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ALTERNATIVE METHODS
OF FINANCING GROWTH
ON MICHIGAN DAIRY FARMS

by

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ABSTRACT

ALTERNATIVE METHODS OF FINANCING GROWTH ON MICHIGAN DAIRY FARMS

by

Richard David Duvick

Increased size and specialization of farms has led to the increased use of capital and credit by many farmers. In Michigan the trend on dairy farms is toward herds of 100 or more cows and many of these herds will be housed and handled in free-stall, milking parlor systems. How can farm operators finance the move from their present operations to these modern, larger-scale operations? What are some of the major factors that can aid the expansion process? And how do these factors affect other aspects of the farm organization over time?

This research used a synthetic approach to examine these questions with production relationships and costs corresponding to dairy farms in south central Michigan. A multiperiod linear programming model was developed for a 10-year period with primary emphasis on the financial aspects of the expansion process. After accounting for certain minimum establishment costs, the farm operation could expand through various means. The model allowed for land rental or purchase, grain sale or purchase, and the hiring of labor. Annual accounting was made of cash withdrawals for taxes and family living expenses. Borrowing was limited by institutional restraints based on type of equity for different assets and by repayment capacity. The desired growth of the firm was assumed to consist of two primary, equally-weighted operator goals: (1) to maximize net worth, and (2) to maximize income for family living

expenses.

The study examined the effects on the growth of a firm of different (1) levels of beginning equity, (2) down payment requirements for both short and long term borrowing, and (3) repayment terms on long term debt. Also examined were the effects of alternative goals of the operator, appreciation of land values, investment credit, and lower milk prices.

Larger amounts of beginning equity led to proportional increases in final net worth and less than proportional increases in consumption. In addition, the size of the farm operation was increased, both in year 1 and over time. In some situations the smaller equity levels resulted in unused capacity, as financing was insufficient for both the needed investments and current operating expenses. A minimum of $50,000 was needed to establish a farm operation under the normal down payment requirements assumed, and $35,000 under the smaller down payments. These amounts are more than most young or beginning farm operators would have, and they emphasize the need to know what factors may act as substitutes for capital and how they affect the growth process.

Smaller down payments allow a greater expansion to occur for any given beginning equity. However, the expansion in size of the operation in terms of total assets or sales is much greater than is the increase in net worth and consumption. This increased size is accompanied by a much larger outstanding debt and a higher debt/asset ratio, indicating a greater degree of risk for the operator.

Alternative length of repayment plans on long term debt had almost no effect on growth in terms of net worth and consumption. They do provide flexibility in matching repayment capacity to desired investments and allow the operator to gain ownership control over a larger operation. In addition, deferred payment plans had little merit as an aid to farm income.

Alternative goals led to only small differences in results, but different strategies were pursued through time to achieve these results.

Appreciation of land values led to increased purchases of land at earlier points in time and allowed a greater portion of the total debt load to be in the form of long term debt.

Repeal of investment credit would reduce the rate of growth of expanding operations, such as those examined, by about 4 percent per year.

Other factors not explicitly examined, which seemed to have a major impact on the actual growth achieved are: family living expenses, the tax structure, land rental, purchase of nonfarm inputs, required initial investments, and management ability.

It appears that results need to be interpreted not only in terms of the primary growth goals, but also in terms of the operator's view of other items such as outstanding debts and family consumption.

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Chapter I

INTRODUCTION

1.1 The Problem Situation

One characteristic of our changing agricultural sector in recent years has been the increasing amount of capital and credit necessary for a profitable farm operation yielding an adequate net farm income. Related to this is the continued outmigration of people from farms, the increasing size of farms, and the decline in number of farms. Changes in the methods of obtaining capital, the acquisition of debt, and the terms of repayment of debt, can either retard or speed up such outmigration. In the future there will continue to be more individuals who desire to farm than there are farms available, and capital needs will increase for the remaining farmers. Therefore, it is important that we gain further knowledge related to the establishment and expansion of farm firms.

In Michigan, dairying has long been the predominant agricultural enterprise. The sale of dairy products has comprised more than one-fourth of the total cash receipts from farm marketings [24].1/ Additional income is received from the sale of dairy animals for milk, breeding purposes, and for slaughter. In the past, large numbers of producers with small herds produced the bulk of Michigan's milk. But in recent years large numbers of farmers have quit dairying. Many of those remaining in dairying have expanded their operations, and average herd size has increased. This larger herd size necessitates a much

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1/ Bracketed numbers refer to items listed in the bibliography.

larger investment compared to former years. These larger investments have also led to increased use of credit for many farm operators. For instance, in 1956 only 2.2 percent of all PCA loans made in the St. Paul District were above $10,000, while in 1966 21.3 percent exceeded this amount [14]. This undoubtedly is also a reflection of the increased annual production costs including substantial purchases of nonfarm inputs.

The average total investment for specialized dairy farms in Michigan State University's farm record project has increased from $86,179 in 1961 to $142,775 in 1967 [7]. The largest 79 of these 290 farms in 1967 had an average investment of $238,070 or nearly one-quarter of a million dollars. These largest farms averaged 84.9 cows and had lower production costs per hundredweight of milk produced than the smaller farms. Farms of this size and larger seem destined to be the primary sources of milk in the next decade and the farms with the greatest promise of returning a profit.

Assuming tomorrow's dairy farms will milk 80-100 cows with the associated investment in land, building, and equipment, how do farmers move from their present farm size situations to these modern large-scale operations? In the United States, farming has traditionally been associated with the concept of family farm. Our values have held this to be a desirable form of control and much of our legislation and social custom have helped to promote this concept. In addition to farm size being limited to a family operation, farmers have felt it best not only to control these resources, but also to have ownership of them. However, individual ownership of farms requires that each successive generation of farmers must accumulate the necessary capital to create their own firms. But if the capital base necessary for a dairy farmer to receive an adequate net income continues to increase, the question of how farmers are going to achieve this increasingly larger task of capital accumulation becomes of greater importance.

Various proposals have been made for alleviating this problem of capital accumulation. Changes in the form of tenure, and primarily corporation farms, are currently a widely discussed change. Other proposals have referred to various forms of integration where capital is furnished by a firm outside the farm production unit, generally in partial exchange for some measure of control of the farm operation. A third general area relates to changes in the institutional means by which farmers gain access to credit. This involves questions about the merit of such credit forms as low-equity financing, permanent or semi-permanent debt, and insured low-equity loans. This is not an all-inclusive listing but illustrates some proposals that are currently being examined to see if they may help to alleviate the problems associated with capital accumulation by individual farmers.

1.2 Objectives of the Study

Various strategies are available to any particular individual as he attempts to create a profitable farm organization. Individual background, motivation, ability, and resources controlled, in addition to outside forces such as general economic conditions can affect the success or failure of these strategies. Hence, the relative importance of these and other variables needs to be assessed. Such analysis can provide insight into the desirability of institutional changes affecting the availability and use of credit by farmers. This research will be oriented toward an examination of changes that could occur within those agencies whose primary function is to extend credit to farmers. Such focus has led to the following objectives:

1. What is the relative importance of different equity levels, down payment requirements, and terms of repayment on the growth of a firm?
2. What are the effects of other factors, such as operator goals or land appreciation on firm growth?
3. How do these factors affect outstanding debt, taxes paid, value of assets controlled and other aspects of the farm business over time?

1.3 General Approach

In a study of firms and how they expand over time it is necessary to have a model which will: (a) incorporate the necessary production, marketing, consumption, and financing relationships; (b) allow adjustments to occur and be recorded on a periodic basis to show adjustment paths through time; and (c) generate measurable output in terms relevant to the questions of growth. There are a number of approaches that could be used to study firm growth with emphasis on capital accumulation by the farm firm. But in order to answer questions about future capital accumulation, and examine the usefulness of institutional practices not yet widely used, it is necessary to adopt a synthetic approach such as a programming or simulation model. For this study a multiperiod linear programming model would seem to be most appropriate. Such a model cannot incorporate as much detail as a simulation model, but it can do a fairly complete job of detailing the internal and external flow of funds and can provide conclusions relevant to the problem.

The basic model is developed for a dairy farm, with production relationships and costs corresponding to dairy farms located in south central Michigan. Only one farm type is considered in the study, corresponding to the increasing trend of specialization on today's farms. The model could readily be modified at a later time to examine effects on other farm types.

Primary emphasis is on financial aspects of the farm operation. To keep the matrix size from becoming too large and unwieldy the production and labor aspects of the farm operation are limited. The bulk of the model is devoted to capital and credit relationships.

1.4 Organization of the Thesis

The organization of the thesis will have a brief review of previous research in the area of capital accumulation and firm growth in Chapter II. Chapter III will present the assumptions of the research model, while Chapter IV will describe the research model and define the restrictions and activities of both the basic model and variations on the basic model.

The latter half of the thesis will present the results and implications of the research. In Chapter V the results of the primary factors examined—beginning equity, down payment requirements, and length of repayment terms—will be presented and a comparison made of their relative importance. Chapter VI will present the results of selected other factors affecting growth such as goals of the operator and appreciation of land values. The implications of these results for both farm operators and farm lenders will be presented in Chapter VII. A summary of the method and of the major conclusions of the research will be made in Chapter VIII.

Chapter II

PREVIOUS RESEARCH

The problems associated with establishing and enlarging farm firms have become a major concern of agricultural economists in recent years. Of special significance has been the process by which the firm increases the amount of capital which it controls and/or owns.

In 1957, Alvin Tostlebe's book, Capital in Agriculture: Its Formation and Financing Since 1870 [32], presented a comprehensive look at long term trends in the accumulation of real capital and the means of financing capital additions and replacements for agriculture. Over this period, financing came largely from gross farm income, with little use of external financing. However, this study was made on an aggregate basis, and what is internal to the agricultural sector is not necessarily internal to the individual farm units. Some farmers are borrowing money and adding to their debt while others are paying off previous debts. Only the difference appears as a debt from external sources, but the actual external financing is greater than this.

In 1959, Edith Penrose's book, The Theory of the Growth of the Firm [28], focused attention on the problem of firm growth in a more general context. It also served to emphasize the dynamic nature of firm growth.

Other studies have attempted to describe how individual firms acquired capital during their periods of growth. In 1964, Brake and Wirth [4] reported on a sample of Michigan farmers. Data were collected from the interviewers from the time of starting farming to 1961. Some farmers started prior to 1930; others as recently as the 1950's. This survey information provided an indication of the process of capital accumulation over time and indicated some of the problems and general relationships.

In the report, firm growth is viewed as occurring in three stages: establishment, expansion, and consolidation. As emphasized in the report, the expansion stage is the one of critical importance to firm growth. At this time, the operator is attempting to increase both his income and his net worth. This expansion stage is, perhaps, the stage most worthy of study.

A 1965 report by Curnutt and Ferber [10] was a cross-sectional study of a sample of central Illinois farmers surveyed in 1961 and 1962. This analysis examined the effects of various characteristics such as age, family size, years in farming, and acres operated on the value of farm assets. Both of the above studies emphasize that younger farmers (who are generally the ones in the expansion stage) try to build farm assets as rapidly as possible, while maintaining sufficient financial assets to meet emergency and family needs. Later years are devoted more to increasing the degree of ownership of assets.

These studies give us insight into the problem of capital accumulation by individual firms. However, they report what happened in the past, and we wish to deal with future needs and the means by which farmers can achieve future growth. In recent years several researchers have attempted to examine these questions using computer-oriented models.1/ The three basic approaches which have been used are:

1/ An excellent discussion of the various computer-oriented models which have been used in the area of firm growth is the article by Irwin [21].

multiperiod linear programming, recursive linear programming, and simulation.

In 1959, Plaxico [29] outlined a theoretical approach to firm growth in a paper presented to the Great Plains Research Technical Committee GP-2. Martin [23] built upon this basic model to study capital accumulation and firm growth of Oklahoma and Texas farms in his 1966 Ph.D. thesis at Oklahoma State University. This analysis utilized a multiperiod linear programming model to examine the effect of hypothesized variables on firm growth at two starting equity situations to obtain specific growth rates over time. The effects on firm growth of land rental, a Keynesian consumption function, and capital rationing were studied. In this model profit maximization gave exactly the same results as four other objective functions. The model considered a 30-year planning horizon with perfect knowledge assumed for the period as a whole.

Johnson [22] used a similar multiperiod linear programming model in his 1965 Ph.D. dissertation at Texas A & M University, but he also introduced probability distributions of crop yields as a source of variation to the farm firm over time. These analyses were initiated at about the same time and examined basically the same hypotheses, but Johnson's analysis injects an element of uncertainty. Both Martin's and Johnson's analyses tend to confirm the intuitional ideas that more conservative investment policies and more liberal consumption policies tend to restrict investment. However, neither study examined alternative credit policies for land purchase, nor did they include the progressive income tax in the analysis.

Another approach to examining the question of firm growth and capital accumulation is recursive programming. Recursive programming solves for an optimum program in a single period, such as one year, subject to several flexibility constraints limiting the change of several variables to that consistent with past behavior. The output for one period then determines the resources available at the start of the next period. Heidhues [17] has used this technique in studying farm adjustment in northern Germany.

The final approach to be discussed here is that of simulation. Simulation model is a term which is not easily defined, since it refers not to a basic mathematical form of a model, but rather to a class of models utilizing the idea that, ". . . in a general way, simulation is some representation of reality " [29, p. 23]. In fact, each of the previous models is an attempt to "represent reality". But each of the prior models utilized some analytical optimizing procedure to determine the optimum solution. Simulation models vary in their formulation, but none guarantee that the solution given is an optimum solution. The simulation models generally have more flexibility in terms of accounting for various facets of any situation to be examined. But this flexibility is not costless. The complexity of defining and validating detailed decision processes within a simulation model is very time consuming. In fact, due to the complexity and manpower requirements in building many of the simulation models, it is imperative that they be designed and utilized for several research projects, with successive projects building on earlier projects. The work of Eisgruber and others at Purdue University illustrates such a procedure. The initial simulation program was written by Eisgruber [13] to simulate a farm operation. The program was altered and expanded by Patrick [27] to examine the effects of levels of management efficiency, interest rates, and length of loans. Additional modifications have been and are being made to the simulation by other research personnel.

Each of the above approaches has merit in the overall approach to studying capital accumulation by the farm firm. But in order to answer questions about future capital accumulation, and deal with institutional practices that have not previously existed, it is necessary to adopt a synthetic approach such as the programming or simulation model. This research utilizes a multiperiod linear programming model.

Chapter III

ASSUMPTIONS OF THE RESEARCH MODEL

Research models must abstract from reality and emphasize those items which seem to be most crucial to the problem under study. In order to limit the problem to manageable size, many relatively insignificant items are ignored, and certain conditions and parameters are hypothesized for items which must be explicitly accounted for in the analysis. Any conclusions which are made from the analysis must be interpreted in light of these basic assumptions.

3.1 Physical Location

The study area is assumed to be the general area of south central Michigan. This has been the area of greatest concentration of dairy farms in Michigan. At least in the short run, this area should continue as a primary dairy-producing area with its combination of natural resources suited to dairying and its proximity to a large metropolitan market. Future changes in milk marketing laws or the rapid acceptance of milk substitutes could alter the situation.

It is also assumed that within this general area, dairy farming would primarily be found on a soil group designated S_2 [see 8]. These soils rank second in productivity in a four-part classification of Michigan soils. They are typically loam-clay-loam soils with Miami and Conover as representative soil types. The land is level to rolling and durable under cultivation except on the steeper slopes.

3.2 Production Technology

It is assumed that the managerial ability of the operator is above average for both crop and livestock production. Above average management can be defined as the level of management (and corresponding technology) required to obtain yields intermediate between present average yields, and the highest yields presently attained experimentally or by a few producers.

Crop production is assumed to use four-plow power units and associated machinery. The assumed per acre yields for each crop are: 85 bushels of corn for grain, 16 tons of corn silage, 6.4 tons of haylage, 3.2 tons of hay, and 9 tons of oat silage.

Dairy production assumed a herd averaging 13,000 pounds annual production. All replacement stock is assumed to be raised, but cows for expansion purposes are purchased. All feed except supplement and mineral is produced on the farm. Feed is stored in tower silos with unloaders and a mechanized feed handling system. Housing is assumed to be a cold-covered enclosed facility with free stalls and a liquid manure disposal system. A double-four herringbone milking parlor and milkhouse are part of this housing complex in which the cows are fed, housed, and milked.

3.3 Prices

Prices assumed for products sold and major input purchases are based on current and expected prices for these items (Table 3.1).

3.4 Goals of the Operator and Family

Implicit in the model are several assumptions related to goals of the operator and his family. The first is a desire that the farm firm survive and grow. This implies that annual income must be sufficient to meet all required expenses. At the same time, a minimum level of income is assumed necessary to be used for family living expenses each

Table 3.1 Prices assumed for products sold and inputs purchased

Item	Unit	Price per unit
Milk 1/	cwt.	$ 5.50
Cows purchased	head	350.00
Cull cows	head	160.00
Calves	head	30.00
Corn sold 2/	bushel	.90
Corn purchased 2/	bushel	.95
Urea	ton	110.00
Soybean oil meal	ton	104.00
Hired labor	hour	3.50
Land	acre	350.00

1/ This represents the blend price currently being received for Grade A milk in south central Michigan.

2/ This is the price for 26.5 percent moisture corn sold at harvest time. Moisture is discounted at 1/2 cent per 1/2 percent moisture above 15.5 percent and assumes a cost of 4 cents per bushel for hauling. Assuming a corn price of $1.05 per bushel at harvest time, net sales price would be $.90. By offering $.95 per bushel, corn of similar grade and moisture should be able to be purchased in the area.

year. In addition, it is assumed that the operator, by both ability and inclination, wants to operate a dairy farm with most feed produced on the farm. Subject to these goals, the operator will attempt to combine his labor and investments in such a way as to maximize his consumption and net worth over a period of years.

Chapter IV

THE LINEAR PROGRAMMING MODEL

This chapter presents the general statement of the linear programming (LP) problem to be examined, including a definition of the rows and activities of the basic LP tableau, and a discussion of the variations that will be made from the basic model in order to compare the alternative means of financing expansion of farm firms.

4.1 A General Statement of the Linear Programming Model

The multiperiod LP model to be used in this study corresponds to the general linear programming problem:

Given a set of M linear inequalities or equations in n variables, we wish to find nonnegative values of these variables which will satisfy the constraints and maximize or minimize some linear function of the variables. In matrix notation this can be written as:

$$\text{Max } z = cx$$

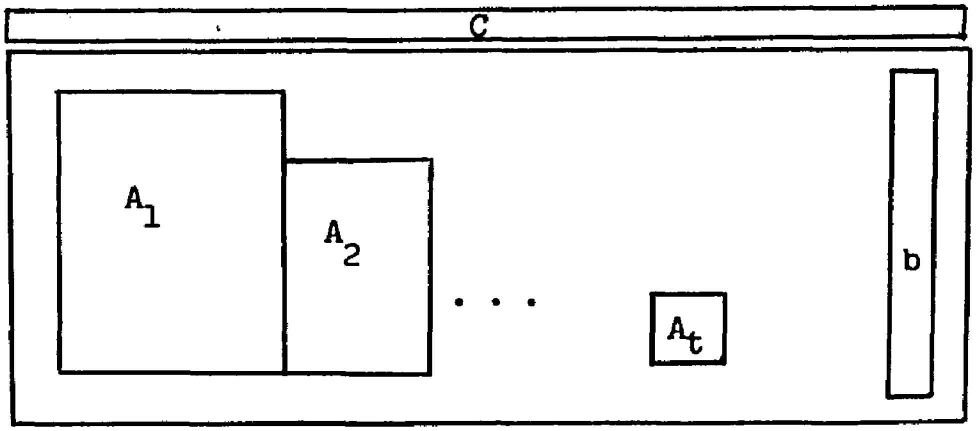
subject to:

$$Ax \leq b$$
$$x \geq 0$$

where A is an mxn matrix, x and c are lxn vectors, and b is an mxl vector [16].

Implicit in the general LP model are the assumptions of linearity, divisibility, additivity, and finiteness [31].

The multiperiod LP model used in this study is formulated according to these basic rules, but it approximates a form called "lower triangular." The tableau can be visualized in matrix form as:



Most nonzero coefficients in the A matrix are found on or below the main diagonal. Each submatrix A_k, $k = 1, \ldots, t$ represents activities initiated in any period of time. Some of these activities affect only restrictions within that time period. Other activities also affect restrictions in one or more of the subsequent time periods. The problem is solved as a unit, and thus, decisions made in period 1 affect those made in later periods and vice versa.1/ The objective function maximizes the value of z for the entire period.

4.2 The Basic Model

The complete basic model encompasses a time horizon of 10 years. Although the farm production sections of the model are quite abbreviated, the base model contains 255 rows and 214 columns. However, only 171 of these rows are constraint rows, as 84 rows merely perform accounting calculations to save time in summarizing

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1/ Irwin [21] suggests that there may be little impact on the solution from feedback of later period decisions. However, this may be a function of the particular model.

the results. Because of the large size of the matrix and the fact that much of the data for each activity is repeated in subsequent periods, only representative portions of the model will be presented. The procedure for developing the complete matrix from the data presented here is explained in Appendix A.

4.2.1 Definition of constraint rows

In the following definitions, each constraint row is identified by the name used in the programming model. The letter or number at the start of each row name designates the year(s) to which the restriction applies: (1) i means that it applies to each of the 10 periods, (2) R shows that it is a summary of that item for all 10 periods, and (3) a specific number means that it applies only in that year.

iLAND — is a constraint on the total acres of land controlled by the operator during that year. Additions through renting can be made on a one-year basis. Additions through purchase are available in the year of purchase and all succeeding years.

iLABOR — corresponds to the annual labor supply available. The initial labor base available is the annual labor supply of the operator and family labor reduced by the hours of labor needed for overhead work. Additional labor can be hired on an annual basis.

iCASH — is the liquid money supply used for purchases and payments. At the start of each year cash is available as the result of income transferred forward from the previous year. Additional cash within each year can be obtained through borrowing.

iSTCR — reflects the institutional limit of credit allowable on short (1-year) or intermediate (5-year) term loans. Short term credit refers to money borrowed for only one year, while intermediate term credit refers to debts which are to be repaid over a 5-year period. The same items are assumed to serve as collateral for these two types of loans, and borrowing for both purposes cannot exceed these credit limits. Collateral for this restriction is equal to 75 percent of the current value of machinery, equipment, feed, and livestock.

iBDCR — reflects the institutional limit on borrowing against collateral in the form of buildings and facilities such as silos. Debts may be contracted with the initial assumptions being 60 percent credit and a 15-year repayment period. (Applies only to years 1, 5, and 9—the only years in which additional investments in buildings are allowed.)

iRECR -- reflects the institutional limit on borrowing against owned land. The initial assumptions are for borrowing up to 60 percent with the debt amortized over a 30-year period. (Applies only to years 1, 5, and 9—the only years in which additional investments in land are allowed.)

iMCHY -- is a constraint on machinery and equipment available for field work. Offsetting annual cash outlays and depreciation maintain the original stock of machinery sufficient to operate 200 acres of land. Additional equipment capacity can be purchased when over 200 acres are operated.

iLSFAC — accounts for the capacity of livestock facilities, housing and feed storage for cows and replacements.

5MPCAP and 9MPCAP -- limits the capacity of the original milking parlor to 130 cows unless expansion of the parlor is made.

iGRAIN — is an equation to allow corn to be fed to dairy stock, to be sold, or to purchase additional grain.

OSALEG — allows raised corn to be either sold or stored in the final year.

iFIXC — is an equality which forces certain fixed costs to be met annually. These costs are for family living, minimum ownership of machinery, and purchase of a milking parlor in year 1.

1OWNLD — is a constraint requiring the owner to purchase a minimum of 80 acres of land in year 1.

RGRAIN — is a constraint to force the final year cropping program to be consistent with the previous year.

iTAXY — is an equation to record the amount of taxable income received each year. Taxable income consists of the capital gain or loss on purchased livestock, 50 percent of the sale price on raised livestock, plus regular income from sales of milk, grain, and other livestock. Allowable expenses include purchased feed, labor, seed, etc., depreciation on investment items, and interest paid on loans. Given that the stated operation is profitable, the positive level of taxable income can be used to levy income taxes, with the balance transferred to after tax income.

iTAXj (j = 1, 2, 3) — are 3 constraints designed to approximate segments of the progressive income tax. The first segment allows taxation at a low rate for the first $2,400 of taxable income. The taxation rate increases as taxable income increases.

iINVCR — is an equation for investment credit.

iTAXES — is an equation for Federal income taxes paid annually and which may be reduced by investment credit.

iATAXY — is an equation for after tax income. This is equal to net income after deducting for income taxes, plus the 50 percent of income received on raised dairy cattle which was not income for tax purposes. Net income after taxes must be great enough to meet the $4000 annual minimum family consumption.

iNCASH — is an equation for the net amount of cash transferred to the succeeding year. It consists of net farm income (minus income taxes and consumption), savings, certain farm expenses and depreciation. Farm expenses which are removed from both the iCASH and iTAXY row must be added back through iNCASH so they are not charged twice as annual expenses. Likewise, depreciation is an expense for tax purposes, but it is not an actual cash withdrawal. Hence, it may be added back into the cash flow. The actual purchase of investment items involves cash payments or acquisition of debts, but depreciation need not be removed from available cash unless it is assumed the money is set aside and saved until replacements must be purchased.

The following equations are simply used to record information that was felt to be of use in summarizing the results. Their inclusion has no effect on the optimum solutions, they merely record certain dimensions associated with the solutions.

iGY — records the total amount of gross income generated annually.

iSTAX — records the total Social Security, State and Federal taxes, after deductions for investment credit, paid annually.

iCNS — records the annual expenditure for family living expenses.

iNETWR — records the net worth of the firm at the end of each year.

iDEBT — records total debt outstanding at the end of each year.

iPRINP — records the total principal payments made each year.

iINTP — records the total interest payments made each year.

iDEPR — records annual depreciation.

RCNS — records the total amount of money allocated to family consumption during the 10-year period.

RTAXY — records the 10-year total of taxable income.

RATAXY — records after tax income for the full 10-year period.

RTAXES — records the total taxes paid for the 10-year period.

4.2.2 Definition of activity columns

The complete basic model contains 214 activities in the A matrix. There are 25 basic activities each year, with 19 of them occurring in each of the 10 years; 1 occurring in the first 9 years only; 1 occurring in years 1, 5, 8, and 9 only; 1 occurring in years 5 and 9 only; and 3 occurring only in years 1, 5, and 9. Activity columns are identified by the name used in the programming model, and the letter or number at the beginning of the constraint indicates whether it occurs in each model period (i) or in only specified years.

In order to concentrate the analysis on the effects of financial decisions, only one grain production and one dairy production possibility are assumed to exist each year. This allows the bulk of the matrix to present investment alternatives, how to finance these investments, and relevant aspects of taxation and consumption. Activities are presented in final matrix form for a single year, as succeeding years can be derived from these activities. The procedure for developing the complete matrix from the data presented here is explained in Appendix A. Background data used to develop certain activity coefficients are given in Appendix B.

Production activities (Table 4.1)

1GRPD -- The grain production activity produces corn which is then available for the dairy enterprise or for sale off the farm. Only one-sixth of the corn produced is assumed to be available for use by the dairy enterprise during the current year. The value of corn produced but not used within the year is added to net worth. Corn is assumed to be harvested as high moisture corn and stored in tower silos if fed to the dairy herd. If sold off the farm it is assumed to be harvested at 26.5 percent moisture and marketed immediately.

In order to maintain essentially the same enterprise combinations as in earlier years the RGRAIN row has entries in the final two years of the matrix to force corn acreage in the terminal year to be as large or larger than the previous year. This simply requires a +1 in the RGRAIN row of the 9DYPD activity and a -1 in the same row of the 0DYPD activity.

1DYPD -- The dairy production activity includes the raising of nurse crops, forage, and replacement dairy stock in addition to milk production. The activity is set up as if the dairy farm had been operating at a given level for some time, with replacements equalling culls. When herd size is expanded, deviations from this pattern have to be accounted for, and this is handled through the buy dairy facilities activity (1BDFC).

Cows and replacements generate intermediate term credit. Taxable

Table 4.1 Production activities for year 1 1/

Row Name	Unit	1GRPD	Dairy Production Activity		
			Forage	Cows	1DYPD
CNC 2/	Dollar				
1LAND	Acre	.97	2.635		2.635
1LABOR	Hour	3.18	18.46	31.5	49.96
1CASH	Dollar	31.86	65.31	84.35	149.66
1STCR	Dollar			-337.5	-337.5
1MCHY	Acre	.97	2.635		2.635
1LSFAC	Cow+R			1.	1.
1GRAIN	Bushel	-13.75		82.5	82.5
1GY	Dollar			-783.5	-783.5
1TAXY	Dollar	31.86	65.31	-673.15	-607.84
1ATAXY	Dollar			-26.	-26.
1NCASH	Dollar	-31.86	-65.31	-84.35	-149.66
1NETWR	Dollar	-74.25	-103.72	-450.	-553.72
2GRAIN	Bushel	-68.75			
2NETWR	Dollar	-61.87			

1/ See appendix tables B.1, B.2, and B.3 for additional details. Negative values in this and succeeding tables in this chapter indicate an addition to the resource or restriction.

2/ The objective function (CNC) given in this and succeeding tables is the discounted present value of consumption for each of the 10 years plus the discounted present value of the activities' contributions to the firm's net worth at the end of the 10th year.

income is a net figure composed of milk sales, sales of calves and cull cows, and cash expenses for crop and livestock production. After tax income represents the income received from the sale of cull cows which is not taxable, i.e., only 50 percent of the sale value of raised dairy cows is taxable, so the additional income is accounted for here. The figure for net worth is based on market value of one cow plus replacement and 5/12 of the value of roughage produced.

Investment activities (Table 4.2)

To reduce the divisibility problem, the activities for investment in land, buildings, and machinery are primarily limited to years 1, 5, and 9. However, since machinery is assumed to be completely depreciated and must be traded in after 7 years, machinery purchases may be made in year 8 to replace any machinery purchased in year 1.

<u>1BMEC</u> -- This activity allows additional machinery and equipment to be purchased when more than 200 acres of land are operated. The investment cost of $70 per acre is based on the per acre investment for machinery and equipment of specialized dairy farmers in southern Michigan as reported in recent Telfarm reports [7]. This per acre investment held fairly constant for the small, intermediate and large size of farm groupings as reported in Telfarm, so no adjustment is made for size of farm.

An additional 20 percent depreciation is assumed to be taken in the first year along with normal depreciation based on a 7-year life and 10 percent salvage value. Hence, if the optimal solution designated 300 acres of cropland for each of the 10 years, it would require 100 units of the 1BMEC activity to be purchased in both years 1 and 8. Depreciation is an expense for taxable income purposes, but this amount

Table 4.2 Investment activities for year 1

Row name	Unit	Activity name			
		1BMEC	1BDFC	5MILKP 1/	1LANC
CNC	Dollar		-138.7	-27.78	-162.1
1LAND-OLAND	Acre				-1.
1CASH	Dollar	70.	1353.22		350.
1STCR	Dollar	-52.5	75.		
1BDCR	Dollar		-539.7		
1RECR	Dollar				-210.
1MCHY-7MCHY	Acre	-1.			
1LSFAC-OLSFAC	Cow+R		-1.		
1GY	Dollar		52.		
1TAXY	Dollar	19.8	257.2		
1INVCR 2/	Dollar	-3.27	-29.02		
1ATAXY	Dollar		26.		
1NCASH	Dollar	-19.8	-231.2		
1NETWR	Dollar	-50.2	-705.08		-350.
1OWNLD	Acre				1.
1DEPR	Dollar	-19.8	-127.48		
2CASH	Dollar		43.75		3.5
2STCR	Dollar	-43.55	75.		
2GY	Dollar		52.		
2TAXY	Dollar	7.2	158.5		3.5
2ATAXY	Dollar		26.		
2NCASH	Dollar	-7.2	-132.5		-3.5
2NETWR	Dollar	-43.0	-688.5		-350.
2DEPR	Dollar	-7.2	-132.5		
3CASH	Dollar		87.5		3.5
3STCR	Dollar	-33.89	45.		
3GY	Dollar		48.		
3TAXY	Dollar	7.2	144.		3.5
3ATAXY	Dollar		24.		
3NCASH	Dollar	-7.2	-120.		-3.5
3NETWR	Dollar	-35.8	-638.25		-350.
3DEPR	Dollar	-7.2	-120.		
4CASH	Dollar				3.5
4STCR	Dollar	-26.85			
4GY	Dollar		40.		
4TAXY	Dollar	7.2	115.		3.5
4ATAXY	Dollar		20.		
4NCASH	Dollar	-7.2	-95.		-3.5
4NETWR	Dollar	-28.6	-590.75		-350.
4DEPR	Dollar	-7.2	-95.		
5CASH	Dollar			100.	3.5
5STCR	Dollar	-21.45			
5BDCR	Dollar		-395.7	-60.	
5RECR	Dollar				-210.

Table 4.2 (cont'd.)

Row name	Unit	Activity name: 1BMEC	1BDFC	5MILKP	1LANC
5MPCAP	Head		1.	-1.	
5GY	Dollar		40.		
5TAXY	Dollar	7.2	99.38	6.67	3.5
5INVCR	Dollar			-7.	
5ATAXY	Dollar		20.		
5NCASH	Dollar	-7.2	-79.38	-6.67	-3.5
5NETWR	Dollar	-21.4	-562.	-93.33	-350.
5DEPR	Dollar	-7.2	-79.38	-6.67	
6CASH	Dollar				3.5
6STCR	Dollar	-16.05			
6GY	Dollar		40.		
6TAXY	Dollar	7.2	90.	6.67	3.5
6ATAXY	Dollar		20.		
6NCASH	Dollar	-7.2	-70.	-6.67	-3.5
6NETWR	Dollar	-14.2	-539.5	-86.66	-350.
6DEPR	Dollar	-7.2	-70.	-6.67	
7CASH	Dollar				3.5
7STCR	Dollar	-10.65			
7TAXY	Dollar		60.	6.67	3.5
7NCASH	Dollar	-7.	-60.	-6.67	-3.5
7NETWR	Dollar		-479.5	-79.99	-350.
7DEPR	Dollar		-60.	-6.67	
8CASH	Dollar				3.5
8TAXY	Dollar		60.	6.67	3.5
8NCASH	Dollar		-60.	-6.67	-3.5
8NETWR	Dollar		-419.5	-73.32	-350.
8DEPR	Dollar		-60.	-6.67	
9CASH	Dollar				3.5
9BDCR	Dollar		-251.7	-43.99	
9RECR	Dollar				-210.
9MPCAP	Head		1.	-1.	
9TAXY	Dollar		60.	6.67	3.5
9NCASH	Dollar		-60.	-6.67	-3.5
9NETWR	Dollar		-359.5	-66.65	-350.
9DEPR	Dollar		-60.	-6.67	
0CASH	Dollar				3.5
0TAXY	Dollar		60.	6.67	3.5
0NCASH	Dollar		-60.	-6.67	-3.5
0NETWR	Dollar		-299.5	-59.98	-350.
0DEPR	Dollar		-60.	-6.67	

1/ This activity was not needed before year 5.

2/ See Appendix Table B.4 for details on calculating investment credit.

is assumed to be included in the cash flow for the farm operation, so an equivalent amount is added to the iNCASH row.

iBDFC -- The buy dairy facilities activity incorporates several different functions: (1) the purchase of dairy housing, feed storage facilities, and mechanical feeding equipment, (2) the purchase of additional cows, and (3) the cost of additional roughage needed in the first part of the year in which the expansion takes place (see Table 4.3). This activity adjusts for the changes necessitated when herd expansion is brought about through the purchase of additional cows, not only in the first year but in later years as well. When no expansion is underway the iDYPD activity coefficients apply. But when expansion occurs the net effect of the iDYPD and iBDFC activities give the proper coefficients for each row.

The basic model assumes there is no existing housing, feed storage for dairy cattle, or dairy cattle. These items must be purchased before the iDYPD activity can enter. And replacements must be purchased for cull cows in the 2nd and 3rd years until raised replacements are available. Thus, there is a cash outlay of $350 for the purchase of 1 cow in year 1, $43.75 for 1/8 cow in year 2, and $87.50 for 1/4 cow in year 3. From year 4 on, the 1/4 cow per unit needed for replacement is available from raised stock through the iDYPD activity. Likewise, although the iDYPD activity accounts for raising the necessary roughage, none will be available for the first 5 months of the expansion year, so a charge is made in the first year of the iBDFC activity.

The adjustments to the iSTCR rows account for the fact that while short term credit is generated in the iDYPD activity for $337.50 based on 1 cow and replacement, when herd size is increased through purchases

Table 4.3 Purchase of dairy facilities, dairy cows, and additional roughage combined in the first 6 years of the 1BDFC activity

Row name	Unit	Buy dairy facilities 1/	Buy dairy cows 2/	Buy additional roughage 3/	1BDFC
CNC	Dollar	-138.7			-138.7
1CASH	Dollar	899.5	350.	103.72	1353.22
1STCR	Dollar		75.		75.
1BDCR	Dollar	-539.7			-539.7
1LSFAC-0LSFAC	Cow+R	-1.			-1.
1GY	Dollar		52.		52.
1TAXY	Dollar	60.	93.48	103.72	257.2
1INVCR	Dollar	-29.02			-29.02
1ATAXY	Dollar		26.		26.
1NCASH	Dollar	-60.	-67.48	-103.72	-231.2
1NETWR	Dollar	-839.50	134.42		-705.08
1DEPR	Dollar	-60.	-67.48		-127.48
2CASH	Dollar		43.75		43.75
2STCR	Dollar		75.		75.
2GY	Dollar		52.		52.
2TAXY	Dollar	60.	98.5		158.5
2ATAXY	Dollar		26.		26.
2NCASH	Dollar	-60.	-72.5		-132.5
2NETWR	Dollar	-779.5	91.		-688.5
2DEPR	Dollar	-60.	-72.5		-132.5
3CASH	Dollar		87.5		87.5
3STCR	Dollar		45.		45.
3GY	Dollar		48.		48.
3TAXY	Dollar	60.	84.		144.
3ATAXY	Dollar		24.		24.
3NCASH	Dollar	-60.	-60.		-120.
3NETWR	Dollar	-719.5	81.25		-638.25
3DEPR	Dollar	-60.	-60.		-120.
4GY	Dollar		40.		40.
4TAXY	Dollar	60.	55.		115.
4ATAXY	Dollar		20.		20.
4NCASH	Dollar	-60.	-35.		-95.
4NETWR	Dollar	-659.5	68.75		-590.75
4DEPR	Dollar	-60.	-35.		-95.
5BDCR	Dollar	-395.7			-395.7
5MPCAP	Head	1.			1.
5GY	Dollar		40.		40.
5TAXY	Dollar	60.	39.38		99.38
5ATAXY	Dollar		20.		20.
5NCASH	Dollar	-60.	-19.38		-79.38
5NETWR	Dollar	-599.5	37.5		-562.
5DEPR	Dollar	-60.	-19.38		-79.38
6GY	Dollar		40.		40.
6TAXY	Dollar	60.	30.		90.

Table 4.3 (cont'd.)

Row name	Unit	Buy dairy facilities 1/	Buy dairy cows 2/	Buy additional roughage 3/	1BDFC
6ATAXY	Dollar		20.		20.
6NCASH	Dollar	-60.	-10.		-70.
6NETWR	Dollar	-539.5			-539.5
6DEPR	Dollar	-60.	-10.		-70.

1/ Cash expense for year 1 is budgeted in Appendix Table B.5. 1BDCR is equal to 60 percent of [$899.50 (cash paid) -accumulated depreciation]. Depreciation is for 15 years, equal to 6-2/3 percent or $60.00 per year. Net worth is based on initial cost minus accumulated depreciation.

2/ See Appendix Tables B.5 through B.11 for additional details.

3/ See Appendix Table B.12 for additional details.

there is something less than 1 cow and replacement available until year 4. The necessary adjustments to the 1TAXY and 1ATAXY rows result from fewer calves and cull cows sold in years 1 to 3, and for differences in expenses and income for tax purposes with purchased versus raised cows.

5MILKP and 9MILKP — This activity provides for the expansion of the milking parlor facilities when the herd size exceeds 130 cows.

1LANC — The purchase of land makes the land available in that and all succeeding years. Real estate credit is assumed to be 60 percent of the land value. From year 2 on, real estate taxes of $3.50 per acre, or 1 percent of the value of the land, must be paid. At the end of each period the full value of the land is added to net worth.

Production resource acquisition and sale activities (Table 4.4)

1LANR — This activity allows additional land to be rented annually

Table 4.4 Production resource acquisition and sale activities, year 1

		Activity name				
Row name	Unit	1LANR	1HLAB	1SGRAN	1BGRAN	1BUYG
CNC	Dollar					
1LAND	Acre	-1.				
1LABOR	Hour		-1.			
1CASH	Dollar	30.	3.5		5.7	.95
1GRAIN	Bushel			1.	-1.	-1.
1GY	Dollar			-5.4		
1TAXY	Dollar	30.	3.5	-5.4	5.7	.95
1NCASH	Dollar	-30.	-3.5		-5.7	-.95
1NETWR	Dollar			5.4	-5.7	-.95
2GRAIN	Bushel			5.	-5.	
2NETWR	Dollar			4.5	-4.75	

at a cost of $30 per acre.1/ Since at least 80 acres of land are required to be owned, it is assumed this is bare land rented for crop use only.

1HLAB — Allows any amount of hired labor to be hired at a competitive wage by the farm operator.

1SGRAN — Allows grain to be sold off the farm at harvest time.

1BGRAN — Allows corn to be purchased at harvest time. Since high moisture corn must be purchased for storage in tower silos, the sum of purchased plus raised grain must be sufficient for the last 2 months of that year and the first 10 months of the following year.

1BUYG — Allows additional grain to be purchased during expansion for the ten-month period until raised grain is available in years 1, 5,

1/ This is approximately 8.5 percent of the assumed land value and corresponds to the current cash rental price in central Michigan. A price of 8 percent of the value of the property is suggested for bare land in Farm Management Handbook [15, p. 80].

and 9.

Borrowing activities (Table 4.5)

The four borrowing activities are differentiated by their source of credit and length of repayment terms. However, in each case they furnish cash which may then be used for any purpose needed within the model. The program determines which source of borrowed funds is most desirable and this can be used up to the limits of that credit source. Having the lending activities defined in this manner will readily show the amounts of the various types of credit used.

Any debt outstanding at the end of the year reduces net worth. Borrowing activities are limited both by the institutional restraints assumed with regard to minimum equity required in various assets and by the repayment capacity of the farm operation.

1BMST — This activity allows money to be borrowed for one year as long as the short term credit limits and the ability to repay are not exceeded.

1BMIT — This activity allows money to be borrowed for a five-year period up to the credit limit and ability to repay. Repayment is made in five equal installments and the short term credit limit is restored as repayments are made.

1BCR15 — This activity permits borrowing against equity in buildings and storage facilities. In the basic model equal payments are made over a 15-year period, again with credit being restored as the principal is retired.

1RCR30 — This activity permits borrowing on a 30-year mortgage using land as collateral. Equal payments are made so as to amortize

Table 4.5 Borrowing activities for year 1

Row name	Activity name			
	1BMST	1BMTT	1BCR15	1RCR30
	dollar			
CNC			.2424	.4045
1CASH	-1.	-1.	-1.	-1.
1STCR	1.	1.		
1BDCR			1.	
1RECR				1.
1NETWR	1.	1.	1.	1.
1DEBT	-1.	-1.	-1.	-1.
2CASH	1.08	.2505	.1098	.0806
2STCR		.8295		
2TAXY	.08	.08	.07	.07
2NCASH	-.08	-.08	-.07	-.07
2NETWR		.8295	.9602	.9894
2DEBT		-.8295	-.9602	-.9894
2PRINP	.1	-.1705	-.0398	-.0106
2INTP	-.08	-.08	-.07	-.07
3CASH		.2505	.1098	.0806
3STCR		.6454		
3TAXY		.0664	.0672	.0693
3NCASH		-.0664	-.0672	-.0693
3NETWR		.6454	.9176	.9781
3DEBT		-.6454	-.9176	-.9781
3PRINP		-.1841	-.0426	-.0113
3INTP		-.0664	-.0672	-.0693
4CASH		.2505	.1098	.0806
4STCR		.4466		
4TAXY		.0516	.0642	.0685
4NCASH		-.0516	-.0642	-.0685
4NETWR		.4466	.8721	.9660
4DEBT		-.4466	-.8721	-.9660
4PRINP		-.1989	-.0456	-.0121
4INTP		-.0516	-.0642	-.0685
5CASH		.2505	.1098	.0806
5STCR		.2319		
5BDCR			.7332	
5RECR				1.
5TAXY		.0357	.0611	.0676
5NCASH		-.0357	-.0611	-.0676
5NETWR		.2319	.8233	.9530
5DEBT		-.2319	-.8233	-.9530
5PRINP		-.2148	-.0487	-.0130
5INTP		-.0357	-.0611	-.0676
6CASH		.2505	.1098	.0806
6TAXY		.0186	.0576	.0667
6NCASH		-.0186	-.0576	-.0667

Table 4.5 (cont'd.)

Row name	Activity name 1BMST	1BMIT	1BCR15	1RCR30
6NETWR			.7712	.9391
6DEBT			-.7712	-.9391
6PRINP		-.2319	-.0522	-.0139
6INTP		-.0186	-.0576	-.0667
7CASH			.1098	.0806
7TAXY			.0540	.0657
7NCASH			-.0540	-.0657
7NETWR			.7154	.9242
7DEBT			-.7154	-.9242
7PRINP			-.0558	-.0149
7INTP			-.0540	-.0657
8CASH			.1098	.0806
8TAXY			.0501	.0647
8NCASH			-.0501	-.0647
8NETWR			.6557	.9084
8DEBT			-.6557	-.9084
8PRINP			-.0597	-.0159
8INTP			-.0501	-.0647
9CASH			.1098	.0806
9BDCR			.4664	
9RECR				1.
9TAXY			.0459	.0636
9NCASH			-.0459	-.0636
9NETWR			.5918	.8913
9DEBT			-.5918	-.8913
9PRINP			-.0639	-.0170
9INTP			-.0459	-.0636
0CASH			.1098	.0806
0TAXY			.0414	.0624
0NCASH			-.0414	-.0624
0NETWR			.5234	.8732
0DEBT			-.5234	-.8732
0PRINP			-.0684	-.0182
0INTP			-.0414	-.0624

the loan over a 30-year period.

Taxation, consumption, and saving activities (Table 4.6)

iTAk (k = 1, . . . , 4) -- The four tax activities allow the rate of taxation to increase from 6.4 to 33 percent. These rates include State and Federal income taxes and Social Security taxes. They are based on a fmaily of 4 using the standard deductions. All taxable income above the $20,000 is taxed at the 33 percent rate.

iREDTX -- This activity allows for reduction in the amount of Federal income taxes paid whenever there is unused investment credit.

iTINVC -- Any unused investment credit is transferred to the following year. This activity appears only in years 1 through 9.

iCS -- This activity allocates after tax income between consumption and savings. The fixed cost activity assures a minimum level of consumption of $4000 and it is assumed that 35 percent of net income after taxes will be used for consumption above this $4000 minimum.1/ The 65 percent for savings is added to the 1NCASH row.

iSAVE -- This activity assumes that unused cash can be deposited in a savings account and earn 4 percent interest.

iTNCAS -- This activity allows the total amount of available cash transferred to the beginning of the following year to be recorded for checking and comparison purposes.

1/ An attempt was made to include a step function to accommodate decreasing rates of consumption and increasing rates for savings. However, since the primary need within the model is for additional cash, the LP routine selected the highest rate of savings activity exclusively. Thus, a single consumption-savings function was developed for the model. Allocating a minimum $4000--and 35 percent of all additional net income after taxes to consumption is based on data on family consumption by Brake [2]. The balance of net income after taxes (65 percent) is then allocated to savings.

Table 4.6 Taxes, consumption, and saving activities for year 1

Row name	Unit	Activity name								
		1TA1	1TA2	1TA3	1TA4	1REDTX	1TINVC	1CS	1SAVE	1TNCAS
CNC	Dollar							-.3241		
1CASH	Dollar								1.0	
1TAXY	Dollar	1.0	1.0	1.0	1.0				-.04	
1TAX1	Dollar	1.0								
1TAX2	Dollar		1.0							
1TAX3	Dollar			1.0						
1STAX	Dollar	-.064	-.174	-.25	-.33	1.0				
1INVCR	Dollar					1.0	1.0			
1TAXES	Dollar		-.109	-.179	-.258	1.0				
1ATAXY	Dollar	-.936	-.826	-.75	-.67	-1.0		1.0		
1CNS	Dollar							-.35		
1NCASH	Dollar							-.65	-1.0	1.0
1NETWR	Dollar							-.35		-1.0
2CASH	Dollar									-1.0
2INVCR	Dollar						-1.0			
RATAXY	Dollar							-1.0		
RCNS	Dollar							-.35		
RTAXY	Dollar	-1.0	-1.0	-1.0	-1.0					
RTAXES	Dollar	-.064	-.174	-.25	-.33	1.0				

Fixed cost activities (Table 4.7)

iFCOST — These activities require: (1) the purchase in year 1, and maintenance thereafter, of equipment to operate 200 acres of cropland; (2) the purchase of a milking parlor, milkhouse, and equipment in year 1; and (3) minimum levels of consumption each year. The first item was required to be purchased in its entirety to reflect the necessity of a minimum stock of machinery. The milking parlor is assumed to be able to handle herds up to 130 cows. Credit generated by these assets is built into the model through the RHS vector, along with machinery capacity, investment credit, and additions to iNCASH from depreciation. The amounts in the iFIXC rows force in the iFCOST activities to the desired level. The value of the milking parlor and the value of the machinery, less their respective depreciation, is added to net worth in each year.

4.2.3 Resource levels

Nonzero initial resource levels are assumed for only a small proportion of the model rows (Table 4.8). The items shown in the RHS for iSTCR, iBDCR, iMCHY, and iFIXC have just been discussed in connection with the iFCOST activities.

The 1OWNLD restraint requires a minimum of 80 acres of land to be purchased in the first year. While cropping operations are readily undertaken on rented land, it is assumed that at least this minimum acreage must be owned before making investments in buildings and facilities.

The operator and his family are assumed to furnish up to 3,000 hours of labor annually. This is less than is reported by Telfarm

Table 4.7 Allocation of fixed investments and minimum family living expenses between iFCOST activities and resource constraints

Activity Name	Row Name	Unit	Required purchases and minimum consumption: Purchase of Machinery 1/	Purchase of Milking Parlor 2/	Minimum Consumption	Total	Model Allocation: iFCOST	RHS
	CNC	Dollar					-1.187	
1FCOST	1CASH	Dollar	14,000	16,800		30,800	11.154	
	1STCR	Dollar	-10,500			-10,500		10,500
	1BDCR	Dollar		10,080		-10,080		10,080
	1MCHY	Acre	-200			-200		200
	1FIXC	Dollar					1.0	3,120
	1TAXY	Dollar	2,000	1,120		3,120	1.0	
	1INVCR	Dollar	-653	-798		-1,451	-.465	
	1ATAXY	Dollar			4,000	4,000	1.282	
	1CNS	Dollar			-4,000	-4,000	-1.282	
	1NCASH	Dollar	-2,000	-1,120		-3,120	-1.0	
	1NETWR	Dollar	-12,000	-15,680		-27,680	-8.872	
	1DEPR	Dollar	-2,000	-1,120		-3,120	-1.0	
	RCNS	Dollar			-40,000	-40,000	-12.82	
2FCOST 3/	1CASH	Dollar	2,000			2,000	.641	
	2STCR	Dollar	-10,500			-10,500		-10,500
	2MCHY	Acre	-200			-200		200
	2FIXC	Dollar					1.0	3,120
	2TAXY	Dollar	2,000	1,120		3,120	1.0	
	2INVCR	Dollar	-93			-93		93
	2ATAXY	Dollar			4,000	4,000	1.282	
	2CNS	Dollar			-4,000	-4,000	-1.282	
	2NCASH	Dollar	-2,000	-1,120		-3,120		3,120
	2NETWR	Dollar	-12,000	-14,560		-26,560	-8.513	
	2DEPR	Dollar	-2,000	-1,120		-3,120	-1.0	

1/ Annual depreciation of $2,000 is assumed to be equal to the annual expenditure necessary to maintain this stock of equipment.

2/ See Appendix Table B.13 for cost of milking parlor.

3/ 3FCOST to 0FCOST and right hand sides for these years are identical to 2FCOST except for the iNETWR entries. In later years these values are: year 3 = -8.154, year 4 = -7.795, year 5 = -7.436, year 6 = -7.077, year 7 = -6.718, year 8 = -6.359, year 9 = -6.000, year 10 = -5.641

Table 4.8 Right-hand side values for basic model

Row name 1/	Unit	Right-hand side
1OWNLD	Acre	80
iLABOR	Hour	3,000
1CASH	Dollar	Variable
iSTCR	Dollar	10,500
1BDCR	Dollar	10,080
5BDCR	Dollar	7,392
9BDCR	Dollar	4,704
iMCHY	Acre	200
5MPCAP	Head	130
9MPCAP	Head	130
iFIXC	Dollar	3,120
iTAX1	Dollar	2,400
iTAX2	Dollar	2,400
iTAX3	Dollar	15,200
iINVCR	Dollar	93
jNCASH	Dollar	3,120

1/ When the first item in the row name is a number, it applies to only that year, a j applies to years 2 through 10, and an i applies to years 1 through 10.

cooperators, since time spent on management activities is included in their estimates.

Cash is assumed available only in year 1 in an amount that varies between computer runs. Three alternative cash levels for year 1 are used in the analysis: $55,000; $70,000; and $95,000. $55,000 is slightly above the minimum amount needed for the operation to expand over time with the basic model. The larger amounts are used to illustrate medium and large size starting situations. The initial cash restriction for years 2 to 10 will always be zero, as the available cash for each of the subsequent years will be determined internally from farm profits and savings.

The restrictions for 1TAX1, 1TAX2, and 1TAX3 reflect the points at which there were significant changes in tax rates. Assuming a family of four, up to $2,400 taxable income, the only tax payable is Social Security. From $2,400 to $4,800 taxable income, both Social Security and Federal taxes are due. Above $4,800, State income taxes are also payable. Social Security reaches a maximum at $7,800 and although State and Federal income tax rates are rising in the range, the 25 percent tax rate was found to be a fairly good approximation for the entire range from $4,800 to $20,000. Above $20,000 taxable income 33 percent is deducted for State and Federal taxes.

4.2.4 Definition of objective functions

In any LP problem the objective function is used to reflect the goals the decision maker is attempting to maximize (or minimize) during the planning horizon. In this study, three objective functions are employed to represent the long-range goals of an individual farm operator (Table 4.9). Although none of these objective functions may be strictly representative of the goals of individual farmers, in conjunction with the satisficing constraints built into the model they should approximate some of the more prominent sets of goals held by individual farmers. These satisficing constraints are the implicit goals of meeting a minimum consumption level and maintaining a solvent and profitable farm operation.

The first objective function (CN) maximizes the net worth of the operation at the end of the 10-year period. The second (CC) maximizes the value of income allocated to consumption over the entire period. And the third objective function (CNC) maximizes an equal weighting of

Table 4.9 Nonzero entries for objective functions of the basic model 1/

Row name	Objective function CN	CC	CNC	Row name	Objective function CN	CC	CNC
	- - -	dollar	- - - -		- - - -	dollar	- - - -
1BDFC	-138.7		-138.7	8BMEC	-16.6		-16.6
1LANC	-162.1		-162.1	8BMIT	.2989		.2989
1BCR15	.2424		.2424	8CS		-.1891	-.1891
1RCR30	.4045		.4045	8FCOST		-.693	-.693
1CS		-.3241	-.3241	9GRPD	-28.66		-28.66
1FCOST		-1.187	-1.187	9BMEC	-19.9		-19.9
2CS		-.3001	-.3001	9BDFC	-318.9		-318.9
2FCOST		-1.099	-1.099	9MILKP	-40.14		-40.14
3CS		-.2778	-.2778	9LANC	-162.1		-162.1
3FCOST		-1.018	-1.018	9SGRAN	2.08		2.08
4CS		-.2572	-.2572	9BGRAN	-2.08		-2.08
4FCOST		-.942	-.942	9BMIT	.3842		.3842
5BMEC	-6.6		-6.6	9BCR15	.4448		.4448
5BDFC	-249.9		-249.9	9RCR30	.4583		.4583
5MILKP	-27.78		-27.78	9CS		-.1751	-.1751
5LANC	-162.1		-162.1	9FCOST		-.641	-.641
5BCR15	.3572		.3572	0GRPD	-34.39		-34.39
5RCR30	.4350		.4350	0DYPD	-222.22		-222.22
5CS		-.2382	-.2382	0SGRAN	2.50		2.50
5FCOST		-.872	-.872	0BGRAN	-2.50		-2.50
6BMIT	.1074		.1074	0BMST	.4632		.4632
6CS		-.2206	-.2206	0BMIT	.4632		.4632
6FCOST		-.808	-.808	0CS		-.1621	-.1621
7BMIT	.2069		.2069	0TNCAS	-.4632		-.4632
7CS		-.2042	-.2042	0FCOST	-2.91	-.594	-3.504
7FCOST		-.748	-.748				

1/ These entries are the discounted present values using an 8 percent discount rate.

total consumption and terminal value of net worth. Each of these objective functions represents the discounted present values of the flow of consumption and/or stock of terminal net worth. The discount rate reflects the time preference for spendable funds and a discount for the uncertainty of future revenues. A discount rate of 8 percent is assumed in computing these values.

In the bulk of the analysis the final objective function (CNC) will be employed under the assumption that farm operators will continue to pursue the goal of building an equity in their farm operation, but not at the complete expense of foregoing an increasing level of consumption. Comparisons with results from the other objective functions (CN and CC) should provide some insight into the relative impact of these two competing goals on the long-run outcomes of the farm operation.

4.3 Variations on the Basic Model

The basic model which has been presented up to this point incorporates prices, yields, personal and institutional behavioral constraints which correspond to those which exist in society today. Optimum solutions will be determined for this basic model maximizing the CNC objective function for the three levels of initial cash. These solutions will be used as the norm to which other solutions, subject to alternative financial constraints will be compared. Such comparisons will help to evaluate the potential effects of alternative financial constraints on minimum equity, length of repayment period, or other strategic variables. The optimum solutions determined by this model do not necessarily represent the outcome which can be achieved by any one individual following such a course of action. But comparisons of these outcomes can serve as the basis for recommending courses of action for a decision maker faced with such alternatives.

The model incorporates a large number of items which can be varied to compare their relative impact on the outcomes as determined by the model. This section describes the various alternatives to be examined and presents the changes that must be made in the coefficients of the LP model.

4.3.1 Goals of the farm operator

Farm operators differ from one another in the goal or set of goals they hope to achieve. The pursuit of one goal may result in a quite different plan through time than pursuit of some different goal or goals. The objective functions presented in Section 4.2.4 allow comparison of three primary goals: (1) maximizing net worth, (2) maximizing consumption, and (3) maximizing an equally weighted combination of net worth and consumption. Each of these primary goals is also subject to meeting the subgoals contained in the matrix itself. These solutions will be compared with the solutions of the basic model. Other runs will only employ the CNC objective function, which is the combination of consumption and net worth.

4.3.2 Equity requirements

Although the prevailing equity requirements from institutional lenders correspond to those in the basic model, it is known that large numbers of borrowers purchase land and other items with lower down payment through other lenders. What might be the effect of lower equity requirements on expanding farm size? What might it imply for financing needs? In order to look at these and similar questions, the equity requirements were reduced from 25 and 40 percent on chattel and real estate loans respectively, to 10 and 20 percent respectively, on such loans.

The changes needed to reflect this in the model are handled through the iDYPD, iBMEC, iBDFC, and iLANC activities and the RHS (Appendix Table A.4). Only the coefficients which change are presented. These values will allow borrowing to be as much as 90 percent on the purchase of chattel items and up to 80 percent on the purchase of real estate.

Comparisons of each of these solutions will be made with the basic solutions. The joint effects of initial cash, equity requirements, and length of repayment period will also be examined from the standpoint of determining their relative importance on capital accumulation.

4.3.3 Length of repayment period

The entrance of the Federal government into the field of agricultural credit early in this century was instrumental in providing farm loans that allowed for amortization of the loan and repayment over a longer period of time than was previously possible. But what are the relative effects on farm expansion of a 40-year loan versus a 20- or 30-year loan? Will the longer loan allow the operator to gain control of significant amounts of additional capital?

To reflect differing lengths of repayment periods in the model, additional long term borrowing activities are developed (Appendix Table A.3). The iBCR10 activities are for investments in buildings and facilities and assume a repayment period of 10 years. Real estate debts can alternately be financed for 20 or 40 year periods through the iRCR20 or iRCR40 activities. Three combinations of those borrowing activities will be examined: (1) iBCR10 and iRCR20, (2) iBCR15 and iRCR30 (as in the basic model), and (3) iBCR15 and iRCR40.

An innovative means by which real estate might be financed involves deferring principal payments for a number of years while the new organization is becoming established. Then the farm operation may be able to more easily repay the debt out of a higher level of income.1/ This possibility is presented in the iDPA10 and iDPA25 activities. These activities completely amortize the debts in about the same number of years as the iBCR15 and iRCR30 activities assumed in the basic model. However, the deferred payment activities require only interest payments for the first four years and then the loan is repaid over the later years of the loan. These activities are assumed to be available to the borrower in years 1 and 5 only. By the 10th year the farm operation should be solvent enough to use conventional mortgages.

4.3.4 Removal of investment credit allowance

The basic model incorporates investment credit which can be used as a direct reduction of Federal income taxes. In view of the current discussions of tax law revisions, including the suspension of investment credit, it seems useful to examine the potential benefit of

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1/ The Federal Land Bank Associations are able to make some loans of this type. However, it is the author's impression that these are being used by older farmers with substantial equity who desire cash for other purposes rather than to help young farmers become established or expand their farm operations.

investment credit on the establishment and growth of a farm firm. Most runs will be made including investment credit. Removal of the iFEDTX activities for each year are the only changes that need to be made in any version of the model to exclude investment credit. Again comparisons will be made only with the set of solutions from the basic model.

4.3.5 Appreciation of land values

Land values have been increasing more or less steadily for the last three decades. This represents an increasingly larger expense for the operator who is attempting to become established or one who wishes to expand through the purchase of additional land. But appreciation of land values may also provide benefits in the financial side of the farm operation, by providing a larger credit base as the land value increases. Thus, it would seem that appreciation may affect the strategies of when and how to gain control of the land resource.

To examine the effect of appreciation of land values on the production and financial organization of the farm firm, solutions will be obtained with a 5 percent annual rate of appreciation assumed. This leads to three primary changes: net worth of owned land increases over time, credit or borrowing potential increases over time, and purchases of land made at a later point in time are more costly than earlier purchases. To incorporate this possibility into the model, only the iLANC activities must be modified (Appendix Table A.5). Comparisons will again be made with the set of solutions from the basic model.

4.3.6 Lower milk prices

A price of $5.50 per cwt. is assumed in the basic model. But to what extent would expansion be curtailed by lower prices? To examine the impact of lower milk prices, runs were made with the blend prices of milk assumed to be $5.15 and $4.80 per cwt., rather than $5.50 per cwt. as originally assumed. To incorporate this change in the model, it is only necessary to change the iTAXY coefficient for the iDYPD activities. For milk at $5.15 per cwt., iTAXY becomes -$562.34, and for $4.80 per cwt., it becomes -$516.84 compared to -$607.84 per cow assumed in the original model.

Chapter V

PRESENTATION AND ANALYSIS OF MODEL RESULTS

5.1 Results of the Basic Model

The linear programming results were organized to more readily present the effects of the various situations on minimum equity, capital accumulation, and level and structure of debt—the major objectives of the study. Thus, some data can be directly obtained from the LP solutions, while other items such as debt payments require additional calculations. The first five sections of the summary tables present data on the annual production, income, expenses, and investments of the farm. The final section provides an annual balance sheet as of December 31 of each year, and traces these measures of growth over time.

Using comparative analysis, the results from alternative formulations of the model are compared with results from the basic model. The initial section presents detailed results for each year for the medium initial cash position used, so as to clearly demonstrate the operation of the multiperiod LP model. Later sections use abbreviated versions of the results, concentrating on the primary items of interest.

5.1.1 Results of the basic model with $70,000 beginning cash

The results for the basic model indicated substantial growth over the 10-year period (Table 5.1). The number of cows milked and the acres used for forage more than doubled during this period. Since these production processes are part of the same activity, they change at the same rate. Corn grain for the dairy herd was produced on the farm the first four years, but purchased off the farm thereafter. All labor for the farm operation was furnished by the farm operator and his family

Table 5.1 Summary of production and financial data for basic model by years and 10-year totals, $70,000 beginning equity

Item	Unit	Year 1	2	3	4	5	6	7	8	9	10	10 Year Totals 1/
Farm Organization												
Cows milked	Head	56	56	56	56	93	93	93	93	119	119	---
Corn for grain	Acre	55	55	55	55	---	---	---	---	---	---	---
Forage production	Acre	148	148	148	148	245	245	245	245	314	314	---
Total acres	Acre	203	203	203	203	245	245	245	245	314	314	---
Input Acquistion or Sales												
Land rented	Acre	123	123	123	123	165	165	165	165	---	---	---
Corn purchased or sold	A.E. 2/	45	1	(3)	15	108	91	87	107	119	139	---
Labor hired	M.E. 3/	---	---	---	---	0.6	0.6	0.6	0.6	1.1	1.1	---
Investments												
Savings account	$1000	---	---	---	---	---	---	---	---	---	2.4	2.4
Machinery	Acre	203	---	---	---	42	---	---	---	69	---	314
Dairy facilities	Cow+R	56	---	---	---	37	---	---	---	26	---	119
Land	Acre	80	---	---	---	---	---	---	---	234	---	314
Income Data												
Gross income	$1000	41.1	41.1	41.6	41.8	68.7	68.7	71.1	71.4	90.7	90.7	626.9
Taxes paid	$1000	0.5	0.7	1.1	2.6	1.6	3.2	4.2	4.3	6.3	5.1	29.5
Investment credit	$1000	0.7	1.2	1.3	0.1	1.3	0.1	0.1	0.1	1.1	0.1	6.1
Net income after taxes	$1000	6.9	9.6	11.2	10.9	12.9	12.8	16.9	17.4	24.5	19.1	142.2
Consumption	$1000	5.0	6.0	6.5	6.4	7.1	7.1	8.5	8.7	11.2	9.3	75.8
Reinvestment income	$1000	1.9	3.6	4.7	4.5	5.8	5.7	8.4	8.7	13.3	9.8	66.4
Building depreciation	$1000	4.5	4.5	4.5	4.5	6.7	6.7	6.7	6.7	8.3	8.3	61.4
Other depreciation	$1000	5.8	6.1	5.4	4.0	6.4	5.5	4.5	3.6	6.2	5.1	52.6
Debt Payment												
Short-term 4/ 5/	$1000	---	27.4	17.6	10.8	---	44.7	30.9	19.0	1.1	13.6	178.7
Buildings 5/	$1000	---	4.4	4.4	4.4	4.4	6.6	6.6	6.6	6.6	8.2	60.4
Land	$1000	---	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	5.3	21.8
Balance Sheet												
Total assets	$1000	167.9	164.4	159.8	156.1	230.6	225.9	219.0	214.0	342.0	342.8	---
Short-term debt 4/	$1000	25.4	16.3	10.0	---	41.4	28.6	17.6	4.3	53.5	44.2	---
Long-term debt	$1000	57.2	55.4	53.5	51.5	69.1	66.0	62.6	59.1	118.7	113.5	---
Net worth	$1000	85.3	92.7	96.3	104.6	120.1	131.3	138.8	150.6	169.8	185.1	---
Debt-asset ratio	Percent	49.2	43.6	39.7	33.0	47.9	41.9	35.6	29.6	50.4	46.0	---

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain. Bracketed figures indicate corn sold.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
5/ Total figures include the payment due on Jan. 1 of year 11. Thus, these totals are also for a 10 year period.

during the first four years. With the expansion in year 5, labor needs increased and 0.6 man equivalents (one M.E. equals 2600 hours of labor) of hired labor were needed in years 5 to 8, and 1.1 M.E. in years 9 and 10. Once the initial supply of operator and family labor is exhausted, the farm organization changes from raising to buying corn for grain. With the added cost for hired labor, it is more profitable to buy all corn for the dairy operation.

Only the minimum requirement of 80 acres of land was purchased in the first year. Slightly more than the minimum of 200 acres of machinery was purchased in year 1.1/ An additional 123 acres of land were rented in each of the first four years and 165 acres in years 5 through 8. All cash for down payment had its greatest utility for investment in dairy facilities. Thus, investment in additional land was deferred until year 9 when the size of the operation had increased. A total of 314 acres was operated in year 10. But if the grain required by the dairy operation had been raised on the farm rather than purchased, it would have required another 139 acres of land with the associated machinery and labor expense.

The section on income data indicates an initial year gross income of $41,100. This provides an indication of size that can be related to the U.S. Census definition of economic class of farms. Taxes paid represent the net tax bill after reduction for investment credit. Primary generation of investment credit occurs in years 1, 5, and 9,

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1/ There are also purchases of approximately 29 acres of machinery made each year to maintain this initial stock of equipment, but only additional purchases are reported in the summary table. The same holds for year 8 replacements of any machinery purchased in year 1 above the 200 acre minimum.

but portions of the credit have been deferred for use in later years. Investment credit can only be used to offset Federal income taxes. The taxes actually paid in years 1 and 2 consist only of Social Security and State income taxes with all Federal income tax offset by investment credit and the balance of the credit deferred to the next year.

Gross income remains fairly constant from year to year, increasing substantially only in years 5 and 9 when additional investments in production units occur. Net income follows this pattern to some extent, but is subject to more fluctuation. Depreciation and most production expenses remain fairly constant between expansion years, but interest on short term debt and purchased feed costs show substantial variation. Whenever the dairy operation expands, additional forage must be purchased for the first 5 months of the operation and additional grain purchased for the first 10 months. This represents a major cash expense in year 1. Payment on short term debt begins in year 2 with the total payment of principal and interest varying from year to year.

Net income after taxes corresponds to net farm income and is the return to unpaid labor, capital, and management. Consumption withdrawals are defined as the payment for unpaid labor and management. The balance of net income after taxes is available for reinvestment purposes or payment on debt.

The importance of accounting for withdrawals for taxes and consumption in as realistic a manner as possible can be seen in this table. Withdrawals for consumption and taxes amount to $105,300 for the 10-year period, and the total would have been at least $6100 more if investment credit had not been accounted for. This amounts to substantially more than the $66,400 that was available for reinvestment over this period. A failure to incorporate realistic figures for family living expenses, Social Security, and income taxes could cause a farm operator who is considering expansion to seriously overestimate his future repayment capacity.

In considering the debt load that can be handled by a firm, Nelson [25] discusses the source of repayment by type of debt. Short term debt for production purposes such as feed and fertilizer can be repaid out of gross income, given that the business is profitable. Debt for depreciable items such as cows, machinery, and buildings can also be paid out of gross income, provided annual depreciation is equal to the payments. Any excess payment over depreciation must come out of reinvestment income. All repayment of debt on land must come out of reinvestment income since land is not depreciable.

This approach affords an opportunity to compare the depreciation charges for assets with the annual cost incurred through debt payment and, thus, can help to identify repayment problems. In line with this approach, the amounts of annual expenses for depreciation from buildings and other depreciable items are reported along with the annual payments required for short term, building, and land debts. It can be seen that depreciation on buildings is nearly equal to the annual payment on building loans. Reinvestment income exceeds the amount needed to repay land debt, with the difference used to meet production expenses and short term debts rather than to pay for additional investment in land.

The final section of the summary table corresponds to annual balance sheets for the farm operation. In addition to total assets and net worth, the debt outstanding at the end of each period is separated as to short term or long term debt. The category short term debt includes both debts of a one-year duration and intermediate term debt which is amortized over a five-year period. The final item is a debt/asset ratio (D/A ratio) providing an indication of the degree of risk of the operation. A high D/A ratio indicates greater leverage for the farm operator and indicates that he has acquired more total assets for a given amount of owned assets than one with a low D/A ratio. But at the same time, the operator's equity is in a more vulnerable position through the principle of increasing risk. This risk is not considered in the model, but it must be taken into account when making recommendations based on these results.

Unless otherwise noted, the model uses only short term (1 year) debt through year 7, and then uses intermediate term or a combination of short term and intermediate term debt the last 3 years considered in the model. Comparing short term debt from the balance sheet sections for any given year with short term debt payment for the following year, it is apparent that intermediate term credit is not used until year 8. The reason for the lack of intermediate term debt use is related to the cumulative costs of short term versus intermediate term debt and the repayment capacity of the assumed production unit. A loan of $1.00 on short term debt requires repayment one year later of $1.08. If necessary, another loan can be granted in the next year on some or all of this money. Conceivably this could continue for 5 years—the length of time involved in using intermediate term credit. A loan of $1.00 on intermediate term credit requires 5 annual payments of $0.2505 or a total cost of $1.2525. In either case the annual cost per dollar outstanding is eight percent. But unless some of this debt is outstanding for the entire 5-year period after the loan is granted, there is no reason to finance it through intermediate term credit. In the context of a long-run planning program such as this one, where repayment capacity is such that very little short term debt is needed beyond the third year following expansion, intermediate term debt is used only when the loan cannot be completely retired within 5 years after the debt is incurred.

The 10-year totals for several items are also summarized. The aggregate impacts of various items can be compared more readily by observing 10-year totals than by checking year-by-year totals. Yearly figures will not be ignored, however, since the timing of returns is also important.

As mentioned in the previous chapter, twc primary constraints on lending are built into the model: (1) repayment capacity, and (2) loan limits based on equity by type of asset. The latter constraint is the limiting one for the basic model. Initial cash, short term credit, building credit, and real estate credit limits were all utilized to the limit in year 1. Available credit was also fully utilized in the expansion years 5 and 9, but short term credit was not fully utilized in intervening years.

5.1.2 Cash flow of the basic model

To further illustrate the model formulation and its effect on interpretation of the results, the cash flows through time are traced for the basic model with $70,000 of initial cash (Table 5.2). The total cash available each year is composed of cash on hand at the end of the previous year, plus money borrowed, plus gross income received during the year. Cash disbursements include investments, interest,

Table 5.2--Annual cash flow of basic model for $70,000 beginning equity

Item	Year 1	2	3	4	5	6	7	8	9	10
	$1,000									
Cash available Jan.1	$70.0	35.6	34.5	33.9	32.8	59.9	58.4	58.4	58.4	73.2
+ Money borrowed	82.6	16.3	10.0	---	61.2	28.6	17.6	4.3	113.4	---
+ Gross income	41.1	41.1	41.6	41.8	68.7	68.7	71.1	71.4	90.7	90.7
	---	---	---	---	---	---	---	---	---	---
(1) Total Cash Available	193.7	93.0	86.1	75.7	162.7	157.2	147.1	134.1	262.5	163.9
Investments	129.2	4.5	6.9	2.0	50.9	3.6	5.2	2.2	121.9	3.2
+ Cash expenses	23.4	14.2	14.1	15.4	37.4	32.3	31.9	33.5	40.8	40.5
+ Interest payments	---	6.0	5.2	4.5	3.6	8.1	6.9	5.8	4.5	12.6
+ Principal payments	---	27.2	18.2	12.0	2.2	44.5	32.0	21.2	4.6	14.5
+ Saving	---	---	---	---	---	---	---	---	---	2.4
+ Taxes	0.5	0.7	1.1	2.6	1.6	3.2	4.2	4.3	6.3	5.1
+ Consumption	5.0	5.9	6.5	6.4	7.1	7.1	8.5	8.7	11.2	9.3
(2) Total cash expenditures	158.1	58.5	52.0	42.9	102.8	98.8	88.7	75.7	189.3	87.6
(3) Cash available Dec. 31 (1)-(2)	35.6	34.5	33.9	32.8	59.9	58.4	58.4	58.4	73.2	76.3

and principal payments on previous loans, other cash expenses, money put into savings accounts, taxes, and consumption. The surplus of cash available over cash expenditures is transferred to the following year. But within each year a further distinction can be made. Cash available January 1 plus money borrowed must equal all expenditures except taxes and consumption. These expenditures primarily occur during the first part of the year and cannot be assumed to be met out of the current year's income. But taxes, which are due later in the year, and consumption, which occurs throughout the entire year, are assumed to be payable from current gross income. Hence, the actual amount transferred to the following year is simply gross income minus taxes and consumption.

In Table 5.1 it can be seen that year 1 has the lowest net income after taxes of any year. From Table 5.2 it can be seen that, although no charges for interest payments are yet incurred, other cash expenses are much greater than for the next three years. This is caused by having to purchase forage for the first 5 months and grain for the first 10 months for the entire herd. In later expansion years, this expense is mitigated since at least part of the herd has been in production and forage and grain are already on hand for those cows. Even without accounting for lower production levels, high cash needs occur in expansion years.

By year 4, cash available on January 1 is sufficient to meet all cash expenses and debt commitments. If intermediate term credit had been used in year 1, payments on this debt would still be required in years 5 and 6, possibly restricting expansion in year 5. These two tables illustrate that the farm operation assumed in the LP model is a profitable one, but the model appears to reflect the economic actions that a farmer may take as he expands his farm operation over time. It is evident that the primary changes take place during the expansion years 1, 5, and 9. Intervening years produce changes which can be anticipated as a result of the actions taken during the expansion years. For example, the investment in dairy facilities implies that additional cows must be purchased the next two years until raised replacements are available. Outstanding debt is reduced and incomes rise in the years between expansion. Accordingly, the presentation of results need only report data from years 1, 5, and 9, and the summary totals, to have the essential data necessary for analysis. Whenever an exception occurs to the general expansion pattern shown in Tables 5.1 and 5.2, it is footnoted in the table and mentioned in the text.

5.1.3 Plans for presentation of other results

As discussed in Chapter 3, several modifications are made in the basic model to test the importance of various items on capital accumulation, debt position, and growth of the farm operation. In order to clarify the items included in each set of results, Table 5.3 indicates a name for each model used and defines the status of each of the items being examined. The basic model that was discussed in Section 5.1.2 is the one titled "N15&30." The letter at the start of the name will indicate whether normal (N) or liberal (L) down payments are required. Items such as "15&30" relate to the length of repayment required—15 years on building debt and 30 years on land purchase debt. CC or CN indicate that the objective function maximizes the discounted present value of consumption or net worth respectively. Models 11 through 17

Table 5.3--Model names and status of variable items for the basic model and variations from the basic model

Model name and number	Items Varied in the Model: Required Down Payment: Chattel	Real Estate	Length of Repayment Period: Bldg.	Land	Objective Function 1/	Other
	-----percent-----		-----years------			
1. N15&30 2/	25	40	15	30	CNC	---
2. N15&30CN	25	40	15	30	CN	---
3. N15&30CC	25	40	15	30	CC	---
4. N15&40	25	40	15	40	CNC	---
5. N10&20	25	40	10	20	CNC	---
6. NDelay	25	40	3/ 14	3/ 29	CNC	---
7. L15&30	10	20	15	30	CNC	---
8. L15&40	10	20	15	40	CNC	---
9. L10&20	10	20	10	20	CNC	---
10. LDelay	10	20	3/ 14	3/ 29	CNC	---
11. NNOCR	25	40	15	30	CNC	No investment credit
12. NAPPR	25	40	15	30	CNC	Appreciation of land
13. NAP&REF	25	40	15	30	CNC	Appreciation of land values plus refinancing every 4 years.
14. N$5.15	25	40	15	30	CNC	Milk at $5.15/cwt.
15. N$4.80	25	40	15	30	CNC	Milk at $4.80/cwt.
16. L$5.15	10	20	15	30	CNC	Milk at $5.15/cwt.
17. L$4.80	10	20	15	30	CNC	Milk at $4.80/cwt.

1/ The CNC objective function maximizes the discounted present value of total consumption over time and the value of net worth at the end of the 10th year. The two values are weighted equally. CN maximizes only the discounted present value of ending net worth. CC maximizes only the discounted present value of consumption.

2/ This is the basic model which is used as the standard of comparison.

3/ Payment of interest only for four years, then the loan is amortized over 10 years for buildings and 25 years for land.

all include 15- and 30-year repayment plans, so the items following N or L are a mnemonic code for the included change in these models.

As pointed out earlier, the primary items of interest centered on the expansion years 1, 5, and 9, and the 10-year totals. Accordingly, throughout this chapter and Chapter VI, only results for these years will be presented with the following modifications. The annual payment due in the following year rather than the current payment made, in each of these years, will be shown in the section on debt payments to illustrate the annual payment required as a result of funds borrowed during the current and previous years. For example, year 1 presently shows no debt payments, but in the shortened summary the debt payments from year 2 will appear in the year 1 column for each type of debt. Also the balance sheet data for year 10 will be entered in the column titled "10-year totals" so that the final equity positions will be available for comparisons.

5.2 Effect of Alternative Repayment Plans on Firm Expansion

5.2.1 Alternative repayment plans with normal down payments

Four models incorporate different sets of repayments with the traditional lending limits: N10&20, N15&30, N15&40, and NDelay (Table 5.4). This order would be expected to correspond to the ranking of assets controlled at the end of the time period. The substitution of long term borrowing activities which change the models from N10&20 through N15&40 result in progressively smaller annual payments to retire the loan, although the longer repayment terms mean that the overall sum of principal and interest will be greater. The NDelay model allows a farmer with limited repayment capacity to expand more rapidly initially,

Table 5.4 Summary of results from the N15&30, N15&40, N10&20, and NDelay models to compare the effect of variations in repayment terms, $70,000 beginning equity

		Model Name															
		N15&30				N15&40				N10&20				NDelay			
		Year			10 Year	Year			10 Year	Year			10 Year	Year			10 Year
Item	Unit	1	5	9	Totals 1/	1	5	9	Totals 1/	1	5	9	Totals 1/	1	5	9	Totals 1/
Farm Organization																	
Cows milked	Head	56	93	119	---	56	93	120	---	56	87	105	---	56	100	127	---
Corn for grain	Acre	55	---	---	---	55	---	---	---	55	---	---	---	54	---	---	---
Forage production	Acre	148	245	314	---	148	246	317	---	148	228	276	---	148	265	334	---
Total acres	Acre	203	245	314	---	203	246	317	---	208	228	276	---	202	265	334	---
Input Acquisition or Sale																	
Land rental	Acre	123	165	---	---	123	166	---	---	123	148	---	---	122	186	---	---
Corn purchased or sold	A.E. 2/	45	108	119	---	45	104	121	---	45	109	100	---	45	97	123	---
Labor hired	M.E. 3/	---	0.6	1.1	---	---	0.6	1.2	---	---	0.5	0.9	---	---	0.8	1.3	---
Investments																	
Savings account	$1000	---	---	---	2.4	---	---	---	2.8	---	---	---	6.2	---	---	---	0.5
Machinery	Acre	203	42	69	314	203	44	70	317	203	25	48	276	202	62	70	334
Dairy facilities	Cow+R	56	37	26	119	56	37	27	120	56	31	18	105	56	44	27	127
Land	Acre	80	---	234	314	80	---	237	317	60	---	196	276	80	---	254	334
Income Data																	
Gross income	$1000	41.1	68.7	90.7	626.9	41.1	69.0	91.2	629.1	41.1	64.0	80.0	586.2	41.1	74.2	96.3	660.6
Taxes paid	$1000	0.5	1.6	6.3	29.5	0.5	1.7	6.3	29.5	.5	1.8	6.4	30.1	.5	1.5	6.6	29.2
Investment credit	$1000	0.7	1.3	1.1	6.1	0.7	1.3	1.1	7.1	.7	1.1	.8	5.7	.7	1.6	1.1	6.4
Net income after taxes	$1000	6.9	12.9	24.5	142.2	6.9	13.1	24.6	142.2	6.9	12.4	23.7	142.0	6.9	13.8	25.2	142.3
Consumption	$1000	5.0	7.1	11.2	75.8	5.0	7.2	11.2	75.8	5.0	7.0	10.9	75.7	5.0	7.4	11.4	75.8
Reinvestment income	$1000	1.9	5.8	13.3	66.4	1.9	5.9	13.4	66.4	1.9	5.4	12.8	66.3	1.9	6.4	13.8	66.5
Building depreciation	$1000	4.5	6.7	8.3	61.4	4.5	6.7	8.3	61.4	4.5	6.3	7.4	58.0	4.5	7.1	8.7	63.8
Other depreciation	$1000	5.8	6.4	6.2	52.6	5.8	6.5	6.3	53.2	5.8	5.7	5.0	48.5	5.8	7.4	6.5	56.2
Debt Payment Due																	
Short-term 4/ 5/	$1000	27.4	44.7	13.6	178.7	27.4	44.9	13.6	178.6	27.4	41.9	12.4	109.0	27.4	48.0	14.4	183.9
Building 5/	$1000	4.4	6.6	8.2	60.4	4.4	6.6	8.2	60.4	5.8	8.1	8.5	74.6	2.8	7.4	10.7	62.2
Land 5/	$1000	1.4	1.4	5.3	21.8	1.3	1.3	5.0	20.4	1.5	1.6	6.5	25.4	1.2	1.5	5.8	22.4
Balance Sheet																	
Total assets	$1000	167.9	230.6	342.0	342.8	167.9	231.5	344.3	345.5	167.9	216.4	298.7	303.3	167.9	246.8	363.5	362.5
Short-term debt 4/	$1000	25.4	41.4	53.5	44.2	25.4	41.6	53.8	44.4	25.4	38.8	47.7	47.1	25.4	44.4	56.5	46.6
Long-term debt	$1000	57.2	69.1	118.7	113.5	57.2	69.8	120.5	115.7	57.2	58.3	85.3	76.3	57.2	81.1	134.6	127.6
Net worth	$1000	85.3	120.1	169.8	185.1	85.3	120.1	170.0	185.4	85.3	118.8	165.7	179.9	85.3	121.3	172.4	188.2
Debt-asset ratio	Percent	49.2	47.9	50.4	46.0	49.2	48.1	50.6	46.3	49.2	45.1	44.5	40.7	49.2	50.8	52.6	48.0

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
5/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

and then make repayment out of a larger income producing unit.

The results do indicate that assets controlled at the end of 10 years follow the pattern discussed above. Cows milked, acres operated, total assets, total debts, and net worth all respond in this manner. N10&20 results show from $40,000 to $60,000 less total assets controlled than the other 3 models. However, because of much smaller debt outstanding, the N10&20 model achieved a net worth within $5000 to $8000 of the 3 other models.

A similar situation occurs with respect to income. Cumulative gross income for the N10&20 model was $40,000 to $75,000 less, yet the net income after taxes, consumption, and reinvestment income are almost identical for the individual years and especially for the 10-year total. Two reasons that may account for the closeness of net incomes are: (1) the time horizon is too short to reflect the actual long-run impacts, and (2) their relative effects are muted due to the fact that repayment capacity is not a limiting factor on the farm operation.

In line with the question of time horizon, it is worth noting that, regardless of repayment plans, all production and financial characteristics for year 1 are identical. Hence, in years one to five, the only differences which occur relate to differences in interest and principal payments and their effects on net income, equity, and reinvestment income. The larger debt payments for N10&20 represent a larger drain on the reinvestment income generated by the farm organization, leading to greater use of short term credit in nonexpansion years. As a result, less cash is available to finance further expansion in years 5 and 9.

Another difference occurs with regard to the balance between short term and long term debt. In year 1, short term debt was about 31% of total debt for all models. In year 10, short term debt was 27% of total debt for NDelay, but represented 38% of total debt for N10&20. This increased need for rates of short term debt is a result of the larger annual payment on long term debt. This difference must come out of net reinvestment income, thus lowering the amount of cash available for other purposes. However, overall, the farm operation expanded relatively fast and should be entering a period of years in which the farm operation would fare much better income-wise than with the other repayment plans. The initial building debt will be fully repaid in year 11, which would lead to an increase in taxable income. But the building depreciation will continue to reduce taxable income until year 16. Thus, net income after taxes of the N10&20 model should increase substantially after year 11.

5.2.2 Alternative repayment plans with liberal down payments

Examining the effect of the alternative repayment plans in conjunction with the more liberal credit terms of 10 and 20 percent equity for purchase of chattel and real estate items respectively, reveals a similar pattern (Table 5.5). The size of the farm organization, investments made, assets, debts, net worth, and D/A ratio again increased as the repayment plan changed from that present in the L10&20 model to those in the L15&30, L15&40, and LDelay models respectively. Likewise, there again are substantial differences in gross income. But net income after taxes, consumption, and reinvestment income for the entire period, are quite similar, although the L10&20 model accumulated 3-4 percent less net income after taxes than the other models. Again, there is a greater reliance on short term debt by the L10&20 model to meet annual expenses.

Table 5.5--Summary of results from the L15530, L15540, L10520, and LDELAY models to compare the effect of variations in repayment terms, $70.000 beginning equity

		Model Name															
		L15530				L15540				L10520				LDELAY			
		Year			10 Year	Year			10 Year	Year			10 Year	Year			10 Year
Item	Unit	1	5	9	Totals 1/	1	5	9	Totals 1/	1	5	9	Totals 1/	1	5	9	Totals 1/
Farm Organization																	
Cows milked	Head	65	130	179	---	65	130	182	---	65	126	154	---	55	141	199	---
Corn for grain	Acre	---	---	207	---	---	---	169	---	---	---	26	---	---	---	184	---
Forage production	Acre	223	343	432	---	223	343	479	---	223	332	407	---	223	372	524	---
Total acres	Acre	223	343	639	---	223	343	648	---	223	332	433	---	223	372	708	---
Input Acquisition or Sale																	
Land rental	Acre	143	58	---	---	143	48	---	---	143	252	---	---	143	---	---	---
Corn purchased or sold	A.E. 2/	150	147	---	---	150	151	---	---	150	122	118	---	150	188	---	---
Labor hired	M.E. 3/	.5	1.3	2.5	---	.5	1.3	2.6	---	.5	1.3	1.8	---	.5	1.6	2.9	---
Investments																	
Savings account	$1000	---	---	---	7.0	---	---	---	8.2	---	---	---	---	---	---	---	4.5
Machinery	Acre	223	120	297	639	223	120	306	648	223	109	101	433	223	149	336	708
Dairy facilities	Cow+R	85	45	49	179	85	45	52	182	85	41	28	154	85	57	57	199
Land	Acre	80	205	354	639	80	215	353	648	80	---	353	433	80	292	336	708
Income Data																	
Gross income	$1000	61.9	96.1	176.0	912.8	61.9	96.1	137.9	916.6	61.9	93.2	117.9	864.9	61.9	104.4	150.4	974.9
Taxes paid	$1000	.3	2.6	6.1	30.2	.3	2.6	5.9	30.0	.3	1.6	8.1	31.1	.3	2.1	5.3	28.9
Investment credit	$1000	.4	1.3	2.8	9.4	.4	1.8	3.0	9.6	.4	1.7	1.4	7.9	.4	2.3	3.3	10.3
Net income after taxes	$1000	5.0	17.9	30.1	157.9	5.0	17.9	30.1	158.1	5.0	14.4	29.9	153.4	5.0	18.4	30.2	159.0
Consumption	$1000	4.4	8.9	13.1	81.3	4.4	8.9	13.2	81.3	4.4	7.6	13.0	79.7	4.4	9.1	13.2	81.7
Reinvestment income	$1000	0.6	9.0	17.0	76.6	0.6	9.0	16.9	76.8	0.6	6.8	16.9	73.7	0.6	9.3	17.0	77.3
Building depreciation	$1000	6.2	8.9	12.2	84.8	6.2	8.9	12.3	35.0	6.2	8.7	10.6	80.8	6.2	9.7	13.5	90.6
Other depreciation	$1000	8.2	9.3	13.1	78.1	8.2	9.3	13.5	78.8	8.2	8.7	7.6	68.0	8.2	10.6	14.9	85.0
Debt Payment																	
Short-term 4/ 5/	$1000	44.9	75.3	27.5	375.0	44.9	75.0	27.8	369.0	44.9	73.2	22.7	392.4	44.8	81.3	30.2	370.9
Building 5/	$1000	8.2	11.7	16.1	111.8	8.2	11.7	16.3	112.2	10.6	14.8	18.0	137.6	5.2	13.5	21.7	118.2
Land 5/	$1000	1.8	6.5	14.4	62.0	1.6	6.2	13.6	58.4	2.1	2.1	11.5	39.8	1.6	7.6	16.5	69.8
Balance Sheet																	
Total assets	$1000	228.2	376.5	535.4	587.2	228.2	380.1	594.8	597.8	228.2	295.4	449.4	447.3	228.2	433.3	654.1	652.2
Short-term debt 4/	$1000	41.5	69.7	134.0	97.8	41.5	69.7	105.4	99.0	41.5	47.8	83.1	80.4	41.5	75.3	114.5	107.4
Long-term debt	$1000	96.7	172.5	274.1	273.4	96.7	176.0	291.4	251.9	96.7	100.2	177.5	160.4	96.7	220.3	335.8	321.1
Net worth	$1000	90.0	134.3	127.3	216.0	90.0	134.4	198.0	216.9	90.0	130.4	188.8	206.5	90.0	137.7	203.8	223.7
Debt-asset ratio	Percent	60.6	64.3	76.3	63.2	60.6	64.6	66.7	63.7	60.6	56.3	58.0	53.8	60.6	68.2	68.8	65.7

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
5/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

The initial farm organization is once more identical in year 1 for each of the four models. Likewise, the changes in farm organization for the four models occur in the same fashion, but the size of the change for the various repayment terms differs according to ability to provide cash to serve as down payment for additional investments.

5.2.3 Summary of effects of alternative repayment terms

Comparison of the results from the models with different repayment terms indicates that delayed payment and longer repayment terms can aid a farm operator in expanding the size of his operation. In terms of total assets, level of production, and gross income, the longer terms help to speed the expansion process. Increases of a lesser magnitude occur in net worth. But this added size also requires a higher level of outstanding debt, a higher D/A ratio with but little increase in net income after taxes, consumption, or reinvestment income. Each of these models assumed the same long-range goals of the farm operator. However, in deciding on the particular strategy to follow, these goals must be considered in line with the other effects arising from contracting long term debt by these various means.

The comparison of results from the N10&20 and N15&40 models illustrates how shorter repayment periods slow down the growth process. Repayment within 10 and 20 years still represents fairly realistic time periods for purchasing buildings and land respectively. But, if lenders try to set up real estate loans on too short a repayment basis, the annual payments can easily become more than the farm operation can handle. On the other hand, if repayment capacity is not limiting, there is little reason to amortize the loan over an extremely long number of years.

5.3 Effect of Alternative Levels of Beginning Cash on Firm Expansion and Minimum Equity Levels

5.3.1 Alternative levels of beginning cash with normal down payments

The effects of varying the level of initial cash can be seen from examining the results for the N15&30 and L15&30 models for $55,000, $70,000, and $95,000 levels of beginning cash. For the N15&30 model the most evident effect is in the scale of operation—both initially and over time (Table 5.6). Increasing the level of beginning cash allows the firm to begin operations on a larger scale in year 1, provides a larger annual gross income, and leads to a larger net income (except for the $95,000 level) and increased net worth. The relative change in most production and investment levels, gross income and balance sheet values is an increase of about 1 1/3 times from the $55,000 to the $70,000 level, and an increase of roughly 1 3/4 times from the $55,000 to the $95,000 level. However, for net farm income after taxes, the increases were more on the order of 1 1/4 times to $70,000 and 1 1/2 times to $95,000. This is associated with the exhaustion of certain fixed resources leading to added cash expenses as output increases. Since farm machinery for 200 acres is required to be purchased in year 1, this represents a fixed cost for the firm whether it is used or not. Likewise, there is no cash expense for up to 3000 hours of labor furnished by the farm operator and his family. Once the scale of the farm operation passes each of these points, the total cost curve becomes steeper and marginal costs are increased for any given farm organization. A third point of change occurs when the number of cows milked exceeds 130, since this necessitates additional investment in milking parlor capacity. In addition, as net farm income increases,

Table 5.6--Comparison of N15530 results for three levels of beginning equity: $55,000, $70,000, and $95,000

		Beginning Equity											
		$55,000				$70,000				$95,000			
		Year			10 Year	Year			10 Year	Year			10 Year
Item	Unit	1	5	9	Totals 1/	1	5	9	Totals 1/	1	5	9	Totals 1/
Farm Organization													
Cows milked	Head	40	66	88	---	56	93	119	---	79	127	156	---
Corn for grain	Acre	38	27	---	---	55	---	---	---	---	---	---	---
Forage production	Acre	105	173	231	---	148	245	314	---	207	334	412	---
Total acres	Acre	143	200	231	---	203	245	314	---	207	334	412	---
Input Acquisition or Sale													
Land rented	Acre	2/ 63	120	---	---	123	165	---	---	127	254	---	---
Corn purchased or sold	A.E. 3/	32	37	123	---	45	108	119	---	140	123	146	---
Labor hired	M.E. 4/	---	0.1	0.5	---	---	0.6	1.1	---	0.4	1.3	1.8	---
Investments													
Savings account	$1000	---	---	---	3.7	---	---	---	2.4	---	---	---	2.2
Machinery	Acre	200	---	31	231	203	42	69	314	207	127	78	412
Dairy facilities	Cow+R	40	26	22	88	56	37	26	119	79	48	29	156
Land	Acre	80	---	151	231	80	---	234	314	80	---	332	412
Income Data													
Gross income	$1000	29.1	48.6	66.5	549.3	41.1	68.7	90.7	626.9	57.5	93.7	118.9	850.9
Taxes paid	$1000	0.3	1.5	3.7	21.2	0.5	1.6	6.3	29.5	0.4	1.8	8.8	36.3
Investment credit	$1000	0.3	1.2	0.8	4.9	0.7	1.3	1.1	6.1	0.5	1.9	1.4	7.8
Net income after taxes	$1000	4.7	12.0	18.0	113.7	6.9	12.9	24.5	142.2	5.6	16.0	31.0	165.6
Consumption	$1000	4.3	6.8	8.9	65.8	5.0	7.1	11.2	75.8	4.6	8.2	13.5	84.0
Reinvestment income	$1000	0.4	5.2	9.1	47.9	1.9	5.8	13.3	66.4	1.0	7.8	17.5	81.6
Building depreciation	$1000	3.5	5.1	6.4	47.2	4.5	6.7	8.3	61.4	5.8	8.7	10.7	79.4
Other depreciation	$1000	4.7	4.5	4.6	41.3	5.8	6.4	6.2	52.6	7.5	9.4	7.4	67.7
Debt Payment													
Short-term 5/ 6/	$1000	22.5	33.2	10.0	162.7	27.4	44.7	13.6	178.7	34.0	61.0	17.4	235.9
Buildings 6/	$1000	3.5	5.0	6.3	46.6	4.4	6.6	8.2	60.4	5.8	8.6	10.5	78.6
Land 6/	$1000	1.4	1.4	3.9	19.0	1.4	1.4	5.3	21.8	1.4	1.4	7.0	25.2
Balance Sheet Data													
Total assets	$1000	134.7	174.9	255.7	256.9	167.9	230.6	342.0	342.8	215.0	300.5	443.9	444.3
Short-term debt 5/	$1000	20.9	30.7	40.1	33.2	25.4	41.4	53.5	44.2	31.5	56.5	68.1	56.1
Long-term debt	$1000	48.3	56.1	88.7	84.8	57.2	69.1	118.7	113.5	69.3	85.2	154.6	147.9
Net worth	$1000	65.5	88.1	126.9	138.9	85.3	120.1	169.8	185.1	114.2	158.8	221.2	240.3
Debt-asset ratio	Percent	51.4	49.6	50.4	45.9	49.2	47.9	50.4	46.0	46.9	47.2	50.2	45.9

1/ Totals may not add due to rounding.
2/ Only 63 acres are rented in year 1, but 120 acres are rented in years 2, 3, and 4. Corn for grain then increases to 101 acres and corn is sold off the farm.
3/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
4/ Man equivalent. One man equivalent is assumed to be 2600 hours.
5/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
6/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

the progressive income tax takes out increasing amounts of cash for taxes. Each of these points is encountered as the amount of beginning cash increases from $55,000 to $95,000, resulting in increased average variable costs and decreased average net returns over this span since gross income increases linearly (given the same farm organization).1/

In addition, in a longer-run context, there are changes in the farm organization as the amount of beginning cash increases. With $55,000 initial cash, the only investment made, other than the required land and machinery purchase, is to invest in dairy facilities for 40 head of cows. Corn is produced for grain and no corn is bought except as needed for expansion.2/ With $70,000 initial cash, investments are again made in dairy facilities, plus machinery for an additional 3 acres of land. No hired labor is needed and grain production is still included. At the $95,000 initial cash level, there is sufficient capital to allow the farm organization to specialize on the dairy enterprise using hired labor and purchased corn. Each of these would imply a different cost curve in the context of a one-year planning horizon as different resources become fixed.

Two other situations can be noted concerning the effect of the different levels of initial cash. First, at the $55,000 level, capital

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1/ Another point of increased cost occurs when more than the required 80 acres of owned land is used. However, the output of all solutions requires more than this amount of land.

2/ In year 1, the corn bought is necessary for feed since the first corn crop is not harvested until 10 months after purchase of cows. But the fact that corn grain acres are nearly identical to cow numbers indicates that in years 2-4 no corn will be purchased. If corn acreage is greater than cow numbers, it is an indication of the number of acre equivalents of corn sold. This is due to the dairy activity requiring 82.5 bushels of corn or .97 acres at the assumed production levels.

is so limiting that only 143 acres are operated in year 1. Thus 67 acres of owned machinery capacity are left idle. However, in years 2 to 4, an additional 67 acres are rented and used to produce grain which is sold off the farm. Since investments can only be made in years 1, 5, and 9, it is more profitable (in terms of the objective function) to make as large an investment in the dairy enterprise in year 1 as possible, then to expand the corn production enterprise in year 2, using rented land and idle machinery capacity.

Second, reinvestment income and net cash available for reinvestment are quite limited during the first year at the $55,000 level, and the only expansion that can be undertaken in year 5 is to increase the size of the dairy herd. This expansion still does not require the full 200 acres for forage production, so the corn grain enterprise is continued at a reduced level to utilize available machinery capacity.

5.3.2 Alternative levels of beginning cash with liberal down payments

Examination of the results of the models incorporating more liberal credit terms reveals differences in scale again to be the major effect (Table 5.7). Likewise, the proportional increase in net income after taxes is less than the increases in production levels, gross income, and balance sheet items. As beginning cash increases from $55,000 to $70,000, the increase in net income after taxes is about 1 1/10 times, while the increase for these other items is about 1 1/5 times. When beginning equity is increased from the $55,000 level to $95,000, the increase is about 1 1/4 times for net income after taxes and about 1 1/2 times for production levels, gross income, and items in the balance sheet.

Table 5.7--Comparison of L15&30 results for three levels of beginning equity: $55,000, $70,000, and $95,000

Item	Unit	Beginning Equity: $55,000 Year 1	$55,000 Year 5	$55,000 Year 9	$55,000 10 Year Totals 1/	$70,000 Year 1	$70,000 Year 5	$70,000 Year 9	$70,000 10 Year Totals 1/	$95,000 Year 1	$95,000 Year 5	$95,000 Year 9	$95,000 10 Year Totals 1/
Farm Organization													
Cows milked	Head	67	105	147	---	85	130	179	---	111	164	225	---
Corn for grain	Acre	22	---	137	---	---	---	167	---	---	---	208	---
Forage production	Acre	178	276	387	---	223	343	472	---	292	431	593	---
Total acres	Acre	200	276	524	---	223	343	639	---	292	431	801	---
Input Acquisition or Sale													
Land rental	Acre	120	2	---	---	143	58	---	---	161	38	---	---
Corn purchased or sold	A.E. 2/	98	102	19	---	150	147	---	---	198	236	---	---
Labor hired	M.E. 3/	.2	.9	1.8	---	.5	1.3	2.5	---	1.0	2.0	3.4	---
Investments													
Savings account	$1000	---	---	---	7.5	---	---	---	7.0	---	---	---	8.4
Machinery	Acre	200	76	248	524	223	120	297	639	292	140	370	801
Dairy facilities	Cow+R	67	38	42	147	85	45	49	179	111	53	61	225
Land	Acre	80	194	250	524	80	205	354	639	131	262	408	801
Income Data													
Gross income	$1000	49.3	77.4	111.4	736.6	61.9	96.1	136.0	912.8	81.0	121.1	170.9	1161.9
Taxes paid	$1000	.5	3.0	4.3	26.6	.3	2.6	6.1	30.2	.3	2.0	6.9	35.5
Investment credit	$1000	.6	1.4	2.2	7.7	.4	1.8	2.8	9.4	.2	2.3	3.7	11.9
Net income after taxes	$1000	6.3	17.5	24.3	142.4	5.0	17.9	30.1	157.9	4.0	18.6	35.3	182.3
Consumption	$1000	4.8	8.7	11.1	75.9	4.4	8.9	13.1	81.3	4.0	9.1	15.0	89.8
Reinvestment income	$1000	1.5	8.8	13.2	66.5	0.6	9.0	17.0	76.6	---	9.5	20.3	92.5
Building depreciation	$1000	5.2	7.4	10.0	70.4	6.2	8.9	12.2	84.8	7.7	11.1	15.2	105.6
Other depreciation	$1000	6.5	7.3	11.1	64.4	8.2	9.3	13.1	78.1	11.4	11.2	16.4	99.1
Debt Payment													
Short-term 4/ 5/	$1000	37.3	61.3	22.7	312.6	44.9	75.3	27.5	375.0	58.7	92.7	34.4	465.2
Building 5/	$1000	6.8	9.7	13.2	92.4	8.2	18.7	16.8	111.8	10.2	14.7	20.4	140.4
Land 5/	$1000	1.8	6.2	11.8	55.6	1.8	6.5	14.4	62.0	3.0	8.9	18.1	83.8
Balance Sheet													
Total assets	$1000	191.2	319.8	481.1	483.4	228.2	376.5	585.4	587.2	304.2	486.6	738.5	739.2
Short-term debt 4/	$1000	34.5	56.8	86.3	81.4	41.5	69.7	104.0	97.8	54.4	85.8	129.9	121.6
Long-term debt	$1000	84.4	153.4	232.1	223.3	96.7	172.5	284.1	273.4	129.9	226.0	357.5	344.0
Net worth	$1000	72.3	109.6	162.7	178.7	90.0	134.3	197.3	216.0	119.9	174.8	251.1	272.6
Debt-asset ratio	Percent	62.2	65.7	66.2	63.0	60.6	64.3	66.3	63.2	60.6	64.1	66.0	63.0

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
5/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

There again is a difference in farm organization in year 1 for the $55,000 level. The initial expansion of the dairy herd is not large enough to require 200 acres of cropland for forage production, so 22 acres of corn for grain are raised in years 1 to 4. However, with the lower down payment requirements, the full 200 acres of machinery capacity is utilized right from year 1.

In year 9, the farm organization turns to production of both the corn grain and the dairy enterprises at all three levels of beginning equity. This combination provides a lower cost of production per cow than would occur if specialization in dairy production had been continued. The low down payment requirements allow a larger sized operation to be controlled than was possible with the normal down payment requirements. By purchasing land, annual costs are reduced since the annual payment plus real estate tax—when a 20 percent down payment is made—is only $25.07 per acre of land, compared to $30.00 per acre for rented land. Likewise, the grain enterprise is not as labor intensive and the farm operation becomes a large user of hired labor. These effects, plus having a large share of net income taxed at the 33 percent rate in years 9 and 10, appear to make it more profitable to diversify the farm operation at that point.

As an indication of how costs are changing, the average cost per cow can be compared including and excluding the grain enterprise in year 9. Although the farm organization differs, all products are marketed through the dairy enterprise in both cases, and so average variable cost per cow provides a basis for comparison. Gross sales minus net income after taxes approximate variable costs. Dividing this figure by cow numbers gives the average variable cost per cow. For the organization shown in Table 5.7 at $70,000 beginning cash, the average cost in year 9 is $587 per cow. When the grain production activities were excluded from the solution, the average variable cost per cow in year 9 rose to $608 for 186 cows. Net income after taxes declined in year 9 from $30,100 to $28,100 and the total for the 10-year period decreased from $157,900 to $155,600. The reduction that occurs in consumption is more than offset by increased net worth when the operation combines both grain and dairy production, and the overall effect is to increase the objective function value.

5.3.3 Summary of effects of alternative beginning equity levels

The amount of equity available to the farm operator when he wishes to expand his farm operation can be seen to have a potent effect on both the speed with which growth can occur and the amount of that growth. If an operation is underfinanced it may not be able to effectively utilize all its resources. Thus, it is necessary for a farm operator and his lender to examine the entire program and see whether the probable success of the operation might be improved by advancing a slightly larger loan than comfortably meets the loan limits based on equity requirements.

There is also a need to consider relative prices and costs as the size of the operation changes. If grain prices are relatively cheap and the operator does not have the land quality or managerial ability for top corn yields, it may be more profitable to purchase all corn for grain. Similar decisions need to be made with other inputs. Likewise, tax management should enter into the decision to determine the probable impacts of income taxes.

5.4 Effect of Alternative Down Payment Requirements on Firm Expansion

The results of the N15&30 and L15&30 models for $70,000 beginning cash illustrate the primary differences resulting from alternative down payment requirements (Table 5.8). As with the comparisons of beginning equity, the predominant difference appears to be the size of operation. The level of production activity, gross income, assets, and debts are from 1 1/2 to 2 times as great under the liberal credit terms as for the normal terms. However, this greatly increased size results in only about a 15 percent increase in final net worth and a 10 percent increase in net income after taxes. This indicates that the average cost per unit of production must be substantially higher for the liberal down payment models.

The ending level of debt outstanding for both operations is large compared to most of today's dairy operations, amounting to $157,700 for normal terms, and $371,200 for more liberal terms. The debt payment for year 10 was $27,100 and $58,000 for the normal and liberal credit terms respectively, with about half consisting of short and intermediate term credit payments in each case. Loans of this magnitude, even the short term debt portion of them, are beyond the legal lending limits of many country banks today. In addition, there are probably few country banks with personnel who are able to properly assess the advisability of loans of this magnitude on a farm operation.

Farm organization differs among some situations that have been mentioned earlier. With normal down payment, the dairy herd does not require 200 acres for forage production, and all corn for grain is raised on the farm during years 1 to 4. But under the liberal down payment requirements, no corn for grain is raised until years 9 and 10

Table 5.8--Summary of results from the N15&30 and L15&30 models to compare the effect of different down payment requirements, $70,000 beginning equity

		Model Name							
		N15&30				L15&30			
		Year			10 Year	Year			10 Year
Item	Unit	1	5	9	Totals 1/	1	5	9	Totals 1/
Farm Organization									
Cows milked	Head	56	93	119	---	85	130	179	---
Corn for grain	Acre	55	---	---	---	---	---	167	---
Forage production	Acre	148	245	314	---	223	343	472	---
Total acres	Acre	203	245	314	---	223	343	639	---
Input Acquisition or Sale									
Land rental	Acre	123	165	---	---	143	58	---	---
Corn purchased or sold	A.E. 2/	45	108	119	---	150	147	---	---
Labor hired	M.E. 3/	---	0.6	1.1	---	.5	1.3	2.5	---
Investments									
Savings account	$1000	---	---	---	2.4	---	---	---	7.0
Machinery	Acre	203	42	69	314	223	120	297	639
Dairy facilities	Cow+R	56	37	26	119	85	45	49	179
Land	Acre	80	---	234	314	80	205	354	639
Income Data									
Gross income	$1000	41.1	68.7	90.7	626.9	61.9	96.1	136.0	912.8
Taxes paid	$1000	0.5	1.6	6.3	29.5	.3	2.6	6.1	30.2
Investment credit	$1000	0.7	1.3	1.1	6.1	.4	1.8	2.8	9.4
Net income after taxes	$1000	6.9	12.9	24.5	142.2	5.0	17.9	30.1	157.9
Consumption	$1000	5.0	7.1	11.2	75.8	4.4	8.9	13.1	81.3
Reinvestment income	$1000	1.9	5.8	13.3	66.4	1.5	8.8	13.2	76.6
Building depreciation	$1000	4.5	6.7	8.3	61.4	6.2	8.9	12.2	84.8
Other depreciation	$1000	5.8	6.4	6.2	52.6	8.2	9.3	13.1	78.1
Debt Payment Due									
Short-term 4/ 5/	$1000	27.4	44.7	13.6	178.7	44.9	75.3	27.5	375.0
Building 5/	$1000	4.4	6.6	8.2	60.4	8.2	11.7	16.1	111.8
Land 5/	$1000	1.4	1.4	5.3	21.8	1.8	6.5	14.4	62.0
Balance Sheet									
Total assets	$1000	167.9	230.6	342.0	342.8	228.2	376.5	585.4	587.2
Short-term debt 4/	$1000	25.4	41.4	53.5	44.2	41.5	69.7	104.0	97.8
Long-term debt	$1000	57.2	69.[illegible]	118.7	113.5	96.7	172.5	284.1	273.4
Net worth	$1000	85.3	120.1	169.8	185.1	90.0	134.3	197.3	216.0
Debt-asset ratio	Percent	49.2	47.9	50.4	46.0	60.6	64.3	66.3	63.2

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
5/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

when all grain is raised on the farm.

The other major difference is that additional purchases of land above the minimum 80 acres occur in year 5 under liberal terms, but not until year 9 under normal down payment terms. As mentioned previously, this is a means of lowering average costs per dollar of revenue from pursuing a mixed strategy of milk and grain production.

Liberal down payment requirements allow the farm operator to acquire control of a much larger operation than under normal terms. This allows a high sales volume to be reached quite early in the expansion process. If the operator received favorable yields and prices for several years and then converted his debts to more conventional terms, he could probably be much better off in terms of net income after taxes at the end of 10 years than is indicated when he continues to expand. However, the danger in this situation is the high debt load and small amount of equity. The risks of loss are much greater if adverse prices or yields occur than for the individual who uses normal down payment financing. Under the liberal terms there is little reserve upon which to obtain additional credit, if needed.

There is also a legal difference between buying with 20 percent down compared to 40 percent down. With less than a 30 percent down payment, the land would likely be bought on a land contract. In case of payment delinquency, the land can be more readily reclaimed by the lender than when the land is purchased with a traditional mortgage.

5.4.1 Minimum equity situations for the N15&30 and L15&30 models

The difference in down payment requirements also makes a substantial difference in the minimum equity necessary to establish a viable operation (Table 5.9). When 25 and 40 percent equities in chattel and real estate items respectively are required, as in the N15&30 model, at least $50,000 beginning cash is needed to establish a farm operation that meets the conditions built into the model. However, lowering the equity requirements to 10 and 20 percent down on chattel and real estate items respectively allows the minimum equity needed to drop to $35,000. Differences of this magnitude are of crucial importance to a young farm operator with good management ability who wishes to expand his dairy operation but is short on equity capital.

Comparing the minimum equity position necessary to begin farming for the N15&30 model with that for the L15&30 model, it can be seen that several other benefits besides the smaller initial equity stem from the lower down payment requirements. Even though the initial equity was $15,000 less, at the end of 10 years each of the production levels, income figures, and all balance sheet items except net worth are greater than for the usual lending rules. However, total debts are nearly double and the D/A ratio is 63 percent compared to 45 percent with normal down payment terms. This, of course, is the element of risk connected with the low down payment. If prices and yields remain favorable, the final outcome will be favorable; but a series of years with low prices and/or yields can more readily lead to bankruptcy for the operator financed beyond normal lending limits.

The fact remains that even $35,000 is more equity than many young farmers possess. An operation of this size and level of technology is still beyond the realm of most beginning farmers unless they have family help. The importance of father-son arrangements may be due to a lack of new tenure forms making it possible for young operators to

Table 5.9 Effect of initial equity position on final size of operation, total income, and final equity position for the N15&30 and L15&30 models

Item	Unit	Beginning cash level 1/ $35,000	$40,000	$45,000	$50,000	$55,000	$70,000	$95,000
N15&30 model								
Cows milked	Head				77.0	88.0	119.0	156.0
Total income	Acre				204.0	231.0	314.0	412.0
Land purchased	Acre		No feasible		204.0	231.0	314.0	412.0
Gross income	$1000				393.7	459.3	626.9	850.9
Net income after taxes	$1000				102.4	113.7	142.2	165.6
Consumption	$1000		solution		61.9	65.8	75.8	84.0
Reinvestment income	$1000				40.5	47.9	66.4	81.6
Total assets	$1000				230.4	261.0	348.1	450.9
Total debts	$1000				104.5	118.0	157.7	204.0
Net worth	$1000				125.9	143.0	190.4	246.9
L15&30 model								
Cows milked	Head	96.0	113.0	130.0	136.0	147.0	179.0	225.0
Total acres	Acre	341.0	402.0	463.0	486.0	524.0	639.0	801.0
Land purchased	Acre	341.0	402.0	463.0	486.0	524.0	639.0	801.0
Gross income	$1000	477.6	562.6	648.3	679.0	736.6	912.8	1161.9
Net income after taxes	$1000	104.4	117.2	129.1	136.9	142.4	157.9	182.3
Consumption	$1000	62.6	67.0	71.2	73.9	75.8	81.3	89.8
Reinvestment income	$1000	41.8	50.2	57.9	63.0	66.6	76.6	92.5
Total assets	$1000	322.1	377.3	431.1	453.9	483.4	593.0	746.1
Total debts	$1000	203.9	238.6	272.6	283.1	304.7	371.2	465.6
Net worth	$1000	118.2	138.7	153.5	170.8	183.7	221.8	280.5

1/ To indicate the necessary minimum equity to begin farming under the assumed conditions, the N15&30 and L15&30 models were submitted with beginning cash successively reduced in $5000 amounts. Solutions were obtained for beginning cash as low as $50,000 for N15&30 and $35,000 for L15&30. Below these amounts the operations could not be established (no feasible solution).

first prove their ability, and then move to an operation where they command sufficient resources to provide an adequate income. Low equity insured loans could be one way to stretch a young operator's equity to gain control of more assets. However, there is also the problem that it would keep some individuals on the farm who would be better off in some other occupation. New tenure forms may be needed if there is a desire on the part of society to retain the individualistic element in farming as we have known it in the past.

5.5 Relative Effects of Alternative Repayment Plans, Beginning Equities, and Down Payment Requirements Examined

The previous sections have independently examined the effects of each of three different variables on certain aspects of farm expansion, when the assumed goals of the farm operator are to maximize a combination of net worth and consumption. But the relative effect of one variable or another cannot be readily obtained from such an analysis. To get some indication of the relative effects of these three variables on each of several measures of growth, totals at the end of year 10 are compared using index numbers (Table 5.10). For each statistic the final year total or value for the $55,000 beginning cash level for the N15&30 model is taken as the base value. The same statistic for other repayment plans, beginning equity levels, and down payment requirements are then calculated as a percentage of this base value. This allows comparison of the effect of the three variables for each growth statistic for 24 different combinations.

For any given item the base number would reflect the combined effect of the three variables. Using the $55,000 beginning equity level for the N15&30 model as a base of 100, the contribution of each

Table 5.10 Comparison of alternative solutions with basic model solution for various measures of growth

Item	Base value	Beginning Equity		Solution title 1/ N15&30	N15&40	N10&20	NDelay	L15&30	L15&40	L10&20	LDelay
	$1000	percent	value	percent of base value							
Gross income	459.3	100	$55,000	100	101	93	106	160	161	151	175
		127	70,000	136	137	128	144	199	200	188	212
		173	95,000	185	186	175	194	253	252	233	271
Net income after taxes	113.7	100	55,000	100	100	99	100	125	125	122	126
		127	70,000	125	125	125	125	139	140	135	140
		173	95,000	146	146	145	146	160	160	157	161
Consumption	65.8	100	55,000	100	100	100	100	115	115	113	116
		127	70,000	115	115	115	115	124	124	121	124
		173	95,000	128	128	128	128	136	136	135	137
Reinvestment income	47.9	100	55,000	100	100	99	101	139	139	134	140
		127	70,000	139	139	138	139	160	160	154	161
		173	95,000	170	170	170	170	193	193	189	194
Total assets	261.0	100	55,000	100	101	88	106	188	192	147	212
		127	70,000	133	134	118	141	229	233	174	254
		173	95,000	173	174	153	183	288	293	217	321
Total debts	118.0	100	55,000	100	102	77	111	258	266	176	303
		127	70,000	134	136	104	147	315	323	204	363
		173	95,000	173	175	136	191	395	404	253	458
Net worth	143.0	100	55,000	100	100	97	102	129	129	122	134
		127	70,000	133	133	130	135	156	156	149	161
		173	95,000	173	173	168	176	196	198	187	204

1/ See Table 5.3, p. 57, for definition of each title.

of the other items to gross income would be calculated as follows: (1) for repayment terms, use the difference between N15&30 and the other 3 models with normal down payment. The effect would be 1 percent for 15&40 years, minus 7 percent for 10&20 years, and 6 percent for NDelay repayment plans. (2) For beginning equity, use the difference between the levels of beginning equity of the N15&30 model. This amounts to 36 percent for the $70,000 level and to 85 percent for the $95,000 level. (3) For liberal down payment terms, use the difference between the N15&30 and L15&30 models at the $55,000 beginning cash level. This indicates an increase of 60 percent resulting from the lower down payment requirements. (4) If the sum of these three items differs from the index of the item being measured, the difference is due to the interaction of the three items. For example, the gross income level achieved by the NDelay model at the $95,000 beginning cash level of 194 percent would have zero contribution from liberal down payment, 6 percent from the repayment plan, 85 percent from increased beginning equity, and 3 percent joint effects. The gross income for the SDelay model at the same level of initial cash is 271 percent and the increase would be composed of the 6 percent for repayment plans, 85 percent for beginning equity level, 60 percent for liberal down payment terms, and 20 percent joint effects. As always, the index number system is partly a function of the base value chosen. But since the basic model with $55,000 beginning cash is near the minimum equity level to begin farming, this solution is used as a base.

It can be seen in the table that the alternative repayment plans represent the least expansionary factor of the three variables examined with the largest increase being 11 percent on total debts for the

NDelay model. At the same time the N10&20 model resulted in a 23 percent decrease in total debts compared to the N15&30 model. With respect to net income after taxes, consumption, and reinvestment income, there was no difference between the different repayment plans for normal lending rules and very small differences under the more liberal credit terms.

The contribution of more liberal down payment terms varied from a low of 15 percent greater for consumption to a high of 158 percent for total debts. There is also a negative joint effect between liberal credit terms and increasing levels of beginning cash for net income after taxes, consumption, and reinvestment income. This is probably related to the underlying cost structure through the range examined.

This negative joint or interaction effect can be seen by comparing the index values for any item under the same repayment plans, but with different down payment requirements. For example, using consumption with the N15&30 and L15&30 models at $55,000 beginning cash, the contribution of lower down payments is to raise consumption for the 10-year period by 15 percent. When beginning cash is $70,000 the table indicates only a 9 percent increase goes to consumption with lower down payment, and at the $95,000 level only an 8 percent increase. Similar comparisons on items such as total debt show a positive interaction between increased beginning cash and lower down payments. This suggests that a farm operator with smaller equity (such as the $55,000 level), who is able to obtain funds under the liberal down payment terms, would be better off in selecting shorter repayment periods. Net worth and consumption would be nearly as great as for longer repayment periods, while total debt and the degree of risk would be much smaller.

In assessing the impact of increasing levels of beginning equity, it is also desirable to note the percentage increase in the amount of initial cash itself and the related effect on each of the statistics in the table. Increasing the amount of initial cash leads to at least proportional increases in all statistics except consumption when going from the $55,000 to the $70,000 level. The increases from $55,000 to $95,000 beginning cash generally result in at least proportional increases for all statistics except net income after taxes, consumption, and reinvestment income. The impact of increasing the initial cash position has the least effect on consumption and net income after taxes, and the greatest effect on gross income. In general, its effect is much more expansionary than is varying the repayment plans, but it is less expansionary than obtaining more liberal credit terms. However, a potential borrower would need to weigh the cost of waiting until additional beginning equity is available against the alternative of following a more liberal credit strategy with the amount he has available.

Knowledge of the relative effects of these variables on possible outcomes can be of importance to both lenders and borrowers. Depending on the goals of the operator, he may decide to choose a different combination when his major desire is to expand the size of the business in terms of size of production units and assets controlled, than if he is primarily concerned with maintaining an adequate income.

From the results presented in the table, for an operator maximizing a combination of annual consumption and net worth, it is of no significance to the operator in terms of consumption which of the four repayment plans considered is chosen. But in terms of final net worth, primarily in conjunction with liberal down payment terms, there is some advantage to be gained from using the shorter 10- and 20-year repayment periods. However, the other items in the table also need to be considered in making the decision especially when using liberal down payment terms. For example, would the delayed payment plan still seem favorable after considering that net income after taxes is no greater, but total debts are roughly 1/5 greater than with regular repayment over 15 and 30 years?

The questions of assessing the importance of these related variables becomes of much greater importance in evaluating the decision of using normal versus liberal down payments in acquiring title to assets. Is an additional 15 percent consumption and 28 percent net worth adequate compensation for assuming the risk of an additional 158 percent of debt? Farm operators with different amounts of beginning equity may choose to follow different strategies as a result of examining the potential outcomes of not only the primary goals of consumption and net worth, but also the outcomes of the related measures.

5.6 Expected Consumption, Net Worth and Debt at the End of 10 Years by Herd Size

If dairy farm operators expand along the lines suggested here, it is evident that the amount of debt outstanding per farm will increase sharply. Brake [3] has estimated that by 1980 the average debt outstanding per farm will be about $48,000 with a D/A ratio of 28.4 percent. For only those farms grossing $40,000 and more of sales annually he estimates total assets in the range of $500,000 by 1980. If these farms had the same D/A ratio as for all farms, this would mean $142,000 debt per farm.

The results of this study suggest the amount of debt that might arise on farms with dairy herds of various sizes from following different financial strategies (Figure 5.1). This diagram shows the outstanding debt at the end of 10 years of expansion. Each line segment represents the debt associated with either normal or liberal down payments and a given repayment plan. The points used to plot the line correspond to the $55,000, $70,000, and $95,000 levels of beginning equity from lowest to highest point repsectively, for all but the N15&30 and L15&30 models. N15&30 begins with the $50,000 level, while L15&30 begins at the $35,000 level and also has observations at the $40,000, $45,000, and $50,000 levels in addition to the usual three.

The diagram illustrates several relationships that have been brought out earlier. Greater expansions of herd size are realized from either (1) increased levels of beginning equity, (2) longer repayment periods, or (3) more liberal down payment requirements.

This diagram also allows the amount of debt outstanding to be estimated for a given herd size from following various strategies.1/ For example, a herd size of 100 cows could be attained by any of 4 borrowing strategies, with the amount of debt outstanding varying roughly from $120,000 for N10&20 to $215,000 for L15&30. Likewise, for a 100 cow herd, consumption in year 10 varies from $9,100 for N10&20 to $7,700 for L15&30, and net worth varies from $175,000 for N10&20 to $120,000 for L15&30 (Figures 5.2 and 5.3). In addition,

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1/ The names correspond to the alternative models defined in Table 5.3 on page 57. In the context of this discussion each name may be thought of as defining a strategy of borrowing, using a given repayment plan and down payment requirements. The N15&40 and L15&40 results are not included since the results are so similar to the N15&30 and L15&30 results.

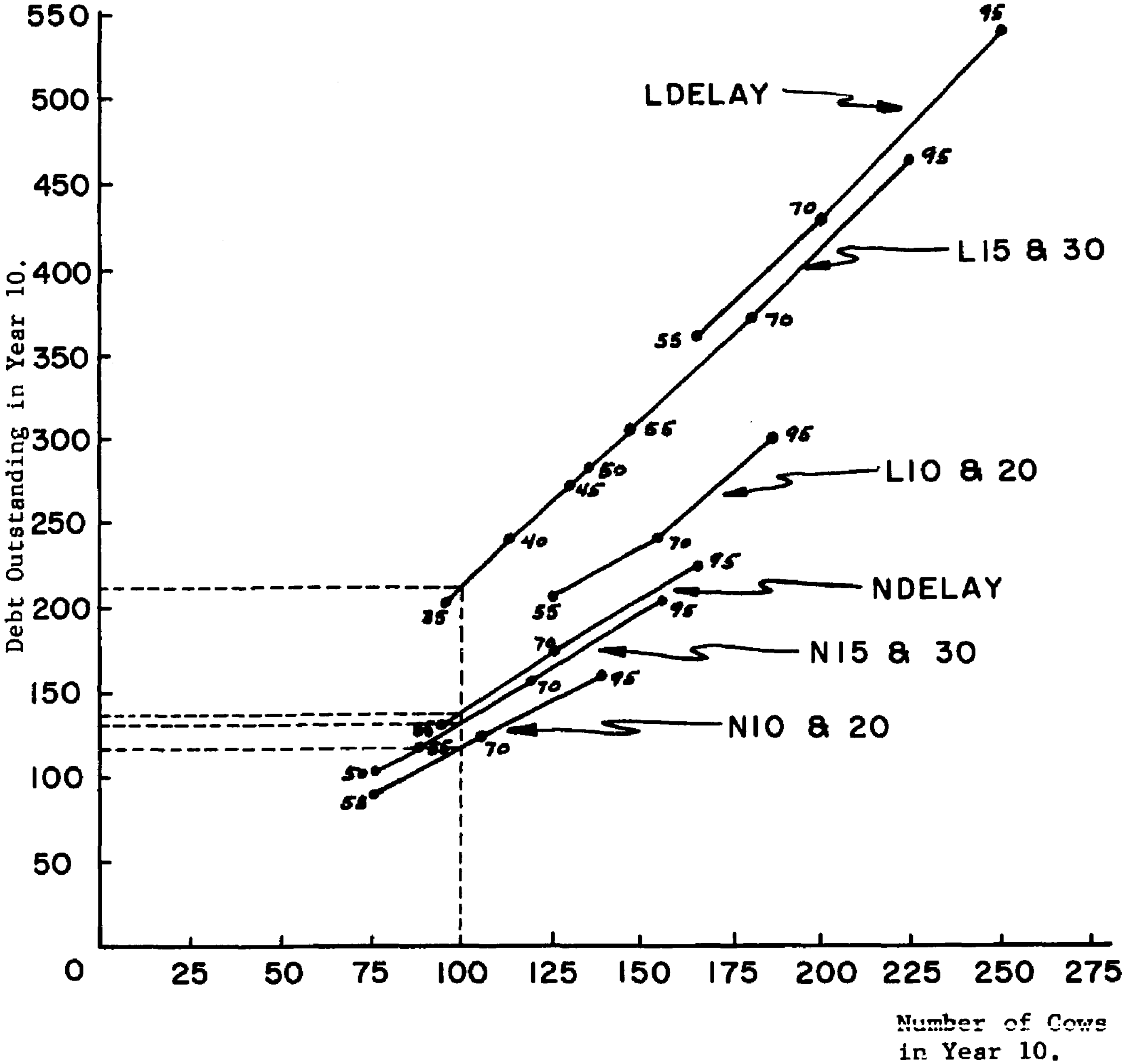

Figure 5.1 Relationship of herd size and outstanding debt at the end of 10 years, by beginning equity, repayment plan and downpayment requirement. 1/

1/ The points on each line correspond to the results of the various models, defined in table 5.3, page 62, for the different beginning equity levels ($1,000). For example, the upper right hand point (95) refers to the $95,000 level of beginning cash for the LDelay model. Because of the linear relationships the points may be connected with straight lines. Interpolation can then be used to estimate the required beginning equity and debt associated with any given herd size.

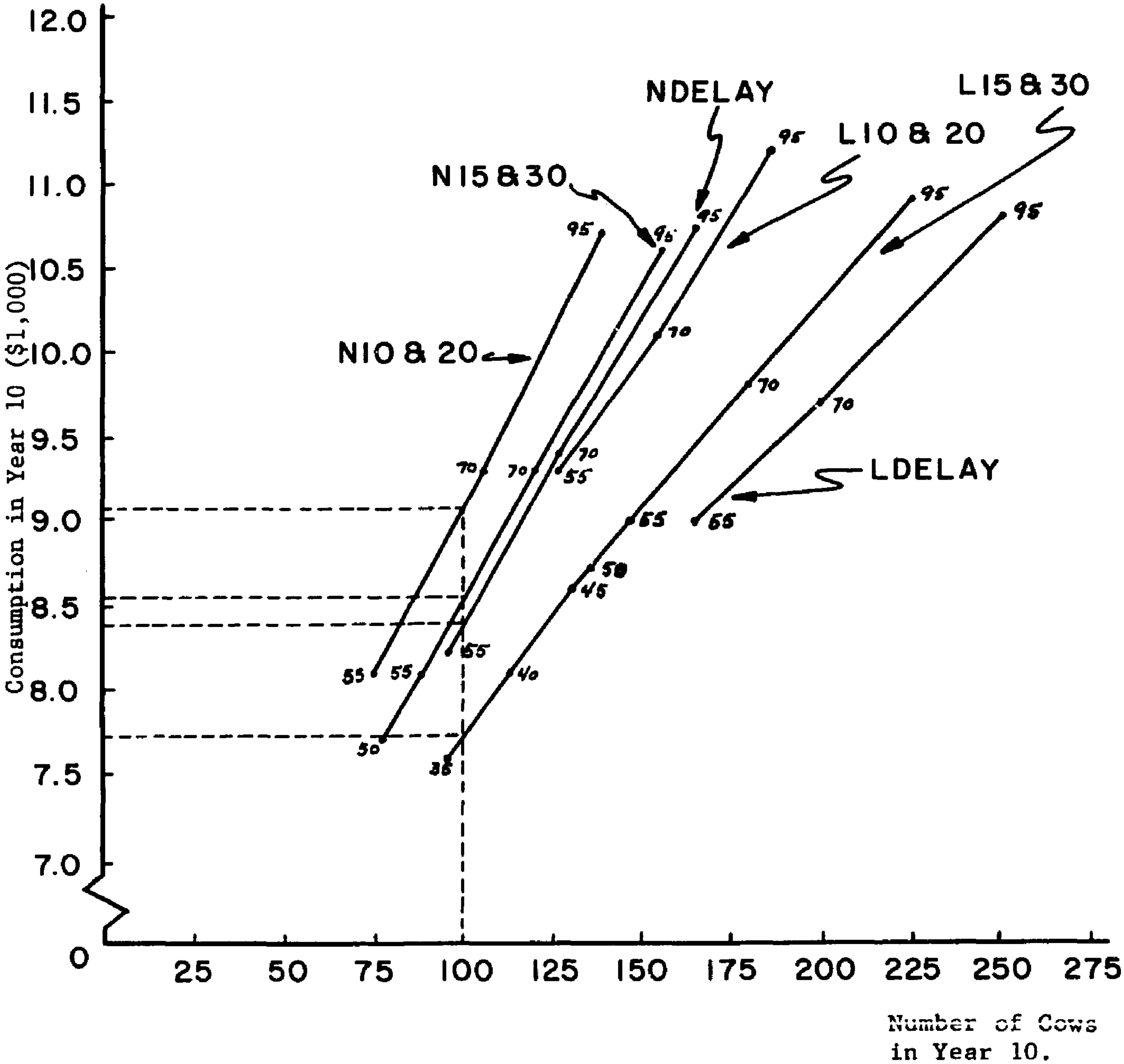

Figure 5.2 Relationship of herd size and annual consumption in year 10, by beginning equity, repayment plan and downpayment requirement. 1/

1/ The points on each line correspond to the results of the various models, defined in table 5.3, page 62, for the different beginning equity levels ($1,000). For example, the upper right hand point (95) refers to the $95,000 level of beginning cash for the LDelay model. Because of the linear relationships the points may be connected with straight lines. Interpolation can then be used to estimate the required beginning equity and consumption associated with any given herd size.

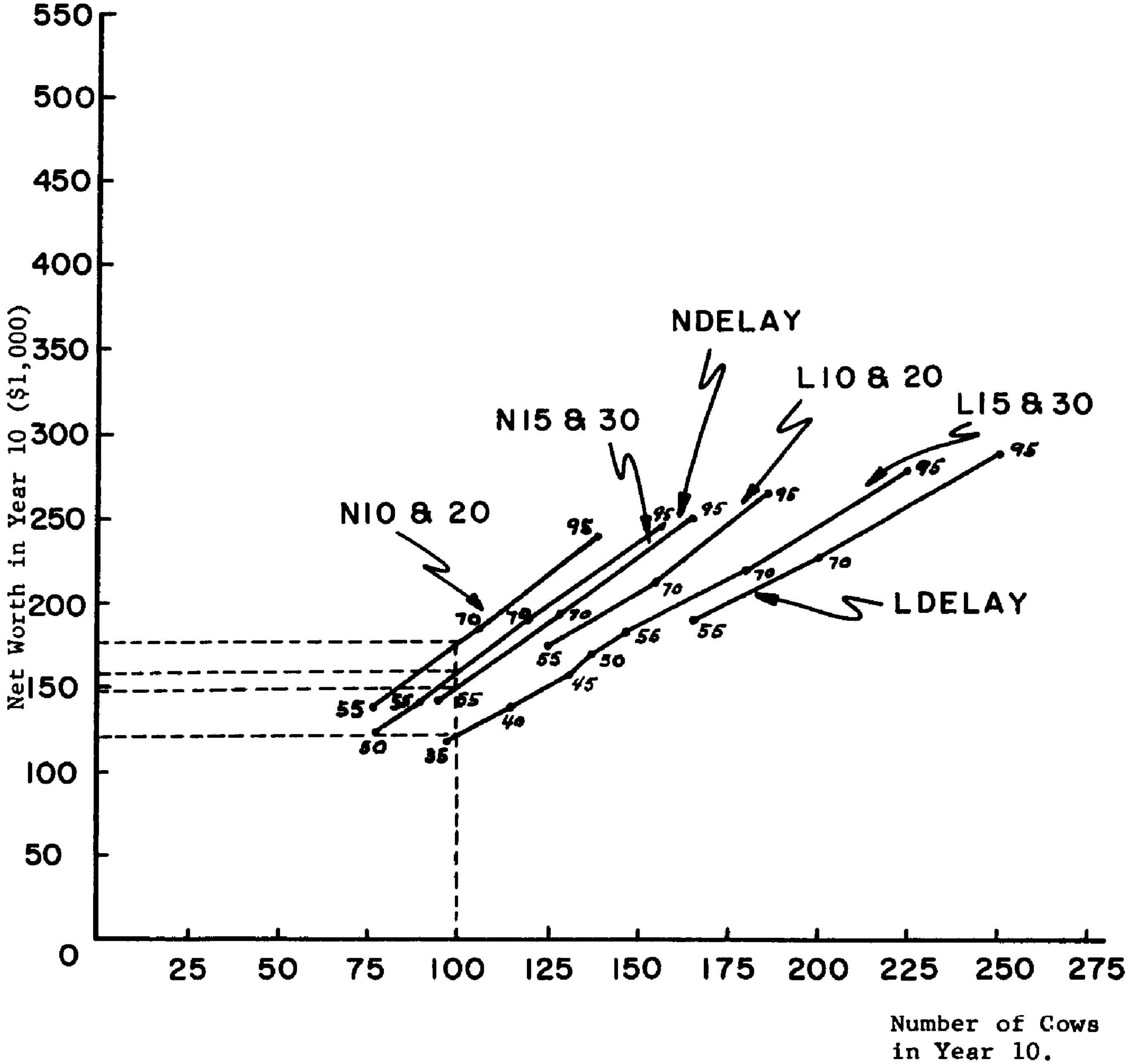

Figure 5.3 Relationship of number of cows and net worth at the end of 10 years, by beginning equity, repayment plan and downpayment requirement. 1/

1/ The points on each line correspond to the results of the various models, defined in table 5.3, page 62, for the different beginning equity levels ($1,000). For example, the upper right hand point (95) refers to the $95,000 level of beginning cash for the LDelay model. Because of the linear relationships the points may be connected with straight lines. Interpolation can then be used to estimate the required beginning equity and net worth associated with any given herd size.

we can estimate the necessary beginning equity associated with a given herd size in year 10 by interpolation between the points for any given strategy. For a 100 cow herd, about $67,000 beginning equity is needed with N10&20 compared to only $37,000 for L15&30.

The L15&30 strategy which requires the least amount of beginning equity for any given herd size, also provides the least net worth and year 10 consumption income, but it has the greatest amount of debt outstanding. This is true for all situations. For any given herd size, moving from shorter to longer repayment periods and/or from normal to liberal down payment requirements, the following occur:

1. The required beginning equity decreases.
2. The amount of net worth decreases.
3. The level of consumption decreases.
4. The amount of debt outstanding increases.

Thus, the dual personality of lower down payments and longer repayment periods are brought out rather clearly. They allow a farm operator with limited capital to obtain a larger production unit per dollar of equity, but he must accept the risk of a greater debt load along with a lower level of consumption and a lower net worth than if his beginning equity were larger.

5.7 Summary of the Effects of Alternative Repayment Plans, Beginning Equities, and Down Payment Requirements on the Growth of the Firm

Three primary variables were examined for their effects on firm expansion. With respect to each variable, the primary effects compared with a given starting cash position were:

1. The extended repayment plans for long term debt made virtually no difference in total consumption, and only

slight increases in net worth. However, they can aid a farm operator in expanding the size of his farm operation. The levels of production, gross income, and total assets were increased with the longer repayment plans, but they were accompanied by an even greater increase in outstanding debt. The shorter repayment plans necessitated a greater amount of the total debt load to be in terms of short term debt. No differences in farm organization occurred as a result of using different repayment plans for long term debt.

2. Increased amounts of beginning equity led to roughly proportional increases in net worth as well as for most other size aspects of the farm: level of production, gross income, total assets, and total debts. However, net income, and especially family consumption, increased less than proportionally. At the lower equity levels and with normal down payments the operation was underfinanced and could not utilize all resources and still make the necessary investments.

   The larger levels of beginning equity allowed the size of the operation to increase, both in year 1 and over time. The interaction of the increased equity and certain fixed resources of the firm also led to changes in farm organization. With normal down payments, only family labor was used and both dairy and grain production took place until the last two years examined for the $55,000 and $70,000 beginning cash levels. With $95,000 beginning cash there was sufficient capital to allow specialization on the dairy enterprise using hired labor and purchased grain. Similar effects were observed for the lower down payments, although the lower down payments seem to act as a substitute for additional beginning cash.

3. Lower down payment requirements brought about modest increases of 10 to 25 percent in consumption and net worth. Increases of 1 1/2 to 2 times occurred for the level of production, gross income, total assets, and debts. The minimum equity necessary to begin a profitable operation was about 30 percent less with the lower down payment requirements.

   The lower down payments allowed specialization in dairy production from year 1 on. The ability to finance more purchases per dollar of equity brought about land purchases in year 5 and discontinuance of renting. Changes in costs led to production of corn for grain in the final two years, rather than greater expansion of the dairy operation.

When the 3 primary variables were examined jointly, their effects were seen to be offsetting in terms of some of the outcomes, and reinforcing in terms of others. Increased beginning equity combined with lower down payments resulted in smaller increases in net income after taxes, consumption, net worth, and reinvestment income. Thus, their mutual effects seem to offset some of their impact when examined independently. But for total assets and outstanding debt, their joint effect was greater than was indicated from the sum of their individual effects. Greater beginning cash and lower down payments are complementary with respect to these items.

Chapter VI

PRESENTATION AND ANALYSIS OF MODEL RESULTS FOR OTHER SELECTED GROWTH VARIABLES

6.1 The Effects of Alternative Goals of the Farm Operator

All results presented thus far have assumed the goals of the farm operators as desiring to maximize a combination of annual consumption and terminal net worth (CNC). The results of the N15&30CN and N15&30CC models illustrate the production levels, investments, and financial positions from pursuing the alternative goals of maximizing only terminal net worth (CN) or annual consumption (CC) respectively (Table 6.1).

6.1.1 The effects of maximizing only net worth

The maximization of net worth alone leads to only a small increase in net worth over that received when the goal was maximizing both consumption and net worth. Only $1700 additional net worth was attained and it was accompanied by a $2600 reduction in total consumption.

There is little difference in the results from the N15&30 and N15&30CN models until year 9. At that point investments in dairy production are emphasized rather than investing in both land and dairy as with the CNC objective function. This reduces total assets and long-term debt while increasing short term debt.

Maximizing net worth alone leads to a much reduced D/A ratio—40.8 percent compared to 45.3 percent. The emphasis on dairy production in year 9 allows gross income to increase sharply for the final two years. And in year 10, this $107,100 gross income is reduced by only $1400 for taxes and $9700 for consumption. Thus, $96,000 in cash is added to final net worth compared with a total of $76,200 cash when

Table 6.1--Summary of results from N15&30, N15&30CN, and N15&30CC models to compare effects of alternative operator goals, $70,000 beginning equity

		Model Name											
		N15&30				N15&30CN				N15&30CC			
		Year			10 Year	Year			10 Year	Year			10 Year
Item	Unit	1	5	9	Totals 1/	1	5	9	Totals 1/	1	5	9	Totals 1/
Farm Organization													
Cows milked	Head	56	93	119	---	56	94	142	---	56	80	80	---
Corn for grain	Acre	55	---	---	---	54	---	---	---	55	---	260	---
Forage production	Acre	148	245	314	---	148	246	374	---	148	211	211	---
Total acres	Acre	203	245	314	---	202	246	374	---	203	211	471	---
Input Acquisition or Sale													
Land rental	Acre	123	165	---	---	122	166	294	---	123	---	---	---
Corn purchased or sold	A.E. 2/	45	108	119	---	46	90	132	---	46	98	(121)	---
Labor hired	M.E. 3/	---	0.6	1.1	---	---	0.6	1.6	---	---	0.4	0.7	---
Investments													
Savings account	$1000	---	---	---	2.4	---	---	---	4.1	---	---	---	4/ 4.3
Machinery	Acre	203	42	69	314	202	44	127	374	203	8	260	471
Dairy facilities	Cow+R	56	37	26	119	56	38	48	142	56	24	---	80
Land	Acre	80	---	234	314	80	---	---	80	80	131	260	471
Income Data													
Gross income	$1000	41.1	68.7	90.7	626.9	41.1	69.1	107.1	661.6	41.1	59.2	75.9	558.7
Taxes paid	$1000	0.5	1.6	6.3	29.5	.5	2.5	5.0	24.7	.5	3.2	4.1	31.5
Investment credit	$1000	0.7	1.3	1.1	6.1	.7	.7	5/	7.0	.7	.8	.9	5.5
Net income after taxes	$1000	6.9	12.9	24.5	142.2	6.9	13.3	18.5	134.8	6.9	15.6	19.6	145.5
Consumption	$1000	5.0	7.1	11.2	75.8	5.0	7.3	9.1	73.2	5.0	8.0	9.5	76.9
Reinvestment income	$1000	1.9	5.8	13.3	66.4	1.9	6.0	9.4	61.6	1.9	7.6	10.1	68.6
Building depreciation	$1000	4.5	6.7	8.3	61.4	4.5	6.7	9.7	64.2	4.5	5.9	5.9	53.4
Other depreciation	$1000	5.8	6.4	6.2	52.6	5.8	6.5	8.8	57.6	5.8	4.9	7.7	48.9
Debt Payment Due													
Short-term 6/ 7/	$1000	27.4	44.7	13.6	178.7	27.4	45.0	16.0	188.9	27.4	39.1	17.9	170.2
Building 7/	$1000	4.4	6.6	8.2	60.4	4.4	6.6	9.6	63.2	4.4	5.8	5.8	52.4
Land 7/	$1000	1.4	1.4	5.3	21.8	1.4	1.4	1.4	14.0	1.4	3.6	8.0	36.0
Balance Sheet													
Total assets	$1000	167.9	230.6	342.0	342.8	167.9	230.6	313.6	315.4	167.9	245.4	343.9	336.6
Short-term debt 6/	$1000	25.4	41.4	53.5	44.2	25.4	41.6	62.5	51.5	25.4	36.2	51.4	37.7
Long-term debt	$1000	57.2	69.1	118.7	113.5	57.2	69.4	82.2	77.1	57.2	89.5	130.2	125.5
Net worth	$1000	85.3	120.1	169.8	185.1	85.3	119.6	168.9	186.8	85.3	119.7	162.3	173.4
Debt-asset ratio	Percent	49.2	47.9	50.4	46.0	49.2	48.1	46.1	40.6	49.2	51.2	52.8	48.5

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Savings occurred in year 4 ($1100) and year 8 ($3200).
5/ $3600 of investment credit was deferred from years 6 through 9 and used in year 10.
6/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
7/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

maximizing both net worth and consumption.

In connection with this final year, when maximizing net worth, investment credit was deferred from years 6 to 9 and used to offset all Federal income taxes due in year 10. The goal of maximizing net worth also led to the use of short term debt to alter the timing of corn purchases in years 4 and 8, so as to have slightly larger amounts of investment capital available in years 5 and 9. This was possible at the expense of lower consumption in years 4 and 8.

While the above comparisons show that slight increases in net worth can be obtained when pursuing that goal alone, the primary implications of pursuing a goal of maximizing net worth rather than maximizing both net worth and consumption may be "when" rather than "how". Increases in consumption and net worth are both dependent on a high level of income, and it appears that maximizing both goals will give a result near to that attained when maximizing net worth alone and at little expense to consumption. The major factor involved when maximizing only net worth may be the time horizon involved and the point at which this net worth is to be maximized.

6.1.2 The effects of maximizing only consumption

Little change occurs in total consumption when the objective is strictly to maximize consumption rather than maximize both consumption and net worth. For the 10-year period, the $1100 increase in consumption was accompanied by a $11,700 decrease in net worth. The result of the N15&30CN model indicated that increased net worth was obtained with only a small reduction in consumption, but the converse indicates how increased consumption levels can seriously inhibit the accumulation of net worth.

The emphasis on change in farm organization is evident from year 5 on. Dairy herd expansion is reduced, and additional land is purchased. In year 9, more land is purchased and used in the production of corn for sale while the herd size remains the same. This organization allows total assets and short term debts to be reduced, while long term debt is greater than for maximizing both net worth and consumption. Less hired labor is required for this organization, thus, reducing cash costs.

The effect on farm organization between the goals of maximizing only consumption or only net worth is quite evident. The emphasis is on expanding the dairy herd with no additional land purchases when maximizing only net worth. But the emphasis shifts to land acquisition and limiting expansion of the dairy herd when maximizing consumption. The emphasis on land ownership reduces gross sales, but allows slightly larger net income after taxes. The investment in land requires a larger cash outlay in the year of purchase than land rental, and this slows the expansion process. However, in terms of operating costs, owned land is less expensive than rented land. An acre of purchased land with 40 percent down, amortized over 30 years, has an annual charge of $16.92 for both principal and interest, of which no more than $13.10 of interest is tax deductible. Coupled with the $3.50 real estate tax, the tax deduction for owned land is at most $16.60 per acre compared to $30.00 per acre for rented land. Likewise, with greater emphasis on grain production rather than milk production, much less expense is incurred for hired labor. The net result is to lower average variable costs per cow and allow the farm organization to achieve slightly larger net income after taxes, despite sharply reduced gross income.

The results of the models incorporating alternative goals of the farm operator indicate that only minor improvements can be made to improve either one singly over what is achieved when both are included in the objective function. But this is not too surprising, given the structure of the model. In order to increase net worth, net income after taxes and reinvestment income need to be large. But increasing net income necessarily increases consumption as well. And the opposite is true for any attempt to increase consumption alone. However, the investments undertaken and the organization of the farm can change to take advantage of differences in average costs and returns.

Although it was not possible to test the idea with the present model, it would seem that other strategies may arise if different time horizons were considered. Over time, the dairy facilities purchased are completely depreciated out and thus make none or only a small contribution to net worth. But land does not depreciate over time, although land values in general may fall. If the relevant time horizon encompassed 25 or 30 years, maximizing net worth alone may lead to a strategy of emphasizing land purchase rather than dairy production.

6.2 The Effects of a Repeal of Investment Credit

An aid to expanding farmers in recent years has been the investment credit provision of the Federal income tax laws. This has allowed a direct reduction of income taxes payable through credit based on investments in machinery, equipment, and buildings with an expected life of 4 or more years. A repeal of this provision would reduce the rate of expansion (Table 6.2). Without the $6100 investment credit, taxes paid increased by $5700, and net income after taxes was reduced by $7000.

Table 6.2--A comparison of results with and without investment credit, $70,000 beginning equity

Item	Unit	Model Name: N15&30 Year 1	N15&30 Year 5	N15&30 Year 9	N15&30 10 Year Totals 1/	NNOCR Year 1	NNOCR Year 5	NNOCR Year 9	NNOCR 10 Year Totals 1/
Farm Organization									
Cows milked	Head	56	93	119	---	56	90	116	---
Corn for grain	Acre	55	---	---	---	55	---	---	---
Forage production	Acre	148	245	314	---	148	238	306	---
Total acres	Acre	203	245	314	---	203	238	306	---
Input Acquisition or Sale									
Land rental	Acre	123	165	---	---	123	158	---	---
Corn purchased or sold	A.E. 2/	45	108	119	---	45	116	118	---
Labor hired	M.E. 3/	---	0.6	1.1	---	---	0.6	1.1	---
Investments									
Savings account	$1000	---	---	---	2.4	---	---	---	10.0
Machinery	Acre	203	42	69	314	203	36	67	306
Dairy facilities	Cow+R	56	37	26	119	56	34	26	116
Land	Acre	80	---	234	314	80	---	226	306
Income Data									
Gross income	$1000	41.1	68.7	90.7	626.9	41.1	66.9	88.2	614.2
Taxes paid	$1000	0.5	1.6	6.3	29.5	1.2	2.7	7.2	35.2
Investment credit	$1000	0.7	1.3	1.1	6.1	---	---	---	---
Net income after taxes	$1000	6.9	12.9	24.5	142.2	6.2	11.0	22.9	135.2
Consumption	$1000	5.0	7.1	11.2	75.8	4.8	6.4	10.6	73.3
Reinvestment income	$1000	1.9	5.8	13.3	66.4	1.4	4.6	12.3	61.9
Building depreciation	$1000	4.5	6.7	8.3	61.4	4.5	6.5	8.1	60.2
Other depreciation	$1000	5.8	6.4	6.2	52.6	5.8	6.2	6.0	51.8
Debt Payment Due									
Short-term 4/ 5/	$1000	27.4	44.7	13.6	178.7	27.4	43.6	11.3	181.8
Building 5/	$1000	4.4	6.6	8.2	60.4	4.4	6.5	8.0	59.6
Land 5/	$1000	1.4	1.4	5.3	21.8	1.4	1.4	5.2	21.6
Balance Sheet									
Total assets	$1000	167.9	230.6	342.0	342.8	167.3	224.7	331.8	340.6
Short-term debt 4/	$1000	25.4	41.4	53.5	44.2	25.4	40.4	52.1	51.4
Long-term debt	$1000	57.2	69.1	118.7	113.5	57.2	67.8	115.3	110.1
Net worth	$1000	85.3	120.1	169.8	185.1	84.7	116.5	164.4	179.1
Debt-asset ratio	Percent	49.2	47.9	50.4	46.0	49.4	48.2	50.5	47.4

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
5/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

The primary effect of no investment credit is the direct reduction of net income after taxes and the related decreases in the size of operation. This is apparent in the smaller level of the productive enterprises and a lower level of net worth. Lower repayment capacity results in a greater use of short term debt. Total short term debt payments are greater and while short term debt outstanding at the end of year 9 was less, additional borrowing was necessary in year 10. Brooker and Herr [6] estimate that about one farmer in five uses investment credit each year, with an average increase in disposable income per farm of one percent per year. For the growth situation assumed in this study, the increase in disposable income averages over four percent per year.

If the investment credit provision were not available to farm operators, it would mean a slower growth rate and a greater reliance on short term debt, thus making the operation more vulnerable to adverse consequences. It would also mean the loss of a valuable tool for tax management. New equipment purchases are often undertaken in years of high income so as to reduce the income tax payable. Such purchases can still be used as a tax management tool through rapid depreciation; but loss of investment credit means that it will no longer directly reduce the tax bill. Investment credit has provided a relatively simple way to reduce taxes in years of very high incomes while making needed investments.

6.3 The Effects of Appreciation of Land Values

Appreciation of land values has been occurring over the past three decades in the United States. Two primary benefits accrue to land owners from appreciation: (1) increased credit to keep in reserve or use for additional borrowing, and (2) increased returns when the land is sold. In the NAPPR model, a 5 percent rate of appreciation is assumed, and this appreciation is reflected through increased real estate credit for land owned over time, higher prices for land purchased at later points in time, and increased values for net worth. Thus, land bought at $350.00 per acre in year 1 with the 40 percent down payment requirement would allow up to $210.00 to be borrowed to finance its purchase. By year 5 this land would be worth $425.23 and would then provide $255.25 of real estate credit. This means credit reserves could be increased or additional money could be borrowed, using the land as collateral. By year 9 its value would have risen to $517.11 and furnish $310.27 of real estate credit. Similar effects would apply to land bought in years 5 and 9.

The NAP&REF model includes these same coefficients, but also allows for refinancing of outstanding loans on land purchases. Over time, the principal is repaid and some lenders allow additional borrowing to be undertaken up to the original value of the loan, as long as the original property has not declined in value.

Comparing the results of the NAPPR model with the basic model, N15&30, it can be seen that in year 1 the same organization, income levels, etc. occur (Table 6.3). The only changes are that total assets are higher and the D/A ratio is lower, due to the appreciation of land values.1/ In year 5 expansion of the dairy operation is less than in the basic model; land rental ceases, and 182 acres of land are purchased.

1/ With $95,000 of beginning equity, 223 acres of land was purchased in year 1 rather than just the required 80. At the lower beginning cash levels, the land purchases were deferred until a moderate-sized dairy herd was established.

Table 6.5--Summary of results from the N15&30, NAPPR, and NAP&REF models to examine the effects of land appreciation and refinancing, $70,000 beginning equity

Item	Unit	N15&30 Year 1	N15&30 Year 5	N15&30 Year 9	N15&30 10 Year Totals 1/	NAPPR Year 1	NAPPR Year 5	NAPPR Year 9	NAPPR 10 Year Totals 1/	NAP&REF Year 1	NAP&REF Year 5	NAP&REF Year 9	NAP&REF 10 Year Totals 1/
Farm Organization													
Cows milked	Head	56	93	119	---	56	73	105	---	56	73	108	---
Corn for grain	Acre	55	---	---	---	55	70	97	---	55	71	100	---
Forage production	Acre	148	245	314	---	148	192	277	---	148	194	284	---
Total acres	Acre	203	245	314	---	203	262	374	---	203	265	384	---
Input Acquisition or Sale													
Land rental	Acre	123	165	---	---	123	---	---	---	123	---	---	---
Corn purchased or sold	A.E. 2/	45	108	119	---	45	10	22	---	45	2	24	---
Labor hired	M.E. 3/	---	0.6	1.1	---	---	0.3	1.0	---	---	0.3	1.0	---
Investments													
Savings account	$1000	---	---	---	2.4	---	---	---	3.0	---	---	---	2.0
Machinery	Acre	203	42	69	314	203	59	112	374	203	62	119	384
Dairy facilities	Cow+R	56	37	26	119	56	17	32	105	56	17	35	108
Land	Acre	80	---	234	314	80	182	112	374	80	185	119	384
Income Data													
Gross income	$1000	41.1	68.7	90.7	626.9	41.1	53.9	79.9	545.7	41.1	54.4	81.8	551.7
Taxes paid	$1000	.5	1.6	6.3	29.5	.5	3.6	3.8	28.0	0.5	3.8	3.7	27.9
Investment credit	$1000	.7	1.3	1.1	6.1	.7	.7	1.4	5.8	0.7	0.8	1.5	6.0
Net income after taxes	$1000	6.9	12.9	24.5	142.2	6.9	16.7	20.2	139.4	6.9	17.3	20.2	139.2
Consumption	$1000	5.0	7.1	11.2	75.8	5.0	8.5	9.7	74.8	5.0	8.6	9.7	74.7
Reinvestment income	$1000	1.9	5.8	13.3	66.4	1.9	8.2	10.5	64.6	1.9	8.7	10.5	64.5
Building depreciation	$1000	4.5	6.7	8.3	61.4	4.5	5.5	7.4	54.8	4.5	5.5	7.6	55.2
Other depreciation	$1000	5.8	6.4	6.2	52.6	5.8	5.4	7.2	50.4	5.8	5.5	7.4	51.0
Debt Payment													
Short-term 4/ 5/	$1000	27.4	44.7	13.6	178.7	27.4	40.0	13.0	175.5	27.4	40.3	13.3	178.1
Building 5/	$1000	4.4	6.6	8.2	60.4	4.4	5.4	7.3	53.8	4.4	5.5	7.5	54.6
Land 5/	$1000	1.4	1.4	5.3	21.8	1.4	5.4	9.4	46.0	1.4	5.5	9.9	47.4
Balance Sheet													
Total assets	$1000	167.9	230.6	342.0	342.8	169.3	275.4	414.3	422.7	169.3	277.7	424.8	433.1
Short-term debt 4/	$1000	25.4	41.4	53.5	44.2	25.4	37.0	50.8	41.8	25.4	37.3	51.9	42.7
Long-term debt	$1000	57.2	69.1	118.7	[illegible]	57.2	109.4	160.7	[illegible]	57.2	110.2	169.0	163.4
Net worth	$1000	85.3	120.1	169.8	[illegible]	86.7	130.0	202.8	225.7	86.7	130.2	203.9	227.0
Debt-asset ratio	Percent	49.2	47.9	50.4	46.0	48.8	52.8	51.0	46.6	48.8	53.1	52.0	47.6

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
5/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

Additional land and dairy facilities are purchased in year 9. Overall, more land is purchased and at an earlier point in time. With land ownership, the operation continues to raise all corn for grain rather than buying corn.

The decreased emphasis on dairy production leads to lower gross incomes, while total net income after taxes is only $2800 less. Although net income is lower overall, it is higher in years 4 to 6.

Total assets and net worth both increase substantially over the 10 year period. Of course, this increased net worth is only realized if the property is sold. Also, if sold, the increase in value would be subject to capital gains tax, thus offsetting part of this gain.

The impact on the debt structure of the farm operation is one of the more important factors. Short term and building debt are somewhat less when land appreciation is considered, while land debt increases substantially. But while the land is the collateral that makes this borrowing possible, not all money borrowed against the land is used to purchase land. In year 5, borrowing against land was $3800 greater than was needed for the 182 acres purchased. In year 9, the difference amounts to $15,400. Thus, land appreciation increased the overall borrowing capacity of the farm operation and allowed more of its debt load to be in the form of long term debts—even though part of this money was used to meet other expenses. Land appreciation thus operates as a substitute for lower down payment requirements for an operator who owns land.

Appreciation of land values and generally rising prices has no doubt led some individuals to make investments sooner in time than they may otherwise have done. Land purchases made at an early point in time have often proven to be cheaper in terms of their initial cost per acre. They have provided additional credit on loan funds as time passed, and they have been repaid with "cheaper" dollars. Once farm operators begin to expect appreciation, they place more emphasis on land ownership.

6.3.1 The effects of land appreciation and refinancing real estate loans

The effect of also allowing refinancing of real estate (NAP&REF model) allows slightly greater expansion to occur since this increases the amount of long term loans which can be obtained. In some cases, however, farm operators may prefer not to use this credit except in case of unexpected expenses. They may treat it more as a credit reserve. As the loan is repaid, this amounts to an increasing proportion of the loan. After 9 years of payments on the 30-year loan, only 11 percent of the principal had been retired. Over a longer period of time, this would represent a much greater source of credit reserves or expansion capital for the farm operator.

6.4 The Effects of Lower Milk Prices

A milk price of $5.50 per cwt. has been assumed in the previous models, corresponding to the blend price currently being received in south central Michigan. It was pointed out that repayment capacity was never the limiting factor, with the prices and yields assumed in the model. By lowering the price of milk, we get an indication of when repayment capacity begins to limit growth and its effects.

6.4.1 Normal down payment requirements and lower milk prices

With milk at $5.15 per cwt. and normal down payment requirements, repayment capacity is still sufficient to allow the same investments to be made in year 1 as with the basic model (Table 6.4). However, lowering the price to $4.80 per cwt. brings about a different investment pattern in year 1. More long term debt is assumed, but short term debt is limiting, and 33 acres of machinery capacity go unused in year 1. By shifting from short term to long term debt, the annual payments are reduced. Related to this is the emphasis on purchasing land rather than renting. Land ownership allows additional long term debt to be acquired, and the annual cost per acre of land is less than for rented land.

As the milk price is lowered, the emphasis in farm organization shifts from milk production to a combination of grain and milk production. Land acquisition is undertaken right from year 1 at the lowest milk price. The changes allow the annual average variable cost per cow to be reduced over the other farm organizations. In the N15&30 model, average variable cost was over $600 per cow in year 1. But as the income from milk sales per cow declines, it becomes necessary to switch to less costly production procedures. The average variable cost per cow in year 1 drops to about $550 per cow under the revised organization with milk at $4.80 per cwt. Even with this lower cost structure it barely meets the minimum consumption level of the farm.1/

Consumption and net worth are, of course, substantially reduced with the lower milk prices. Even with milk at the lower price, however, the operation is able to adjust the farm organization and make considerable growth.

1/ With $55,000 beginning cash, the farm operation was not able to meet even this minimum with $4.80 milk.

Table 6.4 Comparison of basic model when milk prices are varied from $5.50 to $5.15 and $4.80 per cwt., $70,000 beginning equity

Item	Unit	N15&30 Year 1	N15&30 Year 5	N15&30 Year 9	N15&30 10 Year Totals 1/	NS5.15 Year 1	NS5.15 Year 5	NS5.15 Year 9	NS5.15 10 Year Totals 1/	NS4.80 Year 1	NS4.80 Year 5	NS4.80 Year 9	NS4.80 10 Year Totals 1/
Farm Organization													
Cows milked	Head	56	93	119	---	56	76	105	---	46	56	81	---
Corn for grain	Acre	55	---	---	---	55	2	---	---	2/ 43	55	77	---
Forage production	Acre	148	245	314	---	148	201	276	---	122	149	214	---
Total acres	Acre	203	245	314	---	203	203	276	---	167	204	291	---
Input Acquisition or Sale													
Land rental	Acre	123	165	---	---	123	2	---	---	3/ 4	---	---	---
Corn purchased or sold	A.E. 4/	45	108	119	---	45	88	98	---	2/ 38	18	---	---
Labor hired	M.E. 5/	---	0.6	1.1	---	---	0.3	0.9	---	---	---	0.5	---
Investments													
Savings account	$1000	---	---	---	2.4	---	---	---	1.0	---	---	---	1.0
Machinery	Acre	203	42	69	314	203	---	73	276	200	4	87	291
Dairy facilities	Cow+R	56	37	26	119	56	20	29	105	46	10	25	81
Land	Acre	80	---	234	314	80	121	75	276	163	41	87	291
Income Data													
Gross income	$1000	41.1	68.7	90.7	626.9	38.6	52.9	74.9	521.4	29.6	36.7	54.6	386.1
Taxes paid	$1000	0.5	1.6	6.3	29.5	.3	2.4	3.0	20.1	.3	.7	1.5	12.6
Investment credit	$1000	0.7	1.3	1.1	6.1	.3	.7	1.2	5.7	.2	1.4	1.1	5.0
Net income after taxes	$1000	6.9	12.9	24.5	142.2	4.5	12.7	17.7	115.2	4.0	10.5	12.7	88.5
Consumption	$1000	5.0	7.1	11.2	75.8	4.2	7.0	8.8	66.3	4.0	6.3	7.1	57.0
Reinvestment	$1000	1.9	5.8	13.3	66.4	0.3	5.7	8.9	48.9	---	4.2	5.6	31.5
Building depreciation	$1000	4.5	6.7	8.3	61.4	4.5	5.7	7.4	55.6	3.9	4.5	6.0	45.6
Other depreciation	$1000	5.8	6.4	6.2	52.6	5.8	4.4	5.8	46.2	5.1	3.7	5.6	40.8
Debt Payment Due													
Short-term 6/ 7/	$1000	27.4	44.7	13.6	178.7	27.4	37.5	12.4	179.5	24.4	22.5	10.2	147.5
Building 7/	$1000	4.4	6.6	7.9	60.4	4.4	5.6	7.3	54.6	3.8	4.5	5.9	45.0
Land 7/	$1000	1.4	1.4	5.6	21.8	1.4	3.4	4.7	28.6	2.8	3.4	4.9	34.6
Balance Sheet													
Total assets	$1000	167.9	230.6	342.0	342.8	166.3	231.8	301.4		173.1	194.2	274.6	269.8
Short-term debt 6/	$1000	25.4	41.4	53.5	44.2	25.4	34.8	47.6	39.1	22.6	20.8	53.0	44.8
Long-term debt	$1000	57.2	69.1	118.7	113.5	57.2	85.3	104.0	98.2	69.2	75.5	95.4	91.2
Net worth	$1000	85.3	120.1	169.8	185.1	83.7	111.7	149.8	161.1	81.3	97.9	126.2	133.8
Debt-asset ratio	Percent	49.2	47.9	50.4	46.0	49.7	51.8	50.3	46.0	53.0	49.6	54.0	50.4

1/ Totals may not add due to rounding.
2/ Corn grain produced was 78 acres in years 2, 3, and 4 and corn was sold each of these years.
3/ Land rented increased to 37 acres for years 2, 3, and 4.
4/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
5/ Man equivalent. One man equivalent is assumed to be 2600 hours.
6/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
7/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.

In view of the above results, it would appear that a dairy organization that expanded its operations along these lines should be able to withstand some rather severe price drops. Repayment capacity still appears to be sufficient to support an ongoing operation, as the debt load for the N$4.80 model is nearly as large as that of the N15&30; but there is greater emphasis on long term debt. The farm operator and his lender may be able to shift more of the debt to intermediate or long term debt, thus lowering his annual payments. But this will depend in part on what the debts consist of—feed bills, machinery, or whatever. Further expansion may not be possible, or at least proceed less rapidly, and family living expenditures would have to be reduced, but the farm operation need not be forced out of business.

6.4.2 Liberal down payment requirements and lower milk prices

The effect of lower milk prices in conjunction with liberal down payment terms alters the farm organization right from year 1, even with milk at $5.15 per cwt. (Table 6.5). The initial expansion of the farm reduces herd size and emphasizes land purchase compared to the results obtained with a milk price of $5.50, thus bringing about a shift toward more long term debt and reducing annual payments. In year 1, long term debt is nearly 7/10 of the total debt in the L15&30 model. The proportion of long term debt rises to over 3/4 in the L$5.15 model and to 9/10 in the L$4.80 model. By year 9, the proportion of long term to total debt was slightly over 70 percent for all three models.

While the initial year organization differed between the L15&30 and L$5.15 models, the expansion in years 5 and 9 proceeded along similar lines. Both models specialized in milk production until year 9

Table 6.5--Comparison of liberal down payment requirement results with milk prices at $5.50, $5.15 and $4.80 per cwt., $70,000 beginning equity

Item	Unit	Model Name											
		L15&30				L$5.15				L$4.80			
		Year			10 Year Totals 1/	Year			10 Year Totals 1/	Year			10 Year Totals 1/
		1	5	9		1	5	9		1	5	9	
Farm Organization													
Cows milked	Head	85	130	179	---	79	113	151	---	59	64	128	---
Corn for grain	Acre	---	---	167	---	---	---	141	---	44	50	126	---
Forage production	Acre	223	343	472	---	207	296	398	---	156	169	336	---
Total acres	Acre	223	343	639	---	207	296	539	---	200	219	462	---
Input Acquisition or Sale													
Land rental	Acre	143	58	---	---	---	---	---	---	---	---	---	---
Corn purchased or sold	A.E. 2/	150	147	---	---	141	200	32	---	61	27	(4)	---
Labor hired	M.E. 3/	.5	1.3	2.5	---	.4	1.0	1.9	---	.1	.1	1.5	---
Investments													
Savings account	$1000	---	---	---	7.0	---	---	---	5.3	---	---	---	4/ 2.9
Machinery	Acre	223	120	297	639	207	89	243	539	200	19	167	5/462
Dairy facilities	Cow+R	85	45	49	179	79	34	38	151	59	5	64	128
Land	Acre	80	205	354	639	207	89	243	539	200	19	243	462
Income Data													
Gross income	$1000	61.9	96.1	136.0	912.8	54.0	78.2	108.2	753.1	37.8	41.9	85.7	496.0
Taxes paid	$1000	.3	2.6	6.1	30.2	.4	.4	2.2	16.8	.4	.6	1.0	10.1
Investment credit	$1000	.4	1.8	2.8	9.4	.5	.5	2.2	8.0	.4	1.1	2.0	6.7
Net income after taxes	$1000	5.0	17.9	30.1	157.9	5.7	6.5	20.0	117.8	5.2	9.2	15.2	89.7
Consumption	$1000	4.4	8.9	13.1	81.3	4.6	4.9	9.6	67.2	4.4	5.8	7.9	57.4
Reinvestment income	$1000	.6	9.0	17.0	76.6	1.1	1.6	10.4	50.6	.8	2.4	7.3	32.3
Building depreciation	$1000	6.2	8.9	12.2	84.8	5.8	7.9	10.3	75.4	4.7	5.0	7.7	54.2
Other depreciation	$1000	8.2	9.3	13.1	78.1	7.5	7.6	10.8	67.3	5.9	4.9	11.6	57.1
Debt Payment													
Short-term 6/ 7/	$1000	44.9	75.3	27.5	375.0	41.7	66.2	23.5	346.4	15.5	12.8	18.5	109.2
Building 7/	$1000	8.2	11.7	16.1	111.8	7.7	10.4	13.6	99.6	6.1	6.1	11.5	71.8
Land 7/	$1000	1.8	6.5	14.4	62.0	4.7	6.7	12.2	70.0	4.6	4.6	10.5	57.8
Balance Sheet													
Total assets	$1000	228.2	376.5	585.4	587.2	256.1	344.7	490.0	488.8	211.0	214.8	419.6	417.1
Short-term debt 6/	$1000	41.5	69.7	104.0	97.8	38.6	61.3	88.6	83.7	14.3 8/	11.4	74.0	70.2
Long-term debt	$1000	96.7	172.5	284.1	273.4	128.1	162.3	234.6	225.2	111.9	99.4	205.4	197.8
Net worth	$1000	90.0	134.3	197.3	216.0	89.4	121.1	166.8	179.9	84.8	104.0	140.2	149.1
Debt-asset ratio	Percent	60.6	64.3	66.3	63.2	65.1	64.9	66.0	63.2	59.8	51.6	66.6	64.2

1/ Totals may not add due to rounding.
2/ Acre equivalent. Corn purchased (or sold) is reported as the acres replaced by (or required to produce) this amount of grain.
3/ Man equivalent. One man equivalent is assumed to be 2600 hours.
4/ Saving occurred in year 7 rather than year 10.
5/ An additional 76 acres of machinery was purchased in year 8. This was used with 76 acres of rented land to raise 126 acres of corn in year 8.
6/ Short-term debt in years 1 through 7, intermediate term debt in years 8, 9, and 10.
7/ Figures are for debt payment due on Jan. 1 of following year, rather than payment made in current year. Total figure is for 10 years.
8/ Purchases of buildings and land in year 5 were financed on short-term credit.

when corn production was also undertaken.

But in the L$4.80 model, cash is more limiting. The initial acreage operated was limited to 200 acres, just utilizing the fixed supply of machinery. Most, but not all corn is raised in years 1 to 8, and all corn is raised in years 9 and 10. Small investments are made in year 5 in land and dairy facilities, but these investments are paid with cash. All three sources of credit are in surplus in year 5, indicating there would not be sufficient improvement in consumption and net worth over time for it to pay to take on additional debt.

Again, the reductions in milk price do not force the farm operation out of business, but the reductions in income are quite severe. Net income after taxes drops from $158,000 to $118,000, and to $90,000 as the milk price declines from $5.50 to $5.15, and $4.80 per cwt. respectively. This happens despite a $20,000 reduction of taxes between the results for the models with highest and lowest milk prices.

The level of consumption is sharply reduced, with an average for the $4.80 price of only $1700 a year above the minimum $4000 level specified. This leaves little room for further belt-tightening.

This farm operation may be able to withstand a drop in milk prices to $5.15, but the same may not be true at the $4.80 level—especially if the price drop occurs during the first 5-7 years of the operation. The large amount needed for annual payments in the L15&30 model—especially for short term debt—puts a severe strain on repayment capacity. In addition, the L15&30 model shows $138,000 debt in year 1, and $143,000 debt in year 5. The L$5.15 model indicates it only has capacity to handle $125,000 debt in year 1, $110,000 in year 5, and then only if the debt is largely long term. These amounts are not strictly comparable, however, since the L15&30 model has already made the down payments and is operating on a larger scale. But the risk of failure would seem to be quite high in this situation. With the assets so highly indebted right from the start, there would be less chance of lenders being willing to grant additional loans against the property. An operator with 40 to 50 percent equity in his business would probably be more apt to be able to refinance and lower his equity to 30 than one who has 30 percent equity and desires to lower it to 20.

6.5 Summary of the Effects of Other Selected Growth Variables

Several variables felt to be of importance to expansion of the firm were included in the analysis. The primary results of each when compared with the results of the basic model are as follows:

1. Maximizing a goal of net worth alone led to only a small increase in net worth and a small decrease in consumption compared to pursuing a combination of goals of net worth and consumption. The farm organization specialized in the dairy enterprise, utilizing all rented land except for the required ownership of 80 acres.
2. Maximizing a goal of consumption alone led to only a slight increase in consumption, but this was accompanied by a rather large decrease in net worth. The dairy enterprise was limited in size as the emphasis was placed on land purchase. Both the dairy and grain enterprises were included in the final 2 years.
3. Repealing investment credit led to a direct reduction of disposable income, but the changes affected only the size of the organization. Net income after taxes was reduced

slightly more than 4 percent per year. The lower income led to a slightly smaller expansion and an increased use of short term credit.

4. Appreciation of land values brought about sharply increased acquisition of land as soon as possible. Under the lower beginning capital situation, expansion of the dairy herd occurred first and land purchase was delayed to year 5. Corn was raised for grain along with the dairy enterprise. Consumption was slightly reduced, while the appreciating land values allowed greater use of long term debt. This additional borrowing, with land as equity, was used partially for purposes other than land purchase.

5. Appreciation of land values and refinancing reinforced the tendencies noted for appreciation only. However, since early payments on land are composed primarily of interest charges, the impact would be greater in a longer run context.

6. Lower milk prices resulted in repayment capacity becoming more limiting. Changes occurred in farm organization, but with $55,000 beginning cash and a milk price of $4.80, it was not possible to operate the farm under the assumed conditions. Lower milk prices led to investments and enterprises more dependent on long term debt in the early years. Land purchases increased and the farm organization diversified to corn and dairy. At $4.80 per cwt. milk, the farm operation would be quite susceptible to failure from setbacks such as disease, poor yields, or other problems.

Chapter VII

IMPLICATIONS

7.1 Growth Factors Examined

This study has examined several factors that are felt to be important in financing farm expansion. These results have implications for farm lenders, as well as farm operators interested in such expansion.

7.1.1 Level of beginning equity

The beginning equity position of the farm operator is a major factor in determining the potential growth that may be achieved. The primary effects of larger amounts of beginning equity were to increase the size of the farm operation, both in year 1 and over time. Each additional dollar of beginning equity led to approximately an additional dollar of assets by year 10, but only about 50 cents of additional consumption. The greater initial cash positions allowed increased size of operation, but these increases were not the same for all aspects of the operation. There were also occasions in which the lower levels of beginning equity resulted in unused capacity. The necessity of making initial investments under strict borrowing limits related to assets resulted in insufficient funds for both investment and operating purposes, even though there was adequate repayment capacity. In similar situations, farm lenders need to consider the entire picture to see if a loan, although larger than normal lending procedures may dictate, would be desirable to allow full advantage to be taken of the capital investments. At the same time, some under-financed organizations may be better advised not to expand, but to search for other solutions.

This study also provided an indication of the minimum level of equity necessary to begin dairy farming. At least $50,000 was necessary to establish an operation capable of providing $4000 a year for family living expenses, under the basic lending rules of 25 percent down on chattel items and 40 percent down on real estate. When the down payment requirements were lowered to 10 percent on chattel items and 20 percent on real estate, this minimum equity dropped to $35,000. These amounts are dependent on the assumptions of the study, but they do give an indication of the equity needed for dairy farms of this size and technology.

For other farm types the level of required equity may be lower. A dairy farm, with the technology assumed in the model, requires over half of the investment to be in buildings and livestock. Cash grain farmers, however, would need to invest primarily in land and machinery. Swine and feeder cattle operations would probably require a minimum investment somewhere between those required for dairy and cash grain farms. But livestock operations--especially hog farms--could be essentially a feeding operation with a small land base, purchasing all feeds from other sources.1/ This alternative was not deemed to be economically feasible for providing forage on dairy farms in this study. On operations for which such conditions existed, the investment could be sharply reduced. However, such an organization would lead to a primary dependence on short term credit to finance the feed and livestock purchases.

1/ An indication of the importance of this can be seen from the equivalent of 50 to 200 additional acres that would have been needed had all corn for grain been purchased in this analysis.

A beginning equity of $35,000 to $50,000 is still more than most young or beginning farm operators would have, however. Although beginning equity was treated as a variable in this anaylsis, it is not a variable to any given individual. But the individual's equity position, combined with what he views as the necessary size of his farm operation, may provide the incentive to search for ways to stretch his available equity. The old adage, "It takes money to make money," still applies. But there are substitutes for capital, and most of the other growth factors examined in the study are, in a sense, substitutes for beginning capital.

7.1.2 Alternative repayment plans on long term debt

An operator with the primary goals of increasing his net worth and consumption, gains little advantage from the alternative repayment plans on long term debt. The various repayment plans offer flexibility in matching repayment capacity to the desired investment, and thus allow farm operators to gain ownership control over larger operations. Shorter repayment periods necessitate a greater dependence on short term debt, and lenders need to guard against an imbalance of short term debt in the total debt load of the farm operation.

The results do not indicate any great merit in deferred payment plans as a tool to aid farm incomes. They did allow the operator to own 15 to 20 percent more total assets at the end of 10 years, but with 30 to 35 percent more debt. For a given individual, the essential point is whether one is concerned with ownership control of assets or with increasing equity and consumption levels. For asset control, the deferred payment plans do provide some assistance.

7.1.3 Smaller down payment requirements on short and long term loans

Smaller down payments have a pronounced impact on all aspects of the farm operation. The smaller down payments allow much greater expansion to occur for a given equity level and repayment plan, with only modest increases in consumption and net worth. But the large increase in debt implies that a much greater degree of risk is associated with this growth. This risk arises from both the larger debt load and higher debt/asset ratios. There is also more risk from the legal standpoint in that purchases of land with less than 30 percent equity would likely be on a land contract, thus affording less legal protection for the purchaser in times of financial difficulties. At the present time, low equity loans of this type are available through individuals but normally not through lending institutions. Insured low equity loans, such as have been used by the Farmers Home Administration and Federal Housing Administration, could encourage greater use of such loans while removing some of the risks to both borrower and lender.

There are also interrelationships between these items. The combined effects of a larger beginning equity and a lower down payment requirement are less than their individual effects would indicate for consumption and net worth. On the other hand, these factors are reinforcing with regard to total assets, and especially so in terms of total debts. The borrower needs to keep in mind that the same factors which allow him to expand his operation more rapidly, also lead to much greater debt loads and increased risks. Therefore, it is important to keep the total situation in mind when planning.

7.1.4 Goals of the operator

In developing the model for this analysis it was assumed that the major goals over time for a farm operator were those of net worth and family consumption. But interpretation of the results required consideration of other goals as well. How does the operator view a heavy debt load? What about his willingness to assume risk? Is a possible 15 percent increase in consumption and a 30 percent increase in net worth an acceptable return for using low equity financing when it means assuming 2 1/2 times more debt? Lenders need to know not only how good a manager each individual is, but also what his primary goals are and how he might view the other questions that occur during farm expansion.

7.1.5 Appreciation of land values

Appreciation of land values caused more land to be purchased, and at an earlier point in time. It also allowed additional borrowing on land to be made as it appreciated in value over time. But not all the money borrowed against land was used to purchase land. It merely allowed the farm operation to carry more of the debt load in the form of long term debt, as part of the money was used for other purposes. Appreciation increases borrowing capacity and can operate as a substitute for longer repayment plans. While appreciation is not an item either borrowers or lenders can control, appreciation or the expectation of appreciation can influence land purchases.

7.2 Other Factors Important to Growth

This analysis focused on the factors discussed above: beginning equity, down payment requirements, length of repayment, goals of the operator, land appreciation, and investment credit. Each of these was seen to be important in influencing the growth of the firm. But several other factors, though not explicitly examined, could also be seen to have a major impact on the actual growth achieved. These factors are: family living expenses, the tax structure, land rental, purchase of nonfarm inputs, required initial investments, and management ability.

The amount of cash needed to meet family living expenses represents a major drain on the net income produced by the farm operation. In this study, consumption withdrawals took from $65,000 to $90,000 over the 10-year period, compared with additions to net worth of from $85,000 to $190,000. Since the operator can adjust his consumption withdrawals somewhat (within the needs and desires of his family), this is an item that needs to be explicitly considered by both borrower and lender in discussion of financial arrangements and planning.

Taxes also represent a major reduction of net income, totaling from $20,000 to $38,000 over the 10-year period in this study. This was net of the rather sizable reduction due to investment credit as well. If the investment credit provision should be repealed, the rate of growth on such expanding operations would be reduced. In this study, net income after taxes was reduced about 4 percent per year. Repeal of the investment credit provision would also mean the loss of a valuable tool for tax management. The total annual outlay for Social Security taxes, and State and Federal income taxes is too large to ignore in any long-run planning.

Within the model, increasing net worth was included as part of the primary goals of the farm operator. Despite this, land rental was still highly important in expanding the farm operation. Control of the asset, at least in the earlier years and especially with limited capital, can be more important than ownership in achieving rapid growth. This reemphasizes what has been occurring on many farms—that renting of farm land can be a valuable substitute for capital. Other rental forms are available and may be necessary for many individuals to have enough of a financial base to expand using technology of the type discussed here.

The purchase of inputs such as feed grains may also benefit the overall growth of the farm business. Unused resources, such as labor or machinery, may dictate production of the needed grain, while competition for available cash between production expenses and investments may favor purchase of the grain. The actual decision made will be dependent on examining all the restraints on the business and seeing which procedure is best for it at a given point in time.

A related aspect is the matter of fixed resources. This study assumed beginning equity was entirely in cash and that certain investments in land, buildings, and machinery were necessary in year 1 of the expansion process. For a given individual, the starting situation would more likely be some combination of assets in the form of land, buildings, machinery, livestock, and cash. Naturally, the growth possible, and the pattern by which this growth occurs, will vary depending on this beginning position. But the study illustrated the importance of fixed investments and unused capacity in the expansion process. When surplus machinery and labor were available, additional land was rented, and all corn for grain was raised on the farm. As the family labor supply and stock of machinery was exhausted, it often became more profitable to purchase grain off the farm and use the land resource strictly for the necessary forage production. The actual forms this may take depend as well on other factors, such as relative prices. But the set of resources available at the start of the expansion does influence both the rate and path of expansion.

Finally, the size and scope of the operation examined here have assumed an operator with above average management ability. But how many farmers have the production management ability to operate dairy farms of 100-200 cows? How many have the financial management ability to operate dairy farms with one-quarter to three-quarters of a million dollars of assets? And do the same persons necessarily have both of these management abilities? This analysis assumed an individual with both qualities, but it certainly will not apply to all individuals who wish to expand their operations. Yet overall management ability is one of the major factors affecting the success or failure of these operations.

7.3 Growth Factors and Decision Making

A major purpose of this study has been to examine factors important to growth and attempt to determine their relative impact. Knowledge of some of the factors that affect growth can help both borrowers and lenders in planning for firm expansion. However, not all factors that affect the expansion of the firm can be controlled by either the farm operator or his lending agency. In planning for an expansion of the farm operation, it may be useful to classify these growth factors into the following three groups.

The first category includes those factors over which neither the borrower nor lender has much control. These include beginning equity, prices, weather, the tax structure, and land appreciation. These items all affect the repayment capacity and growth of a farm operation, but are not variables that lenders or borrowers can manipulate.

In the second group are items over which the operator can exert some influence, but about all the lender can do is to try and assess the operator's behavior. These include the goals of the operator, his management ability (in financial matters as well as production), the size of operation, and his spending for family living expenses. These factors also affect repayment capacity, but they are primarily a function of the operator and his situation. Lenders can aid in planning and supervision, but the farm operator must do the execution.

In the third category are items which can be affected by the actions of both lenders and operators. These include alternative repayment plans, down payment requirements, and sound financial planning. These items provide alternatives that can be adapted to a given repayment capacity in order to meet an operator's goals. But in recommending one course of action over another, the related effects on other parts of the farm organization need to be pointed out and assessed.

Chapter VIII

SUMMARY AND CONCLUSIONS

8.1 Review of the Method and Underlying Assumptions

A polyperiod programming model was developed to represent a south central Michigan dairy farm. The model provided only two activities per year for production alternatives with the balance devoted to investment, borrowing, taxes, consumption, input acquisition and sale, and fixed cost activities. The model assumed yields presently being received on similar soils by the better farm operators. Prices corresponded to those currently being received and paid by farmers.

The model encompassed a 10-year period and allowed investments to occur in years 1, 5, and 9. Borrowing was limited by institutional restraints based on equity by type of asset and by repayment capacity.

In year 1, the model required the purchase of 80 acres of land, equipment to operate 200 acres, and a milking parlor to handle up to 130 cows. The operator and family were assumed to furnish 3000 hours of labor annually. A minimum of $4000 was assumed necessary each year for family consumption. After tax income above this minimum was allocated 35 percent to consumption and 65 percent for reinvestment. The primary goals of the farm operator were assumed to be maximizing the discounted present value of a combination of consumption and net worth.

In order to test the effect of various items on growth of the firm, modifications were made in the basic model. The items examined were: length of long term debt repayment period, level of beginning cash, down payment requirements, operator goals, appreciation of land values, investment credit, and changing milk prices. The effects of these different items on production, income, and financial progress of the farm operation were examined through comparative analysis.

Since the model used was a programming model with perfect knowledge assumed by the model, the results are more favorable than would occur in most farm operations. Constant prices and yields through time, along with perfect foresight, allowed the model to take advantage of every favorable circumstance, no matter how slight. Nonetheless, the results suggest implications concerning the effects of the various items examined.

8.2 Summary of Primary Results

1. Three items were examined rather intensively: length of repayment period, amount of beginning cash, and down payment requirement on loans. The effect of longer repayment periods for long term debt was negligible on total consumption; but did lead to slight increases in final net worth. These longer repayment plans also brought about rather modest increases in gross income, production levels, and total assets over the 10-year period. However, almost no difference resulted from the different repayment plans with respect to total net income after taxes, and reinvestment income. The longer repayment periods did lead to larger debt loads and a higher debt/asset (D/A) ratio.

2. Increasing amounts of beginning cash led to increasingly larger levels of net worth, as well as gross income, reinvestment income, total assets, and total debts. Smaller relative increases accompanied the larger amounts of beginning equity for net income after taxes and consumption. At the lower equity levels, cash was sometimes too limited to fully employ all fixed resources. In addition, limited capital forced expansion to be delayed to a later point in time. As the equity level increased, the farm organization changed

from a diversified one—producing both milk and corn for grain—to one specializing in milk.

3. The most expansionary factor on size of the firm of these three factors was the lower down payment requirement. Production levels, gross income, assets, and debts all increased 1 1/2 to 2 1/2 times with the more liberal credit terms. However, its effect on the primary goals of consumption and net worth along with net income after taxes and reinvestment income was an increase of only 1 1/4 times. The lower down payment allowed the assets controlled to increase quite rapidly, but a high D/A ratio of about 60 percent meant that the operator's risk of failure was much greater than for an operator using normal terms.

The effects of increasing costs as the firm began to hire labor, rent land, make additional investments, and be affected by the progressive income tax rates were all evident in the strategies pursued under different situations. Specialization in dairy production was generally striven for, but when capital was limiting in small output situations and when costs became quite high in very large output situations, the farm organization diversified to include production of corn for grain.

Repayment capacity was not a limiting factor as long as the assumed milk price remained at $5.50. Thus, the predominant restraints on expansion were down payment requirements and beginning equity.

4. The minimum beginning cash necessary to operate a farm within the assumption of the model was $50,000 for normal down payment requirements and $35,000 with liberal terms. The smaller initial equity under the liberal terms allowed the operator to achieve a slightly

greater level of consumption but a lower level of net worth than was received with a larger amount of beginning cash and normal terms. The increase in consumption was accompanied by increased gross income, net income after taxes, and assets; but also by a much larger debt and higher D/A ratio.

5. Summarizing the results for debts, consumption, and net worth by number of cows provided an indication of the initial equity necessary to achieve a given herd size 10 years hence, by following different financial strategies. These strategies involve length of repayment period and down payment requirements. The impact of these decisions on debt position, net worth, and annual consumption could then be estimated so as to evaluate the pro's and con's of the different strategies. For a given herd size, increases in length of repayment period and more liberal down payment requirements led to (1) a need for less beginning equity, (2) a lower level of consumption, (3) a lower net worth, and (4) a greater debt load.

6. Little difference in results was obtained when a goal of maximizing only net worth was used. The farm organization specialized in dairy, using all rented land except for the required 80 acres of owned land. When the goal of maximizing only consumption was tried, little increase in consumption resulted; but it led to a sizable reduction in net worth. The farm organization put less emphasis on dairy production, purchased land, and produced grain both for feed and sale in years 9 and 10. The goal of maximizing a combination of net worth and consumption appears to be the most satisfactory.

7. When investment credit is not allowed, it directly affects net income after taxes, consumption, reinvestment income, and net worth.

With the high repayment capacity of the model, it had little effect on reducing overall growth in production levels. However, greater use of short term debt was necessitated. In a situation where repayment capacity was limited, the impact on growth over time may be more crucial than was noted here.

8. The appreciation of land values led to investment in land as soon as a modest-sized dairy herd was established. Total consumption was only slightly reduced. The appreciating land values not only placed emphasis on land ownership, but also were a source of funds for other purposes in later years. Land appreciation can be a very real motivation for investment in land at as early a point in time as possible for the credit advantages as well as long term gains and a hedge against inflation. When refinancing of loans on land was also allowed, it created only a small additional expansion. If a longer number of years were considered, the amount of principle retired would be much greater and its impact would then be increased.

9. Lowering milk prices from $5.50 to $5.15 and $4.80 per cwt. substantially altered the results of the expansion period. With normal down payment requirements and $55,000 beginning cash, the farm operation was unable to become established with milk at the $4.80 price level.

With lower milk prices, limited repayment capacity brought about changes in farm organization and credit use. Lower milk prices led to a shift in land use from rented to owned land, and a diversification of production to include raising of corn for grain. Income and net worth were substantially lowered. However, with milk prices of $5.15 per cwt., the farm operation was able to continue with few changes.

Lower milk prices in conjunction with liberal down payment terms reduced expansion in production levels and resulted in a shift toward land ownership. In year 1, the lower milk prices caused the farms to depend more heavily on long term debt. However, similar ratios of long term debt to total debt existed for all three price levels by the end of the 10-year period. The lower milk prices put a severe strain on repayment capacity. The high D/A ratios that existed, plus the limited repayment capacity represented a situation of high risk. The farm operation could probably continue with a drop in milk price to \$5.15 per cwt., but if the original organization were suddenly faced with a \$4.80 per cwt. milk price, it is questionable whether it could continue.

10. The model also provided an indication of the importance of adequately accounting for taxes and consumption in a study of this nature. The amount withdrawn for consumption alone was always greater than income available for reinvestment. Taxes were often equal to 1/2 of consumption.

8.3 Suggestions for Further Research

While the analysis presented in this study examined nine separate variables that affect growth, only three of the variables were examined in detail: repayment periods, beginning equity, and down payment requirements. Additional analysis is needed on these variables and on others not specifically examined in this study. In addition, further analysis could consider alternative assumptions to those used in the study, and modifications of the model.

Only three items were examined in conjunction with each other: repayment plans, beginning equity, and down payment requirements. All other items examined were for normal down payments and 15- and 30-year amortization periods on loans, for buildings and land respectively. Further analysis could indicate the direction and magnitude of interaction between these different variables. For example, would land appreciation and lower down payments have offsetting effects on consumption and reinforcing effects on debt when considered jointly, as did lower down payments and higher beginning equity? The substitution or complementary effects of these variables need to be examined further.

Several variables that were examined only briefly or in a secondary manner merit further study. Only one rate of land appreciation was assumed and no allowance was made for appreciation in buildings and equipment. Neither was recognition made of potential increases in costs. Further increases in the cost of purchased inputs would seem to be a likely companion for appreciation of land values in the agricultural sector. Similarly, additional analysis could be done on goals of the operator. The importance of a particular strategy was shown to depend on the operator's desire to expand and willingness to assume debts as well as the primary goals of increasing consumption and net worth.

Although not explicitly considered for analysis, consumption, taxes, and willingness to assume debts (or attitude toward risk) were seen to be important factors to an individual considering expansion. The large withdrawals for taxes and consumption emphasize their importance, but additional analysis is needed using alternative consumption functions. In addition, the large debt loads (compared to those normally found on Michigan dairy farms today) generate several additional questions. What are the attitudes of farm operators to assuming debts of this magnitude? How about their willingness to assume the risk? What can farm lenders do to protect their interests on loans of this magnitude? These questions indicate a need for additional research on both lenders and borrowers.

Likewise, there are items that are highly relevant to the growth process which were not examined here. These include such items as semi-permanent or permanent debt, leasing of equipment, and tax advantages that may accrue from other tenure forms such as incorporation. Tax withdrawals of $2000 to $4000 per year should be sufficient incentive for operators to search for ways to reduce their tax load.

Another major area of further research evolves from examination of the basic assumptions used in this analysis. What is the sensitivity of these results to alternative interest rates on loans? Or to alternative yields and prices? What would be the effects of varying the fixed commitments required in year 1?

In addition, the form of the model used could be modified to take account of several items. The question of time horizon was mentioned. At the present time, no long term debt was completely amortized within the time horizon considered in the model. Would any of the conclusions be altered if the time span was lengthened?

Another modification could be to limit expansion to the earlier years, then to consolidate the gains and pay off debts. This, of course, assumes a different set of goals for the farm operator. Would longer repayment periods appear more or less favorable under such circumstances?

Variation in prices and yields, and the recognition of risk and uncertainty may require substantial modification of the model. The best way to evaluate the effects of such variation may be to modify the present multiperiod linear programming model and use it in combination with a simulation model. The LP model could be altered to have one period representative of the year in which investments are made, but with transfers accumulating debt payment and cash reserves for a period of years. Thus, a smaller multiperiod model could serve as the planning tool for year 1, while taking into account a longer time horizon. These year 1 actions would then be used in a simulation model to trace out the year by year effects for a variety of prices and yields until the next planning year was reached. New coefficients for expected prices and yields would then be inserted into the LP model, plus the updated resource levels and further investment plans determined. A series of runs with a simulator, in conjunction with the LP model, could give some indication of the riskiness of the various situations.

There are other useful, yet rather simple modifications of the present model which could be made. These include the examination of other dairy technologies or other farm types. The model includes a large number of items crucial to the growth of the firm, and reflects the financial environment in which any farm must operate. But additional financial arrangements or alternative production technologies could be rather easily incorporated. Further research uses are dependent on the ability of the interested researcher to modify the model and bring it to bear on relevant problems.

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APPENDICES

APPENDIX A

Procedure for Generating the Complete Matrix

APPENDIX A

PROCEDURE FOR GENERATING THE COMPLETE MATRIX

A.1 Constructing the Full 10-Year Matrix of the Basic Model

Chapter IV presented the activities for year 1 of the basic model. This appendix shows: (1) the combined activities for years 9 and 10, since these years contain some items not general to the entire matrix (Appendix Table A.1); and (2) describes how the year 1 activities can be used to generate the complete 10-year matrix.

Appendix Table A.1 illustrates the interdependence of the activities in the model, both within and between years. It also shows the coefficients for the OSALEG and RGRAIN constraints which only apply to years 9 and 10.

In constructing the overall matrix, the problem can be visualized in terms of the general model described on pp. 15-16. The C row, or objective function, for the basic model is given under the CNC columns of Table 4.9, page 40. The b vector, or RHS values, are given in Table 4.8, page 38. Tables 4.1, 4.2, and 4.4 through 4.7 present the coefficients for the A_1 submatrix, i.e. all the activities for year 1. The procedure for constructing the full 10-year matrix is, thus, to expand from the A_1 submatrix to the complete A matrix. This expanded matrix must be adjusted for data given in the footnotes of these tables and in Appendix Table A.1. Since constant prices and yields were assumed over the entire period, coefficients in most of the activities remain the same, although the activities originate in different years.

The year 1 activities can be classified in a way to simplify the matrix expansion (Appendix Table A.2). Eleven activities have coefficients which affect only the year in which the activity originates.

Appendix Table A.1 Basic model (N15%20) for years 9 and 10 to illustrate construction of the model from the material presented in Chapter IV

Row Name	Column Name																				
	9CFED	9DYPD	9SMFC	9BDFC	9MILKP	9LAND	9LANR	9HLAB	9SCRAN	9BUYG	9ECRAN	9BMST	9BMIT	9BCR15	9RCR30	9TA1	9TA2	9TA3	9TA4	9REDTX	9TINVC
CNC	-28.66		-19.9	-318.9	-40.14	-162.1			2.08		-2.08		.3842	.4448	.4583						
CN	-28.66		-19.9	-318.9	-40.14	-162.1			2.08		-2.08		.3842	.4448	.4583						
CC																					
9LAND	.97	2.635				-1.0	-1														
9LABOR	3.18	49.96						-1.0													
9CASH	31.86	149.66	70.0	1353.22	100.0	350.0	30	3.5		.95	5.70	-1.0	-1.0	-1.0	-1.0						
9STCR		-337.5	-52.5	75.0								1.0	1.0								
9DDCR				-539.7	-60.0									1.0							
9RECR						-210.0									1.0						
9MCHY	.97	2.635	-1.0																		
9LSFAC		1.0		-1.0																	
9MPCAP				1.0	-1.0																
9GRAIN	-13.75	82.5							1.0	-1.0	-1.0										
9FIXC																					
9CY		-783.5		26.0					-5.40												
9TAXY	31.66	-627.84	19.8	257.2	6.67		30	3.5	-5.40	.95	5.70					1.0	1.0	1.0	1.0		
9TAX1																1.0					
9TAX2																	1.0				
9TAX3																		1.0			
9TAXES																	-.109	-.179	-.258	1.0	
9INVCR			-3.27	-29.02	-7.0															1.0	1.0
9STAX																-.064	-.174	-.25	-.33	1.0	
9ATAXY		-26.0		26.0												-.936	-.826	-.75	-.67	-1.0	
9CNS																					
9NCASH	-31.86	-149.66	-19.8	-231.2	-6.67		-30	-3.5		-.95	-5.70										
9NETWR	-74.25	-479.47	-50.2	-705.08	-93.33	-350.0			5.40	-.95	-5.70	1.0	1.0	1.0	1.0						
9DEBT												-1.0	-1.0	-1.0	-1.0						
9PRINP																					
9INTP																					
9DEPR			-19.8	-127.48	-6.67																
0LAND						-1.0															
0LABOR																					
0CASH				43.75		3.50						1.08	.2505	.1098	.0806						
0STCR			-43.55	75.0									.8295								
0MCHY			-1.0																		
0LSFAC				-1.0																	
0GRAIN	-68.75								5.0		-5.0										
0SALEC																					
RGRAIN	1.0																				
0FIXC																					
0CY				26.0																	
0TAXY			7.2	158.5	6.67	3.5						.08	.08	.07	.07						
0TAX1																					
0TAX2																					
0TAX3																					
0TAXES																					
0INVCR																					-1.0
0STAX																					
0ATAXY				26.0																	
0CNS																					
0NCASH			-7.2	-132.5	-6.67	-3.5						-.08	-.08	-.07	-.07						
0NETWR	-61.87		-43.0	-688.5	-86.66	-350.0			4.50		-4.75		.8295	.9602	.9894						
0DEBT													-.8295	-.9602	-.9894						
0PRINP												-1.0	-.1705	-.0398	-.0106						
0INTP												-.08	-.08	-.07	-.07						
0DEPR			-7.2	-132.5	-6.67																
RCNS																-1.0	-1.0	-1.0	-1.0		
RTAXY																					
RATAXY																-.064	-.174	-.25	-.33	1.0	
RTAXES																					

Appendix Table A.1 (Cont'd)

Row Name	Column Name																				
	9CS	9SAVE	9TNCAS	9FCOST	OCRED	ODYLD	OLANR	OHLAB	OSGRAN	OBGRAN	ODMNT	OCMIT	OTA1	OTA2	OTA3	OTA4	OREDTX	OCS	OSAVE	OTNCAS	OFCOST
CNC	-.1751			-.641	-34.39	-222.22			2.5	-2.5	.4632	.4632						-.1621		-.4632	-3.504
CN					-34.39	-222.22			2.5	-2.5	.4632	.4632								-.4632	-2.91
CC	-.1751			-.641														-.1621			-.594
9LAND																					
9LABOR																					
9CASH		1.0		.641																	
9STOR																					
9BDCR																					
9RECR																					
9MONY																					
9LSFAC																					
9MDCAP																					
9GRAIN																					
9FIXC				1.0																	
9CY																					
9TAXY		-.04		1.0																	
9TAX1																					
9TAX2																					
9TAX3																					
9TAXES																					
9INVCR																					
9STAX																					
9ATAXY	1.0			1.282																	
9CNS	-.35			1.282																	
9NCASH	-.65	-1.0	1.0																		
9NETWR			-1.0	-6.0																	
9DEBT																					
9PRINP																					
9INTP																					
9DEPR				-1.0																	
OLAND					.97	2 635	-1.0														
OLABOR					3.18	49 96		-1.0													
OCASH			-1.0		31.86	149 66	30.0	3.5		5.7	-1.0	-1.0							1.0		.641
OSTOR						-337 5					1.0	1.0									
OMONY					.97	2 635															
OLSFAC						1 C															
OGRAIN					-13.75	82 5			1.0	-1.0											
OSALES					-68.75	68 75			5.0	-5.0											
RGRAIN					-1.0																
OFIXC																					1.0
OCY						-793.5			-5.40												
OTAXY					31.86	-607.84	30.0	3.5	-5.40	5.70			1.0	1.0	1.0	1.0			-.04		1.0
OTAX1													1.0								
OTAX2														1.0							
OTAX3															1.0						
OTAXES														-.109	-.179	-.258	1.0				
OINVCR																	1.0				
OSTAX													-.064	-.174	-.25	-.33	1.0				
OATAXY						-26.0							-.936	-.826	-.75	-.67	-1.0	1.0			1.282
OCNS																		-.35			-1.282
ONCASH					-31.86	-149.66	-30.0	-3.5		-5.70								-.65	-1.0	1.0	
ONETWR					-74.25	-479.47			5.40	-5.70	1.0	1.0								-1.0	-5.641
ODEBT											-1.0	-1.0									
OPRINP																					
OINTP																					
ODEPR																					-1.0
RCNS	-.35			-1.282														-.35			-1.282
RTAXY													-1.0	-1.0	-1.0	-1.0					
RATAXY	-1.0																	-1.0			
RTAXYS													-.066	-.174	-.35	-.33	1.0				

Appendix Table A.2 Designation of activities by years included in the model and by presence or absence of year to year linkage 1/

	Activity coefficients affect:			
Activities occur in:	One year only		Two or more years	
Years 1 through 10	iDYPD	iTA3	iGRPD	iBMIT
	iLANR	iTA4	iSGRAN	iCS
	iHLAB	iREDTX	iBGRAN	iTNCAS
	iTA1	iSAVE	iBMST	
	iTA2	iFCOST		
Years 1 through 9 only	---		iTINVC	
Years 1, 5, 8, and 9 only	---		iBMEC	
Years 1, 5, and 9 only	iBUYG		iBDFC	iBCR15
			iLANC	iRCR30
Years 5 and 9 only	---		iMILKP	

1/ Year to year linkage refers to the effects that activities begun in one year have on later years' resources and costs. For example, five-sixths of year i corn production is credited for use in year i+1.

The other fourteen activities have coefficients which affect both that year and one or more succeeding years. This table also gives the years in which each of the activities must be present in the model.

To expand the A_1 submatrix to the full matrix, each activity can be generated for the relevant years as shown in Appendix Table A.2. For example, iDYPD is shown to occur in year 1 through 10, and all coefficients apply within the year the activity begins. Thus, 2DYPD necessitates all coefficients shown in Table 4.1 to be generated for year 2, i.e. 1LAND, 1DYPD = .97 becomes 2LAND, 2DYPD = .97 for year 2. In general, for r years after year 1, r = 0, 1, . . . , 9, the coefficients are labeled: (1+r) row name, (1+r) column name = coefficient value. Thus, in year 1, r = 0 and the labels are as they appear in Table 4.1. For year 2, r = 1 and the labels become 2LAND, 2DYPD = .97, etc. Since the iBUYG activity occurs only in years 1, 5, and 9, the only relevant values for r are 0, 4, and 8, but the same procedure applies.

For activities which have coefficients in both current and succeeding year constraint rows, the procedure must be modified slightly. The year designation of the constraint row for the activity can be labeled s = 1, 2, . . . , 0. Then the general rule for each year in which the activity is needed becomes:

(s+r) row name, (1+r) column name = coefficient value. Thus, for year 4, r = 3, and grain production coefficients of the 4GRPD activity are:

4GRAIN, 4GRPD = -13.75

5GRAIN, 4GRPD = -68.75

For any activity, succeeding years have the same number, or fewer coefficients, since no consideration is given beyond year 10. Any activities which have entries in constraint rows RCNS, RTAXY, RATAXY, and RTAXES will include these constraints each year the activity occurs.

The iFCOST activities require reference to the footnote of Table 4.7 to account for changes in net worth. The OSALEG and RGRAIN constraint requires 1 or more additional cards for 9GRPD, OGRPD, ODYPD, OSGRAN, and OBGRAN as shown in Appendix Table 1.1.

A.2 Modifying the Basic Model

The basic model uses the CNC objective function, with down payments of 25 percent on chattel items and 40 percent on real estate, and with 15 years repayment on building loans and 30 years repayment on land loans. To utilize the other objective functions (CN or CC) it is merely necessary to use the coefficients from Table 4.9 for the CN or CC objective functions.

To allow for alternative payment plans for long term debt, the data shown in Appendix Table A.3 must be used. Additional activities must be generated for years 5 and 9, using the same principles as discussed in Section A.1. In running the program, only the desired activities must be included in the matrix.

To adjust the model for the lower down payments, the coefficients shown in Appendix Table A.4, along with the appropriate coefficients for succeeding year activities, must be generated. These cards are then substituted in the matrix for the identically labeled coefficients reflecting normal down payments. To avoid mistakes, two separate decks were used for normal and liberal down payments when running the program.

To adjust the basic model for land appreciation with normal down

Appendix Table A.3 Borrowing activities for year 1 with 10-, 20-, and 40-year repayment periods and deferred payment for 4 years with 10- and 25-year repayment periods

Row name	1BCR10	1RCR20	1RCR40	1DPA10	1DPA25
	Activity name				
	dollar				
CNC 1/	.0616	.3279	.4354	.2704	.4211
CN 1/	.0616	.3279	.4354	.2704	.4211
1CASH	-1.	-1.	-1.	-1.	-1.
1BDCR	1.			1.	
1RECR		1.	1.		1.
1NETWR	1.	1.	1.	1.	1.
1DEBT	-1.	-1.	-1.	-1.	-1.
2CASH	.1424	.0944	.0750	.07	.07
2TAXY	.07	.07	.07	.07	.07
2NCASH	-.07	-.07	-.07	-.07	-.07
2PRINP	-.0724	-.0244	-.005		
2INTP	-.07	-.07	-.07	-.07	-.07
2NETWR	.9276	.9756	.9950	1.	1.
2DEBT	-.9276	-.9756	-.9950	-1.	-1.
3CASH	.1424	.0944	.0750	.07	.07
3TAXY	.0649	.0683	.0697	.07	.07
3NCASH	-.0649	-.0683	-.0697	-.07	-.07
3PRINP	-.0775	-.0261	-.0053		
3INTP	-.0649	-.0683	-.0697	-.07	-.07
3NETWR	.8502	.9495	.9896	1.	1.
3DEBT	-.8502	-.9495	-.9896	-1.	-1.
4CASH	.1424	.0944	.0750	.07	.07
4TAXY	.0595	.0655	.0693	.07	.07
4NCASH	-.0595	-.0655	-.0693	-.07	-.07
4PRINP	-.0829	-.0279	-.0057		
4INTP	-.0595	-.0655	-.0693	-.07	-.07
4NETWR	.7673	.9216	.9839	1.	1.
4DEBT	-.7673	-.9216	-.9839	-1.	-1.
5CASH	.1424	.0944	.0750	.07	.07
5BDCR	.7332			.7332	
5RECR		1.	1.		1.
5TAXY	.0537	.0645	.0689	.07	.07
5NCASH	-.0537	-.0645	-.0689	-.07	-.07
5PRINP	-.0887	-.0299	-.0061		
5INTP	-.0537	-.0645	-.0689	-.07	-.07
5NETWR	.6786	.8917	.9778	1.	1.
5DEBT	-.6786	-.8917	-.9778	-1.	-1.
6CASH	.1424	.0944	.0750	.1424	.0858
6TAXY	.0475	.0624	.0684	.07	.07
6NCASH	-.0475	-.0624	-.0684	-.07	-.07
6PRINP	-.0949	-.0320	-.0066	-.0724	-.0158

Appendix Table A.3 (cont'd.)

Row name	1BCR10	1RCR20	1RCR40	1DPA10	1DPA25
	Activity name				
	- - - - - - - - - - - - - dollar - - - - - - - - - - - - -				
6INTP	-.0475	-.0624	-.0684	-.07	-.07
6NETWR	.5838	.8597	.9712	.9276	.9842
6DEBT	-.5838	-.8597	-.9712	-.9276	-.9842
7CASH	.1424	.0944	.0750	.1424	.0858
7TAXY	.0409	.0602	.0680	.0649	.0689
7NCASH	-.0409	-.0602	-.0680	-.0649	-.0689
7PRINP	-.1015	-.0342	-.0070	-.0775	-.0169
7INTP	-.0409	-.0602	-.0680	-.0649	-.0689
7NETWR	.4822	.8255	.9642	.8502	.9673
7DEBT	-.4822	-.8255	-.9642	-.8502	-.9673
8CASH	.1424	.0944	.0750	.1424	.0858
8TAXY	.0338	.0578	.0675	.0595	.0677
8NCASH	-.0338	-.0578	-.0675	-.0595	-.0677
8PRINP	-.1086	-.0366	-.0075	-.0829	-.0181
8INTP	-.0338	-.0578	-.0675	-.0595	-.0677
8NETWR	.3736	.7889	.9566	.7673	.9492
8DEBT	-.3736	-.7889	-.9566	-.7673	-.9492
9CASH	.1424	.0944	.0750	.1424	.0858
9BDCR	.4664			.4664	
9RECR		1.	1.		1.
9TAXY	.0262	.0552	.0670	.0537	.0664
9NCASH	-.0262	-.0552	-.0670	-.0537	-.0664
9PRINP	-.1162	-.0392	-.0080	-.0887	-.0194
9INTP	-.0262	-.0552	-.0670	-.0537	-.0664
9NETWR	.2574	.7498	.9486	.6786	.9298
9DEBT	-.2574	-.7498	-.9486	-.6786	-.9298
0CASH	.1424	.0944	.0750	.1424	.0858
0TAXY	.0180	.0525	.0664	.0475	.0651
0NCASH	-.0180	-.0525	-.0664	-.0475	-.0651
0PRINP	-.1244	-.0419	-.0086	-.0949	-.0207
0INTP	-.0180	-.0525	-.0664	-.0475	-.0651
0NETWR	.1330	.7079	.9400	.5838	.9091
0DEBT	-.1330	-.7079	-.9400	-.5838	-.9091

1/ Objective function values for both CNC and CN for years 5 and 9 are: 5BCR10 = .2704, 9BCR10 = .4297, 5RCR20 = .3982, 9RCR20 = .4519, 5RCR40 = .4499, 9RCR40 = .4609, 5DPA10 = .4297, 5DPA25 = .4559.

Appendix Table A.4 Coefficients for year 1 activities of the model to reflect minimum equity of 10 percent on chattel mortgages and 20 percent on real estate mortgages

Row name	Unit	1DYPD	1BMEC	1BDFC	1LANC	RHS
1STCR	Dollar	-405.	-63.	80.		12,600
1BDCR	Dollar			-719.6		13,440
1RECR	Dollar				-280.	
2STCR	Dollar		-45.18	80.		12,600
3STCR	Dollar		-36.70	54.		12,600
4STCR	Dollar		-32.22			12,600
5STCR	Dollar		-25.74			12,600
5BDCR	Dollar			-527.6		9,856
5RECR	Dollar				-280.	
6STCR	Dollar		-19.26			12,600
7STCR	Dollar		-12.78			12,600
8STCR	Dollar					12,600
9STCR	Dollar					12,600
9BDCR	Dollar			-335.6		6,272
9RECR	Dollar				-280.	
0STCR	Dollar					12,600

payment requirements, required substitution of the items shown in Appendix Table A.5. Of course, additional coefficients for the 5LANC and 9LANC activities must again be generated using the procedure described in Section A.1.

Modification of the basic model for low milk prices are discussed on page 46. This requires changing the 1TAXY, 1DYPD =-607.84 coefficient for each of the 10 years to reflect the lower price of milk.

Appendix Table A.5 Modification of the 1LANC activity to reflect a 5 percent annual appreciation of land values 1/

	1LANC	
Row name	No appreciation	With appreciation
	- - - - - - - - - dollar - - - - - - - - -	
CNC	-162.10	-264.07
CN	-162.10	-264.07
1CASH	350.00	350.00
1RECR	-210.00	-210.00
1NETWR	-350.00	-367.50
2NETWR	-350.00	-385.88
3NETWR	-350.00	-405.17
4NETWR	-350.00	-425.43
5RECR	-210.00	-255.26
5NETWR	-350.00	-446.70
6NETWR	-350.00	-469.04
7NETWR	-350.00	-492.49
8NETWR	-350.00	-517.11
9RECR	-210.00	-310.27
9NETWR	-350.00	-542.96
0NETWR	-350.00	-570.10

1/ CN and CNC values are identical for 5LANC and 9LANC. Subsequent land purchases would cost $425.43 per acre with 5LANC, and $517.11 per acre with 9LANC. The subsequent increases on real estate taxes are not felt to be significant enough to merit changing in the activities.

In a second modification it is also assumed that the original loan on land could be refinanced when purchasing additional land. To incorporate this change, the following coefficients are changed in the 1RCR30 activity: 5RECR changes from 1.0 to .953; 9RECR changes from 1.0 to .8913; thus, providing additional borrowing capacity equal to the amount of principal that has been retired.

APPENDIX B

Basic Budgets for Matrix Activities

APPENDIX B

Basic Budgets for Matrix Activities

Appendix Table B.1 Labor requirements per acre for crops, acreage and labor required per cow plus replacement 1/

Item	Unit	Corn grain	Corn silage	Oat silage	Haylage	Hay
Fertilize	Hour	.09	.09	—	.09	.09
Plow (4-16")	Hour	.67	.67	—	—	—
Disc (twice)	Hour	.23	.23	.46	—	—
Plant, fertilize, spray	Hour	.52	.52	—	—	—
Drill and fertilize	Hour		—	.52	—	—
Spray	Hour		—	.16	—	—
Cultivate (4-row) (twice)	Hour	.54	.54	—	—	—
Mow	Hour		—	.43	.43	—
Mow-condition	Hour		—	—		.49
Windrow	Hour		—	.40	.40	.40
Chop	Hour		1.22	1.26	.64	—
Bale	Hour		—	—	—	.53
Haul and store	Hour	2/.85	2.44	2.52	1.28	1.59
Second cutting	Hour		—	—	1.88	2.02
Third cutting	Hour		—	—	1.70	1.90
Total direct labor per acre	Hour	2.90	5.71	5.75	6.42	7.02
Overhead labor	Hour	.38	.74	.75	.83	.91
Total direct and overhead labor	Hour	3.28	6.45	6.50	7.25	7.93
Acreage required per cow plus replacement 3/	Acre	0.97	0.725	0.3775	1.22	0.3125
Labor per cow plus replacement	Hour	3.18	4.68	2.45	8.85	2.48

1/ See Connor [8], Davis [11], and Northeast Dairy Adjustment Study Committee [26].

2/ Harvest was assumed to be custom hired, thus, reducing labor needs by 1.06 hours per acre.

3/ Acreage requirements per cow plus replacement were determined by using the assumed crop yields in Appendix Table 1.1 and feed requirements given in Hoglund [19].

Appendix Table B.2 Cash expenditures per acre for crops, acreage and cash required annually per cow plus replacements 1/

Item	Unit	Corn grain	Corn silage	Oat silage	Haylage	Hay
Seed	$	2.84	2.84	6.64	2/	2/
Fertilizer	$	15.28	15.28	10.38	5.00	5.00
Herbicide	$	5.80	5.80	.21	—	—
Pre-harvest machinery cost	$	1.82	1.82	2.09	.08	.08
Sub-total		25.74	25.74	19.32	5.08	5.08
Interest 3/	$	.90	.90	.68	.18	.18
Custom harvest	$	6.00	—	—	—	—
Harvest and store	$	.20	4.68	4.25	14.42	4.52
Urea 160# @ $110 per ton	$	—	8.80	—	—	—
Totals per acre	$	32.84	40.12	24.25	19.68	9.78
Cash expenditures per cow plus replacement	$	31.86	29.09	9.15	24.01	3.06

1/ See Connor [8], Connor, et al. [9], Davis [11], and Shapley [30].

2/ Alfalfa seed cost is included with the oat enterprise.

3/ Seed, fertilizer, herbicide, and pre-harvest power and machinery cost was assumed to be financed on short term loan for six months at seven percent interest. It is assumed the growing crops furnish collateral for this loan.

Appendix Table B.3 Dairy production activity—13,000# average production, mechanical feeding, herringbone parlor, corn silage, haylage, and grain ration, tower silos and liquid manure system 1/

Labor requirements

Milking	16.9
Feeding	3.0
Manure handling	8.5
Miscellaneous	3.1
	31.5 hours

	Taxable	After-tax
Income		
Milk sales (13,000# @ $5.50/cwt.)	$715.00	---
Sale of calves 1/20 @ 30	16.50	
Sale of cull cow 1/4 @ 160	20.00	20.00
Sale of 2-yr. old cull 3/40 @ 160	6.00	6.00
	$757.50	$26.00
Expense		
General (bedding, breeding, vet., etc.)	47.85	---
Feed handling	5.50	
Manure handling	5.00	
SBOM (500# @ 5.20/cwt.)	26.00	
	$ 84.35	---
Net income	$673.15	$26.00

1/ Based on data in Shapley [30].

Appendix Table B.4 Investment credit allowable on purchases of investment items

	Value of treatment	Estimated life	Value of qualified investment 1/	Investment credit 2/
1BMEC activity	$ 70.00	7 years	$ 46.67	$ 3.27
1BDFC activity				
Free stall equipment	30.00	15 years	30.00	2.10
Silos and unloaders	345.45	15 years	345.45	24.18
Agitator, pump and liquid manure wagon	39.17	15 years	39.17	2.74
1BDFC Total				29.02
iFCOST activities				
Milking parlor stalls and equipment	11,400.00	15 years	11,400.00	798.00
Initial machinery purchase	14,000.00	7 years	9,333.00	653.31
Annual machinery replacement	2,000.00	7 years	1,333.00	93.31

1/ One hundred percent of the value of items with an expected life of 8 years or more qualify for investment credit. Only 66 2/3 percent of the value qualify for items whose expected life is at least 6 but less than 8 years.

2/ Investment credit is 7 percent of the value of qualified investment.

Appendix Table B.5 Buy dairy facilities, excluding milking parlor, for 1BDFC activity

Item	Per 88 cows	Per cow
Free stall milking facility 1/	$22,970.00	
Young stock and dry cow barns	16,340.00	
Silos and unloaders	30,400.00	
Liquid manure system for cows 2/	9,446.00	
Total investment	$79,156.00	$899.50

1/ Includes free stall barn, feed bunk and feeding equipment, maternity stalls and calf pens. Published figure was reduced by $11,700.00 for value of milking parlor which was included in a separate activity.

2/ Published figure was reduced by $4,854.00 for value of tractor, scraper, loader, and manure spreader which is included in the machinery investment.

Source: Hoglund [18] and Hoglund, et al. [20].

Appendix Table B.6 Estimated numbers of annual cattle purchases, sales, births, and deaths to initiate and maintain a 40-cow milking herd

Year	Bought	Culled	Raised Replacements	Born	Died 1/	Sold	2-year Olds Sold
1	40	5	---	40	4	22	---
2	5	10	---	40	5	22	---
3	10	10	---	40	5	22	1
4	---	10	10	40	5	22	3
5	---	10	10	40	5	22	3
6	---	10	10	40	5	22	3
7	---	10	10	40	5	22	3
8	---	10	10	40	5	22	3
9	---	10	10	40	5	22	3
10	---	10	10	40	5	22	3

On a per cow basis, this means that purchased cows bought (B) and sold (S) would be as follows for each year:

		Purchased Cattle Bought in Year					
		1	2	3	4	5	6
Purchased Cattle Sold In Year	1	1B, 1/8S					
	2	1/4S	1/8B				
	3	1/4S		1/4B			
	4	1/4S					
	5	1/8S	1/8S				
	6			1/4S			

Raised animals are available for replacement stock from year 4 onward. All purchased animals are assumed sold from the herd by the end of the year 6.

Thus, cash expense for purchased cows in the 1BDFC activity is: year 1, \$350.00 for 1 cow; year 2, \$43.75 for 1/8 cow; and year 3, \$87.50 for 1/4 cow.

1/ In year 2 and later it was assumed 4 calves died at birth and one heifer died at 6 to 19 months of age.

Appendix Table B.7 Adjustments to short term credit when dairy cows are purchased 1/

Jan. 1 of year	Assumed animals in herd Cow/Yearling/2-year old			Credit generated	Credit shown in iSTCR row in iDYPD	Adjustment to iSTCR
1	1	---	---	$262.50	$337.50	$75.00
2	1	---	---	$262.50	$337.50	$75.00
3	1	1	---	$292.50	$337.50	$45.00
4 on	1	1	1	$337.50	$337.50	---

1/ Since the iDYPD activity assumes an ongoing dairy enterprise, it generates short term credit for a cow and replacements equal to $337.50. But when cows are purchased, raised replacement stock is not available until years 3 and 4. Therefore, the iSTCR constraint of the 1BDFC activity is adjusted to allow for this difference. It is assumed that up to 75 percent of the price of livestock can be borrowed against.

Appendix Table B.8 Depreciation costs on purchased cows 1/

Year	Number of purchased cows held for: All year	9 months	6 months	Depreciation Per cow
1	7/8	1/8	---	$48.42
2	3/4	---	1/4	43.75
3	3/4	---	1/4	43.75
4	1/2	---	1/4	31.25
5	1/4	---	1/4	18.75
6	---	---	1/4	6.25
7 on	---	---	---	---

1/ All purchased dairy animals must be depreciated when filing on the cash basis of accounting for income tax purposes. Purchase price is $350.00 per cow. Assuming a $150.00 salvage value and a 4-year life, this gives annual depreciation of $50.00 per year--$37.50 for 9 months, and $25.00 for 6 months. It is assumed cull cows are in the herd an average of 6 months during the year in which they are culled, except for the year of purchase in which it is assumed they are kept for 9 months.

Appendix Table B.9 Adjustments to the iTAXY row in the 1BDFC activity for capital gain or loss, depreciation, and sale or livestock when dairy cows are purchased

	iTAXY row of 1BDFC activity					
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Taxable income given in 1DYPD activity 1/						
(1) 1/4 cull cow sold @ $160 2/	20.00	20.00	20.00	20.00	20.00	20.00
(2) 11/20 calf sold @ $30	16.50	16.50	16.50	16.50	16.50	16.50
(3) 3/40 of 2-year old sold @ $160 2/	6.00	6.00	6.00	6.00	6.00	6.00
	42.50	42.50	42.50	42.50	42.50	42.50
Taxable income when cows are purchased						
(5) Sale of 1/8 cull cow @ $160	20.00	40.00	40.00	40.00	40.00	40.00
(6) Depreciation on this cow @ $50 per year	4.69	18.75	31.25	43.75	46.87	43.57
(7) Purchase price @ $350	43.75	87.50	87.50	87.50	87.50	87.50
(8) Capital loss on this sale 3/ [(5)+(6)-(7)]	-19.06	-28.75	-16.25	-3.75	-0.63	-3.75
(9) Depreciation on cows 3/	48.42	43.75	43.75	31.25	18.75	6.25
(10) Sale of calves	16.50	16.50	16.50	16.50	16.50	16.50
(11) Sale of other stock	---	---	2.00	6.00	6.00	6.00
(12) Total return (8)-(9)+(10)+(11)	-50.98	-56.00	-41.50	-12.50	3.12	12.50
(13) Adjustment needed in iTAXY row of 1BDFC activity [(4)-(12) = (13)] 4/	93.48	98.50	84.00	55.00	39.38	30.00

1/ Milk sales are not shown as they are assumed to be the same with either raised or purchased cows.

2/ These are capital gains items, therefore, only 50 percent of the sale value enters the taxable income row.

3/ The capital loss and depreciation on cows are book expense items which are then added back to the iNCASH rows for each of these years.

4/ These amounts represent decreases in the taxable income row for the year in which dairy facilities are expanded and the succeeding five years, due to the purchase of dairy cows.

Appendix Table B.10 Adjustments to the iATAXY row in the 1BDFC activity for capital gain or loss, depreciation, and nontaxable income when dairy cows are purchased

	iATAXY row of 1BDFC activity					
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
After tax income shown in 1DYPD activity						
(1) 1/4 cull cow sold @ $160.00 1/	20.00	20.00	20.00	20.00	20.00	20.00
(2) 3/40 of 2-year old @ $160.00 1/	6.00	6.00	6.00	6.00	6.00	6.00
(3) Total in 1DYPD	26.00	26.00	26.00	26.00	26.00	26.00
After tax income when cows are purchased						
(4) 3/40 of 2-year old @ $160.00 1/	---	---	2.00	6.00	6.00	6.00
(5) Adjustment needed in iATAXY row of 1BDFC activity [(3)-(4)]	26.00	26.00	24.00	20.00	20.00	20.00

1/ These are capital gains items of which one-half was reported as taxable income; the other one-half enters directly in after-tax income.

Appendix Table B.11 Adjustments to iNETWR of dairy animals for purchased cows in iBDFC activities

	Number of years after purchase 1/					
	0	1	2	3	4	5
(1) iNETWR shown in iDYPD activity	450.00	450.00	450.00	450.00	450.00	450.00
Amount in iNETWR when cows are purchased						
(2) Value of cow	350.00	350.00	350.00	350.00	350.00	350.00
(3) Depreciation on purchased portion	48.42	37.50	81.25	68.75	37.50	---
(4) Value of replacement stock	14.00	46.50	100.00	100.00	100.00	100.00
(5) iNETWR of dairy animals when cows are purchased [(2)-(3)+(4)]	315.58	359.00	368.75	381.25	412.50	450.00
(6) Correction of iNETWR for dairy animals in iBDFC activity [(1)-(5)]	134.42	91.00	81.25	68.75	37.50	---

1/ For example, cows purchased during year 1 with 1BDFC activity will have the 1NETWR row reduced by $134.42; the 2NETWR row by $91.00; etc., to account for the effect of purchasing additional cows.

Appendix Table B.12 Cash expense in 1BDFC activity for additional roughage needed for the first five months when dairy cows are purchased

Item	Unit	Roughage needed first five months	Price	Total cost
Corn silage	Ton	4.8325	$8.00	$38.66
Haylage	Ton	3.25	12.50	40.62
Oat silage	Ton	1.4175	8.00	11.34
Hay	Ton	.4175	25.00	10.44
Urea	Lbs.	48.325	.055	2.66
				$103.72

Source: Hoglund [19], and mimeographed handout of background material.

Appendix Table B.13 Investment cost of double-4 herringbone milking parlor and equipment, milkhouse, milkhouse equipment, and bulk tank

	Investment cost
Building	$5,400.00
Stalls and feeders	1,600.00
Milking system	3,200.00
Heat, hot water, and other equipment	1,500.00
Sub-total	$11,700.00
Bulk tank, 800-850 gallon 2/	5,100.00
Total	$16,800.00

1/ Hoglund, et al. [20].

2/ Farm Management Handbook [15].

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