A POLYPERIOD PRODUCTION-INVESTMENT MODEL OF GROWTH OF LARGE-SIZE LIVESTOCK FARMS IN SOUTHWEST VIRGINIA

by

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INTRODUCTION

Statement of the Problem

Agriculture in the United States has changed in many aspects. Baum and Bachman 1/ give six important characteristics of agriculture that make the growth in this sector different from the rest of the economy:

(1) a higher rate of technological change

(2) an inelastic demand for its products

(3) the difficulty of controlling production

(4) the "rugged individualism" of farm operators

(5) the chronic high level of underemployment of labor in some regions

(6) a high degree of risk and uncertainty.

All the factors mentioned, associated with the fact that a great proportion of farm investments such as buildings, storage facilities and land are of specified use and fixed, are responsible for the fact that agricultural adjustments are made for relatively long-run periods.

Loomis and Barton 2/ noted that the changes that occurred in agriculture since 1940 were associated with changes in the cost structure

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1/ Baum, E. L. and K. L. Bachman, "The Economic Growth Problem," Capital and Credit Needs in a Changing Agriculture. Editors E. L. Baum, H. G. Deisslin, and E. O. Heady. Ames, Iowa State University Press, 1961, pp. 3-18.

2/ Loomis, R. A. and G. T. Barton, Productivity in Agriculture, United States, 1870-1958. United States Department of Agriculture.

of agriculture. Total owned capital increased by one-third and the use of inputs and capital services from non-farm sources increased by two-thirds. Each unit of farm operator and family income uses now three times the purchased inputs and capital it used in 1930. From the years 1949 to 1959 the value of farm capital on selected commercial farms increased three to five times. Expenditures in 1959 also were at 3 to 4 times the 1940 levels and more than half of these increases were associated with increases in costs. Capital changes, depreciation and repairs on machinery and farm buildings account for more than half of the annual non-farm inputs in the United States.

With the increasing importance of capital formation, capital and credit management are critical factors in planning adjustments in farming. External funds can be obtained by the farmer with different repayment schedules; the selection of the length of the loan that may be more profitable to use may be better looked at by studying more than one production period.

Also, the fact that adjustments in farming takes a relatively long period of time to be done and that the technical relationships of production, the cost of productive factors and the prices for factors and products all change with time increase the problems relating to poly-period farm adjustments.

In Southwest Virginia changes in farm organization occurred between the years 1959 to 1964. Acreage of burley tobacco allotments were reduced and income was obtained from other sources such as milk production, beef production, and cash crops. As a recent study showed the number of

livestock farms had the greatest increase from 1959 to 1964, while tobacco farms showed the greatest decrease during the same period. Beef cows were found in most livestock farms in the area and their number increases with farm size.1/ A more recent study in the area showed that the medium size representative farm (140 acres of open land) has to purchase 44 additional acres to achieve $5,000 of income when hired labor was $1.50 per hour and 108 acres when hired labor was $3.00 per hour.2/ To achieve an annual income of $7,000 the same form had to purchase 111 acres of land with labor at $1.50 per hour and 194 acres with hired labor at $2.50 per hour. Added investments for a $5,000 annual income was $38,058 and $45,836 for wage rates of $1.50 and $3.00 an hour respectively. Added investments for annual incomes of $7,000 was $54,428 for labor at $1.50 an hour and $78,941 for labor at $2.50 an hour. Annual operating capital would have to be increased from $4,486 to $12,218 to increase income from $5,000 to $7,000 per year with labor at $1.50 per hour and from $9,754 to $17,361 with labor prices of $2.50 per hour. These previous studies indicate that representative farms in the area would need to change not only the enterprise organizations and increase

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1/ Givan, W. D. and R. G. Kline, Organization and Operation of Burley Tobacco - Livestock Farms in Southwest Virginia, Bull. 25, Research Division, Virginia Polytechnic Institute, Blacksburg, Virginia, October, 1968.

2/ Givan, W. D., The Effects of Various Wage Rates on Farm Organization and Structure in Southwest Virginia - A Study Minimizing Average Outlay when Obtaining Specified Income Levels, unpublished Ph. D. dissertation, Virginia Polytechnic Institute, Blacksburg, Virginia, December, 1968.

size but also that these changes would be accompanied by large amounts of added investment capital and operating capital in order to obtain incomes comparable to that of non-farm sources. This fact stresses the importance of simultaneously determining finance of added investments and credit policies along with the production organization.

Farmers' motives are seldom only those of profit maximization in the near future. His net worth position in the years ahead and the increase in size of his business over time are motives that must be taken into consideration.

Objectives of the Study

The overall objective of this study is to determine the association of farm growth over time to alternative capital investment schedules, credit policies and enterprise combinations under various resource and capital restraints.

The specific objectives of this study are:

(1) To determine for representative large livestock farms in Southwest Virginia, over a period of 15 years, the investment schedules in terms of time and items of investments, credit policies and combinations of enterprises that will result in optimum growth.

(2) To determine the effects of the above factors when:

(a) Using as a maximizing criteria the present value of net returns discounted zero, six, twelve, and twenty percent.

(b) Using as a maximizing criteria the net worth at the end of the 15-year period.

(c) Changes are made in initial capital position, minimum income requirements for family consumption, and land purchase restriction.

Area of Study

The typical farm organization under study is located in the extreme Southwest portion of Virginia. Farms in this area produce burley tobacco, corn and mixed hay. Most of the feeds grown are consumed by livestock on farms in the area.

The topography of the area consists almost entirely of Limestone Valley and Mountain Upland areas. Most of the intensive farming is done on small areas deposited along streams on heavy textured soils developed on limestone. The mountain and upland areas are underlaid by sandstone and shale and is most frequently not adapted for harvested crops and it is used for livestock farming. This area is fully described in a recent publication.1/

1/ Givan, W. D. and R. G. Kline, Organization and Operation of Burley Tobacco - Livestock Farms in Southwest Virginia, Bulletin 25, Research Division Virginia Polytechnic Institute, Blacksburg, Virginia, October 1968.

Review of Literature

The present study deals with the effect of firm growth of alternative production-investment decisions related to livestock farms in Southwest Virginia. Literature referring to the problem was reviewed.

Studies In Southwest Virginia

Several farm adjustment studies have been made in Southwest Virginia. Kline 1/ conducted a study in the area to determine available resources, forage systems, combinations of enterprises, input-output relations and returns that were realized by farmers in the area. For beef cow enterprises high investments per cow and high expenses for machinery depreciation, repair and operation were associated with low returns. Oliver 2/ analyzed the adjustment possibilities for the beef cow-calf farms in the area to determine the optimum combination of enterprises which would maximize returns to fixed resources while maintaining the number of beef cows that then were in the farm organization.

When investment capital was increased from $15,750 to $47,250 net returns to operator's labor and management increased from $7,806

1/ Kline, R. G., Economic Analysis of Beef Cow and Calf Farms and Manufacturing Milk Dairy Farms, Agricultural Experiment Station Bulletin 529, Virginia Polytechnic Institute, Blacksburg, Virginia, September 1961.

2/ Oliver, J. D. and R. G. Kline, Optimum Enterprise Combinations for Beef Cow and Calf Farms in Southwest Virginia, Technical Bulletin 180, Virginia Agricultural Experiment Station, Blacksburg, Virginia, June 1965.

to $11,306. The study indicated that steer enterprises, made up primarily of wintered steers, fed in drylot, were a relative better alternative than other enterprises such as hogs on the larger typical farms which had less labor and capital relative to land.

Two recent studies in the area provided very useful information about organization of representative farms, crop and livestock practices, production and costs, returns and input requirements for crop and livestock enterprises in the Southwest Virginia area.1/2/ A study based on this information was conducted by Givan 3/ in order to study the effects of various wage rates on farm organization and structure when average outlay was minimized and with specified income levels. Three different levels of returns to operator labor and management were used, $3,500, $5,000, and $7,000, reflecting returns to semi-skilled, skilled, and highly skilled labor in non-farm employment. Three different sizes of farms were analyzed. Results of this study indicate that when average outlay is minimized the small representative farms, consisting of 40

1/ Givan, W. D. and R. G. Kline, Organization and Operation of Burley Tobacco - Livestock Farms in Southwest Virginia, Research Division Bulletin 25, Virginia Polytechnic Institute, Blacksburg, Virginia, October 1968.

2/ Givan, W. D. and R. G. Kline, Estimated Costs, Returns and Input Requirements for Selected Crop and Livestock Enterprises in the Burley Tobacco Area of Southwest Virginia, Research Division Bulletin 27, Virginia Polytechnic Institute, Blacksburg, Virginia, November 1968.

3/ Givan, W. D., "The Effects of Various Wage Rates and Farm Organization and Structure in Southwest Virginia " unpublished Ph. D. thesis, Virginia Polytechnic Institute, Blacksburg, Virginia, 1968.

acres of open land, does not have sufficient land to achieve a $3,500 operator labor income, the medium size farm consisting of 140 acres of open land would have to purchase land at all labor prices to achieve a $5,000 and $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 consisting of 410 acres of open land has sufficient land to achieve incomes including a $7,000 income at labor prices of $2.50 an hour and a $5,000 income at a labor price of $3.00 an hour. None of the farms were able to achieve a $7,000 income level when hired labor was $3.00 an hour. 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. 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. Use of operating capital associated with non-labor inputs increased faster than labor inputs as wage rates and income levels were increased. When land was purchased the amount of land purchased increased at a rate faster than amounts of labor purchased as wage rates and income levels were increased.

Multi-period Linear Programming Models

Numerous studies have been conducted to determine the optimum combination of different types of enterprises in order to maximize profits or

similar objectives but only recently emphasis was given to include time as a decision variable and the maximization of returns for some given period of time as an objective function.

One of the first activity analysis including time as a variable was done by Earl Swanson to select fertilizer programs.1/ As he described it, the model attempted to "deal with the problem of planning over time. That is, more than one period of production is considered . . . a long run farm plan with a transition plan is . . . specified." The maximization of the present value of a stream of net incomes was used as the criterion function. The model had an activity to transfer part of income from one year to the next, above a $5,000 minimum consumption and fixed cost allowance. Although it was primarily an enterprise choice model, investment in equipment was considered as an alternative. Swanson's results showed that a shortening of the planning horizon from 9 to 2 years resulted in a totally different fertilization plan for the farm thus stressing the importance of planning over time. With lower amounts of initial capital the general pattern of enterprise combination was an increase in cash crops and a decrease in livestock numbers.

1/ Swanson, Earl R., "Methodological Procedures in the Economic Analysis of Fertilizer Use Data," Selecting Fertilizer Programs by Activity Analysis, The Iowa State College Press, Ames, Iowa, 1956.

Loftsgard and Heady 1/2/ developed models that involved solving optimum plans for a series of time periods where productive resources in the farm business were related to expenditure needs of the farm family. The model constructed in the form of a block diagonal matrix demonstrated internal generation of surplus funds. The increase in operating capital between years is the difference between the net return for all activities and certain fixed charges and a household consumption allowance. The variable maximized was the sum of present value of net returns using a six percent discount rate. The amount of borrowing capital available was limited. Loftsgard's conclusions showed that different combinations of enterprises were optimum at different time periods until the plan remains stable. The number of years needed to arrive at a plan which became "stable" depended on several factors such as family goals, consumption withdrawals, capital availability, etc. Increases in annual capital supply were reflected mainly in changes in livestock organization. Initially when capital was more limiting than feed supplies the livestock organization with the highest returns to capital was used. As capital was accumulated over time and became less limiting than forage, the operating capital was invested

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1/ Loftsgard, S. D. and E. O. Heady, "Application of Dynamic Programming Models for Optimum Farm and Home Plans," Journal of Farm Economics, Vol. 41, February 1959.

2/ Loftsgard, S. D. and E. O. Heady, Programming Procedures for Farm and Home Planning Under Variable Price, Yield, and Capital Quantities, Iowa Agricultural Experiment Station, Research Bulletin 487, 1960.

in the livestock system with a higher return to feed supplies. The plan became stable after capital was no longer limiting. The conclusion of this study was that the same crop and livestock plan should not be recommended each year if profit maximization over time was the relevant goal.

Barr and Plaxico 1/ studied range improvement practices and optimum cattle systems by static and dynamic analysis. The purchase of land in this study appeared to be much more profitable when evaluated in a dynamic framework than in a static one. Capital rationing was introduced in the form of requiring alternative marginal value products for capital. Conclusions of this study indicated that a different livestock system was profitable when capital was limited than when the amount of capital was unlimited. If the amount of investment capital was limited in the initial time period a cow-calf system was predominant but as net returns were allowed to be transferred to future periods, steers replaced the cow-calf system in the optimum program. When the dynamic analysis was compared with the static analysis, the optimum static plan when the lowest interest rate for capital was assumed, was very similar to the optimum dynamic plan when capital was unrestricted.

1/ Barr, A. L. and J. S. Plaxico, Optimum Cattle Systems and Range Improvement Practices for Northeastern Oklahoma: Dynamic and Static Analysis, Oklahoma Agricultural Experiment Station, miscellaneous publication 62, July 1961.

J. R. Martin 1/ used a polyperiod model for a planning horizon of 30 years with the purpose of studying the capital accumulation process and growth of the firm. He used an optimal farm solution from a minimum resource study as an operating plan and all other activities were included to invest in resources or to handle the investment of funds between years. He simulated growth restrictions based upon different starting farm sizes, tenure, capital rationing and consumption situations. In addition to using as an objective function the maximization of the present value of a stream of net incomes he used other objectives such as maximum present value of gross sales, undiscounted values of net returns, ending owned capital and acres of land operated both through and at the end of the planning period and the maximum present value of land investments. A $3,000 consumption base, plus a marginal propensity to consume of 25 percent was required. Borrowing was limited to 50 percent of mortgage debt. Martin showed that capital accumulation and growth measured in all of these terms resulted in the same farm organization and land acquisition over the planning period considered. A criterion function of maximizing discounted net returns depicted the conditions of capital accumulation and growth for objectives of maximum present value of gross sales, undiscounted value of net returns, ending owned capital and acres of land operated both through and at the end of the planning

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1/ Martin, J. R., "Polyperiod Analysis of Capital Accumulation and Growth Process of Farm Firms, Low Rolling Plains of Southwestern Oklahoma," unpublished Ph. D. thesis, Oklahoma State University, 1966.

period. He concluded that the structure of the system is the important factor. Different objectives resulted in the same growth rates for the same structural relationships of the firm. However, different structural relationships resulted in very different growth rates. Martin also found that when borrowed capital was restricted the growth process decreased in terms of land operated and net returns. The method of land acquisition for situations of equal starting farm sizes, consumption and capital borrowing levels accounted for the greatest differences in growth rates in Martin's study.

Johnson 1/ used a polyperiod model designed basically for investigating the relationship of various financial factors on capital accumulation. He used a planning horizon of 15 years of length divided into five periods of three years each. Risk is introduced in the model by assuming crop yields consisting of an average yield plus a random component. A simulation procedure is used to draw a sample value of the yields for the 15-year period. Using this series of yields the model is solved for the 15-year period. The model maximizes net worth at the end of the planning period. Johnson observed that a greater initial asset position produced a large average growth rate. Also the terminal asset position was more than proportionally greater in the situation with a larger initial position. With the same amount of consumption the number of years with slow growth rate lasted longer in firms of

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1/ Johnson, S. R., "An Analysis of Some Factors Determining Farm Firm Growth," unpublished Ph. D. thesis, Texas A & M University, 1966.

low initial asset position compared with those of higher initial asset position.

A polyperiod linear programming model of capital accumulation was used by Bowman 1/ to determine the effect of various factors such as changes in initial resources available, capital rationing, land acquisition methods, and alternative objective functions on firm growth for farms in the peanut area of Southeastern Virginia. The model uses four production periods of five years of length each covering a 20 year planning horizon. It uses four different discount rates when maximizing the present value of net returns. Also the maximization of net worth is used as an objective function. Capital is transferred from one period to another through different transfer activities. Results of this study showed that family consumption was the major capital consumer. The larger farms had the greater raise in capital accumulation. Growth by land purchases were rare except in the case of maximization of net worth. Initial production periods were dominated by the production of cash crops only and very low amounts of capital were used for the production and investment during this period. Most investments were made during the subsequent periods.

Recursive programming, a modification of conventional linear programming, where dependence between present and past time points

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1/ Bowman, E. G., "Capital Accumulation and Firm Growth - A Polyperiod Linear Programming Analysis of Farms in the Peanut Area of Southeastern Virginia," unpublished M. S. thesis, Virginia Polytechnic Institute, Blacksburg, Virginia, May 1968.

exists was used by Heidues 1/ for predicting supply responses and to evaluate different price policies on groups of farms. He used behavioral constraints to limit the rate and total amount of borrowing in order to reflect the phenomenon that the adoption of new techniques requires a learning period for the firms of an industry to become acquainted with the technical innovations, shortages in factor supplies, and objective barriers to rapid changes in technology caused by existing assets with low salvage value. Conceptually Heidues' recursive model is very similar to the multi-period models where transfer equations are used to link different time periods. The difference is that Heidues' model solves one period at a time, sequentially. The objective function maximizes ability of the farm to accumulate investment capital, subject to the consumption function and other requirements. Between successive years, wage rates, consumption levels and yields increases according to projections from trends. Heidues' results showed cash-crop farms have a considerably higher potential for the accumulation of investment capital than those with a high percentage of forage crops, mostly in the form of permanent pasture. The results also implied a more difficult adjustment to price changes and economic growth for the forage farms, due in part to initially lower potential ability and the required investments through borrowing of this type of organization.

1/ Heidues, T., "A Recursive Programming Model of Farm Growth in Northern Germany," Journal of Farm Economics, Vol. 48, No. 3, August 1966.

The problem under study is based on previous adjustment studies done in Southwest Virginia, in particular Givan's minimization study concerned with large farm organizations. Procedures and results associated with different factors used in previous multi-period studies are considered in this study such as different maximizing criteria and the effect of variables such as initial debt position and different consumption policies. This study differs from previous polyperiod studies in that analyses are made to study simultaneously investment and production decisions.

THEORETICAL CONCEPTS

Criteria for Selecting Investment Programs for Long-Run Profits and Growth

Hicks stresses the importance of realizing that "the decisions of entrepreneurs to buy and sell always form part of a system of decisions which is not bounded by the present but has some reference to future events." 1/ Hicks defines economic statics as part of the economic theory where we do not trouble about dating and economic dynamics those parts where every quantity must be dated. In Hicks dynamic model the firm chooses the course of action which maximize the value of a pay-off function. This function depends upon both the future and the current actions of the firm. Dividing the history of the firm in T time periods the present and the future is distinguished by regarding only the first period as the "present" whereas the remaining T periods comprise "the future." The Hicksian model assumes that the firm has a defined set of goals summarized in terms of the firm's "pay-off function." The pay-off function that the firm attempts to maximize in the Hicksian model is the present value of profits over the entire horizon. For Hicks the decision problem confronting the firm at any point in time is the selection of the entire best course of action over the horizon. "The decision which confronts any particular entrepreneur at any date. . . may be regarded as the establishment

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1/ Hicks, J. R. Value and Capital, Oxford University Press, New York, 1941.

of a production plan." 1/ The firm is assumed to solve a T-period constrained maximization problem and determine the optimal values of all variables over the entire horizon.

Baumol 2/ classifies the Hicks approach as statics involving time rather than dynamics, and emphasizes the structural aspects of dynamics as studying the economic phenomena in relation to preceeding and succeeding events. Harrod 3/ also emphasizes the changing structural relationship in economic dynamics. In dynamics the unknown to be solved will not be a specific magnitude per time period but increases or decreases in the magnitude per time period.

Penrose 4/ assumes that managers of firms wish to maximize long-run profits derived from the investment in the enterprise itself. Penrose explains the relationship between growth and profits under this assumption saying that if profits are a condition of successful growth but profits are sought primarily for the sake of the firm and to be reinvested in the firm the criteria of growth and profits become equivalent as the criteria for the selection of investment programs.

Penrose gives great importance to the inducements to expansion that exist within the firm. The inducement arises from the existence

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1/ Ibid

2/ Baumol, William T. Economic Dynamics, The Macmillan Co., New York, 1959.

3/ Harrod, R. F. Towards a Dynamic Economics, Macmillan and Co., Ltd., London, 1948.

4/ Penrose, E. T. The Theory of the Growth of the Firm, John Wiley and Sons, Inc., New York, 1959.

of a pool of unused productive services, resources, and special knowledge within the firm. Many types of resources are only attainable in discrete amounts and the amount and kind of productive services obtainable from each class may be different. Penrose's theory is that as long as expansion can provide a way of using the services of its resources more profitably than they are being used, a firm has an incentive to expand, or alternatively, as long as any resources are not used fully in current operations there is an incentive for a firm to find a way of using them more fully.

The existence of durable resources yielding services that last more than one production period is what characterizes polyperiodic production. Using Carlson's 1/ notation:

X_I and X_{II} are products furnished and sold at the end of Period I and Period II

and $V_{I_1} \ldots V_{II_n}$

$V_{II_1} \ldots V_{II_n}$

are inputs of variable services in Period I and II, then products X_I and X_{II} are written as functions of the inputs of the period, the inputs of the subsequent or previous periods and the output of the next or the previous period:

1/ Carlson, Sune, A Study on the Pure Theory of Production, Kelley and Millman, Inc., 1965.

$$X_I = \xi\,(X_I)\quad (V_{I_1} \ldots V_{I_n}, V_{II_1} \ldots V_{II_n}, X_{II})$$
$$X_{II} = \xi\,(X_{II})\ (V_{I_1} \ldots V_{I_1}, V_{II_1} \ldots V_{II_n}, X_I)$$

These functions express what Carlson calls the technical interdependence between periods.

Another characteristic of polyperiodic production is that service prices of one period are not determined exclusively by the amount of services bought at a particular time but also are determined by earlier and later purchases, borrowing, or investments. This is what Carlson defines as price interdependence between periods. Because of this price interdependence the costs of productive services bought in one period are influenced by service purchases in other periods. This is defined by Carlson as joint cost in time. If

C = total cost of the production activity, C is a function of two outputs X_I and X_{II} and the marginal cost is given by the partial derivatives

$$\frac{\delta C}{\delta X_I}$$
$$\frac{\delta C}{\delta X_{II}}$$

The properties of the marginal cost are determined by the second derivatives and the mixed derivative which shows the technical interdependence between products of different dates

$$\frac{\delta^2 C}{\delta X_I^2}, \frac{\delta^2 C}{\delta X_{II}^2}, \frac{\delta^2 C}{\delta X_I \delta X_{II}}$$

A positive, negative or zero value of the mixed derivative indicates if the products rendered in Period I and in Period II are complementary, competing or independent.

When a durable resource yields services which in consecutive periods enter the production of the same product these services will be distributed between periods so that their marginal productivities will be the same.

$$\frac{\delta X_I}{\delta V_I} = \frac{\delta X_I}{\delta V_{II}} \text{ and } \frac{\delta X_{II}}{\delta V_I} = \frac{\delta X_{II}}{\delta V_{II}}$$

The firm will employ each productive service until its marginal cost is equal to the discounted value productivity with respect to each product.

$$-\frac{\delta X_I}{\delta X_{II}} = \frac{PX_{II}\left[(1+r)^n\right]^{-1}}{PX_I\left[(1+r)^n\right]^{-1}}$$

$$-\frac{\delta V_I}{\delta V_{II}} = \frac{PV_{II}\left[(1+r)^n\right]^{-1}}{PV_I\left[(1+r)^n\right]^{-1}}$$

It is required that the rate of product transformation and the rate of technical substitution between inputs be equal to the ratio of the discounted prices.

The discounted value of the marginal product applied during the r^{th} period with respect to each output in each time period must be equated to the discounted price of the input on the r^{th} marketing date.

$$\frac{\delta X_I}{\delta V_I} PX_I \left[(1+r)^n\right]^{-1} = PV_I \left[(1+r)^n\right]^{-1}$$

The Model

A polyperiodic model of growth over time was developed within the general framework of linear programming. This framework is appropriate since it incorporates many of the important aspects of the problem such as available resources, alternatives by which resources may be used over time and the possibility of introducing the effects of choices of decision in an earlier time period binding on alternatives in later production periods. The characteristics of a polyperiod model is that each coefficient is identified with a particular time period. The model is dynamic in a Hicksian sense as inputs and outputs are dated. The multiperiod linear programming model can be expressed as maximizing:

$$Z = C_{11}X_{11} + C_{21}X_{21} + \ldots C_{jk}X_{jk} + \ldots\ldots C_{nt}X_{nt}$$

subject to:

$$a_{111}X_{11} + \ldots + a_{1j1}X_{j1} + a_{1j2}X_{j2} + \ldots + a_{1nt}X_{nt} \leq b_{11}$$

$$a_{211}X_{11} + \ldots + a_{2j1}X_{j1} + a_{2j2}X_{j2} + \ldots + a_{2nt}X_{nt} \leq b_{21}$$

$$\vdots$$

$$a_{i11}X_{11} + \ldots + a_{ij1}X_{j1} + a_{ij2}X_{j2} + \ldots + a_{int}X_{nt} \leq b_{i1}$$

$$\vdots$$

$$a_{ilk}X_{lk} + \ldots + a_{ijk}X_{jk} + \ldots\ldots\ldots a_{int}X_{nt} \leq b_{i2}$$

$$\vdots$$

$$a_{ilk}X_{lk} + \ldots + a_{ijk}X_{jx} + \ldots\ldots\ldots a_{int}X_{nt} \leq b_{ik}$$

$$\vdots$$

$$a_{mlt}X_{lt} + \ldots + a_{mjt}X_{jt} + \ldots\ldots\ldots a_{mnt}X_{nt} \leq b_{mt}$$

where k is the period in which the activity or restriction occurs and k = 1, 2, ... t; i is the number of the row or restriction and i = 1, 2, ... m; j is the number of the column or activity and j = 1, 2, ... n. The a_{ijk} represents the output of the jth activity for the ith resource in the kth period; X_{jk} would be the level of the jth activity in the kth period; b_{ik} would be the level of ith resource in the kth period. The letter Z would indicate the maximum present value of the future net returns and C_{jk} is the discounted net revenue of the jth activity in the kth period. The maximum is subject to the non-negative condition $X_{jk} \geq 0$ that no activity will be carried on at a negative level.

The input-output matrix of the linear programming model has a block diagonal format and it can be partitioned in submatrices that overlap in some rows or columns or both. Overlapping in rows would mean that certain commodities produced during time period t may also be required for the production of some commodity in time t + k. Overlapping columns indicate that products (or the returns from these products) being produced during time t could be used in the production of products in time t + k. The availability of scarce resources for a future production period is not the same as those available for a former production period because resources may be added or used up or created during the production process.

The Appropriate Discount Rate

Investments for long periods of time involve the assumption that certain amount of risk and uncertainties with respect to the future

exists. For this reason a dollar received today is worth more than a dollar to be received in the future. As a consequence, decisions should be made by comparison of the present discounted values of alternative income streams. Discounting is the way of reducing future incomes to present values. The relevant discount rate for discounting by a farmer with unlimited capital is the market interest rate. It represents his opportunity cost in using investment funds. In this situation investments have to return as much in the future as might be obtained by lending the money out at interest and letting it accumulate. For farmers with limited capital the appropriate discount rate should depend on the capital position of the individual and in the opportunity returns of using his capital elsewhere in the business. The market rate of interest for discounting calculations does not apply to a farmer with limited funds to invest in his own business because of capital rationing by lenders or by farmers with a great risk aversion. Capital rationing is considered here following Hart 1/ and it will be said to exist when the firm is in some way prevented from buying, selling, or borrowing unlimited amounts at the prices and interest rates in effect. The objective functions used reflect the difficulty of using an appropriate discount rate. Undiscounted net returns and the maximization of net returns using the six percent, twelve percent and twenty percent discount rate were used in this study.

1/ Hart, A. G. Anticipations, Uncertainty, and Dynamic Planning. A. M. Kelley, Inc., New York, New York, 1951.

PROCEDURE

Planning Horizon

The planning horizon selected for this study was of 15 years. Consideration was given to the fact that it takes time for a farm to accumulate capital and make the necessary adjustments to achieve expansion.

Previous studies indicate that periods of time longer than 15 years would have no (or little) effect on the solutions obtained.1/2/3/

The 15-year period is divided in three sub-periods of five years length each. The underlying assumption is that although farmers change their production decisions during the planning periods, the adjustments that involve major investments are made not in a year to year fashion but by units of larger periods of time. This model is concerned with solutions covering the whole time horizon being distinct from those decision models in which only the time period nearest the present is considered relevant.

1/ Plaxico, J. S. "Dynamic Programming and Management Strategies in the Great Plains." GP. No. 2, Technical Committee Meeting, Lincoln, Nebraska.

2/ Barr, A. L. and J. S. Plaxico. Optimum Cattle Systems and Range Improvement Practices for Northeastern Oklahoma. Oklahoma State University, Miscellaneous Publication 62, Stillwater, Oklahoma, 1961.

3/ Johnson, S. P. "An Analysis of Some Factors Affecting Farm Firm Growth." Unpublished Ph. D. Dissertation, Texas A & M University, August, 1966.

The manager may reformulate his plans at the end of each period. This would involve a new and shorter planning horizon.

The Enterprise Budgets 1/

The enterprise budgets contain a listing of all inputs needed to produce a product, cost of variable inputs, output produced and value of the output. The source of data was a survey of farms in the area conducted in 1965 and related information of cost, returns, and input requirements for the area compiled for a Regional Research Project. 2/ The representative farm organization and physical resources are those of farms classified as large having 410 acres of open land. Other data from previous studies of the area were also taken into consideration. Net returns from these budgets are net returns to fixed resources (present investment in land, buildings and equipment, fixed labor and management). Enterprise budgets were made for three five year periods.

Input-output coefficients for Period II and Period III were projected taking into account past rates of adoption in new technology, yield increases and specialists opinions of future improvement in those coefficients.

Prices used were obtained from the most reliable sources available. In general these included the United States Department of Agriculture,

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1/ See Appendix A

2/ Givan, W. D. and R. G. Kline, Organization and Operation of Burley Tobacco-Livestock Farms in Southwest Virginia, Bulletin 25, Research Division, Virginia Polytechnic Institute, Blacksburg, Virginia, October 1968.

the Virginia Crop Reporting Service and agencies selling farm supplies. Prices for subsequent periods were projected taking into account past trends.1/ The price resulting from a moving average calculated for the years between 1961-63 to 1965-67 for livestock were used for the three production periods. An increase in the beef/corn price ratio of 0.28 percent per year was estimated. A tendency in a decrease in corn prices was observed in the past so corn prices were projected accordingly. The price ratio between steers and soybean oil meal did not change significantly during the years 1935 to 1966 and both prices were maintained constant during the three production periods. The price of Alfalfa No. 1 was increased one percent per year. Burley tobacco prices were increased one percent per year according to past trends and the estimation of specialists in the field. No increase in fertilizer prices or seed prices were projected according to past trends in indexes for these inputs. Wages and custom rates were increased ten percent per year.

The value per acre used for open land in Southwest Virginia for the year 1966 was $152.00. One third of total land was considered woodland so this value was adjusted accordingly. For calculating land values for the period 1966-80 a six percent increase in land value per acre per year was used according to past trends in land values (Table 2, Appendix B). The cost of renting land was assumed to be of $15.00 per acre. This value takes into account the proportion of different classes of land possible to be rented.

1/ See Appendix B

The Operational Model

The 15-year planning horizon was divided into three production periods of five years of duration each. The input-output matrix was partitioned into three submatrices, each submatrix representing a production period. The coefficients were zero for other periods than the period considered except for those coefficients representing inter-year capital flows or changes to be introduced in the input-output coefficients of the present period due to decisions of a previous period. The matrix has a block diagonal format.

Twelve activities were used in each period to handle alternative investments and the finance of these investments. In Table 1 and Table 2 separate abbreviated forms of the entire matrix show respectively the investment and finance alternatives and the production activities and requirement (or supply) coefficients in the specified constraint rows. 1/ The full matrix and control program are given in Appendix G . The ASET1 activity summarizes the present assets (and liabilities), and the initial supply of services or the requirements of specified rows for each of the three periods. In the full matrix the investment activities included were buy land (BLND), buy tractor (TRACTOR), buy barn space (BRNSP), buy fence (FNC), buy grain storage (GRS), buy trench silo (TRSS), buy feeding equipment (FEQQ), buy equipment (EQIP). In the abbreviated matrix the investment alternatives are represented by buy land (BLND) and buy tractor (TRACTOR).

1/ The last digit of the row or column identifies the Period I, I I, and III, respectively.

Table 1. Abbreviated Matrix for Purchase of Durable Assets and Finance Alternatives

	Time periods and processes																		
	Period I							Period II						Period III					
	ASET1	BLND1	TRACTOR1	C101	TCP1	CNW1	FXTX1	BLND2	TRACTOR2	C102	TCP2	CNW2	FXTX2	BLND3	TRACTOR3	C103	CNW3	FXTX3	Con.	RHS
PROF3	-2984.			-767.68	-567.42	±34.05	-0.37			-435.59	-321.96	±16.03	-0.37			-247.17	±5.80	-0.37	=	0.
PROF5						±1000.						±1000.					±1000.		=	0.
PERIOD I																				
BCAP1	-61333.			1000.															<	0.
CAPT1	17480.	22800.	3548.	-1000.															<	0.
NETW1	-17810.	-6840.	1774.	500.	-1000.	±1000.													=	0.
FAM51	-2190.			-679.	-1000.	±25.	-1000.												<	20000.
FTAX1	-2190.			-679.	-1000.	±25.													=	0.
LND1	-410.	-100.																	<	0.
TRAC1	-1800.		-1200.																<	0.
PERIOD II																				
BCAP2	-12477.	-4788.	1242.	-350.	-700.			29640.	4036.	1000.									<	0.
CAPT2					-1000.			-6480.	2018.	-1000.									<	0.
NETW2	-26659.	-6840.	1774.	-500.						-500.	-1000.	±1000.							=	0.
FAM52	-2190.			-679.		±25.				-679.	-1000.	±25.	-1000.						<	20000.
FTAX2	-2190.			-679.		±25.				-679.	-1000.	±25.							=	0.
LND2	-410.	-100.						-100.											<	0.
TRAC2			-1200.						-1200.										<	0.
PERIOD III																				
BCAP3	-18661.	-4788.	1242.	-350.				-4788.	1413.	-350.	-700.					1000.			<	0.
CAPT3											-1000.			36480.	4523.	-1000.			<	0.
NETW3	-28044.	-6840.						-6840.	2018.	-500.				-6840.	2262.	-500.	±1000.		=	0.
FAM53	-2190.					±25.				-679.		±25.				679.	±25.	-1000.	<	20000.
FTAX3	-2190.					±25.				-679.		±25.				679.	±25.		=	0.
LND3	-410.	-100.						-100.	-1200.					-100.					<	0.
TRAC3															-1200.				<	0.

Table 2. Abbreviated Matrix for Production Enterprises

	Time periods and processes																	
	Period I						Period II					Period III						
	CSTR1	PAST1	BFCO1	BFC1	SWSW1	STER1	CSTR2	PAST2	BFCO2	SWSW2	STER2	CSTR3	PAST3	BFCO3	SWSW3	STER3	Con.	RHS
PROF3	-702.42	-25.59	1854.37	6369.5	833.68	5775.74	-427.29	-18.31	1044.03	473.05	3271.80	-254.35	-13.86	587.53	268.42	1853.17	=	0.
PROF5																	=	0.
PERIOD I																		
BCAP1	94.6	3.4	112.4	138.9	42.4	1734.											<	0.
CAPT1			4750.	4750.													<	0.
NETW1			4750.	-1480.														0.
FAM51	-974.3	-35.50	2572.	2850.	1156.	8011.											<	20000.
FTAX1	-974.3	-35.50	2572.	2850.	1156.	8011.												0.
LND1	5.0	1.0															<	0.
TRAC1	34.9	0.8	10.0	12.5	0.6	10.0											<	0.
PERIOD II																		
BCAP2	-94.6	-3.4	3212.	-610.2		-1734.	101.41	4.35	114.4	42.37	1734.						<	0.
CAPT2			-4750.						4750.								<	0.
NETW2				-6280.					4750.									0.
FAM52				4730.			-1044.	-44.72	2552.	1156.	7998.						<	20000.
FTAX2				4730.			-1044.	-44.72	2552.	1156.	7998.							0.
LND2							5.0	1.0									<	0.
TRAC2				24.9			35.4	0.8	10.0	0.6	10.0						<	0.
PERIOD III																		
BCAP3				-3808.			-101.41	-4.35	3211.		-1737.	106.39	5.30	116.43	42.37	1890.	<	0.
CAPT3									-4750.					4750.			<	0.
NETW3				-12170.										4750.				0.
FAM53				10253.								-1096.	-59.70	2531.	1156.	7983.	<	20000.
FTAX3				10253.								-1096.	-59.70	2531.	1156.	7983.		0.
LND3												5.0	1.0				<	0.
TRAC3				49.7								35.9	0.8	10.0	0.6	10.0	<	0.

For the investment in added assets four finance possibilities were included in each period, a five, ten and fifteen year (for land purchases) amortization or reinvesting net income above taxes and family consumption, generated in the previous five-year period. In the abbreviated matrix (Table 1) the finance possibilities are represented by the ten-year amortization (C10) and by the transfer of income from previous period (TCP). A $1000 invested at the beginning of a specified five-year period, I, II, III would require from income for family consumption during that period $1187, $679, or $498 if the finance arrangement included was the amortization during five, ten or fifteen years or $1000 if financed with funds generated in the previous period. For amortizations of ten and fifteen years similar withdrawals are made in Period II and in Period II and III, respectively. In each period two activities were included to indicate increases (IW) and decreases (DW) in net worth. These activities are represented in the abbreviated matrix by the activity (CNW). Real estate taxes were increased or decreased according to the associated increase and decrease in net worth.

Two activities were included in each period for income tax, a tax of $100 per $1000 net income (FXTX) and a surcharge tax of $300 per $1000 on incomes over $8000 per year (SXTX). A capital gains tax was also included in the last period (CGTX).

Eighteen production activities were used in each period including activities used to permit sale of hay and corn grain, sale of beef calves at various ages and transfer feed to various feed balance rows. Crop enterprises included were: a five-year corn silage, oats, red

clover-orchardgrass rotation (CSTR); a five-year corn grain, oats, red clover-orchardgrass rotation (CGRT); continuous corn for silage (CRNSIL); alfalfa hay (ALF) and burley tobacco (BRTB); which utilize land suitable for crops, and pasture (PAST) which could utilize cropland and land suitable only for pasture. The crop production activities are represented in the abbreviated matrix (Table 2) by the five-year corn silage rotation (CSTR) and the permanent pasture enterprise (PAST).

Livestock production alternatives included were two beef cow calf activities, one which consists of the investment on a beef breeding herd at the beginning of each period and the disposal of the breeding herd at the end of the five-year period (BFCO) and a beef cow-calf activity (BFCW) that permits, at the beginning of the first production period only, the selection of the size of a breeding herd base with a predetermined rate of growth through the rest of the production periods. Sixty beef cows, the number presently on the large farms in the area was specified as the minimum number to be included in Period I. Beef cows would be included in the enterprise combinations for Period II and III only if they are more profitable than selling hay and grain or steers when 700 pound feeder steers are purchased and finished on drylot (STER). The calves produced by either beef cow enterprises may be sold as 450 pound calves (SLCF), or wintered and sold in spring at 650 pounds (SWSS), or sold off pasture at approximately 18 months of age (SWSF) or finished on drylot (SWSW). In the abbreviated matrix the steer activities are represented by feeder steers bought at 700 pounds

and finished on drylot (STER) and by the feeder steers produced in the farm and sold finished on drylot (SWSW).

In addition to the 2720 hours of fixed labor available, two activities for hiring seasonal labor were included (HDML and HJNL). Other transfer and sale activities included are: sell hay (SCHY), sell corn grain (SLGR), activities for transferring different types of feed as corn silage into pasture (CSPST), hay to silage (HYSL), corn silage to straw and stover (CSST). Land was available also by renting (RLND). Only 40 percent of total open land plus 40 percent of land purchased was allowed to be rented.

Five objective functions were used to evaluate the effects of different maximizing criteria on firm growth and associated investments, finance policies and enterprise combinations. They were:

PROF1: Maximize undiscounted value of net returns.

PROF2: Maximize net returns discounted at a six percent discount rate. 1/

PROF3: Maximize net returns discounted at a twelve percent discount rate. 1/

PROF4: Maximize net returns discounted at a twenty percent discount rate. 1/

PROF5: Maximize net worth at the end of the planning period.

The objective function with a twelve percent discount rate was used to evaluate the effect of variations in initial debt, family

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1/ See Appendix E for the discounting coefficients used.

consumption and land purchases on firm growth. In the abbreviated matrices (Table 1 and Table 2) PROF3 and PROF5 are shown. Also those constraint rows which show the supply, utilization and requirements of specified resources and financial constraints are shown.

Borrowing capital (BCAP) is limited to 70 percent of the net worth at beginning of Period I or $61,333 (ASET1, Table 1). Users of the borrowing capital restriction are the three different loans amortized during five, ten and fifteen years and the production capital for the production activities. Production capital used in one period is supplied in the subsequent period (Table 2 CSTR + 94.6 BCAP1 and -94.6 BCAP2). The borrowing capital row can be represented as:

$$\Sigma \text{ borrowing capital supplied } (-), \text{ used } (-) \leq 0.$$

The investment capital row is represented in the abbreviated matrix by CAPT1 (Table 1 and Table 2). The investment capital row can be represented as:

$$\Sigma \text{ capital supplied } (-), \text{ used } (+) \leq 0.$$

Net worth in each period is increased by the amount of each investment paid during the period and reduced by the depreciation of the owned assets (NETW1, Table 1 and Table 2).

The family consumption was included in terms of one year (FAM1) and the 5-year period (FAM5). In the abbreviated matrices FAM5 is shown (Table 1 and Table 2).

Two rows for taxes were included, one for income up to $8,000 per year (FTAX) and a row for a surcharge tax for incomes over $8,000

(FXTX). In the abbreviated matrices only taxes for income less than $8,000 per year are shown (FTAX, Table 1 and Table 2).

Land restriction is represented in the full matrix by three rows LND1, LND2, LND3 representing the three different classes of soils in cropland and one for pasture land (PSTR). In the abbreviated matrix land restrictions are represented by one row (LND, Table 1 and Table 2). Land bought in one production period is made available in subsequent periods and the buy land activity adds the amount bought simultaneously in each row of the future periods during the period when the purchase is made.

Two rows were included in the full matrix for tractor and equipment requirements (TRAC and EQP). In abbreviated matrix these are represented by (TRAC) (Table 1 and Table 2). Requirements are expressed in tractor equivalent hours (Appendix D). The tractor equivalent hours were calculated by estimating a factor with the purchase cost and the wear-out life of each piece of equipment assuming a wear-out life of ten years. An initial amount of 6,000 tractor equivalent hours is available and it is for one and one-half tractors and other equipment commonly used in large farms in the area. Hours of the different pieces of equipment required by the production enterprises are in terms of tractor equivalent hours. The purchase of tractor hours in any production period made these hours available for use in subsequent periods. Tractor and equipment bought in one period is available in subsequent period during a period of ten years and it should be replaced after this time has elapsed.

In the full matrix rows for use or supply of other durable assets such as trench silo (TRSL), barn space (BRSP), fence (FNCE), feeding equipment (FEQ) and grain storage (GRST) were included. Accounting equations for investment capital (INCP) operating capital (OPCP), production expenses (EXP), gross income (GRSI) and beef cow numbers (BFCW) are included in the full matrix.

A basic solution was obtained using a twelve percent discount rate. The results obtained in the basic solution were compared to the results using a zero, six, and twenty percent discount rate. Also changes in factor such as not permitting additional land purchases, an increase in family consumption from $20,000 to $65,000 for period and increases in initial debt from $17,480 to $32,838 1/ were done using the same discount rate as in the basic solution.

1/ The maximum amount of initial debt that would give a feasible solution was $32,838.

RESULTS

The Present Situation

The initial situation for the analysis of growth for a large livestock farm in Southwest Virginia is a 60-cow farm with 410 acres of open land. Although only two percent of farm operations were in this size group in 1964 a tendency to grow in size exists in the farms of this area. 1/ This size farm includes steers as one of its important enterprises. In a previous study 2/ it was determined that an operator labor income of $7,000 can only be obtained in small and medium farms with considerably larger amounts of land, labor, and average outlay. As labor prices increase, dry lot feeder steers are the enterprises added. Determining growth possibilities of different beef enterprises such as been cows and steers and related investment and financial possibilities are objectives of this study so the initial resources available in this size farm are considered the most appropriate for the starting situation. Land on the farm at the beginning is:

Item	Unit	Amount
Land		
Cropland	Acre	180
Pasture	Acre	230
Open Land	Acre	410

1/ Givan, W. D. and R. G. Kline, Burley Tobacco-Livestock Farms in Southwest Virginia, Bull. 25, Research Division, Virginia Polytechnic Institute, Blacksburg, Virginia, October, 1968.

2/ Givan, W. D., "The Effect of Various Wage Rates on Farm Organization and Structure in Southwest Virginia," unpublished Ph. D. thesis, Virginia Polytechnic Institute, Blacksburg, Virginia, December 1968.

Operator labor in each of two periods is:

Item	Unit	Amount
Labor		
Operator December-May	Hour	1,288
Operator June-November	Hour	1,432

The amount of tractor and machinery hours, buildings, and storage facilities existing at the present in the representative farm are:

Item	Unit	Amount
Tractor	Eq. hour	1,800
Equipment	Eq. hour	4,200
Barn space	Sq. ft.	1,500
Grain storage	Bu.	1,000
Fences	Acre	230

The beginning value of assets is $105,099, liabilities $17,480 debt on land, and initial net worth is estimated to be $87,618 (Table 3). Remaining years of life of different buildings and equipment is taken into consideration for net worth calculations. Borrowing capacity for Period I is assumed to be 70 percent of net worth.

For the study of a basic solution, a discount rate of 12 percent is used on the assumption that a certain amount of capital rationing exists and that the farmer will not borrow unlimited amounts of capital at the existing marketing rate because of lenders' policies and/or because certain amount of internal capital rationing is assumed to exist due to the risk and uncertainties involved in planning and investing for a long period of years.

Table 3. Net Worth at Beginning of the First Production Period, Large-size Livestock Farms, Southwest Virginia

Item	Net worth	Remaining life
	(dollars)	(years)
Land	93,480.00	
Unpaid debt on land	17,480.00	
Net worth land	76,000.00	
Tractor and equipment	8,848.00	5
Barn space	937.50	10
Grain storage	300.00	10
Fences	1,533.00	10
Total net worth at beginning	87,618.50	

The Basic Solution

Factors Associated with Growth

During the 15-year period, farm growth was considerable. Growth was reflected in increasing returns per period, increasing net worth and by changes in acres operated, added investments and enterprise combinations.

Returns Returns per year increased considerably during the 15-year period. Five-year gross returns are four times greater for Period II than for Period I and almost eight times greater in Period III as compared to Period I (Table 4). The distribution of gross income was different between the different periods (Table 5). Annual operating expenses increased from 57 percent of total gross income during Period I to 79 percent during Period III. Net income during Period II is $5,100 per year over the minimum required for family consumption. During Period III $45,800 annual net income over the minimum required for family consumption is generated and this amount may be considered as an increase in net worth at the end of the planning period. Net worth increases from $87,618 at the beginning of the planning period to $416,500 or a net increase of $328,871.

Added Investments During the first production period investment capital is used mostly for the purchase of the required 60 beef cows and the rest is used for buildings and livestock equipment. Fifty-five percent of added investment in Period III is used for the purchase of

Table 4. Firm Growth when Maximizing Net Returns Discounted Twelve Percent during Fifteen Years, Large-size Livestock Farms, Southwest Virginia[1/]

Item	Unit	Five-year period I	Five-year period II	Five-year period III	Total[2/]
Returns					
Gross returns	$1000	294.85	1173.62	2315.63	3784.11
Undiscounted net	$1000	22.11	55.98	417.72	824.80[3/]
Discounted net	$1000				223.78
Net worth at the end of the period	$1000	180.64[4/]	381.56	416.51	416.51
Land					
Purchased	Acre	-	22.7	377.3	400.0
Rented	Acre	-	94.6	252.0	
Total available	Acre	410.0	527.3	1062.0	
Total used	Acre	346.8	290.5	559.0	
Added investment					
Land	$1000	-	6.73	137.63	144.36
Farm machinery	$1000	-	22.90	16.83	39.73
Buildings and livestock equipment	$1000	13.15	53.71	80.24	147.10
Livestock[5/]	$1000	14.25	5.76	13.17	33.18
Total	$1000	27.40	89.10	247.87	364.37
Operating capital (annual)	$1000	16.45	79.66	173.07	
Finance for investment					
15-year loan	$1000	17.48[6/]	-	-	
10-year loan	$1000	27.40	-	-	
5-year loan	$1000	-	-	46.40	
Reinvest income	$1000	-	89.10	201.50	

1/ Land acquired, capital use, and credit policies are simultaneously determined with maximum returns.

2/ Total for the three five-year periods or amount at the end of 15 years.

3/ The difference in the total amount is increase in net worth at the end of the planning period.

4/ Net worth at the beginning of the planning period is $87,618.

5/ Sixty beef cows presently on farm are fixed for Period I.

6/ $17,480 is initial debt on land at the beginning of the planning period.

Table 5. Distribution of Annual Gross Income When Maximizing Net Returns Discounted Twelve Percent during Fifteen Years, Large-size Livestock Farms, Southwest Virginia

Item	Unit	Five-year period I	II	III
Gross Income	$1000	58.9	234.7	463.1
Production expenses	$1000	33.4	176.5	364.1
Other expenses 1/	$1000	6.1	7.8	14.6
Taxes 2/	$1000	0.4	2.1	33.9
Transferred capital 3/	$1000	15.0	39.0	-
Net income				
Family consumption	$1000	4.0	4.0	4.0
Other	$1000	-	5.1	45.8

1/ Includes loan amortization costs, cost for net worth increases and taxes on owned resources.

2/ Income taxes are 10 percent for annual incomes less than $8,000 and a 30 percent for annual incomes over $8,000.

3/ Capital transferred to be reinvested in next period.

additional land. All land permitted to be purchased is purchased during the 15-year period and mostly in the last five years.

Finance of investments During the first period of the $61,333 of available capital that would be borrowed $17,480 is used to pay a debt on land with a 15-year loan, $27,400 is used for added investments and $16,450 for production items. Added investments during this period are financed with a 10-year loan. During Period II and III added investments are financed in its major part with capital transferred from the previous period.

Enterprise organization The growth of the farm is also associated with great changes in enterprise combination (Table 6). The farm organization during the first period consisted of the 60 beef cows required in the problem and 108 dry-lot fattened steers. Additional income of $17,692 was obtained from the sale of corn grain. This is the only production period where grain is being sold. Increasing amounts of hay are being sold during the three production periods. The growth of the firm is mainly due to the increase in the steer enterprise. The number of steers increased from 108 to 800 head from Period I to Period II and to 1,594 head in Period III. Cropland during the last two periods is used mostly to produce corn silage for the increasing amounts of steers being fattened on dry-lot. Much land suitable only for pasture is left unused.

Table 6. Annual Enterprise Combinations, Hired Labor, and Returns Associated with the Growth of Livestock Farms in Southwest Virginia[1/]

Item	Unit	Five-year periods I	II	III
Livestock				
Beef cows	Head	60.[2/]	24.	55.
Steers	Head	108.	800.	1594.
Crops produced				
Continuous corn for silage	Acre	23.27	70.74	142.50
Corn grain, small grains, hay rotation	Acre	128.73	-	34.16
Corn silage, small grain, hay rotation	Acre	-	125.65	222.06
Burley tobacco	Acre	3.0	3.0	3.0
Pasture	Acre	166.85	58.85	93.01
Crops sold				
Hay sold	Ton	132.60	158.75	413.78
Grain sold	Bu.	3892.79	-	-
Labor				
Resident operator	Hour	2720.	2720.	2720.
Seasonal hired	Hour	2199.	5924.	13196.
Gross returns per year	$1000	58.9	234.7	463.1

1/ When maximizing net returns discounted twelve percent for fifteen years.

2/ The present number of beef cows (60) are being maintained through Period I.

The Effect of Selected Variables on Investment, Finance Policies, Enterprise Combinations and Firm Growth

Results reported in this section indicates the effects of changes in factors assumed in the basic solution.

Different Maximizing Criteria

A change in the maximizing criteria such as varying the discount rate used or changing from maximizing net returns to maximizing net worth had a great effect, especially during the III period, on investment, finance policies, enterprise combination and growth of the firm over the 15-year period.

Changes in the maximizing criteria had little or no effect during the first production period on investments, finance policies, or enterprise combinations (Table 4 and Appendix Tables F).

Returns The growth of the firm expressed in terms of undiscounted net returns or in terms of net worth at the end of the planning period is not different when maximizing undiscounted net returns or when using a six percent discount rate. Net returns are $8,285 greater than when a twelve percent discount rate is used and net worth is increased $8.575 with a lower discount rate (Table 4 and Table 3 Appendix F). This difference between the three maximizing criteria is not great taking into consideration that growth over a 15-year period is under study. An increase in the discount rate to 20 percent has a significant influence in the growth of the firm expressed in terms of undiscounted

net returns or in terms of final net worth (Table 4 and Table 5 , Appendix F). A twenty percent discount rate reduces undiscounted net returns $203,846 and net worth $233,353 as compared with a twelve percent discount rate. When the criteria is to maximize net worth, growth expressed in terms of undiscounted net returns is reduced $212,846 as compared to the basic solution (Table 4 and Table 7 , Appendix F).

Net worth is increased to $627,539 or $202,455 more than in the basic solution.

Added investments When the maximizing criteria was net returns discounted at twelve percent there was little effect on added investments. However, as shown, changes in added investment occurs when a 20 percent discount rate is used or when net worth is being maximized:

	Maximizing Criteria				
	Discounted Net Returns				Net
	0%	6%	12%	20%	Worth
			($1000)		
Land	144.36	144.36	144.36	5.85	142.76
Farm machinery	38.90	38.90	39.73	23.16	27.29
Buildings and livestock equipment	154.63	154.63	147.10	76.09	80.17
Livestock	39.29	39.29	33.18	27.18	94.98
Total added investments	377.18	377.18	364.37	132.28	345.21

An increase in the discount rate reduces added investment. The greatest reductions are on land investments and on buildings and livestock equipment. When net worth is being maximized total added investments are reduced but the greatest change is on the composition of added investments. A reduction in buildings and livestock equipment

and an increase in livestock investments are the main differences from the basic solution (12% discount).

The greatest changes in added investments when different maximizing criteria are used occurs during period III. The nature of these changes are:

	Maximizing Criteria				
	Discounted Net Returns				Net
	0%	6%	12%	20%	Worth
			($1000)		
Land	137.63	137.63	137.63	-	129.10
Farm machinery	16.00	16.00	16.83	0.21	4.67
Buildings and livestock equipment	87.77	87.77	80.24	9.08	14.20
Livestock	19.28	19.28	13.17	6.50	80.73
Total added investments	260.68	260.68	247.87	15.79	288.71

An increase in the discount rate reduces added investments and this reduction is considerable with a twenty percent discount rate. The increase in the discount rate reduces land purchases to zero. Investments in farm machinery, buildings, livestock equipment and livestock are reduced considerably also. When the criteria is to maximize net worth the same percentage of added investments is invested on land but 35 percent of added investments is invested on livestock as compared to five percent when the criteria is to maximize net returns discounted twelve percent.

Finance of investments A change in the maximizing criteria has no effect on finance policies during Period I. When the criteria used is to maximize undiscounted net returns as compared to basic solutions, more capital is reinvested from Period II to Period III and less is borrowed with a five-year loan during this period (Table 1 , Appendix F).

An increase in the discount rate from 12 percent to 20 percent reduces the amount of capital reinvested from Period II in Period III from $201,469 to $14,208 (Table 5, Appendix F). The amount borrowed with a 5-year loan is reduced from $46,397 to $1,578. When maximizing net worth at the end of the planning period, as compared to basic solution, reinvestment capital used in Period III is increased $12,434 and the amount of capital borrowed and amortized during the period of five years is increased from $46,397 to $191,509 (Table 7, Appendix F).

Enterprise organization Changes in the maximizing criteria does not affect considerably the enterprise organization during Period I and Period II (Tables in Appendix F). During Period III an increase in the discount rate and changing from maximizing net returns to maximizing net worth had great effects on enterprise organizations as shown below:

		Maximizing Criteria				
		Discounted Net Returns				Net
	Unit	0%	6%	12%	20%	Worth
				($1000)		
Beef cow	Head	81	81	55	27	339
Steer	Head	1792	1792	1594	791	320
Hay sold	Ton	-	-	413.8	204.7	267.0
Grain sold	Bu.	-	-	-	-	7849.5

An increase in the discount rate decreases the number of livestock produced and the amount of hay sold. Maximizing net worth increases the beef cow enterprise and reduces considerably the number of dry-lot steers fattened.

Not Permitting Additional Land Purchases

Returns When additional land purchases are not permitted undiscounted net returns are reduced $211,994 or 26 percent (Table 4 and Table 7). Discounted net returns are reduced $19,361 or 9 percent. Growth expressed in terms of net worth at the end of the planning period was reduced in a similar amount as the reduction when family consumption was increased because no land was bought during the three production periods when an increase in family consumption occurred. Net worth, when no additional land is being purchased, decreased from $416,509 to $173,732 or 58 percent less than the net worth resulting from the basic solution.

Added investments When no additional land is allowed to be purchased the total amount of added investment and its composition is the same for Period I because no land was bought during this period when no restriction on land purchases existed. During Period II change in added investments are due only to the reduction in land investments. During Period III as compared to basic solution, total added investment is reduced from $247,867 to $14,430. The composition of the added investments changed from 55.54 percent invested in land during this period in the basic solution to zero. A 42.67 percent of added investment was used in livestock as compared to 5.3 percent when land purchases were not restricted. Investments in farm machinery decreased to 1.75 percent of the total added investment of Period III. Investments on buildings and livestock equipment were increased from 33.27 percent to 55.57 percent of total added investment.

Table 7. Firm Growth when Maximizing Net Returns Discounted Twelve Percent during Fifteen Years and when Land Purchases are not Permitted, Large-size Livestock Farms, Southwest Virginia 1/

Item	Unit	Five-year periods I	II	III	Total 2/
Returns					
Five-year gross returns	$1000	294.85	1133.33	1108.08	2536.26
Undiscounted net	$1000	26.65	245.17	246.20	612.85 6/
Discounted net	$1000				204.42
Net worth at the end of the period	$1000	176.23 7/	183.86	182.45	182.45
Land					
Purchased	Acre	-	-	-	
Rented	Acre	-	92.0	92.0	
Total available 3/	Acre	410.0	502.0	502.0	
Total used	Acre	346.8	263.8	264.0	
Added investment					
Land	$1000	-	-	-	-
Farm machinery	$1000	-	22.44	0.2	22.64
Buildings and livestock equipment	$1000	13.15	51.30	8.0	72.45
Livestock 4/	$1000	14.25	5.47	6.2	25.92
Total	$1000	27.40	79.21	14.43	121.04
Operating capital (annual)	$1000	16.45	76.57	81.03	
Finance for investment					
15-year loan	$1000	17.48 5/	-	-	
10-year loan	$1000	16.46	-	-	
5-year loan	$1000	10.94	-	0.8	
Reinvest income	$1000	-	79.22	136.54	

1/ Land acquired, capital use and credit policies are simultaneously determined with maximum returns.

2/ Total for the three five-year periods or amount at the end of 15 years.

3/ Available through purchases or renting.

4/ Sixty beef cows presently on farm are fixed for Period I.

5/ Initial debt on land at beginning of planning period is $17,480.

6/ The difference in the total amount is increase in net worth at the end of the planning period.

7/ Net worth at the beginning of the planning period is $87,618.

Finance of investments Although the same amount of added investment is used during Period I the way investments are financed differs from the basic solution. In the basic solution only a 10-year loan is used. In the present case 60 percent is financed with a 10-year loan and 40 percent with a 5-year loan. As in the basic solution no investment capital is borrowed during Period II and added investments are financed with capital transferred from the previous period. During Period III only $775 is borrowed with a 5-year loan and the added investments are financed mostly by reinvesting capital transferred from the previous period.

Enterprise organization Farm organization during Period I and II was not affected by not permitting land purchases because no land was purchased during Period I in the basic solution and only 22.7 acres were purchased during Period II (Table 8). During Period III, the number of beef cows were reduced more than 50 percent and steer numbers 53 percent. The production of corn for grain, silage and alfalfa were all reduced more than 50 percent. All land possible to be rented is rented during this period and all cropland is being used. Although additional land was not permitted to be purchased, it was more profitable to use only 43 acres of pasture land and leave idle 238 acres. The organization resulting at the end of the planning period because of the effect of no land purchases is similar to an increase in the discount rate from the 12 percent of the basic solution to 20 percent because no land was purchased during the three planning periods when this discount rate was used.

Table 8. Annual Enterprise Combinations, Hired Labor and Returns Associated with Growth when Maximizing Net Returns Discounted Twelve Percent and Additional Land Purchases are not Permitted, Large-size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods		
		I	II	III
Livestock				
Beef cows	Head	60. 1/	23.	25.
Steers	Head	108.	779.	749.
Crops produced				
Continuous corn for silage	Acre	23.3	67.3	67.3
Corn grain, small grains hay rotation	Acre	128.7	-	15.9
Corn silage, small grains, hay rotation	Acre	-	119.5	103.5
Alfalfa hay	Acre	25.0	30.7	30.7
Pasture	Acre	166.8	43.3	43.5
Burley tobacco	Acre	3.0	3.0	3.0
Hay sold	Ton	132.6	151.0	-
Grain sold	Bu.	3892.79	-	-
Labor				
Resident operator	Hour	2720.	2720.	2720.
Seasonal hired	Hour	2200.	5534.	5395.
Gross returns per year	$1000	58.9	226.67	221.62

1/ The present number of beef cows (60) are being maintained through Period I.

Increase in Family Consumption

Returns An increase in capital withdrawals for family consumption has a considerable effect on firm growth. When family consumption is increased from $20,000 per period to $65,000 discounted net returns are reduced 30 percent. Growth expressed in terms of net worth at the end of the planning period is reduced 57 percent when consumption is increased as compared with the basic solution (Table 4 and Table 10). No optimal solution exists for family withdrawals over $68,331.

Added investments An increase in family consumption does not affect the added investments composition during Period I (Table 4, Table 10). During Period II added investment in farm machinery increased from 26 percent to 79 percent when family consumption is increased. Buildings, livestock equipment and other capital investments are reduced to 21 percent. No investment capital is used on land or livestock. During Period III an increase in family consumption reduced total added investment from $247,867 to $30,140. The greatest reduction occurred in land investments that were reduced from $137,632 to no added investment on land. Added investment on buildings, livestock equipment and other capital investments were reduced from $80,240 to $28,580. No added investment capital is used for livestock during this period. Of the total added investment 95 percent is used in buildings and livestock equipment.

Finance of investments Added investments in Period I are financed in the same way as in the basic solution. Income from Period I transferred

Table 9. Firm Growth when Maximizing Net Returns Discounted Twelve Percent during Fifteen Years and when Family Consumption is Increased to $65,000 per Period, Large-size Livestock Farms Southwest Virginia 1/

Item	Unit	Five-year periods I	II	III	Total 2/
Returns					
Gross returns	$1000	294.85	480.11	781.64	1556.60
Undiscounted net	$1000	88.22	88.22	175.14	448.71 3/
Discounted net	$1000				161.28
Net worth at the end of the period	$1000	116.14 4/	166.38	184.75	184.75
Land					
Purchased	Acre	-	-	-	-
Rented	Acre	-	-	-	-
Total available	Acre	410.0	410.0	410.0	
Total used	Acre	346.85	180.0	180.0	

1/ Land acquired, capital use, and credit policies are simultaneously determined with maximum returns.

2/ Total for the three five-year periods or amount at end of 15 years.

3/ The difference in the total amount is increase in net worth at the end of the planning period.

4/ Net worth at the beginning of the planning period is $87,618.

Table 10. Added Investments and Finance for Investments when Maximizing Net Returns Discounted Twelve Percent during Fifteen years and when Family Consumption is Increased to $65,000 per Period, Large-Size Livestock Farms, Southwest Virginia 1/

Item	Unit	Five-year periods I	II	III	Total 2/
Added investment					
Land	$1000	-	-	-	-
Farm machinery	$1000	-	19.21	1.56	20.77
Buildings and livestock equipment	$1000	13.15	9.16	25.58	50.89
Livestock 3/	$1000	14.25	-		14.25
Total	$1000	27.40	28.37	30.14	85.91
Operating capital (annual)	$1000	16.45	30.74	56.27	
Finance for investment					
15-year loan	$1000	17.48 4/			
10-year loan	$1000	27.40	3.77	9.64	
5-year loan	$1000	-			
Reinvest income	$1000	-	24.60	20.50	

1/ Land acquired, capital use, and credit policies are simultaneously determined with maximum returns

2/ Total for the three five-year periods or amount at end of 15 years.

3/ Sixty beef cows presently on farm are fixed for Period I.

4/ Initial debt on land at the beginning of the planning period is $17,480.

to Period II to be reinvested was reduced by $24,600 as compared to $89,102 in the basic solution. During Period II $3,770 is borrowed with a 10-year loan. Income transferred from Period II to be reinvested during Period III was reduced from $201,500 to $20,500 or ten times due to capital withdrawals for family consumption during the previous periods that reduced capital accumulation.

Enterprise organization Changes in farm organization occurred during the last two production periods with an increase in family consumption (Table 11). Compared with the basic solution (Table 4), where corn grain was used as an important source of income only during the first production period, when family consumption is increased large amounts of corn grain are sold during Period II and Period III. A great reduction in the number of livestock produced occurs also during Period II and Period III and all pasture land is left unused. Cropland is used mostly for corn grain production.

Increased Initial Debt Position

Returns The increase in the initial debt position was the variable that most affected firm growth (Table 4 and Table 12). When initial debt was increased from $17,480 to $32,838 1/ gross returns were reduced

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1/ The maximum amount of initial debt that would give a feasible solution was $32,838.

Table 11. Annual Enterprise Combinations, Hired Labor, and Returns Associated with Growth when Maximizing Discounted Net Returns and Increasing Family Consumption to $65,000 per Period, Large-size Livestock Farms, Southwest Virginia.

Item	Unit	Five-year periods		
		I	II	III
Livestock				
Beef cows	Head	60.1/	-	-
Steers	Head	108.	296.	521.
Crops produced				
Continuous corn for silage	Acre	23.3	36.6	55.0
Corn grain, small grains, hay rotation	Acre	128.7	115.4	48.21
Alfalfa hay	Acre	25.0	25.0	25.0
Pasture	Acre	166.8	-	-
Burley tobacco	Acre	3.0	3.0	3.0
Hay sold	Ton	132.6	130.8	157.68
Grain sold	Bu.	3892.8	3876.0	1940.
Labor				
Resident operator	Hour	2720.	2720.	2720.
Seasonal hired	Hour	2200.	1782.	3177.
Gross returns per year	$1000	58.9	96.0	156.3

1/ The present number of beef cows (60) are being maintained through Period I.

Table 12. Firm Growth when Maximizing Net Returns Discounted Twelve Percent during Fifteen Years and when Initial Debt is Increased to $32,838, Large-size Livestock Farms, Southwest Virginia 1/

Item	Unit	Five-year periods I	II	III	Total 2/
Returns					
Gross returns	$1000	71.01	201.29	591.35	863.65
Undiscounted net	$1000	22.21	22.21	133.50	287.14 3/
Discounted net	$1000				77.49
Net worth at the end of the period	$1000	112.03 4/	170.35	196.84	196.84
Land					
Purchased	Acre	-	-	-	
Rented	Acre	-	-	-	
Total available 5/	Acre	410.0	410.0	410.0	
Total used	Acre	173.8	180.0	180.0	
Added investment					
Land	$1000	-	-	-	-
Farm machinery	$1000	-	18.11	1.92	20.03
Buildings and livestock equipment	$1000	0.90	3.76	25.59	31.25
Livestock 6/	$1000	14.25	-	-	14.25
Total	$1000	15.15	21.87	28.51	65.53
Operating capital (annual)	$1000	1.83	11.29	41.47	
Finance for investment					
15-year loan	$1000	17.48 7/	7.62	10.64	
10-year loan	$1000	30.51 7/	-	-	
5-year loan	$1000	-	-	-	
Reinvest income	$1000	-	14.25	17.87	

1/ Land acquired, capital use and credit policies are simultaneously determined with maximum returns.

2/ Total for the three five-year period or amount at the end of 15 years.

3/ The difference in the total amount is increase in net worth at the end of the planning period.

4/ Net worth at the beginning of the planning period is $72,260.

5/ Available through purchases or renting.

6/ Sixty beef cows presently on farm are fixed for Period I.

7/ Initial debt on land at beginning of planning period is $32,838.

$2,920,460 or 77 percent and discounted net returns were reduced $146,291 or 65 percent. Firm growth expressed in terms of net worth at the end of the planning period was reduced 50 percent with an increase in the initial debt position.

Added investments An increase in the initial debt position affected added investments in amount and in composition in the three production periods (Table 4 and Table 12).

During Period I capital used for added investment is reduced from $27,403 to $15,150 and 94 percent is used for livestock investment for the required minimum amount of 60 beef cows during Period I.

During Period II total added investment is reduced from $89,102 to $21,878. No added investment is used in livestock and 83 percent is used for investment in farm machinery. Investments on buildings and livestock equipment are reduced from 60 percent to 17 percent.

During Period III total added investment is reduced from $247,867 to $28,510 when initial debt is increased. Of the total added investment 93 percent is used in buildings and livestock equipment. No investment on land is made during the three production periods and this accounts for the greatest difference in total added investments.

Finance of investments Added investments are financed with a 10-year loan during Period I. During Period II one third of added investments are financed with a 10-year loan and the rest with capital reinvested from the previous period. In the basic solution no capital was borrowed during this period. During Period III

investments are financed with a 10-year loan and capital reinvested from the previous period.

Enterprise organization Enterprise organization during the three production periods differs substantially from the basic solution (Table 13). During Period I no steers are produced and only the amount of beef cows required to be maintained during this period are produced. Land is used only for a corn grain rotation and 135 acres of cropland are left idle. Only 832 bushels of corn grain are sold in this period.

During Period II, no beef cows are produced and steers are reduced from 800 heads to 121 heads. Cropland is used for corn for grain and 4,958 bushels of corn are being sold. No corn grain was sold during this period in the basic solution.

During Period III the farm organization resulting from an increase in the initial debt position is similar to the one resulting from an increase in family consumption. No beef cows are produced and steer numbers are reduced to 302 heads. All pasture land is left unused. Cropland is used mostly for corn grain production and 4,302 bushels of corn grain are being sold. No corn grain was sold in the basic solution during this period.

Table 13. Annual Enterprise Combinations, Hired Labor and Returns Associated with Growth when Maximizing Discounted Net Returns and when Initial Debt is Increased to $32,838, Large-Size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods		
		I	II	III
Livestock				
Beef cows	Head	60 1/	-	-
Steer	Head	-	121	374
Crops produced				
Continuous corn for silage	Acre	-	1.6	45.3
Corn grain, small grain, grain rotation	Acre	41.7	147.6	106.7
Corn silage, small grain, hay rotation	Acre	-	-	-
Alfalfa hay	Acre		27.8	25.0
Pasture	Acre	129.1	-	-
Burley tobacco	Acre	3.0	3.0	3.0
Hay sold	Ton	1.7	155.4	132.8
Grain sold	Bu.	831.8	4958.7	4302.6
Labor				
Resident operator	Hour	2720	2720	2720
Seasonal hired	Hour	186.7	977.7	2252
Gross returns per year	$1000			

1/ The present number of beef cows (60) are being maintained through Period I.

Summary of the Effects of Specified Restrictions on Firm Growth

An increase in capital withdrawals for family consumption or in the initial debt position and restricting expansion in size by not permitting additional land purchases had great effects on firm growth. The increase in initial debt was the variable that restricted most the growth of the firm over the 15-year period expressed in terms of discounted net returns (Figure 1). Increased capital withdrawals reduced net returns more than not permitting additional land purchases. Growth expressed in terms of net worth at the end of the 15-year period was almost equally restricted by the three variables used (Figure 2). Net worth was reduced more than fifty percent when any of the three variables were used.

Added investments in land, buildings, and in livestock equipment for the fifteen year period by the different restrictions used were as follows:

			Restriction		
Added Investment (15-year total)	Unit	Basic Solution	Family consumption increased	No land purchased	Initial debt increased
Land	$1000	144.36	-	-	-
Farm machinery	$1000	39.73	20.77	22.64	20.03
Buildings and livestock equipment	$1000	147.10	50.89	72.45	31.25
Livestock	$1000	33.18	14.25	25.92	14.25
Total	$1000	364.37	85.91	121.04	65.53

Investments in the basic solution were financed during Period II and III in its major part with transferred capital from the previous period. A five-year loan was used during Period III also. When family consumption is increased, income transferred to be reinvested in subsequent

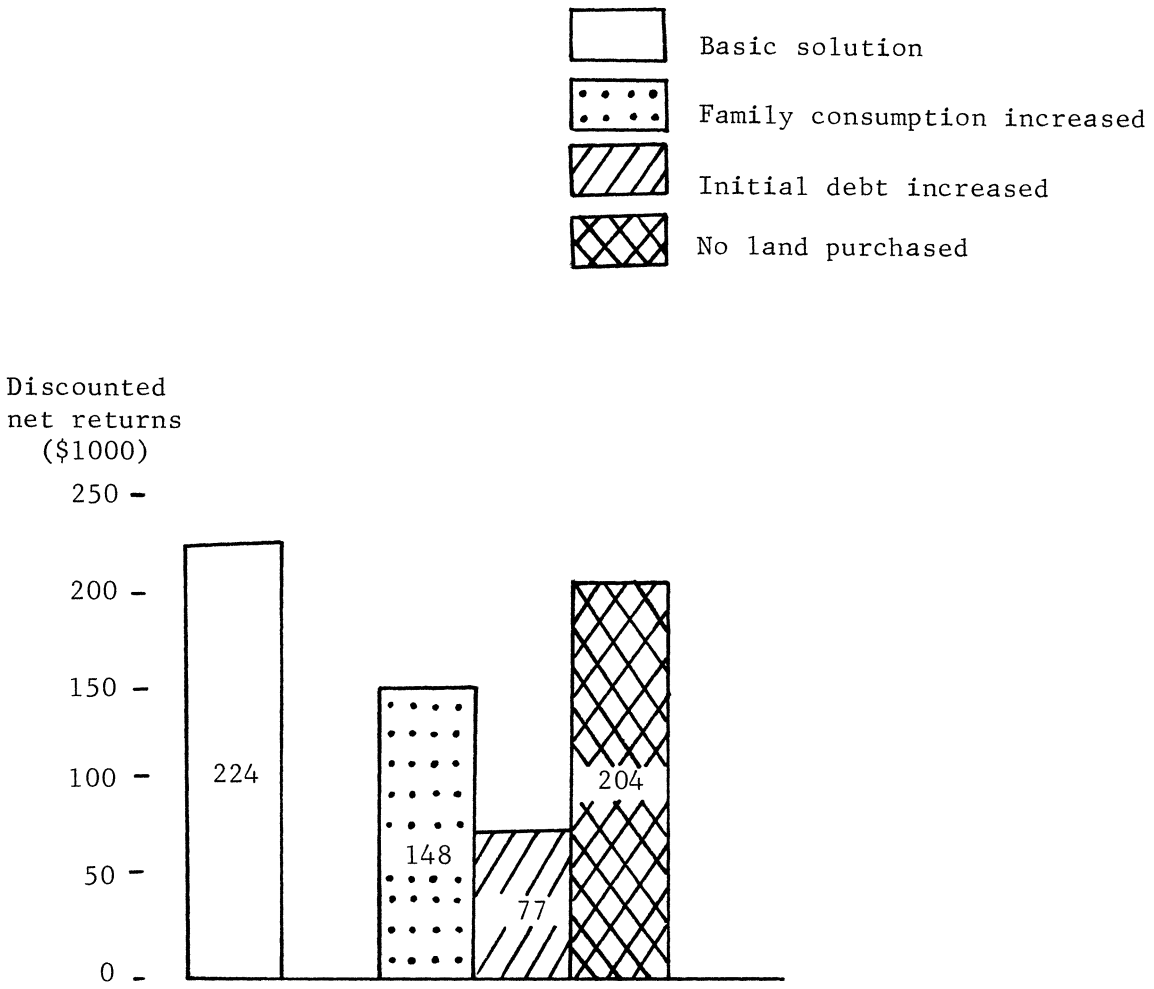

Figure 1. Effect of Specified Restrictions on Growth of the Firm Expressed in Terms of Discounted Net Returns.

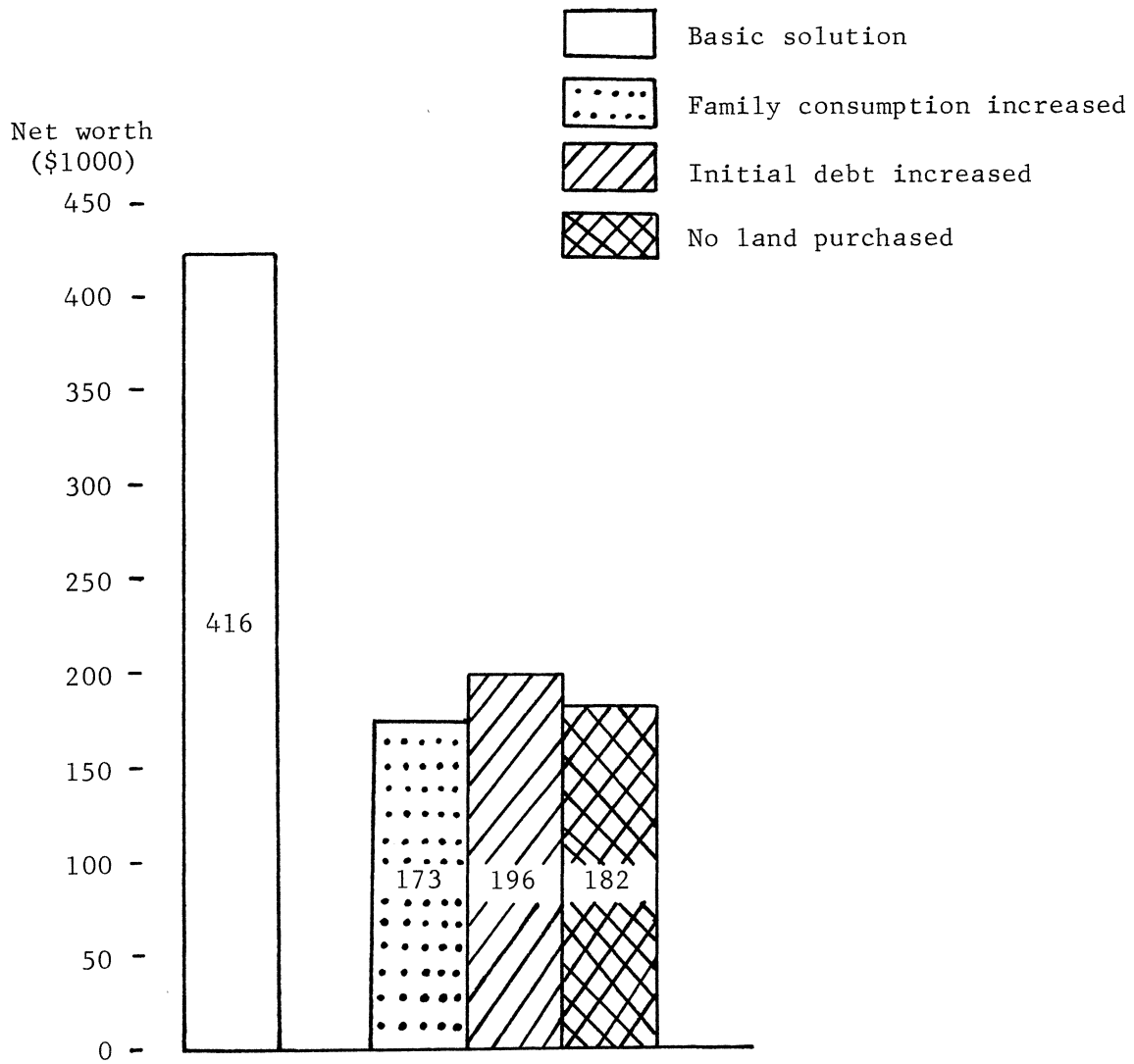

Figure 2. Effect of Specified Restrictions on Growth of the Firm Expressed in Terms of Net Worth at the End of the Planning Period.

periods are greatly reduced and investments are financed also with loans of 10-years length. When land purchases are not permitted income transferred is not greatly reduced and investments are financed with this source of capital. When initial debt is increased transferred capital to be reinvested is reduced considerably and 15-year loans are used for finance added investments.

Farm organization at the end of fifteen years in the basic solution was affected by the specified restrictions introduced in the problem. Beef cows were reduced 50 percent when land purchases are not permitted and do not enter the optimum farm organization when the other restrictions are used.

			Restriction		
Enterprise	Unit	Basic Solution	Family consumption increased	No land purchased	Initial debt increased
Beef cows	Head	55	-	25	-
Steer	Head	1594	521	749	374
Hay sold	Ton	413.8	157.7	-	132.8
Grain sold	Bu.	-	1940.0	-	4302.6

Steer numbers are reduced considerably by the three different restrictions. When capital accumulation is reduced either by increases in capital withdrawals for family consumption or by increasing the initial debt additional income is obtained by selling corn grain.

IMPLICATIONS OF THE STUDY

Capital and credit management are critical factors in planning adjustments in farming. This study deals with the effect on firm growth of alternative production-investment decisions related to large livestock farms located in Southwest Virginia.

The overall objective of this study was to determine the association of farm growth over time with alternative capital investment schedules, credit policies, and enterprise combinations under various resource and capital restraints.

The present study indicates the possibilities of considerable growth: 78 percent annually expressed in terms of present value of net returns discounted at 12 percent, or 23 percent annually if growth is expressed in terms of net worth over the 15-year period, for livestock farmers who already own large farms (over 400 acres of open land) with small debt ($17,480). A considerable amount of this growth is related to the assumption of continued increases in land values. Even farmers with this favorable resource situation will experience much less growth under conditions of high costs for added investments or if farmers require high returns on investments such as 20 percent. Growth also will be retarded as income for family consumption is increased.

In early years much of the added investment will require borrowed capital. Since very few farmers in Southwest Virginia now have farms with 400 acres of open land, they likely would require liabilities much exceeding $17,480 to attain the initial size used in this study.

Farmers with an initial debt exceeding $33,000 would not be able to meet debt payments and have $4000 annually for family consumption. This factor will have wide implications for the possibilities of livestock farming in Southwest Virginia.

Many of the results previously reported by other authors can be substantiated by the results of this analysis.

As in the study by Oliver increases in the amount of investment capital are associated with increases in the number of steers produced and this enterprise is a better alternative than beef cows for the expansion of the firm. It is interesting to note the similarities of results because Oliver's study covers only a single production period. The present study gives additional information on timing of investments, credit policies and resource use over time for changing from the original beef cow enterprise organization to a specialized dry-lot steer organization and the factors affecting its growth. As in Givan's study increasing family incomes were obtained through increasing amounts of investments and size of the farm. The effect of capital accumulation in the change of livestock organization was previously reported by Loefstgard and Heady. Results of this study differs with Martin's study in that under the assumptions of the present study, different farm organizations resulted when the maximizing criteria was to maximize the present value of net returns than when the criteria was to maximize net worth at the end of the planning period. The fact that cash crops have a greater importance in the earlier periods of the planning horizon was also

reported by Bowman. As in Swanson's study a pattern of increase in cash crops and a decrease in livestock numbers was found when initial capital was decreased. Great reductions in net returns when a 20 percent discount rate was used were also reported by Bowman.

Implications for Further Research

The model used in this analysis showed the importance of simultaneously determining investment policies with optimum farm organization. Finance of investments were handled in a very simplified way and further research emphasizing the different finance alternatives for different equipment and other types of investments should be made. Borrowing capacity was related to initial net worth of the firm. Other sources of security such as value of assets or bonds and other external sources of funds should be analyzed. A minimum annual consumption of $4,000 was specified in the problem for every year of the planning horizon. Givan's study showed that incomes of $7,000 were not possible to be achieved by representative farms in the area when labor price was assumed to be $3.00 an hour. The starting capital position of the farm in the present study was a relatively favorable one. Further studies may be useful in order to analyze the problems of expansion, faced by farmers with higher debt position and with minimum consumption levels above $4,000 per year under different prices for resources and products than those assumed in the present study. In addition to the use of a higher minimum consumption requirement a marginal propensity to consume

over the minimum amount may be specified and this may affect growth in a more restrictive and realistic way than a fixed amount for all periods.

Price trends as well as trends in technical coefficients were incorporated into the model in a simplified manner. The incorporation of risk and uncertainty in the model as done by Johnson by using a distribution of crop yield to demonstrate the effects of random variations on firm growth or the use of recursive programming to incorporate the coefficients resulting from previous periods may reflect in a more realistic way decisions made by farmers. Competition for resources such as land and labor from farms trying simultaneously to expand should be analyzed and also the problems of the exit of firms that cannot achieve growth efficiently.

SUMMARY

A polyperiod model was developed for investigating the effect of production-investment decisions on firm growth. A planning horizon of fifteen years of length divided into three production periods of five years each was used. The expected prices and yields for future years were calculated according to past trends. Initial resources were those of a large-size livestock farm (410 acres of open land) located in Southwest Virginia. The model maximizes the present value of a stream of net returns. A twelve percent discount rate was used to obtain a basic solution. Effects of changes in the maximizing criteria, such as varying the discount rates or maximizing net worth at the end of the planning period, in the growth of the firm were analyzed. Growth was measured in terms of net returns and net worth at the end of the planning period. Family consumption affected capital accumulation by the withdrawal of fixed amounts of capital per period from net returns generated during the period; net returns generated during a production period were possible to be reinvested if profitable in subsequent periods. The effect of different initial capital position in terms of different amounts of initial debt was analyzed.

The study showed that different maximizing criteria results in different growth. The effect on firm growth was associated with changes in enterprise organization, amount and composition of investments and finance policies. This study showed that a high

discount rate and a high initial debt were the variables that most affected firm growth over the 15-year period. This stresses the importance of the internal and external capital rationing on the future expansion of the firm.

Increases in capital withdrawals for purposes of family consumption reduces growth of the firm considerably by reducing the amount of capital generated during a production period available to be reinvested in subsequent periods.

Growth was associated with great increase in the size of the firm through land purchases. When land purchases were restricted, growth was reduced considerably.

The dry-lot steer enterprise was a more profitable enterprise and had a greater potential for expansion of the firm than the beef cow enterprise. This conclusion is in agreement with results of previous static analysis done in the area.

Of the total amount of investment capital used for expansion the major proportion was financed with funds generated within the firm. In the first period investments were mainly in livestock and livestock equipment and in the second period investments were mainly for replacing depreciated machinery and buildings. The greatest amount of investments were done during the last five years of the fifteen year planning horizon. This stresses the importance of time in the capital accumulation process for growth of the firm.

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APPENDIX A

Enterprise Budgets

Appendix A, Table 1. Estimated Costs, Returns, and Input Requirements Per Acre of Burley Tobacco, Large-Size Livestock Farms, Southwest Virginia

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Receipts:										
Tobacco	Lb.	0.69	0.72	0.76	3,000	3,100	3,200	2070.00	2232.00	2432.00
Variable costs:										
Plants								18.10	19.00	19.91
Rye (cover crop)	Bu.	3.00	3.00	3.00	1.00	1.00	1.00	3.00	3.00	3.00
Fertilizer:										
Nitrogen	Lb.	0.117	0.117	0.117	200.00	200.00	200.00	23.40	23.40	23.40
P_2O_5	Lb.	0.062	0.062	0.062	225.00	225.00	225.00	13.95	13.95	13.95
K_2O	Lb.	0.049	0.049	0.049	250.00	300.00	350.00	12.25	14.70	17.15
T.D.E. (25% E.C.)	Pint	0.25	0.26	0.27	4.00	4.00	4.00	1.00	1.04	1.08
Transplanting	Acre	20.00	25.00	30.00	1.00	1.00	1.00	20.00	25.00	30.00
Hauling to market	Cwt.	0.50	0.62	0.77	30.00	31.00	32.00	15.00	19.22	24.64
Marketing (3½% of selling price plus 25¢ per basket)								73.95	79.67	86.72
Insurance	Cwt.	6.50	7.80	9.10	4.00	4.00	4.00	26.00	31.20	36.40
Tractor operating	Hr.	0.82	0.82	0.82	14.00	14.00	14.00	11.48	11.48	11.48
Equipment operating								3.15	3.15	3.15
Subtotal								221.28	244.81	270.88
Interest on production capital								6.64	7.34	8.13
Total variable costs								227.92	252.15	279.01
Net returns above variable costs								1842.08	1979.85	2152.99

Appendix A, Table 2. Equipment Used for One Acre of Burley Tobacco Expressed in Tractor Equivalent Hours, Large-Size Livestock Farms, Southwest Virginia

Equipment	Factor	Hours[a/]	Equivalent hours
Two 14" bottom plows	0.4247	2.20	0.93
Tandem disk 7'	0.7685	2.50	1.92
Two section harrows 8'	0.1853	0.30	0.06
Tractor cultivator	0.4883	2.50	1.22
Fertilizer spreader	1.1302	0.40	0.45
Grain drill	2.8434	0.60	1.71
Wagon	0.1941	5.50	1.07
Tractor	1.0000	14.00	14.00

a/ The same number of hours was used for the three production periods in burley tobacco.

Appendix A, Table 3. Labor Requirements for One Acre of Burley Tobacco, Large-Size Livestock Farms, Southwest Virginia

Month	Hour
December-May	33.2
June-November	367.8
Total	401.0

Appendix A, Table 4. Estimated Costs, Returns, and Input Requirements for One Acre of Continuous Corn for Silage, Large-Size Livestock Farms, Southwest Virginia

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Receipts:										
Corn silage	Ton				18.00[a/]	20.70[b/]	22.50[c/]			
Variable costs:										
Seed corn	Lb.	0.176	0.176	0.176	18.00	20.00	22.00	3.17	3.52	3.87
Fertilizer:										
Nitrogen	Lb.	0.117	0.117	0.117	160.00	175.00	190.00	18.72	20.47	22.23
P_2O_5	Lb.	0.062	0.062	0.062	90.00	100.00	100.00	5.58	6.20	6.20
K_2O	Lb.	0.049	0.049	0.049	120.00	150.00	170.00	5.88	7.35	8.33
Atrazine	Lb.	2.50	2.62	2.74	2.00	2.00	2.00	5.00	5.24	5.48
Lime	Ton	5.85	5.85	5.85	0.40	0.40	0.40	2.34	2.34	2.34
Cover for silo	Ton	0.20	0.20	0.20	18.00	20.70	22.50	3.60	4.14	4.50
Tractor operating	Hour	0.82	0.82	0.82	11.50	12.25	12.73	9.43	10.04	10.44
Equipment operating								2.51	2.67	2.71
Subtotal								56.23	61.97	66.10
Interest on production capital	$	0.06/2	0.06/2	0.06/2				1.69	1.86	1.98
Total variable costs								57.92	63.83	68.08

a/ Twenty tons silage produced with 10% loss.
b/ Twenty-three tons silage produced with 10% loss.
c/ Twenty-five tons silage produced with 10% loss.

Appendix A, Table 5. Equipment Used for One Acre of Continuous Corn for Silage Expressed in Tractor Equivalent Hours, Large-Size Livestock Farms, Southwest Virginia

Periods:		I	II	III	I	II	III
Equipment	Factor	Hours			Equivalent hours		
Two 14" bottom plows	0.4247	1.30	1.30	1.30	0.55	0.55	0.55
Tandem disk 7'	0.7685	0.80	0.80	0.80	0.61	0.61	0.61
Two section harrow 8'	0.1853	0.30	0.30	0.30	0.05	0.05	0.05
Tractor corn planter - 2 row	1.6120	0.80	0.80	0.80	1.29	1.29	1.29
Fertilizer spreader	1.1302	0.40	0.40	0.40	0.45	0.45	0.45
Field sprayer - 2 row	0.6469	0.20	0.30	0.30	0.19	0.19	0.19
Wagon 16	0.1941	3.80	4.35	4.90	0.74	0.84	0.95
Field chopper P.T.O.	3.9685	1.80	1.90	2.00	7.14	7.54	7.94
Tractor	1.0000	11.50	12.15	12.80	11.50	12.15	12.80
Total tractor equivalent hours					22.53	23.67	24.83

Appendix A, Table 6. Labor Requirements for One Acre of Continuous Corn for Silage, Large-Size Livestock Farms, Southwest Virginia

Month	Hour
December-May	4.4
June-November	8.7
Total	13.10

Appendix A, Table 7. Corn (Grain), Corn Stover, Oats (Grain), Oats (Straw), and Red Clover-Orchard Grass Hay Produced by a Five-Year Corn (Grain), Oats (Grain), Red Clover-Orchard Grass Rotation, Large-Size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods		
		I	II	III
Corn grain[a/]	Bushel	151.20[c/]	168.0[d/]	201.6[e/]
Corn stover[b/]	Ton	0.74	0.82	0.99
Oats grain[a/]	Bushel	33.88	33.88	33.88
Oat straw[b/]	Ton	0.39	0.39	0.39
Red clover, orchard grass hay[b/]	Ton	4.58	4.58	4.58

a/ No. 2 yellow corn equivalent.
b/ No. 1 alfalfa hay equivalent.
c/ Ninety bushel per acre, two acres with sixteen percent loss.
d/ One-hundred bushel per acre, two acres with sixteen percent loss.
e/ One hundred and twenty bushel per acre, with sixteen percent loss.

Appendix A, Table 8. Estimated Costs and Input Requirements for a Five-Year Corn (Grain), Oats (Grain), Red Clover-Orchard Grass Rotation, Large-Size Livestock Farms, Southwest Virginia[a/]

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Variable costs:										
Seed:										
Corn	Lb.	0.176	0.176	0.176	30.00	40.00	44.00	5.28	7.04	7.74
Oats	Bu.	1.80	1.80	1.80	2.50	2.50	2.50	4.50	4.50	4.50
Orchard grass	Lb.	0.32	0.32	0.32	8.00	8.00	8.00	2.56	2.56	2.56
Red clover	Lb.	0.417	0.417	0.417	5.00	5.00	5.00	2.09	2.09	2.09
Fertilizer:										
Nitrogen	Lb.	0.117	0.117	0.117	330.00	370.00	410.00	38.61	43.29	47.97
P_2O_5	Lb.	0.062	0.062	0.062	260.00	320.00	330.00	16.12	19.84	20.46
K_2O	Lb.	0.049	0.049	0.049	280.00	320.00	340.00	13.72	15.68	16.66
Lime	Ton	5.85	5.85	5.85	2.00	2.00	2.00	11.70	11.70	11.70
Atrazine	Lb.	2.50	2.62	2.74	7.00	7.00	7.00	17.50	18.34	19.18
Inoculant	Acre	0.25	0.26	0.27	1.00	1.00	1.00	0.25	0.26	0.27
Harvesting oats - custom	Acre	4.60	5.75	7.19	1.00	1.00	1.00	4.60	5.75	7.19
Tractor operating	Hr.	0.82	0.82	0.82	25.90	26.50	27.10	21.24	21.73	22.22
Equipment operating	Hr.							18.22	18.66	19.37
Subtotal								156.39	171.44	181.91
Interest on production capital	$	0.06/2	0.06/2	0.06/2				4.69	5.14	5.46
Total variable costs								161.08	176.58	187.37

a/ Two acres of corn for grain, one acre of oats and one of red clover-orchard grass planted each year with one acre of red clover-orchard grass being maintained.

Appendix A, Table 9. Equipment Used for Five Acres of a Five-Year Corn (Grain), Oats (Grain), Red Clover-Orchard Grass Hay Rotation, Large-Size Livestock Farms, Southwest Virginia

Periods:		I	II	III	I	II	III
Equipment	Factor	Hours			Equivalent hours		
Two 14" bottom plows	0.4247	1.30	1.30		0.55	0.55	0.55
Tandem disk 7'	0.7685	1.70	1.70		1.31	1.31	1.31
Two section harrow 8'	0.1853	0.30	0.30		0.05	0.05	0.05
Tractor corn planter - 2 row	1.6120	1.20	1.20		1.93	1.93	1.93
Fertilizer spreader	1.1302	1.60	1.60		1.81	1.81	1.81
Grain drill	2.8434	0.40	0.40		1.14	1.14	1.14
Mower, 7' trailing	1.1904	2.40	2.40		2.86	2.86	2.86
Field sprayer - 2 row	0.6469	0.60	0.60		0.39	0.39	0.39
Wagon 16	0.1941	7.50	7.70		1.46	1.49	1.53
Hay baler P.T.O.	2.8651	2.90	2.90		8.31	8.31	8.31
Hay rake, side delivery	0.8901	3.00	3.00		2.67	2.67	2.67
Corn picker-husker	2.8410	3.00	3.40		8.52	9.66	10.79
Tractor	1.0000	25.90	26.50		25.90	26.50	27.10
Total tractor equivalent hours					56.90	58.67	60.45

Appendix A, Table 10. Labor Requirements for a Five-Year Corn (Grain), Oats (Grain), Red Clover-Orchard Grass Hay, Large-Size Livestock Farms, Southwest Virginia

Month	Hour
December-May	8.9
June-November	28.9
Total	37.80

Appendix A, Table 11. Fertilizer Requirements for a Five-Year Corn (Grain), Oats (Grain), Red Clover-Orchard Grass Hay Rotation, Large-Size Livestock Farms, Southwest Virginia

Crop	Nutrient	Period I	Period II	Period III
Corn:	N	150	170	190
	P_2O_5	60	90	100
	K_2O	60	100	120
Oats:	N	30	30	30
	P_2O_5	30	30	30
	K_2O	30	30	30
Clover:	N	0	0	0
	P_2O_5	55	55	55
	K_2O	65	65	65

Appendix A, Table 12. Corn Silage, Oats (Grain), Oats (Straw), Red Clover-Orchard Grass Hay Produced by a Five-Year Corn (Silage), Oats (Grain), Red Clover-Orchard Grass Rotation, Large-Size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods		
		I	II	III
Corn silage	Ton	32.00[c/]	38.00[d/]	42.00[e/]
Oats grain[a/]	Bushel	33.88	33.88	33.88
Oat straw[b/]	Ton	0.39	0.39	0.39
Red clover, orchard grass hay[b/]	Ton	4.58	4.58	4.58

a/ No. 2 yellow corn equivalent.
b/ No. 1 alfalfa hay equivalent.
c/ Eighteen tons per acre with two tons loss.
d/ Twenty-one tons per acre with two tons loss.
e/ Twenty-three tons per acre with two tons loss.

Appendix A, Table 13. Estimated Costs and Input Requirements for a Five-Year Corn (Silage), Oats (Grain), and Red Clover-Orchard Grass Rotation, Large-Size Livestock Farms, Southwest Virginia[a/]

Period:		I	II	III	I	II	III	I	II	III
Item	Unit	Price	Price	Price	Quantity	Quantity	Quantity	Amount	Amount	Amount
		$	$	$				$	$	$
Variable costs:										
Seed:										
Corn	Lb.	0.176	0.176	0.176	36.00	40.00	44.00	6.34	7.04	7.74
Oats	Bu.	1.80	1.80	1.80	2.50	2.50	2.50	4.50	4.50	4.50
Red clover	Lb.	0.417	0.417	0.417	5.00	5.00	5.00	2.09	2.09	2.09
Orchard grass	Lb.	0.320	0.320	0.320	8.00	8.00	8.00	2.56	2.56	2.56
Fertilizer:										
Nitrogen	Lb.	0.117	0.117	0.117	400.00	430.00	460.00	46.80	50.31	53.82
P_2O_5	Lb.	0.062	0.062	0.062	305.00	345.00	345.00	18.91	21.39	21.39
K_2O	Lb.	0.049	0.049	0.049	405.00	465.00	505.00	19.84	22.78	24.74
Lime	Ton	5.85	5.85	5.85	2.00	2.00	2.00	11.70	11.70	11.70
Atrazine	Lb.	2.50	2.62	2.74	7.00	7.00	7.00	17.50	18.34	19.18
Inoculant	Acre	0.25	0.26	0.27	1.00	1.00	1.00	0.25	0.26	0.27
Harvesting oats - custom	Acre	4.60	5.75	7.19	1.00	1.00	1.00	4.60	5.75	7.19
Cover for silo	Ton	0.20	0.20	0.20	32.00	38.00	42.00	6.40	7.60	8.40
Tractor operating	Hr.	0.82	0.82	0.82	34.90	35.40	35.90	28.62	29.03	29.44
Equipment operating	Hr.							19.08	19.47	19.75
Subtotal								189.19	202.82	212.77
Interest on production capital	$	0.06/2	0.06/2	0.06/2				5.67	6.08	6.38
Total variable costs								194.86	208.90	219.15

a/ Two acres of corn, one acre of oats, one acre of clover planted each year, one acre of clover being maintained.

Appendix A, Table 14. Equipment Used for Five Acres of a Five-Year Corn (Silage), Oats (Grain), Red Clover-Orchard Grass Hay Rotation, Large-Size Livestock Farms, Southwest Virginia

Periods: Equipment	Factor	I	II	III	I	II	III
		Hours			Equivalent hours		
Two 14" bottom plows	0.4247	1.30	1.30	1.30	0.55	0.55	0.55
Tandem disk 7'	0.7685	1.70	1.70	1.70	1.31	1.31	1.31
Two section harrow 8'	0.1853	0.30	0.30	0.30	0.05	0.05	0.05
Tractor corn planter - 2 row	1.6120	1.20	1.20	1.20	1.93	1.93	1.93
Fertilizer spreader	1.1302	1.60	1.60	1.60	1.81	1.81	1.81
Grain drill	2.8434	0.40	0.40	0.40	1.14	1.14	1.14
Mower, 7' trailing	1.1904	2.40	2.40	2.40	2.86	2.86	2.86
Field sprayer - 2 row	0.6469	0.60	0.60	0.60	0.39	0.39	0.39
Wagon 16	0.1941	11.90	12.00	12.10	2.31	2.33	2.35
Hay baler P.T.O.	2.8651	2.90	2.90	2.90	8.31	8.31	8.31
Hay rake, side delivery	0.8901	3.00	3.00	3.00	2.67	2.67	2.67
Field chopper P.T.O.	3.9685	3.60	4.00	4.40	14.29	15.87	17.46
Tractor	1.0000	34.90	35.40	35.90	34.90	35.40	35.90
Total tractor equivalent hours					72.52	74.62	76.73

Appendix A, Table 15. Labor Requirements for a Five-Year Corn (Silage), Oats (Grain), and Red Clover-Orchard Grass Rotation, Large-Size Farms, Southwest Virginia

Month	Hour
December-May	8.9
June-November	36.9
Total	45.80

Appendix A, Table 16. Fertilizer Requirements for a Five-Year Corn (Silage), Oats (Grain), and Red Clover-Orchard Grass Rotation, Large-Size Livestock Farms, Southwest Virginia

Crop	Nutrient	Period		
		I	II	III
Corn:	N	185	200	215
	P_2O_5	80	100	100
	K_2O	120	150	170
Oats:	N	30	30	30
	P_2O_5	35	35	35
	K_2O	35	35	35
Clover:	N	0	0	0
	P_2O_5	55	55	55
	K_2O	65	65	65

Appendix A, Table 17. Estimated Costs, Returns, and Input Requirements for One Acre of Alfalfa, Large-Size Livestock Farms, Southwest Virginia

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Receipts:										
Alfalfa hay	Ton	--	--	--	2.76[a/]	3.17[b/]	3.45[c/]			
Variable costs:										
Seed								7.56	7.56	7.56
Fertilizer:										
Nitrogen	Lb.	0.117	0.117	0.117	--	--	--	--	--	--
P_2O_5	Lb.	0.062	0.062	0.062	60.00	80.00	100.00	3.72	4.96	6.20
K_2O	Lb.	0.049	0.049	0.049	160.00	240.00	300.00	7.84	11.76	14.70
Lime	Ton	5.85	5.85	5.85	0.33	0.33	0.33	1.93	1.93	1.93
Malathion	Gal.	6.80	7.14	7.50	0.25	0.25	0.25	1.70	1.78	1.87
Tractor operating	Hr.	0.82	0.82	0.82	9.64	11.40	13.00	7.90	9.35	9.35
Equipment operating								10.36	12.08	13.78
Subtotal								41.01	49.42	55.39
Interest on production capital	$	0.06/2	0.06/2	0.06/2				1.23	1.48	1.66
Total variable costs								42.24	50.90	57.05

a/ Tons of hay produced was 3.0 with 92% utilized by livestock.
b/ Tons of hay produced was 3.44 with 92% utilized by livestock.
c/ Tons of hay produced was 3.75 with 92% utilized by livestock.

Appendix A, Table 18. Equipment Used for One Acre of Alfalfa Expressed in Tractor Equivalent Hours, Large-Size Livestock Farms, Southwest Virginia

Periods: Equipment	Factor	I	II	III	I	II	III
		Hours			Equivalent hours		
Two 14" bottom plows	0.4247	0.25	0.25	0.25	0.11	0.11	0.11
Tandem disk 7'	0.7685	0.15	0.15	0.15	0.11	0.11	0.11
Two section harrow 8'	0.1853	0.12	0.12	0.12	0.02	0.02	0.02
Fertilizer spreader	1.1302	0.48	0.48	0.48	0.54	0.54	0.54
Grain drill	2.8434	0.12	0.12	0.12	0.34	0.34	0.34
Mower, 7' trailing	1.1904	2.70	3.00	3.40	3.21	3.57	4.05
Field sprayer - 2 row	0.6469	0.60	0.60	0.60	0.39	0.39	0.39
Wagon 16	0.1941	2.00	2.50	3.00	0.39	0.48	0.58
Hay baler	2.8651	1.60	2.00	2.40	4.58	5.73	6.88
Hay rake, side delivery	0.8901	1.60	2.00	2.40	1.42	1.78	2.14
Tractor	1.0000	9.62	11.22	12.92	9.62	11.22	12.92
Total tractor equivalent hours					20.75	24.30	28.08

Appendix A, Table 19. Labor Requirements for One Acre of Alfalfa, Large-Size Livestock Farms, Southwest Virginia

Month	Hour
December-May	1.05
June-November	12.83
Total	13.88

Appendix A, Table 20. Estimated Costs, Returns, and Input Requirements for Maintenance of One Acre of Permanent Pasture (Blue Grass-White Clover), Large-Size Livestock Farms, Southwest Virginia

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Receipts:										
Pasture										
April-June					0.79	0.90	1.01			
July-August					0.20	0.22	0.25			
September-October					0.32	0.38	0.42			
Total					1.31[a/]	1.50[b/]	1.68[c/]			
Variable costs:										
Fertilizer:										
Nitrogen	Lb.	0.117	0.117	0.117	0.00	0.00	0.00	--	--	--
P_2O_5	Lb.	0.062	0.062	0.062	35.00	50.00	75.00	2.17	3.10	4.65
K_2O	Lb.	0.049	0.049	0.049	35.00	50.00	75.00	1.72	2.45	3.67
Lime	Ton	5.85	5.85	5.85	0.33	0.33	0.33	1.93	1.93	1.93
Tractor operating	Hr.	0.82	0.82	0.82	0.80	0.90	1.00	0.66	0.74	0.82
Equipment operating								0.41	0.47	0.52
Subtotal								6.89	8.69	11.59
Interest on production capital	$	0.06/2	0.06/2	0.06/2				0.21	0.26	0.35
Total variable costs								7.10	8.95	11.94

a/ Six tons green pasture with 70% utilized by livestock.
b/ Six and seven-tenths tons green pasture with 70% utilized by livestock.
c/ Seven and five-tenths tons green pasture with 70% utilized by livestock.

Appendix A, Table 21. Equipment Used for One Acre of Permanent Pasture (Blue Grass-White Clover) Expressed in Tractor Equivalent Hours, Large-Size Livestock Farms, Southwest Virginia

Equipment	Factor	Hours[a/]	Equivalent hours
Fertilizer spreader	1.1302	0.40	0.54
Mower, 7' trailing	1.1904	0.40	0.48
Tractor	1.0000	0.80	0.80
Total tractor equivalent hours			1.82

a/ The same number of hours used for the three production periods in permanent pasture.

Appendix A, Table 22. Labor Requirements for Maintenance of One Acre of Permanent Pasture (Blue Grass-White Clover), Large-Size Livestock Farms, Southwest Virginia

Month	Hour
December-May	1.5
June-November	0.5
Total	2.0

Appendix A, Table 23. Beef Cow Herd A,[a/] Estimated Costs and Input Requirements, Large-Size Livestock Farms, Southwest Virginia

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Receipts:										
Cull cows	Lb.	0.15	0.15	0.15	3900.00	3900.00	3900.00	585.0	585.0	585.0
Cull bull	Lb.	0.10	0.10	0.10	500.00	500.00	500.00	50.0	50.0	50.0
Gross receipts								635.0	635.0	635.0
Variable costs:										
Replacement bull	Head	300.0	300.0	300.0	0.33	0.33	0.33	100.0	100.0	100.0
Feed:										
Corn stover or oat straw	Ton				56.36	56.36	56.36			
Pasture hay	Ton				26.14	26.14	26.14			
Salt	Cwt.	2.96	3.11	3.25	5.00	5.00	5.00	14.80	15.55	16.25
Minerals	Cwt.	5.00	5.25	5.50	2.50	2.50	2.50	12.50	13.12	13.75
Veterinary and medicines	Head	2.00	2.10	2.20	21.00	21.00	21.00	42.00	44.10	46.20
Spray materials	Head	0.50	0.52	0.55	21.00	21.00	21.00	10.50	10.92	11.55
Hauling and marketing	Head	2.00	2.00	2.00	18.00	18.00	18.00	36.00	36.00	36.00
Tractor operating	Hour	0.82	0.82	0.82	10.00	10.00	10.00	8.20	8.20	8.20
Equipment operating	Hour	0.09	0.09	0.09	10.00	10.00	10.00	0.90	0.90	0.90
Subtotal	$							224.90	228.79	232.85
Interest on production capital	$	0.06/2	0.06/2	0.06/2				6.75	6.86	6.98
Total variable costs								231.65	235.65	239.85
Manure credit								111.07	111.07	111.07
Net returns								514.42	510.42	506.22

a/ The beef herd is sold at the end of the period.

Appendix A, Table 24. Equipment Used for Beef Cow Herd A, Large-Size Livestock Farms, Southwest Virginia

Equipment	Factor	Hours	Equivalent hours
Manure spreader	1.2621	11.00	14.00
Tractor	1.0000	11.00	11.00
Total tractor equivalent hours			25.00

Appendix A, Table 25. Labor Requirements for Beef Cow Herd A, Large-Size Livestock Farms, Southwest Virginia

Month	Hour
December-May	158.6
June-November	85.4
Total	244.0

Appendix A, Table 26. Manure Credit for Beef Cow Herd A, Large-Size Livestock Farms, Southwest Virginia

Manure credit	N	P	K	Total
Lbs.	529	244	695	
Price ($)	0.117	0.062	0.049	
Value ($)	61.89	15.13	34.05	111.07

Appendix A, Table 27. Beef Cow Herd B,[a/] Estimated Cost and Input Requirements, Large-Size Livestock Farms, Southwest Virginia

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Receipts:										
Cull cows	Lb.	0.15	0.15	0.15	4420.0	8320.0	17160.0	663.0	1248.0	2574.0
Cull bull	Lb.	0.10	0.10	0.10	500.0	500.0	1000.0	50.0	50.0	100.0
Gross receipts								713.0	1298.0	2674.0
Variable costs:										
Replacement bull	Head	300.0	300.0	300.0	0.40	0.83	1.66	120.0	249.0	498.00
Feed:										
Corn stover or oat straw	Ton				79.28	159.54	318.57			
Pasture	Ton				34.46	69.38	138.50			
Salt	Cwt.	2.96	3.11	3.25	6.1	12.47	24.85	18.10	38.80	80.75
Minerals	Cwt.	5.0	5.25	5.50	3.05	6.23	12.42	15.30	32.70	68.30
Veterinary and medicines	Head	2.0	2.10	2.20	26.0	52.88	104.36	52.00	110.00	229.60
Spray materials	Head	0.50	0.52	0.55	26.0	52.88	104.36	13.00	27.50	57.40
Hauling and marketing	Head	2.00	2.00	2.00	22.3	44.80	89.00	44.60	89.60	178.01
Tractor operating	Hr.	0.82	0.82	0.82	12.5	24.40	49.69	10.25	20.01	40.75
Equipment operating	Hr.	0.09	0.09	0.09	12.5	24.40	49.44	1.12	2.19	4.45
Subtotal	$							274.37	569.79	1157.26
Manure credit								135.5	276.56	552.01
Net expenses								138.87	293.23	605.25
Interest on production capital	$	0.06/2	0.06/2	0.06/2				4.17	8.79	18.16
Total variable costs								143.03	302.03	623.41
Net returns								569.97	945.99	2050.59

a/ The beef cow herd is maintained throughout the three periods and it grows with the numbers of heifers produced during the production period.

Appendix A, Table 28. Equipment Used by Beef Herd B, Expressed in Tractor Equivalent Hours, Large-Size Livestock Farms, Southwest Virginia

Equipment	Factor	Hours	Equivalent hours
Manure spreader	1.2621	10.0	12.62
Tractor	1.0000	10.0	10.00
Total tractor equivalent hours			22.62

Appendix A, Table 29. Labor Requirements for Beef Cow Herd B, Large-Size Livestock Farms, Southwest Virginia

Month	Hour
December-May	130.0
June-November	70.0
Total	200.0

Appendix A, Table 30. Manure Credit for Beef Cow Herd B, Large-Size Livestock Farms, Southwest Virginia

Periods:		I	II	III	I	II	III
Nutrients	Price	Quantity			Amount		
	$				$	$	$
N	0.117	645	1345	2629	75.50	151.32	307.59
P	0.062	297	581	1213	18.46	36.00	75.20
K	0.049	848	1699	3554	41.54	83.24	169.23
Total ($)					135.50	276.56	552.01

Appendix A, Table 31. Estimated Costs, Returns, and Input Requirements for a Twenty-Steer Unit Purchased in Fall, Wintered on a Silage-Supplement Ration, Sold in Spring, Large-Size Farms, Southwest Virginia

Period: Item	Unit	I Price	II Price	III Price	I Quantity	II Quantity	III Quantity	I Amount	II Amount	III Amount
		$	$	$				$	$	$
Receipts:										
Steers	Cwt.	24.5	24.5	24.5	221.00	221.00	221.00	5414.5	5414.5	5414.5
Variable costs:										
Feeder calves	Cwt.	22.67	22.67	22.67	140.00	140.00	140.00	3173.80	3173.80	3173.80
Feed:										
Corn silage	Ton				63.20	63.20	63.20			
Soybean oil meal	Cwt.	4.87	4.87	4.87	105.00	105.00	105.00	511.35	511.35	511.35
Salt	Cwt.	2.96	3.11	3.25	1.50	1.50	1.50	4.44	4.44	4.44
Minerals	Cwt.	5.00	5.25	5.50	1.00	1.00	1.00	5.00	5.25	5.50
Veterinary and medicines	Head	1.00	1.10	1.20	20.00	20.00	20.00	20.00	22.00	24.00
Spray materials	Head	0.50	0.52	0.55	20.00	20.00	20.00	10.00	10.40	11.00
Hauling and marketing	Head	2.00	2.00	2.00	20.00	20.00	20.00	40.00	40.00	40.00
Tractor operating	Hr.	0.82	0.82	0.82	10.00	10.00	10.00	8.20	8.20	8.20
Equipment operating	Hr.	0.09	0.09	0.09	10.00	10.00	10.00	0.90	0.90	0.90
Subtotal								3773.69	3776.34	3779.19
Interest on production capital[a/]								104.21	104.25	104.26
Total variable costs								3877.90	3880.59	3883.46
Net returns above variable costs								1536.60	1533.91	1531.04
Manure credit								65.65	65.65	65.65
Total net returns								1602.25	1599.56	1596.69

a/ Six percent times one half the cost of calves plus one fourth of other expenses.

Appendix A, Table 32. Equipment Used for a Twenty-Steer Unit Purchased in Fall, Wintered on a Silage-Supplement Ration, Sold in Spring, Large-Size Farms, Southwest Virginia

Equipment	Factor	Hours	Equivalent hours
Manure spreader	1.2621	10.0	12.62
Tractor	1.0000	10.0	10.00
Total tractor equivalent hours			22.62

Appendix A, Table 33. Labor Requirement for a Twenty-Steer Unit Purchased in Fall, Wintered on a Silage-Supplement Ration, Sold in Spring, Large-Size Farms, Southwest Virginia

Month	Hour
December-May	88.0
June-November	20.0
Total	108.0

Appendix A, Table 34. Manure Credit for a Twenty-Steer Unit Purchased in Fall, Wintered on a Silage-Supplement Ration, Sold in Spring, Large-Size Livestock Farms, Southwest Virginia

Manure credit	N	P	K	Total
Lbs.	311.4	246.6	284.4	
Price ($)	0.117	0.062	0.049	
Value ($)	36.43	15.29	13.93	65.65

Appendix A, Table 35. Estimated Cost, Returns and Input Requirements for One Steer Wintered on Corn Silage-supplement Ration and Sold in Spring, Large-size Livestock Farms, Southwest Virginia 1/

Receipts	Unit	Price	Quantity	Amount
		$		$
Steer	Lb.	0.275	650.0	178.25
Adjustment for death loss				3.57
Gross receipts				175.18
Expenses:				
Feed:				
Corn grain	Bushel		2.5	
Corn silage	Ton		0.8	
Supplement	Cwt.	4.70	1.5	7.05
Veterinary and medicine	Each	1.00	1.0	1.00
Spray materials	Each	0.50	1.0	0.50
Salt	Cwt.	1.80	0.09	0.16
Minerals	Cwt.	5.00	0.06	0.30
Hauling	Each	2.00	1.00	2.00
Miscellaneous	Each	0.50	1.00	0.50
Operating costs	Hour	0.78	0.10	0.08
Equipment				0.01
Subtotal				11.60
Interest on operating capital	Dollar	0.06/2		0.35
Total variable costs				11.95
NET RETURNS				163.23

1/ Modified from a 50-unit steer livestock budget from Agricultural Experiment Station, Research Report 110, Virginia Polytechnic Institute, Blacksburg, June 1966, p. 18.

Appendix A, Table 36. Labor Requirements for One Steer Wintered on Corn Silage-supplement Ration and Sold in Spring, Large-size Livestock Farms, Southwest, Virginia

Month	Hour
December-May	7.1
June-November	0.1
Total	7.2

Appendix A, Table 37. Estimated Cost, Returns and Input Requirements for One Steer Wintered on a Corn Silage-supplement Ration, Grazed and Sold Off Grass, Large-size Livestock Farms, Southwest, Virginia[1/]

Receipts	Unit	Price	Quantity	Amount
		$		$
Steer	Lb.	0.223	850.0	189.55
Adjustment for death loss				4.43
Gross receipts				185.12
Expenses:				
Feed:				
Corn grain	Bu.		2.5	
Corn silage	Ton		0.8	
Supplement	Cwt.		1.5	7.05
Veterinary and medicine	Each	1.00	1.0	1.00
Spray materials	Each	0.50	1.0	0.50
Salt	Cwt.	1.80	0.18	0.32
Minerals	Cwt.	5.00	0.12	0.60
Hauling	Each	2.00	1.00	2.00
Miscellaneous	Each	0.50	1.00	0.50
Operating costs	Hour	0.78	0.1	0.08
Equipment				0.01
Subtotal				12.10
Interest on operating capital				0.36
Total variable costs				12.46
NET RETURNS				172.66

1/ Modified from a 50-unit steer livestock budget from Agricultural Experiment Station, Research Report 110, Virginia Polytechnic Institute, Blacksburg, June 1966, p. 14.

Appendix A, Table 38. Labor Requirements for One Steer Wintered on a Corn Silage-supplement Ration, Grazed and Sold Off Grass, Large-size Livestock Farms, Southwest, Virginia

Month	Hour
December-May	7.1
June-November	0.25
Total	7.34

Appendix A, Table 39. Estimated Cost, Returns and Input Requirements for One Steer Finished in Dry Lot on a Corn Silage--supplement Ration, Large-size Livestock Farms, Southwest Virginia 1/

Receipts	Unit	Price	Quantity	Amount
		$	$	
Steer	Lb.	0.25	1120.0	280.00
Adjustment for death loss				5.09
Gross receipts				274.91
Expenses:				
Expenses up to feed lot				23.70
Feed:				
Corn grain	Bu.		2.5	
Corn silage	Ton		3.96	
Supplement	Cwt.	4.70	3.0	14.10
Veterinary and medicine	Each	1.00	1.0	1.00
Spray material	Each	0.50	1.0	0.50
Salt	Cwt.	1.80	0.07	0.13
Minerals	Cwt.	5.00	0.05	0.25
Hauling	Each	2.00	1.00	2.00
Miscellaneous	Each	0.50	1.00	0.50
Operating costs	Hour	0.78	0.1	0.16
Equipment				0.03
Subtotal				42.37
Interest on operating capital	Dollar	0.06/2		1.27
Total variable costs				43.64
NET RETURNS				231.27

1/ Modified from a 50-unit steer livestock budget from Agricultural Experiment Station, Research Report 110, Virginia Polytechnic Institute, Blacksburg, June 1966, p. 22.

Appendix A, Table 40. Labor Requirements for One Steer Finished in Dry Lot on a Corn Silage Supplement Ration, Large size Livestock Farms, Southwest, Virginia

Month	Hour
December-May	11.5
June-November	1.25
Total	12.75

APPENDIX B

Assumed Resource and Product Prices

Appendix B, Table 1. Past Price Indexes Used in Price Projections for Prices Used in Budgets for Large-size Livestock Farms in Southwest Virginia (1957-59 = 100)

Year	Farm machinery	Buildings and fences	Fertilizer	Seed	Wages	Farm real estate	Motor supplies
1957	96	99	100	103	96	95	173
1958	100	99	100	101	99	99	172
1959	104	102	100	96	105	106	173
1960	107	102	100	101	109	111	175
1961	110	101	100	100	110	112	176
1962	111	101	100	103	114	118	174
1963	113	101	99	110	116	123	175
1964	116	100	100	109	119	131	174
1965	120	101	100	113	127	139	176
1966	124	103	100	110	134	157	177

Source: United States Department of Agriculture, Economic Research Service, Agricultural Outlook Digest, Economic Research Service, February, 1967.

1/ Source: United States Department of Agriculture, Economic Research Service, Handbook of Agricultural Charts, 1966.

Appendix B, Table 2. Purchase Price Per Acre Used for Open Land Large-size Livestock Farms, Southwest Virginia (1966-1980 Projections) a/

Year	Value per acre (dollars)
1966-70	228.00 b/
1971-75	296.40
1976-80	364.80

a/ A 6% increase in value per acre was used taking into account past trends in land values.

b/ The value per acre used for the year 1966 for the Appalachian region is $152.00. (Source: Agricultural Statistics 1966 USDA.) One third of total land is considered woodland so this value was adjusted accordingly.

Appendix B, Table 3. Wage Rates Used for Hired Labor, Large-Size Livestock Farms, Southwest Virginia

	Price per hour[1/]
	$
Period I	1.00
Period II	1.53
Period III	2.06

1/ Price projected according to past trends in the Index of Wage Rates.

Appendix B, Table 4. Projected Price of Corn Grain and Beef Calves, Large-size Livestock Farms, Southwest Virginia.

	1961-1966	Period I	Period II	Period III
Projected price for 450-pound beef calves (dol./cwt.)	25.0	25.0	25.0	25.0
Projected beef calves/corn price ratio 1/	19.08	19.66	21.11	22.56
Projected price of corn 2/	1.31	1.27	1.18	1.11

1/ Ratio increases 0.29 per year.

2/ Assuming price of beef calves constant, the beef calves/corn price ratio decreases 0.29 per year and corn prices projected accordingly.

Appendix B, Table 5. Prices Used in Crop and Livestock Budgets, Period I, for Large-size Livestock Farms, Southwest Virginia

Item		Unit	Price per unit paid	Price per unit received
			$	$
Cash crop				
Burley tobacco		Lb.		0.69
Beef				
Feeder calves	450 lbs.	Cwt.		25.00
Steers (good grade-fall)	700 lbs.	Cwt.		22.67
Steers (low choice-spring)	1100 lbs.	Cwt.		24.50
Cull cows	1300 lbs.	Cwt.		15.00
Brood cows	1300 lbs.	Each	200.00	
Cull bulls	1500 lbs.	Each		150.00
Breeding bulls	1500 lbs.	Each	300.00	
Feed				
Soybean oil meal		Cwt.	4.87	
No. 2 yellow corn		Bu.	1.37	1.27
No. 1 alfalfa hay		Ton		41.50
Fertilizer				
Nitrogen		Cwt.	11.70	
Phosphorus		Cwt.	6.20	
Potassium		Cwt.	4.90	
2-12-12 with borax		Cwt.	2.28	
Lime		Ton	5.85	
Seed				
Tobacco		Oz.	5.00	
Rye		Bu.	3.00	
Corn (hybrid)		Lb.	0.176	
Oats		Bu.	1.80	
Red clover		Lb.	0.417	
Orchard grass		Lb.	0.32	
Alfalfa		Lb.	0.455	
Supplies 1/				
Atrazine		Lb.	2.50	
Malathion		Gal.	6.80	
Salt for livestock		Cwt.	2.96	
Minerals for livestock		Cwt.	5.00	
TDE (25% E.C.)		Pint	0.25	
Custom rates 2/				
Transplanting tobacco		Acre	20.00	
Hauling tobacco to market		Cwt.	0.50	
Hauling silage		Hour	2.00	
Harvesting oats		Acre	4.60	

1/ Prices increased 1% per year according to past changes in Farm Supplies Index.

2/ Costs increased 5% per year according to past changes in the Index of Wage Rates.

Appendix B, Table 6, Prices Used in Crop and Livestock Budgets, Period II, for Large-size Livestock Farms, Southwest Virginia

Item		Unit	Price per unit paid	Price per unit received
			$	$
Cash crop				
Burley tobacco		Lb.		0.72
Beef				
Feeder calves	450 lbs.	Cwt.		25.00
Steers (good grade-fall)	700 lbs.	Cwt.		22.67
Steers (low choice-spring)	1100 lbs.	Cwt.		24.50
Cull cows	1300 lbs.	Cwt.		15.00
Brood cows	1300 lbs.	Each	200.00	
Cull bulls	1500 lbs.	Each		150.00
Breeding bulls	1500 lbs.	Each	300.00	
Feed				
Soybean oil meal		Cwt.	4.87	
No. 2 yellow corn		Bu.	1.28	1.18
No. 1 alfalfa hay		Ton		43.57
Fertilizer				
Nitrogen		Cwt.	11.70	
Phosphorus		Cwt.	6.20	
Potassium		Cwt.	4.90	
2-12-12 with borax		Cwt.	2.28	
Lime		Ton	5.85	
Seed				
Tobacco		Oz.	5.00	
Rye		Bu.	3.00	
Corn (hybrid)		Lb.	0.176	
Oats		Bu.	1.80	
Red clover		Lb.	0.417	
Orchard grass		Lb.	0.32	
Alfalfa		Lb.	0.455	
Supplies 1/				
Atrazine		Lb.	2.62	
Malathion		Gal.	7.14	
Salt for livestock		Cwt.	3.11	
Minerals for livestock		Cwt.	5.25	
TDE (25% E.C.)		Pint	0.26	
Legume inoculant		Acre	0.26	
Custom rates 2/				
Transplanting tobacco		Acre	25.00	
Hauling tobacco to market		Cwt.	0.62	
Hauling silage		Hour	2.50	
Harvesting oats		Acre	5.75	

1/ Prices increased 1% per year according to past changes in Farm Supplies Index.

2/ Costs increased 5% per year according to past changes in the Index of Wage Rates.

Appendix B, Table 7. Prices Used in Crop and Livestock Budgets, Period III, for Large-size Livestock Farms, Southwest Virginia

Item		Unit	Price per unit paid ($)	Price per unit received ($)
Cash crop				
Burley tobacco		Lb.		0.76
Beef				
Feeder calves	450 lbs.	Cwt.		25.00
Steers (good grade-fall)	700 lbs.	Cwt.		22.67
Steers (low choice-spring)	1100 lbs.	Cwt.		24.50
Cull cows	1300 lbs.	Cwt.		15.00
Brood cows	1300 lbs.	Each	200.00	
Cull bulls	1500 lbs.	Each		150.00
Breeding bulls	1500 lbs.	Each	300.00	
Feed				
Soybean oil meal		Cwt.	4.87	
No. 2 yellow corn		Bu.	1.21	1.11
No. 1 alfalfa hay		Ton		45.75
Fertilizer				
Nitrogen		Cwt.	11.70	
Phosphorus		Cwt.	6.20	
Potassium		Cwt.	4.90	
2-12-12 with borax		Cwt.	2.28	
Lime		Ton	5.85	
Seed				
Tobacco		Oz.	5.00	
Rye		Bu.	3.00	
Corn (hybrid)		Lb.	0.176	
Oats		Bu.	1.80	
Red clover		Lb.	0.417	
Orchard grass		Lb.	0.32	
Alfalfa		Lb.	0.455	
Supplies 1/				
Atrazine		Lb.	2.74	
Malathion		Gal.	7.50	
Salt for livestock		Cwt.	3.25	
Minerals for livestock		Cwt.	5.50	
TDE (25% E.C.)		Pint	0.27	
Legume inoculant		Acre	0.27	
Custom rates 2/				
Transplanting tobacco		Acre	30.00	
Hauling tobacco to market		Cwt.	0.77	
Hauling silage		Hour	3.12	
Harvesting oats		Acre	7.19	

1/ Prices increased 1% per year according to past changes in Farm Supplies Index.

2/ Costs increased 5% per year according to past changes in the Index of Wage Rates.

APPENDIX C

Depreciation Costs for Tractor Equipment,
Buildings and Livestock Equipment

Appendix C, Table 1. Depreciation for Five-year Periods for Buildings, Livestock Equipment, Tractor and Equipment for Large-size Livestock Farm, Southwest Virginia

Item	Unit	Purchase cost ($)	Life (years)	Annual depreciation ($)	Five year depreciation ($)
Fence	1 add. acre	10.00	15	0.67	3.35
Feeding equipment	20 steers	850.00	10	85.00	425.00
Barn	1000 ft.	1250.00	20	62.50	312.50
Trench silo	1 ton	8.50	20	0.40	2.00
Grain storage	100 bushel	60.00	15	4.00	20.00
Tractor	1200 eq. hrs.	3548.00	10	354.80	1774.00
Equipment	4200 eq. hrs.	12375.00	10	1237.50	6187.50

APPENDIX D

Tractor Equivalent Hours

Appendix D, Table 1. Factor Used to Express Tractor and Equipment in Tractor Equivalent Hours, Large-size Livestock Farms, Southwest Virginia

Item	Purchase cost ($)	Wear-out life 10 years (hours)	Purchase cost wear-out hours	Factor (tractor equiv. hours)	Total hours available per year (tractor equiv. hours)
Tractor	3548.0	12,000	0.2957	1.0000	1200.0
Two 14" bottom plows	314.0	2,500	0.1256	0.4247	107.5
Tandem disk 7'	567.0	2,500	0.2268	0.7685	192.5
Two section harrow 8'	137.0	2,500	0.0548	0.1853	45.0
Tractor cultivator	361.0	2,500	0.1444	0.4883	122.5
Tractor corn planter - 2 row	572.0	1,200	0.4767	1.6120	193.2
Fertilizer spreader	401.0	1,200	0.3342	1.1302	135.6
Grain drill	1009.0	1,200	0.8408	2.8434	178.5
Mower, 7' trailing	704.0	2,000	0.3520	1.1904	325.0
Field sprayer, 2 row	287.0	1,500	0.1913	0.6469	68.0
Wagon 16'	287.0	5,000	0.0574	0.1941	100.0
Hay baler P.T.O.	2118.0	2,500	0.8472	2.8651	715.0
Hay rake, side delivery	658.0	2,500	0.2632	0.8901	222.5
Field chopper, P.T.O.	2347.0	2,000	1.1735	3.9685	792.0
Manure spreader	933.0	2,500	0.3732	1.2621	315.0
Cornpicker-husker	1680.0	2,000	0.8400	2.8410	568.0
Total	15923.0				5380.3

APPENDIX E

Present Value of Cost and Returns

Present Value of Costs and Returns 1/

The constant flows of cost or returns forthcoming each year during five years in Period I were multiplied by the coefficients corresponding to $\frac{(1 + r)^n - 1}{r (1 + r)^n}$ where n = 5 and r = six percent, twelve percent or twenty percent depending on the discount rate used in the analysis.

The constant flows of costs or returns forthcoming each year during five years in Period II were multiplied by the coefficients corresponding to $\frac{(1 + r)^n - 1}{r (1 + r)^n}$ where n = 5 and r = six percent, twelve percent or twenty percent depending on the discount rate used in the analysis, to obtain the present value at the beginning of Period II (or end of year five). The present value at the beginning of the fifteen year period was calculated by multiplying this amount by the coefficients corresponding to $\frac{1}{(1 + r)^n}$ where n = 5 and r = six percent, twelve percent or twenty percent depending on the discount rate used in the analysis.

The constant flows or returns forthcoming each year during five years in Period III were multiplied by the coefficients corresponding to $\frac{(1 + r)^n - 1}{r (1 + r)^n}$ where n = 5 and r = six percent, twelve percent or twenty percent depending on the discount rate used in the analysis to obtain the present value at the beginning of Period III (or end of

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1/ For more detail on Present Value Formulas used and Tables, see J. R. Martin "The 'Real Cost' of Alternative Investments", Processed Series p-541, Oklahoma State University, May 1966.

year 10). The present value at the beginning of the fifteen year period was calculated by multiplying this amount by the coefficients corresponding to $\frac{1}{(1 + r)^n}$ where n = 10 and r = six percent, twelve percent or twenty percent depending on the discount rate used in the analysis.

The coefficients used to calculate the present value of the annual flows of cost and returns at the beginning of the fifteen year period were:

	Percent Discount			
Periods	0	6	12	20
Period I	5.0	4.21236	3.60477	2.990612
Period II	5.0	3.14771	2.04544	1.201850
Period III	5.0	2.25215	1.16063	0.482990

APPENDIX F

Firm Growth and Enterprise Combinations for Different Maximizing Criteria

Appendix F, Table 1. Firm Growth when Maximizing Undiscounted Net Returns during Fifteen Years, Large-size Livestock Farms, Southwest Virginia 1/

Item	Unit	Five-year periods I	II	III	Total 2/
Returns					
Gross returns	$1000	294.85	1173.62	2529.28	3997.75
Undiscounted net	$1000	22.21	22.21	453.43	835.31 3/
Net worth at the end of the period	$1000	180.64 4/	414.45	425.08	425.08
Land					
Purchased	Acre	-	22.7	377.3	400.0
Rented	Acre	-	94.6	252.0	
Total available 5/	Acre	410.0	527.3	1062.0	
Total used	Acre	346.8	290.5	603.1	
Added investment					
Land	$1000	-	6.73	137.63	144.36
Farm machinery	$1000	-	22.90	16.00	38.90
Buildings and livestock equipment	$1000	13.15	53.71	87.77	154.63
Livestock 6/	$1000	14.25	5.76	19.28	39.29
Total	$1000	27.40	89.10	260.68	377.18
Operating capital (annual)	$1000	16.4	79.7	192.6	
Finance for investment					
15-year loan	$1000	17.48 7/	-	-	
10-year loan	$1000	27.40	-	-	
5-year loan	$1000	-	-	26.23	
Reinvest income	$1000	-	89.10	234.45	

1/ Land acquired, capital use and credit policies are simultaneously determined with maximum returns.

2/ Total for the three five-year periods or amount at the end of 15 years.

3/ The difference in the total amount is increase in net worth at the end of the planning period.

4/ Net worth at the beginning of the planning period is $87,618.

5/ Available through purchases or renting.

6/ Sixty beef cows presently on farm are fixed for Period I.

7/ Initial debt on land at the beginning of planning period is $17,480.

Appendix f, Table 2. Annual Enterprise Combinations, Hired Labor, and Returns Associated with Growth when Maximizing Undiscounted Net Returns during Fifteen Years, Large-size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods		
		I	II	III
Livestock				
Beef cows	Head	60. 1/	24.	81.
Steers	Head	108.	800.	1792.
Crops produced				
Continuous corn for silage	Acre	23.3	70.7	142.5
Corn grain, small grains, hay rotation	Acre	128.7	-	204.0
Corn silage, small grains, hay rotation	Acre	-	125.1	52.2
Alfalfa hay	Acre	25.0	32.2	65.2
Pasture	Acre	166.8	58.8	136.2
Burley tobacco	Acre	3.0	3.0	3.0
Hay sold	Ton	132.6	158.7	-
Grain sold	Bushel	3892.8		
Labor				
Resident operator	Hour	2720.	2720.	2720.
Seasonal hired	Hour	2200.	5924.	14478.
Gross returns per year	$1000	58.9	234.7	505.6

1/ The present number of beef cows (60) are being maintained through Period I.

Appendix F, Table 3. Firm Growth when Maximizing Net Returns Discounted Six Percent during Fifteen Years, Large-size Livestock Farms, Southwest Virginia 1/

Item	Unit	Five-year periods I	II	III	Total 2/
Returns					
Gross returns	$1000	294.85	1173.62	2529.28	3997.75
Undiscounted net	$1000	22.11	22.11	453.43	833.09 3/
Discounted net	$1000				374.46
Net worth at the end of the period	$1000	180.64 4/	400.52	425.08	425.08
Land					
Purchased	Acre	-	22.7	377.3	400.0
Rented	Acre	-	94.6	252.0	
Total available 5/	Acre	410.0	527.3	1062.0	
Total used	Acre	346.8	290.5	603.1	
Added investment					
Land	$1000	-	6.73	137.63	144.36
Farm machinery	$1000	-	22.90	16.00	38.90
Buildings and livestock equipment	$1000	13.15	53.71	87.77	154.63
Livestock 6/	$1000	14.25	5.76	19.28	39.29
Total	$1000	27.40	89.10	260.68	377.18
Operating capital (annual)	$1000	16.4	79.7	192.6	
Finance for investment					
15-year loan	$1000	17.48 7/	-	-	
10-year loan	$1000	27.40	-	-	
5-year loan	$1000	-	-	40.15	
Reinvest income	$1000	-	89.10	220.53	

1/ Land acquired, capital use, and credit policies are simultaneously determined with maximum returns.

2/ Total for the three five-year periods or amount at end of 15 years.

3/ The difference in the total amount is increase in net worth at the end of the planning period.

4/ Net worth at the beginning of the planning period is $87,618.

5/ Available through purchases or renting.

6/ Sixty beef cows presently on farm are fixed for Period I.

7/ Initial debt on land at the beginning of the planning period is $17,480.

Appendix F, Table 4. Annual Enterprise Combinations, Hired Labor, and Returns Associated with Growth when Maximizing Net Returns Discounted Six Percent, Large-size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods		
		I	II	III
Livestock				
Beef cows	Head	60. 1/	24.	81.
Steers	Head	108.	800.	1792.
Crops produced				
Continuous corn for silage	Acre	23.3	70.7	142.5
Corn grain, small grains, hay rotation	Acre	128.7	-	204.3
Corn silage, small grains, hay rotation	Acre	-	125.65	52.19
Alfalfa hay	Acre	25.0	32.2	65.2
Pasture	Acre	166.8	58.8	136.2
Burley tobacco	Acre	3.0	3.0	3.0
Hay sold	Ton	132.6	158.7	-
Grain sold	Bushel	3892.8	-	-
Labor				
Resident operator	Hour	2720.	2720.	2720.
Seasonal hired	Hour	2200.	5924.	14478.
Gross returns per year	$1000	58.9	234.7	505.6

1/ The present number of beef cows (60) are being maintained through Period I.

Appendix F, Table 5. Firm Growth when Maximizing Net Returns Discounted Twenty Percent during Fifteen Years, Large-size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods I	II	III	Total 2/
Returns					
Gross returns	$1000	294.85	1167.69	840.25	2302.79
Undiscounted net	$1000	22.11	248.75	256.43	631.45 3/
Discounted net	$1000				119.78
Net worth at the end of the period	$1000	180.64 4/	192.57	191.73	191.73
Land					
Purchased	Acre	-	19.7	-	19.7
Rented	Acre	-	99.9		
Total available 5/	Acre	410.0	529.6	529.6	
Total used	Acre	346.8	298.4	278.6	
Added investment					
Land	$1000	-	5.85	-	5.85
Farm machinery	$1000	-	22.95	0.21	23.16
Buildings and livestock equipment	$1000	13.15	53.86	9.08	76.09
Livestock 6/	$1000	14.25	6.43	6.50	27.18
Total	$1000	27.40	89.09	15.79	132.28
Operating capital (annual)	$1000	16.45	79.66	85.57	
Finance for investment					
15-year loan	$1000	17.48 7/	-	-	
10-year loan	$1000	27.40	-	-	
5-year loan	$1000	-	-	1.6	
Reinvest income	$1000	-	89.10	14.21	

1/ Land acquired, capital use, and credit policies are simultaneously determined with maximum returns.

2/ Total for the three five-year period or amount at the end of 15 years.

3/ The difference in the total amount is increase in net worth at the end of the planning period.

4/ Net worth at the beginning of the planning period is $87,618.

5/ Available through purchases or renting.

6/ Sixty beef cows presently on farm are fixed for Period I.

7/ Initital debt on land at the beginning of the planning period is $17,480.

Appendix F, Table 6. Annual Enterprise Combinations, Hired Labor, and Returns Associated with Growth when Maximizing Net Returns Discounted Twenty Percent, Large-size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods I	II	III
Livestock				
Beef cows	Head	60. 1/	27.	27.
Steers	Head	108.	798.	791.
Crops produced				
Continuous corn for silage	Acre	23.3	71.1	71.1
Corn grain, small grains, hay rotation	Acre	128.7	-	16.8
Corn silage, small grains, hay rotation	Acre	-	126.21	109.38
Alfalfa hay	Acre	25.0	32.4	32.4
Pasture	Acre	166.8	65.8	45.9
Burley tobacco	Acre	3.0	3.0	3.0
Hay sold	Ton	132.6	159.7	204.7
Grain sold	Bushel	3892.8		
Labor				
Resident operator	Hour	2720.	2720.	2720.
Seasonal hired	Hour	2200.	5972.	5780.
Gross returns per year	$1000	58.9	234.8	233.5

1/ The present number of beef cows (60) are being maintained through Period I.

Appendix F, Table 7. Firm Growth when Maximizing Net Worth at the End of the Planning Period, Large-size Livestock Farms, Southwest Virginia 1/

Item	Unit	Five-year periods I	II	III	Total 2/
Returns					
Five-year gross returns	$1000	294.85	1167.69	840.25	2302.79
Undiscounted net	$1000	22.21	22.21	381.26	622.47 3/
Net worth at the end of the period	$1000	180.64 4/	414.37	627.54	627.54
Land					
Purchased	Acre	-	46.1	353.9	400.0
Rented	Acre	-	65.6	-	
Total available 5/	Acre	410.0	521.7	810.0	
Total used	Acre	346.8	229.1	804.6	
Added investment					
Land	$1000	-	13.66	129.10	142.76
Farm machinery	$1000	-	22.62	4.67	27.29
Buildings and livestock equipment	$1000	13.15	52.82	14.20	80.17
Livestock 6/	$1000	14.25	-	80.73	94.98
Total	$1000	27.40	89.10	228.71	345.21
Operating capital (annual)	$1000	16.45	79.66	51.76	
Finance for investment					
15-year loan	$1000	17.48 7/	-	-	
10-year loan	$1000	27.40	-	-	
5-year loan	$1000	-	-	191.51	
Reinvest income	$1000	-	89.10	220.90	

1/ Land acquired, capital use, and credit policies are simultaneously determined with maximum net worth.

2/ Total for the three five-year period or amount at the end 1f 15 years.

3/ The difference in the total amount is increase in net worth at the end of the planning period.

4/ Net worth at the beginning of the planning period is $87,618.

5/ Available through purchases or renting.

6/ Sixty beef cows presently on farm are fixed for Period I.

7/ Initial debt on land at the beginning of the planning period is $17,480.

Appendix F, Table 8. Annual Enterprise Combinations, Hired Labor, and Returns Associated with Growth when Maximizing Net Worth at the End of the Planning Period, Large-size Livestock Farms, Southwest Virginia

Item	Unit	Five-year periods		
		I	II	III
Livestock				
Beef cows	Head	60. 1/	-	339.
Steers	Head	108.	817.	320.
Crops produced				
Continuous corn for silage	Acre	23.3	70.0	108.7
Corn grain, small grains, hay rotation	Acre	128.7	-	194.7
Corn silage, small grains, hay rotation	Acre	-	124.28	-
Alfalfa hay	Acre	25.0	31.9	44.2
Pasture	Acre	166.8	-	454.0
Burley tobacco	Acre	3.0	3.0	3.0
Hay sold	Ton	132.6	155.0	267.0
Grain sold	Bushel	3892.8	-	7849.5
Labor				
Resident operator	Hour	2720.	2720.	2720.
Seasonal hired	Hour	2199.	5397.	9870.
Gross returns per year	$1000	58.9	233.5	168.0

1/ The present number of beef cows (60) are being maintained through Period I.

APPENDIX G

Linear Programming Matrix

LINEAR PROGRAMMING MATRIX

Code to Matrix

Objective Function Rows:[a/]

PROF1 - Maximize undiscounted net returns.

PROF2 - Maximize discounted net returns; six percent discount rate.

PROF3 - Maximize discounted net returns; twelve percent discount rate.

PROF4 - Maximize discounted net returns; twenty percent discount rate.

PROF5 - Maximize net worth at the end of the planning period.

Resource or Restriction Code

The same alphabetic code is used in each period for the same resource or restriction and each name is followed by the number 1, 2, or 3 referring to the production period 1, 2, or 3 respectively.

Code	Unit	Description
NETWC	Dollars	Initial net worth.
CGANS	Dollars	Capital gains due to land appreciation.
BCAP	Dollars	Borrowing capital restriction.
INCP	Dollars	Investment capital accounting row.
OPCP	Dollars	Operating capital accounting row.
CAPT	Dollars	Investment capital requirement.
NETW	Dollars	Net worth at the end of the production period.

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a/ Functionals are all in terms of maximization for 15 years.

FAM1	Dollars	Annual family consumption.
FAM5	Dollars	Family consumption per period.
FTAX	Dollars	Income tax.
FSTAX	Dollars	Tax for annual incomes over $8,000.
LND1	Acres	Class I land.
LND2	Acres	Class II land.
LND3	Acres	Class III land.
PSTR	Acres	Pasture land.
TBAL	Acres	Tobacco allotment.
LBDM	Hour	December - May labor.
LBJN	Hour	June - November labor.
CRNS	Ton	Corn silage.
HYEQ	Ton	No. 1 alfalfa hay equivalent.
GRN	Bushels	Grain
SCRN	Bushels	Sell corn.
PSHY	Ton	Hay from pasture.
STST	Ton	Straw, stover.
TRSL	Ton	Trench silo.
BRSP	Sq. Ft.	Barn space.
EQP	Hour	Farm equipment expressed in tractor equivalent hours.
FNCE	Acre	Fence.
FEQ	Steers	Feeding equipment.
GRST	Bushels	Grain storage.

EXP	Dollars	Production expenses accounting row.
BFCN	Heads	Beef cows accounting row.
GRSI	Dollars	Gross income acccunting row.
ASETR	Unit	Initial assets restriction.
TRAC	Hour	Tractor expressed in tractor equivalent hours.
BL15	Dollars	Buy land with a 15-year loan.
CALF	Heads	Number of calves produced.
ADFC	Acres	Add fences to additional pasture land bought.
MICP	Dollars	Added investment for machinery and equipment accounting row.
LLND3	Acres	Restriction on total amount of land that can be purchased during the three production periods.

Matrix Column Code

The same alphabetic code is used in each period for the same enterprise or activity. Each column name is followed by a number 1, 2, or 3 representing the three production periods.

Code	Description
BRTB	Burley tobacco.
CRNSIL	Continuous corn for silage.
CGRT	Corn for grain, oats, red clover, orchard grass - 5-year rotation.
CSTR	Corn for silage, oats, red clover, orchard grass - 5-year rotation.

ALF	Alfalfa hay.
PAST	Bluegrass-white clover permanent pasture.
BFC0	Beef cow herd A.
BFC1	Beef cow herd B.
SLCF	Sell feeder calves.
SWSS	Calves wintered and sold in spring.
SWSF	Calves wintered and sold in fall.
SWSW	Calves wintered and sold in winter finisned on drylot.
STER	Steers purchased in fall, wintered, and finished on drylot.
TRACTOR	Buy tractor hours equivalent hours.
BLND	Buy land.
BRNSP	Buy barn space.
FNC	Buy fence.
GRS	Buy grain storage.
TRSS	Buy trench silo.
FEQQ	Buy feeding equipment.
EQUIP	Buy equipment.
C05	Borrow with a 5-year loan.
C10	Borrow with a 10-year loan.
C15	Borrow with a 15-year loan.
TBC	Transfer borrowed capital.
TCP	Transfer capital.
IW	Increase in worth.
DW	Decrease in worth.

FXTX	Income tax.
SXTX	Surtax.
HDML	Hire December - May labor.
HJNL	Hire June - November labor.
SCHY	Sell hay.
SLGR	Sell grain.
CSPS	Transfer corn silage to pasture.
HYSL	Transfer hay to silage.
CSST	Transfer corn silage to straw, stover.
ASET1	Initial resources and assets.
RLND	Rent land.
CGTX	Capital gains tax.
INWP	Increase in net worth at the end of the planning period.
DNWP	Decrease in net worth at the end of the planning period.

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          PROGRAM
          TITLE('ALBUQUERQUE AND KLINE PROBLEM')
          INITIALZ
          MOVE (XDATA,'TOBDATA')
          MOVE (XPBNAME,'DATA')
          CONVERT ('CHECK','SUMMARY')
          SETUP('MAX','ROUND','PROD1')
          PICTURE
          TITLE ('OPTIMAL USING PROF3')
          MOVE (XRHS,'RHS1')
          MOVE (XOBJ,'PROF3')
          PRIMAL
          SOLUTION
          SAVE ('NAME','DATA3')
          TRACE
          EXIT
          PEND
NAME           TOBDATA
ROWS
 N  PROF1
 N  PROF2
 N  PROF3
 N  PROF4
 N  PROF5
 L  NETWC
 E  CGANS
 L  BCAP1
 G  INCP1
 G  OPCP1
 L  CAPT1
 E  NETW1
 G  FAM11
 G  FAM51
 E  FTAX1
 L  FSTX1
 L  LND11
 L  LND21
 L  LND31
 L  PSTR1
 L  TBAL1
 L  LBDM1
 L  LBJM1
 L  CRNS1
 L  HYEQ1
 L  GRN1
 L  SCRN1
 L  PSHY1
 L  STST1
 L  TRSL1
 L  BRSP1
 L  EQP1
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L   FNCE1
L   FEQ1
L   GRST1
G   EXP1
G   BFCW1
L   RLN1
G   GRSI1
F   ASETR
L   TRAC1
L   BL151
L   CALF1
G   ADFC1
G   MICP1
L   BCAP2
G   INCP2
G   OPCP2
L   CAPT2
E   NETW2
G   FAM12
G   FAM52
E   FTAX2
L   FSTX2
L   LND12
L   LND22
L   LND32
L   PSTR2
L   TBAL2
L   LBDM2
L   LBJN2
L   CRNS2
L   HYEQ2
L   GRN2
L   SCRN2
L   PSHY2
L   STST2
L   TRSL2
L   BRSP2
L   EQP2
L   FNCE2
L   FEQ2
L   GRST2
G   EXP2
G   BFCW2
L   RLN2
G   GRSI2
L   TRAC2
L   BL152
L   CALF2
G   ADFC2
G   MICP2
L   BCAP3
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 G  INCP3
 G  OPCP3
 L  CAPT3
 E  NETW3
 G  FAM13
 G  FAM53
 E  FTAX3
 L  FSTX3
 L  LND13
 L  LND23
 L  LND33
 L  PSTR3
 L  TBAL3
 L  LBDM3
 L  LBJN3
 L  CRNS3
 L  HYEQ3
 L  GRN3
 L  SCRN3
 L  PSHY3
 L  STST3
 L  TRSL3
 L  BRSP3
 L  EQP3
 L  FNCE3
 L  FEQ3
 L  GRST3
 G  EXP3
 G  BFCW3
 L  RLN3
 G  GRSI3
 L  TRAC3
 L  BLIS3
 L  CALF3
 G  ADFC3
 L  LLND3
 G  MICP3
COLUMNS
    BRTB1     PROF1      921.04      PROF2      775.95
    BRTB1     PROF3     6640.27      PROF4     5508.94
    BRTB1     BCAP1       11.064     OPCP1      110.64
    BRTB1     FAM11     1842.08      FAM51      921.040
    BRTB1     FTAX1      921.040     FSTX1      921.040
    BRTB1     LND21        1.0       LND31        1.0
    BRTB1     TBAL1        1.0       LBDM1       33.2
    BRTB1     LBJN1      367.8       BRSP1      240.0
    BRTB1     EQP1         7.36      GRSI1     2070.0
    BRTB1     TRAC1       14.0       BCAP2   -   11.064
    BRTB1     EXP1       227.92
    CRNSIL1   PROF1   -   28.960     PROF2   -   24.398
    CRNSIL1   PROF3   -  208.78      PROF4   -  173.21
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CRNSIL1	BCAP1		2.811	OPCP1	28.11
CRNSIL1	FAM11	-	57.92	FAM51	- 28.960
CRNSIL1	FTAX1	-	28.960	FSTX1	- 28.960
CRNSIL1	LND11		1.0	LND21	1.0
CRNSIL1	LND31		1.0	LBDM1	4.4
CRNSIL1	LBJN1		8.7	CRNS1	- 18.0
CRNSIL1	TRSL1		18.0	EQP1	11.03
CRNSIL1	TRAC1		11.5	BCAP2	- 2.811
CRNSIL1	EXP1		57.92		
CGRT1	PROF1	-	80.540	PROF2	- 67.853
CGRT1	PROF3	-	580.65	PROF4	- 481.73
CGRT1	BCAP1		7.819	OPCP1	78.19
CGRT1	FAM11	-	161.08	FAM51	- 80.540
CGRT1	FTAX1	-	80.540	FSTX1	- 80.540
CGRT1	LND21		5.0	LND31	5.0
CGRT1	LBDM1		8.9	LBJN1	28.9
CGRT1	HYEQ1	-	4.12	GRN1	- 185.68
CGRT1	SCRN1	-	151.20	STST1	- 1.59
CGRT1	EQP1		31.00	TRAC1	25.9
CGRT1	BCAP2	-	7.819		
CGRT1	EXP1		161.08		
CSTR1	PROF1	-	97.43	PROF2	- 82.082
CSTR1	PROF3	-	702.42	PROF4	- 562.75
CSTR1	BCAP1		9.46	OPCP1	94.6
CSTR1	FAM11	-	194.86	FAM51	- 97.43
CSTR1	FTAX1	-	97.43	FSTX1	- 97.43
CSTR1	LND21		5.0	LND31	5.0
CSTR1	LBDM1		8.9	LBJN1	36.9
CSTR1	CRNS1	-	32.0	HYEQ1	- 4.12
CSTR1	GRN1	-	33.88	STST1	- 0.85
CSTR1	TRSL1		32.0	EQP1	37.61
CSTR1	TRAC1		34.9	BCAP2	- 9.46
CSTR1	EXP1		194.86		
ALF1	PROF1	-	21.120	PROF2	- 17.793
ALF1	PROF3	-	152.27	PROF4	- 126.32
ALF1	BCAP1		2.050	OPCP1	20.50
ALF1	FAM11	-	42.24	FAM51	- 21.120
ALF1	FTAX1	-	21.120	FSTX1	- 21.120
ALF1	LND31		1.0	LBDM1	1.05
ALF1	LBJN1		12.83	HYEQ1	- 2.48
ALF1	STST1	-	0.28	EQP1	11.13
ALF1	TRAC1		9.62	BCAP2	- 2.05
ALF1	EXP1		42.24		
PAST1	PROF1	-	3.550	PROF2	- 2.991
PAST1	PROF3	-	25.59	PROF4	- 21.23
PAST1	BCAP1		.344	OPCP1	3.44
PAST1	FAM11	-	7.10	FAM51	- 3.550
PAST1	FTAX1	-	3.550	FSTX1	- 3.550
PAST1	PSTR1		1.0	LBDM1	1.5
PAST1	LBJN1		0.5	PSHY1	- 1.31
PAST1	EQP1		1.02	FNCE1	1.0

PAST1	TRAC1	0.8	BCAP2	- .344
PAST1	EXP1	7.10		
BFCO1	PROF1	257.21	PROF2	216.692
BFCO1	PROF3	1854.37	PROF4	1538.43
BFCO1	BCAP1	11.245	INCP1	475.0
BFCO1	OPCP1	112.45	CAPT1	475.0
BFCO1	NETW1	475.0	FAM11	514.42
BFCO1	FAMS1	257.21	FTAX1	257.21
BFCO1	FSTX1	257.21	LBDM1	130.0
BFCO1	LBJN1	70.0	PSHY1	56.36
BFCO1	STST1	26.14	BRSP1	500.
BFCO1	EQP1	11.62	BFCW1	20.0
BFCO1	GRSI1	635.0	TRAC1	10.0
BFCO1	CALF1	- 15.	BCAP2	321.25
BFCO1	CAPT2	- 475.0		
BFCO1	EXP1	120.58		
BFC1	PROF1	1783.27	PROF2	1020.19
BFC1	PROF3	6369.5	PROF4	3831.9
BFC1	CGANS	-1993.0	BCAP1	13.887
BFC1	INCP1	475.0	OPCP1	138.87
BFC1	CAPT1	475.0	NETW1	- 148.0
BFC1	FAM11	569.97	FAMS1	284.985
BFC1	FTAX1	284.985	FSTX1	284.985
BFC1	LBDM1	158.6	LBJN1	85.4
BFC1	PSHY1	79.28	STST1	34.46
BFC1	BRSP1	610.	EQP1	12.5
BFC1	BFCW1	24.4	GRSI1	713.0
BFC1	TRAC1	12.5	CALF1	- 13.4
BFC1	EXP1	143.03		
BFC1	BCAP2	- 61.024	OPCP2	146.61
BFC1	NETW2	- 628.	FAM12	945.97
BFC1	FAMS2	472.985	FTAX2	472.985
BFC1	FSTX2	472.985	LBDM2	258.96
BFC1	LBJN2	139.44	PSHY2	159.54
BFC1	STST2	69.38	BRSP2	1245.
BFC1	EQP2	65.23	BFCW2	49.8
BFC1	GRSI2	1298.	TRAC2	24.9
BFC1	CALF2	- 27.4	BCAP3	- 380.853
BFC1	FAM13	2050.59	FAMS3	1025.295
BFC1	OPCP3	302.63	NETW3	-1217.0
BFC1	FTAX3	1025.295	FSTX3	1025.295
BFC1	LBDM3	439.	LBJN3	237.
BFC1	PSHY3	318.57	STST3	138.5
BFC1	BRSP3	2485.	EQP3	130.21
BFC1	BFCW3	99.4	GRSI3	2674.
BFC1	TRAC3	49.7	CALF3	- 54.4
SLCF1	PROF1	54.7	PROF2	46.083
SLCF1	PROF3	394.36	PROF4	327.17
SLCF1	FAM11	109.4	FAMS1	54.7
SLCF1	FTAX1	54.7	FSTX1	54.7
SLCF1	GRSI1	110.5	CALF1	1.

SLCF1	EXP1	1.1		
SWSS1	PROF1	81.615	PROF2	68.758
SWSS1	PROF3	588.41	PROF4	488.16
SWSS1	BCAP1	.580	OPCP1	5.80
SWSS1	FAM11	163.23	FAM51	81.615
SWSS1	FTAX1	81.615	FSTX1	81.615
SWSS1	LBDM1	7.1	LBJN1	0.1
SWSS1	CRNS1	0.8	GRN1	2.5
SWSS1	BRSP1	12.5	EQP1	0.1
SWSS1	FEQ1	1.0	GRST1	2.5
SWSS1	GRSI1	175.18	TRAC1	0.1
SWSS1	CALF1	1.		.
SWSS1	EXP1	11.95		
SWSF1	PROF1	86.330	PROF2	72.731
SWSF1	PROF3	622.4	PROF4	516.36
SWSF1	BCAP1	.605	OPCP1	6.05
SWSF1	FAM11	172.66	FAM51	86.330
SWSF1	FTAX1	86.330	FSTX1	86.330
SWSF1	LBDM1	7.1	LBJN1	.25
SWSF1	CRNS1	0.8	GRN1	2.5
SWSF1	PSHY1	1.10	BRSP1	12.5
SWSF1	EQP1	0.1	FEQ1	1.0
SWSF1	GRST1	2.5	GRSI1	188.39
SWSF1	TRAC1	0.1	CALF1	1.
SWSF1	EXP1	15.73		
SWSW1	PROF1	115.635	PROF2	97.419
SWSW1	PROF3	833.68	PROF4	691.6
SWSW1	BCAP1	4.237	OPCP1	42.37
SWSW1	FAM11	231.27	FAM51	115.635
SWSW1	FTAX1	115.635	FSTX1	115.635
SWSW1	LBDM1	11.5	LBJN1	1.25
SWSW1	CRNS1	3.96	GRN1	2.5
SWSW1	PSHY1	1.10	BRSP1	12.5
SWSW1	EQP1	0.6	FEQ1	1.0
SWSW1	GRST1	2.5	GRSI1	271.66
SWSW1	TRAC1	0.6	CALF1	1.
SWSW1	EXP1	40.39		
STER1	PROF1	801.125	PROF2	674.925
STER1	PROF3	5775.74	PROF4	4791.71
STER1	BCAP1	173.687	OPCP1	1736.87
STER1	FAM11	1602.25	FAM51	801.125
STER1	FTAX1	801.125	FSTX1	801.125
STER1	LBDM1	88.0		
STER1	LBJN1	20.0	CRNS1	63.2
STER1	BRSP1	250.	EQP1	12.62
STER1	FEQ1	20.0	GRSI1	5414.5
STER1	TRAC1	10.0	BCAP2	- 173.687
STER1	EXP1	3812.0		
TRACTOR1	INCP1	354.8	CAPT1	354.8
TRACTOR1	NETW1	177.4	TRAC1	-1200.
TRACTOR1	BCAP2	124.18	NETW2	177.4

TRACTOR1	TRAC2	-1200.	BCAP3	124.18
TRACTOR1	MICP1	354.80		
BLND1	CGANS	0.0	INCP1	2280.0
BLND1	CAPT1	2280.0	NETW1	0.
BLND1	LND11	- 13.42	LND21	- 37.84
BLND1	LND31	- 44.0	PSTR1	- 56.0
BLND1	RLN1	- 40.	BL151	-2280.0
BLND1	BCAP2	0.	NETW2	0.
BLND1	LND12	- 13.42	LND22	- 37.84
BLND1	LND32	- 44.0	PSTR2	- 56.0
BLND1	RLN2	- 40.0		
BLND1	BCAP3	0.	NETW3	0.
BLND1	LND13	- 13.42	LND23	- 37.84
BLND1	LND33	- 44.00	PSTR3	- 56.00
BLND1	RLN3	- 40.0		
BLND1	ADFC1	- 56.		
BLND1	LLND3	100.		
BRNSP1	INCP1	125.0	CAPT1	125.0
BRNSP1	NETW1	31.25	BRSP1	-1000.
BRNSP1	BCAP2	21.875	NETW2	31.25
BRNSP1	BRSP2	-1000.	BCAP3	21.875
BRNSP1	NETW3	31.25	BRSP3	-1000.
FNC1	INCP1	1.0	CAPT1	1.0
FNC1	NETW1	.334	FNCE1	- 1.0
FNC1	BCAP2	.234	NETW2	.334
FNC1	FNCE2	- 1.0	BCAP3	.234
FNC1	NETW3	.334	FNCE3	- 1.0
FNC1	ADFC1	1.		
GRS1	INCP1	6.0	CAPT1	6.0
GRS1	NETW1	2.00	GRST1	- 100.
GRS1	BCAP2	1.4	NETW2	2.0
GRS1	GRST2	- 100.	BCAP3	1.40
GRS1	NETW3	2.00	GRST3	- 100.
TRSS1	INCP1	.8	CAPT1	.8
TRSS1	NETW1	.20	TRSL1	- 1.0
TRSS1	BCAP2	.14	NETW2	.20
TRSS1	TRSL2	- 1.	BCAP3	.140
TRSS1	NETW3	.20	TRSL3	- 1.
FEQQ1	INCP1	85.0	CAPT1	85.0
FEQQ1	NETW1	42.5	FEQ1	- 20.0
FEQQ1	BCAP2	29.75	NETW2	42.5
FEQQ1	FEQ2	- 20.	BCAP3	29.75
EQIP1	INCP1	1237.5	CAPT1	1237.5
EQIP1	NETW1	618.75	EQP1	-4200.
EQIP1	BCAP2	432.15	NETW2	618.75
EQIP1	EQP2	-4200.	BCAP3	433.125
EQIP1	MICP1	1237.50		
CO51	PROF1	- 118.695	PROF2	- 100.000
CO51	PROF3	- 855.761	PROF4	- 709.96
CO51	BCAP1	100.0	CAPT1	- 100.0
CO51	NETW1	- 100.0	FAM11	- 237.40

C051	FAM51	- 118.695	FTAX1	- 118.695
C051	FSTX1	- 118.695	BCAP2	- 70.0
C101	PROF1	- 135.868	PROF2	- 100.000
C101	PROF3	- 767.68	PROF4	- 569.62
C101	BCAP1	100.0	CAPT1	- 100.0
C101	NETW1	- 50.0	FAM11	- 135.87
C101	FAM51	- 67.935	FTAX1	- 67.935
C101	FSTX1	- 67.935	BCAP2	- 35.0
C101	NETW2	- 50.000	FAM12	- 135.87
C101	FAM52	- 67.935	FTAX2	- 67.935
C101	FSTX2	- 67.935	BCAP3	- 35.0
C151	PROF1	- 149.437	PROF2	- 96.758
C151	PROF3	- 678.53	PROF4	- 465.79
C151	BCAP1	100.0	CAPT1	- 100.0
C151	NETW1	- 33.333	FAM11	- 99.63
C151	FAM51	- 49.813	FTAX1	- 49.813
C151	FSTX1	- 49.813	BL151	100.0
C151	BCAP2	- 23.333	NETW2	- 33.333
C151	FAM12	- 99.63	FAM52	- 49.813
C151	FTAX2	- 49.813	FSTX2	- 49.813
C151	BCAP3	- 23.333	NETW3	- 33.333
C151	FAM13	- 99.63	FAM53	- 49.813
C151	FTAX3	- 49.813	FSTX3	- 49.813
TBC1	BCAP1	100.0	BCAP2	- 100.0
TCP1	PROF1	- 100.0	PROF2	- 74.726
TCP1	PROF3	- 567.42	PROF4	- 401.88
TCP1	NETW1	- 100.0	FAM51	- 100.0
TCP1	FTAX1	- 100.	FSTX1	- 100.
TCP1	BCAP2	- 70.0	CAPT2	- 100.
IW1	PROF1	- 7.5	PROF2	- 4.856
IW1	PROF3	- 34.05	PROF4	- 23.37
IW1	PROF5	100.0	NETWC	-1000.
IW1	NETW1	100.0	FAM11	- 5.00
IW1	FAM51	- 2.500	FTAX1	- 2.500
IW1	FSTX1	- 2.500	FAM12	- 5.00
IW1	FAM52	- 2.500	FTAX2	- 2.500
IW1	FSTX2	- 2.500	FAM13	- 5.00
IW1	FAM53	- 2.500	FTAX3	- 2.500
IW1	FSTX3	- 2.500		.
DW1	PROF1	7.5	PROF2	4.856
DW1	PROF3	34.05	PROF4	23.37
DW1	PROF5	- 100.0	NETWC	1000.
DW1	NETW1	- 100.0	FAM11	5.00
DW1	FAM51	2.500	FTAX1	2.500
DW1	FSTX1	2.500	FAM12	5.00
DW1	FAM52	2.500	FTAX2	2.500
DW1	FSTX2	2.500	FAM13	5.00
DW1	FAM53	2.500	FTAX3	2.500
DW1	FSTX3	2.500		
FXTX1	PROF1	- .05	PROF2	- .042
FXTX1	PROF3	- 0.37	PROF4	- 0.30

FXTX1	FAMS1	-	10.0	FTAX1	- 100.0
SXTX1	PROF1	-	.15	PROF2	- .126
SXTX1	PROF3	-	1.11	PROF4	- 0.90
SXTX1	FAMS1	-	30.0	FSTX1	- 100.0
HOML1	PROF1	-	.50	PROF2	- .421
HOML1	PROF3	-	3.60	PROF4	- 2.99
HOML1	BCAP1		.033	OPCP1	0.33
HOML1	FAM11	-	1.0	FAMS1	- .50
HOML1	FTAX1	-	.50	FSTX1	- .50
HOML1	LBOM1	-	1.	BCAP2	- .033
HOML1	EXP1		1.0		
HJNL1	PROF1	-	.50	PROF2	- .421
HJNL1	PROF3	-	3.60	PROF4	- 2.99
HJNL1	BCAP1		.033	OPCP1	0.33
HJNL1	FAM11	-	1.0	FAMS1	- .50
HJNL1	FTAX1	-	.50	FSTX1	- .50
HJNL1	LBJN1	-	1.	BCAP2	- .033
HJNL1	EXP1		1.0		
SCHY1	PROF1		16.600	PROF2	13.985
SCHY1	PROF3		119.68	PROF4	99.29
SCHY1	FAM11	+	33.20	FAMS1	16.600
SCHY1	FTAX1		16.600	FSTX1	16.600
SCHY1	HYEQ1		1.		.
SCHY1	GRS11		33.20		
SLGR1	PROF1		.635	PROF2	.535
SLGR1	PROF3		4.58	PROF4	3.80
SLGR1	FAM11		1.27	FAMS1	.635
SLGR1	FTAX1		.635	FSTX1	.635
SLGR1	GRN1		1.	SCRN1	1.
SLGR1	GRS11		1.27		
CSPST1	CRNS1		1.	PSHY1	- 0.4
HYSL1	CRNS1	-	1.	HYEQ1	0.200
HYSL1	GRN1		4.4	GRST1	4.4
CSST1	CRNS1		1.	STST1	- 0.4
ASET1	PROF1	-	677.1	PROF2	- 425.5
ASET1	PROF3	-2	983.7	PROF4	-2048.28
ASET1	PROF5	8	761.85	CGANS	0.
ASET1	BCAP1	-6	133.3	CAPT1	1748.0
ASET1	NETW1	1	023.325	FAM11	- 438.09
ASET1	FAMS1	-	219.045	FTAX1	- 219.085
ASET1	FSTX1	-	219.085	LND11	- 55.
ASET1	LND21	-	155.	LND31	- 180.
ASET1	PSTR1	-	230.	TBAL1	- 3.
ASET1	LBOM1	-1	288.	LBJN1	-1432.
ASET1	BRSP1	-1	500.	EQP1	-4200.
ASET1	FNCE1	-	230.	GRST1	-1000.
ASET1	RLN1	-	92.	TRAC1	-1800.
ASET1	BL151	-1	748.0	ASETR	1.
ASET1	BCAP2		716.327	NETW2	138.525
ASET1	FAM12	-	438.09	FAMS2	- 219.045
ASET1	FTAX2	-	219.045	FSTX2	- 219.045

ASET1	LND12	- 55.	LND22	- 155.
ASET1	LND32	- 180.	PSTR2	- 230.
ASET1	TBAL2	- 3.	LBDM2	-1288.
ASET1	LBJN2	-1432.	BRSP2	-1500.
ASET1	FNCE2	- 230.	GRST2	-1000.
ASET1	RLN2	- 92.0	BCAP3	96.967
ASET1	NETW3	0.	FAM13	- 438.09
ASET1	FAM53	- 219.045	FTAX3	- 219.045
ASET1	FSTX3	- 219.045	LND13	- 55.
ASET1	LND23	- 155.	LND33	- 180.
ASET1	PSTR3	- 230.	TBAL3	- 3.
ASET1	LBDM3	-1288.	LBJN3	-1432.
ASET1	RLN3	- 92.		
RLND1	PROF1	- 750.0	PROF2	- 631.854
RLND1	PROF3	-5407.16	PROF4	-4485.92
RLND1	FAM11	-1500.	FAM51	- 750.0
RLND1	FTAX1	- 750.0	FSTX1	- 750.0
RLND1	LND11	- 13.42	LND21	- 37.84
RLND1	LND31	- 44.00	PSTR1	- 56.00
RLND1	EXP1	1500.		
RLND1	RLN1	100.		.
BRTB2	PROF1	989.925	PROF2	623.195
BRTB2	PROF3	4049.66	PROF4	2379.48
BRTB2	BCAP2	12.240	OPCP2	122.40
BRTB2	FAM12	1979.85	FAM52	989.925
BRTB2	FTAX2	989.925	FSTX2	989.925
BRTB2	LND22	1.0	LND32	1.0
BRTB2	TBAL2	1.0	LBDM2	33.2
BRTB2	LBJN2	367.8	BRSP2	240.
BRTB2	EQP2	7.36	GRSI2	2232.
BRTB2	TRAC2	14.	BCAP3	- 12.240
BRTB2	EXP2	252.1		
CRNSIL2	PROF1	- 31.915	PROF2	- 20.092
CRNSIL2	PROF3	- 130.56	PROF4	- 76.71
CRNSIL2	BCAP2	3.098		
CRNSIL2	OPCP2	30.98		
CRNSIL2	FAM12	- 63.83	FAM52	- 31.915
CRNSIL2	FTAX2	- 31.915	FSTX2	- 31.915
CRNSIL2	LND12	1.0	LND22	1.0
CRNSIL2	LND32	1.0	LBDM2	4.4
CRNSIL2	LBJN2	8.7	CRNS2	- 20.7
CRNSIL2	TRSL2	20.7	EQP2	11.20
CRNSIL2	TRAC2	12.15	BCAP3	- 3.098
CRNSIL2	EXP2	63.83		
CGRT2	PROF1	- 88.29	PROF2	- 55.582
CGRT2	PROF3	- 361.18	PROF4	- 212.22
CGRT2	BCAP2	8.572	OPCP2	85.72
CGRT2	FAM12	- 176.58	FAM52	- 88.290
CGRT2	FTAX2	- 88.290	FSTX2	- 88.290
CGRT2	LND22	5.0	LND32	5.0
CGRT2	LBDM2	8.9	LBJN2	28.9

CGRT2	HYEQ2	- 4.12	GRN2	- 201.88
CGRT2	SCRN2	- 168.00	STST2	- 1.67
CGRT2	EQP2	32.10	TRAC2	26.5
CGRT2	BCAP3	- 8.572		
CGRT2	EXP2	176.58		
CSTRT2	PROF1	- 104.45	PROF2	- 65.776
CSTRT2	PROF3	- 427.29	PROF4	- 251.07
CSTRT2	BCAP2	10.141	OPCP2	101.41
CSTRT2	FAM12	- 208.9	FAM52	- 104.45
CSTRT2	FTAX2	- 104.45	FSTX2	- 104.45
CSTRT2	LND22	5.0	LND32	5.0
CSTRT2	LBDM2	8.9	LBJN2	36.9
CSTRT2	CRNS2	- 38.0	HYEQ2	- 4.12
CSTRT2	GRN2	- 33.88	STST2	- 0.89
CSTRT2	TRSL2	38.	EQP2	39.20
CSTRT2	TRAC2	35.4	BCAP3	- 10.141
CSTRT2	EXP2	208.9		
ALF2	PROF1	- 25.45	PROF2	- 16.022
ALF2	PROF3	- 104.11	PROF4	- 61.17
ALF2	BCAP2	2.471	OPCP2	24.71
ALF2	FAM12	- 50.9	FAM52	- 25.45
ALF2	FTAX2	- 25.45	FSTX2	- 25.45
ALF2	LND32	1.	LBDM2	1.05
ALF2	LBJN2	12.83	HYEQ2	- 2.85
ALF2	STST2	- 0.32	EQP2	13.08
ALF2	TRAC2	11.22	BCAP3	- 2.471
ALF2	EXP2	50.9		
PAST2	PROF1	- 4.475	PROF2	- 2.817
PAST2	PROF3	- 18.31	PROF4	- 10.76
PAST2	BCAP2	.435	OPCP2	4.35
PAST2	FAM12	- 8.95	FAM52	- 4.475
PAST2	FTAX2	- 4.475	FSTX2	- 4.475
PAST2	PSTR2	1.	LBDM2	1.5
PAST2	LBJN2	0.5	PSHY2	- 1.50
PAST2	EQP2	1.02	FNCE2	1.0
PAST2	TRAC2	0.8	BCAP3	- .435
PAST2	EXP2	8.95		
BFCO2	PROF1	255.210	PROF2	160.665
BFCO2	PROF3	1044.03	PROF4	613.45
BFCO2	BCAP2	11.44	INCP2	475.0
BFCO2	OPCP2	114.4	CAPT2	475.0
BFCO2	NETW2	475.0	FAM12	510.42
BFCO2	FAM52	255.210	FTAX2	255.210
BFCO2	FSTX2	255.210	LBDM2	130.0
BFCO2	LBJN2	70.0	PSHY2	56.36
BFCO2	STST2	26.14	BRSP2	500.
BFCO2	EQP2	12.62	GRSI2	635.0
BFCO2	BFCW2	20.		
BFCO2	TRAC2	10.0	CALF2	- 15.
BFCO2	BCAP3	321.06	CAPT3	- 475.0
BFCO2	EXP2	124.58		

SLCF2	PROF1	54.7	PROF2	34.436
SLCF2	PROF3	223.77	PROF4	131.48
SLCF2	FAM12	109.4	FAM52	54.7
SLCF2	FTAX2	54.7	FSTX2	54.7
SLCF2	GRSI2	110.5	CALF2	1.
SLCF2	EXP2	1.1		
SWSS2	PROF1	81.615	PROF2	51.38
SWSS2	PROF3	333.88	PROF4	196.18
SWSS2	BCAP2	.580	OPCP2	5.80
SWSS2	FAM12	163.23	FAM52	81.615
SWSS2	FTAX2	81.615	FSTX2	81.615
SWSS2	LBDM2	7.1	LBJN2	0.1
SWSS2	CRNS2	0.8	GRN2	2.5
SWSS2	BRSP2	12.5	EQP2	0.1
SWSS2	FEQ2	1.0	GRST2	2.5
SWSS2	GRSI2	175.18	TRAC2	0.1
SWSS2	CALF2	1.		.
SWSS2	EXP2	11.95		
SWSF2	PROF1	86.33	PROF2	54.348
SWSF2	PROF3	353.17	PROF4	207.51
SWSF2	BCAP2	.605	OPCP2	6.05
SWSF2	FAM12	172.66	FAM52	86.33
SWSF2	FTAX2	86.33	FSTX2	86.33
SWSF2	LBDM2	7.1	LBJN2	0.25
SWSF2	CRNS2	0.8	GRN2	2.5
SWSF2	PSHY2	1.10	BRSP2	12.5
SWSF2	EQP2	0.1	FEQ2	1.0
SWSF2	GRST2	2.5	GRSI2	188.39
SWSF2	TRAC2	0.1	CALF2	1.
SWSF2	EXP2	15.73		
SWSW2	PROF1	115.635	PROF2	72.797
SWSW2	PROF3	473.05	PROF4	277.95
SWSW2	BCAP2	4.237	OPCP2	42.37
SWSW2	FAM12	231.27	FAM52	115.635
SWSW2	FTAX2	115.635	FSTX2	115.635
SWSW2	LBDM2	11.5	LBJN2	1.25
SWSW2	CRNS2	3.96	GRN2	2.5
SWSW2	PSHY2	1.10	BRSP2	12.5
SWSW2	EQP2	0.6	FEQ2	1.0
SWSW2	GRST2	2.5	GRSI2	271.66
SWSW2	TRAC2	0.6	CALF2	1.
SWSW2	EXP2	40.39		
STER2	PROF1	799.78	PROF2	503.495
STER2	PROF3	3271.80	PROF4	1922.43
STER2	BCAP2	173.753	OPCP2	1737.53
STER2	FAM12	1599.56	FAM52	799.78
STER2	FTAX2	799.78	FSTX2	799.78
STER2	LBDM2	88.	LBJN2	20.
STER2	CRNS2	63.2	BRSP2	250.
STER2	EQP2	12.62	FEQ2	20.0
STER2	GRSI2	5414.5	TRAC2	10.0

STER2	BCAP3	- 173.753		.
STER2	EXP2	3814.94		
TRACTOR2	INCP2	403.6	CAPT2	403.6
TRACTOR2	NETW2	201.8	TRAC2	-1200.
TRACTOR2	BCAP3	141.26		.
TRACTOR2	NETW3	201.8	TRAC3	-1200.
TRACTOR2	MICP2	403.60		
BLND2	CGANS	0.	INCP2	2964.0
BLND2	CAPT2	2964.0	NETW2	0.
BLND2	LND12	- 13.42	LND22	- 37.84
BLND2	LND32	- 44.0	PSTR2	- 56.0
BLND2	RLN2	- 40.	BL152	-2964.0
BLND2	BCAP3	0.	NETW3	0.
BLND2	LND13	- 13.42	LND23	- 37.84
BLND2	LND33	- 44.0	PSTR3	- 56.0
BLND2	RLN3	- 40.0		
BLND2	ADFC2	- 56.		
BLND2	LLND3	100.		
BRNSP2	INCP2	125.0	CAPT2	125.0
BRNSP2	NETW2	31.25	BRSP2	-1000.
BRNSP2	BCAP3	21.875	NETW3	31.25
BRNSP2	BRSP3	-1000.		.
FNC2	INCP2	1.0	CAPT2	1.0
FNC2	NETW2	.334	FNCE2	- 1.
FNC2	BCAP3	.234	NETW3	.334
FNC2	FNCE3	- 1.		.
FNC2	ADFC2	1.		
GRS2	INCP2	6.0	CAPT2	6.0
GRS2	NETW2	2.0	GRST2	- 100.
GRS2	BCAP3	1.4	NETW3	2.0
GRS2	GRST3	- 100.		.
TRSS2	INCP2	.8	CAPT2	.8
TRSS2	NETW2	.2	TRSL2	- 1.
TRSS2	BCAP3	.14	NETW3	.2
TRSS2	TRSL3	- 1.		.
FEQQ2	INCP2	85.0	CAPT2	85.0
FEQQ2	NETW2	42.5	FEQ2	- 20.0
FEQQ2	BCAP3	29.75	NETW3	42.5
FEQQ2	FEQ3	- 20.		.
EQIP2	INCP2	1407.7	CAPT2	1407.7
EQIP2	NETW2	703.85	EQP2	-4200.
EQIP2	BCAP3	492.695	NETW3	703.85
EQIP2	EQP3	-4200.		.
EQIP2	MICP2	1407.70		
CO52	PROF1	- 118.695	PROF2	- 74.725
CO52	PROF3	- 485.57	PROF4	- 289.31
CO52	BCAP2	100.0	CAPT2	- 100.0
CO52	NETW2	- 100.	FAM12	- 237.40
CO52	FAM52	- 118.695	FTAX2	- 118.695
CO52	FSTX2	- 118.695	BCAP3	- 70.0
C102	PROF1	- 135.868	PROF2	- 74.725

C102	PROF3	- 435.59	PROF4	- 228.91
C102	BCAP2	100.0	CAPT2	- 100.0
C102	NETW2	- 50.0	FAM12	- 135.87
C102	FAM52	- 67.935	FTAX2	- 67.935
C102	FSTX2	- 67.935	BCAP3	- 35.0
C102	NETW3	- 50.0	FAM13	- 135.87
C102	FAM53	- 67.935	FTAX3	- 67.935
C102	FSTX3	- 67.935		.
C152	PROF1	- 149.437	PROF2	- 72.302
C152	PROF3	- 385.01	PROF4	- 187.18
C152	BCAP2	100.0	CAPT2	- 100.
C152	NETW2	- 33.333	FAM12	- 99.63
C152	FAM52	- 49.813	FTAX2	- 49.813
C152	FSTX2	- 49.813	BL152	100.0
C152	BCAP3	- 23.333	NETW3	- 33.333
C152	FAM13	- 99.63	FAM53	- 49.813
C152	FTAX3	- 49.813	FSTX3	- 49.813
TBC2	BCAP2	100.0	BCAP3	- 100.0
TCP2	PROF1	- 100.0	PROF2	- 55.839
TCP2	PROF3	- 321.96	PROF4	- 161.50
TCP2	NETW2	- 100.0	FAM52	- 100.0
TCP2	FTAX2	- 100.	FSTX2	- 100.0
TCP2	BCAP3	- 70.0	CAPT3	- 100.0
IW2	PROF1	- 5.0	PROF2	- 2.75
IW2	PROF3	- 16.03	PROF4	- 8.42
IW2	PROF5	100.	NETWC	-1000.
IW2	NETW2	100.0	FAM12	- 5.00
IW2	FAM52	- 2.500	FTAX2	- 2.500
IW2	FSTX2	- 2.500	FAM13	- 5.00
IW2	FAM53	- 2.5	FTAX3	- 2.5
IW2	FSTX3	- 2.5		.
DW2	PROF1	5.0	PROF2	2.75
DW2	PROF3	16.03	PROF4	8.42
DW2	PROF5	- 100.0	NETWC	1000.
DW2	NETW2	- 100.0	FAM12	5.00
DW2	FAM52	2.500	FTAX2	2.500
DW2	FSTX2	2.500	FAM13	5.00
DW2	FAM53	2.500	FTAX3	2.500
DW2	FSTX3	2.500		.
FXTX2	PROF1	- .05	PROF2	- .042
FXTX2	PROF3	- 0.37	PROF4	- 0.30
FXTX2	FAM52	- 10.0	FTAX2	- 100.0
SXTX2	PROF1	- .15	PROF2	- .126
SXTX2	PROF3	- 1.11	PROF4	- 0.90
SXTX2	FAM52	- 30.0	FSTX2	- 100.0
HDML2	PROF1	- .765	PROF2	- .482
HDML2	PROF3	- 3.13	PROF4	- 1.84
HDML2	BCAP2	.051	OPCP2	0.51
HDML2	FAM12	- 1.53	FAM52	- .765
HDML2	FTAX2	- .765	FSTX2	- .765
HDML2	EXP2	1.53		

HDML2	LBDM2	-	1.	BCAP3	- .051
HJNL2	PROF1	-	.765	PROF2	- .482
HJNL2	PROF3	-	3.13	PROF4	- 1.84
HJNL2	BCAP2		.051	OPCP2	0.51
HJNL2	FAM12	-	1.53	FAM52	- .765
HJNL2	FTAX2	-	.765	FSTX2	- .765
HJNL2	EXP2		1.53		
HJNL2	LBJN2	-	1.	BCAP3	- .051
SCHY2	PROF1		17.4	PROF2	10.954
SCHY2	PROF3		71.81	PROF4	41.82
SCHY2	FAM12		34.8	FAM52	17.4
SCHY2	FTAX2		17.4	FSTX2	17.4
SCHY2	HYEQ2		1.0		
SCHY2	GRST2		34.8		
SLGR2	PROF1		.590	PROF2	.370
SLGR2	PROF3		2.41	PROF4	1.42
SLGR2	FAM12		1.18	FAM52	0.59
SLGR2	FTAX2		0.59	FSTX2	0.59
SLGR2	GRN2		1.	SCRN2	1.
SLGR2	GRST2		1.18		
CSPST2	CRNS2		1.	PSHY2	- 0.4
HYSL2	CRNS2	-	1.	HYEQ2	0.2
HYSL2	GRN2		4.4	GRST2	4.4
CSST2	CRNS2		1.	STST2	- 0.4
RLND2	PROF1	-	975.0	PROF2	- 613.8
RLND2	PROF3	-3	988.61	PROF4	-2343.61
RLND2	FAM12	-1	950.	FAM52	- 975.0
RLND2	FTAX2	-	975.0	FSTX2	- 975.0
RLND2	LND32	-	44.0	PSTR2	- 56.0
RLND2	LND12	-	13.42	LND22	- 37.84
RLND2	RLN2		100.	EXP2	1150.
BRTB3	PROF1	1	076.495	PROF2	506.414
BRTB3	PROF3	2	498.83	PROF4	1039.67
BRTB3	BCAP3		13.544	OPCP3	135.44
BRTB3	FAM13	2	152.99	FAM53	1076.495
BRTB3	FTAX3	1	076.495	FSTX3	1076.495
BRTB3	LND23		1.0	LND33	1.0
BRTB3	TBAL3		1.0	LBDM3	33.2
BRTB3	LBJN3		367.8	BRSP3	240.0
BRTB3	EQP3		7.36	GRST3	2432.0
BRTB3	TRAC3		14.0		.
BRTB3	EXP3		279.01		
CRNSIL3	PROF1	-	34.04	PROF2	- 16.013
CRNSIL3	PROF3	-	79.02	PROF4	- 32.88
CRNSIL3	BCAP3		3.305	OPCP3	33.05
CRNSIL3	FAM13	-	68.08	FAM53	- 34.04
CRNSIL3	FTAX3	-	34.04	FSTX3	- 34.04
CRNSIL3	LND13		1.0	LND23	1.0
CRNSIL3	LND33		1.0	LBDM3	4.4
CRNSIL3	LBJN3		8.7	CRNS3	- 22.5
CRNSIL3	TRSL3		22.5	EQP3	12.0

CRNSIL3	TRAC3	12.8			.
CRNSIL3	EXP3	68.08			
CGRT3	PROF1	- 93.685	PROF2	-	44.072
CGRT3	PROF3	- 217.47	PROF4	-	90.5
CGRT3	BCAP3	9.096	OPCP3		90.96
CGRT3	FAM13	- 187.37	FAM53	-	93.685
CGRT3	FTAX3	- 93.685	FSTX3	-	93.685
CGRT3	LND23	5.0	LND33		5.0
CGRT3	LBDM3	8.9	LBJN3		28.9
CGRT3	HYEQ3	- 4.12	GRN3	-	235.48
CGRT3	SCRN3	- 201.6	STST3	-	1.84
CGRT3	EQP3	33.30	TRAC3		27.1
CGRT3	EXP3	187.37			
CSRT3	PROF1	- 109.575	PROF2	-	51.547
CSRT3	PROF3	- 254.35	PROF4	-	105.85
CSRT3	BCAP3	10.639	OPCP3		106.39
CSRT3	FAM13	- 219.15	FAM53	-	109.575
CSRT3	FTAX3	- 109.575	FSTX3	-	109.575
CSRT3	LND23	5.0	LND33		5.0
CSRT3	LBDM3	8.9	LBJN3		36.9
CSRT3	CRNS3	- 42.0	HYEQ3	-	4.12
CSRT3	GRN3	33.88	STST3	-	0.85
CSRT3	TRSL3	42.0	EQP3		40.82
CSRT3	TRAC3	35.9			.
CSRT3	EXP3	219.15			
ALF3	PROF1	- 28.525	PROF2	-	13.419
ALF3	PROF3	- 66.21	PROF4	-	27.56
ALF3	BCAP3	2.770	OPCP3		27.70
ALF3	FAM13	- 57.05	FAM53	-	28.525
ALF3	FTAX3	- 28.525	FSTX3	-	28.525
ALF3	LND33	1.	LBDM3		1.05
ALF3	LBJN3	12.83	HYEQ3	-	3.11
ALF3	STST3	- 0.34	EQP3		15.13
ALF3	TRAC3	12.92			.
ALF3	EXP3	57.05			
PAST3	PROF1	- 5.97	PROF2	-	2.809
PAST3	PROF3	- 13.86	PROF4	-	5.77
PAST3	BCAP3	.530	OPCP3		5.30
PAST3	FAM13	- 11.94	FAM53	-	5.970
PAST3	FTAX3	- 5.970	FSTX3	-	5.970
PAST3	PSTR3	1.	LBDM3		1.5
PAST3	LBJN3	0.5	PSHY3	-	1.68
PAST3	EQP3	1.02	FNCE3		1.0
PAST3	TRAC3	0.8			.
PAST3	EXP3	11.94			
BFCO3	PROF1	253.110	PROF2		119.071
BFCO3	PROF3	587.53	PROF4		244.5
BFCO3	BCAP3	11.643	INCP3		475.00
BFCO3	OPCP3	116.43	CAPT3		475.00
BFCO3	FAM13	506.22	FAM53		253.110
BFCO3	FTAX3	253.110	FSTX3		253.110

BFCO3	LBDM3	130.0	LBJN3	70.0
BFCO3	PSHY3	56.36	STST3	26.14
BFCO3	BRSP3	500.0	EQP3	12.62
BFCO3	BFCW3	20.0	GRSI3	635.0
BFCO3	TRAC3	10.0	CALF3	- 15.
BFCO3	EXP3	128.78		
SLCF3	PROF1	54.70	PROF2	25.733
SLCF3	PROF3	126.97	PROF4	52.84
SLCF3	FAM13	109.4	FAM53	54.70
SLCF3	FTAX3	54.70	FSTX3	54.70
SLCF3	GRSI3	110.5	CALF3	1.
SLCF3	EXP3	1.1		
SWSS3	PROF1	81.615	PROF2	38.394
SWSS3	PROF3	189.45	PROF4	78.84
SWSS3	BCAP3	.580	OPCP3	5.80
SWSS3	FAM13	163.23	FAM53	81.615
SWSS3	FTAX3	81.615	FSTX3	81.615
SWSS3	LBDM3	7.1	LBJN3	0.1
SWSS3	CRNS3	0.8	GRN3	2.5
SWSS3	BRSP3	12.5	EQP3	0.1
SWSS3	FEQ3	1.0	GRST3	2.5
SWSS3	GRSI3	175.18	TRAC3	0.1
SWSS3	CALF3	1.		.
SWSS3	EXP3	11.95		
SWSF3	PROF1	86.33	PROF2	40.612
SWSF3	PROF3	200.39	PROF4	83.39
SWSF3	BCAP3	.605	OPCP3	6.05
SWSF3	FAM13	172.66	FAM53	86.33
SWSF3	FTAX3	86.33	FSTX3	86.33
SWSF3	LBDM3	7.1	LBJN3	0.25
SWSF3	CRNS3	0.8	GRN3	2.5
SWSF3	PSHY3	1.10	BRSP3	12.5
SWSF3	EQP3	0.1	FEQ3	1.0
SWSF3	GRST3	2.5	GRSI3	188.39
SWSF3	TRAC3	0.1	CALF3	1.
SWSF3	EXP3	15.73		
SWSW3	PROF1	115.635	PROF2	54.398
SWSW3	PROF3	268.42	PROF4	111.70
SWSW3	BCAP3	4.237	OPCP3	42.37
SWSW3	FAM13	231.27	FAM53	115.635
SWSW3	FTAX3	115.635	FSTX3	115.635
SWSW3	LBDM3	11.5	LBJN3	1.25
SWSW3	CRNS3	3.96	GRN3	2.5
SWSW3	PSHY3	1.10	BRSP3	12.5
SWSW3	EQP3	0.6	FEQ3	1.0
SWSW3	GRST3	2.5	GRSI3	271.66
SWSW3	TRAC3	0.6	CALF3	1.
SWSW3	EXP3	40.39		
STER3	PROF1	798.345	PROF2	375.565
STER3	PROF3	1853.17	PROF4	771.19
STER3	BCAP3	188.960	OPCP3	1889.60

STEP3	FAM13	1596.69	FAM53	798.345
STER3	FTAX3	798.345	FSTX3	798.345
STER3	LBDN3	88.0	LBJN3	20.0
STER3	CRNS3	63.2	BRSP3	250.
STER3	EQP3	12.62	FEQ3	20.0
STER3	GRSI3	5414.5	TRAC3	10.0
STER3	EXP3	3817.8		
TRACTOR3	INCP3	452.3	CAPT3	452.3
TRACTOR3	NETW3	226.2	TRAC3	-1200.
TRACTOR3	MICP3	452.30		
BLND3	CGANS	0.	INCP3	3648.0
BLND3	CAPT3	3648.0	NETW3	0.
BLND3	LND13	- 13.42	LND23	- 37.84
BLND3	LND33	- 44.0	PSTR3	- 56.0
BLND3	RLN3	- 40.	BL153	-3648.
BLND3	ADFC3	- 56.		
BLND3	LLND3	100.		
BRNSP3	INCP3	125.0	CAPT3	125.0
BRNSP3	NETW3	31.25	BRSP3	-1000.
FNC3	INCP3	1.0	CAPT3	1.0
FNC3	NETW3	.334	FNCE3	- 1.
FNC3	ADFC3	1.		
GRS3	INCP3	6.0	CAPT3	6.0
GRS3	NETW3	2.0	GRST3	- 100.
TRSS3	INCP3	.8	CAPT3	.8
TRSS3	NETW3	.20	TRSL3	- 1.
FEQQ3	INCP3	85.0	CAPT3	85.0
FEQQ3	NETW3	42.5	FEQ3	- 20.
EQIP3	INCP3	1577.8	CAPT3	1577.8
EQIP3	NETW3	787.9	EQP3	-4200.
EQIP3	MICP3	1577.80		
CO53	PROF1	- 118.695	PROF2	- 55.839
CO53	PROF3	- 285.19	PROF4	- 114.67
CO53	BCAP3	100.0	CAPT3	- 100.0
CO53	NETW3	- 100.0	FAM13	- 237.4
CO53	FAM53	- 118.695	FTAX3	- 118.695
CO53	FSTX3	- 118.695		
C103	PROF1	- 135.868	PROF2	- 55.839
C103	PROF3	- 247.17	PROF4	- 92.00
C103	BCAP3	100.0	CAPT3	- 100.0
C103	NETW3	- 50.0	FAM13	- 135.87
C103	FAM53	- 67.935	FTAX3	- 67.935
C103	FSTX3	- 67.935		
C153	PROF1	- 149.437	PROF2	- 37.088
C153	PROF3	- 218.47	PROF4	- 75.23
C153	BCAP3	100.0	CAPT3	- 100.0
C153	NETW3	- 33.333	FAM13	- 99.63
C153	FAM53	- 49.813	FTAX3	- 49.813
C153	FSTX3	- 49.813	BL153	100.
FXTX3	PROF1	- .05	PROF2	- .042
FXTX3	PROF3	- 0.37	PROF4	- 0.30

FXTX3	FAM53	-	10.0	FTAX3	- 100.0
SXTX3	PROF1	-	.15	PROF2	- .126
SXTX3	PROF3	-	1.11	PROF4	- 0.90
SXTX3	FAM53	-	30.0	FSTX3	- 100.0
HDML3	PROF1	-	1.030	PROF2	- .485
HDML3	PROF3	-	2.39	PROF4	- 0.95
HDML3	BCAP3		.069	OPCP3	0.69
HDML3	FAM13	-	2.06	FAM53	- 1.030
HDML3	FTAX3	-	1.030	FSTX3	- 1.030
HDML3	LBDM3	-	1.	EXP3	2.06
HJNL3	PROF1	-	1.030	PROF2	- .485
HJNL3	PROF3	-	2.39	PROF4	- 0.95
HJNL3	BCAP3		.069	OPCP3	0.69
HJNL3	FAM13	-	2.06	FAM53	- 1.030
HJNL3	FTAX3	-	1.030	FSTX3	- 1.030
HJNL3	LBJN3	-	1.	EXP3	2.06
SCHY3	PROF1		18.30	PROF2	8.609
SCHY3	PROF3		42.48	PROF4	17.68
SCHY3	FAM13		36.60	FAM53	18.30
SCHY3	FTAX3		18.30	FSTX3	18.30
SCHY3	HYEQ3		1.		.
SCHY3	GRSI3		36.60		
SLGR3	PROF1		.550	PROF2	.259
SLGR3	PROF3		1.28	PROF4	0.53
SLGR3	FAM13		1.10	FAM53	.550
SLGR3	FTAX3		.550	FSTX3	.550
SLGR3	GRN3		1.	SCRN3	1.
SLGR3	GRSI3		1.10		
CSPST3	CRNS3		1.	PSHY3	- 0.4
HYSL3	CRNS3	-	1.	HYEQ3	0.2
HYSL3	GRN3		4.4	GRST3	4.4
CSST3	CRNS3		1.	STST3	- 0.4
RLND3	PROF1		-1200.0	PROF2	- 564.516
RLND3	PROF3		-2785.51	PROF4	-1159.18
RLND3	FAM13		-2400.	FAM53	-1200.0
RLND3	FTAX3		-1200.0	FSTX3	-1200.0
RLND3	LND13	-	13.42	LND23	- 37.84
RLND3	LND33	-	44.00	PSTR3	- 56.00
RLND3	RLN3		100.	EXP3	2400.0
CGTX	CGANS		100.0	FAM53	- 12.5
IW3	PROF1	-	2.5	PROF2	- 1.176
IW3	PROF3	-	5.80	PROF4	- 2.41
IW3	PROF5		100.0	NETWC	-1000.
IW3	NETW3		100.0	FAM13	- 5.
IW3	FAM53	-	2.5	FTAX3	- 2.5
IW3	FSTX3	-	2.5		.
DW3	PROF1		2.5	PROF2	1.176
DW3	PROF3		5.80	PROF4	2.41
DW3	PROF5	-	100.0	NETWC	1000.
DW3	NETW3	-	100.0	FAM13	5.0
DW3	FAM53		2.50	FTAX3	2.50

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    DW3         FSTX3          2.50                          .
    INWP        PROF1        100.          PROF2          31.18
    INWP        PROF3        182.7         PROF4          64.91
    INWP        NETMC       1000.
    DNWP        PROF1      - 100.0         PROF2        - 31.18
    DNWP        PROF3      - 182.7         PROF4        - 64.91
    DNWP        NETMC      -1000.
RHS
    RHS1        FAM11       4000.                          .
    RHS1        FAM51       2000.                          .
    RHS1        FSTX1       4000.0                         .
    RHS1        ASETR          1.                          .
    RHS1        FAM12       4000.                          .
    RHS1        FAM52       2000.0                         .
    RHS1        FSTX2       4000.0                         .
    RHS1        FAM13       4000.                          .
    RHS1        FAM53       2000.0                         .
    RHS1        FSTX3       4000.0                         .
    RHS1        LLND3        400.
    RHS2        FAM11       3000.
    RHS2        FAM51       1500.
    RHS2        FAM12       3000.
    RHS2        FAM52       1500.
    RHS2        FAM13       3000.
    RHS2        FAM53       1500.
    RHS3        LLND3      - 100.
    RHS4        FAM11       3000.
    RHS4        FAM51       1500.
    RHS4        FAM12       3000.
    RHS4        FAM52       1500.
    RHS4        FAM13       3000.
    RHS4        FAM53       1500.
    RHS4        LLND3      - 100.
    CHVEC1      BCAP1        750.
    CHVEC1      CAPT1       1000.
BOUNDS
 LO PROD1       BPCD1          3.0
 LO PROD1       TRACTOR2       1.
 LO PROD1       EQIP2          1.
ENDATA
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A POLYPERIOD PRODUCTION-INVESTMENT MODEL OF GROWTH OF LARGE-SIZE LIVESTOCK FARMS IN SOUTHWEST VIRGINIA

by

Lilian S. de Alburquerque

ABSTRACT

A polyperiod model was developed for investigating production-investment decisions associated with firm growth. A fifteen year planning horizon divided into three production periods was used. Initial resources were those of a large-size livestock farm (410 acres of open land) located in Southwest Virginia. The model maximizes the present value of net returns. A twelve percent discount rate was used to obtain a basic solution. The effect of varying the discount rates or maximizing net worth at the end of the planning period were analyzed. Growth was measured in terms of net returns and net worth at the end of the planning period. Family consumption affected capital accumulation by the withdrawal of fixed amounts of capital per period from returns generated during the period. The effect in the amount of initial debt was studied. Growth was associated with changes in enterprise organization, added investments and finance policies. A high discount rate and a high initial debt were the variables that most affected growth. When land purchases were restricted growth was reduced considerably. The dry-lot steer enterprise was more profitable and had a greater potential for expansion than the beef cow enterprise. A major proportion of investments were financed with capital generated within the firm. The greatest amount

of investments were done during the last production period. This stresses the importance of time in the capital accumulation process for the growth of the firm.