THE EFFECTS OF VARIOUS WAGE RATES ON FARM

ORGANIZATION AND STRUCTURE IN

SOUTHWEST VIRGINIA--A STUDY MINIMIZING AVERAGE OUTLAY

WHEN OBTAINING SPECIFIED INCOME LEVELS

by

William Dale Givan

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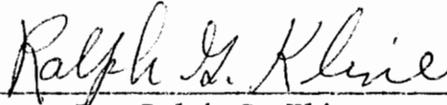
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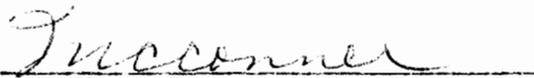
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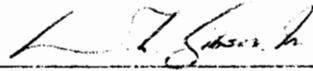APPROVED:

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Chairman, Dr. Ralph G. Kline

_____
Dr. M. C. Conner

_____
Dr. Thomas E. Snider

_____
Mr. R. Lee Chambliss, Jr.

_____
Dr. W. L. Gibson, Jr.
Acting Department Head

December, 1968

Blacksburg, Virginia

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CHAPTER I

INTRODUCTION

Statement of the Problem

According to the 1964 Census of Agriculture, 40 percent of all rural farm families in the United States had annual incomes of less than $2,500. Low net farm income, or underemployment of labor in farming exists when the real return received from the use of labor is less than the real return received for comparable resource services in other uses. Underemployment of labor in farming is almost always associated with restricted amounts of land and/or capital.

Underemployment of labor effects both the individual and society. The characteristics of various degrees of ability and training of individuals are usually distinguished by varying wage rates. In a full employment economy one should obtain a return to his labor and management in farming equal to the return to similar labor in non-farm employment. From the standpoint of society, efficient resource use is necessary for optimum production and growth in the economy. The maximum efficiency level is, in general, attainable only when the marginal value productivity of all resources is equal among all the various uses of the resources.

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Farming in Southwest Virginia presents a typical problem of under-employment of labor.[1] This area is mostly rural and contains approximately 11,000 farms, of which 75 percent have less than 30 acres of cropland. Operators of the smaller farms have difficulties conducting farming operations of a magnitude sufficient to enable them to have a labor income comparable to that of non-farm workers in this locality.[2] In 1964, approximately 70 percent of all farms in the area had less than $2,000 gross sales of all farm products.[3]

A recent farm adjustment study in this area indicates that a labor income in excess of $2,500 cannot be achieved on a representative farm of 17 acres cropland and 23 acres of pasture even when a high level of management is assumed. These results take into effect a sale price of tobacco of $0.672 per pound, and a wage rate of $1.00 an hour for hired labor. Farms of this size and smaller compose 76 percent of all farms in this area. Further analysis indicated that a farm with 55 acres of cropland and 85 acres of pasture has sufficient

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[1] In this study the area of Southwest Virginia consists of the counties of Lee, Russell, Scott, Smyth, and Washington.

[2] William Givan and Ralph Kline, Adjustment Opportunities on Farms Raising Burley Tobacco in Southwest Virginia, Division of Research, Virginia Polytechnic Institute and Farm Production Economics Division, Economic Research Service, U. S. Department of Agriculture, Unpublished Manuscript.

[3] United States Census of Agriculture, 1964, U. S. Department of Commerce, Bureau of the Census, Vol. 1, Part 24, Virginia.

land to achieve an operator labor income of approximately $8,000. A farm with 180 acres of cropland and 230 acres of pasture has the land resources to achieve an operator labor income of approximately $18,000 using these same assumptions. This latter size farm, however, is representative of only three percent of all farms in the area. The smaller farm operators are apparently faced with a lack of resources for farming that will permit earning an income level which will permit an acceptable standard of living.

Over 90 percent of the burley tobacco production in Virginia is produced in Southwest Virginia, and accounts for approximately 80 percent of the receipts from crop sales and approximately 40 percent of the receipts from total farm sales in this area. Tobacco is a labor intensive crop, requiring relatively large amounts of labor during specific seasons of the year. Currently large quantities of labor must be hired at local wage rates to help produce this crop.

Recent federal legislation requires that farmers must pay a minimum hourly wage to all hired employees if they have used 500 man days or more in any calendar quarter in 1966. The level of this minimum wage is scheduled to rise in following years. This legislation will apply to many farmers in this area. Even though an individual farmer may not be required to pay the minimum wage rate because of the size of his operation, he will have to compete with non-farm employment for hired workers. An expansion of industry in this area has provided off-farm jobs for the labor force in the area, and farm laborers can demand an hourly wage rate comparable to that offered

by non-farm industry. The farm operator is presently faced with rising labor costs, and these costs will continue to rise in the future.

Emphasis is currently being placed by policymakers on levels of family income that will enable families to enjoy a satisfactory level of living. With the majority of farms in the study area lacking the potential to reach this income level with their present resources, and with the total amount of the land in the area fixed, problems of distributing land and obtaining additional resources arise. The number of farms would of necessity decrease if all farms should adjust to reach these income levels.

When the price of a production input increases, it is often replaced by some other input. An increase in wage rates increases farm operators' production costs. This may cause them to change their combination of enterprises in order to reduce the labor required, if possible, and to utilize other inputs which may replace labor. The effect of higher wage rates on the number of farm units and size distribution should all farms adjust their size to attain a specified income level will be determined.

Objectives

The overall objective of this study is to determine the effects of various wage rates on the minimum amounts of resources needed to obtain specified income levels on farms in Southwest Virginia, and the aggregate effects of these wage rates on the structure and organization of farms in this area. More specifically, the objectives are:

(1) To determine the optimum organization of enterprises and resources required to obtain farm operator incomes equal to wage levels of semi-skilled, skilled, and highly skilled non-farm employees in the area of study.

(2) To determine the effects of wage rates of hired farm labor on resources required and enterprise combinations when obtaining these income levels.

(3) To determine the number of farms that could exist under varying wage rates if all farms below the minimum size required to reach the specified income levels were enlarged to the minimum size.

(4) To determine the aggregate production of crops and live-stock on the farms in this area when specified operator income levels are obtained by all farms.

(5) To determine the aggregate amounts of hired labor and related resources that would be demanded by all farms in this area when specified operator incomes are obtained.

Description of the Area

The area under study located in the extreme Southwest portion of Virginia bordering Tennessee and Kentucky, is composed mostly of tobacco, livestock, and general farms (Figure 1.1). The counties included are Lee, Scott, Smyth, Russell, and Washington. It is described as an agricultural section of the state. The major crops grown in the area are burley tobacco, corn, and mixed hay. Traditionally, this has been a livestock-burley tobacco producing area. Most of the feeds grown are consumed by livestock on farms in the area.

In 1964, there were slightly over 10,000 farms in this area.[4] One-half of these had less than 50 acres total land, and 70 percent had less than 100 acres total land. Tobacco farms (being defined as farms on which 50 percent or more of the total income is from tobacco) made up 26 percent of the farms. Those farms termed miscellaneous and unclassified made up 60 percent of all farms. The average annual value of products sold from all farms was $2,550.

Slightly over one-half of all farms were classified as commercial farms. Fifty-eight percent of these farms sold farm products valued at $50-$2,499, while only one percent had sales of farm products valued more than $40,000.

The topography of the area consists almost entirely of Limestone Valley and Mountain Upland areas. Most of the intensive farming is done in small areas along streams on heavy textured soils developed over limestone. The mountain and upland area is underlain by sandstone and shale and is most frequently used for livestock farming. The elevation of tillable land varies from 1,500 feet to 2,400 feet with some mountain ranges approximately 4,000 feet above sea level.

The growing season for the area is between late April and mid-October, approximately 170 days. Annual rainfall averages approximately 45 inches with 23 inches falling from April through September.

In 1960 there were 164,213 people living in this five-county area and the independent city of Bristol, which is the largest city in

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[4] United States Census of Agriculture, 1964, U. S. Department of Commerce, Bureau of the Census, Vol. 1, Part 2, Virginia.

Figure 1.1. Study Area of Southwest Virginia.

the area with a population of slightly over 17,000 residents.[5] Only

one other city has over 5,000 residents, Marion in Smyth County, with

a population of 8,385. Eighty percent of the total population is

classified as rural, with 29 percent classified as rural farm and

51 percent classified as rural non-farm. Of the total rural male

population, 31 percent were classified as farm operators, managers,

or laborers. The average age of all farm operators was 54.3 years.

Forty percent of the operators reported some off-farm employment

during the year, and 30 percent reported working more than 100 days

annually off the farm.

Review of Literature

Farm adjustment studies with the objective of profit maximization

are numerous. The theory of the firm based on profit maximization

has been criticized, however, on the basis that: (1) the theory

does not have enough (or the right) variables in it, and (2) that

the principle of maximization itself is not an accurate account of

human behavior.[6] With doubts about profit maximization being an

accurate, or sufficient measure of human behavior, other goals have

been offered as criteria. One of these is to attain a specific income

while minimizing various types of resources.

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[5] United States Census of Population, 1960, Virginia, General Social and Economic Characteristics, U. S. Department of Commerce, Bureau of the Census, PC(1)--48C, Va.

[6] Kenneth Boulding, "The Impact on General Economics of More Realistic Theories of the Firm," Econometrica, July 1952, p. 483.

Previous work on studies of resource minimization to attain specified farm income levels has been limited. Only in the last 15 years has major attention been focused on this problem. A century ago it was thought that access to land and to knowledge would solve the income problem of rural people. In the 1920's the focus was on commodity price and markets, and cooperatives were advocated. In the 1950's the futility of achieving prosperity through commodity prices for those who had little to sell was generally recognized. When most people lived near the subsistence level, little attention was given to incomes, but when most people are above these margins, those who remain at low levels are cause for concern.

It is recognized that one of the factors contributing to the low income problem in agriculture is that of lack of various resources on the farm. This lack of resources has prompted the concern of how these limited resources can be organized in order for the farm operator to obtain an income comparable to that of non-farm workers. This has prompted resource minimization studies.

Analyses emphasizing the minimization of farm resources as a criterion of obtaining specified operator income levels was first conducted by Brewster.[7] His study involved an analysis of the farm resources needed to obtain certain income levels for specified types of farms in various locations in the United States. He indicated

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7/ 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.

what investment, land, and labor in addition to operator's labor

was required to reach these income levels. In particular, he

defined the problem of resource minimization, and set up a method-

ological framework for making further studies of this type.

Most of the minimization studies relating to farm organization

have used land as a minimization criterion in a linear programming

model. One of the first studies using this criterion was by Plaxico

and Goodwin[8] constituting a study of minimum resource requirements

for specified income levels in certain areas of Oklahoma, Arkansas,

Mississippi, Louisiana, and North Carolina. This study contributed

a model and basic assumptions on which several studies involving the

minimization of land were done. This criterion (land) was minimized

for it was believed that land investment is the largest proportion

of the total capital requirement, so that minimizing the capital re-

quirement and minimizing land should give almost identical solutions.

It was felt that within the study areas the labor supply was ample,

therefore, minimizing the labor requirement did not seem to be as

important as minimizing other, more scarce resources. A study by

Strickland, Plaxico, and Lagrone[9] conducted in Oklahoma was a study

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8/ James S. Plaxico and John W. Goodwin, "Adjustment for
Efficient Organization of Southern Farms," Summary of Papers Pre-
sented at a Seminar for Southern Agricultural Leaders, Agricultural
Policy Institute, North Carolina State College, Raleigh, North
Carolina, January 1961.

9/ Percy L. Strickland, Jr., James S. Plaxico, and William F.
Lagrone, Minimum Land Requirements and Adjustments For Specified
Income Levels, Southwestern Oklahoma, Oklahoma State University and
U. S. Department of Agriculture, May 1963.

of this type. Results indicated that when no purchase of feed is allowed, some land would have to be purchased by as many as one-half of the farmers in the study area to permit them to realize an annual net income of $3,000. These farms do not have sufficient land to permit them to earn an income of this level.

Many studies followed using the same minimization criterion. McArthur, Brodnax and Saunders[10] conducted a study in the Southwest Coastal Plain Area of Georgia in which land requirements were minimized under alternative cotton price-allotment situations. Cotton was shown to be a relatively profitable enterprise. This study indicated that an inverse relationship exists between capital and labor requirements, and between the level of cotton prices and acreage allotments. Another study minimizing land was done by Jones, Strickland, and Partenheimer[11] in Alabama. This study indicated that the value of land had little effect on the minimum resource requirement. When hogs, steers, and selling hay were not considered as activities, the minimum land requirements increased approximately 83 percent. Each of these studies used minimum land as a criterion as all apparently agreed that land is an appropriate resource to minimize to determine resources to give specified income levels.

10/ W. C. McArthur, Henry D. Brodnax, and Fred B. Saunders, Minimum Land Requirements for Specified Income for General Crop-Livestock Farms, Southwest Coastal Plain Area, Georgia, University of Georgia, College of Agriculture and U. S. Department of Agriculture, Bulletin N. S. 178, December 1966.

11/ Gary C. Jones, P. L. Strickland, Jr., and Earl J. Partenheimer, Minimum Open Land Requirements for $5,000 Farm Income, Wiregrass Area, Alabama, Agricultural Experiment Station of Auburn University and U. S. Department of Agriculture, Agricultural Economics Series 6, July 1965.

A study by Ou[12] of an area in Southside Virginia indicated that minimization criteria other than land might be more appropriate for specific situations. In this study, both land and annual costs were minimized. The results indicated that, although land required was significantly more, and initial investment somewhat higher, annual costs were considerably less for a specific income when minimizing annual cost than when minimizing acres of land purchased. It would generally appear feasible to use the annual cost criterion of size when sufficient land in a contiguous unit can be obtained at the land price indicated in the study, $250 per acre, rather than the land purchased minimization criterion. However, should the price of land greatly exceed the price used in the study, or the farmer have a limited amount of funds available for capital investment, the minimum land criterion may be a more desirable criterion.

Minimization criteria other than land were used in a study of farms in Northeastern Virginia by Huddleston.[13] Land, average outlay, and initial investment were each respectively minimized. Results indicate that when only land-based enterprises were considered, almost identical results were obtained for all specified income levels, when

12/ Bor Ming Ou, "Minimum Resource Requirement and Optimum Enterprise Combinations for Specified Incomes for Flue-Cured Tobacco Areas of Virginia," Unpublished M.S. Thesis, Virginia Polytechnic Institute, July 1966.

13/ John S. Huddleston, "Minimum Resource Requirements and Related Optimum Enterprise Combinations for Specified Income Levels for the Cash-Grain Area of Northeastern Virginia," Unpublished M.S. Thesis, Virginia Polytechnic Institute, August 1966.

each of the three minimization criteria was used. When livestock
enterprises were considered, additional land was purchased when
average outlay was minimized, and initial investment was higher.
Large quantities of labor were required when land and initial invest-
ment were minimized. It appears that minimizing average outlay gives
results more nearly consistent with those being carried on in terms
of enterprise combinations by the more successful farmers in the
study area. This would suggest that minimizing the average outlay
criterion is a more realistic explanation of present farmers' behavior
than minimizing land.

Although farmers hire substantial amounts of labor, particularly
those farmers who produce labor-intensive commodities, they have not
been directly affected by minimum wage levels until the passage of the
Fair Labor Standards Act of 1966. Prior to this legislation small
(local) retail shops, services, and agriculture were excluded from the
requirement for paying minimum wages.

The first minimum wage law in the United States was passed in
Massachusetts in 1912.[14] The first federal legislation with general
coverage was included in the National Industrial Recovery Act of 1933.
This required a minimum wage for adult males, women, and children to
be paid by firms in industry which participated in this program.
This allowed these firms some freedom from competitive pressures.

14/ Arthur D. Butler, Labor Economics and Institutions, The
Macmillan Company, New York, 1961, p. 390.

This act was declared unconstitutional, and the Fair Labor Standards
Act of 1938 was passed setting a minimum wage of $0.25 per hour. This
was amended in 1949, raising the minimum to $0.75 per hour, and again
in 1955, raising the minimum to $1.00 per hour, effective in 1956.
These benefits were extended to agricultural workers by legislation
in 1966, setting a minimum wage of $1.00 per hour in 1967, with $1.15
becoming effective in 1968, and $1.30 per hour in 1969.

Of the studies previously discussed, only the ones by McArthur,
Jones, and Strickland, respectively, contained any analysis of the
effect of various wage rates on the criterion minimized, and other
resources required for various income levels. The studies by McArthur,
and Jones contained an analysis with wage rates of both 50 and 100
percent of the base wage price. The farm organizations of the base
situations in both studies required only small amounts of hired labor.
Increasing the labor price, therefore, had little effect on the
minimum land requirements to produce specified farm operator incomes.
The optimum organizations remained almost unchanged with changes in
wage rates. The study by Strickland indicated that if the productivity
of land is so low that large quantities of land must be purchased to
reach some income level, and this additional land greatly increases
the requirement for hired labor, then changes in the price of hired
labor can significantly affect the minimum resource requirements at
the same income level. In more productive soils, however, where little
additional land is required, and, in turn, little hired labor is re-
quired, increasing the hired labor price affected resource requirements

only slightly. In each of these three studies, no crop required labor at a rate of intensity similar to that of burley tobacco.

Some of the effects of various labor prices on the individual farm were determined from a profit maximization study conducted by Kline in Southside Virginia.[15] His results indicate that when Grade-A dairy is considered as an enterprise possibility, production of flue-cured tobacco on large farms is not profitable when the hourly wage rate is increased from $0.90 to $1.35 and the sale price of tobacco is at its 1963 level. Further research of this project indicates that the aggregate supply of flue-cured tobacco would be relatively unresponsive to price changes when the price of labor is $1.35 per hour (as compared to $0.90 per hour) and no restrictions are present on acreage allotments.

Maier[16] in a theoretical analysis indicates that the answer to an increase in farm wages is to substitute capital for labor. He indicated, however, that some regions may be vulnerable to increased rates for hired labor. This is the case where an area is capable of producing only one important farm crop but cannot adopt labor-saving mechanization made profitable by a rise in wage rates. The incidence of increasing wage costs will fall most heavily on non-mechanized

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15/ Ralph G. Kline, Economics of Adjustment For Large Flue-Cured Tobacco Farms, Southside Virginia, Division of Research, Virginia Polytechnic Institute, Unpublished Manuscript.

16/ Frank H. Maier, "The Incidence of Increasing Wage Costs in Farm Production," Journal of Farm Economics, Vol. XLIII, December 1961, pp. 1193-1200.

labor intensive operations and will be reflected in lower returns to land, fixed capital, family labor, and management. He then theorizes that output of labor-intensive products will fall in the long run, with the remaining output produced by small-scale family type farms. Where mechanization can be adopted, he feels that the small inefficient farming units too small to avail themselves of expansion and mechanization will be driven out of production.

Other studies of labor in farming and how it can be replaced by other inputs have been conducted. Most of these are studies at the aggregate level rather than considering the effects on the individual farm when specific inputs are substituted for labor.

A cost minimization study was conducted by Tyner and Tweeten[17] to show the economically optimum level and combination of aggregate resources in agriculture. This study indicated that two-fifths of the total U. S. agricultural labor was estimated to be in excess supply in the 1952-1961 period. The analysis indicated that a higher level of investment in machinery, increased operating expenditures for machinery, and about a doubling of the real estate input allowed a halving of the labor force to produce the 1952-1961 agricultural output at minimum cost using the aggregate production function of that period. With real estate fixed and labor priced at 85 percent

17/ Fred H. Tyner and Luther G. Tweeten, "Optimum Resource Allocation in U. S. Agriculture," Journal of Farm Economics, Vol. 48, August 1966, pp. 613-631.

of the non-farm rate, a labor reduction of 35 percent and increases

in machinery stock, machinery operating expense, and miscellaneous

operating expenses of 28, 49, and 34 percent, respectively, would

have produced the average 1952-1961 output at the minimum cost to

farmers.

Results of a study by Johnson[18] indicate if there is a particular

disequilibrium in the use of resource, and if some or all inputs other

than labor have a value of marginal product in excess of their supply

price, output may be increased as a result of an increase in quanti-

ties of non-labor inputs while the quantity of labor used remains

constant or is reduced. This would tend to indicate that output

need not to be reduced absolutely as a result of a labor outflow

from agriculture in order for an increase in real labor earnings to

occur.

None of the studies discussed here attempted to determine the

aggregate farm output and quantities of labor demanded by use of an

individual firm analysis and aggregating these firms for an entire

area. Studies estimating the total labor demanded were based on the

assumptions that certain non-labor inputs could and would be sub-

stituted for labor. Only one study, a theoretical analysis by Maier,

considered areas where labor intensive crops are produced, and

mechanization cannot be carried on in the production of these crops.

18/ D. Gale Johnson, "Output and Income Effects of Reducing
the Farm Labor Force," Journal of Farm Economics, Vol. XLIL,
November, 1960, pp. 779-796.

The land minimization studies were an attempt to minimize an input which would be a realistic criterion by which farming decisions are actually made. None of these studies were in areas of labor-intensive crops, such as burley tobacco, and some doubt has been cast on the validity of this criterion where the land is farmed more intensively.

The introduction of the concept of minimizing average outlay has provided a criterion presumed to be superior in cases of labor intensive farming. This criterion, therefore, is used as an attempt to determine the basis for decision making should individual farmers in the area of study attempt to reach one of the income levels specified as wage rates vary. This will form a basis for estimating the aggregate effect on the structure of farming in the study area.

CHAPTER II

DESIGN OF THE STUDY

The operational models for this analysis are developed within

the general framework of the linear programming technique. The

purpose of the analysis is to determine from the array of alter-

natives what changes, if any, should be made in the organization

of a farm at a particular point in time in order to be consistent

with the objectives of that farm's managerial unit over subsequent

production periods, and to determine the aggregate effects of these

changes on farm structure in the study area. The economic time

concept, however, is nebulous when used in the aggregative or macro

analysis. Reorganization requiring construction and equipping of

a new set of buildings will take more time to accomplish than a

reorganization such as changing the composition of a ration. How-

ever, this is not the type of time consideration that is of main

concern in a normative analysis of optimum farm organization from

the standpoint of profit maximization or some other criterion on

which decisions are based. On an aggregative basis, long-run,

intermediate-run, and short-run decisions are being made by farmers

at any point in calendar time.

Theoretical Concepts

A firm is a technical unit in which commodities or services are

produced. An enterpreneur transforms inputs into outputs subject to

the technical restraints specified by his production function. The difference between his revenue from the sale of outputs and the cost of his inputs is his profit if positive, or his loss if negative.

The entrepreneur's production function gives mathematical expression to the relationship between the quantities of inputs he employs and the quantity of output he produces. A production process in which two variable inputs and one or more fixed inputs are utilized to produce a single output may be expressed as:

(1) $Y = f(X_1, X_2/X_3)$

and is defined where

Y = output

X_1 = variable input

X_2 = variable input

X_3 = fixed inputs.

The total cost of production (c) may be represented as:

(2) $C = P_{x1}X_1 + P_{x2}X_2 + b$

where P_{x1} and P_{x2} are the respective prices of X_1 and X_2 and b is the cost of the fixed inputs.

To minimize the cost of producing a prescribed level of output in a market where perfect knowledge of prices and production coefficients exists, the cost function (2) is minimized subject to the production function (1). The cost for producing a prescribed output with two variable inputs is minimized where the ratio of the marginal

products is equal to that of the two input prices in a perfectly com-
petitive market, or

(3)
$$\frac{MPP_{x1}}{MPP_{x2}} = \frac{P_{x1}}{P_{x2}}.$$

This condition is a necessary condition for cost minimization but
not a sufficient condition. In order for all conditions to be present
which insure this minimization, the rate of change of the slope of the
tangent to an isoquant must be positive at the point of tangency with
an iso-cost line, or at the point of tangency, the isoquant is convex
from below.[1]

In instances where a firm has both multiple outputs as well as
multiple inputs, the conditions for cost minimization are that

(4)
$$\frac{MPP_{x1}}{P_{x1}} = \frac{MPP_{x2}}{P_{x2}} = \ldots = \frac{MPP_{xn}}{P_{xn}}.$$

This type of analysis depends on being able to differentiate the pro-
duction revenue, and cost functions with respect to each input and
output independently. This procedure involves no direct means of
obtaining the optimum, and has operational significance only when
corresponding variations of values are possible. When many production
factors are used by a firm when producing multiple products, linear
programming is an efficient model to obtain a numerical solution to
optimum resource use once the necessary information of resources, pro-
ducts, and production processes is available to the firm. The general

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[1] James M. Henderson and Richard E. Quandt, Microeconomic
Theory, McGraw-Hill Book, Co., New York, 1958, p. 51.

case of a firm producing $\underline{n}$ products with $\underline{m}$ fixed factors is to select the combination of activities that will create a minimum cost subject to the set of linear inequalities which specify that no more than 100 percent of any fixed factor can be used. In addition, no activity can be at a negative level.

The case of cost minimization using two variable input factors and one output is illustrated in Figure 2.1. The highest possible output is obtained where the price ratio line is tangent to the highest possible iso-product curve -- i.e., the slopes of the two lines are equal. In this case (Figure 2.1), costs are at a minimum with X_{2a} units of X_2 and X_{1a} units of X_1 for an output of Y_1 when the price of X_2 is P_{x2} per unit and the price of X_1 is P_{x1} per unit. In a similar manner for an output of Y_2, costs are minimized when X_{2b} units of X_2 and X_{1b} units of X_1 are used. Lines OF and OG are ridge lines. The OF ridge line shows the point where further increases in the use of X_1 will require the same or larger quantities of X_2 to produce the same output. Thus, the ridge lines show the boundary between those combinations of X_1 and X_2 which would rationally be selected. Line OB shows the points where costs are minimized for various levels of output, or where the ratios of the marginal physical products are equal to the ratios of the prices of the inputs for given levels of expenditures and output.
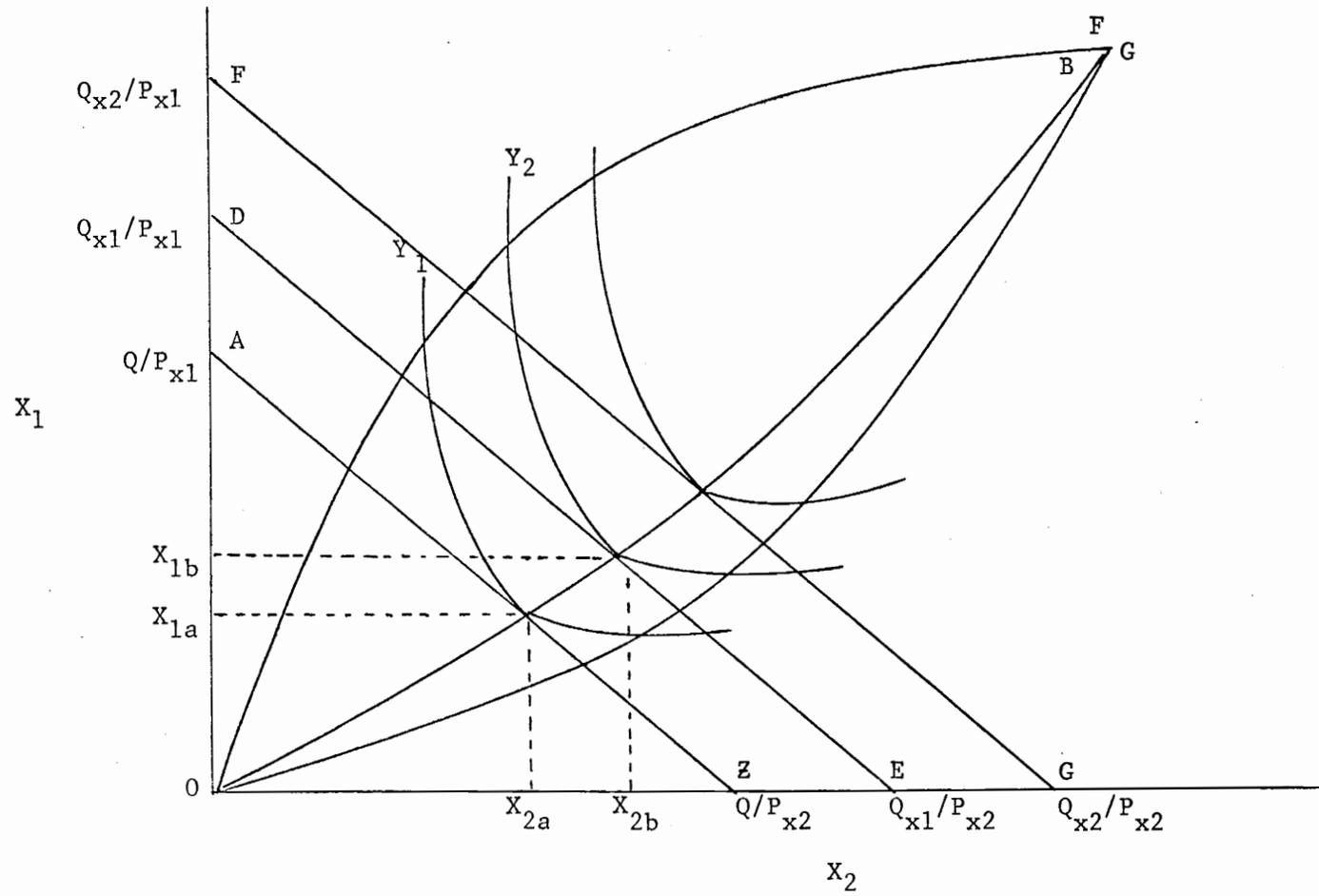
Figure 2.1. Illustration of the Minimization Criterion.

To the firm, labor is a factor of production, a cost, and is demanded (as a general rule) not because the work to be done is desired for and by itself, but because it is to be used in the production of some other item which is directly desired. Wages are the price of labor, and in the absence of control, are determined, like all prices, by supply and demand.

In a perfectly competitive market with labor the only variable factor of production, there are two conditions necessary for equilibrium. The first condition is that the wages of laborers of equal efficiency are equalized in different occupations (allowance being made for other advantages or disadvantages of employment).

The second condition for equilibrium in this type market is a wage which equals the value of the marginal product (or marginal revenue product) of the laborers. The amount which an additional worker adds to the total revenue of a firm is referred to as the marginal revenue product. The employer's demand curve for labor in this type of market is the marginal revenue product curve. With the demand for labor of each employer being determined by this method, the total demand of all employers is determined from it by addition. Since at equilibrium it is necessary that the total demand should equal the total supply, the wage must be that which just enables the total number of laborers available to be employed.

The demand curve for a factor of production of an individual firm seeking to maximize profit is no longer the value of the marginal product curve (marginal revenue product) when a firm uses more than

one variable resource.[2/] When several variable resources are used

by the firm, a change in the price of one variable (labor), will bring

about changes in the quantities used of other resources, and these

changes will in turn affect the utilization of the one resource as

the firm attempts to maximize profits and to re-establish a least-cost

combination of resources.

An illustration of this is shown in Figure 2.2. With price P_1,

for factor A, a firm has the marginal revenue product of product A

(MRP_{A1}) and uses amount A_1. With price P_2, MRP_{A2} exists, and quantity

A_2 is employed. Points X and Y are points on the firm's demand curve

for resource A. These points show the quantities of A which the firm

would take at various prices of A, holding the prices of other resources

constant and when the quantities of all other resources are adjusted

appropriately for each price of A.

A first approximation of the market demand curve for a resource is

the horizontal summation of individual firm demand curves for the re-

source. This is based on the assumption that the price of all other

inputs will remain constant and any change in production of the firm

will continue to sell at the same price.

The equilibrium labor market, however, can never exist. Imper-

fection in the market prevents this from occurring. Exploitation based

on worker immobility has occurred. Collective bargaining is one form

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2/ Richard H. Leftwich, The Price System and Resource Allocation,
Holt, Rinehart, and Winston, New York, February 1955, p. 286.

Price
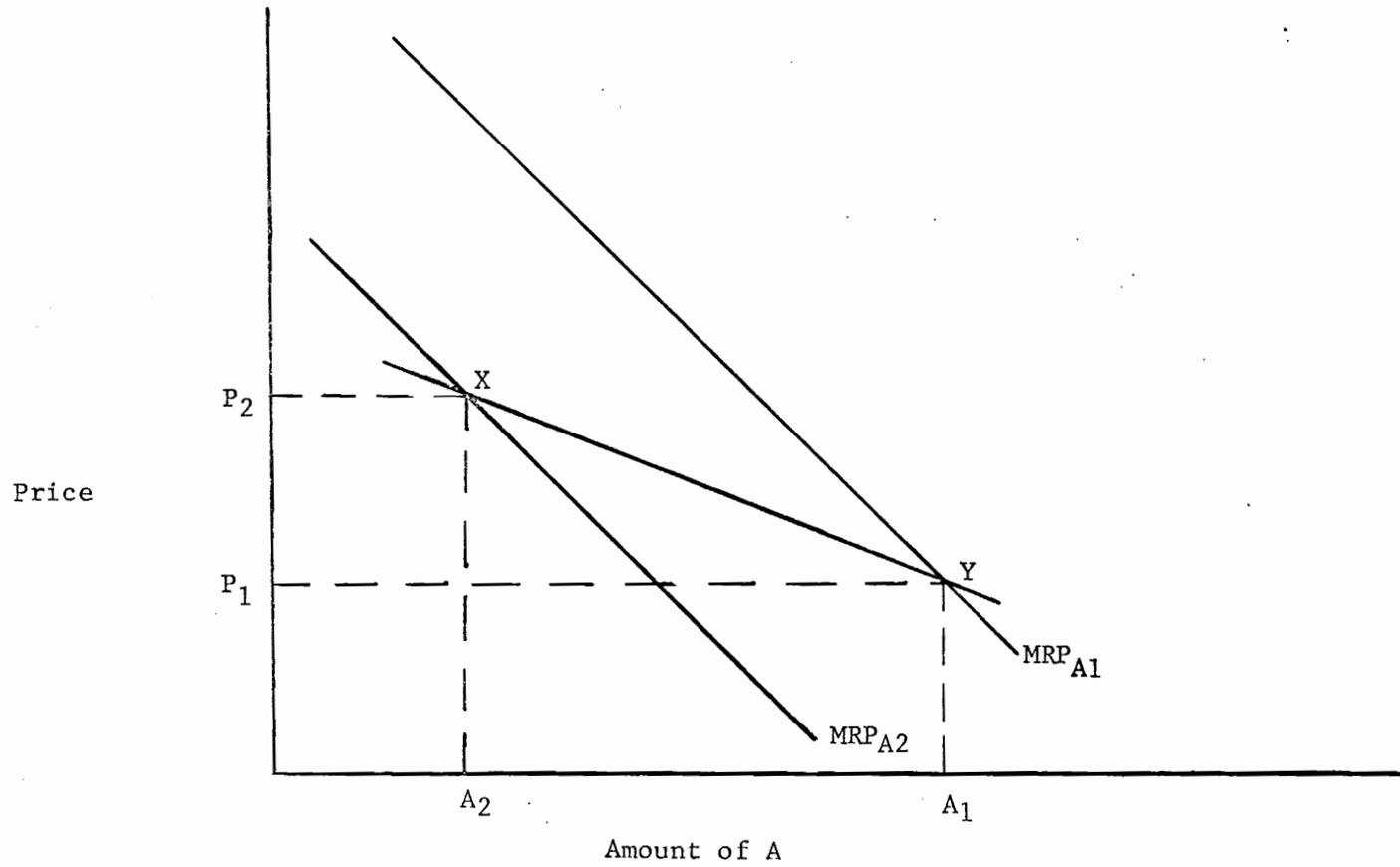
Figure 2.2. Demand Curve of a Firm For Input A, When the Firm Uses Several Variable Inputs.

of interference. The other kind of intervention is legislation which establishes a minimum hourly rate of pay, with the employees to be covered determined by a process either of inclusion or exclusion.

Because of the nature of the model constructed for this study, the demand curve of the firm for hired seasonal labor may not necessarily be of the type illustrated in Figure 2.2. A linear programming model is used which permits the determination of resources (especially labor) required to maintain specified operator labor income levels. Consider the inequality

(5) $A_{m1}Q_1 + A_{m2}Q_2 + \ldots - A_{mn}Q_n \geq b_m$

which states that the amount of income produced by activities Q_1, $Q_2\text{-----}Q_n$ is equal to or greater than a specified income level, b_m. If the activity A_{mn} represents the cost of hiring labor, and this cost increases by some positive amount, then the activities Q_1 and Q_2 must increase gross income in order for the net income level, b_m, to be achieved. As a result, if labor cannot be replaced by non-labor inputs, or if enterprises requiring less labor are not profitable relative to enterprises requiring more labor, the amount of labor hired will increase when the price of labor increases, when a specified net income level is attained.

Whether or not the aggregate demand for hired labor by all farmers in the area, after they achieve an income level by adjustment, increases or decreases with an increase in labor price depends on how fast the amount of labor demanded by the individual farm increases in relation to the decrease in the number of farms in the area after an adjustment occurs.

Operational Procedures

To obtain the alternatives of the farm firm and determine the amounts of labor required at various wage rates, a linear programming model is used. This model minimizes an objective function subject to a set of linear constraints. This can be expressed mathematically as: Minimize the objective function

(6) $f = P_1Q_1 + P_2Q_2 + \ldots + P_nQ_n$

subject to:

(7) $A_{11}Q_1 + A_{12}Q_2 + \ldots A_{1n}Q_n \leq b_1$

$A_{21}Q_1 + A_{22}Q_2 + \ldots A_{2n}Q_n \leq b_2$

$A_{31}Q_1 + A_{32}Q_2 + \ldots A_{3n}Q_n \leq b_3$

$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

$A_{m1}Q_1 + A_{m2}Q_2 + \ldots A_{mn}Q_n \geq b_m$

(8) $Q_i \geq 0$ (i = 1, 2, ... n)

where P_j, b_i, and A_{ij} are known constants. The first inequality in (7) assures that the amount of land used by activities does not exceed the amount supplied. The second equation assures that the amount of labor used by activities does not exceed the amount of labor supplied. The third inequality states that the amount of resources required by an activity cannot be greater than the amount supplied by other activities. The fourth inequality assures that the amount of income produced by the activities must be equal to the amount specified. The inequality in (8) assures that no enterprise may be produced at a negative level.

The approach is to seek to minimize the objective function of a farm for the immediate production period, because the results that can be achieved in subsequent production periods will depend in part upon how effectively the farm is organized in the preceeding production periods. The model is cast in terms of a calendar year, even when considering the purchase and/or sale of resources of widely different lengths of useful life. The costs of multiple-period resources, however, must be prorated over the series of production periods in which their services are available.

If all resources were variable and there were perfect knowledge of prices and production coefficients, minimizing total cost would be the best criterion for this type of study. With a given set of prices and knowledge of isoquants, an expansion path could be derived which would permit the highest income level to be obtained with a fixed amount of money to be spent on resources. However, perfect knowledge of prices and production does not exist. Therefore, some reservation exists as to the reliability of using the minimum total cost criterion, for the individual firm is not operating in a purely competitive economy where no one firm can not affect input or product prices, or output.

As this reservation exists, some criterion is needed that will approach the expansion path (line OB) in Figure 2.1. A study by Huddleston[3] evaluating different minimization criteria indicates that

3/ John S. Huddleston, "Minimum Resource Requirements and Related Optimum Enterprise Combinations for Specified Income Levels for the Cash-Grain Area of Northeastern Virginia," Unpublished M. S. Thesis, Virginia Polytechnic Institute, August 1966.

minimizing average outlay gives results nearly consistent with those being carried on in terms of enterprise combinations by the more successful farmers in the study area. This criterion is a measure of annual production capital plus interest, plus compound interest cost on initial investment as an opportunity cost involved when making a long-term investment.

As average outlay consists of two types of capital; it is calculated in two parts. Annual production capital plus interest is obtained as follows:

$$(9) \quad P = \frac{C}{T} (1 + i)$$

where P = annual production capital

    C = total production capital

    T = times turnover per year

    i = rate of interest per annum.

Initial investment plus compound interest is obtained as follows:

$$(10) \quad C = I (1 + i)^n$$

where C = compounded investment

    I = initial investment

    i = rate of interest per annum

    n = median year of life expectancy.

A median year of life expectancy is used because a point in time is under consideration.

Once the unique solution for each representative farm was obtained for each income level at each labor price, a linear programming model was constructed that would determine the size and number of farms in

the area that would maximize total operator profit for the entire area.
A model was constructed for each labor price for the three income levels.
The model may be expressed as:

Maximize the objective function

(11) $f = F_1Q_1 + F_2Q_2 + F_3Q_3$

subject to:

$$(12) \quad A_{11} \quad + 0 \quad + 0 \quad \leq b_1$$

$$0 \quad + A_{21} \quad + 0 \quad \leq b_2$$

$$0 \quad + 0 \quad + A_{33} \quad \leq b_3$$

$$A_{41}Q_1 + A_{42}Q_2 + A_{43}Q_3 \leq b_4$$

$$A_{51}Q_1 + A_{52}Q_2 + A_{53}Q_3 \leq b_5$$

$$A_{61}Q_1 + A_{62}Q_3 + A_{63}Q_3 \leq b_6$$

(13) $Q_i \geq 0$ (i = 1, 2, 3)

where F_j, b_i, and A_{ij} are known constants. The first three inequalities
in (12) assure that the number of farms in each size group does not ex-
ceed its original number. The fourth, fifth, and sixth inequalities
assure that the amount of open land in the small and medium groups of
farm, total open land, and total tobacco allotment used, respectively,
do not exceed their original amounts. The inequality in (13) assures
that no activity enter the solution at a negative level.

For farm situations where no additional open land was required,
the number of farms remained constant, and the maximum output of these
farms was added to the productivity of the farms that adjusted. In
addition to obtaining the size-distribution of farms, the model obtained

the aggregate productivity of all farms, and the resources required for this aggregate productivity.

Assumptions

Income Levels

A study was made of wage rates in various industries in the study area and the entire State of Virginia for 1966 (Table 2.1). The wage rates of most industries were of different levels for the two areas. However, these two levels should both be considered, for when one seeks non-farm employment he will usually not limit his employment opportunities to one town or county.

In determining income goals, industries were selected which would represent employment of workers that were semi-skilled, skilled, and highly skilled. For Virginia, average non-farm wages in 1966 ranged from $5,600 for workers in the fields of transportation, communication, and utilities to $3,800 in the field of services. Transportation, communication, and utilities industries usually require highly trained employees, while the services industries normally require employees with little training.

The levels of return to operator labor and management selected for this study are $3,500, $5,000, and $7,000. To the individual farmer, these would approximate the return to semi-skilled, skilled, and highly skilled labor, respectively, in non-farm employment. These income levels are not the goals of any specific policy, but are based on approximate income levels in non-farm employment in or near the area of study.

Table 2.1.   Average Annual Wage Per Full-Time Employee for Industry
             Groups for Southwest Virginia* and the State of Virginia,
             1966

Industry	Average wage[1]	
	Southwest Virginia	Virginia
	Dollars	Dollars
All industries	4,000	4,600
Agriculture, forestry, and fisheries	**	3,000
Mining and quarrying	5,200	4,800
Construction	4,300	4,950
Manufacturing	4,300	4,900
Transportation, communication, and utilities	5,300	5,600
Trade	2,400	4,000
Finance, insurance, and real estate	4,450	5,000
Services	2,750	3,800

*   Includes the counties of Lee, Russell, Scott, Smyth, and
Washington.

**   Data not available.

1/   "Covered Employment and Wages By County and Independent City--
State of Virginia," Research, Statistics, and Information Division,
Virginia Employment Commission, September 30, 1966.

Representative Farms

The representative farms are based on data obtained from a field survey of farms in this area in 1965.[4] From data obtained from this survey, the farms were classified into three groups that were considered homogeneous and representative of all farms in each group, and are referred to as small, medium, and large farms (Table 2.2).

The land and buildings on these farms are considered fixed, however, activities permitting the purchase of additional land and buildings as well as other resources are allowed. Average outlay is minimized for additional investments and for production costs of included enterprises. For each size representative farm, an annual cost of taxes and interest on the land, and taxes, depreciation, and repairs on the buildings is charged for resources initially available on the farms.

Only Class I land can be continually planted in row crops. Pasture land is suitable only for permanent pasture. Tobacco is the only enterprise considered that is grown under allotment. Current (1965) allotments of the representative farms were used as the restriction for tobacco.

4/ William Givan and Ralph Kline, Organization and Operation of Burley Tobacco-Livestock Farms in Southwest Virginia, Division of Research, Virginia Polytechnic Institute, and Farm Production Economics Division, Economic Research Service, U. S. Department of Agriculture, Blacksburg, Virginia, October 1968.

Table 2.2. Land and Building Resources of Representative Farms, South-
west Virginia, 1965

Item	Unit	Size of farm		
		Small	Medium	Large
Cropland harvested	Acre	11.0	32.0	100.0
Cropland pastured	Acre	6.0	21.0	75.0
Other cropland	Acre	0	2.0	5.0
Total cropland	Acre	17.0	55.0	180.0
Pasture	Acre	23.0	85.0	230.0
Total open land	Acre	40.0	140.0	410.0
Tobacco allotment	Acre	0.9	1.75	3.0
Class I land[a]	Acre	3.0	18.0	55.0
Class II land[b]	Acre	12.0	30.0	100.0
Class III land[c]	Acre	2.0	7.0	25.0
Storage capacities				
Grain	Bushel	400.0	850.0	2,000.0
Hay	Ton	25.0	90.0	200.0
Tobacco	Stick	1,600.0	3,400.0	6,700.0
Silage	Ton	0	30.0	135.0
Animal shelter space	Sq. ft.	600.0	850.0	1,450.0

a/ Land suitable for continuous row crops.

b/ Land suitable for row crops in rotation with close-growing
crops.

c/ Land suitable for close-growing crops only.

Labor

The productive labor of one full time operator, 2,730 hours annually, was assumed available for each farm. This is distributed as 240 hours per month during March-November, and 190 hours per month during December-February. No other available family labor is assumed in the analysis. In addition to operator labor, monthly seasonal labor can be obtained as needed at specified hourly wage rates.

Even though there is a fixed amount of operator labor available during each month, there are specific jobs in some enterprises that cannot be done by the operator alone -- i.e., more than one individual is required to perform certain jobs. For these jobs that require more than one worker, a specified amount of hired labor is required. This labor must be hired at a competitive price.

Capital

Capital costs are divided into two categories: 1) operating capital and 2) investment capital. Both types are considered available in unlimited quantities. Operating capital includes expenditures for factors of production that are used for one year or less such as fertilizer, feed, machinery operating costs, and seasonal hired labor. Investment capital includes the costs of resources which have a productive life of longer than one year. Examples of this type of capital are breeding animals, buildings, and machinery.

Interest, a cost for using capital, is charged at a rate of six percent per annum for both operating and investment capital.

Machinery

Full ownership of a two-row tractor and a complement of land preparation, cultivating, and harvesting equipment except a combine was assumed for each situation. Preliminary program solutions for the different income levels were first obtained to examine the acreage of various crops in the optimum solutions. The solutions were then obtained with only a tractor and basic equipment for tillage. All harvesting jobs were custom hired. Evaluating the different solutions indicated that full ownership of all machinery would require little additional total capital. Also, with all machinery owned, harvesting and other jobs can be performed when needed, eliminating the possibility of crop loss due to being unable to get the job performed when needed by a custom operator. In the final programming model, the first complement of machinery was a requirement for any size farm at any income level (Appendix A).

Overhead costs for buildings as well as machinery are charged to the total farm operation rather than the activity using these buildings. This procedure insured that the fixed cost would be charged to the farming operation, even should the buildings remain idle for all or part of the planning period.

Prices

Input prices used in the study are current (1967), adjusted for abnormal conditions. These prices were determined from a review

of various current agricultural reports, and agencies selling farm
supplies (Appendix F).

The price received for burley tobacco was the 1966 average sale
price per pound in Virginia. Beef cattle prices were averages for
the ten years 1957-1966 of feeder cattle prices based on organized
sales in Virginia. The prices for all other livestock and livestock
products were also averages for the same ten-year period, 1957-1966,
except for fluid milk sold for manufacturing purposes, which was the
current price. The sale prices of corn and hay were averages of the
previous five years.

The land price used was estimated from data contained in the
1964 Census of Agriculture (Appendix C). This price represents the
value of one acre of open land with no improvements. No value was
determined for woodland or wasteland.

Machinery costs used in the study are based on data prepared
by the Agricultural Engineering and Agricultural Economics Depart-
ments of Virginia Polytechnic Institute.[5]

Activities Considered

Budgets were developed for the enterprises which were considered
to be feasible and for which there was believed to be a sufficient

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[5] Easley E. Smith and James D. Oliver, Estimating Farm
Machinery Costs, Virginia Agricultural Extension Service, Blacksburg,
Virginia, Bulletin 290, June 1965.

market to permit them to be considered by all farmers as adjustment

opportunities (Appendix A). These budgets were compiled from various

sources which include data from Extension Specialists and Research

Reports. Crop enterprises considered include burley tobacco, corn

for grain, corn for silage, oat hay, alfalfa hay, red clover-orchardgrass

hay, and bluegrass-clover pasture. Livestock enterprises considered in-

clude market hogs, cow-calf operations, feeder steers, sheep, and fluid

milk for manufacturing purposes.

Several enterprises were not considered because of agronomic or

economic reasons. Grade-A dairying was not considered as an adjust-

ment possibility as market conditions tend to limit the entry of new

dairy farms. Because of a limited demand for their products, fruits

and vegetables were excluded as alternatives. Poultry enterprises

were not considered, as they require no open land for operation.

Input-output coefficients used in the enterprise budgets are

based on the use of efficient practices, representative of that level

achieved by the better farmers in the area. Yields that are now being

achieved of the principal crops in the area, and the estimated yields

used in the enterprise budgets are presented in Table 2.3. This level

of technology is used, for the objective of this research is to de-

termine the most efficient organization of farms to give specified

income levels; thus, the technology assumed is the optimum level cur-

rently available.

This assumption about the level of technology is a critical factor

in the determination of production costs. A change in the level of

Table 2.3. Average Yields and Assumed Yields of Major Crops in
Southwest Virginia, 1964

Crop	Unit	Average yield 1964[a]	Assumed yield
Burley tobacco	Lb.	2,330.0	3,000.0
Corn for grain	Bu.	68.0	100.0
Corn for silage	Ton	15.2	20.0
Alfalfa hay	Ton	2.5	4.0
Red clover-orchardgrass hay	Ton	1.7	2.5
Small grain hay	Ton	2.1	2.2

[a] Yield estimates based on a field survey of farms in this area
in 1965.

technology would change the factor-product transformations and
cause the costs of production to shift. This high level of techno-
logy permits a lower cost of production than would have been possible
had a lower rate of efficiency been assumed.

Distribution of Farms and Land

Total land in farms in the area of study was obtained from the
1964 Census of Agriculture (Table 2.4). As the representative farms
in this study were grouped by acres of cropland, all farms with less
than 10 acres of cropland were omitted from the study, for these
are actually rural residences and do not have the potential for
adjustment opportunities. Also, survey data indicated that farms
producing Grade-A milk are much larger than those not producing this
commodity, and are organized differently, and have a greater potential
for achieving a higher income level. As a result, the land in Grade-A
dairy farms was omitted from the study. The farms and land included
in the study are those non-Grade-A dairy farms with more than 10 acres
of cropland. Farms and acreages in the excluded classes were subtracted
from each respective size unit and from the total farm number and total
acreage (Table 2.6).

The total amount of open land in the study area that is considered
for adjustment possibilities is 490,379 acres, composed of 5,446 farms.
The distribution of these farms at the present and the amounts of open
land in these farms are shown in Figure 2.3.

As a land buying activity is included in the model, a fixed pro-
portion of various types of land is available with each acre of land

Table 2.4. Type and Amount of Land in Farms, Southwest Virginia, 1964*

Total farm size (Acres)	Total land (Acres)	Open land (Acres)	Cropland (Acres)
Less than 10	6,139	3,966	1,586
10-49	96,651	62,437	24,959
50-69	73,067	47,201	18,870
70-99	99,751	64,439	25,760
100-139	108,832	70,305	28,104
140-179	84,918	54,857	21,930
180-219	62,237	40,205	16,074
220-259	45,354	29,299	11,714
260-499	141,351	91,312	36,501
500-999	105,929	68,430	27,351
1,000-1,999	50,086	32,356	12,936
2,000-and over	42,994	27,774	11,105
Totals	917,309	592,581	236,894

* United States Bureau of the Census, Census of Agriculture 1964, Statistics for States and Counties, Virginia, U. S. Government Printing Office, Washington, D. C., 1967.

Table 2.5. Number of Farms, Type and Amount of Land, and Tobacco
Allotment by Type and Size of Farm, Southwest Virginia,
1964*

| | | Size farm (acres of cropland) | | | | |
| | | Less than | | | 100 and | |
	Unit	10	10-29	30-99	over	Total
All farms	Number	4,577	3,609	1,601	403	10,190
Grade-A dairy farms	Number	0	0	92	75	167
Non-Grade-A farms	Number	4,577	3,609	1,509	328	10,023
Open land in all farms	Acre	52,667	144,358	223,166	172,390	592,581
Open land in Grade-A dairy farms	Acre	0	0	11,960	37,575	49,535
Open land in non-Grade-A farms	Acre	52,667	144,358	211,206	134,815	543,046
Cropland in all farms	Acre	9,611	61,353	88,515	77,415	236,894
Cropland in Grade-A dairy farms	Acre	0	0	5,520	18,375	23,895
Cropland in non-Grade-A farms	Acre	9,611	61,353	82,995	59,040	212,999
Tobacco allotment on all farms	Acre	2,060	3,248	2,756	1,152	9,216
Tobacco allotment on Grade-A dairy farms	Acre	0	0	115	210	325
Tobacco allotment on non-Grade-A farms	Acre	2,060	3,248	2,641	942	8,891

* Data for land acreage taken from Table 2.4. Data for tobacco
allotments taken from state ASCS reports and sample of farms taken in
the study area. Data for Grade-A dairy farms taken from Southeastern
Milk Producers Cooperative and sample of farms taken in the study area.

Table 2.6. Farm Numbers, Land, and Tobacco Allotment: Total and Amount Considered for Adjustment, Southwest Virginia*

Item	Unit	Total in area	Amount in** rural residences	Amount in Grade-A farms	Included in study
Farms	Number	10,190	4,577	167	5,446
Open land	Acre	592,581	52,667	49,535	490,379
Cropland	Acre	236,894	9,611	23,895	203,388
Tobacco allotment	Acre	9,216	2,060	325	6,831

* Farm numbers and amounts of land are taken from Figure 2.5. The farms and land included in the study are the aggregate for the area less the amounts included in rural residences and Grade-A dairy farms.

** Rural residences are defined as those farms with less than 10 acres of cropland.

Number
of
Farms

4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0

25-74 75- 250 and
       249 over

Acres of Open Land per Farm

Acres
of
Open land
(1,000 acres)

225
200
175
150
125
100
75
50
25
0

25-74 75- 250 and
       249 over

Acres of Open Land per Farm
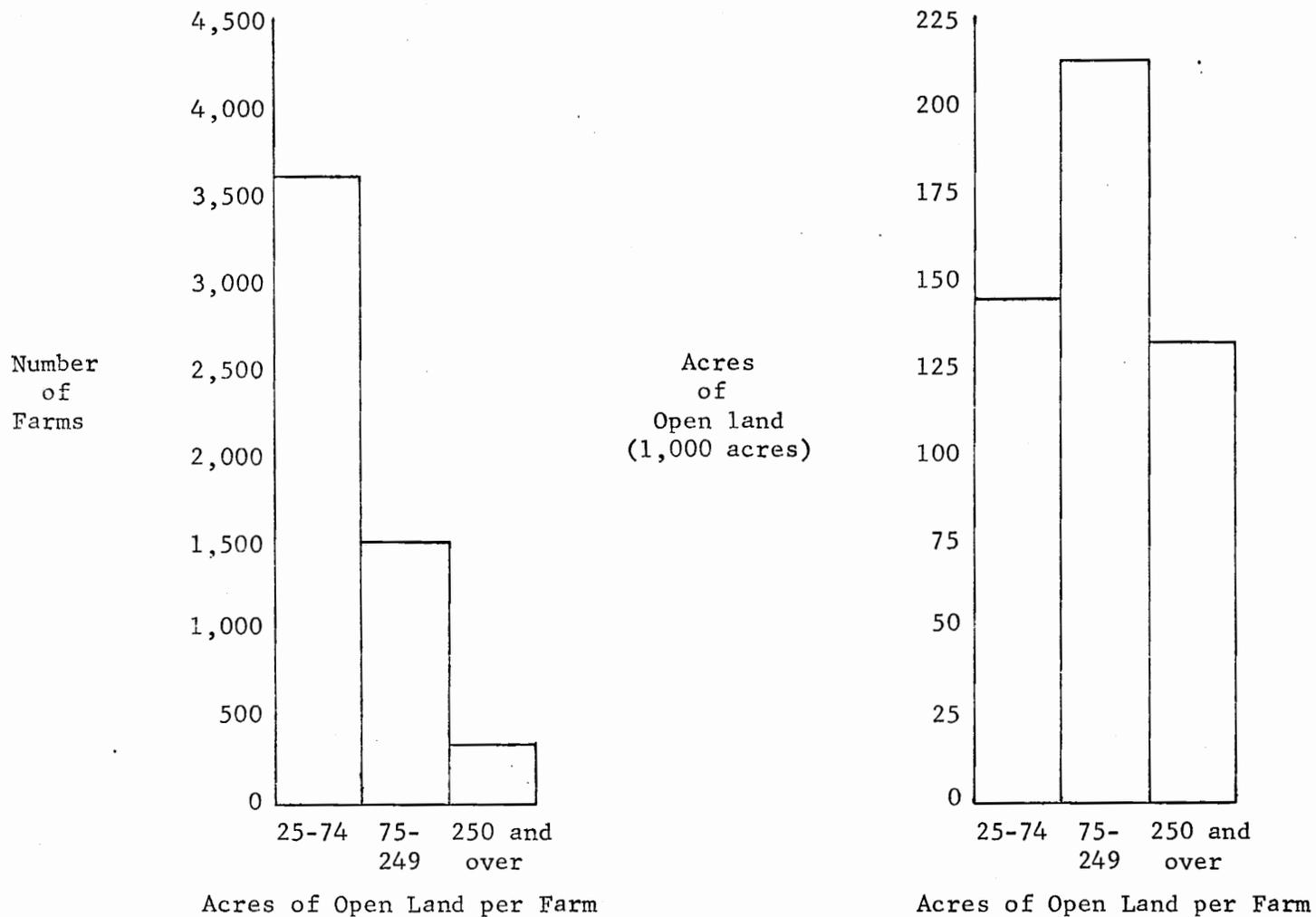
Figure 2.3. Distribution and Open Land Acreage of Study Farms, Southwest Virginia, 1964.

purchased. When one acre of land is purchased, it is assumed to be composed of the following types and amounts of land: Class I land, .09 acre; Class II land, .27 acre; Class III land, .05 acre; permanent pasture, .59 acre; tobacco allotment, .019 acre.

CHAPTER III

RESOURCE REQUIREMENTS AND ENTERPRISE COMBINATIONS WHEN OBTAINING
SPECIFIED INCOME LEVELS

This section of the results relates to the resource use and enter-
prise combinations required by the representative farms to produce
operator labor incomes of $3,500, $5,000, and $7,000 when minimizing
added average outlay. The effects of various hired wage rates on
these requirements and combinations are determined.

Representative farms of 40, 140, and 410 acres of open land, re-
spectively, are used as farm sizes for which the three income levels
are obtained. For each typical farm, added average outlay is minimized
subject to the specified income levels. Total average outlay includes
the amount of outlay added as well as that initially associated with
the representative farms. Total investment capital includes the values
of investment resources added as well as the capital value of fixed
resources.

Results of the analysis indicate that, when average outlay is
minimized, the small representative farm, consisting of 40 acres open
land, does not have sufficient land to achieve a $3,500 operator labor
income. The medium size representative farm, initially consisting of
140 acres of open land, would have to purchase land at all labor prices
to achieve a $5,000 or $7,000 income, and would have to purchase land
at all labor prices except $1.00 per hour to achieve a $3,500 operator
income. The large size representative farm, initially consisting of

410 acres open land, has sufficient land to obtain all incomes, except

a $7,000 income at labor prices of $2.00 and $2.50 per hour, and a

$5,000 income at $3.00 per hour.

None of the farms were able to achieve a $7,000 income level when

hired labor was $3.00 an hour. As the production items (land, labor,

and other inputs) tend to have a complementary relationship, there

were no items which could be substituted for labor which would permit

this labor income. The costs of an additional hour of labor, plus

the added costs associated with the resources with which this labor

would work, would be greater than the added revenue received from this

hour of labor.

The total amount of average outlay, after adjustment, was higher

on the larger farms because of the greater amounts of fixed resources

on the larger farms. However, amounts of average outlay added were

less on the larger farms because of the larger amounts of initial

resources that could be used for production. Total average outlay

was not significantly different for a given size representative farm

when results were compared between minimizing added average outlay

and minimizing total outlay, which consists of added outlay plus the

outlay associated with the resources considered to be fixed on the

farm.

As expenses of the farming operation increased with higher labor

costs, the increase in size of the operation to raise gross returns

was accompanied by an increase in many inputs. Generally, gross in-

come increased faster than labor, indicating that a higher amount of

gross income resulted from each additional unit of labor as the labor price increased. This is due to the effect of a more rapid increase of non-labor inputs than of labor inputs. There is, therefore, a relatively greater amount of non-labor capital per hour of labor producing a greater gross income per hour of labor as the cost of hiring labor becomes more expensive.

Use of operating capital associated with non-labor inputs increased faster than labor inputs as wage rates and income levels were increased. In instances where land was purchased by a representative farm, the amounts of land purchased increased at a rate faster than amounts of labor purchased as wage rates and income levels were increased.

The most profitable enterprise, relative to other enterprises, is burley tobacco with a return of approximately $5.00 per hour to operator labor devoted to this enterprise. The relatively high profitability of this crop is a major factor causing the purchase of land, together with a prorated amount of tobacco allotment, to be more profitable than the utilization of large amounts of existing pasture with livestock. This fact can be illustrated by comparing the land required for the small and medium farms to achieve a $3,500 income at a $1.50 hired wage rate. On a small farm, 65 acres of open land were purchased in addition to the 40 acres of open land available, in order to obtain a $3,500 income (Table 3.1). As the next largest size representative farm contains 140 acres of open land, it would appear that this farm could obtain this same income level without purchasing

any land. Yet, using the minimization of added average outlay crite-
rion, with the same labor price and income goal, seven acres of open
land were purchased (Table 3.3).

The small farm, due to a higher percentage of its land being in
a tobacco allotment, had two-tenths of an acre more tobacco with 105
total acres than the medium farm had with a total of 147 acres. Thus,
due in part to this larger tobacco acreage, this size farm was able
to obtain a $3,500 income level on less open land than a farm initially
consisting of more total open land but a lower percentage of this land
in a tobacco allotment. The medium farm was able to compensate for
this smaller tobacco allotment (in terms of producing gross income)
by using its larger supply of cropland to produce crops other than
tobacco to be marketed either through direct sales or through livestock.

All of the tobacco allotment on each size farm was utilized. Al-
falfa hay occupied the greatest amount of cropland when it was necessary
to purchase land. Sales of hay increased as both the income level and
wage rates increased. Also accompanying an increase in wage rates and
income levels were a decrease in dairy cattle numbers and increases in
amounts of unused pasture. No dairy cattle were in the optimum solutions
for the large farm.

Income Level of $3,500

Small Farm

With a hired labor price of $1.00 per hour, a farm of 40 acres
open land would have to be increased to 2½ times its present size in

order to achieve a labor income of $3,500 (Table 3.1). This would

involve a total capital investment of approximately $50,000 and total

average outlay of approximately $66,000. Of the total capital invest-

ment, nearly $39,000 was added investment, of which 37 percent was for

additional cropland purchased.

Total hired labor required was 441 man hours, of which one-third

was required during the months of October-December, and one-half re-

quired during the months of July-September. All cropland available

was utilized, mainly in the production of hay, corn for silage, and

corn for grain. Dairy cows producing milk for manufacturing purposes

and steers, wintered to gain 1.3 pounds daily and sold in the spring,

were the main livestock enterprises. Dry lot steers require only about

one-half of the amount of average outlay as do pasture-fed steers, even

though the latter give a higher absolute return. All grain produced

was marketed through livestock; however, 55 percent of the hay produced

was sold.

As the hourly wage of hired labor was increased from $1.00 to

$3.00 per hour, the land/labor and land/investment capital ratios

remained essentially the same (Table 3.2). In this instance an in-

crease in land purchased was accompanied by a relatively similar

increase in labor to complement this added land. Resources other than

land requiring capital of a long-run nature were added to complement

this added land and labor.

Labor increased at a rate approximate to that of increased average

outlay and gross income; however, land increased at a faster rate. Annual

Table 3.1. Resource Requirements and Optimum Enterprise Combinations to Produce a $3,500 Income Level on a Farm Initially Consisting of 40 Acres Open Land, Specified Hired Labor Price, Southwest Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	25	27	29	33	37
Pasture land purchased	Acre	35	38	42	47	54
Added average outlay	Dollar	53,302	55,740	58,792	62,807	68,324
Total average outlay	Dollar	66,158	68,596	71,648	75,663	81,180
Labor:						
Resident operator	Hour	1,894	1,975	2,070	2,188	2,327
Seasonal hired	Hour	441	476	527	601	687
Capital:						
Added investment*	Dollar	38,929	40,821	43,189	46,305	50,103
Total investment*	Dollar	50,386	52,278	54,646	57,762	61,560
Annual operating	Dollar	2,030	2,165	2,335	2,558	3,387
Open land use:						
Burley tobacco	Acre	2.1	2.1	2.3	2.4	2.6
Corn, grain	Acre	9.2	9.5	10.0	10.6	12.0
Corn, silage	Acre	6.4	6.7	7.2	7.8	7.9
Alfalfa hay	Acre	24.3	25.7	26.5	29.2	31.5
Total cropland	Acre	42.0	44.0	46.0	50.0	54.0
Permanent pasture	Acre	26.0	28.0	30.0	32.0	42.0
Pasture unused	Acre	32.0	33.0	35.0	38.0	35.0
Total open land	Acre	100.0	105.0	111.0	120.0	131.0
Livestock:						
Market hogs	Head	5	5	6	6	9
Dairy cows (producing Grade-B milk)	Head	13	14	15	16	16
Pasture-fed steers	Head	0	0	0	0	7
Dry-lot steers	Head	11	10	9	6	0
Total steers	Head	11	10	9	6	7
Crop sales:						
Hay	Ton	53	57	62	69	76
Gross returns	Dollar	13,972	14,487	15,124	15,962	17,519

* Initial value of investment capital.

Table 3.2. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 40 Acres Open Land to Produce a $3,500 Labor Income, Specified Hired Labor Prices, Southwest Virginia

Ratio	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.042	.042	.042	.043	.043
Land/operating capital	.049	.048	.047	.046	.038
Land/investment capital	.002	.002	.002	.002	.002
Labor/operating capital*	1.500	1.700	2.000	2.600	2.300
Labor/investment capital	.046	.046	.047	.048	.048
Average outlay/land	533.0	531.0	529.0	523.0	521.0
Average outlay/operting capital	26.2	25.7	25.2	24.5	20.2
Average outlay/investment capital	1.1	1.1	1.1	1.1	1.1
Average outlay/labor	22.9	22.7	22.6	22.5	22.6
Gross income/labor	5.3	5.0	5.0	5.0	5.0
Gross income/land	121.0	119.0	117.0	113.0	113.0
Gross income/operating capital	6.0	5.8	5.5	5.3	4.4
Gross income/investment capital	.2	.2	.2	.2	.2

* Operating capital exclusive of labor costs.

operating cost increased at its fastest rate at labor prices above
$2.00 per hour. This phenomenon was due not only to an increase in
labor hired at a higher rate, but to increased operating costs re-
sulting from a higher level of crop and livestock enterprises.

Medium Farm

A $3,500 operator labor income could be attained on a medium
farm with 140 acres of open land without purchasing any land at a
$1.00 wage rate (Table 3.3). Eighty percent of the cropland produced
corn for grain and alfalfa hay. Dairy cows producing milk for manu-
facturing purposes was the only livestock enterprise. These cows
utilized only 40 percent of the available permanent pasture.

Seven acres of land had to be purchased to enable the farm to
reach this income level when the price of labor was $1.50 or $2.00
per hour. Land purchased increased to 29 acres when the labor price
was $3.00. As the labor price was raised to $2.00, however, the corn
that was sold at the previous labor price was marketed through hogs.
At the highest labor price, pasture-fed steers, bought in the fall,
wintered, fed on pasture, and sold in the fall were profitable.

Accompanying the increase in gross income necessitated by the
increase in costs of higher labor prices was an increase in average
outlay. This (average outlay) increased faster, however, than did land
or labor, as indicated by the increase in the average outlay/land and
average outlay/labor ratios (Table 3.4). Labor increased at a slower
rate than gross income, further indicating that other factors requiring

Table 3.3. Resource Requirements and Optimum Enterprise Combinations to
Produce a $3,500 Income Level on a Farm Initially Consisting
of 140 Acres Open Land, Specified Hired Labor Prices, South-
west Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	0	3	3	7	12
Pasture land purchased	Acre	0	4	4	9	17
Added average outlay	Dollar	37,037	39,156	41,773	44,987	50,275
Total average outlay	Dollar	78,299	80,418	83,035	86,249	91,537
Labor:						
Resident operator	Hour	2,157	2,236	2,359	2,421	2,456
Seasonal hired	Hour	460	493	517	580	652
Capital:						
Added investment*	Dollar	24,708	26,381	27,518	29,895	33,044
Total investment*	Dollar	62,332	64,005	65,142	67,519	70,668
Annual operating	Dollar	1,992	2,187	2,836	3,406	5,015
Open land use:						
Burley tobacco	Acre	1.7	1.9	1.9	2.1	2.3
Corn, grain	Acre	19.0	19.5	19.9	21.3	24.8
Corn, silage	Acre	8.3	8.6	8.2	8.1	6.5
Alfalfa hay	Acre	26.0	28.0	28.0	30.5	33.4
Total cropland	Acre	55.0	58.0	58.0	62.0	67.0
Permanent pasture	Acre	34.0	35.0	34.0	34.0	43.0
Pasture unused	Acre	51.0	54.0	55.0	60.0	59.0
Total open land	Acre	140.0	147.0	147.0	156.0	169.0
Livestock:						
Market hogs	Head	0	0	20	21	28
Dairy cows (producing Grade-B milk)	Head	22	23	17	17	13
Pasture-fed steers	Head	0	0	0	0	12
Dry-lot steers	Head	0	0	6	10	7
Total steers	Head	0	0	6	10	19
Crop sales:						
Hay	Ton	65	68	68	73	81
Corn	Bu.	838	867	0	0	0
Gross returns	Dollar	15,191	15,749	18,067	19,491	22,207

* Initial value of investment capital.

Table 3.4. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 140 Acres Open Land to Produce a $3,500 Labor Income, Specified Hired Labor Prices, Southwest Virginia

Ratio	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.051	.053	.051	.051	.054
Land/operating capital	.070	.067	.051	.045	.033
Land/investment capital	.002	.002	.002	.002	.002
Labor/operating capital*	1.700	1.880	1.600	1.530	1.020
Labor/investment capital	.041	.043	.044	.044	.044
Average outlay/land	265.0	266.0	284.0	288.0	297.0
Average outlay/operating capital	18.6	17.9	14.7	13.2	10.0
Average outlay/investment capital	.6	.6	.6	.6	.7
Average outlay/labor	14.1	14.3	14.5	15.0	16.2
Gross income/labor	4.5	4.5	5.4	5.6	6.2
Gross income/land	82.5	82.7	106.7	108.5	114.6
Gross income/operating capital	5.9	5.6	5.5	5.0	3.9
Gross income/investment capital	.2	.2	.2	.2	.3

* Operating capital exclusive of labor costs.

operating capital complemented this increase in farm size. Even though open land was purchased, none of the pasture associated with added open land was utilized, while all the cropland was utilized.

Large Farm

The large farm with 410 acres of open land had available more than sufficient land for a $3,500 operator labor income at labor prices up to $3.00 an hour (Table 3.5). The added average outlay required was used for non-land variable inputs required.

Income Level of $5,000

Small Farm

To achieve a $5,000 operator's income on the small farm, the additional land and hired labor required are similar to those re- quired to reach a $3,500 income. Both additional land and labor required increased as the price of hired labor increased (Table 3.6). With labor prices at $3.00 per hour, 169 acres of land were purchased, a 60 percent increase over the amount of purchased land required to reach a $3,500 income level.

In all instances, all of the cropland was utilized by crops; how- ever, a portion of the pasture purchased was unused, ranging from 93 percent at a $2.50 labor price to 76 percent at a labor price of $1.00. As the labor price was raised from $1.00 to $2.50, the number of market hogs and dry-lot steers increased while the number of dairy cows decreased. At the $3.00 labor level, steers on pasture were

Table 3.5. Resource Requirements and Optimum Enterprise Combinations to Produce a $3,500 Income Level on a 410 Acre Farm, Specified Hired Labor Prices, Southwest Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	0	0	0	0	0
Pasture land purchased	Acre	0	0	0	0	0
Added average outlay	Dollar	34,720	36,370	38,084	40,180	43,490
Total average outlay	Dollar	150,410	152,060	153,774	155,870	159,181
Labor:						
Resident operator	Hour	2,219	2,154	2,171	2,165	2,265
Seasonal hired	Hour	1,042	969	1,018	1,077	1,191
Capital:						
Added investment*	Dollar	22,463	20,732	20,871	20,943	21,855
Total investment*	Dollar	129,084	127,353	127,492	127,564	128,476
Annual operating	Dollar	4,042	6,949	8,236	9,910	11,896
Open land use:						
Burley tobacco	Acre	3.0	3.0	3.0	3.0	3.0
Corn, grain	Acre	92.0	87.8	91.0	92.0	85.7
Corn, silage	Acre	0	0	0	0	6.4
Alfalfa hay	Acre	60.0	53.8	57.0	62.0	68.9
Oat-lespedeza hay	Acre	0	3.4	3.0	0	0
Cropland unused	Acre	25.0	32.0	26.0	23.0	16.0
Total cropland	Acre	180.0	180.0	180.0	180.0	180.0
Permanent pasture	Acre	0	0	0	0	0
Pasture unused	Acre	230.0	230.0	230.0	230.0	230.0
Total open land	Acre	410.0	410.0	410.0	410.0	410.0
Livestock:						
Sheep	Head	55	19	11	0	0
Dry-lot steers	Head	0	60	78	103	130
Total steers	Head	0	60	78	103	130
Crop sales:						
Hay	Ton	156	147	155	160	175
Corn	Bu.	7,223	6,608	6,682	6,679	6,463
Gross returns	Dollar	24,773	30,719	33,482	37,072	41,392

* Initial value of investment capital.

Table 3.6. Resource Requirements and Optimum Enterprise Combinations to
Produce a $5,000 Income Level on a Farm Initially Consisting
of 40 Acres Open Land, Specified Hired Labor Prices, South-
west Virginia

		Hired labor price per hour				
Item	Unit	$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	38	43	50	60	69
Pasture land purchased	Acre	54	61	72	86	100
Added average outlay	Dollar	68,157	73,015	79,465	87,970	99,509
Total average outlay	Dollar	81,013	85,871	92,321	100,826	112,365
Labor:						
Resident operator	Hour	2,360	2,430	2,437	2,418	2,389
Seasonal hired	Hour	718	811	917	1,034	1,135
Capital:						
Added investment*	Dollar	50,953	54,463	58,918	64,264	69,792
Total investment*	Dollar	62,410	65,920	70,375	75,721	81,249
Annual operating	Dollar	2,263	2,914	4,195	6,487	10,645
Open land use:						
Burley tobacco	Acre	2.7	2.9	3.2	3.7	4.1
Corn, grain	Acre	11.5	13.3	17.0	23.7	28.4
Corn, silage	Acre	8.7	8.5	7.4	4.1	2.5
Alfalfa hay	Acre	32.1	35.3	39.4	45.5	51.0
Total cropland	Acre	55.0	60.0	67.0	77.0	86.0
Permanent pasture	Acre	36.0	35.0	29.0	29.0	44.0
Pasture unused	Acre	41.0	49.0	66.0	80.0	79.0
Total open land	Acre	132.0	144.0	162.0	186.0	209.0
Livestock:						
Market hogs	Head	7	9	14	25	36
Dairy cows (producing Grade-B milk)	Head	18	18	14	8	0
Pasture-fed steers	Head	0	0	0	9	32
Dry-lot steers	Head	5	10	24	36	44
Total steers	Head	5	10	24	45	76
Crop sales:						
Hay	Ton	77	84	94	108	122
Gross returns	Dollar	17,411	19,212	22,503	27,248	34,397

* Initial value of investment capital.

profitable. Even though these steers require relatively large amounts of average outlay, the labor requirements during the summer months are less than those required by dairy cows.

Even though the absolute amounts of labor increased with a rise in labor prices, the percentage increase in these amounts increased at a decreasing rate as the price of labor was raised. Land increased at a rate faster than labor as indicated by the increase in land/labor ratio as the labor price was increased (Table 3.7).

Medium Farm

Some cropland was purchased for this size farm at all labor prices to obtain a $5,000 income, even though it was previously shown that this same income level could be achieved on a 40 acre farm by expanding to an acreage which was smaller than that of the representative medium size farm consisting of 140 acres of open land. Average added outlay and added investment capital were lower for this size farm than for the small farm because of the greater amount of resources initially available (Table 3.8). The amount of labor purchased decreased as the price of labor rose up to a labor price of $2.00 per hour. Above this price, the amount of labor hired increased at an increasing rate. Up to the point ($2.00 per hour) where a smaller percentage of labor was hired, a more extensive use was made of labor. As more labor was hired at a higher labor price, a more intensive use was made of labor. Market hogs increased, pasture-fed steers decreased, and dry-lot steers increased in numbers over 500 percent as the labor price increased from $2.00 to $3.00.

Table 3.7. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 40 Acres Open Land to Produce a $5,000 Labor Income, Specified Hired Labor Prices, Southwest Virginia

Ratio	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.042	.044	.049	.053	.057
Land/operating capital	.058	.049	.038	.028	.017
Land/investment capital	.002	.002	.002	.002	.002
Labor/operating capital*	2.000	1.910	1.420	.880	.480
Labor/investment capital	.049	.049	.048	.053	.040
Average outlay/land	516.0	507.0	491.0	473.0	495.0
Average outlay/operating capital	30.1	25.1	18.9	13.5	8.5
Average outlay/investment capital	1.1	1.1	1.1	1.1	1.2
Average outlay/labor	22.1	22.5	23.7	25.5	28.6
Gross income/labor	5.7	5.9	6.7	7.9	9.9
Gross income/land	131.9	133.4	138.9	146.5	171.1
Gross income/operating capital	7.7	6.6	5.4	4.2	2.9
Gross income/investment capital	.3	.3	.3	.3	.4

* Operating capital exclusive of labor costs.

Table 3.8. Resource Requirements and Optimum Enterprise Combinations to Produce a $5,000 Income on a Farm Initially Consisting of 140 Acres Open Land, Specified Hired Labor Prices, Southwest Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	13	18	25	34	44
Pasture land purchased	Acre	18	26	37	50	64
Added average outlay	Dollar	50,586	55,665	61,959	69,904	82,695
Total average outlay	Dollar	91,850	96,929	103,221	111,166	123,957
Labor:						
Resident operator	Hour	2,530	2,550	2,527	2,464	2,571
Seasonal hired	Hour	723	818	869	963	1,245
Capital:						
Added investment*	Dollar	34,650	38,058	41,357	45,836	53,170
Total investment*	Dollar	72,274	75,682	78,981	83,460	90,794
Annual operating	Dollar	3,458	4,486	7,044	9,754	13,620
Open land use:						
Burley tobacco	Acre	2.3	2.6	2.9	3.3	3.8
Corn, grain	Acre	23.4	25.4	32.0	37.4	40.0
Corn, silage	Acre	8.2	8.0	4.0	1.5	2.4
Alfalfa hay	Acre	34.1	37.0	41.1	47.0	52.8
Total cropland	Acre	68.0	73.0	80.0	89.0	99.0
Permanent pasture	Acre	34.0	31.0	46.0	46.0	32.0
Pasture unused	Acre	69.0	80.0	76.0	89.0	117.0
Total open land	Acre	171.0	184.0	202.0	224.0	248.0
Livestock:						
Market hogs	Head	23	26	39	49	45
Dairy cows (producing Grade-B milk)	Head	17	15	8	0	0
Pasture-fed steers	Head	0	0	22	32	24
Dry-lot steers	Head	15	26	19	34	106
Total steers	Head	15	26	41	66	130
Crop sales:						
Hay	Ton	82	90	100	113	97
Gross returns	Dollar	21,786	24,370	28,188	33,515	43,011

* Initial value of investment capital.

Even though more labor was hired to produce a $5,000 income by this size farm than on the small farm, there was less concentration of labor on the land as indicated by the land/labor ratio which had higher values here than on the small farm (Table 3.9). This ratio also increased with the rise in labor price. The gross income/labor ratio was also higher for this size farm than for the small farm, indicating a greater gross income per unit of labor.

Large Farm

The large farm, consisting of 410 acres, provided more than sufficient land for a $5,000 income until the labor price reached $3.00 per hour (Table 3.10).

Even though the optimal organization at this point utilized a greater amount of labor than any other optimum farm organization previously mentioned, this organization has a greater land acreage and investment capital per man hour than any other solution. This is borne out by the high land/labor, and low labor/operating capital ratios, respectively (Table 3.11). There is more average outlay and gross income per man hour than in any of the previous situations. The total amount of investment capital in farms of this size has a greater proportion composed of land values than have the smaller farms.

Income Level of $7,000

Small Farm

Considerably larger amounts of land, labor, and average outlay were required by the small farm to obtain a $7,000 income than to obtain a

Table 3.9. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 140 Acres Open Land to Produce a $5,000 Labor Income, Specified Hired Labor Prices, Southwest Virginia

Ratio	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.052	.055	.059	.065	.065
Land/operating capital	.049	.041	.029	.023	.018
Land/investment capital	.002	.002	.002	.002	.003
Labor/operating capital*	1.190	1.030	.630	.470	.390
Labor/investment capital	.045	.045	.043	.041	.042
Average outlay/land	537.1	526.8	511.0	496.3	499.8
Average outlay/operating capital	26.6	21.6	14.7	11.4	9.1
Average outlay/investment capital	1.3	1.3	1.3	1.3	1.4
Average outlay/labor	28.2	28.8	30.4	32.4	32.5
Gross income/labor	6.7	7.2	8.3	9.8	11.3
Gross income/land	127.4	132.4	139.5	149.6	173.4
Gross income/operating capital	6.3	5.4	4.0	3.4	3.2
Gross income/investment capital	.3	.3	.3	.4	.5

* Operating capital exclusive of labor costs.

Table 3.10. Resource Requirements and Optimum Enterprise Combinations to Produce a $5,000 Income Level on a Farm Initially Consisting of 410 Acres Open Land, Specified Hired Labor Prices, Southwest Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	0	0	0	0	6
Pasture land	Acre	0	0	0	0	9
Added average outlay	Dollar	38,773	41,091	44,065	47,923	59,804
Total average outlay	Dollar	154,464	156,782	159,756	163,614	175,495
Labor:						
Resident operator	Hour	2,151	2,219	2,294	2,390	2,599
Seasonal hired	Hour	1,057	1,139	1,270	1,393	1,691
Capital:						
Added investment*	Dollar	20,792	21,574	22,688	23,557	29,418
Total investment*	Dollar	127,413	128,195	129,309	130,178	136,039
Annual operating	Dollar	8,796	9,999	11,443	13,988	18,442
Open land use:						
Burley tobacco	Acre	3.0	3.0	3.0	3.0	3.3
Corn, grain	Acre	92.0	92.0	92.0	85.2	84.9
Corn, silage	Acre	0	0	0	6.8	9.3
Alfalfa hay	Acre	60.0	68.0	80.0	85.0	88.5
Cropland unused	Acre	25.0	17.0	5.0	0	0
Total cropland	Acre	180.0	180.0	180.0	180.0	186.0
Permanent pasture	Acre	0	0	0	0	0
Pasture unused	Acre	230.0	230.0	230.0	230.0	239.0
Total open land	Acre	410.0	410.0	410.0	410.0	425.0
Livestock:						
Dry-lot steers	Head	98	112	128	157	200
Total steers	Head	98	112	128	157	200
Crop sales:						
Hay	Ton	156	174	199	210	205
Corn	Bu.	6,712	6,613	6,496	6,137	5,203
Gross returns	Dollar	36,228	38,914	42,140	47,708	58,320

* Initial value of investment capital.

Table 3.11. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 410 Acres Open Land to Produce a $5,000 Labor Income, Specified Hired Labor Prices, Southwest Virginia

Ratio	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.128	.122	.115	.108	.099
Land/operating capital	.047	.041	.036	.029	.023
Land/investment capital	.003	.003	.003	.003	.003
Labor/operating capital*	.410	.400	.400	.360	.320
Labor/investment capital	.025	.026	.027	.029	.031
Average outlay/land	376.7	382.4	389.6	399.0	412.9
Average outlay/operating capital	17.6	15.7	13.9	11.7	9.5
Average outlay/investment capital	1.2	1.2	1.2	1.3	1.3
Average outlay/labor	48.1	46.7	44.8	43.2	40.9
Gross income/labor	11.3	11.6	11.6	12.6	13.6
Gross income/land	88.4	94.9	102.8	116.4	137.2
Gross income/operating capital	4.1	3.9	3.7	3.4	3.2
Gross income/investment capital	.3	.3	.3	.4	.4

* Operating capital exclusive of labor costs.

$5,000 income. At a $1.00 wage rate, the same enterprises were in
the optimum organization that were present when a $5,000 income was
obtained. At this income, however, all enterprises except corn silage
were at a higher level. Particularly higher were burley tobacco and
alfalfa hay, the former resulting from an increase in tobacco allotment
that accompanied the purchase of 151 acres of open land (Table 3.12).

As the price of labor increased from $1.00 to $2.00 the purchases
of non-labor inputs increased at rates faster than those of labor in-
puts (Table 3.13). As in previous cases, more intensive uses of labor
were made.

Medium Farm

Purchases of both land and labor increased with the price of labor
as was the case at lower income levels. The amount of labor hired
decreased as wages changed from $1.00 to $1.50 (Table 3.14). Less
pasture was utilized. Dairying became unprofitable, dry-lot steers
increased, and market hogs and pasture-fed steers were added enter-
prises. Sales of both hay and corn dropped, and more of these crops
were marketed through increased numbers of steers and hogs.

At a labor price of $2.50, the percentage increase in land and
labor purchased was greater than at any other price level. The in-
creases in crop enterprises were in tobacco, corn silage, and hay.
The only livestock enterprises were dry-lot and feeder steers which
utilized the silage and part of the hay and corn. Both labor and land
had higher values per dollar of gross income at the $2.50 labor price
than when a $5,000 income was achieved, but the productivity of these

Table 3.12. Resource Requirements and Optimum Enterprise Combinations to Produce a $7,000 Income Level on a Farm Initially Consisting of 40 Acres Open Land, Specified Labor Prices, Southwest Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	62	74	86	95	*
Pasture land purchased	Acre	89	106	123	136	
Added average outlay	Dollar	91,569	101,064	113,097	134,390	
Total average outlay	Dollar	104,425	113,920	125,953	147,246	
Labor:						
Resident operator	Hour	2,597	2,431	2,420	2,473	
Seasonal hired	Hour	1,274	1,316	1,529	1,814	
Capital:						
Added investment**	Dollar	68,556	73,790	81,524	92,070	
Total investment**	Dollar	80,013	85,247	92,981	103,527	
Annual operating	Dollar	4,679	8,049	10,738	16,637	
Open land use:						
Burley tobacco	Acre	3.8	4.3	4.9	5.3	
Corn, grain	Acre	20.9	28.0	33.2	22.5	
Corn, silage	Acre	7.7	4.7	3.7	17.5	
Alfalfa hay	Acre	46.6	54.0	61.2	66.7	
Total cropland	Acre	79.0	91.0	103.0	112.0	
Permanent pasture	Acre	31.0	10.0	0	0	
Pasture unused	Acre	81.0	119.0	146.0	159.0	
Total open land	Acre	191.0	220.0	249.0	271.0	
Livestock:						
Market hogs	Head	18	29	36	11	
Dairy cows (producing Grade-B milk)	Head	16	5	0	0	
Pasture-fed steers	Head	0	0	0	0	
Dry-lot steers	Head	32	76	104	165	
Total steers	Head	32	76	104	165	
Crop sales:						
Hay	Ton	111	128	145	158	
Corn	Bu.	0	0	0	471	
Gross returns	Dollar	26,707	34,544	41,042	53,661	

* No feasible solution.

** Initial value of investment capital.

Table 3.13. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 40 Acres Open Land to Produce a $7,000 Labor Income, Specified Hired Labor Prices, Southwest Virginia

| Ratio | Hired labor price per hour | | | | |
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.049	.059	.063	.063	*
Land/operating capital	.041	.027	.023	.016	
Land/investment capital	.002	.002	.002	.003	
Labor/operating capital**	1.140	.620	.510	.354	
Labor/investment capital	.048	.044	.042	.041	
Average outlay/land	546.7	517.8	505.8	543.3	
Average outlay/operating capital	22.3	14.1	11.7	8.8	
Average outlay/investment capital	1.3	1.3	1.3	1.4	
Average outlay/labor	26.8	30.4	31.9	34.3	
Gross income/labor	6.9	9.2	10.4	12.5	
Gross income/land	139.8	157.0	164.8	198.0	
Gross income/operating capital	5.7	4.3	3.8	3.2	
Gross income/investment capital	.3	.4	.4	.5	

* No feasible solution.

** Operating capital exclusive of labor costs.

Table 3.14. Resource Requirements and Optimum Enterprise Combinations to Produce a $7,000 Income Level on a Farm Initially Consisting of 140 Acres Open Land, Specified Hired Labor Prices, Southwest Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	43	46	58	79	*
Pasture land purchased	Acre	62	65	83	115	
Added average outlay	Dollar	73,831	82,724	94,583	117,561	
Total average outlay	Dollar	115,095	123,986	135,847	158,823	
Labor:						
Resident operator	Hour	2,616	2,580	2,580	2,524	
Seasonal hired	Hour	1,344	1,297	1,564	1,965	
Capital:						
Added investment**	Dollar	54,000	54,428	63,160	78,941	
Total investment**	Dollar	91,624	92,052	100,784	116,565	
Annual operating	Dollar	5,288	12,218	13,515	17,361	
Open land use:						
Burley tobacco	Acre	3.8	3.9	4.4	5.4	
Corn, grain	Acre	34.0	39.3	41.8	40.2	
Corn, silage	Acre	8.2	3.9	5.5	14.4	
Alfalfa hay	Acre	52.0	53.9	61.3	74.0	
Total cropland	Acre	98.0	101.0	113.0	134.0	
Permanent pasture	Acre	33.0	24.0	0	0	
Pasture unused	Acre	114.0	126.0	168.0	200.0	
Total open land	Acre	245.0	251.0	281.0	334.0	
Livestock:						
Market hogs	Head	0	40	44	0	
Dairy cows (producing Grade-B milk)	Head	17	0	0	0	
Pasture-fed steers	Head	0	15	0	0	
Dry-lot steers	Head	44	115	144	184	
Total steers	Head	44	130	144	184	
Crop sales:						
Hay	Ton	125	100	127	168	
Corn	Bu.	1,977	102	0	2,351	
Gross returns	Dollar	28,204	43,012	48,330	55,792	

  * No feasible solution.

  ** Initial value of investment capital.

inputs could not be increased sufficiently to permit obtaining a feasible solution at a $3.00 labor price (Table 3.15).

Large Farm

At the $1.00 and $1.50 labor prices, not all land was utilized (Table 3.16). At the $2.00 labor price, 28 acres of open land were purchased, while only the purchased cropland was utilized. The only livestock enterprises were 155 dry-lot steers purchased in the fall, wintered on a maintenance ration, and sold in the spring, and 42 feeder steers, bought in the fall and sold in the spring. The crop enterprises consisted of tobacco, corn for silage and grain, and hay. Over one-half of both the corn and hay were sold. No pasture was utilized. A similar situation with respect to enterprises in the optimum solution existed at the $2.50 price of labor, but on a larger scale. Increases in the amounts of labor hired relative to land purchased resulted in more labor being used per acre of land as the labor price increased (Table 3.17).

Table 3.15. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 140 Acres Open Land to Produce a $7,000 Labor Income, Specified Hired Labor Prices, Southwest Virginia

Ratio	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.062	.065	.068	.074	*
Land/operating capital	.046	.021	.021	.019	
Land/investment capital	.003	.003	.003	.003	
Labor/operating capital**	1.000	.380	.400	.360	
Labor/investment capital	.043	.042	.041	.038	
Average outlay/land	473.1	493.9	483.4	475.5	
Average outlay/operating capital	21.8	10.1	10.1	9.1	
Average outlay/investment capital	1.3	1.3	1.3	1.4	
Average outlay/labor	29.1	31.9	32.8	35.4	
Gross income/labor	7.1	11.1	11.7	12.4	
Gross income/land	115.1	171.4	172.0	167.0	
Gross income/operating capital	5.3	3.5	3.6	3.2	
Gross income/investment capital	.3	.5	.5	.5	

* No feasible solution.

** Operating capital exclusive of labor costs.

Table 3.16. Resource Requirements and Optimum Enterprise Combinations to Produce a $7,000 Income Level on a Farm Initially Consisting of 410 Acres Open Land, Specified Labor Prices, Southwest Virginia

Item	Unit	Hired labor price per hour				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land and average outlay:						
Cropland purchased	Acre	0	0	11	32	*
Pasture land purchased	Acre	0	0	17	46	
Added average outlay	Dollar	46,006	51,256	62,734	87,934	
Total average outlay	Dollar	161,697	166,947	178,425	203,625	
Labor:						
Resident operator	Hour	2,399	2,508	2,622	2,728	
Seasonal hired	Hour	1,387	1,500	1,815	2,399	
Capital:						
Added investment**	Dollar	23,661	24,845	32,847	49,586	
Total investment**	Dollar	130,282	131,466	139,468	156,207	
Annnual operating	Dollar	12,083	15,237	17,705	22,044	
Open land use:						
Burley tobacco	Acre	3.0	3.0	3.5	4.5	
Corn, grain	Acre	85.9	83.7	86.3	86.8	
Corn, silage	Acre	6.1	8.3	9.2	16.5	
Alfalfa hay	Acre	85.0	85.0	92.0	104.0	
Cropland unused	Acre	0	0	0	0	
Total cropland	Acre	180.0	180.0	191.0	212.0	
Permanent pasture	Acre	0	0	0	0	
Pasture unused	Acre	230.0	230.0	247.0	276.0	
Total open land	Acre	410.0	410.0	438.0	488.0	
Livestock:						
Market hogs	Head	0	0	0	0	
Dry-lot steers	Head	150	169	197	229	
Total steers	Head	150	169	197	229	
Crop sales:						
Hay	Ton	210	210	218	256	
Corn	Bu.	6,275	5,107	5,351	5,821	
Gross returns	Dollar	45,700	53,318	59,104	69,613	

* No feasible solution.

** Initial value of investment capital.

Table 3.17. Ratios of Selected Input and Input-Output Factors for a Representative Farm Initially Consisting of 410 Acres Open Land to Produce a $7,000 Labor Income, Specified Hired Labor Prices, Southwest Virginia

Ratio	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
Land/labor	.108	.102	.099	.095	*
Land/operating capital	.034	.027	.025	.022	
Land/investment capital	.003	.003	.003	.003	
Labor/operating capital**	.350	.310	.310	.320	
Labor/investment capital	.029	.030	.032	.033	
Average outlay/land	394.4	407.2	407.4	417.3	
Average outlay/operating capital	13.4	10.9	10.1	9.2	
Average outlay/investment capital	1.2	1.3	1.3	1.3	
Average outlay/labor	42.7	41.7	40.2	39.7	
Gross income/labor	12.1	13.3	13.3	13.6	
Gross income/land	111.5	130.0	134.9	142.6	
Gross income/operating capital	3.8	3.5	3.3	3.2	
Gross income/investment capital	.3	.4	.4	.4	

* No feasible solution.

** Operating capital exclusive of labor costs.

CHAPTER IV

AGGREGATE EFFECTS OF ADJUSTMENTS BY
FARMS TO OBTAIN SPECIFIED INCOME LEVELS

The aggregate estimates of farm numbers, land use, livestock numbers, resource requirements, and income when the representative farms obtain specified net income levels under varying wage rates are presented in this section. The aggregation deals only with those resources in the area available to 5,446 non-Grade-A dairy farms with ten or more acres of cropland. Aggregation analyses are based on three representative farms -- small, medium, and large -- and each group is composed of 144,000, 211,000, and 135,000 acres of open land, respectively.

The estimates are obtained by maximizing aggregate returns to operator labor and management of these farms, after adjustment, subject to the total resources in the study area, principally open land and tobacco allotment. The maximum number of farms consistent with the various income levels would exist if all farms were of the minimum size. In some instances, the large size representative farms had more than adequate amounts of open land to achieve the specified income level. The aggregation, however, includes the resources required and output of the farms which purchased land to enable them to achieve the minimum income levels, plus the associated resources required and maximum output that could be produced by the farms that did not need to purchase land to reach the specified income levels.

In interpreting the results of the aggregate estimates, two factors should be kept in mind. First, no account is taken of the possible effects on the cost of resources or on the demand conditions for agricultural products when tobacco farmers as a group adjust simultaneously. The estimates are not predictions of aggregate results of actions farmers are most likely to take. Second, the estimates are accurate only to the extent that all farms in each size group would be expected to behave like the representative farm for that size group.

An increase in wage rates paid for hired labor on the farms in the area of study had a pronounced effect on the structure and organization of farms under study. Likewise, an increase in the minimum returns to operator labor and management for each farm had a similar effect. Decrease in total farm numbers ranged from 40 percent at a $1.00 wage rate and a $3,500 income to 76 percent at a $2.50 wage rate and a $7,000 income. The greatest decrease occurred in the small farms which were almost eliminated at the $7,000 level. Medium farm numbers changed slightly, and large farm numbers were virtually unaffected.

Aggregation results indicate that from 11 to 22 percent of the land in the small farms would be purchased by owners of the medium farms at the $3,500 income level. At the $5,000 income level with labor prices above $1.00 an hour, land moved from the small to the medium farms, ranging from six percent at a $1.50 wage rate to 46 percent at a $3.00 wage rate. At the $7,000 income level, 48 percent of the open land now in the small farms was added to the medium farms at a $1.00 wage rate. At a $2.50 hired wage rate, 97 percent of the

land in the small farms was purchased by the other farms, with 79

percent purchased by the medium farms and 18 percent by the large

farms.

Presently, the crop occupying the greatest amount of cropland

on these farms is hay of various types, which occupies 44 percent

of the total cropland. Twenty-seven percent of the cropland is in

pasture, and 12 percent is idle. Should all farms in the study area

achieve the specified minimum income levels, aggregate land use and

production would be different from the existing situation. Cropland

presently utilized as pasture, or idle, would be producing field

crops. The acreage of hay would be near its present level, but pro-

duction would be approximately three times as great as present production

because of a higher level of management. In the aggregation model, total

hay production increased with the increased income levels at all labor

prices.

Production of corn for grain and for silage were above the pre-

sent level. At the lower wage rates, total production of corn increased

with increases in the income level. This production, however, decreased

at the $7,000 income level at wage rates greater than $1.50 an hour.

The total allotment of tobacco, 6,800 acres, was utilized at all labor

prices. The estimated production from this acreage was 40 percent

above the total production presently being obtained.

At income levels above a minimum $3,500 income, total beef cattle

and hog numbers would be increased over the present numbers for all

farms in the area (Appendix Table G.2). For the study farms, dairy

cow numbers would be increased at the two lowest income levels, but would be eliminated at the highest income levels. Total sheep numbers would be eliminated at all income levels.

Total hog numbers increased with the higher income levels at wage rates of $1.50 and $2.00 an hour. Corn sold varied inversely with the hog numbers. Dairy cow numbers decreased with the rise in income levels while dry-lot steers increased in numbers. This drop in dairy cow numbers was accompanied by a decrease in pasture being used. In some instances, pasture-fed steers increased when dairy cow numbers were reduced.

Aggregate amounts of hired labor increased with an increase in income levels, while total labor utilized decreased as a result of the decrease in total farm numbers. At the $3,500 income, total labor available, was approximately one-half the amount currently available on all farms. This decreased still more with the increase in income levels, and decreased with increasing wage rates within each income level. Aggregate net returns, at each income level, decreased with higher income levels at hired wage rates greater than $1.50 an hour.

Aggregate Adjustment for $3,500 Income

Farm Numbers

There are presently 5,446 farms in the area with ten or more acres of cropland. With a hired wage rate greater than $1.00 per hour, only 328 farms had open land sufficient to obtain a $3,500 operator labor income (Table 4.1). At the four wage rates higher than $1.00 per hour,

Table 4.1. Optimum Distribution of Farms by Size Consistent with a
Minimum $3,500 Return to Operator Labor and Management
Specified Hired Labor Prices, Southwest Virginia*

Hired labor price per hour	Present number of farms	Minimum requirement per farm**	Number of farms possible	Change in farm numbers	Percentage change in farm numbers
(Dollar)	(Farm)	(Acre)	(Farm)	(Farm)	(Percent)
Small Farms					
1.00	3,609	100	1,444	-2,165	-60
1.50	3,609	105	1,682	-1,927	-53
2.00	3,609	111	1,444	-2,165	-60
2.50	3,609	120	1,349	-2,260	-63
3.00	3,609	131	1,231	-2,378	-66
Medium Farms					
1.00	1,509	140	1,509	0	0
1.50	1,509	147	1,217	-292	-19
2.00	1,509	147	1,329	-180	-12
2.50	1,509	156	1,241	-268	-18
3.00	1,509	169	1,150	-359	-24
Large Farms					
1.00	328	410	328	0	0
1.50	328	410	328	0	0
2.00	328	410	328	0	0
2.50	328	410	328	0	0
3.00	328	410	328	0	0
Total Farms					
1.00	5,446	---	3,281	-2,165	-40
1.50	5,446	---	3,227	-2,219	-41
2.00	5,446	---	3,101	-2,345	-43
2.50	5,446	---	2,918	-2,528	-46
3.00	5,446	---	2,709	-2,737	-50

* The $3,500 return is the minimum income level that could be earned by farms that must purchase land to achieve this level. The farms with more than adequate resources to achieve this level could earn a higher income level ($5,000 or $7,000) at some of the labor rates without purchasing additional land.

** Acres of open land per farm to earn at least a $3,500 return to operator labor when added average outlay is minimized.

the adjustment in farm numbers occurred in the small and medium size groups.

To achieve a $3,500 income, decrease in total farm numbers ranged from 40 percent at an hourly wage rate of $1.00 to 50 percent at $3.00 wage rate. Decreases of farm numbers within each group of farms varied in magnitude as the price of labor increased because of the relative variation in minimum open land requirements for the different size farms and their accompanying tobacco allotments.

Land Use and Production

There are approximately 490,300 acres of open land on the farms under study in the area of study (Table 4.2). Fifty-eight percent of the open land is suited only for pasture. Approximately two-thirds of this pasture land was not utilized in the optimum organizations of the individual representative farms (Chapter 3), and therefore was not utilized in the aggregate land use.

The crop occupying the largest total acreage was alfalfa hay, which was more hay acreage than the total of all types of hay presently grown. Estimated acreage of corn for grain was over 300 percent the amount presently grown, and corn production was over five times as great as the amount presently grown.

Steers constituted the largest number of livestock at all labor prices. The next largest livestock enterprise was dairy cows, with a 200 percent increase over present numbers. With a wage rate of $3.00 per hour, the greatest amount of available pasture was utilized.

Table 4.2. Aggregate Crop and Livestock Production, Present Study Farms, and Estimated for All Farms Earning a $3,500 or Greater Return to Operator Labor and Management, Specified Hired Labor Prices, Southwest Virginia*

Item	Present study farms**	Estimated with hired labor price per hour of				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land use:				1,000 Acres		
Burley tobacco	6.8	6.8	6.8	6.8	6.8	6.8
Corn, grain	19.9	70.3	67.3	72.1	68.8	71.4
Corn, silage	5.8	23.6	24.3	21.8	22.8	20.4
Alfalfa hay	13.9	102.7	105.0	102.7	105.0	104.8
Other hays	77.6	0.	0.	0.	0.	0.
Cropland pastured	54.6	0.	0.	0.	0.	0.
Cropland idle	24.8	0.	0.	0.	0.	0.
Pasture land used	***	88.8	89.7	88.5	85.4	101.1
Pasture land unused	***	198.1	197.2	198.4	201.5	185.8
Total pasture land	286.9	286.9	286.9	286.9	286.9	286.9
Total open land	490.3	490.3	490.3	490.3	490.3	490.3
Crop production:				1,000,000 Pounds		
Burley tobacco	14.4	20.4	20.4	20.4	20.4	20.4
				1,000 Bushels		
Corn, grain	1,124.2	6,669.0	6,393.5	6,754.5	6,536.0	6,783.0
				1,000 Tons		
Corn, silage	57.4	472.0	486.0	426.0	456.0	386.0
Hay	102.4	409.2	420.0	406.8	420.0	399.2
Livestock:				1,000 Head		
Market hogs	4.0	7.2	8.4	35.2	34.2	43.2
Dairy cows	17.7	52.0	51.5	44.2	42.7	34.6
Pasture-fed steers	***	0.	0.	0.	0.	22.4
Dry-lot steers	***	65.1	72.2	63.0	72.1	50.8
Total steers	21.8	65.1	72.2	63.0	72.1	73.2
Sheep	17.1	0.	0.	0.	0.	0.
Beef cows	39.2	0.	0.	0.	0.	0.
Crop sales:				1,000 Bushels		
Corn	***	3,326.3	2,734.8	2,134.9	2,013.1	2,123.9
				1,000 Tons		
Hay	***	243.5	245.6	245.2	252.7	244.2

* Total production is from farms which must purchase land to achieve a $3,500 income, plus the maximum production possible from farms that do not need to purchase land.

** Data taken from Appendix Tables G.1, G.2, and G.3.

*** Data not available.

Resource Requirements and Incomes

Total aggregate operator labor available decreased as labor price increased because of the decrease in the number of farms consistent with this income level (Table 4.3). Operator labor utilized, as a percent of total operator labor available, increased as the price of labor increased. This rate ranged from 77 percent of the total operator labor utilized at a $1.00 labor price to 87 percent utilized at a $3.00 labor price. Total hired labor increased with an increase in the price of labor. Total labor utilized increased relatively little over the range of hired labor prices; however, this factor, as a percentage of total labor available, increased with the rise in wage rates.

Total expenditures for inputs decreased with the rise in hourly wage rates. This was accompanied by a similar decrease in net returns.

Total annual operating capital increased by 40 percent from a wage rate of $1.00 per hour to a rate of $3.00 per hour. Both added investment capital and added average outlay remained relatively constant at labor prices greater than $1.00 per hour.

Aggregate Adjustment for $5,000 Income

Farm Numbers

With a hired labor price of $1.00 per hour, farm numbers decreased 51 percent from present numbers when all farms achieved a minimum $5,000 return to operator labor and management (Table 4.4). Farm numbers decreased by 67 percent when the hired labor price was $3.00 an hour. At the $3.00 labor price, the large representative farm had

Table 4.3. Estimated Aggregate Resource Requirements and Returns for
            All Farms Earning a $3,500 or Greater Return to Operator
            Labor and Management, Specified Hired Labor Prices, South-
            west Virginia*

Item	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
	1,000 Hours				
Operator labor available	8,957.1	8,809.7	8,465.7	7,966.1	7,395.0
Operator labor utilized	6,877.0	6,867.9	6,876.6	6,742.8	6,432.7
Hired labor:					
January-March	68.3	80.7	57.7	70.6	56.2
April-June	138.4	150.2	134.1	138.2	120.8
July-September	920.0	984.4	984.1	1,044.9	1,047.3
October-December	659.6	678.0	688.1	734.7	762.4
Total hired labor	1,786.3	1,893.3	1,864.0	1,988.4	1,986.7
Total labor available**	10,743.4	10,703.0	10,329.7	9,954.5	9,381.7
Total labor utilized	8,663.3	8,761.2	8,740.6	8,731.2	8,419.4
	1,000 Dollars				
Annual operating capital	9,901.6	11,305.9	10,897.6	12,273.7	13,844.5
Non-labor operating capital	8,115.3	8,465.9	7,169.6	7,302.7	7,884.5
	1,000,000 Dollars				
Added investment capital***	101.3	108.9	106.4	107.3	106.9
Total investment capital***	209.6	209.0	207.9	204.6	199.3
Added average outlay	147.9	158.3	154.9	156.3	156.2
Total average outlay	266.7	268.1	266.3	262.9	257.5
Gross returns	58.1	61.0	59.6	61.4	60.7
Net returns	12.6	12.4	11.4	10.7	9.5

    * Aggregate resources required and returns from farms earning a
$3,500 return are for those farms which must purchase additional land to
achieve this minimum level of income. The remainder of the resources
and returns are for those farms which have more than sufficient open land
to produce this minimum income level, and produce at the highest possible
income level ($5,000 or $7,000) at some of the labor rates without pur-
chasing additional land.

    ** Total operator labor plus hired labor presently available on all
farms in the area is 19,670,000 hours. (Data taken from a survey of
farms in this area in 1965).

    *** Initial value of investment capital.

Table 4.4. Optimum Distribution of Farms by Size Consistent with a Minimum $5,000 Return to Operator Labor and Management, Specified Hired Labor Prices, Southwest Virginia*

Hired labor price per hour	Present number of farms	Minimum requirement per farm**	Maximum number of farms possible	Change in farm numbers	Percentage change in farm numbers
(Dollar)	(Farm)	(Acre)	(Farm)	(Farm)	(Percent)
			Small Farms		
1.00	3,609	132	1,149	-2,460	-68
1.50	3,609	144	949	-2,660	-74
2.00	3,609	162	847	-2,762	-77
2.50	3,609	186	632	-2,977	-82
3.00	3,609	209	375	-3,234	-90
			Medium Farms		
1.00	1,509	171	1,192	-317	-21
1.50	1,509	184	1,190	-319	-21
2.00	1,509	202	1,081	-428	-28
2.50	1,509	224	1,061	-448	-30
3.00	1,509	248	1,117	-392	-26
			Large Farms		
1.00	328	410	328	0	0
1.50	328	410	328	0	0
2.00	328	410	328	0	0
2.50	328	410	328	0	0
3.00	328	425	317	-11	-3
			Total Farms		
1.00	5,446	---	2,669	-2,777	-51
1.50	5,446	---	2,467	-2,979	-55
2.00	5,446	---	2,256	-3,190	-59
2.50	5,446	---	2,021	-3,425	-63
3.00	5,446	---	1,809	-3,637	-67

* The $5,000 return is the minimum income level that could be earned by farms that must purchase land to achieve this level. The farms with more than adequate resources to achieve this level could earn a higher income level ($7,000) at some of the labor rates without purchasing additional land.

** Acres of open land per farm to earn at least a $5,000 return to operator labor when added average outlay is minimized.

to purchase relatively small amounts of open land to achieve this income level. This land was purchased from land in the group of large representative farms, reducing by 11 the number of large farms. Had this land been purchased from the smaller farms, the level of aggregate returns to operator labor would have been lower than it was, for the number of smaller farms would have been reduced by a number greater than 11.

Land Use and Production

The total acreage of corn for grain and alfalfa hay was slightly higher than the aggregate acreages when all farms achieved a minimum $3,500 income, making the production of these crops still greater than present production (Table 4.5). These increases were accompanied by smaller acreages of corn silage. The amounts of permanent pasture utilized were less than for the previous income levels, being eight percent less at a $1.00 labor price and 51 percent less at a $3.00 labor price.

These increases in feed were accompanied by a rise in most live-stock numbers except dairy cows numbers which were reduced, in some instances, to below present numbers. The number of market hogs and pasture-fed steers increased. Hogs increased at all wage rates, and steers increased at the higher wage rates. Hog numbers were over twice the total number of hogs presently on all farms (Appendix Table G.2). Steer numbers, at the $3.00 wage rate, were over twice the number of total beef animals on all farms at the present.

Table 4.5. Aggregate Crop and Livestock Production, Present Study Farms, and Estimated for All Farms Earning a $5,000 or Greater Return to Operator Labor and Management, Specified Hired Labor Prices, Southwest Virginia*

Item	Present study farms**	Estimated with hired labor price per hour of				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land use:		1,000 Acres				
Burley tobacco	6.8	6.8	6.8	6.8	6.8	6.8
Corn, grain	19.9	69.3	70.3	80.3	82.7	82.8
Corn, silage	5.8	21.8	20.3	10.6	6.4	6.6
Alfalfa hay	13.9	105.5	105.9	105.7	107.5	107.2
Other hays	77.6	0.	0.	0.	0.	0.
Cropland pastured	54.6	0.	0.	0.	0.	0.
Cropland unused	24.8	0.	0.	0.	0.	0.
Pasture land used	***	81.9	70.1	74.3	67.2	52.3
Pasture land unused	***	205.0	216.8	212.6	219.7	234.6
Total pasture land	286.9	286.9	286.9	286.9	286.9	286.9
Total open land	490.3	490.3	490.3	490.3	490.3	490.3
Crop production:		1,000,000 Pounds				
Burley tobacco	14.4	20.4	20.4	20.4	20.4	20.4
		1,000 Bushels				
Corn, grain	1,124.2	6,583.5	6,688.0	7,524.0	7,856.5	7,818.5
		1,000 Tons				
Corn, silage	57.4	436.0	406.0	212.0	128.0	132.0
Hay	102.4	422.0	422.0	416.4	426.4	424.8
Livestock:		1,000 Head				
Market hogs	4.0	35.5	39.5	54.0	67.9	63.8
Dairy cows	17.7	40.9	35.0	20.5	5.1	0.
Pasture-fed steers	***	0.	0.	23.8	39.7	38.8
Dry-lot steers	***	72.9	95.9	82.9	110.5	198.4
Total steers	21.8	72.9	95.9	106.7	150.2	237.2
Sheep	17.1	0.	0.	0.	0.	0.
Beef cows	39.2	0.	0.	0.	0.	0.
Crop sales:		1,000 Bushels				
Corn	***	2,062.4	1,679.2	2,134.7	2,016.8	1,649.5
		1,000 Tons				
Hay	***	255.2	253.8	253.1	257.3	219.2

* Total production is from farms which must purchase land to achieve a $5,000 income, plus the maximum production possible from farms that do not need to purchase land.

** Data taken from Appendix Tables G.1, G.2, and G.3.

*** Data not available.

Resource Requirements and Incomes

Aggregate net returns at wage rates of $1.00 and $1.50 were

higher when individual farm returns were at least $5,000 than when

all farms achieved a minimum $3,500 income. In other words, the

required reduction in number of farms was not great enough to offset

the increase in income per farm. This situation was reversed, how-

ever, at wage rates above $1.50 an hour (Table 4.6).

Total operator labor available was less at the $5,000 than at

the $3,500 income level, however, a higher percentage of this labor

(approximately 90 percent) was utilized. Total hired labor increased

in all labor periods over that required at a lower income level, but,

remained relatively constant as the price of hired labor increased.

Annual operating capital increased with the increase in labor

prices. With a wage rate of $1.00, total operating capital was only

slightly above the amount required when the farms achieved a $3,500

or greater income. However, total operating capital was nearly twice

the amount required at the lower income level at a wage rate of $3.00

an hour. Total values of inputs are less than those values required

at the $3,500 income.

Aggregate Adjustment for $7,000 Income

Farm Numbers

The present number of small farms would need to be reduced signi-

ficantly if all farm owners are to realize a $7,000 return to operator

labor (Table 4.7). Due to a tremendous increase in demand by the larger

Table 4.6. Estimated Aggregate Resource Requirements and Returns for
All Farms Earning a $5,000 or Greater Return to Operator
Labor and Management, Specified Hired Labor Prices, South-
west Virginia*

Item	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
	1,000 Hours				
Operator labor available	7,286.4	6,734.9	6,158.9	5,517.3	4,938.6
Operator labor utilized	6,516.7	6,163.7	5,549.5	4,931.8	4,593.4
Hired labor:					
January-March	90.9	115.3	74.0	86.6	193.8
April-June	140.8	149.7	134.6	143.8	168.8
July-September	1,114.3	1,144.5	1,086.6	1,053.9	1,068.4
October-December	796.7	826.1	837.1	850.2	922.2
Total hired labor	2,142.7	2,235.6	2,132.3	2,134.5	2,353.2
Total labor available**	9,429.1	8,970.5	8,291.2	7,651.8	7,291.8
Total labor utilized	8,659.4	8,399.3	7,681.8	7,066.3	6,946.6
	1,000 Dollars				
Annual operating capital	10,691.9	13,106.5	14,927.8	19,060.2	25,061.4
Non-labor operating capital	8,549.2	9,753.1	10,663.2	13,723.9	18,001.8
	1,000,000 Dollars				
Added investment capital***	107.6	105.1	102.1	97.1	94.9
Total investment capital***	200.7	195.8	187.5	179.3	175.1
Added average outlay	153.8	152.3	148.8	145.6	148.7
Total average outlay	255.8	251.6	242.3	235.6	236.3
Gross returns	61.0	64.8	63.4	68.5	79.5
Net returns	14.1	13.0	11.3	10.2	9.0

* Aggregate resources required and returns from farms earning a
$5,000 return are for those farms which must purchase additional land to
achieve this minimum level of income. The remainder of the resources
and returns are for those farms which have more than sufficient open
land to produce this minimum income level, and produce at the highest
possible income level ($7,000) at some of the labor rates without pur-
chasing additional land.

** Total operator labor plus hired labor presently available on all
farms in the area is 19,670,000 hours. (Data taken from a survey of
farms in this area in 1965).

*** Initial value of investment capital.

Table 4.7. Optimum Distribution of Farms by Size Consistent with a
$7,000 Return to Operator Labor and Management, Specified
Hired Labor Prices, Southwest Virginia

Hired labor price per hour	Present number of farms	Minimum requirement per farm**	Maximum number of farms possible	Change in farm numbers	Percentage change in farm numbers
(Dollar)	(Farm)	(Acre)	(Farm)	(Farm)	(Percent)
			Small Farms		
1.00	3,609	191	395	-3,214	-89
1.50	3,609	220	363	-3,246	-90
2.00	3,609	249	187	-3,422	-95
2.50	3,609	271	17	-3,592	-99
3.00	3,609	*			
			Medium Farms		
1.00	1,509	245	1,143	-366	-24
1.50	1,509	251	1,098	-411	-27
2.00	1,509	281	1,100	-409	-27
2.50	1,509	334	975	-534	-35
3.00	1,509	*			
			Large Farms		
1.00	328	410	328	0	0
1.50	328	410	328	0	0
2.00	328	438	308	-20	-6
2.50	328	488	328	0	0
3.00	328	*			
			Total Farms		
1.00	5,446	---	1,866	-3,580	-66
1.50	5,446	---	1,789	-3,657	-67
2.00	5,446	---	1,595	-3,851	-71
2.50	5,446	---	1,320	-4,126	-76
3.00	5,446	---			

*   No feasible solution.

**   Acres of open land per farm to earn at least a $7,000 return
to operator labor when added average outlay is minimized.

farms for additional open land to achieve this income level, small
farm numbers decreased by 89 percent when the hired labor price
was $1.00 per hour, and by 99 percent when the labor price was $2.50
per hour. None of the farms were capable of achieving this income
level when the hired labor price was $3.00 per hour.

Land Use and Production

For the $7,000 income, less permanent pasture was utilized than
in the previous income goals (Table 4.8). More land was planted in
corn for grain and less in corn silage at the lower labor prices. At
the higher labor prices, the situation was reversed. Slightly more
land was used in the production of hay at all labor prices.

Total livestock numbers also changed from those numbers produced
for income goals discussed previously. Pasture-fed steers were elimi-
nated under all but one hired labor price. Dairy cow numbers were
reduced at the two lower labor prices, and eliminated at the two higher
prices. The number of dry-lot steers at the $2.50 wage rate was nearly
3 times the total number of all beef cattle presently on all farms in
the area (Appendix Table G.2).

Resource Requirements and Incomes

Aggregate net returns when all farms achieved a minimum $7,000
operator labor income were less than when a $5,000 income level was
obtained at all wage rates (Table 4.9). Both added investment capital
and added average outlay were lower as a consequence of the relatively
greater number of the larger size farms which had more initial resources

Table 4.8. Aggregate Crop and Livestock Production, Present Study
Farms, and Estimated Should All Farms Adjust to Achieve
a $7,000 Return to Operator Labor and Management, Speci-
fied Hired Labor Prices, Southwest Virginia

Item	Present study farms**	Estimated with hired labor price per hour of				
		$1.00	$1.50	$2.00	$2.50	$3.00
Land use:				1,000 Acres		
Burley tobacco	6.8	6.8	6.8	6.8	6.8	*
Corn, grain	19.9	75.8	81.0	78.7	68.0	
Corn, silage	5.8	14.4	8.7	9.6	19.8	
Alfalfa hay	13.9	106.4	106.9	108.3	108.8	
Other hays	77.6	0.	0.	0.	0.	
Cropland pastured	54.6	0.	0.	0.	0.	
Cropland unused	24.8	0.	0.	0.	0.	
Pasture land used	***	50.0	30.0	0.	0.	
Pasture land unused	***	236.9	256.9	286.9	286.9	
Total pasture land	286.9	286.9	286.9	286.9	286.9	
Total open land	490.3	490.3	490.3	490.3	490.3	
Crop production:				1,000,000 Pounds		
Burley tobacco	14.4	20.4	20.4	20.4	20.4	
				1,000 Bushels		
Corn, grain	1,124.2	7,163.0	7,676.0	7,476.5	6,460.0	
				1,000 Tons		
Corn, silage	57.4	288.0	174.0	192.0	386.0	
Hay	102.4	423.2	426.8	428.8	429.6	
Livestock:				1,000 Head		
Market hogs	4.0	7.1	54.5	55.1	0.	
Dairy cows	17.7	25.8	1.8	0.	0.	
Pasture-fed steers	***	0.	16.5	0.	0.	
Dry-lot steers	***	112.3	209.4	238.4	257.3	
Total steers	21.8	112.3	225.9	238.4	257.3	
Sheep	17.1	0.	0.	0.	0.	
Beef cows	39.2	0.	0.	0.	0.	
Crop sales:				1,000 Bushels		
Corn	***	4,322.9	1,790.3	1,646.0	4,209.0	
				1,000 Tons		
Hay	***	255.8	225.3	233.8	250.4	

* No feasible solution.

** Data taken from Appendix Tables G.1, G.2, and G.3.

*** Data not available.

Table 4.9. Estimated Aggregate Resource Requirements and Returns
Should All Farms Adjust to Achieve a $7,000 Return to
Operator Labor and Management, Specified Hired Labor
Prices, Southwest Virginia

Item	Hired labor price per hour				
	$1.00	$1.50	$2.00	$2.50	$3.00
	1,000 Hours				
Operator labor available	5,094.2	4,884.0	4,354.3	3,603.6	*
Operator labor utilized	4,804.8	4,540.6	4,096.1	3,397.7	
Hired labor:					
January-March	158.8	207.4	243.1	292.9	
April-June	180.1	170.3	198.1	210.3	
July-September	1,267.2	1,092.8	1,157.8	1,261.4	
October-December	889.4	924.9	965.2	968.8	
Total hired labor	2,495.5	2,395.4	2,564.0	2,733.4	
Total labor available**	7,589.7	7,279.4	6,918.3	6,337.0	
Total labor utilized	7,300.3	6,936.0	6,660.1	6,131.1	
	1,000 Dollars				
Annual operating capital	11,865.6	21,348.4	22,316.6	24,439.8	
Non-labor operating capital	9,370.1	17,755.3	17,188.6	17,606.3	
	1,000,000 Dollars				
Added investment capital***	96.6	94.7	94.8	94.8	
Total investment capital***	179.2	175.3	171.1	166.6	
Added average outlay	135.7	144.4	144.4	145.8	
Total average outlay	226.0	232.4	227.8	224.1	
Gross returns	57.8	77.3	79.0	78.1	
Net returns	13.1	12.5	11.2	9.2	

* No feasible solution.

** Total operator labor plus hired labor presently available on all
farms in the area is 19,670,000 hours. (Data taken from a survey of
farms in this area in 1965).

*** Initial value of investment capital.

than did the smaller farms. Annual operating capital was at its

highest level of all situations previously discussed.

Total operator labor available was less at this income level

because of the smaller number of farms. Total operator labor utilized,

however, was 94 percent of operator labor available, the highest per-

centages observed for this factor of production. Total amounts of

labor hired was the greatest total amount of labor hired at the speci-

fied labor prices of any of the income levels.

Total labor utilized and total labor available was less than that

for the two previous income levels. Total labor available as a percent

of present total labor available on the study farms ranged from 39 per-

cent at a $1.00 wage rate to 32 percent at a $2.50 wage rate.

CHAPTER V

SUMMARY AND CONCLUSIONS

There are areas in the agricultural sector of our economy where farms exist with insufficient resources (land and/or non-land resources) to permit earning an income level comparable to a level that can be earned in non-farming occupations. The area of Southwest Virginia is composed of many small farms that are typical of farms with insufficient resources. Less than 25 percent of the farms in the area have sufficient land to enable them to earn operator labor incomes in excess of $3,000 annually. The principal cash crop in the area is burley tobacco which is grown in small allotments on these farms. This study hypothesized that increasing wages for hired farm labor would result in additional labor being hired at the farm level when a specified income was obtained, and that the aggregate amounts of labor utilized by all farms obtaining these income levels would be less than that currently used on these farms.

The overall objective of this tudy was to determine the effects of various wage rates on the minimum amounts of resources needed to obtain specified income levels on farms in Southwest Virginia, and the aggregate effects of these wage rates on the structure and organization of farms in this area.

For analytical purposes, the farms were classified into three groups characterized by representative farms of 40, 140, and 410 acres

of cropland, and referred to as small, medium, and large farms, re-
spectively. A linear programming model was constructed for each size
farm to determine the resources and enterprise combinations necessary
for each size farm to achieve a $3,500, $5,000, and $7,000 income,
with added average outlay as a minimization criterion. This specific
minimization criterion was used because it is believed to be a superior
minimization criterion in areas where a labor intensive crop is pro-
duced.

An aggregation model was constructed to determine the aggregate
effects of these changes on farm organization and structure in the
area. This type study permitted the determination of total resources
required, and input-output combinations associated with optimum or-
ganizations at the firm level with various prices for hired labor.

Based on the analysis of this study, the following results were
observed:

(1) There are presently a large number of farms in the study area
with open land acreage below the minimum required to provide full-time
productive employment for the operator.

(2) When available cropland is not sufficient to enable an in-
dividual farm to obtain a specified income, it is more profitable, in
terms of minimizing added average outlay, to purchase additional open
land in order to obtain additional tobacco acreage and other cropland,
than to utilize large amounts of existing unused pasture.

(3) An increase in hired labor wage rates, when an individual farm
is achieving a specified income, may result in the hiring of additional
labor.

(4) On some of the farms large amounts of additional capital would be required to attain the specified income levels.

(5) Should all farms in the area adjust simultaneously to attain a $3,500, $5,000, or $7,000 income, respectively, farm numbers would decrease. This decrease would result in:

(a) Increased production of crop and certain live-stock enterprises for the area. This increased production would result in gross returns from the sale of farm commodities of more than twice the amount presently received for the sale of farm commodities from all farms in the area;

(b) A total labor force approximately one-half the present labor force available (operator labor available plus all hired labor) on all farms in the area when a minimum $3,500 income is obtained, and one-third the present labor force available when a minimum $7,000 is obtained;

(c) An increase in total labor hired as both the wage rates and specified income levels were increased;

(d) A decrease in total labor available as the spec-ified income levels were raised, and when the wage rates were raised within each income level.

The effects of the increase in hired wage rates on optimum allo-cation of inputs when a firm achieves a fixed net income are shown in Figure 5.1. Labor inputs (hours) are measured on the vertical axis, and all other inputs are measured on the horizontal axis in monetary terms. With a hired labor price of $1.00 an hour, a firm will operate at point D, using quantity OX of labor and OA of other inputs. This
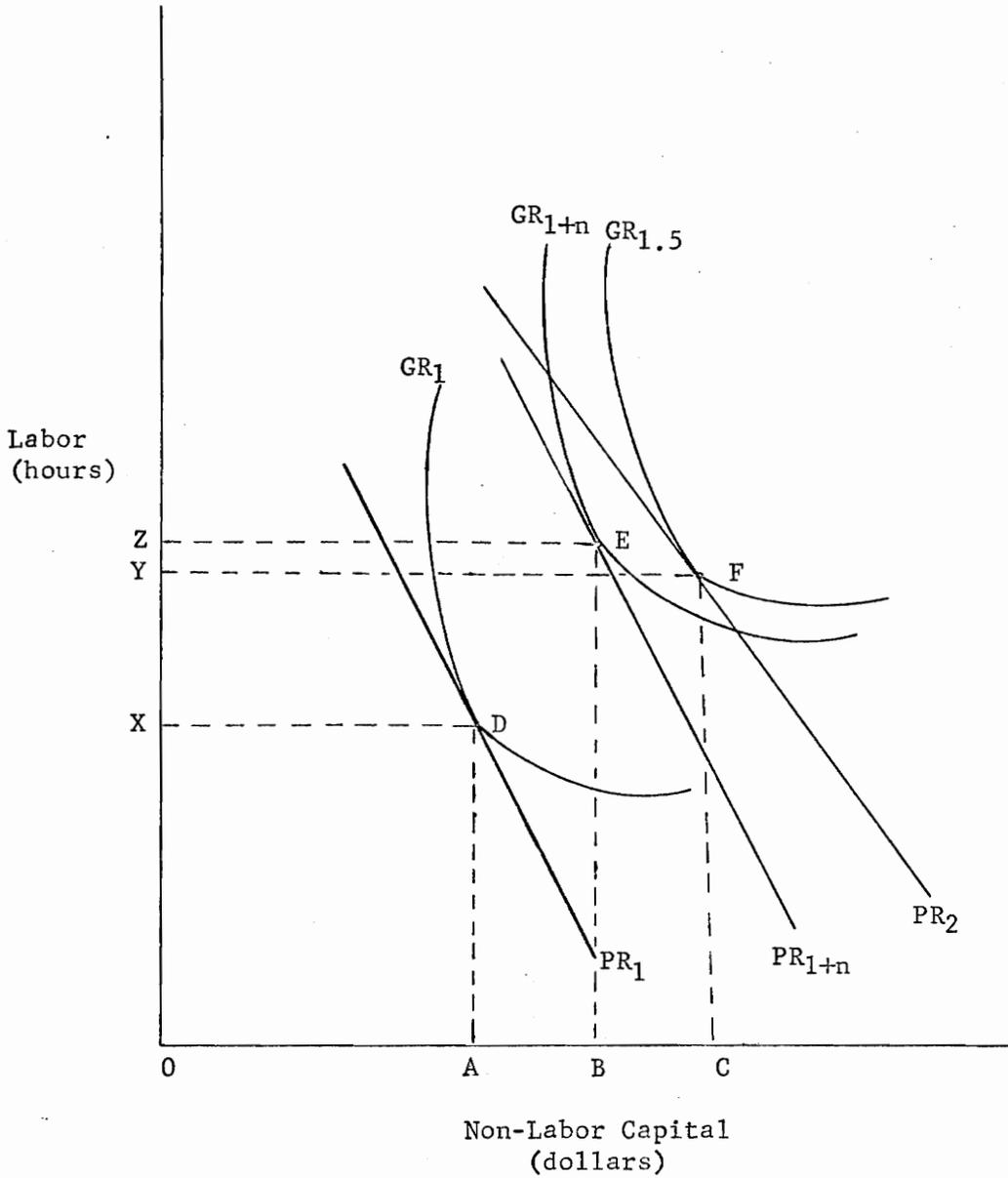
Figure 5.1. Effects of Increased Labor Costs on Optimum Use of Labor and Non-Labor Inputs to Obtain a Fixed Operator-Labor Income.

point, D, is the firm's least-cost combination of inputs, given a set

of factor prices, which is assumed to be approached when the firm

minimizes added average outlay. Isoquant GR_1 shows the various com-

binations of labor and non-labor inputs that will produce a specified

gross income. This line, GR_1, is tangent to the price ratio line PR_1

at point D, and it is at this point that gross income is sufficient to

yield the desired level of net income. The first price increase is an

increase of $0.50 an hour, to an hourly rate of $1.50. As a procedural

technique instead of charging this higher rate, the hourly rate of

$1.00 remains, and the specified net income level is increased by an

amount sufficient to equal the cost effect of paying $0.50 more per

hour on the amount of labor hired at $1.00 per hour. (For example,

at an income level of $5,000, with 1,000 hours of hired labor, the

income level would have to be increased to $5,500 to offset a $0.50

hourly wage increase.) The amounts of labor and other inputs required

to reach this higher income level with the original hourly wage rate

($1.00) are located at point E. More of both inputs are required to

reach the higher gross income level, $GR_{1 + n}$. This isoquant is tangent

to the price ratio line $PR_{1 + n}$, at point E, and it is at this point

that the least-cost combination of resources required to reach this

gross income exists. However, if the price paid for labor is actually

increased to $1.50 per hour, and the operator income level is at its

original level, the least-cost combination of inputs is at point F,

consisting of quantity OY of labor and OC of other inputs. Because

of increased costs in the form of labor, a higher gross income level

is required, $GR_{1.5}$. Because labor is costing more per unit, less labor

is used at point F than at point E. Non-labor inputs have increased
(from OB to OC), and have been substituted for a certain amount of
labor (quantity YZ). The total effect when moving from D to F (from
$1.00 to $1.50 labor) is an increase in both labor and non-labor
inputs to achieve this higher gross income; however, non-labor inputs
have increased at a faster rate than labor inputs. The distance from
D to E may be called the cost effect of the higher labor prices. The
distance from E to F is the substitution effect of non-labor inputs
for labor, and, together, the distance from D to F may be called the
total effect as the result of higher hourly wage rates.

The effects of several different wage rates and the corresponding
least-cost combinations of inputs are shown in Figure 5.2. Each iso-
quant shows the combinations of inputs required at a different wage
rate to produce a specified gross income. The point of least-cost com-
bination of inputs on each isoquant gives a gross income sufficient to
allow the desired income level. With an increase in wage rates, the
points of least-cost combinations on the isoquants become further apart
due to the greater amounts of labor and other inputs required to offset
the higher costs associated with this increase in wage rates. As a result
of increased costs and diminishing substitutability of labor, the area
between the ridge lines becomes smaller as the price of labor is increased.
Finally, a point is reached where the price of hired labor is so high that
it is impossible to produce a gross income, with the assumed technology,
that will permit this specified net income to be obtained. This type of
relationship is found in the instances where none of the representative
farms were able to achieve a $7,000 income with a $3.00 wage rate. The
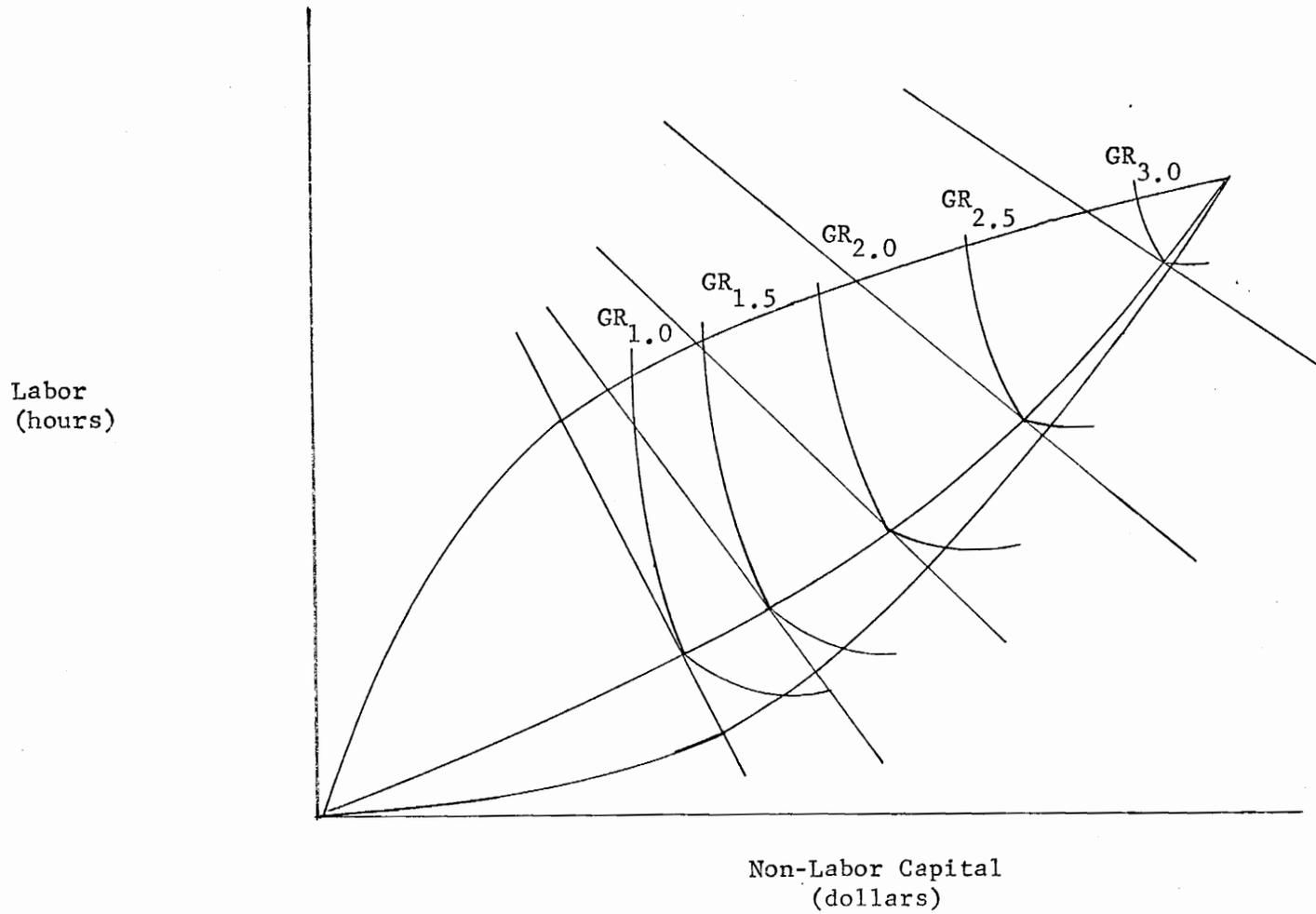
Figure 5.2. Allocation of Inputs at Various Wage Rates to Obtain a Fixed Operator-Labor Income.

expansion path indicates that, even though both inputs increased with higher wage rates, non-labor inputs increased at a faster rate.

It can be concluded that, on the basis of this study, the results previously reported by Maier, and by Tyner and Tweeten, can be substantiated by the results of this analysis. As in the study by Maier, capital was substituted for labor as farm wages were increased, and as in the study by Tyner and Tweeten, an increase in aggregate farm production was obtained with a substantial decrease in total farm labor utilized.

With the reduction in farm numbers necessary for all farms to achieve income levels comparable to those of non-farm employment, a study devoted to the development and analysis of some type of policy to encourage the operators of the more inefficient farms to sell their farms, and the operators of the more efficient farms to purchase these farms would appear to be in order. This would include a means for retraining and/or relocating some of the present agricultural labor that would be unused with the reduction in farm numbers.

None of the representative farms were able to achieve a $7,000 operator labor income when the price of hired labor was $3.00 an hour. With present technology and lack of mechanization for producing burley tobacco, an increased level of support prices for farm commodities, or the introduction of labor-saving innovations for producing these commodities, would be necessary with a continuing increase in the price of labor and other farm inputs.

A reorganization of farms would likely result in a change in quantities produced of various commodities. The structure of beef production would change. Cow-calf production would be decreased while the production of both feeder and fat steers would be vastly increased. A change of this magnitude would necessitate a study to determine the feasibility of processing the animals in the area of production rather than shipping them to other areas for processing.

Production and sale of grain in the aggregation model were much higher than present production and sale in this area, which is normally considered a grain-deficient area. The production of grain for sale rather than for feed for large livestock operations appears to be relatively more profitable when land is considered available for purchase than when farm size is considered fixed. The possibility of large excess quantities of grain in this area, in turn, makes the area a potential producer of large quantities of some type of grain-consuming livestock, perhaps on specialized livestock farms.

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VITA

William Dale Givan, son of Mr. and Mrs. Emmons Dale Givan, was born December 12, 1935, in Liberty, Tennessee.

He attended elementary school in DeKalb County and was graduated from Liberty High School in 1954. He entered the University of Tennessee in September, 1954, and in June, 1958, he was graduated with a Bachelor of Science Degree in Agricultural Education.

In July, 1958, he was employed as teacher of Vocational Agriculture by the Monroe County (Tennessee) Board of Education. In June, 1961, he married Miss Martha Antionette Watson of Madisonville, Tennessee.

He entered graduate school at the University of Tennessee in August, 1962, and completed requirements for a Master of Science Degree in Agricultural Economics in June, 1964.

In September, 1964, he was employed as an Agricultural Economist by the United States Department of Agriculture, and entered graduate school in Agricultural Economics at Virginia Polytechnic Institute. Requirements were completed for a Doctor of Philosophy Degree in Agricultural Economics in December, 1968.

Blacksburg, Virginia, December, 1968

William Dale Givan

APPENDIX A

ENTERPRISE AND MACHINERY BUDGETS

The enterprise budgets used in this study are specifically
adapted to the extreme southwest portion of Virginia and are generally
applicable to similar areas in surrounding states. They can also be
applied to specific situations in other areas by making whatever
changes are necessary in physical resources and price-cost relation-
ships. Budgets included are for those enterprises commonly produced
in the study area, or those which have economic possibilities.

All budgets used in this study have been previously published.[1]
Budgets for tobacco, corn for grain, and steers are included to show
how all budgets were adapted for this study.

An enterprise budget is an estimate of the income and expenses
associated with a unit of a particular enterprise. Included in
this is a value placed on the expected production of the enterprise
and a cost placed on all factors expected to be required for its
production. This latter includes both fixed and variable costs.
These budgets of individual enterprises can be combined with avail-
able resources into a workable plan, which is known as a farm budget.

The enterprise budgets used in this study are constructed pri-
marily for linear programming and differ from the conventional
budgets used in constructing farm budgets. An output of any activity

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1/ William Givan, Estimated Costs, Returns, and Input Requirements
for Selected Crop and Livestock Enterprises in the Burley Tobacco Area
of Southwest Virginia, Division of Research, Virginia Polytechnic
Institute and Farm Production Economics Division, Economic Research
Service, U. S. Department of Agriculture, Unpublished Manuscript.

that can be utilized by another activity has no value placed on it. For example, hay that is produced can be fed to livestock or sold. The cost of the hay activity is the cost of producing this hay for feeding purposes or sale. Thus, the hay is either fed to livestock, which is sold, or sold as hay. Production of cows is a similar situation. The budgets for pasture and corn silage indicate the costs for these enterprises, which cannot be sold, but must be used by livestock or remain unutilized if they are produced. The cost of crop enterprises includes a portion of the fertilizer costs. The remaining fertilizer required can be supplied through buying fertilizer activities or can come from manure produced by livestock, if livestock enterprises enter into the optimum farm organization. The livestock budget costs include a cost for feed that must be purchased, but do not include a cost for feed raised on the farm. This cost is incurred by the cost of each particular crop enterprise producing the feed. Manure credit is given to livestock based on the amounts of nitrogen, phosphorus, and potassium available for crop use (Appendix D). The cash value of the manure is equal to the cost of the commercial fertilizer it replaces, assuming it is used. If it is not used, it is a residual and has no value.

Roughages with the exception of corn silage are expressed in terms of Number 1 alfalfa hay equivalents. The feed grains are expressed in terms of Number 2 yellow corn equivalents. Converting similar feeds into some type of a "common denominator" readily

permits the determination of the relative values of feeds, and permits the inclusion of crops producing feed for livestock at the lowest cost.[2]/

Machinery costs in the enterprise budgets are for variable costs. The fixed costs are fixed regardless of the amount the machinery is used, and are included in each activity for purchasing machinery.

Cost budgets were developed for major pieces of equipment. The minor items of equipment were grouped into two groups, and a cost budget developed for each group (Table A.11). Shelter space for the livestock and storage space for the farm-produced feeds they consumed were charged to each livestock enterprise. Additional space could be purchased through various buying activities. Cost budgets were developed for each of these buying activities (Table A.13).

Prices used in the budgets were obtained from a number of sources including the United States Department of Agriculture, the Virginia Crop Reporting Service, and agencies selling farm supplies. The Animal Science Department at Virginia Polytechnic Institute provided feeder cattle prices based on organized sales, and the Agricultural Engineering Department provided cost figures for buildings and equipment. The prices used for livestock and livestock products were averages for the 10 years 1957-1966, except for fluid milk sold for

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2/ F. B. Morrison, Feeds and Feeding, 22nd Edition, Ithaca, New York, The Morrison Publishing Company, 1956, pp. 216-217.

manufacturing purposes, which was priced at the current annual price.
All other prices were current (1967), adjusted for abnormal conditions.
These prices were different from those previously published, which
were projected prices for 1975.[3]

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3/   William Givan, op. cit.

Appendix Table A.1. Estimated Costs, Returns, and Input Requirements for One Acre of Burley Tobacco, Class I Land

Item and description	Unit	Price	Quantity	Amount
		Dollars		Dollars
Receipts:				
Burley tobacco	Lb.	.67	3,000.0	2,010.00
Expenses:				
Fertilizer-Nitrogen	Lb.	.125	160.0	20.00
P_2O_5	Lb.	.09	215.0	19.35
K_2O	Lb.	.06	190.0	11.40
Manure -Nitrogen	Lb.		40.0	
P_2O_5	Lb.		10.0	
K_2O	Lb.		60.0	
Plants (Table A.2)				23.78
T.D.E. (25% E.C.)	Pint	.25	4.0	1.00
Transplanting (custom)	Acre	25.00	1.0	25.00
Hauling to market	Cwt.	.50	30.0	15.00
Insurance				26.00
Cover crop seed (Rye)	Bu.	2.50	1.0	2.50
Operating costs:				
Tractor	Hr.	.82	14.0	11.48
Equipment	Hr.			3.15
Sub-total				158.66
Interest on production capital				4.76
Annual cost of added investment (Table A.3)				4.21
Total expenses				167.63
Net revenue and c_j for programming				1,842.37
Average outlay				140.17

Appendix Table A.2. Estimated Costs and Input Requirements for Establishing Plant Bed for One Acre of Burley Tobacco

Item and description	Unit	Price	Quantity	Amount
		Dollars		Dollars
Expenses:				
Seed	Oz.	5.00	.25	1.25
Fertilizer 4-9-3	Cwt.	2.15	1.00	2.15
Fermate	Lb.	.70	10.00	7.00
DDT	Lb.	.50	.50	.25
Canvas				5.00
Methyl bromide	Can	.85	9.00	7.65
Operating costs:				
Tractor	Hr.	.82	.40	.33
Equipment	Hr.			.15
Total expenses				23.78

Appendix Table A.3. Annual Cost of Added Investment for One Acre of Burley Tobacco*

Item	Cost New	Average	Life	Depreciation	Repairs[a]	Interest[b]	Insurance[c] and taxes	Total
	Dollars	Dollars	Year	Dollars	Dollars	Dollars	Dollars	Dollars
Sticks	30.00	15.00	15	2.00	.30	.90	.14	3.34
Press	6.00	3.00	10	.60	.06	.18	.03	.87
Total	36.00	18.00		2.60	.36	1.08	.17	4.21

*   Tobacco storage space required for one acre is approximately 1,600 sticks.

a/ 2 percent of average value.

b/ 6 percent of average value.

c/ .9 percent of average value.

Appendix Table A.4. Monthly Labor Distribution for One Acre
of Burley Tobacco

Month	Hours	Month	Hours
January	0	July	13.0
February	6.6	August	48.0
March	1.0	September	142.3
April	2.2	October	50.0
May	23.4	November	100.0
June	14.5	December	0
Total	47.7		353.3
	Annual Total		401.1

Appendix Table A.5. Estimated Costs, Returns, and Input Requirements
for One Acre of Continuous Corn, Class I Land

Item and description	Unit	Price	Quantity	Amount
		Dollars		Dollars
Receipts:				
Corn (No. 2 yellow corn equivalent)	Bu.		84.0[a]/	
Corn stover (No. 1 alfalfa hay				
equivalent)	Ton		.39[b]/	
Expenses:				
Seed corn	Lb.	.20	15.0	3.00
Fertilizer-Nitrogen	Lb.	.125	100.0	12.50
P_2O_5	Lb.	.09	40.0	3.60
K_2O	Lb.	.06	40.0	2.40
Manure -Nitrogen	Lb.		50.0	
P_2O_5	Lb.		20.0	
K_2O	Lb.		20.0	
Atrazine	Lb.	2.75	2.0	5.50
Operating costs:				
Tractor	Hr.	.82	6.6	5.41
Equipment	Hr.			2.07
Sub-total				34.48
Interest on production capital				1.03
Annual cost of added investment				
(Table A.6)				2.30
Total expenses and c_j for programming				37.81
Average outlay				30.18

a/ 100 bushel yield with 16% loss.

b/ 1.1 tons if utilized by livestock in the field.

Appendix Table A.6.   Annual Cost of Added Investment for One Acre of Continuous Corn

Item	Cost		Life	Depreciation	Interest[a]	Insurance[b] and taxes	Total
	New	Average					
	Dollars	Dollars	Year	Dollars	Dollars	Dollars	Dollars
Lime	10.00	5.00	5	2.00	.30	---	2.30
Total	10.00	5.00		2.00	.30		2.30

a/   6 percent of average value.

b/   .9 percent of average value.

Appendix Table A.7. Monthly Labor Distribution for One Acre of Continuous Corn

Month	Hours	Month	Hours
January	0	July	0
February	0	August	0
March	1.4	September	0
April	2.5	October	4.7
May	0	November	0
June	.6	December	0
Total	4.5		4.7
	Annual total		9.2

Appendix Table A.8.   Estimated Costs, Returns, and Input Requirements
for a 20-Steer Unit Wintered on a Silage-Supplement
Ration, Sold in the Spring

Item and description	Unit	Price	Quantity	Amount
		Dollars		Dollars
Receipts:				
Steers 550 lbs. avg. wt. - Good grade	Cwt.	28.27	110.0	3,109.70
Adjustment for death loss[a]				40.95
Gross cash receipts				3,068.75
Expenses:				
Feeder calves 350 lbs. avg. wt.	Cwt.		70.0	2,047.50
Feed[b] Grain (No. 2 yellow corn equivalent	Bu.		94.3	
Corn silage	Ton		37.5	
Soybean oil meal	Cwt.	5.75	30.0	172.50
Salt 1½ lbs./head/month	Cwt.	2.00	1.5	3.00
Minerals 1 lb./head/month	Cwt.	5.00	1.0	5.00
Veterinary and medicines	Head	1.00	20.0	20.00
Spray materials	Head	.50	20.0	10.00
Hauling and marketing	Head	2.00	20.0	40.00
Operating costs:				
Tractor	Hr.	.82	10.0	8.20
Equipment	Hr.	.09	10.0	.90
Sub-total				2,307.10
Interest on production capital[c]				65.32
Annual cost of added investment (Table A.9)				34.68
Total expenses				2,407.10
Net income[d] and c_j for programming				661.65
Average outlay				1,484.76

a/   2% of purchase price.

b/   Feed requirements based on the following daily feeding rates
to gain 1.33 lbs. daily from November - March:
Corn silage: 25 lbs. per day; Supplement 1 lb. per day
Corn and cob meal: 2 lbs. per day.

c/   6% times $1,088.65 (½ cost of calves plus ¼ of other costs).

d/   Plus manure credits: N - 106 lbs.; P_2O_5 - 84 lbs.; K_2O - 96 lbs.

Appendix Table A.9. Annual Cost of Added Investment for a 20-Steer Unit Wintered on a Silage-Supplement Ration, Sold in the Spring*

Item	Cost		Life	Depreciation	Repairs[a]	Interest[b]	Insurance[c] and taxes	Total
	New	Average						
	Dollars	Dollars	Year	Dollars	Dollars	Dollars	Dollars	Dollars
Feeding equipment	240.00	120.00	10	24.00	2.40	7.20	1.08	34.68
Total	240.00	120.00		24.00	2.40	7.20	1.08	34.68

* Approximately 118 bushels of grain storage space and 38 tons of silage storage space required.

a/ 2 percent of average value.

b/ 6 percent of average value.

c/ .9 percent of average value.

Appendix Table A.10.   Monthly Labor Distribution for a 20-
                       Steer Unit Wintered on a Silage-
                       Supplement Ration, Sold in the Spring

Month	Hours	Month	Hours
January	15.0	July	0
February	15.0	August	0
March	23.0	September	0
April	0	October	0
May	0	November	15.0
June	0	December	15.0
Total	53.0		30.0
	Annual total		83.0

Appendix Table A.11. Description and Costs of Machinery Used in
Enterprise Budgets

Item and description	Estimated life	Hours provided per year	Purchase cost	Operating cost per hour	Average outlay
	Years	Hours	Dollars	Dollars	Dollars
Bundle 1:					
Two 14" bottom plows	15	166	305	0.43	486.11
Tractor cultivator -					
2 row	20	125	331	0.20	610.53
Tandem disk - 7'	15	166	520	0.34	828.78
Two section harrow -					
8'	20	100	126	0.08	232.41
Mower - 7' trailing	12	166	646	0.78	943.87
Wagon - 16'	15	333	263	0.05	419.17
Average	16				
Total		1,056	2,191		3,520.87
Bundle 2:					
Tractor corn planter -					
2 row	15	80	525	0.26	836.75
Fertilizer spreader -					
8'	15	80	368	0.26	586.52
Grain drill - 7'	20	60	926	0.74	1,708.00
Field sprayer	10	150	263	0.05	362.49
Manure spreader	15	166	856	0.09	1,364.29
Average	15				
Total		536	2,938		4,858.05
Field chopper-PTO-					
1 row	10	200	2,153	0.63	2,967.48
Cornpicker-husker-					
1 row	10	200	1,680	0.54	2,315.54
Hayrake - side delivery	12	208	604	0.42	882.50
Hay baler - PTO	10	250	1,943	3.75	2,678.04
Tractor - 35 H.P.	12	1,000	3,255	0.82	4,755.88

Appendix Table A.12. Total Annual Fixed Machinery Costs Used in Machinery Activities

Item	Purchase cost	Estimated life	Salvage value[a]	Depreciation[b]	Interest[c]	Insurance and taxes[d]	Housing[e]	Total
	Dollars	Years	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Tractor	3,255	12	162.75	257.69	102.53	17.09	17.09	394.40
Equipment bundle 1	2,191	16	109.55	141.75	69.02	11.50	11.50	233.77
Equipment bundle 2	2,938	15	146.90	179.73	92.54	15.42	15.42	303.11
Field chopper	2,153	10	107.65	204.54	67.82	11.30	11.30	294.96
Cornpicker-husker	1,680	10	84.00	159.60	52.92	8.82	8.82	230.16
Hay rake	604	12	30.20	47.82	19.03	3.17	3.17	73.19
Hay baler	1,943	10	97.15	184.58	61.20	10.20	10.20	266.18

a/ 5% of purchase cost.

b/ $\dfrac{\text{Purchase cost minus salvage value}}{\text{Years of use}}$

c/ $\dfrac{\text{Purchase cost plus salvage value}}{2} \times 6\%.$

d/ $\dfrac{\text{Purchase cost plus salvage value}}{2} \times 1\%.$

e/ $\dfrac{\text{Purchase cost plus salvage value}}{2} \times 1\%.$

Appendix Table A.13. Costs of Purchasing Capital Items Other Than Machinery

Item	Unit	Price	Quantity	Amount	Estimated life
		Dollars		Dollars	Years
Land	Acre	241.00	1	241.00	--
Tobacco storage	Stick	1,575.00	1,600	1,575.00	20
Grain storage	1,000 bu.	500.00	1	500.00	20
Hay storage	100 tons	2,500.00	1	2,500.00	20
Silage storage	100 tons	1,000.00	1	1,000.00	20
Animal shelter space	1,000 sq. ft.	1,250.00	1	1,250.00	20

Item	Depreciation	Interest[a]	Repairs[b]	Insurance and taxes[c]	Total	Average outlay
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Land	---	14.46	---	4.82[d]	19.28	255.46
Tobacco storage	78.75	47.25	15.75	7.09	148.84	2,905.09
Grain storage	25.00	15.00	5.00	2.25	47.25	922.25
Hay storage	125.00	75.00	25.00	11.25	236.25	4,611.25
Silage storage	50.00	30.00	10.00	4.50	94.50	1,844.50
Animal shelter space	62.50	37.50	12.50	5.62	118.12	2,305.62

[a] $\frac{\text{Purchase price}}{2} \times 6\%$.

[b] $\frac{\text{Purchase price}}{2} \times 2\%$.

[c] $\frac{\text{Purchase price}}{2} \times .09\%$.

[d] Purchase price x 2%.

Appendix Table A.14. Costs of Purchasing Production Items

Item	Unit	Price	Quantity	Amount	Interest	Total	Average outlay
		Dollars		Dollars	Dollars	Dollars	Dollars
Nitrogen	Lb.	0.125	100	12.50	0.37	12.87	6.625
Phosphorus	Lb.	0.09	100	9.00	0.27	9.27	4.77
Potassium	Lb.	0.06	100	6.00	0.18	6.18	3.18
Seasonal labor	Hr.	1.00	10	10.00	0.30	10.30	5.30
Seasonal labor	Hr.	1.50	10	15.00	0.45	15.45	7.95
Seasonal labor	Hr.	2.00	10	20.00	0.60	20.60	10.60
Seasonal labor	Hr.	2.50	10	25.00	0.75	25.75	13.25
Seasonal labor	Hr.	3.00	10	30.00	0.90	30.90	15.90
Grain	Bu.	1.40	100	140.00	4.20	144.20	74.20
Hay	Ton	35.00	1	35.00	1.05	36.05	18.55

Appendix Table A.15. Annual Costs of Present Fixed Resources for Small Farm

Item	Cost New[a]	Average	Life	Depreciation	Repairs[b]	Interest[c]
Grain storage	150.00	75.00	20	7.50	1.50	4.50
Hay storage	480.00	240.00	20	24.00	4.80	14.40
Tobacco storage	1,200.00	600.00	20	60.00	12.00	36.00
Animal shelter space	575.00	287.50	20	28.75	5.75	17.25
Fences	1,230.00	615.00	25	49.20	12.30	36.90
Land	9,640.00	9,640.00	--	---	---	578.40
Total	13,275.00	11,457.50		169.45	36.35	687.45

Item	Insurance and taxes[e]	Total	Average outlay[f]
Grain storage	0.67	14.17	103.37
Hay storage	2.16	45.36	330.79
Tobacco storage	5.40	113.40	826.98
Animal shelter space	2.59	54.34	396.26
Fences	5.53	103.93	980.19
Land	192.80[d]	771.20	10,218.40
Total	209.15	1,102.40	12,855.99

a/ New cost equals cost of replacement less cost due to increase in price level of past ten years of 3% annually.

b/ 2% of average cost.

c/ 6% of average cost.

d/ 2% of average cost.

e/ .9% of average cost.

f/ Average outlay equals present value ($\frac{1}{2}$ of new cost) times $(1 + i)^n$ where n equals median year of remaining life.

Appendix Table A.16. Annual Costs of Present Fixed Resources for Medium Farm

Item	Cost New[a]	Cost Average	Life	Depreciation	Repairs[b]
Grain storage	327.00	163.50	20	16.35	3.27
Hay storage	1,731.00	865.50	20	86.55	17.30
Tobacco storage	2,354.00	1,177.00	20	117.70	23.54
Silage storage	231.00	115.50	20	11.55	2.31
Animal shelter space	817.00	408.50	20	40.85	8.71
Fences	2,308.00	1,154.00	25	92.32	23.08
Land	33,740.00	33,740.00	--	---	---
Total	41,508.00	37,624.00		365.32	78.21

Item	Interest[c]	Insurance and taxes[e]	Total	Average outlay[f]
Grain storage	9.81	1.47	30.90	225.35
Hay storage	51.93	7.79	163.57	1,192.92
Tobacco storage	70.62	10.59	222.45	1,622.26
Silage storage	6.93	1.04	21.83	159.19
Animal shelter space	24.51	3.68	77.21	563.04
Fences	69.24	10.39	195.03	1,735.15
Land	2,024.40[d]	674.80	2,699.20	35,764.40
Total	2,257.44	709.76	3,410.19	41,262.31

a/ New cost equals cost of replacement less cost due to increase in price level of past ten years of 3% annually.

b/ 2% of average cost.

c/ 6% of average cost.

d/ 2% of average cost.

e/ .9% of average cost.

f/ Average outlay equals present value ($\frac{1}{2}$ of new cost) times $(1 + i)^n$ where n equals median year of remaining life.

Appendix Table A.17. Annual Costs of Present Fixed Resources for Large Farm

Item	Cost New[a]	Cost Average	Life	Depreciation	Repairs[b]
Grain storage	769.00	384.50	20	38.45	6.79
Hay storage	3,846.00	1,923.00	20	192.30	38.46
Tobacco storage	4,638.00	2,319.00	20	231.90	46.38
Silage storage	1,038.00	519.00	20	51.90	10.38
Animal shelter space	1,394.00	697.00	20	69.70	13.94
Fences	3,938.00	1,969.00	25	157.52	39.38
Land	98,810.00	98,810.00	--	---	---
Total	114,433.00	106,621.50		741.77	155.33

Item	Interest[c]	Insurance and taxes[e]	Total	Average outlay[f]
Grain storage	20.37	3.06	68.67	467.93
Hay storage	115.38	17.31	363.45	2,650.47
Tobacco storage	139.14	20.87	438.29	3,196.28
Silage storage	31.14	4.67	98.09	715.34
Animal shelter space	41.82	6.27	131.73	960.67
Fences	118.14	17.72	332.76	2,960.59
Land	5,928.60[d]	1,976.20	7,904.80	104,739.00
Total	6,394.59	2,046.10	9,337.79	115,690.28

a/ New cost equals cost of replacement less cost due to increase in price level of past ten years of 3% annually.

b/ 2% of average cost.

c/ 6% of average cost.

d/ 2% of average cost.

e/ .9% of average cost.

f/ Average outlay equals present value ($\frac{1}{2}$ of new cost) times $(1 + i)^n$ where n equals median year of remaining life.

APPENDIX B

LINEAR PROGRAMMING MATRIX

The linear programming matrix includes the enterprises and other activities considered, the restraints, and the specified functional rows. Because of the size and complexity of the matrix, the entire matrix will not be presented. Selected activities and restrictions will be included to illustrate how the model was constructed (Tables B.1-B.3). A copy of the matrix and computer printout are on file in the Department of Agricultural Economics, Virginia Polytechnic Institute.

To better understand the illustration that follows, a code to the illustration is as follows:

Objective function row -

MIN11 - Minimization of average outlay; dollar

Resource or restriction row -

1.   GRI11 - Gross income; dollar

2.   NTI11 - Net income; dollar

3.   LAND1 - Class I land; acre

4.   LAND2 - Class II land; acre

5.   LAND3 - Class III land; acre

6.   PASTR - Pasture land; acre

7.   TOBAC - Tobacco allotment; acre

8.   LBMAR - Labor (March); hour

9.   LBSEP - Labor (September); hour

10.   STTOB - Tobacco storage space; stick

11.   STGRN - Grain storage space; bushel

12.   GRAIN - Grain (No. 2 yellow corn equivalent); bushel

13.   SLGRN - Sell grain (No. 2 yellow corn equivalent); bushel

14. HAYEQ - Hay (No. 1 alfalfa hay equivalent); ton

15. NITRO - Nitrogen; pound

16. TRACT - Tractor; hour

17. TRINT - Tractor integer; hour

Activities -

1. BRTOB - Burley tobacco; 1 acre

2. CORN - Corn for grain; 1 acre

3. ALFHY - Alfalfa hay; 1 acre

4. BFCOW - Beef cows; 20

5. SHEP - Sheep; 30

6. BYLND - Buy land; 1 acre

7. BYTRT - Buy tractor; 1,000 hours

8. BYGRS - Buy grain storage; 1,000 bushels

9. BYMAR - Buy March labor; 10 hours

10. BYSP - Buy September labor; 10 hours

11. BYNT - Buy nitrogen; 100 pounds

12. SLGN - Sell grain; 100 bushels

The model is constructed to minimize the objective function, average outlay, while satisfying the restrictions of the other rows. The gross income row is a count row (≥0) while the net income row sets an income goal (≥$3,500 or $7,000) Table B.3. The land is divided into three classes and is restricted by the amount available, although land can be purchased to raise the land restrictions (Table B.2). Rows 8 and 9 show the amount of labor required in two months (March and September) and the amount available from the operator in these periods. Tobacco and grain storage (rows 10 and 11) show similar

relationships for tobacco and grain storage. Rows 12 and 14 are
for the production and utilization of grain and hay respectively.
Row 17 insures that the tractor will be bought in an entire unit.
If the tractor provides 1,000 hours of annual use (row 16) this
figure of 1,000 entered in the tractor integer row and the restraint
of ≥1,000 (Table B.3) will cause the entire unit to enter the optimum
solution.

Selected activities were chosen to show how these restrictive
rows operate. Tobacco is produced as a cash crop, and must be sold
(Table B.1). Corn or alfalfa hay can be used by beef cattle or sheep,
or sold. Activities for buying land, a tractor, grain storage space,
labor and nitrogen are included in this illustration (Tables B.2 and
B.3).

Activities for buying labor in all 12 months and for buying several
items of machinery were present. Other possibilities included buying
storage space for all crops, shelter space for animals, and transfer
activities for transferring hay and/or silage to pasture, and for
transferring silage to hay. The restriction rows were also enlarged
in number. These included rows for all labor, equipment, and added
objective function rows and net income rows for the various labor prices.

Each size representative farm and its resources constituted three
separate right-hand sides. Although the resources remained the same for
each size farm, the net income goal changed, making three separate right-
hand sides necessary for each size farm. For each size farm, row 2 (the
net income row) was set ≥$3,500, $5,000, and $7,000. This insured these
net incomes being obtained, if a feasible solution was possible.

Appendix Table B.1. Illustration of Linear Programming Matrix for Optimum Enterprise Combinations; Crop and Livestock Enterprises

Resource or restriction						
Row number	Row symbol	Unit	1BRTOB	2CORN	3ALFHY	4BFCOW
C_j	MIN11	Dollar	140.17	30.18	73.90	5,509.38
1	GRI11	Dollar	2,010.00			2,402.20
2	NTI11	Dollar	1,842.37	-37.81	-45.11	1,739.91
3	LAND1	Acre	1.0	1.0		
4	LAND2	Acre	1.0	1.0		
5	LAND3	Acre	1.0	1.0	1.0	
6	PASTR	Acre				
7	TOBAL	Acre	1.0			
8	LBMAR	Hour	1.0	1.0	.6	7.0
9	LBSEP	Hour	140.0		3.7	7.0
10	STTOB	Stick	1,400.0			
11	STGRN	Bu.				24.0
12	GRAIN	Bu.		-84.0		24.0
13	SLGRN	Bu.		-84.0		
14	HAYEQ	Ton			-3.1	87.0
15	NITRO	Lb.	40.0	50.0		-500.0
16	TRACT	Hour	14.0	6.6	7.8	10.0
17	TRINT			-		

Appendix Table B.2. Illustration of Linear Programming Matrix for Optimum Enterprise Combinations; Livestock Enterprises, and Activities for Buying Farm Inputs

Row number	5SHEP	6BYLND	7BYTRT	8BYGRS	9BYMAR	10BYSP
C_j	1,257.81	255.46	4,755.00	922.25	5.30	5.30
1	813.56					
2	641.46	-19.28	-394.40	-47.25	-10.30	-10.30
3		.09				
4		.36				
5		.41				
6		.59				
7		.019				
8	40.0				-10.0	
9	25.0					-10.0
10						
11	70.0			-1,000.00		
12	56.0					
13						
14	5.4					
15	-74.0					
16	1.5		-1,000.00			
17			1,000.00			

Appendix Table B.3. Illustration of Linear Programming Matrix for Optimum Enterprise Combinations; Buying and Selling Activities, Restraint Row, and Right-Hand Sides

Row number	11BYNT	12SLGN	Restraint	Small farm	Large farm
C_j	6.625				
1		140.0	$\geq$	0	0
2	-12.87	140.0	$\geq$	3,500	7,000
3			$\leq$	3.0	55.0
4			$\leq$	15.0	155.0
5			$\leq$	17.0	180.0
6			$\leq$	23.0	230.0
7			$\leq$	.9	3.0
8			$\leq$	240.0	240.0
9			$\leq$	240.0	240.0
10			$\leq$	1,400.0	6,700.0
11			$\leq$	400.0	2,000.0
12		100.0	$\leq$	0	0
13		100.0	$\leq$	0	0
14			$\leq$	0	0
15	-100.0		$\leq$	0	0
16			$\leq$	0	0
17			$\geq$	1,000.0	1,000.0

APPENDIX C

LAND VALUES

Land values in various parts of the study area vary greatly due to both agricultural productivity and potential non-agricultural use. Interviews with Extension personnel, individuals who work with real estate transactions, and farmers in the area indicated that land values based on information from these sources would be highly variable.

The 1964 Census of Agriculture indicates that the average size farm in the study area consists of 90 acres total land, and this has an average total value of $15,790 (Table C.1). Of the total land area that is included in farms, 34.4 percent is classified as woodland. Based on the assumption that all farms have this same percentage in woodland, the average size farm of 90 acres contains 31 acres of woodland, and 59 acres of open land.

Interviews with various agricultural workers in the area indicate that $50 per acre for woodland is a near-average value for this type land. These workers were consistent in this estimate. This means that the total woodland in an average size farm of 90 acres would have a value of $1,550 ($50 x 31 acres). If this value is subtracted from the total value of the average size farm, the value of 59 acres of open land would be $14,240 ($15,790 - $1,550). This results in an average value of open land of $241 per acre ($14,240/59). The annual cost per acre for land purchased was obtained by multiplying the purchase cost ($241) by 8 percent. This is a cost for the interest on investment and taxes.

Appendix Table C.1. Total Farms, Average Size, Value Per Acre, and Value Per Farm, Southwest Virginia, 1964*

	Total farm	Average size	Value per farm	Value per acre
	(Number)	(Acres)	(Dollars)	(Dollars)
County				
Lee	1,969	74.4	11,775	155.64
Russell	1,750	114.1	15,212	132.48
Scott	2,411	74.0	10,955	149.06
Smyth	1,292	117.5	17,571	159.78
Washington	2,768	87.0	21,492	247.01
Total	10,190	90.0**	15,790**	175.45**

* United States Bureau of the Census, Census of Agriculture, 1964, Statistics for the State and Counties, Virginia, United States Government Printing Office, Washington, D. C., 1967.

** Weighted Average.

APPENDIX D

MANURE CREDITS TO LIVESTOCK

A credit for manure was given to all classes of livestock (Table D.1). To determine this credit, the average amount of manure produced by each class of livestock and the amount of plant food elements present in this manure were first determined. It is realized, however, that all manure produced by livestock cannot be recovered and applied to crops. Therefore, the amount of nutrients lost through leaching and fermentation were subtracted from the original credit. Also, no credit was given to manure deposited in lanes and pasture as there is no control of its use. Thus, the manure credits take into account the various types of nutrient losses, and consist of an estimate of the amount of nutrients present in manure deposited in buildings.

Appendix Table D.1. Nutrients Available Annually for Crop Use
from Manure from Specified Classes of
Livestock[a]/

Animal	Nutrient		
	Nitrogen	Phosphorus	Potash
	Pounds	Pounds	Pounds
Cow	23.0	10.6	30.2
Sheep	2.4	1.0	2.5
Hog	3.7	3.1	3.6
Steer (1,000 lbs., wintering)	12.5	9.9	11.4
Steer (1,000 lbs., drylot)	17.3	13.7	15.8

[a]/ J. D. Oliver, "Optimum Enterprise Combinations for Beef Cow
and Calf Farms in Southwest Virginia," Masters Thesis, Virginia
Polytechnic Institute, Blacksburg, Virginia, May 1963, p. 174.

APPENDIX E

<u>CONVERSION FACTORS FOR FORAGE AND GRAIN</u>

When more than one feed is grown or fed in a farming operation, the relative value of feeds can more easily be determined if the feed values are given in terms of some "common denominator." All forages except silage were converted into tons of Number 1 alfalfa hay, and all feed grains into bushels of Number 2 yellow corn equivalent.[1] This permits inclusion of crops producing feed for livestock at the lowest cost. Also, stating requirements in this manner provides flexibility in substituting feeds when the feeds come from alternative sources. In the analysis, hay can be substituted for pasture and for corn stover and oat straw.

As corn silage was not converted into either a standard forage or grain conversion, several beef cattle budgets were prepared with varying levels of silage and other forage and grain. However, since silage is composed of both forage and grain, the possibility of substituting silage for hay and grain was included.[2]

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[1] F. B. Morrison, Feeds and Feeding, The Morrison Publishing Company, Ithaca, New York, 1956, pp. 216-217.

[2] R. K. Reynolds, Reducing Costs on Selected Grade-A Dairy Farms, Virginia Agricultural Experiment Station, Blacksburg, Virginia, Technical Bulletin 163, June 1963, p. 41.

Appendix Table E.1.　No. 2 Yellow Corn Equivalent Per Bushel of Feed
　　　　　　　　　　　Grain[a]/

Grain	Value as percent of No. 2 yellow corn	Bushels to equal 1 bushel No. 2 yellow corn
	Percent	Bushels
Corn (No. 2 yellow corn)	100.0	1.000
Oats	62.8	1.592
Ear corn (corn and cob meal)	110.0	0.909

　　[a]/　When corn is $1.40 per bushel and soybean oil meal is $115.00
per ton.

Appendix Table E.2. Number 1 Alfalfa Hay Equivalent for Forages[a]

Forage	Value as percent of No. 1 alfalfa hay	Tons to equal 1 ton No. 1 alfalfa hay
	Percent	Tons
No. 1 alfalfa hay[b]	100.0	1.000
Alfalfa hay - all analysis	88.9	1.125
Cornstover - medium water	34.1	2.932
Lespedeza hay - annual, in bloom	65.8	1.520
Oat straw	27.8	3.597
Oat hay	60.7	1.647
Red clover-orchardgrass hay - high in clover	67.3	1.486
Bluegrass - white clover pasture	31.7	3.154
Ladino clover-orchardgrass pasture - high in ladino	23.1	4.329
Alfalfa hay, stemmy (over 34% fiber)	69.7	1.434

[a] When corn is $1.40 per bushel and soybean oil meal is $115.00 per ton.

[b] The nutritive content of No. 1 alfalfa hay used in this conversion was:

Dry matter	Digestible protein	Estimated therms net energy per cwt.	Constant for	
			Corn	Soybean meal
90.5	12.8	43.5	0.286	0.259

APPENDIX F

ASSUMED RESOURCE AND PRODUCT PRICES

Appendix Table F.1. Assumed Resource and Product Prices of Cash Crops, and Beef and Dairy Enterprises, Southwest Virginia

Item	Size	Unit	Price per unit Paid	Price per unit Received
			Dollars	Dollars
Cash crops:				
Burley tobacco		Lb.		.67
Beef:				
Feeder calves	450 lbs.	Cwt.		26.24
Brood cows	1,300 lbs.	Each	200.00	
Cull cows	1,300 lbs.	Cwt.		14.00
Breeding bulls	1,500 lbs.	Each	400.00	
Cull bulls	1,500 lbs.	Each		255.00
Steers (good grade-fall)	350 lbs.	Cwt.	29.25	
Steers (good grade-fall)	720 lbs.	Cwt.		24.00
Steers (low choice-spring)	1,020 lbs.	Cwt.		26.00
Steers (good grade-spring)	550 lbs.	Cwt.		28.27
Steers (good grade-fall)	720 lbs.	Cwt.	24.00	
Dairy:				
Manufacturing milk (4% FCM)		Cwt.		4.00
Brood cows		Each		200.00
Heifers	over 1 yr.	Each		175.00
Heifers	under 1 yr.	Each		50.00
Small calves		Head		20.00
Cull cows		Each		120.00

Appendix Table F.2. Assumed Product Prices of Sheep and Swine Enterprises, Southwest Virginia

Item	Size	Unit	Price per unit Paid	Price per unit Received
			Dollars	Dollars
Sheep:				
Lambs	85 lbs.	Cwt.		21.28
Wool		Lb.		.58
Breeding ewes		Each		25.00
Breeding ram		Each		75.00
Cull ewes		Each		5.00
Cull ram		Each		10.00
Swine:				
Brood sows		Each		60.00
Brood gilts		Each		50.00
Breeding boar		Each		65.00
Feeder pigs	40 lbs.	Lb.		10.00
Market hogs	210 lbs.	Cwt.		18.00
Cull sows		Lb.		.14
Cull boar		Each		25.00

Appendix Table F.3. Assumed Resource and Product Prices of Feed and Fertilizers, Southwest Virginia

Item	Size	Unit	Price per unit	
			Paid	Received
			Dollars	Dollars
Feed:				
Soybean oil meal		Cwt.	5.75	
Pig pre-starter		Cwt.	4.50	
Pig grower		Cwt.	4.00	
No. 2 yellow corn		Bu.		1.40
Urea		Ton	100.00	
No. 1 alfalfa hay		Ton		35.00
Grinding & mixing feed		Ton	5.00	
Supplement, 12%		Cwt.	4.75	
Vitamin - antibiotic mix		Cwt.	43.00	
Fertilizer:				
Nitrogen		Cwt.	12.50	
Phosphorus		Cwt.	9.00	
Potassium		Cwt.	6.00	
2-12-12		Cwt.	2.27	
10-10-10		Cwt.	2.50	
4-9-3		Cwt.	2.15	
2-12-12 w/borax		Cwt.	2.28	
Lime		Ton	5.00	
0-30-15 w/borax		Cwt.	3.50	

Appendix Table F.4. Assumed Resource Prices of Seed and Supplies, Southwest Virginia

			Price per unit	
Item	Size	Unit	Paid	Received
			Dollars	Dollars
Seed:				
Tobacco		Oz.	5.00	
Rye		Bu.	2.50	
Corn (hybrid)		Lb.	.20	
Oats		Bu.	1.80	
Red clover		Lb.	.43	
Orchardgrass		Lb.	.33	
Lespedeza		Lb.	.23	
Alfalfa		Lb.	.50	
Ladino clover		Lb.	.75	
Supplies:				
Methyl bromide		Can	.85	
Fermate w/DDT		Lb.	.70	
Atrazine		Lb.	2.75	
Malathion		Gal.	6.40	
Salt for livestock		Cwt.	2.00	
Minerals for livestock		Cwt.	5.00	
DDT-10%		Lb.	.50	
Bedding (straw)		Ton	15.00	
TDE (25% E.C.)		Pint	.25	
Legume inoculant		Acre	.25	

Appendix Table F.5. Assumed Resource Prices of Equipment, Southwest Virginia

Item	Size	Unit	Price per unit	
			Paid	Received
			Dollars	Dollars
Equipment:				
Tobacco sticks		Hundred	2.00	
Tobacco press		Each	6.00	
Plastic canvas	9 x 100	Each	20.00	
Tobacco canvas	9 x 100	Each	5.00	
Cover for trench silo		Ton	.20	
Stall for boar		Each	200.00	
Hog feeders (automatic)	double	Each	150.00	
Hog waterers (automatic)	single	Each	40.00	
Pig feeder	20 inch	Each	7.75	
Feed rack (steers)	300-600 lbs.	Each	12.00	
Feed rack (steers)	700-1,100 lbs.	Each	17.00	
*Sheep equipment	30 ewes	Each	150.00	
Heat lamps		Each	4.00	
Milking machine (bucket)	pump & unit	Each	200.00	
Milk can	8 gal.	Each	10.00	
Water heater	50 gal.	Each	96.00	
Truck rental		Hr.	2.00	

* $5 per ewe for lambing equipment and heat lamp.

Appendix Table F.6. Assumed Resource Prices of Buildings and Machinery Hire, Southwest Virginia

Item	Size	Unit	Price per unit	
			Paid	Received
			Dollars	Dollars
Buildings and Improvements:				
Tobacco barn and striproom		Acre	1,575.00	
Trench silo		Ton	10.00	
Farrowing house	4-sow	Per sow	200.00	
Pig parlor	900 sq. ft.	Each	825.00	
Barn (with hay storage, loading area and milk room, manufacturing milk)	20-cows	Per cow	60.00	
Fence (average for all types)		Acre	50.00	
Grain storage		Bu.	.50	
Hay storage		Ton	25.00	
Custom rates:				
Combining grain		Acre	4.60	
Setting tobacco		Acre	25.00	
Picking corn		Acre	8.00	
Chopping silage		Ton	1.50	
Baling hay		Bale	.12	
Planting corn		Acre	1.50	
Applying herbicides		Acre	1.50	
Cultivating		Acre	1.50	
Shearing sheep		Each	.50	
Hauling milk		Cwt.	.35	
Artificial breeding (cows)		Each	7.00	
Hauling tobacco		Cwt.	.50	

Appendix Table F.7. Assumed Resource Prices of Hired Labor, Southwest Virginia

Item	Size	Unit	Price per unit	
			Paid	Received
			Dollars	Dollars
Hired labor		Hour	1.00	
Hired labor		Hour	1.50	
Hired labor		Hour	2.00	
Hired labor		Hour	2.50	
Hired labor		Hour	3.00	

APPENDIX G

AGGREGATE FARM PRODUCTION AND

LIVESTOCK NUMBERS, SOUTHWEST VIRGINIA, 1964

Appendix Table G.1. Aggregate Land Use of Farms, Southwest Virginia, 1964*

Item	All farms	Non-Grade-A dairy farms**
Farms	Number	Number
	5,613	5,446
Land use:	1,000 Acres	1,000 Acres
Burley tobacco	8.2	6.8
Corn, grain	21.1	19.9
Corn, silage	9.4	5.8
Alfalfa hay	15.6	13.9
Clover-grass hays	51.9	48.1
Lespedeza hay	8.0	8.0
Small grain hay	11.9	10.9
Other hay	8.9	8.9
Total hay	96.3	89.8
Other crops	1.7	1.7
Cropland pastured	63.8	54.6
Cropland idle	26.8	24.8
Total cropland	227.3	203.4
Permanent pasture	312.6	286.9
Total open land	539.9	490.3

* Data for aggregate land use for all farms taken from the 1964 United States Census of Agriculture, Statistics for States and Counties, Virginia. The term, all farms, includes those farms with more than 10 acres cropland. Farms with less cropland than this are considered rural residences and only the acreage of tobacco of these farms is included in the total land use. Aggregate land use of non-Grade-A dairy farms is the acreage of all farms less the amount of land in Grade-A dairy farms as determined by a field survey in this area in 1965.

** Non-Grade-A dairy farms with more than 10 acres of cropland.

Appendix Table G.2. Aggregate Crop Production and Livestock Numbers,
Southwest Virginia, 1964*

Item	All farms	Non-Grade-A dairy farms**
Crop production:		1,000,000 Pounds
Burley tobacco	17.4	14.4
		1,000 Bushels
Corn, grain	1,218.0	1,124.2
		1,000 Tons
Corn, silage	117.6	57.4
Hay	117.9	102.4
Livestock:		1,000 Head
Sows and gilts	1.8	***
All other hogs and pigs	16.4	***
Sheep	18.9	17.1
Dairy cows	28.4	17.7
Beef cows	40.0	39.2
Heifers and heifer calves	27.3	***
Steers and bulls	23.8	***
Crop sales:		1,000 Bushels
Corn	484.1	***
		1,000 Tons
Hay	16.8	***

* Data for aggregate Crop and Livestock Production taken from the
1964 United States Census of Agriculture, Statistics for States and Counties,
Virginia. The term all farms, includes those farms with more than 10 acres
cropland. Farms with less cropland than this are considered rural resi-
dences, and only the production of tobacco of these farms is included in
the total crop production. Aggregate production of non-Grade-A dairy
farms is the production of all farms less the amount of production on
Grade-A dairy farms as determined by a farm survey in this area in 1965.

** Non-Grade-A dairy farms with more than 10 acres of cropland.

*** As certain census data and data obtained in the field survey
had different classifications, it was impossible to separate the pro-
duction of specified products on Grade-A farms from that production
on non-Grade-A farms. It is speculated, however, that the production
of these items on Grade-A farms is negligible, making the production
on non-Grade-A farms almost identical with that amount produced on all
farms.

Appendix Table G.3. Aggregate Values of Farm Products Sold and Specific
Farm Expenditures, Southwest Virginia, 1964*

Item	All farms	Non-Grade-A dairy farms**
	1,000 Dollars	
Value of open land and buildings	142,812.0	118,181.3
Value of farm products sold	25,920.3	21,420.3
Specific farm expenditures:		
Feed	3,058.0	***
Livestock and poultry	2,172.2	***
Seeds, plants, bulbs	505.3	***
Fertilizers	1,863.5	***
Gasoline, oil, and petroleum fuels	1,058.0	***
Machinery hire	500.9	***
Hired labor	1,962.4	***
Total expenditures	11,120.3	

* Data from all farms taken from the 1964 United States Census
of Agriculture, Statistics for States and Counties, Virginia. The term
all farms, includes those farms with more than 10 acres cropland. Farms
with less cropland than this are considered rural residences, and only
the sale of tobacco is included in the value of total farm products
sold. Aggregate sales from non-Grade-A dairy farms are the sales from
all farms, less the sales on Grade-A dairy farms as determined by a
field survey in this area in 1965.

** Non-Grade-A dairy farms with more than 10 acres of cropland.

*** Data for Grade-A dairy farms was incomplete, making it im-
possible to separate data between the two type farms.

THE EFFECTS OF VARIOUS WAGE RATES ON FARM

ORGANIZATION AND STRUCTURE IN SOUTHWEST VIRGINIA--A STUDY

MINIMIZING AVERAGE OUTLAY WHEN OBTAINING SPECIFIED INCOME LEVELS

by

William Dale Givan

ABSTRACT

This study was undertaken to evaluate the effects of various wage rates on the minimum amounts of resources needed to obtain specified income levels on farms in Southwest Virginia. In addition, the aggregate effects of these wage rates on the structure and organization of farms in this area was determined.

A linear programming model with added average outlay as a minimization criterion was constructed to determine the optimum resource use and enterprise combinations for three representative farms to achieve operator labor incomes of $3,500, $5,000, $7,000, respectively. An aggregation model was used to determine the aggregate effects of these changes on farm organization and structure in the area.

The study indicated that there are presently a large number of farms in the area with open land acreage below the minimum required to provide full-time productive employment for the operator. When available cropland is not sufficient to enable an individual to obtain a specified income, it is more profitable, in terms of minimizing average outlay, to purchase additional open land in order to obtain additional tobacco acreage and other cropland, than to utilize large amounts of existing unused pasture.

An increase in hired labor wage rates, when an individual farm is achieving a specified income, may result in the hiring of additional labor, however, added amounts of non-labor inputs would increase at a faster rate than increases in amounts of labor used.

Should all farms in the area adjust to attain the income levels specified in the study, farm numbers would decrease. An increase in the production of crops and livestock enterprises would result. This increased production would result in gross returns from the sales of crops of more than three times the amount presently received from crop sales in the area, and returns from livestock sales would be more than twice the amount presently received. This production would be produced by a total labor force of one-half, or less, the present labor force available on the farms in the study area.

The results of this analysis substantiate the results of earlier studies which indicate that capital will be substituted for labor as farm wages are increased, and, an increase in aggregate farm production can be obtained with a decrease in total farm labor utilized. A need for some type of labor-saving innovation, as increased price supports for burley tobacco, will become necessary as the price of labor and other farm inputs increase.

A study devoted to the development and analysis of some type of policy to encourage the combination of the smaller farms into larger, more efficient units is in order if all farm operators are to earn income levels comparable to that of off-farm employment. The resulting production from such a change would alter the type of farming presently conducted in the area.