ADJUSTMENT IMPLICATIONS OF GOVERNMENT COTTON PROGRAMS FOR SOUTHWESTERN OKLAHOMA

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CHAPTER I

INTRODUCTION

Statement of the Problem

Every segment of society is affected by, and should be concerned with, government programs for agriculture. Individual farmers and the agri-business complex are directly affected by these programs. Other segments of society are less directly affected.

Assistance programs for agriculture have developed over time because it was generally recognized that the industry possessed some unique characteristics.[1] The highly competitive structure of agriculture precludes the individual's effectiveness in influencing price or total production. A high ratio of fixed to variable assets assures product output to remain near previously established levels though prices decline. The lag between initiation and completion of the production process makes it nearly impossible for the individual to equate with any accuracy marginal costs and marginal revenue.

Continuous out-migration of resources from the industry is implied by the rapid rate of output increasing technological development and acceptance. Small changes in supply lead to relatively large changes

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[1]Dale E. Hathaway, Government and Agriculture-Public Policy in a Democratic Society (New York, 1963), pp. 83-130.

in price and income instability with the highly inelastic demand for agricultural commodities. The perpetuation of the "way of life" concept slows the out-migration of human resources from agriculture and contributes to the income and underemployment problem.

The commercial farmer is concerned with profits. He must realize returns over costs to pay his expenses and provide a living for his family. He recognizes that survival under the competitive structure necessitates continuous adjustments. These adjustments may take the form of a reorganization of enterprises on his farm or the acquisition of additional resources.

Government programs affect the farmer in various ways. Farm income is increased if the support price is set higher than the "free market" price and the program is not highly restrictive. Program restrictions such as allotments must be considered in any enterprise reorganization. His problem is to determine the optimum organization of resources within the purview of program regulations and continuously adapt to changes in these programs.

Businessmen supplying agricultural producers with production inputs and personal goods and services are directly concerned with the welfare of agriculture. This is their livelihood. Since the well being of agriculture is predicated, partly at least, on the form of government programs in effect, the agri-business sector is vitally concerned with the implications of alternative policies. To the fertilizer dealer, high farm income means sales and profits irrespective of the size or numbers of farms in his area. The businessman who depends on numbers of people and income level is deeply concerned with the decline in farm population. Unless the people that move out of agriculture find gainful employment in the area, or are replaced by people employed out of the agricultural sector, this type of business may be forced to close.

Other segments of society are concerned with the welfare of agriculture and the effects of government programs and program changes. Consumers want an abundance of high quality food at reasonable prices. Taxpayers are concerned with the costs of programs. Besides the direct costs of taxes, food costs may be higher than necessary if programs impair efficiency in agriculture by discouraging out-migration of resources from the agricultural sector.

The final decision on agricultural program policies is made in the political arena through the legislative process. Prior to this however, advisors to farm organizations, politicians, and the administration in power must formulate program proposals for the legislative body to consider.

These advisors, and the politicians that make the final decision, face a dilemma. How will a proposed program or change in an existing program affect aggregate and individual farm income? Will it maintain the family farm structure? Will it assure an abundant supply of food and fibre at reasonable prices? What will be the treasury outlay? In other words, how will the proposal fit into the policy goals for agriculture that have developed over time? Will the program be politically feasible and socially acceptable?

The probable response of farmers to alternative program combinations would be helpful to policy advisors and politicians in formulating program proposals.

Knowledge of the optimum organization of resources under various program alternatives would serve as a guide to farmers concerned with profit maximization with a given set of resources. Further, a knowledge of the complement of resources required to attain a particular income level would help farmers decide on the extent of adjustment necessary in their farm unit to remain competitive.

For agri-business firms, the number and size of farms in an area under alternative program combinations would provide guidance to these firms in developing business plans.

Though this study deals specifically with cotton in Southwestern Oklahoma, the problems delineated for policy advisors and producers of other major commodities are very similar.

Objectives

Specifically, this study has the following major objectives:

1. To determine the optimum combination of enterprises and returns to selected resources on delineated representative farm situations for selected soil resource situations under specified government cotton allotment and cotton price support combinations.
2. To develop and apply methodology that will allow the determination of cotton allotment and cotton price support combinations that will maximize returns to the individual producers on the delineated representative farms, given a treasury outlay restraint.
3. To determine the aggregate area returns and output or supply relationships of selected crop and livestock alternatives from the programmed situations.

4. To develop and illustrate the application of methodology to determine the government cotton program allotment and cotton price support combinations that will maximize returns to the aggregate area given a specified treasury outlay.

5. To determine the minimum resources required, and thus the extent of necessary adjustment in resource use, to obtain a specified return to farm operator labor and management under specified combinations of factor prices and cotton acreage allotment and price support combinations, and

6. To determine the number of farms within the area consistent with the specified income level and compare these farm numbers to projections based on past adjustment patterns.

Area of Study

The scope of this study embraces the area designated as Economic Area 4 in Oklahoma by the 1959 census.[2] The area is a part of the low Rolling Plains of Oklahoma and includes Beckham, Caddo, Comanche, Cotton, Grady, Greer, Harmon, Jackson, Kiowa, Tillman, and Washita Counties.

The agriculture in the area is characterized by farms which primarily produce field crops--cotton, wheat, and other small grains--with supplementary livestock enterprises, and by ranching operations interspersed throughout the area.

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[2]According to the U.S. Census of Agriculture for 1959, the area contained approximately 15 percent of all land in farms in Oklahoma, 25 percent of the total cropland harvested, 65 percent of the cotton, 25 percent of the wheat, and about 15 percent of the cattle and calves on farms.

Soil Types

The economic area contains three major soil classifications differentiated primarily on the basis of physical characteristics.[3] These classifications are designated as Clay (C), Loam (L), and Sandy (S). Each major soil group is further classified into productivity classes on the basis of topography and topsoil depth. Productivity classes are designated respectively as a, b, c, d, and e in descending order of productivity.

The classification of clay (claypan) soils, as defined in this study, are normally identified as Foard and Tillman series or their equivalents. Clay soils are both fine and medium textured with a tight topsoil and very slowly permeable subsoils. The productivity classes for clay soils are: C_b, C_c, C_d, and C_e. The tight topsoil condition precludes a C_a productivity classification. These soils are adapted to the production of cotton, wheat, oats, hay, and pasture for livestock. Detailed definitions of these soils classes and estimated yields for various crops on clay soil productivity classes are presented in Appendix A, Table I.

Sandy soils in the study area are course textured with highly permeable subsoils. No sandy soil is classified into productivity class S_a due to wind erosion hazards. The classification of sandy soils are normally identified on soils maps as Miles, Dill, Pratt, or Enterprise Sandy Soils or their equivalents. These soils are adapted to production of cotton, wheat, grain sorghum, alfalfa, other hay, and grazing crops.

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[3]Differentiation based on data from U. S. Census of Agriculture, 1954 and 1959, A.S.C.S. records for the area, sample farm surveys, studies by and opinions of soil scientists.

Severe wind erosion on unprotected cultivated sandy land necessitates the use of winter cover crops or mulching. A detailed definition of these soil classes and estimated yields for crop alternatives are presented in Appendix A, Table II.

Loam soils are medium textured soils with moderately permeable subsoils. On soils maps, loam soils are usually shown as Upland-Tipton, St. Paul, Carey, Bottomland-Spur, and Canadian series with some Quinlan and Vernon series or their equivalents. Five productivity classes, namely, L_a, L_b, L_c, L_d, and L_e are delineated.

Generally there are two recognized phases of loam soils, namely, the rolling phase and the level phase. These are treated separately in this study.

The level loam phase consists predominantly of level bottomland soil. It contains a high percentage of productivity class L_a soil and a very small percentage of the lower productivity classes. The rolling loam phase lies mostly on upland locations. It has a relatively small percentage of productivity class L_a soil. Both phases of the loam soils are well adapted to production of cotton, wheat, grain sorghum, hay, and grazing crops. A detailed definition of these soil classes and estimated yields for adapted crop alternatives are presented in Appendix A, Table III.

Some of the land in the area was excluded from this study under the assumption that land in some particular enterprises will not be subject to significant adjustment pressures under changing price conditions. Land presently in ranches is suitable primarily for pasture and grazing. Thus changes in major crop prices would not affect the use of such lands as cropping it would be impractical.

Similarly Grade A dairying, vegetable farms, fruit and nut farms, specialty crop farms, poultry farms, and farms with irrigated land were excluded from this study.

Review of Previous Research

Considerable work in determining optimum organization of farm enterprises, given particular resource bases and minimum resource requirements to meet particular income targets, has been completed in the past several years. Both types of research results can be used to postulate adjustment implications under various conditions of length of run, asset fixity, factor and/or product prices, institutional restraints, or other specified limitations.

Linear programming[4] has been used extensively in these types of research by agricultural economists. The most frequent applications of the technique have been to specify or suggest the (a) optimum organization of resources and enterprises to maximize farm income, (b) desirable farm adjustments to achieve an income level, (c) profit maximizing mixes of commodities produced by marketing firms, (d) cost minimizing methods of processing products, (e) spatial equilibrium patterns in the flow of agricultural products, (f) optimum interregional patterns of resource use and product specialization, and (g) other related types of problems.[5]

A survey of the agricultural economics departments at land grant colleges conducted in 1960 by Eisgruber and Reisch showed that 87 percent

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[4]The assumptions and techniques of linear programming will be discussed in more detail in Chapter II.

[5]Earl O. Heady and Wilfred Candler, Linear Programming Methods (Ames, 1958), p. 1.

of all departments employed linear programming as a technique in some of their research problems.[6] A bibliography of linear programming and its applications prepared by the same authors shows that the earliest problem solutions sought dealt primarily with optimum organization of resources and enterprises on farms and to specify spatial equilibrium patterns in the flow of agricultural products.[7]

This survey indicated that there were basically two types of limitations to the linear programming approach, namely the lack of available input-output data, and the difficulty of constructing models that realistically represent relevant relationships and alternatives.[8] Considerable progress has been made in the past several years to overcome both of these difficulties. The realism of models has been enhanced by the development of reactive, integer, nonlinear, convex, and stochastic programming. More detailed input-output data are rapidly being accumulated. Several groups have in recent years allocated a considerable quantity of their research resources to area and regional approaches with emphasis on developing applicable input-output data.[9]

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[6]Ludwig M. Eisgruber and Erwin Reisch, "A Note on the Application of Linear Programming by Agricultural Economics Departments of Land Grant Colleges" (Lafayette, 1960), Mimeograph.

[7]Ludwig M. Eisgruber and Erwin Reisch, "Bibliography of Linear Programming and Its Application to Agricultural Economics Problems" (Lafayette, 1960), Mimeograph.

[8]Eisgruber and Reisch, "A Note on Linear Programming," p. 3.

[9]For example, Regional Research Project S-42, "An Economic Appraisal of Farming Adjustment Opportunities in the Southern Region to Meet Changing Conditions." This is a cooperative effort of state agricultural experiment stations in Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia; the Farm Production Economics Division, Economic Research Service; and Cooperative State Research Service of the USDA. Other regions are conducting similar cooperative research projects. This study is a part of the continuing work in the S-42 regional project.

Studies have been and are being conducted to define economically efficient patterns of regional production of agricultural commodities. Egbert and Heady conducted a study analyzing regional production patterns for grain crops in the United States.[10] The express objectives of this and a later study[11] were simultaneously to, (a) examine and emphasize methodological problems, (b) define within the limitations of available data the economic optimum regional distribution of production, (c) show the apparent degree of supply-demand imbalance in the past, and (d) explore the possibilities of correcting this supply-demand imbalance through regional adjustments.

In addition to research on the problems of specifying optimum organization of resources and enterprises on specified farm resource bases and interregional patterns of efficient resource use, emphasis is being placed on estimating the magnitude of change required in the agricultural sector of a specific area to achieve specified returns, that is, the size of farm in terms of land, labor, and capital consistent with a desired income level. The initial work in this field has been basically a determination of the problem and the establishment of an acceptable methodological framework to conduct such studies. Brewster was charged through discussions generated at a conference of the North Central Farm

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[10] Alvin C. Egbert and Earl O. Heady, Regional Adjustments in Grain Production: A Linear Programming Analysis, U. S. Department of Agriculture in Cooperation with Iowa Agricultural Experiment Station, Center for Agricultural and Economic Adjustment, Technical Bulletin No. 1241 (Washington, 1961).

[11] Alvin C. Egbert and Earl. O. Heady, Regional Analysis of Production Adjustments in the Major Field Crops: Historical and Perspective, U. S. Department of Agriculture in Cooperation with Iowa Agricultural Experiment Station, Center for Agricultural and Economic Adjustment, Technical Bulletin No. 1294 (Washington, 1963).

Management Research Committee in 1957[12] to develop research methods applicable to the resource minimization problem. The basic assumptions and the general framework developed are presented in a report to a conference of the Southern Farm Management Committee in 1957.[13] Brewster conducted a study to determine the mimimum farm resource requirements to obtain specified income returns to operator labor and management for representative farms in six areas of the United States using this methodology.[14]

Several linear programming studies have recently been completed in Southwestern Oklahoma under the Oklahoma Experiment Station Hatch Project No. 1040. White, Plaxico, and Lagrone[15] investigated the normative supply relationships on loam soils under selected levels of cotton prices, capital costs, tenure, technology level, and levels of machinery costs. Martin, Lagrone, Plaxico, and Connor[16] determined the effect on farm organization and income on clay soil farms of selected changes in cotton,

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[12]Papers and discussion of this conference are reported in Earl O. Heady et al., ed., Agricultural Adjustment Problems in a Growing Economy (Ames, 1958).

[13]John M. Brewster, "Analyzing Minimum Resource Requirements for Specified Income Levels," Farm Size and Output Research, Southern Cooperative Series Bulletin No. 56, June, 1958, pp. 95-104.

[14]John M. Brewster, Farm Resources Needed for Specified Income Levels, Agricultural Information Bulletin No. 180, Agricultural Research Service, U. S. Department of Agriculture, December, 1957.

[15]James H. White, James S. Plaxico, and William F. Lagrone, The Influence of Selected Restraints on Normative Supply Relationships for Dryland Crop Farms on Loam Soils, Southwestern Oklahoma, Okla. Agri. Exp. Sta. Tech. Bul. T-101, 1963.

[16]James Martin, William F. Lagrone, James S. Plaxico, and Larry J. Connor, Effect of Changes in Product Price Relationships on Farm Organization and Income on Clay Soil Farms, Southwestern Oklahoma, Oklahoma Agri. Exp. Sta. Bul. B-621, 1964.

wheat, cattle prices, and capital costs. Goodwin, Plaxico, and Lagrone[17] developed aggregate supply response relationships for dryland crop farms in this area under various assumptions. These studies did not consider government allotment programs on cotton or wheat as an institutional restriction.

Strickland, Plaxico, and Lagrone[18] estimated the minimum resource requirements for three specified income levels and the magnitude of change required in the agricultural sector of the Southwestern Oklahoma area to achieve these target incomes. This model incorporated acreage allotments for cotton and wheat as a program restraint.

The Basic Model

Representative Farm Approach

Relatively few studies have related alternative national agricultural price and income policy implications to representative farms though it is generally conceded that the effects of various programs will vary widely by resource situations, farm type, and location.[19] In contrast to these studies,[20] the majority of economists have relied

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[17]John Goodwin, James S. Plaxico, and William F. Lagrone, Aggregation of Normative Microsupply Relationships for Dryland Crop Farms in the Rolling Plains of Oklahoma and Texas, Oklahoma Agri. Exp. Sta. Tech. Bul. T-103, 1963.

[18]Percy L. Strickland, Jr., James S. Plaxico, and William F. Lagrone, Minimum Land Requirements and Adjustments for Specified Income Levels, Southwestern Oklahoma, Oklahoma Agri. Exp. Sta. Bul. B-608, 1963.

[19]James S. Plaxico and Luther G. Tweeten, "Representative Farms for Policy and Projection Research," Journal of Farm Economics, Vol. XLV (December, 1963), pp. 1,458-59.

[20]Examples of the representative firm approach are studies by: Warren Bailey and Ronald Aines, How Wheat Farmers Would Adjust to Different Programs, U. S. Department of Agriculture, Production Research Report No. 52 (Washington, 1961); Wheat - The Program for 1964, U. S. Department of Agriculture (Washington, 1963).

mainly on aggregate data at the macro level to determine implications of various government program alternatives.[21]

This study employed the representative farm approach to investigate the effect of various government program combinations and to build aggregate data for an area. The representative farms do not necessarily reflect average or model farms as they presently exist in the study area. They are deemed to be representative of a majority of the commercial farms with respect to adjustment opportunities. Severe criticism has been leveled against the representative farm approach because the delineation criteria are necessarily highly subjective resting largely on the researchers knowledge of the area and its conditions.[22] Presently, there are no statistical procedures available to provide objective criteria for establishing representative farms.

Linear Programming Model

The linear programming maximization model used in this study to determine the optimum enterprise combinations under postulated combinations of cotton acreage allotment-price levels is similar to the model used by White et al. and Martin et al. The linear programming minimization model to determine the minimum combination of resources required to attain a specified income level is similar to the model used by Strickland et al. Specific assumptions and institutional restraints are delineated in detail in Chapter II.

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[21]Cf. Luther Tweeten, Earl Heady, and Leo Mayer, Farm Program Alternatives, CAED Report No. 18 (Ames, 1963).

[22]Luther Tweeten, "The Farm Firm in Agricultural Policy Research." Paper presented at the Workshop on Price and Income Policies, sponsored by the Agricultural Policy Institute, North Carolina State University, Raleigh, April 21, 1965.

Aggregation Procedures

The aggregation procedures in this study consisted of simple summation of commodity outputs and resource inputs over individual representative farm situations within physical resource classifications. It is postulated that farms with similar soil resource situations can be expected to react to various stimuli in a similar manner. Thus, resource groups can be aggregated within groups and these aggregates combined to determine area estimates of supply response and resource requirements.

Content of Chapters

The basic programming model and the farm numbers models are presented in Chapter II. This chapter also sets forth the representative farm situations and the institutional and resource restraints that were assumed.

Chapter III presents and analyzes the results of the maximization model under the various alternative assumed government cotton program combinations. Cotton price allotment indifference curves for the representative farm on the clay soil situations are developed. A mathematical technique to compute a cotton price and allotment combination, given a predetermined government expenditure level, that will maximize returns to the representative farm is developed. This technique is applied to the representative farm on the clay soils.

The area aggregates or normative supply functions for the maximization model are presented in Chapter IV. The technique to determine the optimum cotton price and allotment combinations is applied to the area aggregate net returns.

The results of the minimization model with a target return of $5,000 to operator labor and management for the four soil resource situations are presented in Chapter V.

The results of the farm numbers models are presented and compared in Chapter VI.

The results of the study are summarized and the implications and conclusions presented in Chapter VII.

CHAPTER II

ANALYTICAL MODEL AND RESTRICTIONS

The purpose of this chapter is to (a) outline the basic linear programming models, (b) present the representative resource situations, (c) delineate the product price and factor cost variables, and (d) outline the included alternatives and restrictions.

Linear Programming Models

The analysis in this study was developed within the general framework of the linear programming technique.[1] Linear programming is concerned with the decisions of an economic unit. In this study, the economic unit is the farm firm. It was postulated that the firm's objective was to maximize (or minimize) some measurable function of a set of variables controlled by the decision unit. Such a problem to allow solution must have (a) a quantifiable objective, (b) a finite number of alternative methods or processes by which the objective can be attained, and (c) a set of restrictions which set limits on the plan that can be considered.[2] In addition to the assumptions of mathematical

[1]For detailed discussion of the linear programming technique and some extensions see Robert Dorfman, Application of Linear Programming to the Theory of the Firm (Berkeley, 1951); George B. Dantzig, Linear Programming and Extensions (Princeton, N. J., 1963); and Earl O. Heady and Wilfred Candler, Linear Programming Methods (Ames, 1959).

[2]Heady and Candler, p. 2.

maximization (minimization), linear programming invokes four special postulates, namely, linearity, divisibility, additivity, and finiteness.[3]

The two linear programming models designed to satisfy Objectives (1) and (5) will be referred to respectively as the "maximization" and "minimization" models.

Farm Numbers Model

Models to project future farm numbers in Southwestern Oklahoma are designated as follows:

Model I utilizes the programming results obtained from the linear programming minimization model to determine the size of adjustment necessary to bring about a situation consistent with a $5,000 income return for each resource situation under alternative levels of product prices, factor prices, and allotments.

Model II utilizes simple extrapolation of past trends in farm numbers in total and by size breakdowns. Aggregate data on farm numbers and distribution by farm size breakdowns as reported at five year intervals by the Census will be used.

Model III utilizes the concept of a Markov chain process[4] to trace the movement of groups or "states" over time. The Markov chain process assumes that a population can be classified into various groups or states such as a distribution of farms by size. The states must be defined in a manner such that the process can only be in one state at a particular

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[3]Dorfman, p. 81.

[4]J. G. Kemeny et al., Finite Mathematical Structures (New York, 1959), p. 148.

point in time. A transition or change occurs when the process changes from one state to another. For example, a farm in one time period increases in size as the owner purchases more land and therefore moves into a different size group. The process is stochastic in which the outcome of a given state depends only on the outcome of the immediately preceding state. The probability of this movement is the same in all stages. This probability is a transition probability.

The data used, calculation of the transition matrix, and other details for the operational Markov chain models used to project future farm numbers and size distributions are discussed in detail in Chapter VI.

Land Resource Situations

Maximization Model

Six separate land resource situations were used to represent the four major soil classifications. One representative farm was selected to typify the clay and sandy soil areas respectively while the rolling and level loam soils were each represented by two farms of different sizes denoted as a "small" and a "large" farm. The farm sizes used in this portion of the analysis do not reflect average, modal, or bimodal farms as they presently exist in the area. However, they were deemed to be representative of a majority of the commercial farms with respect to adjustment opportunities. Farm sizes are a function of both acres and machinery and equipment complements. Large farms are operated with four-row equipment and small farms with two-row equipment.

The total acres of land, breakdown of cropland by productivity classes, native pasture, and wasteland for each of the representative farms associated with the soil classifications are presented in Table I. The clay soil farm consisted of 1,280 acres of total land of which 1,000 acres are cropland, 235 acres are native pasture, and 45 acres are farmstead, woods, and other nonproductive land. The representative farm on the sandy soils consisted of a total of 640 acres of which 500 acres are cropland, 115 acres are native pasture, and 65 acres are considered nonproductive. The level loam soil area had two representative farms with 480 acres and 960 acres of total land, respectively. The "small" loam farm consisted of 375 acres of cropland, 85 acres of native pasture, and 20 acres of nonproductive land. The "large" farm consisted of 750 acres of cropland, 175 acres of native pasture, and 35 acres of wasteland. Similarly the rolling loam soil area was represented by a "small" and "large" farm with 240 acres and 960 acres of total land. The small farm contained 188 acres of cropland, 37 acres of native pasture, and 15 acres of wasteland. The large 960 acre farm contained 750 acres of total cropland, 175 acres of native pasture, and 35 acres of wasteland.

For each representative farm, cropland acreage was assumed to be approximately 78 percent of total land in the farm. Acres of native pasture (NP) were calculated from total acreage (TA) and cropland acres (C) as follows:

$$NP = TA - C - 5 - 5(\frac{TA}{160})$$

The remaining acres were then classed as farmstead, roads, and other wasteland. Though the sizes of the representative farms in each soil classification were not considered average farms or modal farms in size, the relationships of cropland to total land and productivity classes to cropland were considered typical of the four major soil classifications.

TABLE I

LAND AND LABOR RESOURCE RESTRICTIONS FOR REPRESENTATIVE FARMS FOR THE FOUR MAJOR SOIL CLASSIFICATIONS, MAXIMIZATION MODEL, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Resource Restriction	Unit	Major Soil Classifications					
				Level Loam		Rolling Loam	
		Clay	Sandy	Large	Small	Large	Small
Total Land	Acre	1,280	640	960	480	960	240
Cropland[a]							
Class a	Acre	0	0	420	210	100	25
Class b	Acre	360	125	260	130	185	50
Class c	Acre	368	230	60	30	225	55
Class d	Acre	160	125	0	0	150	35
Class e	Acre	112	20	10	5	90	23
Total Cropland		1,000	500	750	375	750	188
Native Pasture[b]		235	115	175	85	175	37
Farmstead, Roads, etc.		45	25	35	20	35	15
Operator Labor[c]							
Jan-Apr	Hr.	538[d]	624[d]	581[d]	667	581[d]	710
May-July	Hr.	506	572	539	605	539	638
Aug-Sept	Hr.	352	396	374	418	374	440
Oct-Dec	Hr.	462	528	495	561	495	594
Total	Hr.	1,858	2,120	1,989	2,251	1,989	2,382

[a]Based on Soil Inventory Form N-2, Oklahoma.

[b]Native Pasture = Total Land minus Cropland minus 5 minus

$$5\left(\frac{\text{total acres}}{160}\right)$$

[c]Assumes 22 working days per month except February in which there are 20 working days. Allows eight hours per day December through March; nine hours per day, April, May, and November; and ten hours per day in June-October for nonmanagement time. To determine operator labor available, deduct one-half hour per day for management time for each increment of 240 acres excluding the initial 240 acre unit.

[d]Operator labor distribution also relevant for minimization models.

Minimization Model

One resource situation was analyzed in each of the separate soil classifications as incorporated into the minimization model. Preliminary calculations indicated that the majority of the minimum farm sizes to meet the specified income target under the various assumptions would be equal to or greater in size than the large representative farms of the maximization models. Specific exceptions will be discussed in Chapter V. Thus, only the large farm representative resource situations were relevant in this model. The assumption was made that in each of the soil situations the relationships of (a) cropland to total land, (b) native pasture to cropland, and (c) land productivity classes to cropland in each analysis represented the relationship for the entire area. The total land area in each soil situation contains a specific percentage of cropland, productivity classes within cropland, native pasture, and wasteland. The minimization model thus assumed that each acre as it was added contained these specified percentages for each of the soil classifications.

The specified percentages of land use classes within each farm and productivity classifications for each of the four major soil classifications are presented in Table II.

Allotment Restrictions

The admissable alternative crops in Southwestern Oklahoma include cotton and wheat under government acreage allotment programs. Acreage allotments in effect in 1963 for cotton and wheat were obtained from

State A.S.C.S. office records[5] and the sample survey of farms for each of the major soil classifications.

TABLE II

PERCENTAGE COMPOSITION OF A REPRESENTATIVE ACRE BY SOIL CLASSIFICATIONS WITH RESPECT TO CROPLAND, NATIVE PASTURE, OTHER LAND, PRODUCTIVITY CLASSES WITHIN CROPLAND; MINIMIZATION MODEL, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Land Type and Productivity Class	Unit	Soil Classification: Clay	Sandy	Level Loam	Rolling Loam
Class a	Pct.	0	0	43.75	10.417
Class b	Pct.	28.125	19.531	27.083	19.271
Class c	Pct.	28.750	35.938	6.250	23.437
Class d	Pct.	12.500	19.531	0	15.625
Class e	Pct.	8.750	3.125	1.042	9.375
Cropland Total	Pct.	78.125	78.125	78.125	78.125
Native Pasture	Pct.	18.359	17.969	18.229	18.229
Farmstead, Roads, etc.	Pct.	3.516	3.906	3.646	3.646

Data from these records and the sample survey farms were used to determine the wheat and base cotton allotments for the representative farms in each major soil classification group. Estimated wheat and cotton allotments for the representative farms in each major soil classification, are presented in Table III. These allotments are expressed in terms of acres for the representative farms in the maximization model. For the minimization model, allotments are expressed in terms of percent

[5]Agricultural Stabilization and Conservation Service, "1963 Cotton Allotment After Release and Reapportionment," Oklahoma, 1963 Mimeograph ASCS-63-260; and U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service, "County Acreage Allotments for 1963 Crop of Wheat," 1963 Wheat Bulletin 3, reprinted from Federal Register of August 18, 1962 (27 F. R. 8241).

TABLE III

ESTIMATED WHEAT ALLOTMENTS AND 1963 BASE, 55 PERCENT, 85 PERCENT, AND 115 PERCENT OF BASE COTTON ALLOTMENTS ON REPRESENTATIVE FARMS FOR THE FOUR MAJOR SOIL CLASSIFICATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Allotment Description	Unit	Major Soil Classifications					
				Level Loam		Rolling Loam	
		Clay	Sandy	Large	Small	Large	Small
	Maximization Models (Per Representative Farm)						
Wheat Allotment	Acre	49.6	67.2	225.6	112.8	264	66
Cotton Allotment							
1963 Base	Acre	119.04	153.6	148.8	74.4	141.12	35.28
55% of Base	Acre	65.47	84.48	81.84	40.92	77.62	19.40
85% of Base	Acre	101.18	130.56	126.48	63.24	119.95	29.99
115% of Base	Acre	136.90	176.64	171.12	85.56	162.29	40.57
	Minimization Model (Per Representative Acre)						
Wheat Allotment	Pct.	38.75	10.50	23.5	N.A.[a]	27.50	N.A.
Cotton Allotment							
1963 Base	Pct.	9.30	24.00	15.50	N.A.	14.70	N.A.
55% of Base	Pct.	5.115	13.20	8.525	N.A.	8.085	N.A.
85% of Base	Pct.	7.905	20.40	13.175	N.A.	12.495	N.A.
115% of Base	Pct.	10.695	27.60	17.825	N.A.	16.905	N.A.

[a]N.A. signifies not applicable for the minimization model.

of a representative acre.

In the maximization model, allotments entered the program as a land restriction. In the minimization model it was assumed that each additional acre purchased included the designated percentage of crop allotment.

Labor Restrictions

A specified quantity of operator labor was assumed available for each resource situation under both the maximization and minimization model. It was assumed that the operator was available 22 days per month for all months except February in which there are 20 working days. Eight hours per day were allowed for December through March; nine hours per day for April, May, and November; and ten hours per day for June through October. Required daily management time (M) was considered to be a function of farm size in acres (F) with the following relationship:

$$(1) \quad M = (F - 240) \frac{0.5}{240}$$

The available annual nonmanagement labor distribution by grouped time periods is presented in Table I. Farm size and required management time explain the differences in available operator nonmanagement labor between resource situations in this table.

Operator labor was not a restriction in the same sense as farm size. In periods when necessary labor requirements were higher than available operator labor, both models allow hiring additional skilled labor. The current assumed rate was $1.00 per hour. Thus labor would limit enterprise combinations and/or size only if the marginal value product of labor was below $1.00

Price Assumptions

Prices of factor inputs and product outputs of nonallotment crops used in this analysis were based on price projections under specific assumptions developed by the U. S. Department of Agriculture:[6]

> The price and cost projections contained in this pamphlet are tied to an all-product index of 235 (1910-14 = 100) for prices received by farmers and an index of 265 for prices and rates paid by farmers, including items used in production, interest, taxes, and wages. These general levels were agreed upon by the Agricultural Marketing Service, Soil Conservation Service, Forest Service, and Agricultural Research Service for use in evaluating work plans for watershed protection and flood prevention projects and for river basin development studies.
>
> The projections represent the level of prices that may be expected to prevail over an extended period of years under assumptions of relatively high employment, a trend toward peace, continued population and economic growth, and a stable general price level. Under such conditions, the general level of prices received by farmers and cost-price relationships are not expected to be much different than those prevailing during the period 1953-55. . . . The projections also take account of recent changes that have occurred in supply and requirement expectations of particular crops. In general, the projections reflect the long-term levels that might reasonably be expected with production and requirements in balance under competitive conditions.

The specific assumed prices paid for factors and received for products are presented in Appendix A, Tables IV and V. Prices received for all crops and livestock are assumed to remain constant. Wheat price reflects the 1963 area average support price adjusted for

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[6]U. S. Department of Agriculture, Agricultural Research Service and Agricultural Marketing Service, Agricultural Prices and Cost Projections for Use in Making Benefit and Cost Analysis of Land and Water Resource Projections, U. S. Department of Agriculture, Agricultural Research Service and Agricultural Marketing Service (Washington, 1957), p. 4.

appropriate grade and storage differentials.[7]

Four levels of cotton prices were assumed and analyzed in conjunction with specified allotment levels and variations in land equity, land prices, and labor prices. These combinations will be discussed in more detail in Chapter III. Cotton prices used were $17.60, $22.00, $26.40, and $30.80 per hundredweight of lint cotton.

Land prices used are current estimates for land transactions in the area as developed for an earlier study.[8] The land price for each soil classification was determined by assuming that each acre of land includes the same proportion of all productivity classes of the soil type under consideration. The final price per acre thus reflected a weighted average of the different productivity classes. Price per acre of land included the value of service buildings but excluded value of dwelling, mineral rights, or any other nonagricultural use values. Land values by soil classes as used in this study are presented in Table IV.

Level of Technology

The technical coefficients, production requirements, practices, and physical output assumed improved or advanced technology based on experiment station recommendations. Advanced technology assumes that the best known practices now in the experimental stage or used by farmers on a limited basis will be extensively employed on commercial farms.

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[7]U. S. Department of Agriculture, Commodity Credit Corporation, (1963 Crop Wheat Loan and Purchase Agreement Program," reprinted from Federal Register of July 9, 1963 (28 F. R. 6959) (Washington, 1963).

[8]Percy L. Strickland, Jr., "Minimum Resource Requirements and Resource Adjustments for Specified Farm Income Levels, Low Rolling Plains of Southwestern Oklahoma" (unpub. Ph.D. dissertation, Oklahoma State University, 1962).

TABLE IV

LAND VALUES BY SOIL CLASSIFICATIONS

Soil Classification	Land Values Per Acres			
	Base	+50%	+100%	-50%
	- Dollars -			
Sandy	160	240	320	80
Clay	105	157.50	210	52.50
Level Loam	240	360	480	120
Rolling Loam	170	255	340	85

Capital

No limitations were imposed in either model on the quantity of capital available to the representative firm. It was assumed that operating capital for fertilizer, feeders, machinery, etc., could be obtained at an interest charge of six percent per year. Capital required for land investment in the minimization model was assumed available at a five percent annual charge.

Total capital requirements were computed for both models as an indicator of overall requirements. However, interest charges were computed on an annual basis only. Annual capital requirements for an enterprise was defined as total capital times the proportion of time the item is utilized or held during a year. For example, a beef cow represents a 12 month investment and thus total and annual capital are equal. A feeder steer held for three months might represent $120.00 total capital investment and a $30.00 ($120 x 3/12) annual investment.

Overhead Costs

The basic budgets that underly this analysis were constructed so costs are allocated to individual enterprises so far as feasible. However, expenses including land taxes, pickup truck operation, telephone, insurance, bookkeeping, and tax service could not be allocated to specific enterprises. Generally, such expenses are a function of farm size, and were charged at the rate of $1.25 per acre excluding land taxes which were charged at a fixed rate of $1.00 per acre. The annual average overhead costs assumed in the study are presented in Table V.

TABLE V

ASSUMED ANNUAL OVERHEAD COSTS FOR FARMS, LOW ROLLING PLAINS, SOUTHWESTERN OKLAHOMA

	Size of Operation		
Item	240-480 ac.	640-960 ac.	1280 ac.
Pickup Truck			
Interest	$ 60.00	$ 66.00	$ 72.00
Depreciation	160.00	175.00	200.00
Gas, Oil, Lubrication	110.00	166.00	223.00
Repair	90.00	120.00	150.00
Insurance	75.00	90.00	105.00
Bookkeeping and Tax Service	120.00	150.00	180.00
Insurance on Buildings and Workers	100.00	120.00	150.00
Total Overhead Costs	$715.00	$877.00	$1080.00
Property Taxes/Ac.	$ 1.00	$ 1.00	$ 1.00

CHAPTER III

ANALYSIS OF ALTERNATIVE PROGRAMS WITH THE MAXIMIZATION MODEL

The purpose of this chapter is to analyze and evaluate the alternative combinations of cotton allotment levels and cotton prices for the six resource situations delineated in Chapter II. The analysis was based on the optimum enterprise combinations and land use patterns that maximize net returns to land, labor, management, and unallocated resource costs as determined by the linear programming maximization model.

The analysis and evaluation of the alternative (possible) government program combinations for cotton was carried out in terms of (a) stability of the programs, (b) desirability of programs in terms of income[1] from the viewpoint of the individual producer operating a representative farm, and (c) desirability of program combinations from the standpoint of the producer considering government (taxpayer) costs.

Allotment, Price, and Soil Situation Combinations

A total of 72 separate plans were developed by assuming combinations of cotton lint prices and allotment levels as set out in Table VI.

For ease of exposition, the four cotton prices used in the analysis,

[1]The term income is used here in a broad sense. It will be defined more rigorously later in the chapter with respect to specific resources of land, labor, and management

\$17.60, \$22.00, \$26.40, and \$30.80 per hundredweight of lint cotton were designated respectively as P_1, P_2, P_3, and P_4. These four price levels were assumed to be the Oklahoma farm prices for cotton and correspond respectively to national cotton prices of \$20, \$25, \$30, and \$35 at the farm level. Allotment levels were designated as follows: A - base allotment plus 15 percent; B - base allotment; C - base allotment less 15 percent; and D - base allotment less 45 percent. For example, P_1B refers to the situation characterized by a cotton lint price of \$17.60 per hundredweight and a base allotment level.

TABLE VI

PROGRAMMING COMBINATIONS OF COTTON LINT PRICES AND ACREAGE ALLOTMENT LEVELS AS A PERCENT OF BASE ALLOTMENTS PER REPRESENTATIVE FARM, ROLLING PLAINS, SOUTHWESTERN OKLAHOMA

Farm Price of Cotton Lint in Dollars Per Cwt.	Level of Allotment			
	Base Plus 15 Pct.	Base[a]	Base Less 15 Pct.	Base Less 45 Pct.
17.60	P_1A[b]	P_1B		
22.00	P_2A	P_2B	P_2C	
26.40	P_3A	P_3B	P_3C	P_3D
30.80		P_4B	P_4C	P_4D

[a]Approximate 1963 allotment level.

[b]This nomenclature for program combinations will be used as abbreviations in the text and pertinent appendix tables.

Further, the soil classifications and their respective representative farm sizes were designated as follows: C - clay soil farm; S - sandy soil farm; LL - level loam soil large farm; LS - level loam small farm; RL - rolling loam soil large farm; and RS - rolling loam soil small farm. For example, symbol, LLP_1B, refers to the situation specifically characterized by level loam soil, large farm, $17.60 cotton lint price, and base allotment.

For every representative farm, each alternative allotment-price combination could be considered a potentially possible government cotton control-price support program. Returns to land, labor, and/or management were used as the criteria to evaluate the desirability of particular programs from the producer standpoint. This study assumed that profit maximization was the underlying goal of the farm operator,[2] and implicitly ignored such goals as freedom from government intervention.

Major Activities and Stability of Programmed Plans

There were ten major enterprises[3] that entered into one or more of the 72 programmed situations. These enterprises included: (a) cotton, (b) wheat, (c) grain sorghum, (d) alfalfa hay, (e) oats, (f) small grain hay, (g) annual grazing, (h) reseed cropland to native pasture, (i) beef cows, (j) August marketed feeder cattle, and (k) March marketed feeder cattle.[4]

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[2]Preliminary information from a study in progress at Oklahoma State University on farmer preference of alternative government programs indicates that the acceptability of alternative programs varies greatly between individual farms and depends on a number of factors besides profit (support price level).

[3]For a detailed description of all potential allowable enterprises, their resource and rotational requirements for each soil classification, see Goodwin, Plaxico, and Lagrone, Processed Series P-357; Lagrone, Strickland, and Plaxico, Processed Series P-369; and Connor, Lagrone, and Plaxico, Processed Series P-368.

[4]For a detailed breakdown of the magnitude of each enterprise, the optimum combination of enterprises, and the cropland use pattern for each program situation see Appendix B, Tables I through XI.

Cash crops entering the optimum farm organizations were cotton, wheat, grain sorghum, alfalfa hay, and oats. Small grain hay and/or annual grazing are intermediate products for one or more livestock enterprises. Forage crops and pasture would not enter a particular program unless at least one livestock enterprise was included in the optimum organization and added grazing, besides the quantity supplied by native pasture, was required. Native pasture can be utilized by either the beef cow or August marketed feeder enterprise. Additional grazing was available from winter wheat pasture.

Definite patterns of the magnitude of enterprises, enterprise combinations, and land use patterns were evident within soil and farm size classifications as cotton prices changed. In every programmed situation, wheat was produced at the full allowable allotment level. Cotton also was produced at the full allotment level in all programmed situations with a cotton price equal to or greater than $22.00 per hundredweight of lint. At the low cotton price ($17.60), full allotments were produced on the sandy soil and the rolling loam soil small farm situation; less than full allotments were produced on the level loam soil small and large farm, rolling loam soil large farm situation; no cotton was produced on the clay soil farm.

Land use pattern shifts occurred as the price of cotton was changed. The only exception occurred on the clay soil situation where cotton entered the program on C_b land and no land use shift occurred as cotton prices changed. On other soil situations with a low cotton price, production of cotton occurred on land of lower productivity. As cotton price was increased, production of cotton shifted to the highest productivity land where it generally replaced wheat and/or alfalfa[5]. Though cotton acreage remained constant within an allotment situation, cotton lint production may increase as the price of cotton was increased.

Generally, within any allotment situation, the size of the livestock enterprise decreased as the price of cotton was increased. Since livestock enterprises require a relatively large capital input, capital requirements and labor requirements generally decline slightly, in the situations where livestock numbers declined as cotton price was increased.

Comparison of Expected Returns of Alternative Programs

The net returns to the programmed combinations were used to develop desirability ratings for alternative programs. As indicated earlier, the technique of linear programming employed in the maximization model selected the optimum combinations of enterprises that maximize net returns to resources under a given set of restrictions. In this model, the length of run, or the time period assumed was such that all resources except land are considered variable. The programmed net returns represent returns to the previously unallocated costs, operator labor, management, and land. To determine returns to land, operator labor, and management, unallocated costs were deducted from programmed net returns. Further, to determine returns to operator labor and management, a return to land was imputed based on the assumed land values in each soil classification. Return to land investment was assumed to be five percent.

[5]Alfalfa is not considered a crop alternative in the clay soil situation. Thus in the clay situation cotton replaces wheat as the price of cotton is increased.

The residual return to operator labor and management can be interpreted as spendable income to the operator with zero equity in the resources used in his farm enterprises and all resources paid the assumed market values, i.e., the costs charged in the programming matrix plus the five percent return to land. This return represents the opportunity cost of operator labor and management.

Returns to operator labor and management were determined by deducting from the programmed net returns unallocated overhead costs and a five percent return on land valued at the base price. Programmed net returns and computed returns to specified resources under the delineated assumptions for the clay soil representative farm are presented in Table VII. The highest return was realized with situation P_4B, i.e., a cotton lint price of $30.80 per hundredweight and a base allotment. The second highest return was realized under situation P_4C. From an income standpoint, it is more desirable for an individual operating the clay soil representative farm to accept a 15 percent reduction in level of allotment than an approximate 16 percent reduction in cotton price per hundredweight. A reduction of allotment alone (a move from P_4B to P_4C) reduced income by less than six percent whereas income was reduced by 20 percent as allotment level was held constant and price reduced 16 percent (a move from P_4B to P_3B). Other comparisons and their desirability can be approximately computed from the data in Table VII for discrete changes in allotment and/or price levels.

TABLE VII

PROGRAMMED NET RETURNS AND RESIDUAL RETURNS TO SPECIFIED RESOURCES; CLAY SOIL REPRESENTATIVE FARM, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Allotment Level As Percent of Base	Cotton Price in Dollars Per Cwt. 17.60	22.00	26.40	30.80
	- Dollars -			
Programmed Net Returns[a]				
100	12,618	12,744	13,655	14,566
85		12,725	13,499	14,274
55			13,188	13,689
115	12,618	12,763	13,811	
Returns to Land, Operator Labor, and Management[b]				
100	10,173	10,299	11,210	12,121
85		10,280	11,054	11,829
55			10,743	11,244
115	10,173	10,318	11,366	
Returns to Operator Labor and Management[c]				
100	3,453	3,579	4,490	5,401
85		3,560	4,334	5,109
55			4,023	4,524
115	3,453	3,598	4,646	

[a]Includes returns to unallocated costs, land, labor, and management.

[b]After deduction of unallocated costs from programmed net returns.

[c]After deduction of returns to land imputed at five percent of base land values from Table IV.

Indifference Combinations of Price and Allotment

Various allotment and price combinations were compared with the use of the stability range for programs computed by linear programming. In the clay soil situation the stability range with respect to cotton price was \$21.39 to \$152.45. Cotton did not enter the solutions at prices below \$21.34. Returns to operator labor and management can be computed for any cotton price in this range, ceteris paribus. At a cotton price of \$29.39 and a base allotment, returns to labor and management were \$5,781 or equal to the income from situation P_4C. A cotton grower with a goal of profit maximization would be indifferent between these two price and allotment combinations. Similarly, situations representing (a) 100 percent - \$26.57, (b) 85 percent - \$27.48, (c) 55 percent - \$30.80, and (d) 115 percent - \$25.89, allotment level - cotton price combinations would give identical returns to labor and management.

These combinations form an iso-income line which would represent an income indifference curve to the farm operator concerned with profit maximization.

Four of these computed income indifference curves that portray the cotton allotment and cotton price combinations to obtain returns to labor and management of \$4,500, \$5,000, \$5,500, and \$6,000, respectively, are illustrated in Figure 1.

The income indifference curves depicted in Figure 1 for the clay soil situation were established by computing the necessary cotton price to attain the desired income level at each discrete programmed allotment

[6] A stability range indicates the limits between which the coefficient, in this case cotton price, must lie to maintain the optimality of the current program, ceteris paribus.

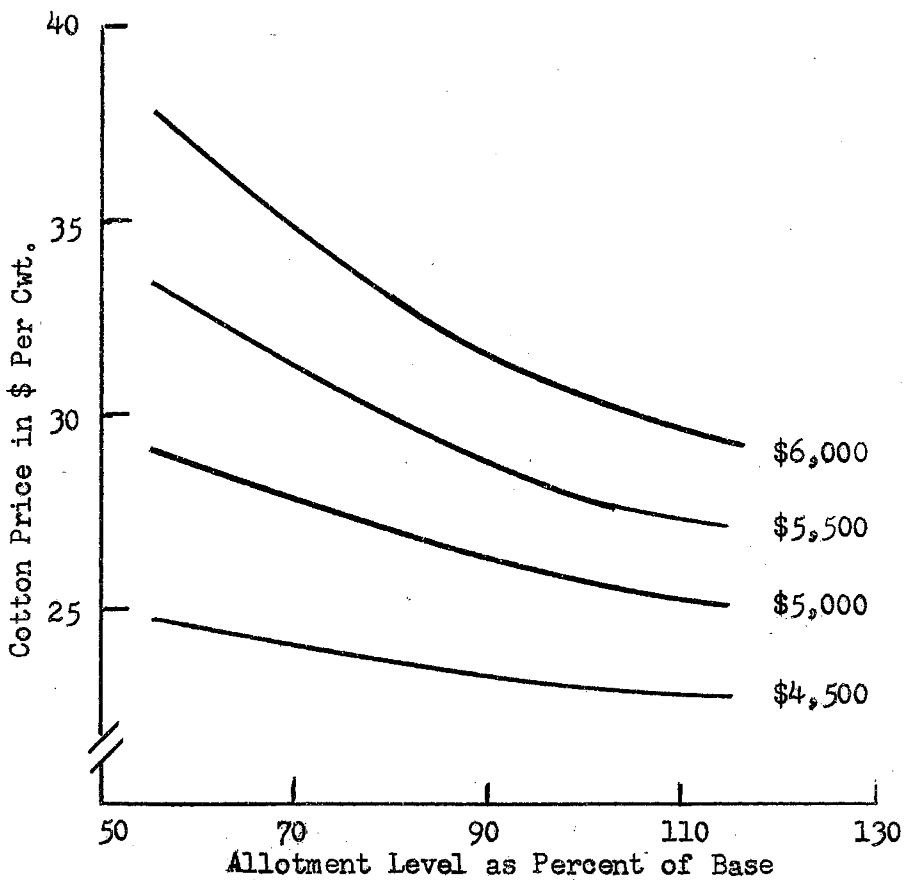

Figure 1. Income Indifference Price Allotment Combinations, Clay Soil Farm

level. The points were then joined freehand to form a smooth curve. Care was exercised not to violate the programmed cotton stability ranges. The slope of the individual computed indifference curves and the computed data imply that a relatively large percentage change in allotment would be offset by a smaller percentage charge in price. This was particularly true at low cotton prices where the relative profitability of cotton was low compared to other enterprise alternatives, ceteris paribus.

Programmed net returns and computed returns to specified resources for the sandy soil, level loam soil large and small, and rolling loam soil large and small representative farms are presented in Tables VIII through XII. In every soil and farm size situation, price allotment combinations P_4B, P_4C, and P_3A resulted in the highest, second highest, and third highest return, respectively. With returns as a program desirability criterion, a specified percentage reduction in allotment with price constant in these situations resulted in a smaller decline in returns as compared to a similar percentage reduction in cotton price with allotment level held constant. This held true for each of the soil and farm size situations.

Programmed stability ranges presented in Table XIII with respect to cotton price were used to compute price allotment combinations to attain a desired return level. These computations were carried out at each discrete programmed allotment level. The indifference curves for the five remaining soil and farm size situations are depicted in Figures 2 through 6.

In every situation, commensurate with the programmed stability ranges, the necessary price to attain the indicated income level was computed at each programmed discrete allotment level. For every soil

TABLE VIII

PROGRAMMED NET RETURNS AND RESIDUAL RETURNS TO SPECIFIED RESOURCES; SANDY SOIL REPRESENTATIVE FARM, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Allotment Level as Percent of Base	Cotton Price in Dollars Per Cwt. 17.60	22.00	26.40	30.80
	- Dollars -			
Programmed Net Returns[a]				
100	5,794	7,843	9,947	12,091
85		7,507	9,342	11,197
55			8,025	9,233
115	5,851	8,178	10,572	
Returns to Land, Operator Labor, and Management[b]				
100	4,189	6,238	8,352	10,486
85		5,902	7,737	9,592
55			6,420	7,628
115	4,246	6,573	8,967	
Returns to Operator Labor and Management[c]				
100	- 931	1,118	3,232	5,366
85		782	2,617	4,472
55			1,300	2,508
115	- 874	1,453	3,847	

[a]Includes returns to unallocated enterprise costs, land, labor, and management.

[b]After deduction of unallocated enterprise costs.

[c]Returns to land imputed at five percent of base land values from Table IV.

TABLE IX

PROGRAMMED NET RETURNS AND RESIDUAL RETURNS TO SPECIFIED RESOURCES; LEVEL LOAM SOIL LARGE REPRESENTATIVE FARM, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Allotment Level	Cotton Price in Dollars Per Cwt.			
as Percent of Base	17.60	22.00	26.40	30.80
	- Dollars -			
Programmed Net Returns[a]				
100	15,617	17,099	18,855	20,655
85		16,970	18,469	19,999
55			17,596	18,586
115	15,617	17,226	19,237	
Returns to Land, Operator Labor, and Management[b]				
100	13,692	15,174	16,930	18,730
85		15,045	16,544	18,074
55			15,671	16,661
115	13,692	15,301	17,312	
Returns to Operator Labor and Management[c]				
100	2,172	3,654	5,410	7,210
85		3,525	5,024	6,554
55			4,151	5,141
115	2,172	3,781	5,792	

[a]Includes returns to unallocated enterprise costs, land, labor, and management.

[b]After deduction of unallocated enterprise costs.

[c]Returns to land imputed at five percent of base land values from Table IV.

TABLE X

PROGRAMMED NET RETURNS AND RESIDUAL RETURNS TO SPECIFIED RESOURCES; LEVEL LOAM SOIL SMALL REPRESENTATIVE FARM, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Allotment Level as Percent of Base	Cotton Price in Dollars Per Cwt. 17.60	22.00	26.40	30.80
		- Dollars -		
Programmed Net Returns[a]				
100	8,127	8,856	9,725	10,625
85		8,789	9,535	10,300
55			9,112	9,607
115	8,127	8,918	9,914	
Returns to Land, Operator Labor, and Management[b]				
100	6,862	7,591	8,460	9,360
85		7,524	8,270	9,035
55			7,847	8,342
115	6,862	7,653	8,649	
Returns to Operator Labor and Management[c]				
100	1,102	1,831	2,700	3,600
85		1,764	2,510	3,275
55			2,087	2,582
115	1,102	1,893	2,869	

[a]Includes returns to unallocated enterprise costs, land, labor, and management.

[b]After deduction of unallocated enterprise costs.

[c]Returns to land imputed at five percent of base land values from Table IV.

TABLE XI

PROGRAMMED NET RETURNS AND RESIDUAL RETURNS TO SPECIFIED RESOURCES; ROLLING LOAM SOIL LARGE REPRESENTATIVE FARM, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Allotment Level	Cotton Price in Dollars Per Cwt.			
as Percent of Base	17.60	22.00	26.40	30.80
	- Dollars -			
Programmed Net Returns[a]				
100	10,732	11,309	12,768	14,385
85		11,257	12,524	13,932
55			11,947	12,886
115	10,732	11,351	13,012	
Returns to Land, Operator Labor, and Management[b]				
100	8,807	9,384	10,843	12,460
85		9,332	10,599	12,007
55			10,022	10,961
115	8,807	9,426	11,087	
Returns to Operator Labor and Management[c]				
100	647	1,224	2,683	4,300
85		1,172	2,439	3,647
55			1,862	2,801
115	647	1,266	2,927	

[a]Includes returns to unallocated enterprise costs, land, labor, and management.

[b]After deduction of unallocated enterprise costs.

[c]Returns to land imputed at five percent of base land values from Table IV.

TABLE XII

PROGRAMMED NET RETURNS AND RESIDUAL RETURNS TO SPECIFIED RESOURCES; ROLLING LOAM SOIL SMALL REPRESENTATIVE FARM, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Allotment Level as Percent of Base	Cotton Price in Dollars Per Cwt. 17.60	22.00	26.40	30.80
	- Dollars -			
Programmed Net Returns[a]				
100	3,032	3,361	3,717	4,111
85		3,296	3,639	3,990
55			3,334	3,569
115	3,078	3,420	3,785	
Returns to Land, Operator Labor, and Management[b]				
100	2,007	2,336	2,692	3,086
85		2,271	2,614	2,965
55			2,309	2,544
115	2,053	2,395	2,760	
Returns to Operator Labor and Management[c]				
100	- 33	296	652	1,046
85		231	574	925
55			269	504
115	13	355	720	

[a]Includes returns to unallocated enterprise costs, land, labor, and management.

[b]After deduction of unallocated enterprise costs.

[c]Returns to land imputed at five percent of base land values from Table IV.

TABLE XIII

PROGRAMMED STABILITY RANGES WITH RESPECT TO COTTON PRICE PER HUNDREDWEIGHT; MAXIMIZATION MODEL, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Program Combination	Stability Ranges					
	Clay Farm	Sandy Farm	Level Loam Large Farm	Level Loam Small Farm	Rolling Loam Large Farm	Level Loam Small Farm
	- Dollars -					
P_1A	N.A.[a]	17.58-18.09	17.59-17.86	15.81-17.70	17.59-18.84	12.91-18.74
P_2A	21.39-152.45	18.09-23.24	19.48-23.28	19.51-23.43	21.43-23.38	21.31-24.06
P_3A	21.39-152.45	23.24- ∞	24.00- ∞	24.15- ∞	24.93- ∞	25.88-29.95
P_1B	N.A.	17.58-18.09	17.59-17.85	15.81-17.69	17.58-18.84	12.64-18.74
P_2B	21.39-152.45	18.09-23.24	19.48-23.28	19.35-24.15	21.71-23.47	21.31-24.06
P_3B	21.39-152.45	23.24- ∞	24.06- ∞	24.15- ∞	24.93- ∞	25.88-29.96
P_4B	21.39-152.45	23.24- ∞	24.06- ∞	24.15- ∞	24.93- ∞	29.96- ∞
P_2C	21.39-152-45	18.09-23.24	19.27-23.34	19.35-24.15	21.71-23.47	19.11-23.05
P_3C	21.39-152.45	23.24- ∞	24.06- ∞	24.15- ∞	24.93- ∞	25.62-28.48
P_4C	21.39-152.45	23.24- ∞	24.06- ∞	24.15- ∞	24.93- ∞	29.96- ∞
P_3D	21.39-152.45	18.17- ∞	17.51- ∞	17.69- ∞	24.58- ∞	23.05- ∞
P_4D	21.39-152.45	18.17- ∞	17.51- ∞	17.69- ∞	24.58- ∞	23.05- ∞

[a]Cotton did not enter the linear programming solution at a cotton price of $17.60 per cwt. irrespective of the allotment level.

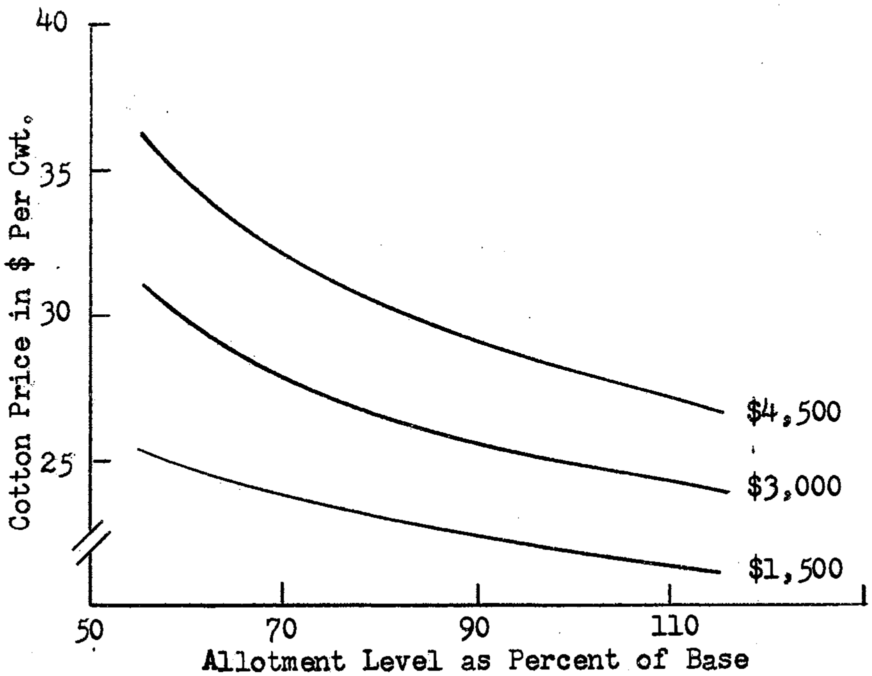

Figure 2. Income Indifference Price Allotment Combinations, Sandy Soil Farm.

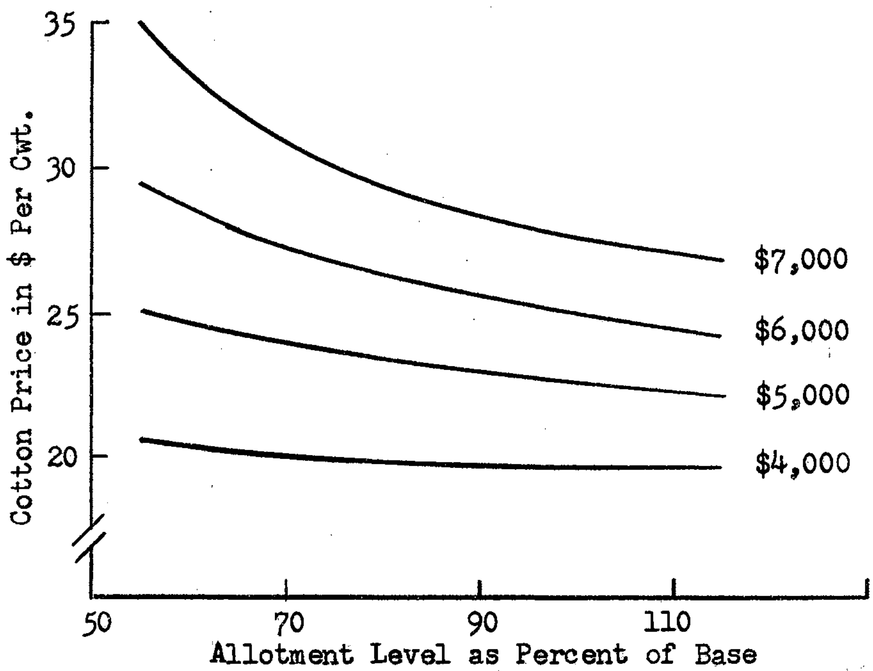

Figure 3. Income Indifference Price Allotment Combinations, Level Loam Soil Large Farm.

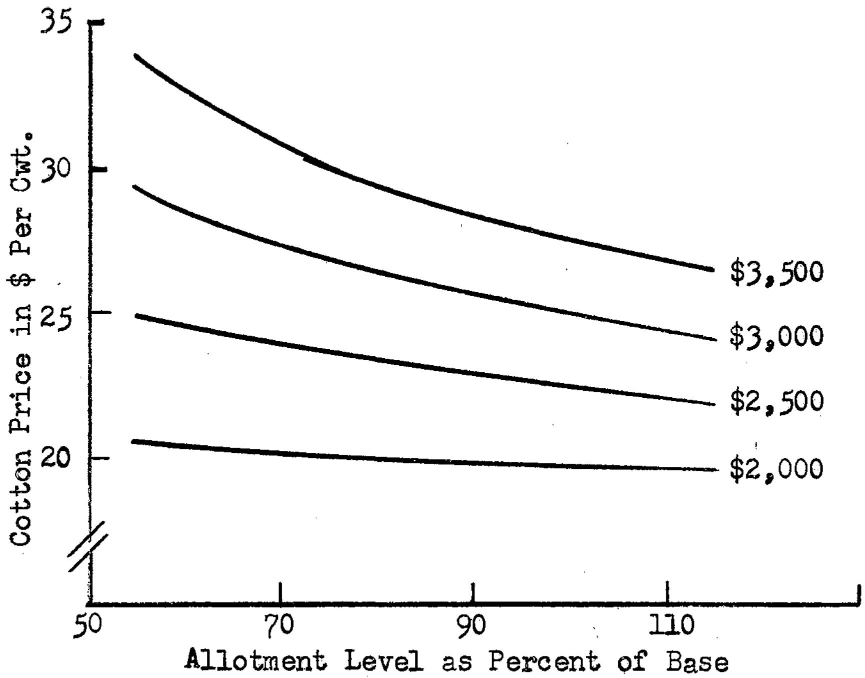

Figure 4. Income Indifference Price Allotment Combinations, Level Loam Soil Small Farm

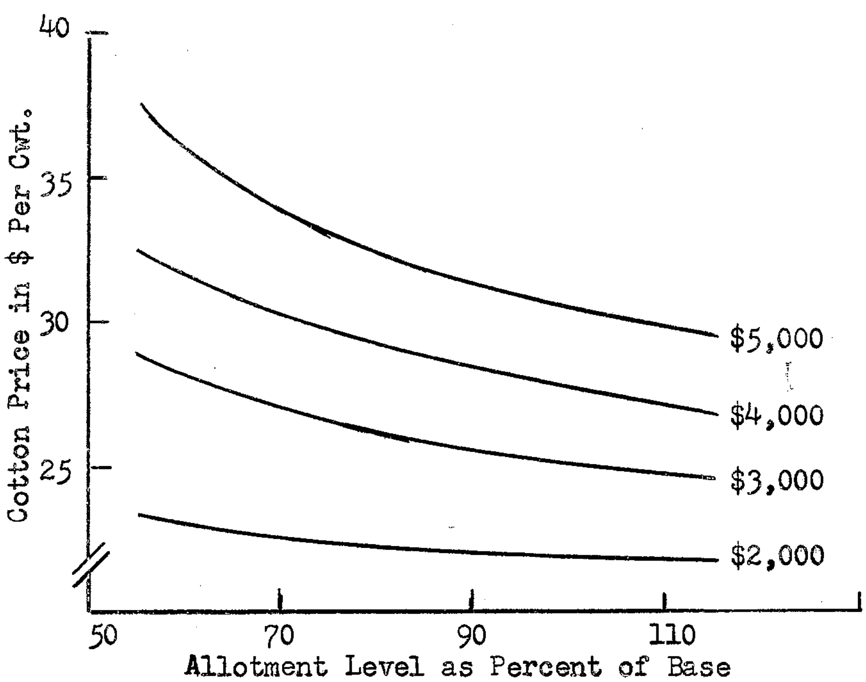

Figure 5. Income Indifference Price Allotment Combinations, Rolling Loam Large Farm.

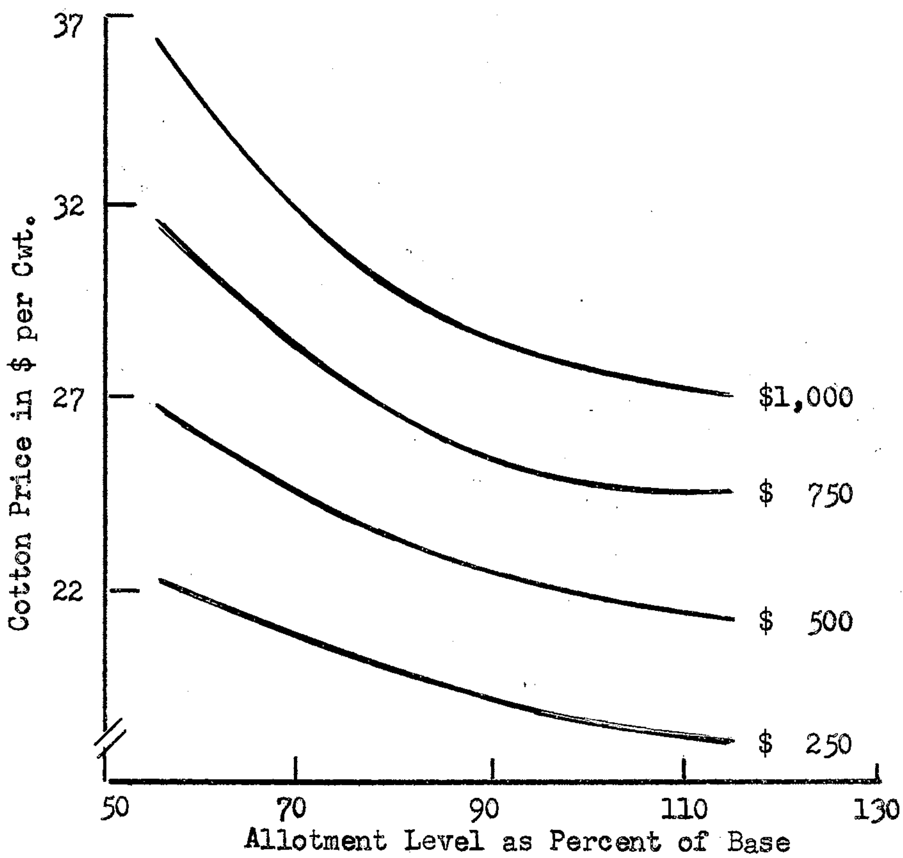

Figure 6. Income Indifference Price Allotment Combinations, Rolling Loam Small Farm.

and farm size situation, the computed points were connected to form a smooth curve to obtain the estimated income indifference curve.

Comparison of Government Outlay and Expected Net Returns

Every potential support price-allotment level combination implies a particular level of taxpayer dollar outlay. One of the goals of government agricultural programs is to maintain or increase farm income. However, government funds are not unlimited. Society through the political process decides the magnitude of income assistance to the farm sector by the type of program that is put into effect. It appears reasonable to assume that society could be indifferent between specified combinations of cotton farm price-allotment levels that required a particular level of government outlay. In essence this would imply an outlay or cost restraint on the part of society. The question that naturally follows given a fixed level of government expenditure: What is the price-allotment combination that will maximize net income to the individual producer given this restraint? In resolving this problem for Southwestern Oklahoma farmers, consideration must be given to the price effects of national cotton output, total cotton demand, and national program outlay.

The combined domestic and foreign demand for cotton was assumed to be:[7]

(3.1) $Q = 46.50 - 1.21Y_2$

where Q = U. S. cotton output in millions of bales

Y_2 = U. S. market price for cotton.

[7]Leo V. Blakley, Quantitative Relationships in the Cotton Economy with Implications for Economic Policy, Oklahoma Agricultural Experiment Station Technical Bulletin T-95, 1962.

To determine the subsidy needed for a desired level of farm cotton price and a given quantity of cotton determined by allotment, equation (3.1) was modified to (3.2):

$$(3.2)\ Q = 46.50 - 1.21(Y_2' - \alpha_1)$$

where α_1 = subsidy per pound

$= G[480Q]^{-1}$

where G = level of government expenditure

Y_2' = desired farm price.

National allotments and total cotton output have been approximately 16 million acres and 16 million bales.[8] Allotments as a percentage of the base allotment of 16 million acres were then converted to equivalent output of cotton in millions of bales, i.e., the national allotment is considered to be 16 million acres comparable to full base allotment and an output of 16 million bales. A 115 percent base allotment was assumed to be 18.4 million acres with an output of 18.4 million bales. Equation (3.1) was used to determine the necessary market clearing prices for the postulated allotment-output relationships. Equation (3.2) then was used to determine the government outlay necessary to maintain any desired national farm price and allotment (quantity output) desired.

A regression equation fitted to the relationship between government subsidy (g), desired Oklahoma farm price (X_2),[9] and allotment level (X_1)

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[8]U. S. Department of Agriculture, Economic Research Service, Statistics on Cotton and Related Data, 1925-1962, Statistical Bulletin 329 (Washington, 1962), pp. 1-3.

[9]To allow relating the regression equation to the income indifference curves developed for the representative Oklahoma farms, national farm price was related to the Oklahoma price where Oklahoma price is 88 percent of the national farm price.

as a percent of the base allotment resulted in equation (3.3):

$$(3.3)\quad G = -2991.5 + 11.09X_1 + 84.997X_2 \qquad R^2 = .9799.$$

Coefficients for variables X_1 and X_2 were both significant at the one percent level. Government expenditure was a linear function of farm price and allotment level.

From the producer's standpoint, net returns were also a function of these two variables. With an income function $Y(X_1X_2)$ and the government expenditures function, $G(X_1, X_2)$, the problem of determining the maximum profit combination of cotton prices and allotments given a predetermined government expenditure is comparable to the production economics problem of maximizing output given a prescribed cost level.[10] Forming the function:

$$(3.4)\quad \pi = Y(X_1, X_2) + \lambda[\bar{G}_0 - G(X_1X_2)]$$

where $\lambda \neq 0$ is an undetermined Lagrangian multiplier

$Y(X_1, X_2)$ is the income function

$G(X_1X_2)$ is the government outlay function

π = profit

G_0 = fixed level of government outlay.

The partial derivatives of π with respect to X_1, X_2, and λ were taken and set equal to zero:

$$(3.5)\quad \frac{\partial\pi}{\partial X_1} = Y_1' - \lambda G_1' = 0$$

$$(3.6)\quad \frac{\partial\pi}{\partial X_2} = Y_2' - \lambda G_2' = 0$$

$$(3.7)\quad \frac{\partial\pi}{\partial\lambda} = G^o - G(X_1X_2) = 0$$

where Y_i' and G_i' refer respectively to the i^{th} partial derivative of the

[10] James M. Henderson and Richard E. Quandt, Microeconomic Theory, A Mathematical Approach (New York, 1958), pp. 49-51.

income and government expenditure functions with respect to X_i.

To determine values for X_1 and X_2 consistent with the restrictions imposed by the functional relationships and the government expenditure, equations (3.5) and (3.6) were solved for , equated and solved for X_1 in terms of X_2. This value of X_1 was substituted into equation (3.7) and solved for the numerical value of X_2. The value of X_1 was determined by using the value of X_2 and equation (3.7).

The returns function for the clay soil situation was fitted by regression techniques. The use of returns to labor and management from the programmed price allotment combinations[11] resulted in the returns function:

$$(3.8)\quad Y = 709.5576 - 25.90758X_1 + 192.22628X_2 - 2.44751X_2^2 + 1.40296X_1X_2 \qquad R^2 = .991$$

where Y is returns to labor and management

X_1 is allotment level in percent of base allotment, and

X_2 is Oklahoma farm cotton price.

Coefficients on X_1, allotment level; X_2, cotton price, and the cross product term, X_1X_2, were significant at the 99 percent level. The coefficient on X_2^2 was significant at the 98 percent level.

The government expenditure relationship (3.1) is applicable to all specified representative farm situations under the assumption of a national cotton policy. The income relationship (3.8) is specifically applicable to the clay soil situation. The determination of a profit maximizing cotton allotment price combination for the clay soil farm,

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[11]Additional income level, allotment-price combinations were computed from programmed stability ranges to provide sufficient degrees of freedom.

given a predetermined government outlay, can be carried out using equations (3.1) and (3.8). Assume for the illustration that G_0 has arbitrarily been set at \$400 million.

Forming the function:

$$(3.9)\quad \pi = 709.5576 - 25.90758X_1 + 192.22628X_2 - 2.44751X_2^2 + 1.40296X_1X_2 + \lambda(400 + 2991.5 - 11.090002X_1 - 84.996622X_2)$$

where $\lambda \neq 0$ is an undetermined Lagrangian multiplier

π is maximum profit

X_1 and X_2 as before

The partial derivatives of π with respect to X_1, X_2, and λ were taken and set equal to zero:

$$(3.10)\quad \frac{\partial \pi}{\partial X_1} = -25.90758 + 1.40296X_2 - 11.090002\lambda = 0$$

$$(3.11)\quad \frac{\partial \pi}{\partial X_2} = 192.22628 - 4.89502X_2 + 1.40296X_1 - 84.996622\lambda = 0$$

$$(3.12)\quad \frac{\partial \pi}{\partial \lambda} = 33991.5 - 11.090002X_1 - 84.996622X_2 = 0$$

Equations (3.10) and (3.11) were solved for λ, equated, and solved for X_2 in terms of X_1:

$$(3.13)\quad X_2 = .089659X_1 + 24.974244.$$

Substituting this value of X_2 into (3.12), the numerical value of X_1 was 67.81. Substituting this value of X_1 into (3.13), the numerical value of X_2 was 31.05. The profit maximizing combination for the clay soil farm of allotment and price for a \$400 million national government outlay was 67.81 percent of base allotment with a \$31.05 cotton price. This combination represents a point of tangency of the government iso-cost curve and a producer income indifference curve. The 67.81 - \$31.05 combination of allotment and price represents the maximum contribution to net income on an efficiently organized representative clay farm given the predetermined government outlay. This analysis ignored any and all conflict that arises between income, freedom, or other individual farmer goals.

The clay soil representative farm results were used as a vehicle to illustrate the methodology necessary to determine the optimum price-allotment combinations. Similar analysis could be made for any or all the other resource situations.

Additional Program Alternatives

Idling Allotment Reductions

The foregoing analysis was carried out under the assumption that a reduction in cotton allotment did not necessitate idling an equivalent number of cropland acres. Thus the analysis was highly restrictive in the sense that a wide range of program alternatives exist which were not considered.

This section broadens the analysis to the extent of comparing the income effects of a reduction in allotment without and with the requirement that an equivalent number of cropland acres must be retired as allotments are reduced. The comparisons were restricted to one allotment change at one price level for each of the six representative farms.

Linear programming was used to determine the optimum organization of enterprises and net returns for each of the representative resource situations under the assumptions that, (a) base allotments were initially in effect, (b) allotments were reduced by 15 percent from this base, (c) a cotton price of $26.40 per hundredweight of cotton was maintained as allotments were reduced, (d) an equivalent amount of cropland must be idled, and (e) in every case the least productive land would be idled first. Returns to land, labor, and management are compared in Table XIV for the situations designated as P_3B, P_3C, and P_3C' representing respectively a \$26.40-100 percent, \$26.40-85 percent, and \$26.40-85 percent situations with the superscript (') referring to the situation necessitating land idling as allotments were reduced.

TABLE XIV

RETURNS TO LAND, LABOR, AND MANAGEMENT UNDER SPECIFIED ALLOTMENT LEVELS; WITH AND WITHOUT LAND IDLING; \$26.40 COTTON PRICE, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Situation	Returns to Land, Labor, and Management		
	P_3B	P_3C	P_3C'
Clay Soil Farm	11,210	11,054	11,027
Sandy Soil Farm	8,352	7,737	7,707
Level Loam Soil Large Farm	16,930	16,544	16,418
Level Loam Soil Small Farm	8,460	8,270	8,223
Rolling Loam Soil Large Farm	10,843	10,599	10,590
Rolling Loam Soil Small Farm	2,692	2,614	2,606

The programming results indicated that forced idling had little effect on net returns contrasted to a reduction in allotment without forced idling. This implied that the marginal value[12] of enterprises forced out of the program was low. A comparison of optimum enterprise combinations for situations P_3C and P_3C' on clay soils showed that the introduction of forced idling, which in this case retired 17.86 acres of C_e land, reduced annual grazing to the extent that feeders were reduced

[12]Marginal value as used in this context refers to the marginal value product (MVP) in linear programming. In conventional marginal analysis, the MVP is usually defined as the change in gross receipts associated with a unit change in factor. However, in linear programming the marginal value is defined as the change in net returns associated with a unit change in a factor.

by two head. On sandy soils, where 20 acres of S_3 and 3.04 acres of S_d land were idled, reseeded cropland was reduced by 23.04 acres necessitating a two head reduction in beef cows. On level loam soil large and small representative farms, sorghum-fallow was reduced on L_c land, grain grazing increased on L_c land replacing the reduced grazing on L_e land while livestock numbers remained constant. On rolling loam soil representative farms, reseeded cropland was reduced on the least productive soils which necessitated a small reduction in beef cows.

The data in Table XIV imply that on any of the postulated representative farms, the operator would tend to be nearly indifferent between allotment reduction programs with or without forced idling. However, this would likely not hold true in cases where (a) all of his cropland was highly productive, (b) an alternative enterprise with a relatively high marginal value was available, or (c) the reduction in allotment was large so that all his low productivity cropland plus additional highly productive cropland was forced into retirement.

The data in Table XIV were used to calculate the maximum average value of an acre of cotton allotment for each of the farm situations over the 100 percent to 85 percent allotment range. For example, reducing the allotment by 15 percent in the clay soil situation necessitated a reduction in allotment of 17.86 acres. Returns to land, labor, and management were reduced by \$183 in total from P_3B to P_3C' or an average of \$10.25 per acre. Theoretically, the value of this acre of allotment is the present value of its future income discounted to the present. The formula for the determination of present value is $PV = R/r$, where "R" is annual net returns and "r" is the market rate of interest. Capitalizing the \$10.25 net return per acre at five percent, the capitalized value of an acre of allotment on clay soils for the 100 percent to 85 percent allotment level range was $205. This capitalized value must be considered as the absolute maximum that the operator could afford to pay for an additional acre of allotment. The $10.25 annual return included returns to land, operator labor, and management. At $205 per allotment, the operator would realize no return to his labor and management. Comparable average maximum values of an acre of cotton allotment for sandy, level loam large, level loam small, rolling loam large, and rolling loam small farms were $560, $459, $425, $238, and $325 per acre, respectively.

Summary of Maximization Model Results

Definite patterns of enterprise size, enterprise combinations, land use patterns, and net returns developed as cotton prices and allotment levels changed. Cotton was produced at full allotment levels on all soil situations at prices greater than $22.00 per hundredweight. Less than full allotments or no cotton appeared on the level loam soils, rolling loam soil large farm, and the clay soil farm with cotton priced at $17.60 per hundredweight.

Income or net returns declined as cotton prices and/or allotments were reduced. Generally, a specified reduction in price, ceterus paribus, lowered net returns a proportionately greater amount than a similar reduction in allotment, ceterus paribus. The slope of the computed income indifference curves show that a relatively large change in allotment was offset by a smaller change in price.

The net returns from the clay soil optimum programs were used to determine a combination of cotton allotment and price that would maximize returns to clay soil representative farms given a predetermined government outlay for the national cotton program. With an arbitrarily assumed level of government expenditure of $400 million, this combination was found to be a cotton price of $31.05 per hundredweight and an allotment level at 67.81 percent of the assumed base. A mathematical technique was employed. The accuracy of the results rest on the assumption that the demand function was correct over a wide range of prices, that allotments can be converted to equivalent output of cotton in bales, and on the results of the linear programming representative farm approach.

The results in terms of net returns were very similar under the assumption that land was idled when allotments were reduced from the base level versus nonidling of land when allotments were reduced. The latter assumption was used throughout this study.

CHAPTER IV

AREA AGGREGATES WITH MAXIMIZATION MODEL

The optimum plans for the six representative farms in the four soil classifications presented and discussed in Chapter III and Appendix B represent the normative micro supply functions for commodities for the length of run where all factors, except the quantity of land per farm, were allowed to vary. A normative supply function describes the optimum relationship between the quantity of a product supplied and its price relative to a given norm.[1] The norm assumed in this study is the maximization of representative farm profits. The normative supply function estimates the optimum supply reaction to product price changes in terms of the norm and does not estimate the actual supply response of producers.

The representative farm optimum supply functions were used to construct an estimate of the aggregate normative cotton supply function. The aggregation model in this study consists of simple summation within cells (or resource situations) and then summation across cells. The process of horizontal aggregation of the programmed normative farm supply relationships involved the determination of appropriate weights related

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[1]Dean E. McKee and Laurel D. Loftsgard, "Programming Intra-Farm Normative Supply Functions," Agricultural Supply Functions-Estimating Techniques and Interpretations, ed. Earl O. Heady et al. (Ames, 1961), p. 152.

to the representative farm size and the total included land base contained in each respective soil classification and the total area included land base. The area aggregations are weighted summations of the programmed optima under the assumption that resource costs remained constant over all levels of resource use and product prices were constant over all output levels. External economies and diseconomies of scale and the 11 county study area's effect on product prices as output varies were not considered. Though these factors are relevant in supply aggregation, they would be difficult or impossible to estimate for this small area comprising a minor percentage of total "industry" output.

It was assumed that with appropriate weights the area aggregate effect of alternative cotton price-allotment combinations on, (a) optimum supply of cotton and other major products, (b) acres of major crops and livestock numbers, (c) labor requirements, and (d) returns to land, operator labor, and management can be ascertained.

Aggregative Resource Bases and Weights

The aggregative resource base is the residual after deducting the resources used by excluded alternatives. It was assumed that this residual was distributed among the physical soil type classifications as total area resources are distributed. Further the cropland capability distribution within representative farm situations was assumed to be identical to the distribution of total area cropland.

Total land in farms, acres considered eligible for adjustment, and the aggregative weights for each representative farm in the four soil situations are presented in Table XV. Since only one representative farm situation was assumed for each of the clay and sandy soil situations, the aggregative weights for these two soils were computed by dividing the included acres by the representative farm size.

TABLE XV

TOTAL LAND IN FARMS, INCLUDED ACRES, AND AGGREGATIVE WEIGHTS FOR REPRESENTATIVE FARMS BY SOIL CLASSIFICATION, SOUTHWESTERN OKLAHOMA

Item	Clay	Sandy	Level Loam	Rolling Loam
Total Acres in Farms	1,786,682	1,339,141	1,119,816	1,101,441
Included Acres	1,043,011	775,000	445,161	598,639
Acres in Representative Farms				
Large Farm	1,280		960	960
Small Farm		640	480	240
Aggregative Weights				
Large Farm	814.85		185.48	286.85
Small Farm		1,210.94	556.45	1,346.94

Two representative farm sizes typify the land eligible for adjustment in both the level and rolling loam soil situation. Aggregations for these two situations were made on the basis of the percentage of land assumed to be in the small and large farm size. On level loam soils, it was estimated that 60 percent of the land was in small farms and 40 percent in large farms. In the rolling loam soil situation, 54 percent of the land was assumed to be in small farms and 46 percent in large farms.

Aggregate Cotton Supply

Normative Cotton Supply

The normative supply functions for cotton for each soil situation determined by the horizontal summation of representative farm cotton supply functions are presented in Figures 7 through 10. The first four figures illustrate the cotton supply functions for each soil situation with allotment held constant.

The text book presentation of a supply function usually takes the form of a smooth curve with a positive relationship between price and quantity. Such a curve commonly assumes that in the long run, all factors are variable, or, in the short run, that a designated group of factors are fixed while others are variable and infinitely divisible. The supply relationships delineated in this chapter assumed, (a) that all factors, except land (allotment level) were variable, and (b) prices of all other factors and products remained constant as the price of cotton was varied by discrete increments. The step form of the illustrated supply functions was due to constant ranges of linearity for cotton prices as determined in the optimum program for each situation. For example, the clay soil farm had a linearity range for cotton of $21.39 to $152.45 per cwt. Within this range, the output of cotton per farm remained constant and the supply function is vertical or perfectly inelastic. Further, no cotton was produced at prices less than $21.39 per cwt. in the clay soil situation. Given the allotment level on clay soils, cotton production had an elasticity of zero with respect to prices between $21.39 and $152.45 per cwt. This held true for all four programmed allotment levels.

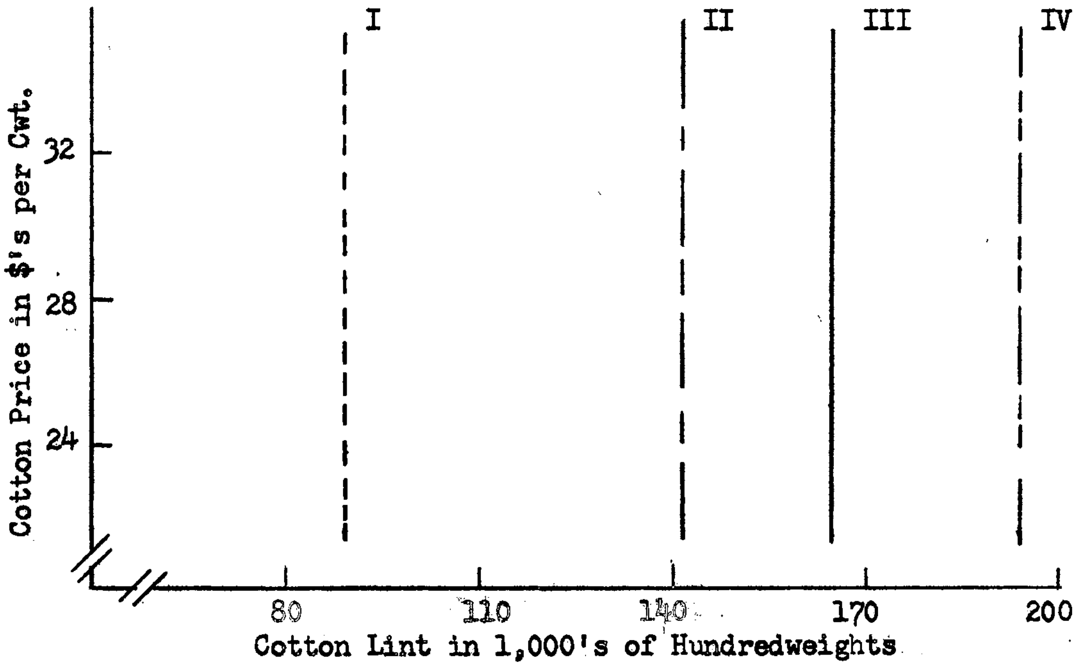

Figure 7. Cotton Supply Functions, Clay Soils, By Allotment Levels.

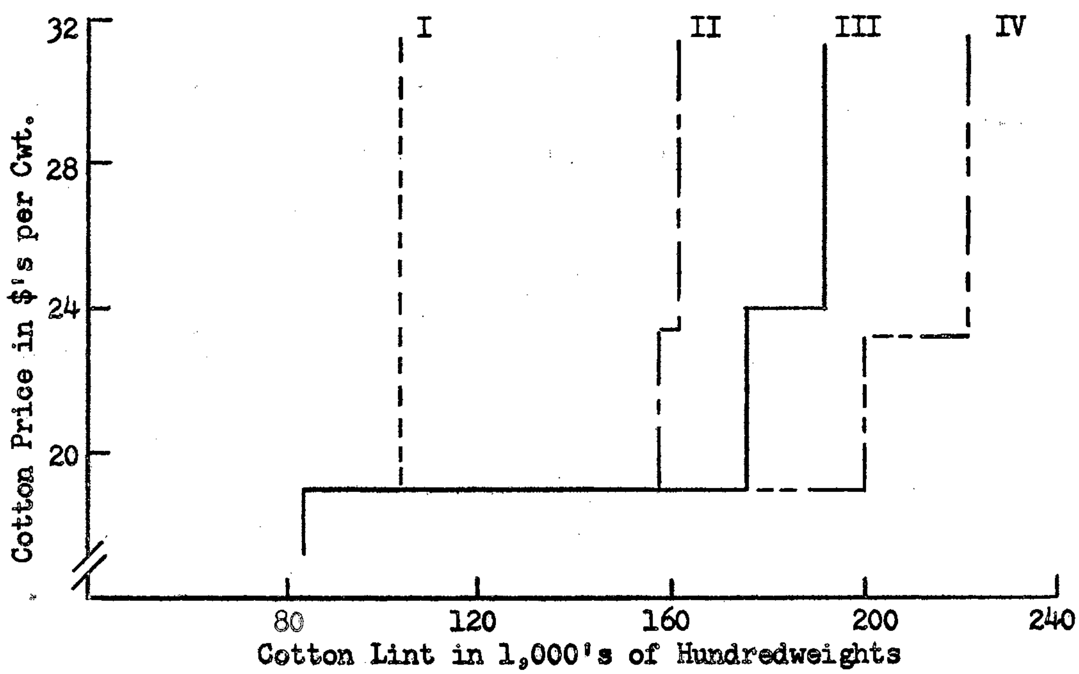

Figure 8. Cotton Supply Functions, Level Loam Soils, By Allotment Levels.

Legend:

I - 55% Allotment Level
II - 85% Allotment Level
III - 100% Allotment Level
IV - 115% Allotment Level

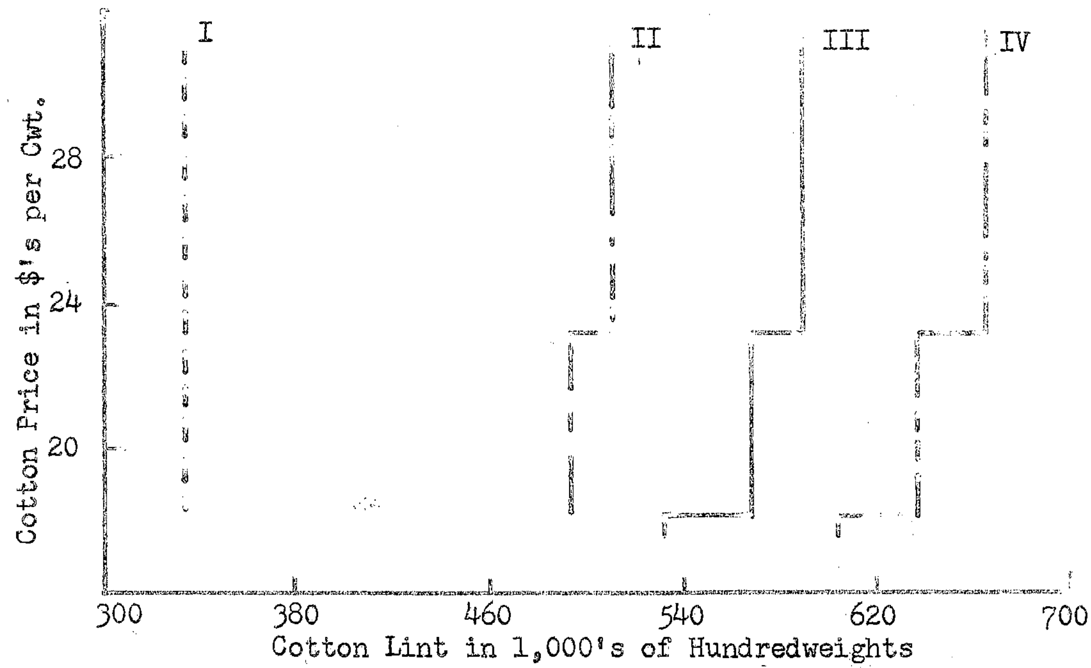

Figure 9. Cotton Supply Functions, Sandy Soils, By Allotment Levels.

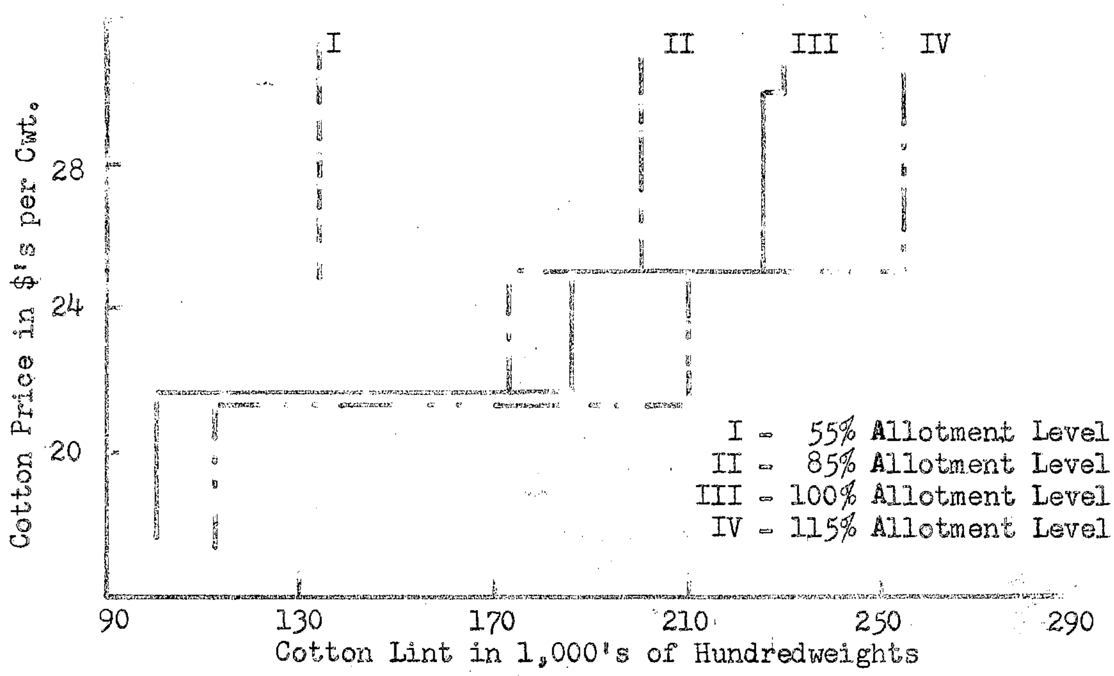

Figure 10. Cotton Supply Functions, Rolling Loam Soils, By Allotment Levels.

Differences existed between soil situations. In the other soil situations, the elasticity of supply of cotton was zero only at the 55 percent allotment level. For the 85 percent, 100 percent, and 115 percent allotment level, the normative cotton supply takes the shape of a step function with elasticity of supply at zero for discrete stability ranges. Though the acreage of cotton, given an allotment level, remained identical for all soil situations at prices greater than $22.00, cotton supply increased as price increased because cotton was shifted to more productive soils. Cotton became relatively more profitable than other crop alternatives as its price was increased. Accordingly, the upper limit of the supply of cotton for each soil situation depends on the size of the allotment, land productivity, and the quantity of highly productive land. With a smooth curve drawn to connect the low points of each stability range, the elasticity of supply would tend to be high at low cotton prices and low at high prices, given the allotment level.

The aggregate supply function for the entire area is illustrated in Figure 11. In constructing these supply curves, stability ranges were not taken into consideration. The aggregate output of cotton at the four programmed price levels were plotted and joined with a smooth curve. These supply curves represent approximations; however, they illustrate the high elasticity of supply for low cotton prices changing to a low supply elasticity at high cotton prices, given the allotment level.

Cotton Output Response to Allotment Changes

The basic purposes of government agricultural programs are to increase or maintain farm income, facilitate agricultural adjustments, and ensure an adequate supply of food and fiber at reasonable prices.

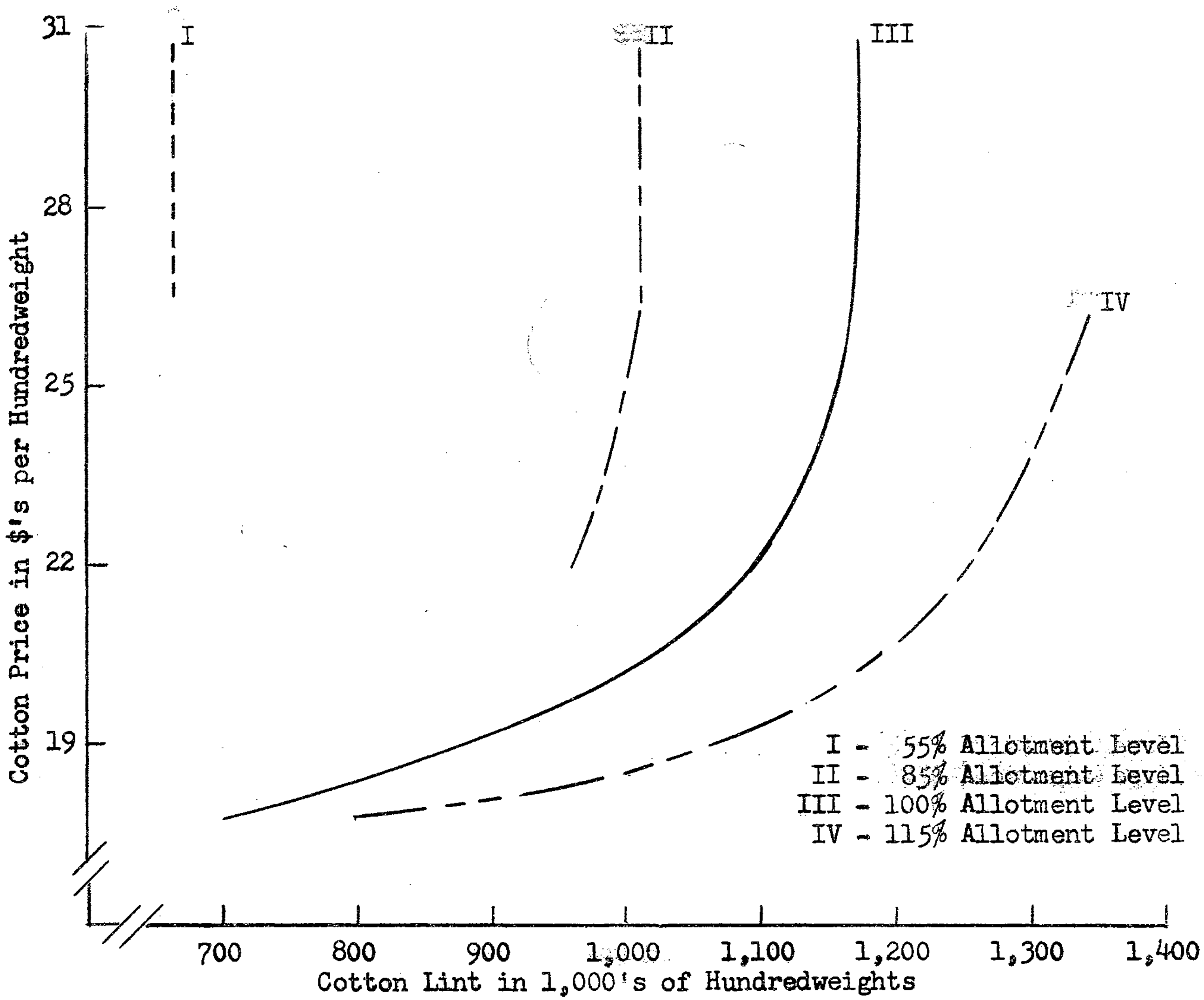

Figure 11. Aggregate Cotton Supply Functions, By Allotment Levels

These objectives are conflicting and their fulfillment usually must be attained within a perdetermined government outlay. In the face of declining total U. S. cotton consumption coupled with output increasing technological changes, continuing decreases in cotton allotments have been necessary to avoid excessive accumulation of stocks at given support price levels. Under these conditions, what percentage allotment decrease would be necessary for a given year to attain a desire reduction in cotton production? In other words, what would be the response of output to allotment changes, i.e., the elasticity of output with respect to allotment $(E_{OA})^2$, given a fixed support price?

For this 11-county Southwestern Oklahoma area, the output response to allotment changes are presented in Table XVI for individual soil situations and the aggregate area.

The elasticity of output with respect to allotment was 1.00 for the clay soil situations for all allotment changes and for the level loam soil situation at prices of $30.80 and $26.40 per cwt. This implies a one to one relationship between output and allotments. With an E_{OA} of 1.00 cotton output would decrease by 10 percent with a cotton allotment decrease of 10 percent.

The relationship between output and allotment is a function of the changes in optimum programs computed by linear programming as allotment levels were varied. In the clay soil situation, as allotment was decreased from 100 percent to 85 percent with price held at $26.40 (a move from P_3B to P_3C), cotton acreage on C_b land decreased from 119 to 101

[2] E_{OA} is an average elasticity defined as $\Delta O/\Delta A \cdot \bar{A}/\bar{O}$ where (O) is output of cotton in cwt's. of lint; (A) is allotment as percent of base.

TABLE XVI

AGGREGATE COTTON OUTPUT BY SOIL SITUATIONS AND AREA; OUTPUT RESPONSE TO ALLOTMENT CHANGES: SPECIFIED PRICE AND ALLOTMENT SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Price-Allotment Combination	Clay Soil		Sandy Soil		Level Loam Soil		Rolling Loam Soil		Area Aggregate	
	Cotton Output	E_{OA}[a]	Cotton Output	E_{OA}	Cotton Output	E_{OA}	Cotton Output	E_{OA}	Cotton Output	E_{OA}
					- Cwt. -					
P_4A[b]	194,003	1.00	663,909	.879	218,212	1.00	254,829	.760	1,330,958	.893
P_4B	168,699	1.00	587,184	.862	189,750	1.00	229,179	.854	1,174,812	.902
P_4C	143,381	1.00	510,458	.985	161,288	1.00	199,488	.932	1,014,615	.979
P_4D	92,779		332,475		104,363		133,087		662,704	
P_3A	194,008	1.00	663,909	.879	218,212	1.00	254,829	.887	1,330,958	.918
P_3B	168,699	1.00	587,184	.862	189,750	1.00	225,128	.753	1,170,771	.883
P_3C	143,381	1.00	510,458	.985	161,288	1.00	199,232	.929	1,014,359	.978
P_3D	92,779		332,475		104,363		133,087		662,704	
P_2A	194,008	1.00	645,139	.906	199,404	.889	198,663	.419	1,237,214	.838
P_2B	168,699	1.00	568,414	.893	176,117	.873	187,373	.506	1,100,603	.838
P_2C	143,381		491,689		152,829		172,611		960,510	
P_1A	0		604,451	.97	85,472	0	112,851	.888	802,774	.850
P_1B	0		527,727		85,472		99,678		712,877	

[a]The elasticity of cotton output with respect to acreage allotment.

[b]Output for all price-allotment combinations of cotton determined with the use of linearity ranges for each situation.

acres.[3] No cotton was produced on C_c land prior to or after the decrease in allotment, so cotton output also was decreased by 15 percent as yields on C_b land were held constant. The E_{OA} would be 1.00 in all situations where cotton was produced on one soil productivity classification only.

However, the E_{OA} would not be unity in a situation where cotton was produced on more than one soil productivity class and the decrease (increase) in allotment decreased (increased) cotton acreage on one soil productivity class only. The E_{OA} would be less than unity if the change in cotton acreage occurred on the least productive land used for cotton production. Conversely, it would be greater than 1.00, if, as allotment was decreased (increased) acreage of cotton decreased (increased) on more highly productive soils. All the computed elasticies of output with respect to allotment in Table XVI are equal to or less than one. This implies that cotton production was relatively more profitable on higher productivity soils and any reduction in allotment reduced production on low productivity soils.

A difference in output response to allotment changes was evident depending on the initial allotment level with a given price level. For example, consider the area aggregate output and E_{OA} at a cotton price of $26.40 per cwt. Given an initial allotment level of 100 percent, each subsequent one percent decrease in allotment would decrease cotton output about 0.88 percent (a move from P_3B towards P_3C) on the average. A desired 12 percent reduction in total area output would necessitate an approximate 15 percent reduction in cotton allotment in this case. With further reductions (i.e., a move from P_3C towards P_3D) the E_{OA} approaches

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[3]See Appendix B, Table I.

unity and any desired percentage reduction in output would necessitate an equivalent percentage reduction in allotment. At allotment levels well below the base level, in most soil situations all of the cotton production took place on one soil productivity classification.

The above analysis rests on the assumptions, (a) that profit maximization was the goal on all farms and (b) that the optimum organization of farm enterprises existed on all farms before and after an allotment change. Should these assumptions be violated, the output response to allotment change would be different than anticipated. For example, if the farmer's goal initially was a satisfactory income level rather than profit maximization and a decrease in his allotment level induced him to, (a) reorganize his farm enterprises, (b) intensify his cotton enterprises, i.e., increase fertilizer use, and/or (c) change his internal discount rate, then the E_{OA} could conceivably approach zero. It would appear intuitively plausible that limits exist with respect to enterprise reorganization, intensification, and/or the individuals change in risk aversion. Therefore, the actual E_{OA} might approximate the values computed.

As a check on the realism of the computed elasticities, actual data on allotments and cotton output for the Southwestern area[4] for the years 1961 through 1964 were used to compute the output to allotment responses.[5] From 1961 to 1964, allotments were reduced from 8,733,000 to 7,629,000

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[4]The Southwestern area as used here includes Texas, Oklahoma, and Kansas.

[5]U. S. Department of Agriculture, Economic Research Service, Statistics on Cotton and Related Data, 1925-1962, Statistical Bulletin 329 (Washington, 1963), pp. 3-5, and 1964 Supplement, p. 2.

acres or 12.64 percent. Output was reduced from 5,135,000 bales to 4,540,000 bales. For this time period the E_{OA} was 0.91. This compares closely to the values obtained for the aggregate area response from Table XVI. Similarly, the E_{OA} for the period 1962-64 in which allotments were reduced by 10.88 percent, was 0.88 which is very similar to the computed values for the aggregate area. However, the actual E_{OA} varied considerably from year to year when data from consecutive years was used. For example, 1962 to 1963, the E_{OA} was .52. From 1963 to 1964, when allotments were decreased by a fraction of a percent, the E_{OA} was 7.049. The elasticities from consecutive years were greatly influenced by yield variations due to weather and factors other than allotment level. Such variations would make it extremely difficult to determine the adjustment in allotment required to realize accurately a desired goal of output reduction on a year-to-year basis. Over a longer period of time, a knowledge of the approximate output response of a commodity to allotment change should be helpful in formulating commodity price support-allotment programs.

Major Product Output and Specified Resource Requirements

The output of other commodities in a region or an area as the allotment and/or support price of a major commodity change are important. Though many agricultural regions tend to specialize[6] in the production

[6]The term specialize as used does not imply the production of one commodity to the exclusion of all others, but implies that areas or regions generally grow one major or basic crop in conjunction with several other more minor field crops and related livestock enterprises. Well known examples are cotton in the Mississippi Delta, corn in the cornbelt, and wheat in the Great Plains.

of a commodity, significant quantities of other commodities are also produced. Any change in the cotton allotment in the Southwestern area of Oklahoma could have far reaching effects on the output of livestock, wheat, grain sorghum, and other crops.

The area aggregations for the 12 programmed cotton allotment-price combinations of major crop acreages, product output, livestock numbers, and specific resource requirements are presented in Tables XVII and XVIII. The only other crop restricted by allotments in the study area was wheat and this crop entered all programs at the full allotment level. Higher cotton prices engender land use pattern shifts as cotton became relatively more profitable and its production was shifted to higher productivity soils assuming a given allotment for cotton. Generally, such shifts replaced wheat acreage and forced wheat production to lower productivity soils. Though wheat acreage was maintained at a constant level in all programmed situations, the output of wheat declined as cotton prices were increased within each cotton allotment level. For example, with cotton at the base allotment, increasing the price of cotton from $17.60 to $30.80 per cwt. reduced wheat output 9.5 percent.

Alfalfa acreage was reduced substantially as cotton prices were increased within every allotment situation. An exception occurred when cotton allotments were reduced to 55 percent. Alfalfa was not restricted by allotments, but rotational requirements limited alfalfa in total and to the higher soil productivity classes. Cotton production shifted to higher productivity soils as cotton prices were increased and alfalfa was replaced and reduced in the optimum organization. The exception that occurred at the 55 percent allotment level was a function of the quantity of high productivity soils. At this allotment level, a sufficient

TABLE XVII

AREA AGGREGATIONS OF MAJOR CROP ACREAGES, PRODUCT OUTPUT, LIVESTOCK NUMBERS, SPECIFIED RESOURCE REQUIREMENTS, AND RETURNS; BY SPECIFIED COTTON PRICE-ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations					
		P_2C	P_3C	P_4C	P_1A	P_2A	P_3A
				- Thousands -			
Crops							
Cotton	Acre	374.0	374.0	374.0	306.3	506.0	506.0
Wheat	Acre	754.8	754.8	754.8	754.8	754.8	754.8
Sorghum	Acre	216.6	267.3	267.8	183.8	140.0	177.3
Oat Grain	Acre	40.2	40.2	40.2	140.6	4.8	4.8
Alfalfa	Acre	210.3	165.2	164.7	228.5	210.3	172.8
Small Grain Hay	Acre	170.4	169.4	169.4	170.6	167.3	168.4
Annual Grazing	Acre	239.2	234.1	234.1	229.0	230.6	231.8
Major Crop Output							
Cotton	Cwt.	960.5	996	996	803	1,237	1,331
Wheat	Bu.	11,684	11,371	11,373	12,400	11,835	11,078
Sorghum	Cwt.	2,664	3,303	3,308	2,283	1,659	2,136
Oats	Bu.	804	804	804	2,812	96	96
Livestock							
Feeders	Head	406.8	407.4	407.4	423.3	398.2	398.8
Beef Cows	Head	26.7	26.4	26.4	27.2	27.2	26.6
Labor Requirements							
Operator	Hour	7,448	7,441	7,441	7,508	7,554	7,543
Hired Skilled	Hour	2,511	2,410	2,410	2,498	2,573	2,477
Hired Unskilled	Hour	904	923	923	673	1,272	1,314
Land, Operator Labor, and Management Return							
Aggregate	Dol.	28,236	32,607	37,072	25,081	29,394	35,042
Av. Per Farm	Dol.	6.416	7.409	8.423	5.699	6.679	7.962

TABLE XVIII

AREA AGGREGATIONS OF MAJOR CROP ACREAGES, PRODUCT OUTPUT, LIVESTOCK NUMBERS, SPECIFIED RESOURCE REQUIREMENTS, AND RETURNS: BY SPECIFIED COTTON PRICE-ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations					
		P_1B	P_2B	P_3B	P_4B	P_3D	P_4D
		- Thousands -					
Crops							
Cotton	Acre	271.2	440.0	440.0	440.0	241.9	241.9
Wheat	Acre	754.8	754.8	754.8	754.8	754.8	754.8
Sorghum	Acre	209.3	183.9	219.3	225.7	290.8	290.8
Oat Grain	Acre	141.0	22.5	22.5	22.5	75.7	75.7
Alfalfa	Acre	228.5	210.3	172.7	164.7	212.5	212.5
Small Grain Hay	Acre	172.0	166.7	168.8	168.9	171.8	171.8
Annual Grazing	Acre	242.0	228.4	231.0	231.2	240.7	240.7
Major Crop Output							
Cotton	Cwt.	713	1,101	1,171	1,175	663	663
Wheat	Bu.	12,409	11,729	11,209	11,242	11,689	11,689
Sorghum	Cwt.	2,611	2,227	2,684	2,761	3,629	3,629
Oats	Bu.	2,812	450	450	450	1,513	1,513
Livestock							
Feeders	Head	425.7	398.8	402.8	403.4	414.0	414.0
Beef Cows	Head	27.1	27.2	26.5	26.5	27.1	27.1
Labor Requirements							
Operator	Hour	7,365	7,493	7,496	7,488	7,083	7,083
Hired Skilled	Hour	2,484	2,543	2,448	2,448	2,430	2,430
Hired Unskilled	Hour	580	1,087	2,375	2,379	558	558
Land, Operator Labor, and Management Return							
Aggregate	Dol.	24,949	28,822	33,832	38,988	29,787	32,703
Av. per Farm	Dol.	5.669	6.549	7.687	8.859	6.768	7.431

quantity of high productivity soils were available on the representative farms to produce the full cotton allotment and still maintain alfalfa acreage.

Grain sorghum output exhibited a slightly different pattern between programmed situations than either wheat or alfalfa. However, it too was directly related to the institutional restrictions imposed on cotton, the rotational restrictions on alfalfa, and grain sorghum's relative profitability. At the $17.60 cotton price, the full allotment of cotton was not produced. Wheat was limited to its allotment. Alfalfa was limited by the rotational restriction. Therefore, grain sorghum output was high when cotton prices were low. As cotton prices were increased, cotton entered at the full allotment level and grain sorghum acreage and output declined sharply. However, at the highest cotton prices cotton had replaced alfalfa on the high productivity soils. Since alfalfa could not enter the program on low productivity soils, grain sorghum acreage and output increased at high cotton prices, i.e., $26.40 and $30.80 per cwt. The above analysis held with all soil situations except clay soils which are not adapted to grain sorghum production.

Oats for grain was an allowable alternative on clay soils but not in any of the other situations. At a $17.60 cotton price, cotton did not enter the program on the clay soil situation. Therefore, at this cotton price, oats acreage and production was relatively high. As cotton entered the programs at the $22.00 cotton price, the output of oat grain dropped sharply and remained at low levels at all cotton prices equal to or greater than $22.00 per cwt. Small grain hay and annual grazing acreages were highly stable within each allotment level. Thus livestock output, remained very stable in all programmed situations.

Total labor requirements generally were directly dependent on the allotment level. Within an allotment level, total labor requirements were lower at the low cotton price at which the full allotment of cotton was not produced. Generally operator labor and skilled hired labor requirements were very stable both within and between allotment levels. The variation in total labor requirements were attributable to the unskilled hired labor required for cotton production.

Net Returns

Policy makers must concern themselves with the returns that farmers in the area would realize for a given crop under various program combinations. On the farm level, the program combination in effect directly affects the farmer's returns and spendable income. If price and allotments were set at a level which allowed the farmer to realize a bare subsistence income, then his ability to educate his children, repay debts, expand his operation, and enjoy the fruits of national economic growth would be impaired.

Conversely, a program combination with a high cotton price would increase farmer's income, may increase government stocks, and require a large government program outlay. Several research studies conclude that the benefits of a price support program are capitalized into the sale value of the farm.[6] Though the capitalization process becomes a realized

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[6]Ted Richard Nelson, "An Econometric Model of the Land Market Stressing Effects of Government Programs on Land Values" (unpub. Ph.D. thesis, Oklahoma State University, 1964); and W. L. Gibson, Jr., C. J. Arnold, and F. D. Aigner, The Marginal Value of Flue Cured Tobacco Allotments, Agricultural Experiment Station, Virginia Polytechnic Institute (Blacksburg, 1962), Technical Bulletin No. 156.

gain and a real cost when a farm is sold and purchased, over time the gains from support programs leave the agricultural sector.

The nonfarm sector in a rural area is affected by farmers returns. Expenditures for operating expenses may remain essentially stable as cotton prices change. However, items purchased out of income above operating expenses would be more sensitive to price changes. The economic welfare of many firms, particularly suppliers of luxury items and recreation is tied very closely to farmers net returns.

The aggregate net returns by resource situation and for the area by specified cotton price-allotment level combinations are presented in Table XIX. For any of the three measures presented in the Table, it was apparent that both allotment level and cotton price had a marked effect on returns. With a 115 percent allotment level, each successive reduction in cotton price reduced area returns to land, operator labor, and management by about 16 percent. For the 100 percent, 85 percent, and 55 percent allotment levels, the reductions were approximately 14 percent, 12 percent, and nine percent, respectively, for each successive increment of cotton price reduction. At lower allotment levels, less net returns were realized from cotton and net returns were reduced proportionately less percentagewise as cotton prices were decreased.

Optimum Area Program

The computation of the combination of cotton price and allotment that would maximize profits on the clay soil representative farm given a predetermined national government outlay were illustrated in Chapter III. However, with a commodity like cotton that is produced in a number of regions, it would not be feasible to assume that a commodity program

TABLE XIX

AGGREGATE NET RETURNS BY RESOURCE SITUATIONS AND AREA, SPECIFIED COTTON PRICE AND ALLOTMENT LEVEL COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Resource Situations			
	Clay Soil	Sandy Soil	Level Loam Soil	Rolling Loam Soil
	- Thousands -			
100% - $30.80[a]				
Programmed Returns	11,869	14,641	9,743	9,664
Land, Operator Labor, and Management Returns[b]	9,877	12,698	8,682	7,731
Operator Labor and Management Returns[c]	4,401	6,498	3,341	2,642
100% - $26.40				
Programmed Returns	11,127	12,057	8,909	8,669
Land, Operator Labor, and Management Returns	9,134	10,114	7,848	6,736
Operator Labor and Management Returns	3,659	3,914	2,506	1,648
100% - $22.00				
Programmed Returns	10,384	9,497	8,099	7,771
Land, Operator Labor, and Management Returns	8,392	7,554	7,038	5,838
Operator Labor and Management Returns	2,916	1,354	1,697	750
100% - $17.60				
Programmed Returns	10,282	7,016	7,419	7,162
Land, Operator Labor, and Management Returns	8,289	5,073	6,358	5,229
Operator Labor and Management Returns	2,814	-1,127	1,016	141
85% - $30.80				
Programmed Returns	11,631	13,559	9,441	9,371
Land, Operator Labor, and Management Returns	9,639	11,615	8,380	7,438
Operator Labor and Management Returns	4,163	5,415	3,038	2,349
85% - $26.40				
Programmed Returns	11,000	11,313	8,731	8,494
Land, Operator Labor, and Management Returns	9,007	9,369	7,670	6,561
Operator Labor and Management Returns	3,531	3,169	2,329	1,473

TABLE XIX (Continued)

Item	Resource Situations: Clay Soil	Sandy Soil	Level Loam Soil	Rolling Loam Soil
	- Thousands -			
85% - $22.00				
Programmed Returns	10,369	9,091	8,038	7,668
Land, Operator Labor, and Management Returns	8,377	7,147	6,977	5,735
Operator Labor and Management Returns	2,901	947	1,636	647
55% - $30.80				
Programmed Returns	11,155	11,181	8,794	8,504
Land, Operator Labor, and Management Returns	9,162	9,237	7,733	6,571
Operator Labor and Management Returns	3,686	3,037	2,391	1,482
55% - $26.40				
Programmed Returns	10,746	9,718	8,334	7,918
Land, Operator Labor, and Management Returns	8,754	7,774	7,273	5,986
Operator Labor and Management Returns	3,278	1,574	1,932	896
115% - $26.40				
Programmed Returns	11,254	12,802	9,085	8,831
Land, Operator Labor, and Management Returns	9,262	10,858	8,024	6,898
Operator Labor and Management Returns	3,786	4,658	2,671	1,809
115% - $22.00				
Programmed Returns	10,400	9,903	8,158	7,863
Land, Operator Labor, and Management Returns	8,408	7,959	7,097	5,930
Operator Labor and Management Returns	2,932	1,759	1,754	841
115% - $17.60				
Programmed Returns	10,282	7,085	7,419	7,225
Land, Operator Labor, and Management Returns	8,289	5,142	6,358	5,292
Operator Labor and Management Returns	2,814	-1,058	1,016	203

[a]Allotment level as a percent of base and cotton lint price.

[b]After deduction of unallocated overhead costs.

[c]Land returns imputed at 5 percent of base land values.

could be tailored to individual soil situations. It might well be reasonable to expect that if data for the major cotton production areas were available, optimum price allotment combinations could be determined for these major areas. These optimum combinations could then be utilized as a guide to formulating national commodity programs.

A cotton allotment-price combination that maximizes returns to operator labor and management for the area under consideration was computed. It would not necessarily be expected that such a combination would maximize returns for each and every soil situation and/or assumed representative farm situation within the soil situation.

The aggregate area returns function was estimated by least squares regression from the aggregate operator labor and management returns data of Table XIX to be:

$$(4.1)\quad Y = 10{,}287.286 - 189.1818X_1 - 430.31957X_2 + 9.43723X_2^2 + 10.34763X_1X_2$$

$$R^2 = .997$$

Where Y = aggregate returns to operator labor and management

X_1 = allotment level as percent of base

X_2 = cotton price in dollars per hundredweight

Coefficients on X_1 and X_1X_2 were significant at the 99 percent level.

The government outlay restraint equation based on the domestic and foreign cotton demand relationship is (4.2) from Chapter III.

$$(4.2)\quad G = -2991.5 + 11.09X_1 + 84.997X_2$$

Where G = level of government outlay

Assuming, for illustrative purposes, that government outlay was set at $400 million, the function formed was:

$$(4.3)\quad \pi = 10{,}287.286 - 189.1818X_1 - 430.31957X_2 + 9.43723X_2^2 + 10.34763X_1X_2 + \lambda\,(400 + 2991.5 - 11.090002X_1 - 84.996622X_2)$$

where $\lambda \neq 0$ is an undetermined Lagrarian multiplier, π is maximum profit and X_1, X_2 as before.

Take the partial derivatives of π with respect to X_1, X_2, and λ and set them equal to zero:

(4.4) $\frac{\partial \pi}{\partial X_1} = -189.1818 + 10.34763X_2 - 11.090002\lambda = 0$

(4.5) $\frac{\partial \pi}{\partial X_2} = -430.31957 + 18.87446X_2 + 10.34763X_1 - 84.996622\lambda = 0$

(4.6) $\frac{\partial \pi}{\partial \lambda} = 3391.5 - 11.090002X_1 - 84.996622X_2 = 0$

Solve (4.4) and (4.5) for λ, equate and solve for X_2 in terms of X_1:

(4.7) $X_2 = .171226X_1 + 16.87204$

Substitute this value of X_2 into (4.6), the numerical value of X_1 is 82.3. Substituting this value of X_1 into (4.7), the numerical value of X_2 is 30.96. Thus the profit maximizing combination of cotton price and allotment level for the Southwestern area with a $400 million national government outlay is 82.3 percent of base allotment with a $30.96 cotton price.

Summary of Area Aggregates

The purpose of this chapter was, (a) to determine aggregate output of various commodities under different government cotton program combinations, (b) to determine the output response to allotment changes, and (c) to illustrate mathematically the computation of an optimum cotton price-allotment combination for the area given a predetermined national government outlay for the cotton program.

For the aggregate individual soil resource situations the cotton supply function at each allotment level were of a step form reflecting the constant ranges of linearity for cotton prices in the programming solutions. The aggregate supply function for the area at each allotment level indicated a high elasticity of supply at low cotton prices and a low supply elasticity at high cotton prices.

A measure of cotton output to allotment (the E_{OA}) was computed for each individual soil situation and for the area. For many of the price-allotment combinations the E_{OA}'s were 1.00, indicating a one to one relationship between change in output and allotments of cotton. For the area as a whole, the E_{OA} ranged from .838 to .979. Since allotments under the cotton program have been decreased over the period 1961 to 1964, the E_{OA} was computed for this period and found to be 0.91, about the midpoint of the range computed in this study. The most logical comparison of the actual E_{OA} for the period 1961-64, when allotments were reduced by nearly 13 percent would be to the change from a 100 percent to 85 percent allotment level at a price of $26.40 per cwt. With this combination the computed E_{OA} was 0.88 and very similar to the actual E_{OA}.

The combination of cotton price and allotment that would maximize net returns to the area under the assumption that the representative farms were organized efficiently was computed. This combination was a cotton price of $30.96 per hundredweight and a cotton allotment 82.3 percent of the base with a $400 million government outlay.

CHAPTER V

PROGRAMMED MINIMUM REQUIREMENTS

The agricultural industry is highly competitive in nature. New technology is developed and accepted quickly by many farmers. Product price and costs fluctuate within and between years. Government agricultural policies change over time. All these factors imply perpetual adjustments in the individual farm in both the quantity and the combination of resources necessary to obtain a satisfactory income level. To the layman farmer it simply boils down to two interrelated questions, namely, "How big[1] must I be" and "How do I combine these resources" to obtain a satisfactory income level.

The minimization model is designed to minimize the quantity of land required to realize a specified return to operator labor and management. It simultaneously determines the optimum combination of resources on this minimum land area. The results of applying this model indicates the extent of adjustment needed in an area for individual farms to realize the predetermined "satisfactory" income level. From these

[1]Size of a farm in the minds of many people is associated too often with land area alone. This is a fallacy. Size to be meaningful must be measured in terms of all resources employed on the unit. Admittedly, there is some justification for the association of land area with size since land quantity in a given area is more nearly fixed than any other resource used in production.

results it is possible to determine the minimum number of farms all realizing this target income in a given land area.

What level of return can be considered satisfactory? The decision is largely subjective. The target return used in this study was $5,000. This level of return does not necessarily represent the "opportunity cost" of the operator's labor and management skills or a "fair" or "parity" return to the farm operator.

Programmed Combinations

For each of the four soil resource situations, linear programming computations were made to determine the minimum land requirements, other resource requirements, and the optimum combination of enterprises for the specified level of return. Separate estimates were made for combinations of cotton price levels, cotton allotment levels, land prices, labor prices, farm type, and equity in land. These combinations allow comparisons, ceteris paribus, of minimum land requirements under specified (a) allotment-price combinations, (b) labor-price combinations, (c) farm type and land price comparisons, and (d) land equity comparisons. The 22 programmed combinations for each soil resource situation are delineated in Table XX.

The detailed results, i.e., land and other resource requirements, optimum enterprise combinations, and selected product output, of these programmed combinations are presented in Appendix C. In this chapter, the total land requirements and nonland capital requirements are presented and discussed. The discussion is carried out for each resource situation in terms of comparisons of land and capital needs to meet the $5,000 income target.

TABLE XX

PROGRAMMED COMBINATIONS UNDER THE MINIMIZATION MODEL FOR EACH RESOURCE SITUATION, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Program Specification	Cotton Allotment Price Combinations											
	P_1B	P_1A	P_2C	P_2B	P_2A	P_3D	P_2C	P_3B	P_3A	P_4D	P_4C	P_4B
A. Allotment-Price and Labor Price Comparisons:												
a. Includes all crop and livestock alternatives												
b. No equity in land												
c. Land price:												
Base price less 50 percent								+				
Base price plus 50 percent								+				
Base price plus 100 percent								+				
Base price												
Base price	+	+	+	+	+	+	+	+	+	+	+	+
Base plus 50 percent								+				
Base plus 100 percent								+				
B. Farm Type-Land Price Comparisons:												
a. Excludes feeder enterprises												
b. Base labor price												
c. No equity in land												
d. Land price:												
Base price less 50 percent								+				
Base price								+				
Base price plus 50 percent								+				
Base price plus 100 percent								+				
C. Land Equity Comparisons:												
a. Includes all alternatives												
b. Base land price												
c. Base labor price												
d. 100 percent land equity								+				

In the first set of comparisons in the minimization model, cotton price and allotment levels were varied in each soil situation. All crop alternatives and livestock alternatives for which supplementary feeds only were purchased were considered. Skilled hired labor prices were held at $1.00 per hour and land values were held at base levels[2] with no equity in land assumed.

Secondly, land price levels were varied. All crop alternatives and livestock alternatives for which supplementary feed only were purchased were allowed to enter the programs. Cotton allotments were held at base levels with a cotton price of $26.40 per hundredweight. Labor price was set at $1.00 per hour.

Labor prices were varied in the third set of comparisons. All crop alternatives and livestock alternatives for which only supplementary feeds were purchased were allowed. Cotton allotments were held at the base level with a cotton price of $26.40 per hundredweight. It was further assumed that the operator had no equity in land and land prices were at base levels.

In the final set of comparisons, land prices were allowed to vary. Labor was held at base levels. Cotton allotments were at base levels and cotton prices set at $26.40 per hundredweight. Zero equity in land was assumed and, in this case, feeder cattle enterprises were excluded as allowable alternatives.

One programmed combination assumed a 100 percent equity in land. The results of this were included in the second set of comparisons and

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[2]Base land prices for Clay, Sandy, Level Loam, and Rolling Loam Soils, respectively, are assumed to be $105, $160, $240, and $170 per acre.

designated as base land price less 100 percent, that is, no charge was made for interest on land investment.

The above programmed combinations indicate some of the farm size adjustments that are necessary to maintain the assumed income target if government cotton programs change, if labor or land prices should change, or if the operator should decide to exclude[3] feeders as an alternative enterprise.

Allotment Price Comparisons

Clay Soils

The lowest land and nonland capital requirement to meet the $5,000 target return on clay soils were 1,293 acres and $60,954 (Table XXI). These occurred with the P_4B or $26.40 price and 100 percent allotment level combination. The highest minimum land and capital requirement occurred when the price of cotton was $17.50 per hundredweight (P_1) and allotments were 115 percent and 100 percent of base (A and B) respectively. At this low cotton price, the cotton enterprise did not enter the optimum program so it was immaterial whether the allotment level was low or high.

The minimum farm sizes obtained by the minimization model in the clay soil situation to attain the $5,000 target return implies a tremendous adjustment problem for the area. In the last census, there were a total of 15,061 farms in the Southwest 11-county area with 852 of these

[3]Such an exclusion could take place because of personal dislikes, risk level whether real or imagined, and so forth.

TABLE XXI

ESTIMATED MINIMUM LAND AND NONLAND CAPITAL REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, BASE LAND AND LABOR PRICES, INCLUDING ALL CROP AND LIVESTOCK ALTERNATIVES; SPECIFIED COTTON PRICE-ALLOTMENT COMBINATIONS, BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Price Allotment Combinations	Requirement	Unit	Resource Situations: Clay Soils	Sandy Soils	Level Loam Soils	Rolling Loam Soils
P_1A						
	Land	Acre	3,213	N.S.[a]	37,338	N.S.
	Total Cap.	Dol.	159,540	N.S.	1,326,590	N.S.
P_2A						
	Land	Acre	2,971	N.S.	1,744	N.S.
	Total Cap.	Dol.	141,280	N.S.	64,599	N.S.
P_3A						
	Land	Acre	1,660	858	840	3,183
	Total Cap.	Dol.	78,265	37,953	29,813	98,090
P_1B						
	Land	Acre	3,213	N.S.	37,338	N.S.
	Total Cap.	Dol.	159,540	N.S.	1,326,590	N.S.
P_2B						
	Land	Acre	2,953	N.S.	1,884	N.S.
	Total Cap.	Dol.	141,392	N.S.	69,148	N.S.
P_3B						
	Land	Acre	1,763	1,162	918	4,384
	Total Cap.	Dol.	83,678	51,085	32,522	135,190
P_4B						
	Land	Acre	1,293	565	651	1,324
	Total Cap.	Dol.	60,954	24,393	22,567	39,808
P_2C						
	Land	Acre	3,030	N.S.	2,048	N.S.
	Total Cap.	Dol.	145,768	N.S.	74,490	N.S.
P_3C						
	Land	Acre	1,885	1,800	1,022	7,039
	Total Cap.	Dol.	90,065	78,666	36,144	217,229

TABLE XX (Continued)

Price Allotment Combinations	Requirement	Unit	Resource Situations: Clay Soils	Sandy Soils	Level Loam Soils	Rolling Loam Soils
P_4C						
	Land	Acre	1,414	704	722	1,624
	Total Cap.	Dol.	67,166	30,073	25,336	48,836
P_3D						
	Land	Acre	2,207	N.S.	1,428	N.S.
	Total Cap.	Dol.	106,906	N.S.	52,377	N.S.
P_4D						
	Land	Acre	1,739	1,844	986	3,717
	Total Cap.	Dol.	83,881	78,468	35,792	117,486

[a]No solution.

larger than 1,000 acres in size.[4] Of the 852 farms larger than 1,000 acres in size, 184 were larger than 2,000 acres. The comparison of present distribution with the results on the clay soil situation are not necessarily entirely valid. In this study advanced technology was assumed. Had present technology been assumed, the minimum farm sizes would have been even larger. However, clay soils make up only a portion of the total area and at least for many of the cotton price allotment combinations, the minimum farm sizes necessary to attain the $5,000 return were much smaller in the other situations than for clay soils.

If the $5,000 return is assumed to be realistic for the future, then (a) substantial adjustments in farm sizes on clay soils must take place and (b) substantial quantities of capital would have to be available to make such size adjustments and to operate large units.

Sandy Soils

No solutions were obtained on sandy soils with (a) cotton prices at $17.60 and $22.00 per hundredweight with allotment levels equal to or greater than 85 percent of base and (b) a cotton price of $26.40 and an allotment level restricted to 55 percent. This implies that there was no possible combination of resources that would return $5,000 to operator labor and management with these allotment-price combinations. Where solutions were obtained, the smallest farm size necessary for the $5,000 return was 565 acres combined with $24,393 nonland capital. This occurred with combination P_4B. With a cotton allotment of 100 percent, a decrease in the price of cotton to $26.40 per hundredweight increased

[4] U. S. Department of Commerce, Bureau of the Census, U. S. Census of Agriculture, 1959, pp. 168-73.

land requirements by 597 acres, or 106 percent. With allotments at the 85 percent level and the same cotton price decrease, land requirements increased by 1,096 acres, or 156 percent. Thus, with a more highly restricted allotment level, similar cotton price decreases required a larger percentage farm size increase. A comparison of price-allotment combinations P_3C and P_4D in the sandy soils indicated a decrease in cotton allotment from 85 to 55 percent was counterbalanced by an increase in cotton price from $26.40 to $30.80 per hundredweight with respect to minimum farm size to attain the target income. Nonland capital requirements were also nearly identical for these two combination.

Level Loam Soils

Solutions were obtained for every price-allotment combination in this soil situation. With a cotton price of $17.60 per hundredweight irrespective of allotment level, the minimum land requirement was 37,338 acres with a nonland capital requirement greater than $1.3 million. This size by present standards must be considered unrealistic. However, with cotton prices equal to or greater than $26.40 per hundredweight and with cotton allotments equal to or greater than 85 percent of base, the minimum land requirements were generally 1,000 acres or less. This is considerably larger than present average farm size.

Rolling Loam Soils

No solutions, that is, no combination of resources was possible to attain the target income with cotton price-allotment combinations P_1A, P_2A, P_1B, P_2B, P_2C, and P_3D in the rolling loam soils. Where solutions were obtained, minimum land requirements ranged from a low of 1,324 acres with a cotton price of $30.80 and a 100 percent allotment (P_4B) to a high of 7,039 acres with a \$26.40 price and 85 percent allotment (P_3C). Capital requirements varied from \$48,836 to \$217,229 for the same two combinations. The minimum resource requirements were extremely sensitive to cotton price changes within a given allotment level. With a 100 percent allotment, decreasing the price from \$30.80 to \$26.40 per hundredweight (P_4B to P_3B) increased the minimum land requirement by 3,060 acres, or 231 percent and the capital requirement by 240 percent.

Land Price Comparisons Including all Enterprises

Clay Soil Situation

Varying the price of land greatly affects the minimum land and nonland capital requirements given the cotton allotment and price (P_3B) and including all crop and livestock enterprises for which supplementary feeds only are purchased. With a land price of \$105 per acre, the base price for clay soils, minimum land requirements were 1,763 acres (Table XXII). With land price reduced by 50 percent to \$52.50 per acre, minimum land requirements were 753 acres, a 57 percent reduction. Nonland capital requirements were reduced by 58 percent when land price was reduced 50 percent.

With no charge for land (designated as base less 100 percent in Table XXII) minimum land requirements were further reduced to 520 acres. This situation would characterize an operator with full equity in land who imputed his entire residual return to operator labor and management. When the price of land was increased by 50 percent, to \$157.50 per acre, no feasible solution was obtained. At this, or higher land price levels, there was no combination of resources that would allow a net return of

TABLE XXII

ESTIMATED MINIMUM LAND AND NONLAND CAPITAL REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, 100 PERCENT COTTON ALLOTMENT, $26.40 COTTON PRICE, BASE LABOR PRICE, INCLUDING ALL CROPS AND LIVESTOCK ENTERPRISES; SPECIFIED LAND PRICE LEVELS BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Land Price Levels as Percent of Base			
Requirement	Unit	Base[a]	Base Less 50 Percent	Base Less 100 Percent	Base Plus 50 Percent
Clay Soil Situation					
Land	Acre	1,763	753	520	N.S.[b]
Total Capital	Dol.	83,678	34,867	24,196	N.S.
Sandy Soil Situation					
Land	Acre	1,162	516	377	N.S.
Total Capital	Dol.	51,085	22,240	16,343	N.S.
Level Loam Soil Situation					
Land	Acre	918	420	284	N.S.
Total Capital	Dol.	32,522	14,579	9,795	N.S.
Rolling Loam Soil Situation					
Land	Acre	4,384	680	440	N.S.
Total Capital	Dol.	135,190	20,004	12,890	N.S.

[a]Base land prices for Clay, Sandy, Level Loam, and Rolling Loam Soils, respectively, are assumed to be $105, $160, $240, and $170 per acre.

[b]No solution.

$5,000 on clay soils under the given assumptions of factor prices, product prices, institutional, and technological restraints.

Sandy Soil Situation

A similar situation existed for the sandy soil situation. Minimum land requirements were 1,162 acres at an assumed base land price of $160 per acre. Nonland capital requirements were $51,085 (Table XXII). A reduction of 50 percent in the price of land reduced land and nonland requirements by some 56 percent. With no charge made for land, land and nonland capital requirements were further reduced by approximately 12 percent. With land priced at greater than 50 percent of base, no solution was obtained.

Level Loam Soil Situation

At a base land price of $240 per acre, minimum land requirements to attain the target return on level loam soils were 918 acres (Table XXI). Reducing the land price to $120 per acre reduced land requirements by 498 acres to 420 acres, or 54 percent. A similar reduction occurred in nonland capital requirements. With no charge for land, minimum requirements were reduced to 284 acres and $9,795 nonland capital, a reduction of approximately 15 percent. No solution was obtained when land price was increased by 50 percent or more over the base price.

Rolling Loam Soil Situation

With a base land price of $170 per acre, minimum land requirements for the rolling loam soil situation were 4,384 acres (Table XXII). However, reducing the price of land by 50 percent reduced the land requirement by 84 percent with a similar reduction in nonland capital needs.

This represented a greater reduction in minimum requirements than in any other soil situation and suggests that the assumed price of rolling loam soils is relatively higher with respect to its productivity than the other three soil classifications.

With no charge levied against land, the minimum requirements were reduced to 440 acres. Again, no solution was obtained with land price 50 percent greater than the base price.

Land Price Comparisons Excluding Feeder Enterprises

Clay Soil Situation

With feeder cattle enterprises excluded, no solutions were obtained in the clay soil situation when land price was at, or greater than, the base level (Table XXIII). With a 50 percent reduction in land price, the minimum land required to attain the returns target was 1,927 acres. This is 164 acres more than the land requirement at base prices when all enterprises were included.

Sandy Soil Situation

At the base price of land, the minimum land requirement to meet the target return was 3,504 acres. This represents an increase of 2,342 acres, or slightly over 200 percent, over the comparable situation on sandy soils with feeder enterprises included. With land prices reduced by 50 percent, minimum land needs were reduced by 2,828 acres to 676 acres, or 80 percent, with a comparable reduction in nonland capital requirements. No solution was obtained with the price of land equal to or greater than 50 percent over base.

TABLE XXIII

ESTIMATED MINIMUM LAND AND NONLAND CAPITAL REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, 100 PERCENT COTTON ALLOTMENT, $26.40 COTTON PRICE, BASE LABOR PRICE, EXCLUDING LIVESTOCK FEEDER ENTERPRISES; SPECIFIED LAND PRICE LEVELS, BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Land Price Levels as Percent of Base		
Requirement	Unit	Base[a]	Base Less 50 Percent	Base Plus 50 Percent
Clay Soil Situation				
Land	Acre	N.S.[b]	1,927	N.S.
Total Capital	Dol.	N.S.	27,741	N.S.
Sandy Soil Situation				
Land	Acre	3,504	676	N.S.
Total Capital	Dol.	104,001	19,140	N.S.
Level Loam Soil Situation				
Land	Acre	1,488	480	N.S.
Total Capital	Dol.	33,922	10,463	N.S.
Rolling Loam Soil Situation				
Land	Acre	N.S.	882	N.S.
Total Capital	Dol.	N.S.	16,695	N.S.

[a]Base land prices for Clay, Sandy, Level Loam, and Rolling Loam Soils, respectively, are assumed to be $105, $160, $240, and $170 per acre.

[b]No solution.

Level Loam Soil Situation

The minimum land requirement at the base land price to attain the target return was 1,488 acres on level loam soils (Table XXIII) when feeder cattle enterprises were excluded as alternative enterprises. This was 570 acres, or 62 percent, greater than the comparable situation with all enterprises included. Reducing the price of land by 50 percent, reduced the land requirement to 480 acres, an approximate reduction of 68 percent. No solution was obtained with land price 50 percent or more above the base price of $240 per acre.

Rolling Loam Soil Situation

No solution was obtained in this soil situation when the price of land was set at, or greater than, the base price of $170 per acre (Table XXIII). With the price of land reduced by 50 percent, the minimum amount of land required to meet the target return was 882 acres. This was 202 acres, or 30 percent, more than the comparable situation on rolling loam soils when all enterprises were allowed to enter the program.

Labor Price Comparisons

Clay Soil Situation

With a labor price of $1.00 per hour, the minimum land requirement to attain the target return on clay soils was 1,763 acres with a nonland capital requirement of $83,678 (Table XXIV). Increasing the price of labor to $1.50 per hour increased land requirements to 4,532 acres, or an increase of 157 percent with a comparable increase in nonland capital needs. No solution was obtained when the price of labor was increased to $2.00 per hour.

TABLE XXIV

ESTIMATED MINIMUM LAND AND NONLAND CAPITAL REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, 100 PERCENT COTTON ALLOTMENT, $26.40 COTTON PRICE, BASE LAND PRICE, INCLUDING ALL CROP AND LIVESTOCK ENTERPRISE ALTERNATIVES; SPECIFIED HIRED LABOR PRICES BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Requirement	Unit	Skilled Hired Labor Prices Per Hour		
		$1.00[a]	$1.50	$2.00
Clay Soil Situation				
Land	Acre	1,763	4,532	N.S.[b]
Total Capital	Dol.	83,678	144,222	N.S.
Sandy Soil Situation				
Land	Acre	1,162	1,512	4,267
Total Capital	Dol.	51,085	58,407	163,153
Level Loam Soil Situation				
Land	Acre	918	1,039	1,315
Total Capital	Dol.	32,522	37,381	47,256
Rolling Loam Soil Situation				
Land	Acre	4,384	N.S.	N.S.
Total Capital	Dol.	135,190	N.S.	N.S.

[a]Base price.

[b]No solution.

Sandy Soil Situation

With a labor price of $1.00 per hour, minimum land requirements were 1,162 acres (Table XXIV). Increasing the price of labor to $1.50 per hour increased land requirements by 350 acres, or 30 percent. This was a much smaller increase than was found in the clay soil situation. Increasing the price of labor to $2.00 per hour increased land requirements to 4,267 acres, an increase of 268 percent.

Level Loam Soil Situation

Minimum land requirements on the soil situation with labor priced at $1.00 per hour were 918 acres (Table XXIV). Increasing the price of labor to $1.50 and to $2.00 per hour, increased the land requirements by 121 acres and 397 acres, or 13 percent and 43 percent, respectively.

Rolling Loam Soil Situation

No solutions were obtained in this situation when labor price was increased from $1.00 per hour to $1.50 and $2.00 per hour. With the base price of labor, minimum land and nonland capital requirements to meet the target income were 4,384 acres and $135,190.

Summary of Minimization Model Results

The purpose of this chapter was to determine the minimum land requirements to realize a $5,000 target income under various assumptions of cotton allotment levels, cotton prices, land prices, labor prices, and land equity levels. The results indicate the extent of adjustment that would be necessary under these assumptions for farmers within the soil resource situations.

The results indicate a tremendous adjustment problem. In several of the resource situations, solutions were not obtained. This was particularly true, when cotton prices or allotment levels were low, or land or labor prices were set at higher levels than the assumed base prices.

The lack of a solution indicated that there was no combination of resources available under the specified set of assumptions that would return $5,000 to the operator's labor and management.

In several other cases and particularly in the level loam soil situation when cotton price was held at the $17.60 per hundredweight level, the minimum land requirements were extremely high. In one situation (LLP_1A and LLP_1B) land requirements to realize the target income were 37,338 acres with a total capital requirement of $1,326,590.

With combinations of the higher cotton price levels or with land prices at below base price levels, minimum land requirements were reduced to levels that would be considered more "normal". An example of this would be the 516 acre requirement in the sandy soil situation with land price at 50 percent of base (Table XXII). This could well typify a relatively small farmer who appears to be realizing a satisfactory income for himself. Had he purchased this land a decade or two ago when land prices were considerably lower than the assumed levels, he is realizing the $5,000 target return and a five percent return on his "initial" investment (the price of the land when he actually purchased it). Further, if in past years he had paid for this land he could use the return to land to cover living expenses. He is not realizing an "opportunity" return to the present value of his land capital. However, if he is an efficient manager and enjoys farming, there is no real pressure on such an individual to increase the size of his unit, or for that matter, to leave farming and seek alternative employment.

CHAPTER VI

FARM NUMBERS PROJECTIONS

The level of income for the individual, a group, or sector of an economy is the generally accepted indicator of well being with respect to other individuals, groups, or sectors. Income comparisons are frequently averages in terms of hourly wages, annual income, per capita income, and so forth. Growth in real income over time implies that the particular group under consideration is sharing in the fruits of national economic growth.

Such comparisons are fraught with pitfalls. Total income for a group may decline, though individual income within the group is increasing, if the number of people in the group is declining. Average data may obscure substantial income variations with some individuals extremely well off and others on the edge of starvation. Hourly wage comparisons can be misleading if time worked, overtime pay, or nonmonetary fringe benefits are not considered or ignored. Special skills, investment required to attain a specified income, may also be overlooked when simple income comparisons between groups are cited.

Available farm income data are subject to many of the criticisms listed above when used to compare returns in agriculture to those received by individuals in other sectors of the economy. It is generally conceded that many real farm incomes are substantially lower than incomes for comparable ability in town.[1] The farm problem for a substantial percentage of the agricultural industry is basically low per capita farm income. This in itself does not necessarily imply less than parity returns to employed resources on low income farms. Low incomes can result from too small a complement of land and capital combined with a relatively fixed quantity of operator and family labor into a producing unit. Underemployment of labor typical in such a situation spawns low annual labor returns.

Though considerable disagreement exists as to the reason(s) for low farm incomes, it is generally conceded that a combination of the main contributing factors are, (a) an inelastic demand for farm products, (b) a low income elasticity for agricultural products, (c) a high ratio of fixed to variable assets in production, (c) atomistic competition, (e) rapid development and acceptance of new technology, (f) lagged production, (g) sensitivity to the state of the economy as a whole, and (h) a value structure that propounds the attributes of farming and rural living as "the way of life."[2]

To maintain parity returns to resources invested in agriculture under such a structure, continuous and rapid adjustment with possible outmigration of resources of land, labor, and/or capital must take place. However, the quantity and quality of land for agricultural purposes in

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[1]Geoffrey S. Shepherd, Farm Policy: New Directions (Ames, 1964), p. 88. Shepherd discusses in considerable detail the problems that arise in determining the measure of farm income that is appropriate and the validity of various income measures to use in comparison with incomes in other sectors. Ibid., pp. 72-88.

[2]Hathaway, pp. 83-130.

an area remains relatively fixed and constant.[3] For example, the Census of Agriculture reports land in farms in Oklahoma for 1950, 1955, and 1960 at 36, 35.6, and 35.8 million acres, respectively.[4] The resources that must migrate out of agriculture are people and possibly capital.[5] To raise per capita or per farm operator income given a particular set of input costs, product prices, technology level, and institutional restrictions, farm size must increase. It follows that farm numbers in the area must decline.

From the standpoint of economic adjustment and area development, past adjustment patterns in farm numbers must be analyzed to project what may occur in the future under various assumptions.

The changes that have occurred in the past 20 year period in terms of farm numbers in total and by specified size group breakdowns are presented in Table XXV. Extrapolation of past trends in total and by size groups was one method used to investigate future size distributions. The Markov chain process, under various assumptions, was also used to estimate future size distribution. Finally, the results of the linear

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[3]This is not necessarily true close to rapidly expanding urban areas where housing or industrial development may remove relatively large areas from agricultural production when received from a local standpoint. In aggregate, however, such land use shifts are extremely small percentagewise.

[4]U. S. Department of Commerce, Bureau of the Census, U. S. Census of Agriculture: 1959, Vol. I, Part XXXVI, p. 3.

[5]This is not to imply that agricultural land cannot be removed from production. Low product prices for an extended period of time would likely result in abandonment of part or whole farms. Government land retirement programs remove land from production but do not necessarily reduce census tabulation of land in farms. Land purchase programs, with or without conversion to uses such as recreation, forestry, and so on, would decrease land in production and decrease land in farms.

programming minimization model were used to determine the number of efficiently[6] organized farms realizing a $5,000 return to operator labor and management that this area could support under the various cotton price, cotton allotment, land price, labor price, and equity relationships delineated in Table XX, Chapter V.

TABLE XXV

FARM NUMBERS IN SOUTHWESTERN OKLAHOMA, 1945-1960

Year	Acres				Total
	0-219	220-499	500-999	Over 1,000	
1945	16,302	7,012	1,395	416	25,125
1950	12,910	6,898	1,582	501	21,891
1955	9,332	6,513	1,989	617	18,451
1960	6,637[a]	5,469	2,461	852	15,419

[a]Adjusted upward to allow for change in definition of a farm in the 1959 census. The adjustment is made in the small size classification under the assumption that the decrease in number of farms due to the definitional change occurred entirely in the small farm size group.

Source: Data from U. S. Census of Agriculture.

Past Changes in Farm Numbers

The total number of farms in the 11-county study area has declined rapidly in the 20-year period from 1945 to 1960. This was not the case in all size groups. The Census of Agriculture gives 11 farm size break-

[6]Efficiency implies a goal of profit maximization through optimum enterprise organization. Further, it implies parity returns to land and other capital investment. The $5,000 return to operator labor and management is therefore assumed to reflect "parity" returns to this resource.

downs. For the purpose of this analysis the smaller size group classifications have been combined and the classifications designated as follows:

Classification or State	Farm Size (acres)
S_1	0-219
S_2	220-499
S_3	500-999
S_4	1,000 and over

The two smaller size groups, state S_1 and S_2, have declined rapidly whereas the two larger groups, S_3 and S_4 have increased in numbers.

The decrease in all farms in the Southwestern Area of Oklahoma was 12.88 percent, 15.72 percent, and 16.44 percent, respectively, for each of the five year periods beginning with 1945. For the 15-year period total farms decreased by 39 percent. Over the entire period, the small farms (S_1) declined 60 percent; farms consisting of those between 220 and 499 acres (S_2) declined 22 percent. The 500 to 999 acre farms (S_3) and farms of 1,000 acres or over (S_4) increased 76 and 105 percent, respectively, in the same time period.

Extrapolation of Past Trends

Regression Analysis

Regression equations were fitted to the farm size and time data of Table XXV. The dependent variable (Y_i) was farm numbers in the respective size state and the independent variable (X_i) was time in terms of the last two digits of the period. Preliminary graphic analysis indicated a possible curvilinear relationship between farm numbers and time in states S_4 (1,000 acres and over), S_3 (500-599 acres), and S_2 (220-499 acres). In these three states both a linear and a quadratic least squares fit was calculated. These estimates of farm numbers in total and by size groups are presented in Table XXVI.

For each fitted equation, farm numbers projections for 1965, 1970, and 1975 are presented in Table XXVII.

A projection of farm numbers, either in total or by size groups from the estimated regression equations can lead to absurd conclusions. Equation (6.1) relating total farm numbers in the area to time, predicted zero farms by the year 1984. For time periods after 1984, equation (6.10) predicted negative farm numbers. Such an occurence is impossible. The negative number problem could be overcome with the use of log or reciprocal transformations of the data. The data, however, does not give any basis for anything other than a linear extrapolation since the R^2 of the simple regression on total farm numbers approached one.

It is very probable that farm numbers in total will continue to decline. It seems intuitively plausible to assume that at some point this decrease will be at a decreasing rate. The data on farm numbers in total for the four time periods considered in this analysis gives no indications of when this might occur.

Similarly, zero farms were projected in state S_2 by the year 2017 with the linear formulation of equation (6.6), and by the year 1974 with the quadratic formulation of equation (6.7). In state S_2, the quadratic form of equation (6.7), decreased at an increasing rate, that is, the first and second derivatives of farm numbers with respect to time are negative.

For states S_3 and S_4, farm numbers increased more rapidly with the

TABLE XXVI

LEAST SQUARES ESTIMATES OF FARM NUMBERS IN TOTAL AND BY SIZE STATES FROM 1945-1960 QUINQUENNIAL CENSUS DATA; ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Equation	Size State	R^2	Constant	X_1	X_1^2
(6.1)	Total	.999	54407.4	-651.16	
(6.2)	S_4	.944	-898.7	28.48	
(6.3)	S_4	.996	3188.8	-129.02	1.5
(6.4)	S_3	.968	-1928.5	72.1	
(6.5)	S_3	.998	5837.75	-227.15	2.85
(6.6)	S_2	.849	11737.7	-100.28	
(6.7)	S_2	.995	-13604.8	876.22	-9.3
(6.8)	S_1	.997	45496.9	-651.46	

TABLE XXVII

PROJECTION OF FARM NUMBERS FOR 1965, 1970, AND 1975 FROM ESTIMATED REGRESSION EQUATIONS; ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Equation Number	Equation Type	Size State	Year		
			1965	1970	1975
(6.1)	Linear	Total	12,082	8,826	5,570
(6.2)	Linear	S_4	952	1,095	1,237
(6.3)	Quadratic	S_4	1,140	1,507	1,950
(6.4)	Linear	S_3	2,758	3,118	3,479
(6.5)	Quadratic	S_3	3,114	3,902	4,832
(6.6)	Linear	S_2	5,219	4,718	4,217
(6.7)	Quadratic	S_2	4,057	2,161	-201[a]
(6.8)	Linear	S_1	3,152	-105[a]	-3,363[a]

[a]We recognize that it is impossible to have a negative number of farms in a size group. The figures were included only to illustrate what may occur if past adjustment patterns were used to predict farm numbers in this manner though the R^2 was extremely high.

quadratic formulations as compared to the linear formulations of the respective regression equations. Both of the quadratic equations for S_3 and S_4 increase at an increasing rate, that is, the first and second derivative of farm numbers with respect to time were both positive in the relevant range.

For states S_2, S_3, and S_4 the quadratic form in each case had the highest R^2. However, when the quadratic formulation of the equations in either one or more of these states was used to project future farm numbers by individual farm sizes, the projected numbers did not total to the projected farm numbers with equation (6.1), the total farm regression equation. For example, in Table XXVI the projected total farm numbers for 1965 of 12,082 is not equal to the sum of the projections for that year of equations (6.3), (6.5), (6.7), and (6.8), though it does equal the summation of the projections of the linear equations in each state.

A simple extrapolation of past trends did not appear to be a feasible method for projecting future farm numbers in total, or by size groups, with any confidence. A more reasonable hypothesis would be that farm numbers in the small size groups will continue to decline in the future but at a diminishing rate. More than likely, a point in time will be reached where a hard core of small farms consisting of semi-retired farmers and part-time farmers will remain. The larger size groups will likely continue to increase but at a decreasing rate. Accordingly, farms in total will continue to decline, possibly quite rapidly for several more census periods. The rate of decline would likely be drastically reduced in the not too distant future. The Markov chain process appeared to be a more feasible approach to the problem of projecting farm numbers.

Markov Chain Distributions

Another approach to describing the possible pattern of future farm size distributions centers around the Markov chain process. As indicated in Chapter II, this process assumes that a population can be classified into various groups or states. Further, it assumes that movements between states over time can be regarded as a stochastic process. The states must be defined in such a way that the process can only be in one state at any point in time, i.e., a farm is in a particular given size state in a given year. A transition occurs when the process changes or shifts from one state to another.

The critical step in the Markov chain process in the construction of the transition probability matrix designated as $[P]$ The elements of this matrix indicate the probability of each firm moving from size i to j in a particular time period. Thus, p_{ij} in $[P]$ is the probability that a firm in state i will move to state j in the next time period. Given a known starting state, the probability that a firm will be in any other state can be determined for the next period or any future period. This assumes that the transition probabilities are known and do not change over time. To determine the size distribution of firms in time period n from a known starting distribution, the transition matrix is multiplied by itself n times yielding a new matrix $[P^n]$ which is then multiplied by the initial known distribution. In addition to estimates of the size distribution of firms in any time period, this method can be used to estimate equilibrium distribution of farms. An equilibrium occurs when sufficient time has passed to make each row in the matrix identical. Equilibrium does not imply lack of further movement between states. The distribution remains constant, that is, the number of firms entering a particular state equals the number of firms leaving.

Ideally, to accurately estimate the transition matrix, data recording the actual size transitions of a large number of firms over a period of time would be required. Data on individual movements were not readily available for the study area. Therefore, base data on farm numbers for the area was obtained from the U. S. Census of Agriculture for 1945, 1950, 1955, and 1960 (Table XXV). Size classifications, the S_i, are as delineated earlier in the chapter.

Two different approaches were used to determine the transition probability matrix. The first approach used past census data. Specific assumptions were made with respect to farm movements over time. The transition probability matrix calculated by this method was denoted as $[P_c]$. The second approach used the latest available census data as a starting point with the transition matrix determined from a personal opinion survey of future change in farm numbers as expressed by real estate agents, county extension agents, farm home administration supervisors, bank agricultural loan officers, and others in each of the 11 counties. The transition probability matrix calculated by this method was denoted as $[P_s]$.

The $[P_c]$ Matrix and Its Interpretation

The basic hypothesis that underlies the computation of the transition probability $[P_c]$ from the farm size distribution of the past four census periods is that firms either move up a size state, that is, increase in size or go out of business.

The transition matrix for this method was determined by the following procedure. A transitional table was computed for each five year interval using the above hypothesis on farm movements. The transitional table shows the hypothesized movements of farms from state to state between each time period. Table XXVIII illustrates the estimated movements for the period 1945 to 1950.

TABLE XXVIII

TRANSITIONAL TABLE OF FARM MOVEMENTS IN SOUTHWESTERN OKLAHOMA FROM 1945 TO 1950

Size State in 1945	Size State in 1950					Total
	S_0	S_1	S_2	S_3	S_4	
S_0	0	0	0	0	0	0
S_1	3,234	12,910	158	0	0	16,302
S_2	0	0	6,740	272	0	7,012
S_3	0	0	0	1,310	85	1,395
S_4	0	0	0	0	416	416
Total	3,234	12,910	6,898	1,582	501	25,125

Initially, only the total size distributions for 1945 (the column totals) and for 1950 (the row totals) were known. The S_0 column total shows the decrease in farms in the five year period. These were the first figures entered into the transitional Table XXVIII. To obtain a total of 501 farms in state S_4 in 1950, the 416 farms that were in this state in 1945 were entered into S_{55} (row 5, column 5) in the transitional table. It was assumed that 85 farms (501 minus 416) from S_3 in 1945 moved into S_4 in 1950. The number 85 was entered into S_{45} of the table.

The 1,310 remaining S_3 farms of 1945 were entered in S_{44} under the assumption that they had stayed in this state in the five year period.

To make up the necessary 1,582 farms in S_3 in 1950, 272 (1,582 minus 1,310) S_2 farms were assumed to have moved into S_3 during the period. This number was entered into S_{34}. This left 6,740 farms in S_2 (7,012 minus 272). To obtain the required 6,898 farms for state S_2 in 1950, 158 farms from S_1 were moved into S_2 and entered into S_{23}. Of the 16,144 remaining farms (16,302 minus 158), only 12,910 were required for state S_1 in 1950. The difference of 3,234 farms (16,144 minus 12,910) were assumed to have gone out of business in the five year interval from 1945 to 1950. This figure was entered in S_{21} of the table. To complete Table XXVIII, zeros were entered into all the cells. The non-zero components in the matrix table were then divided by the row totals and entered into another matrix. This becomes the transition probability matrix for the first five year interval.

The same procedure was repeated for each of the two remaining five year intervals. First, a transition table was computed under the "up or out" hypothesis and a probability matrix computed from the table. To determine the probability matrix P_c for the entire period, the probabilities in corresponding cells for each time interval were totalled and averaged.[7] The P_c matrix is shown in equation (6.9).

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[7]Another method to compute the P_c matrix involves totalling the separate transition tables and dividing the items in the table of totals by the row totals. See Ronald D. Krenz "Projection of Farm Numbers for North Dakota with Markov Chains," <u>Agricultural Economics Research</u>, Vol. XVI, No. 3, ERS, USDA, 1964, pp. 77-83. This method with our data gave less accurate "predictions" when compared to the known farm size distributions for 1950, 1955, and particularly for 1960. It is recognized that such "predictions" are analagous to "testing" a regression equation against the data from which it is derived, but it appears intuitively plausible to use the probability matrix from which the "predictions" agree more nearly with the known distributions.

$$P_c = \begin{array}{c} \\ S_0 \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{ccccc} S_0 & S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ .2512 & .7420 & .0068 & 0 & 0 \\ .0172 & 0 & .9084 & .0744 & 0 \\ 0 & 0 & 0 & .9159 & .0841 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \end{array} \qquad (6.9)$$

A probability of unity was placed in the p_{11} cell and zeros in the p_{1j} $(j=1,\ldots,4)$. This indicates that there can be no new entrants into the farming industry. The p_{11} entry, in computations of future farm size distributions, allows an accumulation of farms that have gone out of business since the base period, in the w_{11} cell of the n^{th} farm size distribution vector (w^n). Each p_{ij} in the $[P_c]$ matrix indicates the probability of a farm moving from state S_i to S_j in the next five year period, or if converted to percent, the percentage of farms in S_i that will be in S_j after five years. Coefficients in each row of the P_c matrix sum to one so that all farms are accounted for from time period (t) to (t + 1). An inspection of the P_c matrix gives an indication of the movement of farms expected over time. Both states S_0 and S_4 are absorbing states, that is, farms once in either of these states remain in them. The coefficients in the P_c matrix show that farms in all size states can move into larger size groups but only the two small size groups, S_1 and S_2, go out of business. About eight percent of S_3 farms moved into the larger size category in each time interval. However, less than one percent of the S_1 farms moved up into the next largest group every period. Farms of this size are not likely to expand. About 25 percent of the small size group S_1 and about 1.7 percent of group S_2 go out of business in every time period. None of the farms in states S_3 or S_4 go out of business or become smaller.

Projected Farm Numbers from P_c Matrix

The projected farm numbers for consecutive five-year time periods may be obtained by multiplying the farm size distribution vector of the base year by the P_c matrix and continue post multiplying the resultant vector of farm numbers by P_c for the desired number of periods.[8] The projection base used in this study was 1960. The estimated farm numbers for different time periods are presented in Table XXIX. This model projected a total of 11,337 farms by 1975. This represented a decrease of 26.5 percent from the 1960 base period. A total of 4,082 farms would go out of business by 1975 with the majority of these coming out of state S_1, the 0-219 acre size group. The programming minimization model results indicated that little if any labor was hired when farm size drops to 500 acres or less. Any decrease in farm numbers in the small size groups would imply a release of farm labor for re-employment in the nonfarm sector in the area, or for relocation and employment in other areas.

The Markov process allows estimating equilibrium distribution of firms. With absorbing chains, the equilibrium distribution would consist of firms in only the absorbing state or states. It was evident from an inspection of the transition probability matrix P_c that all farms in the initial size distribution vector in the base period would either go out of business or eventually be larger than 1,000 acres because S_0 and S_4

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[8]Possibly the most common method used, which yields identical results, is to multiply the P matrix by itself n times then multiply P^n by the initial or starting distribution. This gives the projected distribution for time period n.

TABLE XXIX

PROJECTED FARM NUMBERS IN TOTAL AND BY SIZE DISTRIBUTION FOR SOUTHWESTERN OKLAHOMA (PROJECTION BASE = 1960; TRANSITION BASE = 1945-60)

Size of Farm	Actual 1960	Projected Farm Numbers 1965	1970	1975
S_0 (Out of Business)		1,761	3,085	4,082
S_1 (0-219 Acres)	6,637	4,925	3,654	2,711
S_2 (220-499 Acres)	5,469	5,013	4,587	4,192
S_3 (500-999 Acres)	2,461	2,661	2,810	2,915
S_4 (1,000 Acres and Over)	825	1,059	1,283	1,519
Total S_1 to S_4	15,419	13,658	12,334	11,337

were both asborbing states. Thus the equilibrium distribution of firms in this instance was not of interest.

However, the number of surviving firms can be determined and would be of interest from a policy standpoint. The probability matrix P_c was rearranged and partitioned as in equation (6.10).

$$P_c = \begin{array}{c} \\ S_0 \\ S_4 \\ \\ S_1 \\ S_2 \\ S_3 \end{array} \begin{array}{c} \begin{array}{ccccc} S_0 & S_4 & S_1 & S_2 & S_3 \end{array} \\ \left[\begin{array}{cc|ccc} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ \hline .2512 & 0 & .7420 & .0068 & 0 \\ .0172 & 0 & 0 & .9084 & .0744 \\ 0 & .0841 & 0 & 0 & .9199 \end{array}\right] \end{array} \qquad (6.10)$$

The southeast submatrix was designated as Q and the southwest submatrix was designated as R. With I an indentify matrix, $(I - Q)^{-1}R$ as in equation (6.11) indicates the probabilities of absorption of states S_1, S_2, and S_3 by states S_0 and S_4. The probability was .9786 that S_1 farms would go out of business, and 0.214 that they would ultimately be absorbed by state S_4. It follows that out of the 6,637 farms in State S_1 in the base period, 97.86 percent would go out of business and 2.14 percent would eventually become 1,000 acres or greater in size. Similarly, 18.78 percent of S_2 farms would go out of business and 81.22 percent

$$[I - Q]^{-1} R = \begin{array}{c} S_1 \\ S_2 \\ S_3 \end{array} \begin{array}{c} \begin{array}{cc} S_0 & S_4 \end{array} \\ \left[\begin{array}{cc} .9786 & .0214 \\ .1878 & .8122 \\ 0 & 1 \end{array}\right] \end{array} \qquad (6.11)$$

would move to state S_4. All of the state S_3 farms in the base period would move into the larger size group. A total of 7,897 farms were estimated to survive using the P_c probability matrix and the 1960 farm size distribution projection base.

The P_s Matrix and Its Interpretation

The transition probability matrix $[P_s]$ was developed from a personal opinion survey of future change in farm numbers as expressed by real estate agents, county extension agents, farm home administration supervisors, bank agricultural loan officers, and others, in each of the 11 counties in the study area. Tables were prepared for each individual county showing the trend in farm numbers from census data in the particular county over the past four census periods. The individuals interviewed in each county were asked to indicate the movements they felt had occurred within each size group in the past five year period (1959-64) and the numbers of farms remaining in each group. The opinions of individuals within each county were totalled and averaged and county averages were totalled and averaged. Individual cell entries and row and column totals similar to Table XXVIII were obtained for the area as a whole. The transition probability matrix P_s was calculated by dividing each cell entry by the row total to obtain the individual p_{ij}'s (equation 6.12).

$$P_s = \begin{array}{c} \\ S_0 \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{ccccc} S_0 & S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ .2166 & .7691 & .0095 & .0048 & 0 \\ .0622 & 0 & .8537 & .0841 & 0 \\ .0175 & 0 & 0 & .9208 & .0617 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \end{array} \quad (6.12)$$

The probability matrix $[P_S]$ is quite similar to the $[P_C]$ matrix computed earlier. The difference was basically one of additional allowable movements of farms from state to state. For example, in the $[P_S]$ matrix, state S_3 farms (500-999 acres) could move to state S_0, that is, go out of business over time. Also a small percentage (less than one-half of one percent) of the S_1 farms would move to S_3 farms in each five-year time interval.

Projected Farm Numbers from $[P_S]$ Matrix

The projected total farm numbers and size distribution for 1965 was computed by multiplying the $[P_S]$ matrix by the farm size distribution in the base year of 1960. Continued post multiplication of the results of each preceding computation gave the results for 1970 and 1975. These are presented in Table XXX.

TABLE XXX

PROJECTED FARM NUMBERS IN TOTAL AND BY SIZE DISTRIBUTION FOR SOUTHWESTERN OKLAHOMA (PROJECTION BASE = 1960; TRANSITION BASE = OPINION SURVEY)

	Actual	Projected Farm Numbers		
Size of Farm	1960	1965	1970	1975
S_0 (Out of Business)		1,821	3,269	4,425
S_1 (0-219 Acres)	6,637	5,104	3,925	3,019
S_2 (220-499 Acres)	5,469	4,732	4,088	3,527
S_3 (500-999 Acres)	2,461	2,758	2,962	3,090
S_4 (1,000 Acres and Over)	852	1,004	1,174	1,357
Total (S_1 to S_4)	15,419	13,598	12,150	10,994

By 1975, 4,425 farms would go out of business. The majority of these farms were initially in size state S_1, with the remainder from size state S_2 and S_3. The state S_1 farms decreased in number by 3,618 farms, a decrease of 54.5 percent. Most of this decline was due to S_1 farms going out of business, however, some of them moved up into state S_2. State S_2 farms also decreased in numbers as 6.2 percent moved out of business and 3.4 percent moved into size state S_3 every five-year interval. S_3 farms increased by 25.5 percent though 6.2 percent moved into the S_4 group every five-year period. The S_4 group increased by 59.3 percent by 1975.

In total, farm numbers declined by 28.7 percent from the 1960 base period to 1975. This was a greater decrease than projected from the $[P_c]$ matrix computations (Table XXIX). The projection from the probability matrix $[P_s]$ developed from the opinion survey indicated a less rapid decline in S_1 farms by 1975 (3,019 versus 2,711), a more rapid decline in S_2 farms (3,527 versus 4,192), a slightly greater increase in S_3 farms (3,090 versus 2,915), and a less rapid increase in the large size group S_4 (1,357 to 1,519) than the computations using the $[P_c]$ probability matrix.

The surviving number of farms can be computed from the $[P_s]$ probability matrix and the 1960 projection base by the method employed earlier (equation 6.13).

$$[I - Q]^{-1} R = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \end{array} \begin{array}{c} \begin{array}{cc} S_0 & S_4 \end{array} \\ \begin{bmatrix} .9654 & .0346 \\ .5521 & .4478 \\ .2210 & .7790 \end{bmatrix} \end{array} \qquad (6.13)$$

The probability that state S_1 farms would go out of business is .9654 and .0346 that they would move up to the large farm category. Therefore 96.54 percent of these farms go out of business. In size state S_2, 55.21 percent of the farms go out of business and 44.78 percent moved to the largest size group and 22.1 percent of the S_3 farms go out of business with 77.90 percent moving to S_4. The number of farms that remained in business were approximately three percent of the farms in S_1, 45 percent of the farms in S_2, 78 percent of the farms in S_3, and all farms in S_4. The equilibrium distribution totalled to 5,448 farms or 2,449 farms less than the model using the $[P_c]$ probability matrix.

Minimum Land Model Farm Numbers

The programming results of the minimum land model were utilized to determine the maximum number of farms which each resource situation and the total area could support at a $5,000 income level. Area farm numbers were determined by aggregation across soil resource situations.

To determine the maximum number of farms which each resource situation would support, the resource situation's land base was divided by the minimum farm size for that situation. For this purpose, the entire land base of the resource situation was considered eligible for recombination, that is, no land was reserved for excluded alternatives as delineated in Chapter II. The determination of farm numbers by resource situation and in aggregate was carried out for all of the 22 combinations of cotton price, cotton allotment, land price, and type of farming situation that were delineated in Table XX, Chapter V. The estimated maximum farm numbers by soil resource situation and in aggregate under these assumptions are presented in Table XXXI.

TABLE XXXI

ESTIMATED MAXIMUM NUMBER OF FARMS REALIZING $5,000 RETURNS TO LABOR AND MANAGEMENT, WEIGHTED AVERAGE FARM SIZE; SPECIFIED PRICE, COST, AND INSTITUTIONAL RESTRICTIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Soil Resource Situations				Total	Weighted Average Size
	Clay	Sandy	Level Loam	Rolling Loam		
	- Number of Farms -					(Acres)
Price Allotment Comparison						
P_1A	556	a	30			
P_2A	601		642			
P_3A	1,076	1,561	1,333	346	4,316	1,239
P_1B	556		30			
P_2B	605		594			
P_3B	1,013	1,152	1,220	251	3,636	1,470
P_4B	1,382	2,370	1,720	832	6,304	848
P_2C	590					
P_3C	948	744	1,096	156	2,944	1,815
P_4C	1,264	1,902	1,551	678	5,395	994
P_3D	810					
P_4D	1,027	726	1,136	296	3,185	1,678
Land Price Comparison - I[b]						
Base	1,013	1,152	1,220	251	3,636	1,470
Base less 50 percent	2,373	2,595	2,666	1,620	9,254	577
Base less 100 percent	3,436	3,552	3,943	2,503	13,434	398
Land Price Comparison - II[c]						
Base		382	753			
Base less 50 percent	927	1,980	2,333	1,240	6,489	823
Labor Price Comparisons						
$1.00 per hour	1,013	1,152	1,220	251	3,636	1,470
$1.50 per hour	394	886	1,078			
$2.00 per hour		314	852			

[a]No solution was obtained in the programming model for this and other blanks in the table so farm numbers could not be estimated for these solutions.

[b]Includes all crop and livestock enterprises.

[c]Excludes feeder cattle enterprises.

Programming solutions were not obtained for all of the 22 specified combinations. In such cases, farm numbers were indeterminate for the particular resource situation and for the area.

If it is assumed that the adjustments implied by the minimization model should take place by 1975, an approximate comparison of the maximum number of farms from this model under any of the 22 specific combinations can be made with the projections of the other farm numbers models.

Selected Comparison of Farm Numbers by Programming Minimization and Markov Models

When cotton prices and allotments were varied in the price allotment comparisons of Table XXXI holding land and labor prices at base levels, the maximum number of farms the area could support at the postulated returns levels was 6,304. This occurred at the $30.80 cotton price and a 100 percent allotment level (P_4B). This was 4,690 farms less than the total number of farms projected by the Markov chain model with the probability matrix $[P_s]$.[9] The weighted average size of farm was 848 acres from the minimization model. Relating this size to the distribution of farms in 1975 from the Markov model implied that some 40 percent of the farms in 1975 would have returns to labor and management of $5,000 or more. This assumed that the farms in state S_3 and S_4, a total of 4,447 farms, would have attained or passed the minimum income target. It would likely be more realistic to assume that the S_3 farms were evenly distributed over the S_3 size range. Under this assumption, only 939 of the

[9]All comparisons in this section will be based on the $[P_s]$ matrix projections. Similar conclusions would occur using the $[P_c]$ matrix except for differences in total farms and distribution between size groups as noted earlier.

3,090 farms in state S_3 would be equal to or greater than 848 acres in size. It followed that under this assumption only 2,296 farms, or 20.9 percent of the total (all farms in state S_4 plus the 939 farms in S_3 greater than 848 acres) would have incomes equal to or greater than $5,000.

If by 1975, however, cotton allotments should hold at the 100 percent level but cotton prices were reduced to $26.40 per hundredweight (P_3B), the maximum number of farms the area would support at a $5,000 income level per farm would drop to 3,636 farms. With the lower cotton price, farm size necessarily would have increased to attain the assumed income target. The weighted average farm size would be 1,470 acres under situation P_3B. Again, comparing this result to the 1975 projection results with the P_s probability matrix implied that at least 9,636 farms would receive less than the income target.

When the price of land was decreased by 50 percent from the assumed base levels with cotton at the 100 percent allotment level and price at $26.40 per hundredweight, the area would support a maximum of 9,254 farms (Table XXXI) with an average size of 577 acres. With no charge levied against land, denoted as base less 100 percent in Table XXXI, the area would support a maximum of 13,434 farms. The average size of these farms was 398 acres. This number was greater than the total projected farm numbers for 1975 with the $[P_s]$ projections. However, even with this small a farm size and assuming farms in the S_2 group were distributed evenly over this size range, 5,261 farms, or 47.8 percent of the total would receive an income of less than $5,000.

Reliability of Farm Numbers Projections

The simple extrapolation of past trends in farm numbers in total and by size groups led to some absurd conclusions with respect to farm numbers in total and by size groups. Adjustments in farm numbers have been rapid in the past and the opinions of a number of well informed individuals in the study area was nearly unanimous that rapid adjustments have continued in the past five year period (1959-1964). This does not mean that farm numbers in total would drop to zero by 1984 as indicated by the estimated trend line of equation (6.1). Further, the dilemma of negative farm numbers in certain size categories arose in the regression analysis.

The Markov chain process overcame at least some of these objections. Though farm numbers can decrease to zero in specific size states, it is mathematically impossible to obtain negative farm numbers in any category. The Markov process, similar to other projection procedures, assumes that factors operating during the time period used to compute the transition probability matrix would continue to act in the same manner in the future. Also, detailed data to compute the transition probability matrix was not available and would be difficult and expensive to obtain.

Thus, it was impossible to project the exact number of farms in total or in specified size groups. Farm numbers will continue to decline and farm size will continue to increase in the immediate future.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The major objective of this study was to determine the effects of alternative government cotton programs on, (a) individual farm organization and net returns, (b) aggregate area returns and commodity supply relationships, (c) minimum resource requirements for a specified income, and (d) future farm numbers in the study area. The study area consisted of the 11 counties in Southwestern Oklahoma.

More specifically, the first objective was to determine the optimum combination of enterprises and returns to selected resources on representative farm situations under specified government cotton programs. This involved the use of six representative farm situations on four soil types. These soil situations were the Clay, Sandy, Level Loam, and Rolling Loam Soils. Through linear programming, the income and resource allocation effects of 12 different cotton price and allotment level combinations were determined for each of the six representative farms.

The second objective was to develop and apply to one soil situation, methodology that would allow determination of a cotton allotment and price support combination that would maximize returns to individual producers given a predetermined government outlay. The programmed returns to labor and management were used to determine the combinations of cotton prices and allotment levels between which the operator would be indifferent, given a return level. Conversely, these results can be interpreted to define a hierarchy of government policies that cotton producers could choose assuming a goal of profit maximization and should a choice exist. A mathematical technique to determine the profit maximizing government cotton policy given a predetermined government outlay and the net returns function was developed and applied to the clay soil situation.

The third objective was to determine the aggregate area returns and commodity supply relationships from the representative farm organizations under the assumed government cotton allotment and price support alternatives. Normative supply functions for cotton were developed by simple summation among cells of each soil situation and across cells for the aggregate area. The fourth objective was to apply the mathematical technique to the aggregate area returns function and determine the profit maximizing combination of cotton price and allotment for the aggregate area.

The fifth objective was to determine the adjustment in farm size and other resource use necessary on the assumed representative farm situations to obtain a $5,000 return to labor and management. This involved the simultaneous determination of minimum land requirements and profit maximizing enterprise combinations needed to earn the specified return on each of the resource situations. Alternative assumptions regarding cotton price support levels, allotment levels, land prices, labor prices, and land equity were used in estimating these minimum requirements. The results of this segment of the study imply the adjustment necessary in the area for farm operators to realize "parity" returns to their invested resources.

The final objective was to investigate past adjustments in farm numbers in the study area. Regression analysis and a Markov chain model were used to project future farm numbers. These projections were then compared to the adjustments in farm size and farm numbers consistent with the specified income level in the minimum land model.

The Maximization Model

Cotton entered the programmed solutions at full allowable allotment levels in all resource situations when cotton prices were not less than \$22.00 per hundredweight. At the low cotton price of \$17.60 per hundredweight, no cotton was produced on the clay soil representative farm. At this low price, however, full allotments were produced on the sandy soil farm and on the rolling loam small farm situation. Less than the full allotment level was produced at the low cotton price on the two level loam soil representative farms and the rolling loam large farm situation.

In the clay soil situation, the elasticity of supply of cotton with respect to price, given all allotment levels, was zero. In the other three soil situations, the elasticity of supply of cotton with respect to price varied over the programmed range of cotton prices given an allotment level. In these soil situations, increasing the price of cotton resulted in a land use shift on the representative farms. Cotton at the higher price was relatively more profitable in relation to other crop alternatives and tended to replace these crops on highly productive soils within the resource classification. Thus, the output of other crops such as wheat and grain sorghum was reduced, though their prices were unchanged, when the price of cotton was increased.

Though the supply functions were of a step form because of the stability ranges in the programming model, the supply function for cotton became more inelastic as price was increased. This held true for the aggregate normative supply function obtained by summing across all the soil situations. Within a range, the output of cotton in an area with a fixed cotton acreage can be changed by changing the cotton price.

Of more relevance and possibly of more concern to the policy maker would be the output response of cotton to an allotment change given a cotton price level (the E_{OA}). If for some reason the carryover of a government controlled crop such as cotton became excessive, the decision might be made that the allotment level for the following year should be reduced so that demand could be filled from future production and stocks carried over from the previous year. The magnitude of the allotment reduction necessary to realize the desired goal would become the relevant question.

The programming results indicated considerable difference in cotton output response to allotment changes given a price level in the four resource situations. The E_{OA}'s were unity between all programmed price levels in the clay situation and between cotton prices of $26.40 and $30.80 per hundredweight in the rolling loam soil. In the other soil situations, the E_{OA}'s were less than one indicating that a particular percentage reduction in allotment would call forth a smaller percentage reduction in cotton output. It follows that with an E_{OA} less than one a desired level of reduction in cotton output would be obtained only if allotments were reduced by a greater amount than the desired percentage output reduction.

At the aggregate level, with cotton at the base price of $26.40 per hundredweight and the allotment at the base or 100 percent level, a required reduction in cotton output, ceteris paribus, of 12 percent would require an allotment reduction of 15 percent since the computed average

E_{OA} was 0.883 between the 100 percent and 85 percent allotment level.

Further reductions in allotment would have a different effect on cotton output. Between the 85 percent and 55 percent of base allotment level, the E_{OA} increased implying that further given percentage allotment reductions would result in a cotton output reduction approaching the allotment reduction. This followed from the fact that as the allotment was drastically reduced from the base level, all cotton production occurred on the highest productivity land. Acre allotment-output reductions approached a one to one relationship in these cases.

The programming results of the maximization model were also used to develop sets of income indifference curves for alternative cotton allotment-price combinations. The farmer with a goal of profit maximization should logically be indifferent between combinations of cotton price and allotment levels that result in identical net returns on his farm unit. Thus, any cotton price-allotment level combination on a given income indifference curve computed for a resource situation should be equally acceptable to the operator of a representative farm. In all the situations, the shape of the computed income indifference curve implied that a given percentage change in the cotton allotment was offset by a smaller change in the cotton price. A cotton grower faced with a choice of accepting either a reduction in allotment or an equivalent reduction in price, as might be the case in a referendum, would be wise to choose the allotment reduction.

Under the assumptions that (a) a cotton demand function is definitive, (b) that a relationship between level of government outlay on the national level, desired cotton price, and allotment level is identifiable, and (c) that farm net returns are a function of cotton price and allotment level, an optimum cotton price-allotment combination that would maximize returns in a soil situation was computed. This computation was made for the clay soil situation. The optimum computed combination for the clay soil farm was a 67.81 percent of base cotton allotment and a $31.05 per hundredweight cotton price. A similar computation with aggregate data resulted in an optimum combination of 82.3 percent of base cotton allotment and a $30.96 cotton price. Though the two computed combinations are not identical, both support the conclusion drawn earlier that maximum producer income would be realized with a relatively low cotton allotment and a relatively high price if restrictions were to be placed on either one or both.

The Minimization Model

The minimum land model as used in this study determined the size of the farm in terms of land and capital that would simultaneously give the representative farm operator opportunity returns to invested capital, an efficiently organized farm unit, and the given operator return to labor and management under any postulated set of resource cost-product price assumptions.

The results of this model can be interpreted to imply the extent of adjustment, if any, necessary for the farm operator to realize the desired resource returns. In this study, the variables included the price of cotton, level of cotton allotment, price of land, price of labor, and allowable livestock enterprises.

Marked differences existed in the minimum land requirements under the alternative combinations of variables within a resource situation and between resource situations. With base prices of cotton, land, labor, and a base or 100 percent allotment level, minimum land requirements for the clay, sandy, level loam, and rolling loam situations were respectively 1,763 acres, 1,162 acres, 918 acres, and 4,384 acres. These programmed minimum farm sizes in each situation were considerably larger than the average size farm now found in the area. In 1960, only about five and one-half percent of total numbers of farms in Southwestern Oklahoma were greater than 1,000 acres in size. This would indicate that the majority of farms in the study area are not realizing "parity" returns to their invested resources. Since the programming matrix coefficients reflect advanced technology, the adjustment necessary for the majority of farms in the area would be greater than comparisons of present farm size distributions would indicate.

A comparison of the minimum farm sizes obtained under various cotton price-allotment combinations shows that a change in price, given an allotment level, required a larger adjustment in farm size to maintain the $5,000 target return than a comparable change in allotment level, given a cotton price.

In the sandy and rolling loam soil situations, combinations of prices, allotments, and costs were found that made it impossible for the operator to realize the target return. This held true when the price of cotton was equal to or less than $22.00 per hundredweight with the allotment level at 85 percent or greater. A similar situation existed with the price of cotton at $26.40 per hundredweight and the allotment level restricted to 55 percent of the base. This implies that drastic reductions in allotment and/or price as the case might be, would make it impossible for farmers on the sandy or rolling loam soils to adjust their resource structure to obtain a $5,000 return to labor and management if the prices of other products and production costs were held at the programmed levels.

Varying the price of land in the minimization model, with the price of cotton and the level of the cotton allotment at the assumed base, had a very marked effect on the minimum land requirements to obtain the $5,000 return to operator labor and management. Lowering the price of land to 50 percent of the assumed base levels, decreased the minimum land requirements by more than 50 percent in all four soil resource situations. A similar reduction in total capital requirements occurred. As expected, a further reduction in the price of land to zero, lowered minimum land requirements. In the clay situation, minimum land requirements were 1,763 acres with land at the base price as contrasted to 753 acres and 520 acres with land prices at 50 percent and base less 100 percent, respectively. This would imply that farm operators who purchased their land some years ago when land prices were considerably lower are obtaining a $5,000 return to labor and management and an opportunity return on their initial investment in land at farm sizes that approach the present average in the area.

In all four resource situations, an increase in land values by 50 percent over the assumed base, made it impossible to obtain a feasible solution in the minimization model. There was no combination of resources available with the assumed price, cost, and allotment structure that would make it possible to obtain the target return.

Increasing the cost of skilled labor from the $1.00 per hour base level increased the minimum land requirements considerably. An increase to $1.50 per hour resulted in no feasible solution in the rolling loam situation. The increase in minimum land requirements would be expected as the price of labor was increased since the production of cotton requires relatively high labor inputs. Similarly excluding feeder enterprise alternatives increased the minimum land requirements. The increase was not identical in the four resource situations, In the clay soil situation, excluding the feeder enterprises, made it impossible to find a feasible solution. In this situation, the level of feeding was high in all the programming results in both the maximization and minimization models. Thus, excluding feeder cattle alternatives would have a greater effect in the clay soil situation as compared to the sandy, level, and rolling loam soils.

Farm Numbers Projections

Regression analysis was used to extrapolate past trends in farm numbers both in total numbers of farms and by size group breakdowns. Total farm numbers in the Southwestern Oklahoma area in 1960, was 15,419 farms. In each of the prior five year periods, total farm numbers had decreased by approximately 12 to 16 percent. The total decrease in the 20 year period was 39 percent. A regression equation fitted to total farm numbers over the past projected a total of 5,570 farms in the area in 1975. However, such a projection can lead to ridiculous conclusions. The same equation indicated that by 1984, farm numbers would be down to one. Similar results are obtained with regression equations fitted to farm numbers by size breakdowns. The smaller farms, which have been decreasing in the past, eventually decline to zero. The larger farms, which have been increasing in numbers, continue to do so. Therefore, a simple extrapolation of past trends did not appear to be a feasible method for projecting future farm numbers in total, or by size groups, with any confidence.

A more reasonable hypothesis would be that farm numbers in the small size groups will continue to decline but at a diminishing rate. A hard core of small farms, consisting probably of semi-retired and part-time farmers likely will remain. Farm numbers in the large size groups will continue to increase but at a decreasing rate. Farms in total would probably continue to decline, possibly quite rapidly for several more census periods, but the rate of decline would be drastically reduced in the future.

A more feasible approach to the problem of projecting farm numbers is the Markov chain process. This process assumes that a population, in this case, farm numbers can be classified into states or groups. It further assumes that movements between the states over time can be regarded as a stochastic process. The outcome of a given state depends only on the outcome of the immediately preceding state and this dependence is the same at all stages. In this study, two approaches were used to determine the transition probability matrix. One approach used past census data under specific assumptions with respect tofarm size movements over time. The second approach used the latest available census data as a starting point with the transition probability matrix determined from a personal survey of future change in farm numbers as expressed by agricultural leaders in the study area.

The use of the Markov chain process resulted in estimates of total farm numbers that were considerably higher than those obtained from regression analysis. Using past census data to compute the transition matrix, total farm numbers in 1975, were projected at 11,337 as compared to 5,570 with the regression equation on total farm numbers. With the opinion survey, 1975 total farm numbers were projected at 10,994. This implies that the agricultural leaders surveyed felt that the change in farm numbers would be more rapid in the immediate future than had occurred in the immediate past.

In addition to estimates of size distribution of firms in any time period, the Markov chain process gave estimates of the equilibrium distribution of farms. Equilibrium in this context does not imply a lack of further movement between states, or farm size groups, but means that the distribution remains constant, that is, the number of firms entering a size state equals the number of firms leaving the size state. The equilibrium number of farms in total, using the past census approach and opinion survey to develop the transition probability matrix, were respectively 7,897 and 5,448 farms.

The programming results of the minimum land model were utilized to determine the maximum number of farms that each resource situation and the total area can support at the assumed $5,000 returns level. This was possible only when feasible solutions were obtained in all four resource situations under specified product price, factor cost, and allotment levels. For example, with a cotton price of $26.40 per hundredweight and a base allotment level with all other variables at their assumed base prices, the area could support a total of 3,636 farms all realizing the target return. The regression and Markov chain model indicated that farm numbers by 1975 would be considerably greater than this. This would imply that if past adjustment patterns continue as predicted, a large number of farms in the area would not be realizing "parity" returns even though prices, costs, and allotment levels remained near present levels and technological advances continued in the future.

Additional Inferences of this Study

The programming results of both the maximization and minimization models indicated that substantial adjustments in farm size and/or other resource use levels would be necessary for the majority of farms in the study area to realize concurrently a "desirable" standard of living as measured by returns to labor and management and "parity" returns to invested productive resources.

In the maximization model, returns to operator labor and management greater than $5,000 were realized only on the level loam soil large representative farm when cotton prices and allotment levels were assumed to be at base levels, i.e., $26.40 per hundredweight of lint and 100 percent of cotton base allotment. In the other five assumed representative farm situations, returns to labor and management were all below $5,000 at cotton price-allotment combinations equal to, or less than, base levels.

The results of the minimization model bear this out. In this model, the $5,000 return to labor and management assumed necessary to provide the farm family with a decent standard of living meant considerable adjustment in farm size when base prices of land and labor and base or less than base assumptions of cotton-price allotment combinations were used.

With cotton the most "profitable" alternative in the study area, it followed that any reduction in allotment and/or price of cotton would adversely affect returns on farms of a given size, or imply upward adjustments in size to maintain a desired income level. Since the 1965 Food and Agriculture Act which sets the general program regulations for the four year period from 1966 through 1969 contains provisions to lower both price and allotments as needed to maintain a supply-demand-reserve balance for controlled agricultural commodities, it is logical to assume that strong upward adjustment pressures in farm size will continue in the agricultural sector. It follows that agricultural producers not in the position to increase farm size for reasons such as age, managerial capacity, and capital availability can only expect decreasing incomes and declining standards of living in relation to other sectors of a growing economy.

This is not to imply that a farm family with a low return to labor and management must automatically be classed as a poverty case. Returns to owned land and other equity can be treated as spendable income. Depending on the situation, a family with low returns to labor and management may actually enjoy a high standard of living. For example, an elderly couple with no family obligations, who have accumulated considerable equity in their farm business over their life span may well be considered "wealthy" in terms of spendable income relative to their needs though their returns to labor and management may be low.

However, low returns to labor and management for a farmer possessing skills, or with the capacity to be trained in skills that are in demand outside the agricultural production sector, imply that he could enjoy a higher standard of living outside agriculture. A move of this kind could involve liquidation of all assets invested in the agricultural productive plant with subsequent employment and capital re-investment in the non-agricultural sector. It could involve liquidation of short and intermediate term assets (seed, feed, crop inventories, livestock, and machinery) with retention of land ownership to be operated on a rental basis by a farmer with the need to add land to his farm operation. Since cash renting is a common practice in many states, this approach would give the farmer leaving agriculture an assured annual income from his land holdings and give him the opportunity to share in future land value increases.

This study also contains some implications for policy makers concerned with planning future changes in government farm programs. It should be safe to assume that output increasing technology in agriculture will continue to be developed and accepted by farmers and that for at least some agricultural commodities these output increases will outstrip demand increases at given, or "satisfactory" price levels. For such commodities, the elasticity of output to allotment concept developed in this study and applied to cotton for the study area, could be useful to the policy maker concerned with maintaining a supply-demand-reserve balance at a given support price.

If comparable measurements of product output response to allotment changes were developed for all areas producing a major commodity, the policy maker would have guides to follow if either output increases or decreases were dictated by changing supply-demand relationships.

The technique of computing profit maximizing combinations of cotton price and allotment developed in this study may hold some further implications for policy makers. The urban-rural power structure is undergoing change with reapportionment vesting more political power in urban hands. It is conceivable that in the future, though the urban political power structure may continue to assist the agricultural industry through government programs, this assistance may be couched in terms of a predetermined government outlay in total and for commodities in particular.

The development of a particular commodity's program regulations may be vested in the hands of administrators or possibly a board comprised of producers of the particular commodity. If such were the case, the profit maximizing combinations of price and allotments could be computed for producing areas if the output response and the net returns functions as developed in this study were known for each producing area. If a national program or combination of prices and allotments were required, then obviously each area could not be satisfied, since the maximizing combinations would vary from area to area. The final national combination would likely still be determined through political power or some type of arbitration or bargaining board.

Of particular significance to individual farmers and/or farm organizations concerned with influencing the political processes in commodity program development was the change that occurred in net returns as either price or allotment for cotton was changed with the other held constant. In all cases, a given percentage change in cotton price, given an allotment level, changed net returns a greater absolute amount than a comparable percentage change in allotment given a price level. This implies that should a choice exist as might be the case in a commodity referendum, farmers concerned with profit maximization would be better off selecting a reduction in allotment rather than a reduction in price of the commodity. Conversely, they would be better off selecting an increase in price rather than in allotment in an either/or situation.

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APPENDIX A

APPENDIX A, TABLE I

DEFINITION OF LAND RESOURCE SITUATIONS AND YIELD LEVELS BY LAND CLASS; CLAY SOILS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Dry Land

C_b - Land Capability Class IIs, Soil Units 1 and 5 (Foard-Tillman and equivalents).

C_c - Land Capability Class IIIe, Soil Units 1 and 5 (Foard-Tillman and equivalents).

C_d - Land Capability Class IVe, Soil Units 1 and 5 (Foard-Tillman and equivalents).

C_e - All other cropland classes (not adapted to harvested crops).

Crop	Unit	Land Type			
		C_b	C_c	C_d	C_e
		(Yield Per Acre)			
Wheat (continuous)	Bu.	14	12	10	6
After Row Crop (6 Mo. Fallow)	Bu.	17	14	11	7
(12 Mo. Fallow)	Bu.	19	16	12	8
Cotton	Lb. Lint	175	125		
Oats (continuous)	Bu.	28	20	15	
Small Grain Hay	Ton	1.6	1.5	1.4	
Grazing[a]					
Sudan	AUM	3.0	2.8	2.6	1.9
Grazed Out Small Grains	AUM	3.1	2.9	2.8	1.9
Native Pasture	AUM	1.6	1.5	1.4	1.0
Harvested Small Grain	AUM	.4	.35	.3	.2
Blue Panic	AUM	3.4	3.2	3.0	2.1

[a]Grazing yields are basically expected values since moisture is the limiting factor in forage production. The monthly distribution of grazing is not specified because of seasonal uncertainties. Permanent pasture grazing yield is one AUM per acre of range. The acreage of range land and cropland for livestock budgets can be calculated from this table.

APPENDIX A, TABLE II

DEFINITIONS OF LAND RESOURCE SITUATIONS AND YIELD LEVELS BY LAND CLASS; SANDY SOILS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Dry Land

S_b - Land Capability Class II, Soil Units 70, 7X, 12, 12X. Miles, Dill, Pratt, and Enterprise Soils (or their equivalents).

S_c - Land Capability Class III - same soils as above.

S_d - Land Capability Class IV - same soils above plus some Brownfield and Nobscott Soils (deep-plowed Brownfield Soils would be included in the S_b group).

S_e - All other cropland classes (not adapted to row crops).

Crop	Unit	Land Type S_b	S_c	S_d	S_e
		(Yield Per Acre)			
Cotton	Lb. Lint	325	275	150	
Wheat	Bu.	18	14	8	
Grain Sorghum	Lb.	1,750	1,300	1,000	
Alfalfa					
Hay Basis	Ton	2.5	2.0		
Hay and Seed Basis	Ton Hay	2.0	1.5		
Small Grain Hay	Ton	1.7	1.5	1.2	
Forage Sorghum	Ton	2.0	1.7	1.3	
Grazing[a]					
Sudan	AUM	2.7	1.9	1.3	.9
Grazed Out Small Grain	AUM	3.3	2.8	2.3	1.5
Harvested Small Grain	AUM	.4	.3	.2	
Rye Cover Crop	AUM	.5	.4	.3	

[a]Grazing yields are basically expected values since moisture is the limiting factor in forage production. The monthly distribution of grazing is not specified because of seasonal uncertainties. Permanent pasture grazing yield is one AUM per acre of range. The acreage of range land and cropland for livestock budgets can be calculated from this table.

APPENDIX A, TABLE III

DEFINITIONS OF LAND RESOURCE SITUATIONS AND YIELD LEVELS BY LAND CLASS; LOAM SOILS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Dry Land

L_a - Land Capability Class I, Soil Units 2, 4, 7, and 9. Upland-Tipton, St. Paul, and Carey Soils; Bottomland-Spur and Canadian Soils (or their equivalents).

L_b - Land Capability Class II - same soils as above.

L_c - Land Capability Class III - same soils as above plus Quinlan and Vernon Soils (or their equivalents).

L_d - Land Capability Class VI - same as L_c.

L_e - All other cropland classes (not adapted to row crops).

Crop	Unit	Land Type				
		L_a	L_b	L_c	L_d	L_e
		(Yield Per Acre)				
Cotton	Lb. Lint	275	225	185	100	
Wheat	Bu.	23	18	14	11	
Alfalfa						
Hay Basis	Ton	3.0	2.25			
Hay and Seed Basis	Ton	2.5	1.75			
Grain Sorghum	Lb.	1,600	1,450	1,200	900	
Forage Sorghum	Ton	2.2	2.0	1.7	1.2	
Small Grain Hay	Ton	2.0	1.8	1.5	1.0	
Grazing[a]						
Sudan	AUM	3.0	2.4	1.7	1.3	1.0
Grazed Out Small Grain	AUM	4.0	3.5	3.0	2.8	2.0
Harvested Small Grain	AUM	.6	.5	.4	.3	

[a]Grazing yields are basically expected values since moisture is the limiting factor in forage production. The monthly distribution of grazing is not specified because of seasonal uncertainties. Permanent pasture grazing yield is one AUM per acre of range. The acreage of range land and cropland for livestock budgets can be calculated from this table.

APPENDIX A, TABLE IV

ASSUMED[a] PRICES PAID AND RECEIVED BY FARMERS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Price (Dollars)
Prices Paid		
Seed and Feed		
Seed Cotton	Cwt.	8.00
Seed Wheat	Bu.	2.05
Seed Oats	Bu.	1.10
Sudan, Sweet	Cwt.	6.00
Grain Sorghum	Cwt.	15.00
Alfalfa Seed	Lb.	.50
Forage Sorghum	Cwt.	15.00
Native Grass Seed	Lb.	.60
Rye	Bu.	1.25
Cottonseed Cake	Ton	76.00
Fertilizer		
10-20-10	Ton	105.00
13-39-0	Ton	105.00
16-20-0	Ton	89.00
8-32-16	Ton	106.00
6-46-0	Ton	79.00
Custom Rates		
Combining Wheat and Grain Sorghum	Acre	3.00
Cotton Stripping	Cwt. Seed Cotton	.75
Cotton Snapping	Cwt. Seed Cotton	2.00
Hauling		
Cotton	Cwt. Seed Cotton	.25
Wheat	Bu.	.07
Grain Sorghum	Cwt.	.10
Hay	Cwt.	.08
Cotton Defoliation	Acre	2.00
Cotton Insecticide Spraying	Acre	3.50
Cotton Hoeing	Acre	2.00-2.50
Cotton Ginning and Wrapping	Cwt. Seed Cotton	.85
Cotton Pre-Emerge Chemical	Acre	2.50
Hay Baling	60 Lb. Bale	.16

APPENDIX A, TABLE IV (Continued)

Item	Unit	Price (Dollars)
Fuel and Lubricants		
Gasoline	Gal.	.20
L. P. Gas	Gal.	.09
Diesel Oil	Gal.	.16
Kerosene	Gal.	.15
Motor Oil	Gal.	1.00
Lubricant	Lb.	.20
Prices Received		
Cotton Lint (SLM 15/16)	Cwt.	Variable[b]
Cotton Seed	Ton	50.00
Wheat	Bu.	1.65[c]
Alfalfa Hay	Ton	20.00
Grain Sorghum	Cwt.	1.70
Oats	Bu.	.65
Beef	Cwt.	[d]

[a]These price assumptions are not to be interpreted as predictions of prospective prices.

[b]Four different price levels used in the analysis.

[c]Adjusted 1963 support price.

[d]See Appendix A, Table V.

APPENDIX A, TABLE V

ASSUMED[1] PRICES FOR STOCKER AND FEEDER STEERS, AND CULL COWS
BY MONTHS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Class and Grade	Monthly Averages												Yearly Average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
	(price per cwt.)												
Slaughter Calves													
Prime and Choice: 500 lbs. and less	$22.25	22.75	23.00	23.75	24.00	23.00	22.50	21.75	21.00	20.50	21.00	21.50	22.25
Good and Commercial: 500 lbs.	19.50	20.00	20.25	20.75	20.75	19.25	19.25	18.75	18.25	17.50	17.75	18.50	19.25
Slaughter Bulls													
Commercial: all weights	17.75	18.00	18.50	18.50	18.50	17.75	17.75	16.75	16.50	16.25	15.50	16.75	17.25
Utility and Cutter: all weights	15.25	15.50	16.25	16.25	16.25	15.00	15.00	14.00	14.00	13.75	13.75	14.50	15.00
Slaughter Cows													
Utility: all weights	14.00	14.50	15.00	15.00	15.00	14.25	14.00	13.50	13.50	13.00	13.25	13.25	14.00
Canners and Cutters: all weights	11.75	12.25	12.50	12.50	12.25	11.25	11.00	11.00	10.75	10.25	10.25	10.75	11.25
Stocker and Feeder Steers													
Choice and Good: 500 lbs. and less	23.25	24.50	25.00	25.25	24.50	23.50	23.00	23.25	23.00	22.50	22.50	22.50	23.50
Good: 300-500 lbs.	21.50	22.25	22.25	22.25	22.75	21.50	21.00	20.75	20.50	20.00	20.25	20.50	21.25
800-1050 lbs.	20.75	21.50	21.75	22.25	22.00	21.00	20.75	20.75	20.25	19.75	20.00	20.25	21.00
Medium: 500-1,100 lbs.	18.25	19.00	19.00	19.25	19.50	18.25	18.00	17.75	17.50	16.75	17.50	17.25	18.25
Common: 500-900 lbs.	15.00	16.25	16.25	16.25	16.25	14.75	14.75	14.50	13.75	13.75	14.00	14.25	15.00

[1] The seasonal pattern as well as the class and grade differentials are based on data from Jackson L. James and James S. Plaxico, Beef Cattle Price: Seasonal Movements and Price Differentials on the Oklahoma City Market, Oklahoma Agricultural Experiment Station Bulletin B-486, February, 1957.

APPENDIX A, TABLE VI

ESTIMATED COST PER HOUR OF USE FOR SPECIFIED EQUIPMENT BY TYPE OF SOILS

Item		Cost Per Hour of Use[a] Clay Soil	Loam Soils	Sandy Soil
		(Dollars)		
	Four-Row Equipment			
Tractor	4 or 3-16 tricycle, L.P., P.S., hydraulic, PTO, 3 point hitch, 51 HP.	1.27	1.27	1.27
Moldboard plow	4-16" integral	.36	.46	.46
One-way	12-foot	.57	.57	
Tool bar (Hoeme)	12-foot	.34	.34	.34
Cultivator	4-row	.32	.32	.32
Planter[b]	4-row (with pre-merge)		1.09	
Planter	4-row	.67	.77	.77
Gyromor	5-foot		.22	.22
Mower	7-foot	.27	.27	.27
Side delivery rake	10-foot	.34	.34	.34
Grain drill	16-8 inch	.58	.77	.77
Spike tooth harrow	24-foot	.07	.07	.07
Cyclone rye seeder	6-row			.10
Single action disc	15-foot			.19
Monitor (Go-devil)	4-row			.23
	Two-Row Equipment			
Tractor	3 or 2-16" tricycle, L.P., P.S., Hydraulic, PTO, 3 point hitch, 43 HP.	1.00	.86	.86
Moldboard plow	2-16" integral	.25	.25	.25
One-way	8-foot	.33	.33	
Tool bar (Hoeme)	8-foot	.27	.27	.27
Cultivator	2-row	.15	.15	.15
Planter[b]	2-row (with pre-emerge)		.55	
Planter	2-row	.33	.33	.33
Gyromor	5-foot		.22	.22
Mower	7-foot	.27	.27	.27
Side delivery rake	10-foot	.34	.34	.34
Grain drill	16-8 inch	.58	.78	.78
Spike tooth harrow	18-foot	.05	.05	.05
Monitor (Go-devil)	2-row			.12
Cyclone rye seeder	6-row			.10

[a]These figures include per hour costs of lubrication, repair, depreciation due to wear, and in the case of tractors the per hour cost of fuel and oil. It is assumed that equipment is used at an annual rate such that it would wear out before it becomes obsolete.

[b]Includes per-emerge equipment for cotton.

APPENDIX B

APPENDIX B, TABLE I

CLAY SOIL REPRESENTATIVE FARM; ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations					
		P_1A	P_2A[a]	P_1B	P_2B[b]	P_2C[c]	P_3D[d]
Cotton	Acre		137		119	101	65
Cotton Lint	Cwt.		238		207	176	114
Wheat	Acre	496	496	496	496	496	496
Oats	Acre	173	6	173	27	49	93
Oat Hay	Acre	137	138	137	138	138	138
Annual Grazing[e]	Acre	194	189	194	190	191	192
Fallow	Acre		34		30	25	16
August Feeders	Head	123	140	123	139	136	131
March Feeders	Head	174	134	174	138	144	155
Operator Labor	Hour	1,737	1,756	1,737	1,754	1,751	1,746
Hired Labor	Hour	2,124	2,154	2,124	2,150	2,146	2,138
Annual Capital	Dol.	55,565	52,839	55,565	53,194	53,550	54,262
Total Capital	Dol.	62,557	60,004	62,557	60,338	60,671	61,337
Land Use							
C_b Land							
Cotton	Acre		137		119	101	65
Wheat	Acre	360	189	360	211	234	279
Fallow	Acre		34		30	25	16
C_c Land							
Wheat	Acre	136	307	136	285	262	217
Oats	Acre	173	6	173	27	49	94
Oat Hay	Acre	59	55	59	56	57	57
C_d Land							
Oat Hay	Acre	78	82	78	82	81	80
Annual Grazing	Acre	82	78	82	78	79	80
C_e Land							
Annual Grazing	Acre	112	112	112	112	112	112

[a]Optimum organization identical for situation P_3A.

[b]Optimum organization identical for situations P_3B and P_4B.

[c]Optimum organization identical for situations P_3C and P_4C.

[d]Optimum organization identical for situation P_4D.

[e]Includes small grain, Sudan, and Blue Panic-Sudan grazing.

APPENDIX B, TABLE II

SANDY SOIL REPRESENTATIVE FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations			
		P_1A	P_2A	P_3A	P_3D[a]
Cotton	Acre	177	177	177	84
Cotton Lint	Cwt.	499	533	548	275
Wheat	Acre	67	67	67	67
Sorghum-Fallow	Acre	22	22	53	115
Alfalfa	Acre	89	89	58	89
Small Grain Hay	Acre	24	24	28	24
Annual Grazing[b]	Acre	32	32	36	32
Reseeded Cropland	Acre	89	89	81	89
March Feeders	Head	67	67	76	67
Beef Cows	Head	11	11	11	11
Operator Labor	Hour	1,894	1,894	1,906	1,799
Hired Labor	Hour	290	290	226	235
Annual Capital	Dol.	22,245	22,264	23,078	21,002
Total Capital	Dol.	27,744	27,744	28,153	26,005
Land Use					
S_b Land					
Cotton	Acre	27	94	125	84
Wheat	Acre	67			10
Alfalfa	Acre	31	31		31
S_c Land					
Cotton	Acre	150	83	52	
Wheat	Acre		67	67	57
Alfalfa	Acre	58	58	58	58
Sorghum-Fallow	Acre	22	22	53	115
S_d Land					
Small Grain Hay	Acre	24	24	28	24
Annual Grazing	Acre	32	32	36	32
Reseeded Cropland	Acre	69	69	61	69
S_e Land					
Reseeded Cropland	Acre	20	20	20	20

[a]Optimum organization identical for situation P_4D.

[b]Includes small grain and Sudan grazing.

APPENDIX B, TABLE III

SANDY SOIL REPRESENTATIVE FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations				
		P_1B	P_2B	P_3B[a]	P_2C	P_3C[b]
Cotton	Acre	154	154	154	131	131
Cotton Lint	Cwt.	436	469	485	406	422
Wheat	Acre	67	67	67	67	67
Grain Sorghum-Fallow	Acre	45	45	76	68	99
Alfalfa	Acre	89	89	58	89	58
Small Grain Hay	Acre	24	24	28	24	28
Annual Grazing[c]	Acre	32	32	36	32	36
Reseeded Cropland	Acre	89	89	81	89	81
March Feeders	Head	67	67	76	67	76
Beef Cows	Head	11	11	11	11	11
Operator Labor	Hour	1,870	1,870	1,882	1,846	1,859
Hired Labor	Hour	279	279	215	269	196
Annual Capital	Dol.	21,950	21,950	22,764	21,637	22,447
Total Capital	Dol.	27,311	27,311	27,719	26,877	27,283
Land Use						
S_b Land						
Cotton	Acre	27	94	125	94	125
Wheat	Acre	67				
Alfalfa	Acre	31	31		31	
S_c Land						
Cotton	Acre	127	60	29	37	6
Wheat	Acre		67	67	67	67
Alfalfa	Acre	58	58	58	58	58
Grain Sorghum-Fallow	Acre	45	45	76	68	99
S_d Land						
Small Grain Hay	Acre	24	24	28	24	28
Annual Grazing	Acre	32	32	36	32	36
Reseeded Cropland	Acre	69	69	61	69	61
S_e Land						
Reseeded Cropland	Acre	20	20	20	20	20

[a]Optimum organization identical for situation P_4B.

[b]Optimum organization identical for situation P_4C.

[c]Includes small grain and Sudan grazing.

APPENDIX B, TABLE IV

LEVEL LOAM SOIL REPRESENTATIVE LARGE FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations			
		P_1A	P_2A[a]	P_2C	P_3C[b]
Cotton	Acre	98	171	126	126
Cotton Lint	Cwt.	265	430	329	348
Wheat	Acre	226	226	226	226
Sorghum-Fallow	Acre	192	125	170	170
Alfalfa	Acre	170	170	170	170
Small Grain Hay	Acre	21	21	21	21
Annual Grazing[c]	Acre	33	37	37	37
Reseeded Cropland	Acre	10			
August Feeders	Head				
March Feeders	Head	89	88	88	86
Beef Cows	Head	10	10	10	10
Operator Labor	Hour	1,912	1,927	1,923	1,922
Hired Labor	Hour	738	794	758	749
Annual Capital	Dol.	27,682	28,314	27,807	27,493
Total Capital	Dol.	34,083	34,928	34,240	33,874
Land Use					
L_a Land					
Cotton	Acre	89	89	89	126
Wheat	Acre	226	226	226	189
Alfalfa	Acre	105	105	105	105
Sorghum-Fallow	Acre				
L_b Land					
Cotton	Acre	9	82	37	
Wheat	Acre				37
Alfalfa	Acre	65	65	65	65
Sorghum-Fallow	Acre	156	92	137	137
Small Grain Hay	Acre	21	21	21	21
Annual Grazing	Acre	9			
L_c Land					
Sorghum-Fallow	Acre	36	33	33	33
Annual Grazing	Acre	24	27	27	27
L_e Land					
Reseeded Cropland	Acre	10			
Annual Grazing	Acre		10	10	10

[a]Optimum organization identical for situation P_3A.

[b]Optimum organization identical for situation P_4C.

[c]Includes small grain and Sudan grazing.

APPENDIX B, TABLE V

LEVEL LOAM SOIL REPRESENTATIVE LARGE FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Cotton Price and Allotment Combinations			
Item	Unit	P_1B	P_2B	P_3B[a]	P_3D[b]
Cotton	Acre	98	149	149	82
Cotton Lint	Cwt.	265	380	409	225
Wheat	Acre	226	226	226	226
Sorghum-Fallow	Acre	191	147	148	199
Alfalfa	Acre	170	170	170	170
Small Grain Hay	Acre	22	21	21	25
Annual Grazing[c]	Acre	33	37	36	38
Reseeded Cropland	Acre	10			10
August Feeders	Head				6
March Feeders	Head	89	88	84	90
Beef Cows	Head	10	10	10	10
Operator Labor	Hour	1,912	1,926	1,926	1,924
Hired Labor	Hour	738	775	762	738
Annual Capital	Dol.	27,682	28,060	27,555	28,376
Total Capital	Dol.	34,083	34,610	34,022	34,805
Land Use					
L_a Land					
Cotton	Acre	89	89	149	82
Wheat	Acre	226	226	166	226
Alfalfa	Acre	105	105	105	105
Sorghum-Fallow	Acre				7
L_b Land					
Cotton	Acre	9	60		
Wheat	Acre			60	
Alfalfa	Acre	65	65	65	65
Sorghum-Fallow	Acre	155	114	114	156
Small Grain Hay	Acre	22	21	21	25
Annual Grazing	Acre	9			14
L_c Land					
Sorghum-Fallow	Acre	36	33	34	36
Annual Grazing	Acre	24	27	26	24
L_e Land					
Reseeded Cropland	Acre	10			
Annual Grazing	Acre		10	10	10

[a]Optimum organization identical for situation P_4B.

[b]Optimum organization identical for situation P_4D.

[c]Includes small grain and Sudan grazing.

APPENDIX B, TABLE VI

LEVEL LOAM SOIL REPRESENTATIVE SMALL FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Cotton Price and Allotment Combinations			
Item	Unit	P_1A	P_2A	P_3A	P_3D[a]
Cotton	Acre	24	85	85	41
Cotton Lint	Cwt.	65	215	235	113
Wheat	Acre	113	113	113	113
Sorghum-Fallow	Acre	117	60	62	100
Alfalfa	Acre	84	84	84	84
Small Grain Hay	Acre	13	11	10	13
Annual Grazing[b]	Acre	19	17	16	19
Reseeded Cropland	Acre	5	5	5	5
August Feeders	Head	3			3
March Feeders	Head	45	44	42	45
Beef Cows	Head	5	5	5	5
Operator Labor	Hour	1,815	1,840	1,840	1,825
Hired Labor	Hour	300	356	343	314
Annual Capital	Dol.	14,368	14,636	14,302	14,581
Total Capital	Dol.	17,494	18,032	17,639	17,798
Land Use					
L_a Land					
Cotton	Acre	24	45	85	41
Wheat	Acre	113	113	73	113
Alfalfa	Acre	52	52	52	52
Sorghum-Fallow	Acre	21			4
L_b Land					
Cotton	Acre		40		
Wheat	Acre			40	
Alfalfa	Acre	32	32	32	32
Sorghum-Fallow	Acre	78	47	48	78
Small Grain Hay	Acre	13	11	10	13
Annual Grazing	Acre	7			7
L_c Land					
Sorghum-Fallow	Acre	18	13	14	18
Annual Grazing	Acre	12	17	16	12
L_e Land					
Reseeded Cropland	Acre	5	5	5	5

[a]Optimum organization identical for situation P_4D.

[b]Includes small grain and sudan grazing.

APPENDIX B, TABLE VII

LEVEL LOAM SOIL REPRESENTATIVE SMALL FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations				
		P_1B	P_2B	P_3B[a]	P_2C	P_3C[b]
Cotton	Acre	24	74	74	63	63
Cotton Lint	Cwt.	65	190	205	165	174
Wheat	Acre	113	113	113	113	113
Grain Sorghum-Fallow	Acre	117	71	72	82	82
Alfalfa	Acre	84	84	84	84	84
Small Grain Hay	Acre	13	11	11	11	11
Annual Grazing[c]	Acre	19	17	16	17	17
Reseeded Cropland	Acre	5	5	5	5	5
August Feeders	Head	3				
March Feeders	Head	45	44	42	44	43
Beef Cows	Head	5	5	5	5	5
Operator Labor	Hour	1,815	1,834	1,834	1,827	1,827
Hired Labor	Hour	300	347	334	334	326
Annual Capital	Dol.	14,368	14,498	14,257	14,361	14,213
Total Capital	Dol.	17,494	17,834	17,550	17,637	17,461
Land Use						
L_a Land						
Cotton	Acre	24	45	74	45	63
Wheat	Acre	113	113	84	113	95
Alfalfa	Acre	52	52	52	52	52
Grain Sorghum-Fallow	Acre	21				
L_b Land						
Cotton	Acre		29		18	
Wheat	Acre			29		18
Alfalfa	Acre	32	32	32	32	32
Grain Sorghum-Fallow	Acre	78	58	58	69	69
Small Grain Hay	Acre	13	11	11	11	11
Annual Grazing	Acre	7				
L_c Land						
Grain Sorghum-Fallow	Acre	18	13	14	13	13
Annual Grazing	Acre	12	17	16	17	17
L_e Land						
Reseeded Cropland	Acre	5	5	5	5	5

[a]Optimum organization identical for situation P_4B.

[b]Optimum organization identical for situation P_4C.

[c]Includes small grain and Sudan grazing.

APPENDIX B, TABLE VIII

ROLLING LOAM SOIL REPRESENTATIVE LARGE FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Cotton Price and Allotment Combinations			
Item	Unit	P_1A	P_2A	P_3A	P_3D[a]
Cotton	Acre	22	162	162	78
Cotton Lint	Cwt.	41	320	415	213
Wheat	Acre	264	264	264	264
Sorghum-Fallow	Acre	226	173	183	225
Alfalfa	Acre	63			9
Small Grain Hay	Acre	25	26	22	24
Annual Grazing[b]	Acre	35	35	29	32
Reseeded Cropland	Acre	115	90	90	118
March Feeders	Head	87	87	73	81
Beef Cows	Head	17	15	16	17
Operator Labor	Hour	1,865	1,834	1,834	1,838
Hired Labor	Hour	391	423	394	322
Annual Capital	Dol.	25,946	26,325	24,528	25,006
Total Capital	Dol.	31,096	30,770	28,689	29,346
Land Use					
R_a Land					
Cotton	Acre			100	78
Wheat	Acre	75	100		13
Alfalfa	Acre	25			9
R_b Land					
Cotton	Acre		49	62	
Wheat	Acre	147	136	123	185
Alfalfa	Acre	38			
R_c Land					
Cotton	Acre	22	113		
Wheat	Acre	42		110	66
Sorghum-Fallow	Acre	136	86	93	135
Small Grain Hay	Acre	25	26	22	24
R_d Land					
Wheat	Acre		28	31	
Sorghum-Fallow	Acre	90	87	90	90
Annual Grazing	Acre	35	35	29	32
Reseeded Cropland	Acre	25			28
R_e Land					
Reseeded Cropland	Acre	90	90	90	90

[a]Optimum organization identical for situation P_4D.

[b]Includes small grain and Sudan grazing.

APPENDIX B, TABLE IX

ROLLING LOAM SOIL REPRESENTATIVE LARGE FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations				
		P_1B	P_2B	P_3B[a]	P_2C	P_3C[b]
Cotton	Acre	22	141	141	120	120
Cotton Lint	Cwt.	41	279	368	240	320
Wheat	Acre	264	264	264	264	264
Grain Sorghum-Fallow	Acre	226	194	203	215	224
Alfalfa	Acre	63				
Small Grain Hay	Acre	25	26	22	26	22
Annual Grazing[c]	Acre	35	35	30	35	30
Reseeded Cropland	Acre	115	90	90	90	90
March Feeders	Head	87	88	75	88	76
Beef Cows	Head	17	15	16	15	16
Operator Labor	Hour	1,865	1,834	1,833	1,833	1,833
Hired Labor	Hour	391	406	378	388	363
Annual Capital	Dol.	25,496	26,143	24,469	25,902	24,410
Total Capital	Dol.	31,096	30,485	28,457	30,132	28,403
Land Use						
R_a Land						
Cotton	Acre			100		100
Wheat	Acre	75	100		100	
Alfalfa	Acre	25				
R_b Land						
Cotton	Acre		46	41	46	20
Wheat	Acre	147	139	144	139	165
Alfalfa	Acre	38				
R_c Land						
Cotton	Acre	22	95		74	
Wheat	Acre	42		90		69
Grain Sorghum-Fallow	Acre	136	104	113	125	134
Small Grain Hay	Acre	25	26	22	26	22
R_d Land						
Wheat	Acre		25	30	25	30
Grain Sorghum-Fallow	Acre	90	90	90	90	90
Annual Grazing	Acre	35	35	30	35	30
Reseeded Cropland	Acre	25				
R_e Land						
Reseeded Cropland	Acre	90	90	90	90	90

[a]Optimum organization identical for situation P_4B.

[b]Optimum organization identical for situation P_4C.

APPENDIX B, TABLE X

ROLLING LOAM SOIL REPRESENTATIVE SMALL FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations				
		P_1A	P_2A	P_3A	P_2C	P_3C[a]
Cotton	Acre	41	41	41	30	30
Cotton Lint	Cwt.	75	79	101	77	80
Wheat	Acre	66	66	66	66	66
Sorghum-Fallow	Acre	21	26	28	29	45
Alfalfa	Acre	18	18	18	18	12
Small Grain Hay	Acre	7	6	5	8	5
Annual Grazing[b]	Acre	12	8	7	14	7
Reseeded Cropland	Acre	23	23	23	23	23
August Feeders	Head	2			4	
March Feeders	Head	22	21	18	19	19
Beef Cows	Head	3	3	3	3	3
Operator Labor	Hour	1,410	1,427	1,408	1,400	1,384
Hired Labor	Hour					
Annual Capital	Dol.	7,219	6,828	6,422	7,049	6,380
Total Capital	Dol.	8,668	8,223	7,753	8,430	7,577
Land Use						
R_a Land						
Cotton	Acre		5	19	19	25
Wheat	Acre	19	14			
Alfalfa	Acre	6	6	6	6	
R_b Land						
Cotton	Acre			22	11	5
Wheat	Acre	38	38	16	27	33
Alfalfa	Acre	12	12	12	12	12
R_c Land						
Cotton	Acre	41	36			
Wheat	Acre	7	8	43	39	27
Sorghum-Fallow	Acre		5	7	8	23
Small Grain Hay	Acre	7	6	5	8	5
R_d Land						
Wheat	Acre	2	6	7		6
Sorghum-Fallow	Acre	21	21	21	21	22
Annual Grazing	Acre	12	8	7	14	7
R_e Land						
Reseeded Cropland	Acre	23	23	23	23	23

[a]Optimum organization is identical for situation P_4C.

[b]Includes small grain and Sudan grazing.

APPENDIX B, TABLE XI

ROLLING LOAM SOIL REPRESENTATIVE SMALL FARM; OPTIMUM ENTERPRISE ORGANIZATION AND LAND USE PATTERNS FOR SPECIFIED COTTON PRICE AND ALLOTMENT COMBINATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations				
		P_1B	P_2B	P_3B	P_4B	P_3D[a]
Cotton	Acre	35	35	35	35	19
Cotton Lint	Cwt.	65	80	89	92	53
Wheat	Acre	66	66	66	66	66
Sorghum-Fallow	Acre	23	32	34	39	40
Alfalfa	Acre	18	18	18	12	18
Small Grain Hay	Acre	9	6	5	6	8
Annual Grazing[b]	Acre	14	8	7	7	14
Reseeded Cropland	Acre	23	23	23	23	23
August Feeders	Head	3				4
March Feeders	Head	22	19	18	18	20
Beef Cows	Head	3	3	3	3	3
Operator Labor	Hour	1,326	1,407	1,399	1,393	1,175
Hired Labor	Hour					
Annual Capital	Dol.	7,388	6,587	6,405	6,396	7,003
Total Capital	Dol.	8,841	7,928	7,717	7,606	8,336
Land Use						
R_a Land						
Cotton	Acre		16	19	25	19
Wheat	Acre	19	3			
Alfalfa	Acre	6	6	6		6
R_b Land						
Cotton	Acre			16	10	
Wheat	Acre	38	38	22	28	38
Alfalfa	Acre	12	12	12	12	12
R_c Land						
Cotton	Acre	35	19			
Wheat	Acre	9	19	37	31	28
Sorghum-Fallow	Acre	2	11	13	18	19
Small Grain Hay	Acre	9	6	5	6	8
R_d Land						
Wheat	Acre		6	7	7	
Sorghum-Fallow	Acre	21	21	21	21	21
Annual Grazing	Acre	14	8	7	7	14
R_e Land						
Reseeded Cropland	Acre	23	23	23	23	23

[a]Optimum organization is identical for situation P_4D.

[b]Includes small grain and Sudan grazing.

APPENDIX C

COMPARISON OF ESTIMATED MINIMUM REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, BASE LAND AND LABOR PRICE, INCLUDING ALL CROP AND LIVESTOCK ENTERPRISE ALTERNATIVES SPECIFIED COTTON--PRICE ALLOTMENT COMBINATIONS BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Cotton Price and Allotment Combinations					
Item	Unit	P_1A	P_2A	P_3A	P_2C	P_3C	P_4C
Clay Soil Situation							
Total Land	Acre	3,213	2,971	1,660	3,030	1,885	1,414
Cotton	Acre		318	178	240	149	112
Cotton Lint	Cwt.		553	309	417	259	194
Wheat	Acre	1,245	1,152	643	1,174	730	548
Wheat	Bu.	16,749	14,933	8,341	15,379	9,564	7,173
Oats	Acre	433	14	8	117	73	54
Oats	Bu.	8,664	297	152	2,354	1,454	1,090
Oat Hay	Acre	346	320	178	327	203	152
Annual Grazing	Acre	486	440	246	451	281	210
Fallow	Acre		79	44	60	37	28
August Feeders	Head	310	326	182	322	200	150
March Feeders	Head	436	309	173	340	212	159
Operator Labor	Hour	1,858	1,843	1,830	1,847	1,858	1,777
Hired Labor[a]	Hour	7,832	7,238	3,240	7,384	3,881	2,527
Annual Capital[b]	Dol.	140,738	123,749	68,748	127,924	79,219	59,223
Total Capital[b]	Dol.	159,540	141,280	78,265	145,768	90,065	67,166
Sandy Soil Situation							
Total Land	Acre	No Solution	No Solution	858	No Solution	1,800	704
Cotton	Acre			237		367	144
Cotton Lint	Cwt.			735		1,185	464
Wheat	Acre			90		189	74
Wheat	Bu.			1,261		2,647	1,035
Sorghum-Fallow	Acre			71		279	109
Grain Sorghum	Cwt.			770		3,015	1,179
Alfalfa	Acre			78		163	64
Small Grain Hay	Acre			37		78	31
Annual Grazing	Acre			49		102	40
Reseeded Cropland	Acre			108		227	89
March Feeders	Head			102		215	84
Beef Cows	Head			14		30	12
Operator Labor	Hour			2,120		2,120	1,926
Hired Labor[a]	Hour			489		2,356	263
Annual Capital[b]	Dol.			31,048		64,132	24,728
Total Capital	Dol.			37,953		78,666	30,073

APPENDIX C, TABLE I (Continued)

Item	Unit	Cotton Price and Allotment Combinations					
		P_1A	P_2A	P_3A	P_2C	P_3C	P_4C
Level Loam Soil Situation							
Total Land	Acre	37,338	1,744	840	2,048	1,022	722
Cotton	Acre	330	311	150	270	135	95
Cotton Lint	Cwt.	743	781	412	702	370	262
Wheat	Acre	8,775	410	197	481	240	170
Wheat	Bu.	201,813	9,428	4,181	11,068	5,328	3,762
Sorghum-Fallow	Acre	10,944	227	112	361	182	129
Grain Sorghum	Cwt.	133,645	2,615	1,290	4,220	2,124	1,450
Alfalfa	Acre	6,612	309	149	363	181	128
Small Grain Hay	Acre	841	39	18	46	22	16
Annual Grazing	Acre	1,278	67	31	79	38	27
Reseeded Cropland	Acre	389					
March Feeders	Head	3,462	160	73	188	91	65
Beef Cows	Head	401	18	9	21	10	7
Operator Labor	Hour	1,989	1,989	1,839	1,989	1,940	1,723
Hired Labor[a]	Hour	83,373	2,427	607	3,000	863	442
Annual Capital[b]	Dol.	1,067,218	51,991	24,115	60,077	29,316	20,598
Total Capital[b]	Dol.	1,326,588	64,599	29,813	74,490	36,144	25,336
Rolling Loam Soil Situation							
Total Land	Acre	No Solution	No Solution	3,183	No Solution	7,039	1,624
Cotton	Acre			538		880	203
Cotton Lint	Cwt.			1,377		2,346	541
Wheat	Acre			875		1,936	447
Wheat	Bu.			13,579		31,293	7,220
Sorghum-Fallow	Acre			607		1,639	378
Grain Sorghum	Cwt.			5,326		14,742	3,401
Small Grain Hay	Acre			72		164	38
Annual Grazing	Acre			97		224	52
Reseeded Cropland	Acre			298		660	152
March Feeders	Head			235		559	129
Beef Cows	Head			52		114	26
Operator Labor	Hour			1,989		1,989	1,924
Hired Labor[a]	Hour			4,121		11,303	1,345
Annual Capital[b]	Dol.			82,886		183,625	41,714
Total Capital[b]	Dol.			98,090		217,229	48,836

[a]Unskilled hired labor not included.

[b]Excludes land and building capital.

APPENDIX C, TABLE II

COMPARISON OF ESTIMATED MINIMUM REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, BASE LAND AND LABOR PRICES, INCLUDING ALL CROP AND LIVESTOCK ENTERPRISE ALTERNATIVES; SPECIFIED COTTON PRICE ALLOTMENT COMBINATIONS BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Cotton Price and Allotment Combinations					
		P_1B	P_2B	P_3B	P_4B	P_3D	P_4D
Clay Soil Situation							
Total Land	Acre	3,213	2,953	1,763	1,293	2,207	1,739
Cotton	Acre		275	164	120	113	89
Cotton Lint	Cwt.		478	285	209	196	155
Wheat	Acre	1,245	1,144	683	501	855	674
Wheat	Bu.	16,749	14,911	8,902	6,528	11,306	8,909
Oats	Acre	433	64	38	28	161	126
Oats	Bu.	8,664	1,274	761	558	3,202	2,523
Oat Hay	Acre	346	318	190	139	237	187
Annual Grazing	Acre	486	439	262	192	331	260
Fallow	Acre		68	41	30	28	22
August Feeders	Head	310	318	190	139	227	179
March Feeders	Head	436	320	191	140	266	210
Operator Labor	Hour	1,858	1,858	1,847	1,756	1,858	1,832
Hired Labor[a]	Hour	7,832	7,148	3,530	2,186	4,839	3,445
Annual Capital[b]	Dol.	140,736	123,818	73,555	53,733	94,132	73,998
Total Capital[b]	Dol.	159,538	141,392	83,678	60,954	106,906	83,881
Sandy Soil Situation							
Total Land	Acre	No Solution	No Solution	1,162	565	No Solution	1,844
Cotton	Acre			279	136		249
Cotton Lint	Cwt.			880	428		808
Wheat	Acre			122	59		198
Wheat	Bu.			1,708	830		2,882
Sorghum-Fallow	Acre			138	67		337
Grain Sorghum	Cwt.			1,494	726		3,635
Alfalfa	Acre			105	51		262
Small Grain Hay	Acre			51	25		72
Annual Grazing	Acre			66	32		94
Reseeded Cropland	Acre			147	71		261
March Feeders	Head			138	67		197
Beef Cows	Head			19	9		33
Operator Labor	Hour			2,120	1,801		2,120
Hired Labor[a]	Hour			1,091	136		2,477
Annual Capital[b]	Dol.			41,719	20,051		62,817
Total Capital[b]	Dol.			51,085	24,393		78,468

APPENDIX C, TABLE II (Continued)

Item	Unit	Cotton Price and Allotment Combinations					
		P_1B	P_2B	P_3B	P_4B	P_3D	P_4D
Level Loam Soil Situation							
Total Land	Acre	37,338	1,884	918	651	1,428	986
Cotton	Acre	330	292	142	100	122	84
Cotton Lint	Cwt.	743	745	392	274	335	231
Wheat	Acre	8,775	443	216	151	336	232
Wheat	Bu.	201,815	10,182	4,680	3,271	7,720	5,332
Sorghum-Fallow	Acre	10,945	289	143	100	297	205
Grain Sorghum	Cwt.	133,645	3,353	1,660	1,160	3,489	2,410
Alfalfa	Acre	6,612	334	163	114	253	175
Small Grain Hay	Acre	841	42	20	14	37	26
Annual Grazing	Acre	1,278	73	35	24	57	39
Reseeded Cropland	Acre	389				15	10
August Feeders	Head					8	6
March Feeders	Head	3,462	173	81	56	134	93
Beef Cows	Head	401	19	9	7	15	10
Operator Labor	Hour	1,989	1,989	1,897	1,663	1,989	1,933
Hired Labor[a]	Hour	83,373	2,690	703	345	1,663	785
Annual Capital[b]	Dol.	1,067,224	55,710	26,348	18,325	42,529	29,172
Total Capital[b]	Dol.	1,326,595	69,148	32,522	22,567	52,377	35,792
Rolling Loam Soil Situation							
Total Land	Acre	No Solution	No Solution	4,384	1,324	No Solution	3,717
Cotton	Acre			644	195		300
Cotton Lint	Cwt.			1,678	507		826
Wheat	Acre			1,206	364		1,022
Wheat	Bu.			19,095	5,768		17,606
Sorghum-Fallow	Acre			929	281		871
Grain Sorghum	Cwt.			8,258	2,494		7,836
Alfalfa	Acre						39
Small Grain Hay	Acre			100	30		92
Annual Grazing	Acre			137	41		125
Reseeded Cropland	Acre			411	124		455
March Feeders	Head			342	103		314
Beef Cows	Head			71	22		66
Operator Labor	Hour			1,989	1,883		1,989
Hired Labor[a]	Hour			6,357	923		4,963
Annual Capital[b]	Dol.			114,256	33,983		98,804
Total Capital[b]	Dol			135,190	39,808		117,486

[a]Unskilled hired labor not included.

[b]Excludes land and building capital.

APPENDIX C, TABLE III

COMPARISON OF ESTIMATED MINIMUM REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, 100 PERCENT COTTON ALLOTMENT, $26.40 COTTON PRICE, BASE LABOR PRICE, INCLUDING ALL CROP AND LIVESTOCK ENTERPRISE ALTERNATIVES; SPECIFIED LAND PRICE LEVELS BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Land Price Levels as Percent of Base			
Item	Unit	Base	Base Less 50 Percent	Base Less 100 Percent	Base Plus 50 Percent
Clay Soil Situation					
Total Land	Acre	1,763	753	528	No Solution
Cotton	Acre	164	70	49	
Cotton Lint	Cwt.	285	122	85	
Wheat	Acre	683	292	205	
Wheat	Bu.	8,902	3,801	2,667	
Oats	Acre	38	16	11	
Oats	Bu.	761	325	215	
Oat Hay	Acre	190	81	57	
Annual Grazing	Acre	262	112	79	
Fallow	Acre	41	17	12	
August Feeders	Head	190	81	57	
March Feeders	Head	191	82	57	
Operator Labor	Hour	1,847	1,652	1,495	
Hired Labor[a]	Hour	3,530	644	198	
Annual Capital[b]	Dol.	73,555	30,976	21,595	
Total Capital[b]	Dol.	83,678	34,867	24,196	
Sandy Soil Situation					
Total Land	Acre	1,162	516	377	No Solution
Cotton	Acre	279	124	90	
Cotton Lint	Cwt.	880	391	277	
Wheat	Acre	122	54	40	
Wheat	Bu.	1,708	758	554	
Sorghum-Fallow	Acre	138	61	63	
Sorghum	Cwt.	1,494	663	594	
Alfalfa	Acre	105	47	51	
Small Grain Hay	Acre	51	22	17	
Annual Grazing	Acre	66	29	22	
Reseeded Cropland	Acre	147	65	12	
March Feeders	Head	138	62	46	
Beef Cows	Head	19	9	4	
Operator Labor	Hour	2,120	1,748	1,595	
Hired Labor[a]	Hour	1,091	84		
Annual Capital[b]	Dol.	41,719	18,295	13,481	
Total Capital[b]	Dol.	51,085	22,240	16,343	

APPENDIX C, TABLE III (Continued)

Item	Unit	Land Price Levels as Percent of Base			
		Base	Base Less 50 Percent	Base Less 100 Percent	Base Plus 50 Percent
Level Loam Soil Situation					
Total Land	Acre	918	420	284	No Solution
Cotton	Acre	142	65	44	
Cotton Lint	Cwt.	392	179	121	
Wheat	Acre	216	99	67	
Wheat	Bu.	4,680	2,140	1,446	
Sorghum-Fallow	Acre	143	65	44	
Sorghum	Cwt.	1,660	759	513	
Alfalfa	Acre	163	74	50	
Small Grain Hay	Acre	20	9	6	
Annual Grazing	Acre	35	15	11	
March Feeders	Head	81	36	25	
Beef Cows	Head	9	4	3	
Operator Labor	Hour	1,897	1,475	1,241	
Hired Labor[a]	Hour	703	57		
Annual Capital[b]	Dol.	26,348	11,887	7,995	
Total Capital[b]	Dol.	32,522	14,579	9,795	
Rolling Loam Soil Situation					
Total Land	Acre	4,384	680	440	No Solution
Cotton	Acre	644	100	65	
Cotton Lint	Cwt.	1,678	260	169	
Wheat	Acre	1,206	187	121	
Wheat	Bu.	19,095	2,963	1,918	
Sorghum-Fallow	Acre	929	144	93	
Sorghum	Cwt.	8,258	1,282	829	
Small Grain Hay	Acre	100	16	10	
Annual Grazing	Acre	137	21	14	
Reseeded Cropland	Acre	411	64	41	
March Feeders	Head	342	53	34	
Beef Cows	Head	71	11	7	
Operator Labor	Hour	1,989	1,699	1,361	
Hired Labor[a]	Hour	6,357	57		
Annual Capital[b]	Dol.	114,256	17,220	11,105	
Total Capital[b]	Dol.	135,190	20,004	12,890	

[a]Unskilled hired labor not included.

[b]Excludes land and building capital.

APPENDIX C, TABLE IV

COMPARISON OF ESTIMATED MINIMUM REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, 100 PERCENT COTTON ALLOTMENT, $26.40 COTTON PRICE, BASE LABOR PRICE, EXCLUDING LIVESTOCK FEEDER ENTERPRISE; SPECIFIED LAND PRICE LEVELS BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

		Land Price Levels as Percent of Base		
Item	Unit	Base Less 50 Percent	Base	Base Plus 50 Percent
Clay Soil Situation				
Total Land	Acre	1,927	No Solution	No Solution
Cotton	Acre	179		
Cotton Lint	Cwt.	312		
Wheat	Acre	747		
Wheat	Bu.	9,729		
Oats	Acre	125		
Oats	Bu.	2,509		
Oat Hay	Acre	8		
Annual Grazing	Acre	25		
Fallow	Acre	45		
Idle Cropland	Acre	376		
Beef Cows	Head	39		
Operator Labor	Hour	1,581		
Hired Labor[a]	Hour	1,317		
Annual Capital[b]	Dol.	24,843		
Total Capital[b]	Dol.	27,741		
Sandy Soil Situation				
Total Land	Acre	676	3,504	No Solution
Cotton	Acre	162	841	
Cotton Lint	Cwt.	496	2,570	
Wheat	Acre	71	368	
Wheat	Bu.	993	5,150	
Sorghum-Fallow	Acre	47	246	
Grain Sorghum	Cwt.	511	2,652	
Alfalfa	Acre	94	487	
Small Grain Hay	Acre		2	
Reseeded Cropland	Acre	153	794	
Beef Cows	Head	18	94	
Operating Labor	Hour	1,863	2,120	
Hired Labor [a]	Hour	210	5,567	
Annual Capital[b]	Dol.	14,355	76,858	
Total Capital[b]	Dol.	19,140	104,001	

APPENDIX C, TABLE IV (Continued)

Item	Unit	Land Price Levels as Percent of Base: Base Less 50 Percent	Base	Base Plus 50 Percent
Level Loam Soil Situation				
Total Land	Acre	480	1,488	No Solution
Cotton	Acre	74	231	
Cotton Lint	Cwt.	204	634	
Wheat	Acre	113	350	
Wheat	Bu.	2,403	7,458	
Sorghum-Fallow	Acre	96	298	
Grain Sorghum	Cwt.	1,121	3,480	
Alfalfa	Acre	85	264	
Small Grain Hay	Acre			
Annual Grazing	Acre			
Reseeded Cropland	Acre	5	16	
Idle Cropland	Acre		5	
March Feeders	Head			
Beef Cows	Head	7	21	
Operator Labor	Hour	1,504	1,989	
Hired Labor[a]	Hour	85	1,607	
Annual Capital[b]	Dol.	8,153	26,083	
Total Capital[b]	Dol.	10,463	33,922	
Rolling Loam Soil Situation				
Total Land	Acre	882	No Solution	No Solution
Cotton	Acre	130		
Cotton Lint	Cwt.	338		
Wheat	Acre	243		
Wheat	Bu.	3,650		
Sorghum-Fallow	Acre	172		
Grain Sorghum	Cwt.	1,861		
Alfalfa	Acre	27		
Small Grain Hay	Acre			
Annual Grazing	Acre			
Reseeded Cropland	Acre	83		
March Feeders	Head			
Beef Cows	Head	17		
Operator Labor	Hour	1,832		
Hired Labor[a]	Hour	206		
Annual Capital[b]	Dol.	13,876		
Total Capital[b]	Dol.	16,695		

[a]Unskilled hired labor not included.

[b]Excludes land and building capital.

APPENDIX C, TABLE V

COMPARISON OF ESTIMATED MINIMUM REQUIREMENTS FOR $5,000 RETURN TO OPERATOR LABOR AND MANAGEMENT, 100 PERCENT COTTON ALLOTMENT, $26.40 COTTON PRICE, BASE LAND PRICE, INCLUDING ALL CROP AND LIVESTOCK ENTERPRISE ALTERNATIVES; SPECIFIED HIRED LABOR PRICES BY RESOURCE SITUATIONS, ROLLING PLAINS OF SOUTHWESTERN OKLAHOMA

Item	Unit	Skilled Hired Labor Prices Per Hour		
		$1.00	$1.50	$2.00
Clay Soil Situation				
Total Land	Acre	1,763	4,532	No Solution
Cotton	Acre	164	421	
Cotton Lint	Cwt.	285	733	
Wheat	Acre	683	1,756	
Wheat	Bu.	8,902	22,884	
Oats	Acre	38	502	
Oats	Bu.	761	9,013	
Oat Hay	Acre	190	157	
Annual Grazing	Acre	262	202	
Fallow	Acre	41	105	
Idle Cropland	Acre		397	
August Feeders	Head	190		
March Feeders	Head	191	504	
Beef Cow	Head		43	
Operator Labor	Hour	1,847	1,858	
Hired Labor[a]	Hour	3,530	6,836	
Annual Capital[b]	Dol.	73,555	125,643	
Total Capital[b]	Dol.	83,678	144,222	
Sandy Soil Situation				
Total Land	Acre	1,162	1,512	4,267
Cotton	Acre	279	363	1,024
Cotton Lint	Cwt.	880	1,145	3,233
Wheat	Acre	122	159	448
Wheat	Bu.	1,708	2,222	6,273
Sorghum-Fallow	Acre	139	131	167
Grain Sorghum	Cwt.	1,494	1,410	2,170
Alfalfa	Acre	105	137	386
Small Grain Hay	Acre	51	49	129
Annual Grazing	Acre	66	81	178
Reseeded Cropland	Acre	147		
Idle Cropland	Acre		262	967
March Feeders	Head	139	170	444
Beef Cows	Head	19	14	41

APPENDIX C, TABLE V (Continued)

Item	Unit	Skilled Hired Labor Prices Per Hour		
		$1.00	$1.50	$2.00
Operator Labor	Hour	2,120	2,120	2,120
Hired Labor[a]	Hour	1,091	1,473	6,858
Annual Capital[b]	Dol.	41,719	48,023	131,256
Total Capital[b]	Dol.	51,085	58,407	163,153
Level Loam Soil Situation				
Total Land	Acre	918	1,039	1,315
Cotton	Acre	142	161	204
Cotton Lint	Cwt.	392	443	560
Wheat	Acre	216	244	309
Wheat	Bu.	4,680	5,296	6,700
Sorghum-Fallow	Acre	143	162	224
Grain Sorghum	Cwt.	1,660	1,878	2,632
Alfalfa	Acre	163	184	203
Small Grain Hay	Acre	20	22	28
Annual Grazing	Acre	35	38	45
Reseeded Cropland	Acre			
Idle Cropland	Acre			14
March Feeders	Head	81	91	116
Beef Cows	Head	9	11	14
Operator Labor	Hour	1,897	1,945	1,989
Hired Labor[a]	Hour	703	913	1,372
Annual Capital[b]	Dol.	26,348	30,107	38,070
Total Capital[b]	Dol.	32,522	37,381	47,256
Rolling Loam Soil Situation				
Total Land	Acre	4,384		
Cotton	Acre	644		
Cotton Lint	Cwt.	1,678		
Wheat	Acre	1,206	No Solution	No Solution
Wheat	Bu.	19,095		
Sorghum-Fallow	Acre	929		
Grain Sorghum	Cwt.	8,258		
Alfalfa	Acre			
Small Grain Hay	Acre	100		
Annual Grazing	Acre	411		
March Feeders	Head	342		
Beef Cows	Head	71		
Operator Labor	Hour	1,989		
Hired Labor[a]	Hour	6,357		
Annual Capital[b]	Dol.	114,256		
Total Capital[b]	Dol.	135,190		

[a]Unskilled hired labor not included.

[b]Excludes land and building capital.