	29	0	0
Overhead expenses	dol.	2,115	2,297	2,440	2,449	2,449	2,449
Property taxes	dol.	425	450	476	490	483	490
Lease payment	dol.	8,977	8,977	8,977	8,977	8,977	8,977
Depreciation	dol.	4,258	4,667	5,099	5,196	5,200	5,167
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	75,058	53,681	67,333	72,506	81,456	79,835
Borrowed	dol.	28,749	27,327	24,957	738	22,596	7,748
Accumulation	dol.	0	0	0	0	0	0
Net worth:							
Firm	dol.	85,719	64,674	46,987	85,963	89,631	108,963
Land	dol.	577,480	620,253	657,041	694,909	734,918	777,359
Ranch income (excluding cull cows)	dol.	-22,039	-45,654	-28,672	-4,092	-13,335	-451
Receipts, cull cows	dol.	15,381	14,206	15,030	16,183	16,255	15,722
Net ranch income	dol.	-6,658	-31,448	-13,642	12,091	2,920	15,271
Before-tax income	dol.	-6,658	-31,448	-13,642	12,091	2,920	15,271
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,691	7,103	7,515	8,092	8,128	7,861
Taxable income	dol.	0	0	0	0	0	3,410
Taxes paid	dol.	0	0	0	0	0	520
After-tax income	dol.	-6,658	-31,448	-13,642	12,091	2,920	14,751
Total ranch income - 15 years			\$114,476				
Total after-tax income - 15 years			107,421				
Average after-tax income per year (renter)			7,161				

income for a complete land renter paying an annual rental rate of

Year									
7	8	9	10	11	12	13	14	15	
541	505	539	515	539	532	613	551	500	
97	91	97	93	97	96	111	99	90	
139	85	130	103	194	60	60	60	60	60
20	43	55	123	189	322	365	260	340	
274	276	246	185	48	44	66	120	0	
0	0	0	0	0	0	0	0	85	
3,525	3,525	3,525	3,525	3,525	3,525	3,525	3,525	3,525	3,525
2,974	2,974	2,974	2,974	2,974	2,974	2,974	2,974	2,974	2,974
0	0	0	0	0	0	0	0	0	0
296	296	296	296	296	296	296	296	296	296
255	255	255	255	255	255	255	255	255	255
1,099	1,105	1,096	974	797	682	685	594	379	
0	0	0	0	0	0	0	0	0	0
2,449	2,449	2,449	2,449	2,449	2,449	2,449	2,449	2,449	2,449
484	487	488	490	495	529	529	485	451	
8,977	8,977	8,977	8,977	8,977	8,977	8,977	8,977	8,977	8,977
5,225	5,155	5,221	5,174	5,221	5,208	5,366	5,245	5,145	
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
54,930	76,461	61,882	52,452	51,867	47,224	48,330	56,660	57,040	
0	2,898	0	0	0	0	0	0	0	0
0	0	0	0	4,158	6,726	5,582	10,040	24,995	
108,048	128,534	136,525	137,131	141,490	151,032	151,056	138,670	128,717	
822,374	870,066	920,650	974,230	1,031,054	1,091,295	1,155,098	1,222,778	1,294,547	
-10,285	-5,774	-4,297	84	-285	-4,180	120	-4,469	16,309	
16,656	15,528	16,593	15,830	16,569	16,358	18,869	16,935	15,381	
6,371	9,754	12,296	15,914	16,284	12,178	18,989	12,466	31,690	
6,371	9,754	12,296	15,914	16,284	12,178	18,989	12,466	31,690	
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
8,328	7,764	8,296	7,915	8,284	8,179	9,435	8,468	7,690	
0	0	0	3,999	4,000	0	5,554	0	20,000	
0	0	0	620	620	0	915	0	4,380	
6,371	9,754	12,296	15,294	15,664	12,178	18,074	12,466	27,310	

Table 48. Optimal ranch organization when maximizing after-tax \$3.15 per acre

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	429	522	515	524
Cows, culled	hd.	90	83	77	94	93	94
Weaned calves:							
Halfers, kept	hd.	60	185	100	114	82	139
Calves, sold	hd.	340	91	0	82	104	8
Feeder steers	hd.	0	93	243	221	226	271
Stocker steers	hd.	0	37	0	0	0	0
Land, leased	acre	3,325	3,325	3,325	3,325	3,325	3,325
Native pasture	acre	2,825	2,774	2,774	2,774	2,774	2,774
Land, cleared	acre	500	52	0	0	0	0
Improved pastures:							
Nonirrigated	acre	134	229	283	283	288	288
Irrigated	acre	132	255	264	264	264	264
Labor, hired	hr.	1,064	860	729	1,006	970	1,037
Conservation expenses	dol.	8,857	7,704	1,465	0	100	0
Overhead expenses	dol.	1,995	2,168	2,329	2,340	2,340	2,340
Property taxes	dol.	421	420	449	478	479	472
Lease payment	dol.	10,456	10,456	10,456	10,456	10,456	10,456
Depreciation	dol.	4,072	4,458	4,821	5,034	5,020	5,038
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	71,867	63,773	59,532	73,693	86,698	84,692
Borrowed	dol.	18,934	32,929	30,131	7,890	22,323	29,572
Net worth							
Firm	dol.	94,630	61,376	39,692	65,529	76,561	74,993
Land	dol.	541,965	584,726	621,266	656,943	694,907	734,940
Ranch income (excluding cull cows)	dol.	-12,244	-44,130	-37,860	-9,198	-7,669	-16,854
Receipts, cull cows	dol.	15,381	14,206	13,188	16,053	15,844	16,110
Net ranch income	dol.	3,137	-29,924	-24,672	6,855	8,175	-744
Before-tax income	dol.	3,137	-29,924	-24,672	6,855	8,175	-744
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,691	7,103	6,594	8,027	7,922	8,055
Taxable income	dol.	0	0	0	0	0	0
Taxes paid	dol.	0	0	0	0	0	0
After-tax income	dol.	3,137	-29,924	-24,672	6,855	8,175	-744
Total ranch income - 15 years			\$82,792				
Total after-tax income - 15 years			78,513				
Average after-tax income per year (renter)			5,234				

income for a complete land renter paying an annual rental rate of

Year								
7	8	9	10	11	12	13	14	15
500	536	500	522	524	522	602	550	500
90	96	90	94	94	94	108	99	99
72	125	109	105	190	69	60	60	60
85	55	20	109	177	326	387	308	340
243	249	271	204	52	22	35	72	0
0	0	0	0	0	0	0	0	67
3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325
2,774	2,774	2,774	2,774	2,774	2,774	2,774	2,774	2,774
0	0	0	0	0	0	0	0	0
288	288	288	288	288	288	288	288	288
264	264	264	264	264	264	264	264	264
1,044	1,035	1,047	1,030	802	647	620	510	330
0	0	0	0	0	0	0	0	0
2,340	2,340	2,340	2,340	2,340	2,340	2,340	2,340	2,340
479	476	473	482	481	516	520	481	446
10,456	10,456	10,456	10,456	10,456	10,456	10,456	10,456	10,456
4,991	5,062	4,991	5,034	5,038	5,034	5,191	5,089	4,991
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
69,960	76,907	84,391	55,100	63,948	72,973	48,344	44,747	52,984
0	13,619	24,970	0	0	0	0	0	0
85,056	92,744	96,632	99,038	112,596	147,382	148,675	137,368	127,415
777,400	822,388	870,102	920,642	974,240	1,031,065	1,091,248	1,155,087	1,222,784
-2,565	-9,656	-12,587	-27	-64	-4,028	-1,264	-4,469	8,309
15,381	16,479	15,381	16,053	16,126	16,054	18,526	16,935	15,381
12,816	6,823	2,794	16,026	16,062	12,026	17,262	12,466	23,690
12,816	6,823	2,794	16,026	16,062	12,026	17,262	12,466	23,690
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
7,691	8,240	7,691	8,026	8,063	8,027	9,263	8,468	7,690
1,125	0	0	4,000	3,999	0	3,999	0	12,000
159	0	0	620	620	0	620	0	2,260
12,657	6,823	2,794	15,406	15,442	12,026	16,642	12,466	21,430

Table 49. Optimal ranch organization when maximizing tenant's after-

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	496	489	526	521
Cows, culled	hd.	90	83	89	88	95	94
Weaned calves:							
Heifers, kept	hd.	130	94	139	102	99	126
Calves, sold	hd.	270	156	37	0	53	0
Feeder steers	hd.	0	120	220	289	269	291
Stocker steers	hd.	0	0	0	0	0	0
Land, operated	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,000	3,000	2,947	2,947	2,947	2,947
Land, cleared	acre	500	0	53	0	0	0
Improved pasture:							
Nonirrigated	acre	196	234	281	300	300	300
Irrigated	acre	122	246	253	253	253	253
Labor, hired	hr.	1,127	710	878	1,021	1,118	1,119
Conservation expenses	dol.	9,610	6,648	1,236	380	0	0
Overhead expenses	dol.	2,555	2,715	2,878	2,887	2,887	2,887
Property taxes	dol.	425	453	461	475	486	481
Depreciation	dol.	4,235	4,585	5,083	5,093	5,166	5,156
Capital:							
Total required	dol.	58,295	53,290	60,216	62,691	51,600	41,040
Borrowed	dol.	12,840	21,307	20,236	10,513	0	0
Net worth, firm	dol.	108,515	108,162	111,611	125,355	138,717	137,372
Ranch income (excluding cull cows)	dol.	-12,192	-26,268	-19,070	-9,832	5,759	-2,662
Receipts, cull cows	dol.	15,381	14,206	15,250	15,031	16,188	16,023
Net income shared	dol.	3,189	-12,062	-3,820	5,199	21,947	13,361
Tenant:							
Net worth	dol.	54,258	54,081	55,805	62,678	69,358	68,686
Capital accumulation	dol.	0	0	0	0	0	0
Share of income	dol.	1,595	-6,031	-1,910	2,600	10,974	6,681
Tax deduction and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	3,845	3,551	3,812	3,758	4,047	4,006
Taxable income	dol.	0	0	0	0	2,927	0
Taxes paid	dol.	0	0	0	0	438	0
After-tax income	dol.	1,595	-6,031	-1,910	2,600	10,536	6,681
Total before-tax income (tenant) - 15 years				\$123,384			
Total after-tax income (tenant) - 15 years				116,754			
Average after-tax income per year (tenant)				7,784			

tax income (50-50 cost-revenue tenant-landlord share arrangement)

Year								
7	8	9	10	11	12	13	14	15
514	534	507	528	520	529	582	551	500
93	96	92	95	93	95	105	99	90
81	126	100	115	164	86	60	60	60
65	25	14	55	110	236	282	264	340
266	276	292	252	143	100	123	117	0
0	0	0	0	0	0	0	0	79
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,947	2,947	2,947	2,947	2,947	2,947	2,947	2,947	2,947
0	0	0	0	0	0	0	0	0
300	300	300	300	300	300	300	300	300
253	253	253	253	253	253	253	253	253
1,114	1,097	1,121	1,114	960	831	794	667	376
0	0	0	0	0	0	0	0	0
2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887
487	482	482	486	487	513	517	485	450
5,142	5,181	5,129	5,170	5,154	5,171	5,276	5,215	5,115
41,058	40,650	41,123	40,961	37,853	36,162	35,731	32,535	38,225
0	0	0	0	0	0	0	0	0
139,254	137,743	137,819	138,925	139,187	146,638	147,852	138,508	128,555
7,339	-203	-207	6,398	8,008	7,880	7,062	11,777	24,322
15,815	16,430	15,585	16,256	16,008	16,264	17,900	16,935	15,381
23,154	16,227	15,376	22,654	24,016	24,144	24,962	28,712	39,703
69,627	68,871	68,909	69,462	69,593	73,319	73,926	69,254	64,278
0	0	0	1,128	7,516	13,968	20,829	29,162	41,754
11,577	8,114	7,688	11,327	12,008	12,072	12,481	14,356	19,852
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
3,954	4,107	3,896	4,064	4,002	4,066	4,475	4,234	3,845
3,623	0	0	3,263	4,006	4,006	4,006	6,122	12,007
555	0	0	494	620	620	620	1,023	2,260
11,022	8,114	7,688	10,833	11,388	11,452	11,861	13,333	17,592

Table 50. Optimal ranch organization when maximizing landlord's after-with \$5,000 annual nonranch income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	491	479	525	509
Cows, culled	hd.	90	83	88	86	95	92
Weaned calves:							
Helpers, kept	hd.	125	88	146	90	129	82
Calves, sold	hd.	275	170	43	24	0	50
Feeder steers	hd.	0	111	203	269	291	276
Stocker steers	hd.	10	0	0	0	0	0
Land, operated	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,000	3,000	2,948	2,948	2,948	2,948
Land, cleared	acre	500	0	52	0	0	0
Improved pasture:							
Nonirrigated	acre	143	225	268	300	300	300
Irrigated	acre	123	239	250	252	252	252
Labor, hired	hr.	1,060	706	826	953	1,118	1,121
Conservation expenses	dol.	8,629	7,099	1,366	735	0	0
Overhead expenses	dol.	2,555	2,716	2,868	2,882	2,885	2,885
Property taxes	dol.	425	451	456	472	480	485
Depreciation	dol.	4,235	4,589	5,049	5,064	5,161	5,130
Capital:							
Total required	dol.	57,485	51,968	58,699	60,685	50,817	41,126
Borrowed	dol.	9,927	18,490	19,733	9,089	0	0
Net worth, firm	dol.	111,428	110,379	110,409	125,649	137,080	138,598
Ranch income (excluding cull cows)	dol.	-9,236	-25,302	-18,838	-9,364	-2,553	5,817
Receipts, cull cows	dol.	15,381	14,206	15,102	14,737	16,164	15,656
Net income shared	dol.	6,145	-11,096	-3,736	5,373	13,611	21,473
Landlord:							
Net worth	dol.	625,414	668,349	706,289	753,014	798,455	841,354
Share of income	dol.	3,073	-5,548	-1,868	2,687	6,805	10,737
Land expenses	dol.	8,407	8,407	8,407	8,407	8,407	8,407
Ranch income	dol.	-5,334	-13,955	-10,275	-5,720	-1,601	2,330
Before-tax income	dol.	-334	-8,955	-5,275	-720	3,399	7,330
Tax deduction and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	3,845	3,551	3,776	3,684	4,041	3,914
Taxable income	dol.	0	0	0	0	0	0
Taxes paid	dol.	0	0	0	0	0	0
After-tax income	dol.	-334	-8,955	-5,275	-720	3,399	7,330
Total before-tax income (landlord) - 15 years					\$72,260		
Total after-tax income (landlord) - 15 years					69,780		
Average after-tax income per year (landlord)					4,652		

tax income (50-50 cost-revenue tenant-landlord share arrangement)

Year								
7	8	9	10	11	12	13	14	15
533	507	528	516	517	529	526	550	500
96	91	95	93	93	95	95	99	90
127	95	106	118	105	133	60	60	60
19	23	47	0	55	152	285	335	340
281	287	270	294	253	137	75	45	0
0	0	0	0	0	0	0	0	66
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,948	2,948	2,948	2,948	2,948	2,948	2,948	2,948	2,948
0	0	0	0	0	0	0	0	0
300	300	300	300	300	300	300	300	300
252	252	252	252	252	252	252	252	252
1,117	1,121	1,117	1,119	1,113	938	703	512	280
0	0	0	0	0	0	0	0	0
2,885	2,885	2,895	2,885	2,885	2,885	2,885	2,885	2,885
482	483	484	480	486	501	498	484	450
5,177	5,126	5,167	5,143	5,145	5,169	5,163	5,210	5,112
41,020	41,105	41,028	42,537	40,949	37,516	33,404	29,525	34,497
0	0	0	0	0	0	0	0	0
137,665	137,910	138,427	137,249	138,834	139,670	142,459	138,508	128,555
323	1,598	4,940	-2,357	6,739	14,692	14,736	14,359	15,136
16,391	15,593	16,270	15,875	15,890	16,269	16,182	16,935	15,381
16,714	17,191	21,210	13,518	22,629	30,961	30,918	31,294	30,517
885,582	933,060	983,543	1,036,154	1,093,367	1,153,600	1,218,344	1,283,569	1,349,852
8,357	8,596	10,605	6,759	11,315	15,481	15,459	15,647	15,259
8,407	8,407	8,407	8,407	8,407	8,407	8,407	8,407	8,407
-50	189	2,198	-1,648	2,908	7,074	7,052	7,240	6,852
4,950	5,189	7,198	3,352	7,308	12,074	12,052	12,240	11,852
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
4,098	3,898	4,068	3,969	3,973	4,068	4,046	4,234	3,846
0	0	0	0	0	4,006	4,006	4,006	4,006
0	0	0	0	0	620	620	620	620
4,950	5,189	7,198	3,352	7,908	11,454	11,432	11,620	11,232

Table 51. Optimal ranch organization when maximizing before-tax income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	478	548	528	523
Cows, culled	hd.	90	83	86	99	95	94
Weaned calves:							
Helpers, kept	hd.	112	170	91	103	127	78
Calves, sold	hd.	288	119	0	116	0	84
Feeder steers	hd.	0	80	291	220	295	256
Stocker steers	hd.	0	53	0	0	0	0
Land, owned	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,000	2,965	2,938	2,938	2,938	2,938
Land, cleared	acre	500	35	27	0	0	0
Improved pasture:							
Nonirrigated	acre	186	281	300	300	300	300
Irrigated	acre	154	254	262	262	262	262
Labor, hired	hr.	1,294	761	923	1,116	1,085	1,138
Conservation expenses	dol.	10,947	6,596	746	0	0	0
Overhead expenses	dol.	2,555	2,757	2,888	2,898	2,898	2,898
Property taxes	dol.	5,927	5,947	5,983	5,998	5,989	5,996
Depreciation	dol.	7,140	7,602	7,981	8,146	8,106	8,097
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	67,198	61,166	53,758	74,814	51,098	51,584
Borrowed	dol.	24,820	24,820	24,820	0	0	0
Accumulation	dol.	0	0	0	3,386	4,339	27,267
Net worth, firm	dol.	683,062	734,402	789,841	857,715	894,866	938,966
Ranch income (excluding cull cows)	dol.	-21,209	-38,465	-38,702	2,065	-18,006	998
Receipts, cull cows	dol.	15,381	14,206	14,717	16,852	16,242	16,081
Net ranch income	dol.	-5,828	-24,259	-23,985	18,917	-1,764	17,079
Before-tax income	dol.	-5,828	-24,259	-23,985	18,917	-1,764	17,079
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,690	7,103	7,358	8,426	8,121	8,041
Taxable income	dol.	0	0	0	6,491	0	5,038
Taxes paid	dol.	0	0	0	1,093	0	817
After-tax income	dol.	-5,828	-24,259	-23,985	17,824	-1,764	16,262
Total before-tax income - 15 years			\$123,274				
Total after-tax income - 15 years			101,123				
Average after-tax income per year			6,742				

for a full-equity owner-operator with zero nonranch income

Year								
7	8	9	10	11	12	13	14	15
542	511	547	514	536	531	518	547	500
98	92	99	93	96	96	93	99	90
142	78	128	104	95	135	63	60	60
11	62	46	22	81	0	87	0	340
281	269	264	285	253	289	264	377	0
0	0	0	0	0	0	0	0	135
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,938	2,938	2,938	2,938	2,938	2,938	2,938	2,938	2,938
0	0	0	0	0	0	0	0	0
300	300	300	300	300	300	300	300	300
262	262	262	262	262	262	262	262	262
1,118	1,129	1,125	1,123	1,132	1,120	1,135	1,159	803
0	0	0	0	0	0	0	0	0
2,898	2,898	2,898	2,898	2,898	2,898	2,898	2,898	2,898
5,989	5,995	5,992	5,990	5,995	5,988	5,996	5,985	5,952
8,134	8,073	8,144	8,079	8,123	8,113	8,087	8,144	8,052
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
51,624	48,678	51,964	51,727	52,286	51,654	52,948	53,057	84,719
0	0	0	0	0	0	0	0	0
36,722	57,549	72,712	83,624	104,265	111,656	132,375	140,714	191,698
981,625	1,030,475	1,080,106	1,132,839	1,190,704	1,248,407	1,314,083	1,378,223	1,439,915
-12,070	-3,219	-6,544	-9,652	-678	-11,894	2,462	-10,488	49,186
16,686	15,717	16,833	15,825	16,489	16,332	15,934	16,814	15,381
4,616	12,498	10,289	6,173	15,811	4,438	18,396	6,326	64,567
4,616	12,498	10,289	6,173	15,811	4,438	18,396	6,326	64,567
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
8,343	7,858	8,416	7,912	8,244	8,166	7,967	8,407	7,690
0	640	0	0	3,567	0	6,429	0	52,877
0	90	0	0	545	0	1,082	0	18,524
4,616	12,408	10,289	6,173	15,266	4,438	17,314	6,326	46,043

Table 52. Optimal ranch organization when maximizing after-tax income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	461	476	476	521	508
Cows, culled	hd.	90	83	86	86	93	90
Weaned calves:							
Heifers, kept	hd.	109	97	145	93	123	84
Calves, sold	hd.	291	174	3	47	67	97
Feeder steers	hd.	0	98	233	240	227	226
Stocker steers	hd.	0	0	0	0	0	0
Land, owned	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,000	3,000	2,975	2,975	2,975	2,975
Land, cleared	acre	500	0	25	0	0	0
Improved pasture:							
Nonirrigated	acre	137	244	269	277	277	277
Irrigated	acre	115	220	239	248	248	248
Labor, hired	hr.	1,007	630	773	949	991	967
Conservation expenses	dol.	8,131	7,064	1,383	615	0	0
Overhead expenses	dol.	2,555	2,706	2,843	2,868	2,880	2,880
Property taxes	dol.	5,926	5,946	5,951	5,971	5,981	5,984
Depreciation	dol.	7,140	7,464	7,859	7,925	8,044	8,019
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	65,687	51,641	48,841	63,190	60,668	59,523
Borrowed	dol.	12,675	11,661	10,647	0	0	0
Accumulation	dol.	0	0	0	764	702	2,313
Net worth, firm	dol.	697,864	731,292	767,360	824,922	880,021	933,909
Ranch income (excluding cull cows)	dol.	-14,501	-32,023	-32,877	-10,692	-6,392	-4,821
Receipts, cull cows	dol.	15,381	14,206	14,639	14,628	16,039	15,641
Net ranch income	dol.	880	-17,817	-18,238	3,936	9,647	10,820
Nonranch income	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Before-tax income	dol.	5,880	-12,817	-13,238	8,936	14,647	15,820
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,691	7,103	7,320	7,314	8,020	7,820
Taxable income	dol.	0	0	0	0	2,627	4,000
Taxes paid	dol.	0	0	0	0	390	620
After-tax income	dol.	5,880	-12,817	-13,238	8,936	14,257	15,200
Total ranch income - 15 years			\$119,999				
Total before-tax income - 15 years			194,999				
Total after-tax income - 15 years			180,489				
Average after-tax income per year			12,033				

for a full-equity owner-operator with \$5,000 annual nonranch income

Year								
7	8	9	10	11	12	13	14	15
527	505	517	508	521	516	522	551	500
95	91	93	91	93	93	94	69	90
116	96	117	102	111	137	60	60	60
93	74	51	75	92	95	211	299	340
212	233	245	230	213	180	146	82	0
0	0	0	0	0	0	0	0	69
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,975	2,975	2,975	2,975	2,975	2,975	2,975	2,975	2,975
0	0	0	0	0	0	0	0	0
277	277	277	277	277	277	277	277	277
248	248	248	248	248	248	248	248	248
948	940	995	994	967	926	832	657	332
0	0	0	0	0	0	0	0	0
2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
5,981	5,979	5,979	5,981	5,984	5,985	5,999	5,987	5,952
8,056	8,013	8,036	8,019	8,044	8,034	8,046	8,103	8,003
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
48,452	47,667	48,701	49,316	48,876	48,005	48,620	46,777	49,807
0	0	0	0	0	0	0	0	0
11,806	17,029	22,560	31,631	40,877	48,538	62,771	78,081	98,361
977,603	1,024,337	1,074,632	1,128,552	1,185,634	1,245,694	1,313,167	1,376,825	1,438,133
-5,111	-8,764	-8,955	-4,816	-5,012	-4,942	2,974	10,532	11,309
16,220	15,526	15,909	15,630	16,022	15,882	16,051	16,935	15,381
11,109	6,762	6,954	10,814	11,010	10,940	19,025	27,467	26,690
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
16,109	11,762	11,954	15,814	16,010	15,940	24,025	32,467	31,690
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
8,110	7,763	7,955	7,815	8,011	7,941	8,025	8,467	7,690
3,999	0	0	3,999	3,999	3,999	12,000	20,000	20,000
620	0	0	620	620	620	2,260	4,380	4,380
15,489	11,762	11,954	15,194	15,390	15,320	21,765	28,087	27,310

Table 53. Optimal ranch organization when maximizing after-tax income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	511	503	567	555
Cows, culled	hd.	90	83	92	90	102	100
Weaned calves:							
Heifers, kept	hd.	146	96	169	104	130	118
Calves, sold	hd.	254	273	240	299	276	234
Feeder steers	hd.	0	0	0	0	48	93
Stocker steers	hd.	0	0	0	0	0	0
Land, owned	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,222	3,074	2,950	2,950	2,950	2,950
Land, cleared	acre	278	148	124	0	0	0
Improved pasture:							
Nonirrigated	acre	129	169	179	202	223	238
Irrigated	acre	124	257	288	310	312	312
Labor, hired	hr.	575	957	691	516	592	709
Conservation expenses	dol.	8,413	7,096	1,672	1,465	500	305
Overhead expenses	dol.	2,555	2,718	2,892	2,933	2,961	2,964
Property taxes	dol.	5,927	5,962	5,975	6,000	6,016	6,019
Depreciation	dol.	7,140	7,498	8,057	8,147	8,350	8,334
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	58,067	55,781	46,263	43,411	43,701	45,569
Accumulation	dol.	678	4,380	6,295	16,997	27,166	38,452
Net worth, firm	dol.	703,839	759,115	809,869	855,440	901,340	944,873
Ranch income (excluding cull cows)	dol.	-19,105	-20,243	-18,870	-14,743	-15,722	-15,540
Receipts, cull cows	dol.	15,381	14,206	15,731	15,485	17,443	17,078
Net ranch income	dol.	-3,724	-6,037	-3,139	742	1,721	1,538
Nonranch income	dol.	15,000	15,000	15,000	15,000	15,000	15,000
Before-tax income	dol.	11,276	8,963	11,861	15,742	16,721	16,538
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,691	7,103	7,866	7,742	8,721	8,539
Taxable income	dol.	0	0	0	4,000	4,000	3,999
Taxes paid	dol.	0	0	0	620	620	620
After-tax income	dol.	11,276	8,963	11,861	15,122	16,101	15,918
Total ranch income - 15 years			\$117,578				
Total before-tax income - 15 years			342,578				
Total after-tax income - 15 years			309,319				
Average after-tax income per year			20,621				

for a full-equity owner-operator with \$15,000 annual nonranch income

Year								
7	8	9	10	11	12	13	14	15
571	572	572	571	572	572	613	550	500
103	103	103	103	103	103	111	99	90
117	116	118	117	160	60	60	60	60
246	249	245	249	252	375	381	317	340
94	92	94	91	46	22	49	63	0
0	0	0	0	0	0	0	77	153
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,950	2,950	2,950	2,950	2,950	2,950	2,950	2,950	2,950
0	0	0	0	0	0	0	0	0
238	238	238	238	238	238	238	238	238
312	312	312	312	312	312	312	312	312
789	789	789	789	758	684	614	499	309
0	0	0	0	0	0	0	0	0
2,964	2,964	2,964	2,964	2,964	2,964	2,964	2,964	2,964
6,025	6,025	6,025	6,025	6,026	6,044	6,030	5,987	5,952
8,365	8,367	8,367	8,365	8,367	8,367	8,447	8,324	8,226
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
48,080	48,168	48,025	48,150	47,439	48,710	47,159	55,939	65,678
56,414	74,772	92,519	110,895	129,812	153,248	176,432	198,276	225,390
991,934	1,039,360	1,089,477	1,142,793	1,199,317	1,264,257	1,323,725	1,378,540	1,439,847
-8,241	-7,799	-8,460	-7,784	-7,806	198	-436	792	9,309
17,559	17,596	17,585	17,567	17,610	17,602	18,869	16,935	15,381
9,318	9,797	9,125	9,783	9,804	17,800	18,433	17,727	24,690
15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
24,318	24,797	24,125	24,783	24,804	32,800	33,433	30,727	39,690
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
8,780	8,798	8,793	8,784	8,805	8,801	9,434	8,468	7,690
11,538	11,999	11,332	11,999	11,999	19,999	19,999	20,259	28,000
2,166	2,260	2,124	2,260	2,260	4,380	4,380	4,469	7,100
22,152	22,537	22,001	22,523	22,544	28,420	29,053	28,258	32,590

Table 54. Optimal ranch organization when maximizing after-tax income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	524	547	641	621
Cows, culled	hd.	90	83	94	99	115	112
Weaned calves:							
Helpers, kept	hd.	160	131	210	111	133	126
Calves, sold	hd.	240	239	202	302	340	321
Feeder steers	hd.	0	0	8	24	40	50
Stocker steers	hd.	0	0	0	0	0	0
Land, owned	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,000	3,000	2,887	2,887	2,887	2,887
Land, cleared	acre	500	0	113	0	0	0
Improved pasture:							
Nonirrigated	acre	144	191	215	245	245	245
Irrigated	acre	137	296	351	368	368	368
Labor, hired	hr.	1,137	869	1,021	831	885	896
Conservation expenses	dol.	9,302	8,460	3,099	1,376	0	0
Overhead expenses	dol.	2,555	2,734	2,942	3,015	3,036	3,036
Property taxes	dol.	5,926	5,967	5,998	6,047	6,070	6,066
Depreciation	dol.	7,140	7,543	8,217	8,454	8,697	8,658
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	69,665	57,071	52,365	49,811	51,501	51,612
Borrowed	dol.	2,351	0	0	0	0	0
Accumulation	dol.	0	1,378	4,724	16,160	42,429	68,656
Net worth, firm	dol.	707,320	762,494	818,565	872,767	921,361	962,322
Ranch income (excluding cull cows)	dol.	-23,301	-28,104	-29,065	-17,411	-10,855	-10,552
Receipts, cull cows	dol.	15,381	14,206	16,126	16,818	19,707	19,101
Net ranch income	dol.	-7,920	-13,898	-12,939	-593	8,852	8,549
Nonranch income	dol.	25,000	25,000	25,000	25,000	25,000	25,000
Before-tax income	dol.	17,080	11,102	12,061	24,407	33,852	33,549
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,691	7,103	8,063	8,409	9,853	9,550
Taxable income	dol.	5,389	0	0	11,998	19,999	19,999
Taxes paid	dol.	909	0	0	2,260	4,380	4,380
After-tax income	dol.	16,171	11,102	12,061	22,147	29,472	29,169
Total ranch income - 15 years			\$118,338				
Total before-tax income - 15 years			493,338				
Total after-tax income - 15 years			419,942				
Average after-tax income per year			27,996				

for a full-equity owner-operator with \$25,000 annual nonranch income

Year								
7	8	9	10	11	12	13	14	15
627	624	626	627	624	653	613	550	500
113	112	113	113	112	117	111	99	90
129	128	126	158	92	60	60	60	60
322	320	325	310	407	419	348	335	340
50	51	49	32	0	44	83	45	0
0	0	0	0	0	0	0	0	231
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887
0	0	0	0	0	0	0	0	0
245	245	245	245	245	245	245	245	245
368	368	368	368	368	368	368	368	368
921	921	921	914	859	738	771	515	384
0	0	0	0	0	0	0	0	0
3,036	3,036	3,036	3,036	3,036	3,036	3,036	3,036	3,036
6,067	6,067	6,067	6,066	6,078	6,071	6,030	5,987	5,952
8,670	8,664	8,668	8,670	8,664	8,721	8,642	8,519	8,421
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
52,488	52,381	52,634	51,817	53,828	52,762	62,806	50,587	80,293
0	0	0	0	0	0	0	0	0
95,920	122,898	150,502	176,992	208,879	238,752	268,766	302,279	335,095
1,007,272	1,054,590	1,104,926	1,157,904	1,217,804	1,275,464	1,327,129	1,381,943	1,443,250
-9,202	-9,435	-8,750	-10,622	-2,599	-3,045	-1,351	6,532	7,309
19,279	19,205	19,254	19,242	19,197	20,088	18,869	16,935	15,381
10,077	9,770	10,504	8,620	16,598	17,043	17,518	23,467	22,690
25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
35,077	34,770	35,504	33,620	41,598	42,043	42,	48,467	47,690
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
9,640	9,603	9,627	9,621	9,599	10,044	9,435	8,468	7,691
21,437	21,167	21,877	19,999	27,999	27,999	29,083	35,999	35,999
4,870	4,777	5,019	4,380	7,100	7,100	7,541	10,340	10,340
30,207	29,993	30,485	29,240	34,498	34,943	34,977	38,127	37,350

Table 55. Optimal ranch organization when maximizing after-tax income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	554	581	654	701
Cows, culled	hd.	90	83	99	105	117	126
Weaned calves:							
Helpers, kept	hd.	190	142	195	183	152	144
Calves, sold	hd.	210	228	248	282	353	320
Feeder steers	hd.	0	0	0	0	18	97
Land, owned	acre	3,500	3,570	3,570	3,570	3,570	3,570
Land, purchased	acre	70	0	0	0	0	0
Native pasture	acre	3,070	2,829	2,829	2,829	2,829	2,829
Land, cleared	acre	500	241	0	0	0	0
Improved pasture:							
Nonirrigated	acre	143	200	226	254	300	300
Irrigated	acre	148	319	374	429	441	441
Labor, hired	hr.	1,211	1,593	895	1,152	1,208	1,322
Conservation expenses	dol.	9,836	9,224	3,094	3,164	1,407	0
Overhead expenses	dol.	2,606	2,800	3,024	3,095	3,168	3,183
Property taxes	dol.	6,038	6,092	6,135	6,176	6,221	6,241
Depreciation	dol.	7,263	7,704	8,479	8,724	9,058	9,192
Consumption	dol.	5,000	5,000	5,000	5,000	5,000	5,000
Capital:							
Total required	dol.	89,044	71,348	57,034	60,826	63,779	64,234
Accumulation	dol.	0	8,861	37,125	66,337	102,552	139,231
Net worth, firm	dol.	720,724	785,712	881,579	895,360	951,330	1,002,649
Ranch income, (excluding cull cows)	dol.	-28,172	-33,111	-26,517	-26,938	-20,058	-20,783
Receipts, cull cows	dol.	15,381	14,206	17,033	17,874	20,114	21,564
Net ranch income	dol.	-12,791	-18,905	-9,484	-9,064	56	781
Nonranch income	dol.	50,000	50,000	50,000	50,000	50,000	50,000
Before-tax income	dol.	37,209	31,095	40,516	40,936	50,056	50,781
Tax deductions and exemptions	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	7,691	7,103	8,516	8,937	10,057	10,782
Taxable income	dol.	25,518	19,992	28,000	27,999	35,999	35,999
Taxes paid	dol.	6,262	4,380	7,100	7,100	10,340	10,340
After-tax income	dol.	30,947	26,715	33,416	33,836	39,716	40,441
Total ranch income - 15 years			\$117,754				
Total before-tax income - 15 years			867,754				
Total after-tax income - 15 years			647,132				
Average after-tax income per year			43,142				

for a full-equity owner-operator with \$50,000 annual nonranch income

Year								
7	8	9	10	11	12	13	14	15
709	709	694	721	686	733	647	577	522
128	128	125	130	123	132	117	104	94
129	171	112	189	60	60	60	60	60
371	298	371	311	393	340	198	245	78
67	98	73	77	97	107	260	157	279
3,570	3,570	3,570	3,570	3,570	3,570	3,570	3,570	3,570
0	0	0	0	0	0	0	0	0
2,829	2,829	2,829	2,829	2,829	2,829	2,829	2,829	2,829
0	0	0	0	0	0	0	0	0
300	300	300	300	300	300	300	300	300
441	441	441	441	441	441	441	441	441
1,407	1,393	1,407	1,392	1,386	1,399	1,275	945	1,086
0	0	0	0	0	0	0	0	0
3,183	3,183	3,183	3,183	3,183	3,162	3,084	3,007	3,148
6,243	6,237	6,244	6,238	6,247	6,224	6,164	6,117	6,078
9,208	9,208	9,178	9,231	9,163	9,255	9,086	8,949	8,841
5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
73,044	67,233	73,110	68,237	72,693	68,891	72,061	77,036	79,106
185,823	225,526	271,662	313,099	358,203	406,374	448,139	499,477	512,231
1,048,958	1,095,318	1,148,549	1,203,182	1,261,215	1,315,905	1,363,498	1,418,363	1,480,052
-4,911	-16,747	-4,670	-14,639	-5,129	-5,467	-3,951	16,161	21,976
21,820	21,799	21,337	22,187	21,130	22,557	19,899	17,763	16,046
16,909	5,052	16,667	7,548	16,001	17,090	15,948	33,924	38,022
50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
66,909	55,052	66,667	57,548	66,001	67,090	65,948	83,924	88,022
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
10,910	10,900	10,668	11,094	10,565	11,279	9,949	8,882	8,023
51,999	40,152	51,999	42,454	51,436	51,811	51,999	71,042	75,999
18,060	12,344	18,060	13,455	17,787	17,970	18,060	28,344	31,020
48,849	42,708	48,607	44,093	48,214	49,120	47,888	55,580	57,002

Table 56. Optimal ranch organization when maximizing landlord's after-with \$25,000 annual nonranch income

Item	Unit						
		1	2	3	4	5	6
Cows, mature	hd.	500	462	500	552	636	586
Cows, culled	hd.	90	83	90	99	114	105
Weaned calves:							
Helpers, kept	hd.	134	157	200	78	175	86
Calves, sold	hd.	266	213	114	214	134	213
Feeder steers	hd.	0	0	86	150	199	169
Stocker steers	hd.	0	0	0	0	0	0
Land, operated	acre	3,500	3,500	3,500	3,500	3,500	3,500
Native pasture	acre	3,000	3,000	2,847	2,847	2,847	2,847
Land, cleared	acre	500	0	153	0	0	0
Improved pasture:							
Nonirrigated	acre	191	202	265	305	305	305
Irrigated	acre	121	298	348	348	348	348
Labor, hired	hr.	1,115	864	1,203	1,025	1,244	1,257
Conservation expenses	dol.	9,477	8,616	3,593	776	0	0
Overhead expenses	dol.	2,555	2,714	2,945	3,011	3,011	3,011
Property taxes	dol.	425	455	490	545	551	557
Depreciation	dol.	4,235	4,582	5,272	5,548	5,713	5,615
Capital:							
Total required	dol.	58,023	57,040	64,822	76,036	63,458	46,318
Borrowed	dol.	12,996	18,967	36,034	20,855	3,601	0
Net worth, firm	dol.	108,359	118,468	104,161	134,744	157,507	159,297
Ranch income (excluding cull cows)	dol.	-12,422	-22,658	-32,868	-9,770	-9,557	5,822
Receipts, cull cows	dol.	15,381	14,206	15,381	16,983	19,553	18,013
Net income shared	dol.	2,959	-8,452	-17,487	7,213	9,996	23,835
Landlord:							
Networth	dol.	625,929	674,604	708,420	763,067	814,173	857,208
Capital accumulation	dol.	11,203	17,795	20,645	33,596	47,752	66,883
Share of income	dol.	1,480	-4,226	-8,743	3,607	4,998	11,918
Land expenses	dol.	8,407	8,407	8,407	8,407	8,407	8,407
Ranch income	dol.	-6,927	-12,633	-17,150	-4,800	-3,409	3,511
Before-tax income	dol.	18,073	12,367	7,850	20,200	21,591	28,511
Tax deductions and exemption	dol.	4,000	4,000	4,000	4,000	4,000	4,000
Capital gains exclusion	dol.	3,845	3,551	3,845	4,246	4,888	4,503
Taxable income	dol.	10,228	4,816	5	11,954	12,703	20,008
Taxes paid	dol.	1,870	775	0	2,249	2,435	4,380
After-tax income	dol.	16,203	11,592	7,850	17,951	19,156	24,131
Total before-tax income (landlord) - 15 years		\$372,727					
Total after-tax income (landlord) - 15 years		318,077					
Average after-tax income per year (landlord)		21,205					

tax income (50-50 cost-revenue tenant-landlord share arrangement)

Year								
7	8	9	10	11	12	13	14	15
639	596	619	614	605	623	613	550	500
115	108	111	111	109	112	111	99	90
146	121	116	142	118	60	60	60	60
188	163	208	161	189	222	157	194	340
176	193	172	188	177	216	274	187	0
0	0	0	0	0	0	0	0	250
3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
2,847	2,847	2,847	2,847	2,847	2,847	2,847	2,847	2,847
0	0	0	0	0	0	0	0	0
305	305	305	305	305	305	305	305	305
348	348	348	348	348	348	348	348	348
1,255	1,248	1,272	1,248	1,267	1,272	1,222	947	648
0	0	0	0	0	0	0	0	0
3,011	3,011	3,011	3,011	3,011	3,011	2,976	2,976	3,011
556	552	558	552	557	559	528	485	450
5,718	5,634	5,679	5,669	5,652	5,687	5,667	5,544	5,446
42,708	42,650	42,792	42,610	42,981	43,191	42,624	37,940	63,773
0	0	0	0	0	0	0	0	0
159,058	157,787	159,318	157,733	159,080	159,746	150,816	138,405	128,555
-1,215	-2,653	4,056	-3,531	1,446	5,252	5,394	22,361	33,618
19,649	18,330	19,054	18,895	18,600	19,152	18,869	16,935	15,381
18,434	15,677	23,110	15,364	20,046	24,404	24,263	39,256	48,999
901,784	948,503	999,494	1,051,901	1,108,995	1,169,143	1,228,028	1,289,022	1,355,357
84,182	100,392	119,333	135,461	153,267	172,682	192,027	216,168	243,077
9,217	7,839	11,555	7,682	10,023	12,202	12,132	19,648	24,500
8,407	8,407	8,407	8,407	8,407	8,407	8,407	8,407	8,407
810	-568	3,148	-725	1,616	3,795	3,725	11,241	16,093
25,810	24,432	28,148	24,275	26,616	28,795	28,725	36,241	41,093
4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
4,912	4,582	4,764	4,724	4,650	4,788	4,717	4,234	3,845
16,898	15,850	19,384	15,551	17,966	20,007	20,008	28,007	33,249
3,511	3,222	4,207	3,147	3,810	4,380	4,380	7,100	9,184
22,299	21,210	23,941	21,128	22,806	24,415	24,345	29,141	31,909

LIST OF CITED REFERENCES

1. Florida Department of Agriculture. Florida Agricultural Statistics-Livestock Summary. Orlando, Florida: Florida Crop and Livestock Reporting Service, 1971
2. U. S. Bureau of the Census. 1969 U. S. Census of Agriculture. Vol. 1, Part 29, Florida, Section 1, Washington, D. C.: Government Printing Office, 1972.
3. Brodnax, H. D., and Eddleman, B. R. Economic and Operational Characteristics of Beef Cattle Ranches in West Central Florida. Agricultural Economics Research Report EC 69-9, Florida Agricultural Experiment Stations, University of Florida, Gainesville, Florida, April, 1969.
4. Institute of Food and Agricultural Sciences. 1969 DARE Report - Florida Agriculture Plans for the 1970's. Publication No. 7, University of Florida, Gainesville, Florida, October, 1969.
5. Carman, Hoy F. "Tax Shelter in Agriculture: An Example of Beef Breeding Herds," American Journal of Agricultural Economics, Vol. 50, No. 5 (December, 1960), pp. 1591-1595.
6. Penrose, Edith T. The Theory of the Growth of the Firm. New York: John Wiley and Sons, Inc., 1959.
7. Carlson, Sune. A Study of the Pure Theory of Production. New York: Augustus M. Kelley, Bookseller, 1965.
8. Henderson, James M., and Quandt, Richard E. Microeconomic Theory. New York: McGraw-Hill Book Company, 1958.
9. Leftwich, Richard H. The Price System and Resource Allocation. Revised edition, New York: Holt, Rinehart and Winston, 1964.
10. Plaxico, James S. "Dynamic Programming and Management Strategies in the Great Plains," Management Strategies in Great Plains Farming. Great Plains Publication No. 19, Nebraska Agricultural Experiment Station, University of Nebraska, Lincoln, Nebraska (May, 1959), pp. 12-22.
11. Martin, James R. An Analysis of Capital Accumulation and Growth Process of Farm Firms, Rolling Plains of Oklahoma and Texas. Doctoral Dissertation, Oklahoma State University, Stillwater, Oklahoma, 1966.

12. Martin, W. E., and Gatz, J. R. "Effect of Federal Income Taxes on Cattle-Ranch Prices." American Journal of Agricultural Economics, Vol. 50, No. 1 (February, 1968), pp. 41-55.
13. Dean, G. W., and Carter, H. O. "Some Effects of Income Taxes on Large-Scale Agriculture," Journal of Farm Economics, Vol. 44, No. 3 (August, 1962), pp. 754-768.
14. Vieth, Gary and Epp, A. W. The Effects of Selected Federal Income Tax Regulations on After-Tax Net Income from Farming and Ranching. Department of Agricultural Economics Report No. 54, The Agricultural Experiment Station, University of Nebraska, Lincoln, Nebraska, October, 1969.
15. Baker, C. B. "Financing and Managing Farm Firm Growth: Research Progress and Prospects." Joint Meeting of Research Committees W-104 and GP-12, Denver, Colorado, June 16, 1970; (multilithed).
16. Boussard, Jean-Marc. "Time Horizon, Objective Function, and Uncertainty in a Multiperiod Model of Firm Growth." American Journal of Agricultural Economics, Vol. 53, No. 5 (August 1971), pp. 467-477.
17. U. S. Internal Revenue Service. 1971 Instructions for Form 1040 and for Schedules A, B, C, D, E, F, and K. Washington, D. C.: Government Printing Office, 1970.
18. U. S. Internal Revenue Service. Farmer's Tax Guide--1971 Edition. Washington, D. C.: Government Printing Office, 1970.
19. Harrison, Virden L., and Woods, W. Fred. Farm and Nonfarm Investment in Commercial Beef Breeding Herds: Incentives and Consequences of the Tax Law. ERS-497, Economic Research Service, U. S. Department of Agriculture, Washington, D. C., April, 1972.

ADDITIONAL REFERENCES

- Bailey, Warren R. "Necessary Condition for Growth of the Farm Business Firm," Agricultural Economics Research, Vol. XIX, No. 1 (January, 1967), pp. 1-6.
- Baker, C. B. "Financial Organization and Production Choices," American Journal of Agricultural Economics, Vol. 50, No. 5 (December, 1968), pp. 1566-1576.
- Bostwick, Don. Partitioning Financial Returns: An Application to the Growth of Farm Firms. ERS-390, Economic Research Service, U. S. Department of Agriculture, Washington, D. C., January, 1969.
- Bowman, E. Glenn and Chambliss, R. L., Jr. Capital Accumulation and Firm Growth: A Polyperiod Linear Programming Analysis of Farms in the Peanut Area of Southeastern Virginia. Research Division Bulletin 41, Virginia Polytechnic Institute, Blacksburg, Virginia, January, 1970.
- Buss, Merle Roy. The Economics of Tax Management of the Types of Farm Organizations for Oklahoma Commercial Farms. Doctoral Dissertation, Oklahoma State University, Stillwater, Oklahoma, 1971.
- Dorfman, Robert, Samuelson, Paul A., and Solow, Robert M. Linear Programming and Economic Analysis. New York: McGraw-Hill Book Company, Inc., 1958.
- Eddleman, B. R., and Phillips, J. O., Jr. Monthly Variations of Beef Cattle Prices in Florida. Bulletin 732, Florida Agricultural Experiment Stations, University of Florida, Gainesville, Florida, October, 1969.
- Eddleman, B. R., and Golden, W. I. "Theoretical Concepts, Techniques and Problems in Analyzing Firm Growth." WAERC Range Committee Meeting, San Francisco, California, August 13, 1966 (multilithed).
- Golden, Willie I. The Effect of Variation in Physiological, Economic, and Institutional Factors in the Survival and Growth of Dryland Farms in the High Plains of Texas. Doctoral Dissertation, Texas A&M University, College Station, Texas, 1968.
- Greene, R. E. L., Rose, G. N., and Brooke, D. L. Location of Agricultural Production in Florida. Bulletin 733, Florida Agricultural Experiment Stations, University of Florida, Gainesville, Florida, November, 1969.

- Heady, Earl O. "Economics of Farm Leasing Systems," Journal of Farm Economics, Vol. XXIX, No. 3 (August, 1947), pp. 659-678.
- Heady, Earl O., and Chandler, Wilfred. Linear Programming Methods. 4th printing. Ames, Iowa: The Iowa State University Press, 1964.
- Hill, Howard L., and Staniforth, Sydney D. "Adjusting Livestock-Share Leases to Meet Increased Capital Requirements," Journal of Farm Economics, Vol. XLI, No. 1 (February, 1959), pp. 63-69.
- Irwin, George D. "A Comparative Review of Some Firm Growth Models," Agricultural Economics Research, Vol. 20, No. 3 (July, 1968), pp. 82-100.
- Johnson, S. R. An Analysis of Some Factors Determining Farm Firm Growth. Doctoral Dissertation, Texas A&M University, College Station, Texas, 1966.
- Loftsgard, Laurel D., and Heady, Earl O. "Application of Dynamic Programming Models for Optimum Farm and Home Plans," Journal of Farm Economics, Vol. XLI, No. 1 (February, 1959), pp. 51-62.
- Pearson, James Leslie. A Growth Model for Evaluating Investment Alternatives of a Processor of Seasonally Produced Products--An Application to Vegetable Canning. Doctoral Dissertation, North Carolina State University, Raleigh, North Carolina, 1970.
- Rodenwald, Gordon E., Jr. "A Method of Analyzing the Effect of Taxes and Financing on Investment Decisions," American Journal of Agricultural Economics, Vol. 51, No. 5 (December, 1969), pp. 1178-1181.
- Toussaint, W. D. "Two Empirical Techniques Applicable to Land Tenure Research: Linear Programming and Single Equation Models," Journal of Farm Economics, Vol. XXXVII, No. 5 (December, 1955), pp. 1354-1363.
- Woods, W. Fred. The Tax Reform Act of 1969: Provisions of Significance to Farmers. ERS-441, Economic Research Service, U. S. Department of Agriculture, Washington, D. C., April, 1970.
- U. S. Bureau of the Census. 1964 U. S. Census of Agriculture. Vol. 1, Part 29, Florida, Washington, D. C.: Government Printing Office, 1972.
- U. S. Bureau of the Census. 1969 U. S. Census of Agriculture. Vol. 1, Part 29, Florida, Section 2, Washington, D. C.: Government Printing Office, 1972.

BIOGRAPHICAL SKETCH

Henry Doss Brodnax, Jr., was born in Conyers, Georgia, on July 23, 1942, the son of Henry D. and Leora Brodnax. He graduated from Rockdale County High School, Conyers, Georgia, in 1960. In June, 1964, he received the Bachelor of Science degree in agricultural economics and a Master of Science degree in agricultural economics in June, 1966, at the University of Georgia, Athens, Georgia. He enrolled in the Graduate School of the University of Florida and has been employed by the Economic Research Service of the U. S. Department of Agriculture as an Agricultural Economist since 1966.

He married Martha Katherine MacGregor, from Milan, Georgia, on August 13, 1966. He is a member of Alpha Zeta, Gamma Sigma Delta, Phi Kappa Phi, Omicron Delta Epsilon, American Agricultural Economics Association, Southern Agricultural Economics Association, and the American Economic Association.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

B. R. Eddleman

B. R. Eddleman, Chairman
Associate Professor, Food and
Resource Economics Department

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

H. B. Clark

H. B. Clark
Professor, Food and Resource
Economics Department

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

R. E. L. Greene

R. E. L. Greene
Professor, Food and Resource
Economics Department

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

C. H. Donovan

C. H. Donovan
Professor
Department of Economics

This dissertation was submitted to the Dean of the College of Agriculture and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1972


- *isat* Dean, College of Agriculture

Dean, Graduate School

