INSTITUTIONAL CREDIT AND THE EFFICIENCY OF SELECTED DAIRY-FARMS

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Gerald Ian Trant

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This is to certify that the

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INSTITUTIONAL CREDIT AND THE EFFICIENCY OF SELECTED DAIRY-FARMS

AN ABSTRACT

Submitted to the School of Graduate Studies of Michigan State University of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

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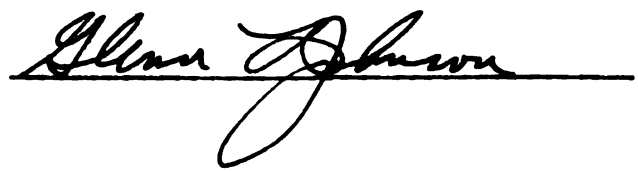
Approved by 

Gerald Ion Trant

ABSTRACT

Institutional Credit and the Efficiency of Selected Dairy-Farms

The purpose of this study was to appraise the adjustment possibilities facing selected dairy farms within the credit restrictions imposed by formal credit institutions.

It was believed that such an appraisal of adjustment possibilities would serve as a useful basis for delineating and evaluating problem areas in a rapidly changing segment of Michigan Agriculture.

Criteria of efficiency suitable to use with both intra-functional and inter-functional types of adjustment were developed. These economic criteria, were presented in conjunction with ethical criteria, that the author considered relevant in appraising the possible adjustments of the studied farms.

Intra-functional adjustment possibilities for the studied farms were explored in conjunction with a statistically fitted production function of the "Cobb-Douglas" type. It was found that more efficient adjustment on the statistically estimated production function, would force the farms out of dairying and organize them as fairly typical cash crop enterprises.

More efficient adjustments for the studied farms, that would maintain them as dairy enterprises were indicated to be possible, if the farms were to be shifted to a new labor efficient production function. In this instance budgeting was the technique used to make the hypothetical adjustment on the individual farms. The coefficients in the modified budgets subsumed a labor efficient technology.

The tentative results of the study were as follows.

1. Enough credit was available from institutions to permit more efficient adjustment of the studied farms, and at the same time maintain them as dairy enterprises.

2. Labor saving technology was required to make the farms both more efficient, and at the same time continue them as dairy enterprises.

3. Earnings of labor and income levels were found to be low, relative to wage rates of industry.

4. The budgeted adjustments on the studied farms implied large increases in milk production, even with land and labor fixed at their initial levels.

5. If the milk production increases implied in the modified budgets are generalized for a large segment of the Detroit milk shed, important reductions in milk prices, and hence in efficiency are implied.

6. Inadequate communications between lenders and borrowers have resulted in credit problem situations for many farm borrowers.

In the light of these results, it was concluded that the consequences of generalized increases in efficiency in the dairy industry, that involved shifting to the production function assumed in the modified budgets, would tend to be self defeating, unless control of production were also to be established. Consequently, in the recommendations, a hypothetical program was formulated that would appear to result in the joint attainment of increased efficiency, and equality of treatment for farm operators, in the dairy industry.

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CHAPTER I

INTRODUCTION

Productive resources in agriculture may be controlled and owned by different sets of individuals. In some instances a formal credit institution stands between the resource owner and the farmer, in other cases there is no intermediary between the borrower and the lender. This thesis, which is directed towards situations in which credit institutions exist as intermediaries between resource owners and resource users, attempts to do two separate but related tasks. The first of these is to determine whether or not the resources available to farm businesses from credit institutions are adequate to admit efficient organization of dairy farms in Sanilac county, Michigan, while the second is to appraise some of the consequences of institutional changes that would increase the availability of credit and perhaps increase efficiency.

Organization of the Thesis

In the last section of Chapter I, the author's reasons for orienting this study to credit problems of the dairy industry, will be presented.

The criteria to be used for evaluating adjustments of firms and institutions will be developed in Chapter II. Special attention will be devoted to a development of limited, but operational, definition of efficiency. The interrelationships of ethical and conditionally normative criteria will also be discussed in the same chapter.

Chapter III will present the empirical procedures and techniques to be used. In the first portion of Chapter III, the selection of

analytical techniques and functional forms will be discussed. The second portion of the same chapter will deal with relevant characteristics of the area sampled, and specific field techniques used.

The procedures used in deriving estimates of regression coefficients and value productivity of input categories will be presented in Chapter IV, with procedures for grouping inputs and reorganizing inputs categories receiving special emphasis.

Procedures used in calculating credit requirements for more efficient adjustment of the studied farms will be included in Chapter V. The relevance of adjustments involving, and not involving technological change, will be discussed in conjunction with the use of functional and budgeting techniques. Estimates will be presented of the credit requirements for the more efficient adjustments secured from budgeting individual farm situations. The chapter will be completed with an appraisal of the budget-estimated credit requirements for the more efficient adjustment of the studied farms.

Chapter VI will appraise the possibilities of securing more efficient adjustment on the dairy farms studied with the credit available from institutions. In the same chapter, the nature of some of the aggregative adjustment problems will be discussed.

Chapter VII includes a summary and evaluation of factual conclusions deriving from the body of the thesis. In the same chapter implications of the conclusions are discussed and elaborated. The final section of the chapter presents some possible institutional adjustments in the dairy industry, that appear consistent with certain criteria of efficiency and even-handed justice.

Orientation of Study to Dairy Farms

Since this study is one of a number of studies on problems in the general area of agricultural credit, currently being undertaken under the supervision of Dr. Glenn Johnson of the Department of Agricultural Economics at Michigan State University, its scope can be more restricted than might otherwise be the case. It is directed toward dairy farms in particular for a number of reasons. For one, the problems of getting and using resources seem to be particularly important in the dairy industry. Recent studies of the value productivity of labor on Michigan farms have indicated, that typically such farms appear to be organized so that the value productivity of labor is low. The socio-economic consequences of this situation appear to be that most dairy farms in the State are not able to compete with industry for hired labor. Earl Fuller, in his thesis (Some Michigan Dairy Farm Organizations Designed To Use Labor Efficiently), indicates that it requires an investment in excess of $100,000 to make earnings on such farms competitive with industry. Along with estimates of the amount of resources required to permit Michigan dairy farms to compete for labor with Michigan industry, are certain other more subtle, and less easily measured items to be considered. These include the level of technology required and the amount of cash expenditures necessary to maintain such farms as producing units. Though a complete list of the new technologies available, and a full discussion of their application in the Michigan dairy industry is beyond the scope of this thesis, it seems worthwhile to indicate the nature of technical changes germaine to the issue of credit and efficient adjustment. These changes include artificial breeding, milking parlors, self-unloading wagons and silos, bulk tanks, and

loose-housing. It is interesting to note that almost all of these changes are, or purport to be of a labor-saving character[1], and with the exception of artificial breeding, require important capital outlays for their initiation on a farm. A further consideration of great importance is that many of these new developments are not good complements with old technology, but can be productive only if they are associated with other new developments. This situation may be illustrated in the following example. If a farm operator wants to acquire a pipeline milker, he finds that it is as cheap or cheaper, to build a milking parlor in which to use it, than to install the pipelines in a stanchion barn. Furthermore, if he has a stanchion barn his investment in stanchions becomes unproductive and useless when he uses the milking parlor. Another complication is that although the milking parlor and its ancillary equipment enable the farmer to complete his milking more rapidly than before, it is difficult to increase net income unless he is thereby enabled to get rid of some of his hired labor, milk more cows or add some other enterprise. Consequently, most changes to milking parlor and pipeline milker are associated with more cows, more forage, more equipment, and more storage capacity. Such increases in the farmer's investment may easily be more than $30,000 on fairly modest-sized farm operations.

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[1] Not only are these changes of a labor-saving nature, i.e. they tend to make possible an increased earning capacity for labor, but some of them are also of a land and feed saving character. Thus their adoption on a wide scale has important consequences for the supply of milk produced from a given quantity of land and feed. In making recommendations to adopt such technologies, the resultant increase in production and its effect on milk prices cannot be neglected.

CHAPTER II

CRITERIA USED FOR EVALUATING ADJUSTMENTS OF FIRMS AND INSTITUTIONS

Although economic theory may be used in a manner that implies the subsumption of ethical norms its design is more appropriate to handle situations in which it is used as a normatively neutral instrumentality for appraising the use of means to achieve more ultimate goals than it is capable of appraising. There is a fairly long list of criteria that economists qua economists have used to judge the use of means by economic entities. This list includes productivity, utility, efficiency, and profitability. The author chose efficiency as his main but not exclusive criterion, since it embodies many of the connotations of the others for general welfare, as well as some characteristics of its own. That certain aspects of utility (as an instrumental goal) are included in a concept of efficiency will become evident as the author presents his definition of efficiency.

In this chapter, the definition of efficiency is treated initially; subsequently a set of normative doctrines that appear relevant to problems of institutional adjustments are presented. The normative doctrines are included because the author believes it is his responsibility to make explicit his point of view, and at the same time to point out what he considers a fruitful approach to problems arising out of situations involving interpersonal utility comparisons.

The Criterion of Efficiency

Although the science of economics is concerned with questions of efficiency, there is a dearth of conceptual material on efficiency in

the literature of economics. Furthermore, there appears to be little consensus on the meaning of the word efficiency. Many past works have[1] dealt with efficiency in abstract, static equilibrium states of perfect or pure competition. The definitions of efficiency used in economics have in common, the notion of a comparison of one set of inputs and outputs with another set. Questions of efficiency do not arise if there exists only one factor[2] combination to produce a given output. Questions and problems of efficiency arise when there are more ways than one, of attaining an end or where there is more than one end to be attained with the same set of resources. This concept of an end or goal is related to another characteristic of efficiency, often omitted from its formal definitions, namely that it is meaningless to speak of a ratio of input and output, unless some value may be assigned to both output and input.[3] With these foregoing considerations in mind the author has taken the liberty of attempting to present a concept of efficiency in a way that avoids some of the difficulties mentioned above. For the purposes of the present study, efficiency will be handled as the following framework indicates.

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1 See for example: Boulding, K.E., Economic Analysis, Harper and Brothers, New York, New York, 1948, p.494, 648 ff.
Scitovsky, Tibor, Welfare and Competition, Richard D. Irwin, Inc., Chicago, Illinois, 1951, pp.148-179.
Stigler, G.J., The Theory of Price, (Revised Edition), Macmillan Co., New York, New York, 1957, pp.101-106.

2 For example: factor combination X_a on page 7 of this chapter.

3 Knight, Frank, Risk, Uncertainty and Profit, Kelley and Millman, Inc., New York, New York, 1957, p.61.

Assumptions and/or Basis Used in Defining Efficiency

1. Prices are assumed to be given to producers in the industry.
2. Costs are computed on an opportunity cost basis if market prices are not applicable.
3. Only factor product relationships are treated.[4]
4. The law of diminishing returns or variable proportions is used.

Though the author does not attempt to defend these assumptions and/or basis as the best or most realistic for the purposes at hand, he finds them sufficiently restrictive to render the problem of defining efficiency manageable and, at the same time, adequate to yield a useful operational concept.

Definitions and Restrictions

Y_a = amount of Y produced by factor combination X_a: $X_a = (X_{1a}, X_{2a}, \ldots, X_{na})$; X_{ia} = amount of X_i in factor combination X_a: X_{ia} is exhausted in the production of Y_a: P_y = price of Y: $V_a = (P_y \cdot Y_a)$ = value of Y_a: $C_a = (X_{1a} \cdot P_{x_{1a}} + X_{2a} \cdot P_{x_{2a}} + \ldots + X_{na} \cdot P_{x_{na}})$ = cost of producing Y_a of Y.

Similarly Y_b = amount of Y produced by factor combination X_b, etc.

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[4] As the empirical material and analytical techniques are discussed and developed in the following sections, it may appear that a problem of handling multiple products with a single output function has apparently been neglected. This omission, however, is more apparent than real. Combining inputs into categories such that there exists between categories of inputs, neither good complimentarity nor good substitutability produces a situation in which the principal problems of adjustment exist between categories of inputs. In this study output of the production function is measured in terms of dollars of gross income produced by joint and supplementary products. It seems not unreasonable to assume that fairly good adjustment exists at this point, and that the principal adjustment problems as previously indicated lie between input categories.

Given that X_a and X_b are both attainable factor combinations, X_a will be said to be efficient relative to X_b if for $(V_a = V_b)$ or $(C_a = C_b)$ the following inequality holds:

I $$\frac{V_a}{C_a} > \frac{V_b}{C_b}$$

X_a will be said to be equally or less efficient than X_b if II holds:

II $$\frac{V_a}{C_a} \leq \frac{V_b}{C_b}$$

Inequality I is implied by any of conditions 1, 2, and 3 which follow:

1. $V_a > V_b$ and $C_a = C_b$
2. $V_a = V_b$ and $C_a < C_b$
3. $V_a > V_b$ and $C_a < C_b$

In the event that factor combinations X_a and X_b are such that relations 4 or 5 hold,

4. $V_a > V_b$ and $C_a > C_b$
5. $V_a < V_b$ and $C_a < C_b$

then X_a will be said to be more efficient than X_b if the result of multiplying both numerator and denominator of $\frac{V_a}{C_a}$ or $\frac{V_b}{C_b}$ by a positive integer conforms to condition 1, 2, or 3 provided such conditions are also capable of realization.

If an existing state is represented by X_b and an attainable state by X_a, and X_a and X_b together with appropriate prices produce 1, 2, or 3 then an inefficient state will be said to exist.

For a given production function each of the following inequalities indicates inefficiency:

6. $\dfrac{MPP_{x_i}(Y)}{MPP_{x_j}(Y)} \neq \dfrac{MFC_{x_i}}{MFC_{x_j}}$ [5] $\quad i \neq j;\ i = 1, 2, \ldots, n;\ j = 1, 2, \ldots, n$

7. $MPP_{x_i}(Y) \neq MPP_{x_i}(Y)$ for any pair of firms producing Y $\quad i = 1, 2, \ldots, n$

8. $\dfrac{dTVP}{dTC} \cdot \dfrac{TC}{TVP} \neq 1$ [6] [7] [8]

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[5] If product (Y) depends upon inputs $X_1, X_2, X_3, \ldots, X_i, \ldots, X_n$ i.e. $Y = f(X_1, X_2, X_3, \ldots, X_i, \ldots, X_n)$ then $MPP_{x_i}(Y) = \dfrac{\partial Y}{\partial X_i}$

[6] TVP or total value product is defined as $Y \cdot P_y$

[7] TVC where prices of inputs are fixed is defined as $\sum_{i=1}^{d}(X_i \cdot P_{x_i})$ where $X_1, X_2, \ldots, X_d$ are variable inputs.

[8] To maximize the ratio $\dfrac{V_a}{C_a} = \dfrac{TVP}{TC}$ set the first derivative of the ratio equal zero and solve thus:

$$\frac{d\left(\frac{TVP}{TC}\right)}{dY} = \frac{TC\ \frac{d(TVP)}{dY} - TVP\ \frac{d(TC)}{dY}}{(TC)^2} = 0$$

multiplying through by $(TC^2)dY$ yields

$TC \cdot d(TVP) - TVP \cdot d(TC) = 0$ or $\dfrac{TC \cdot d(TVP)}{TVP \cdot d(TC)} = 1$

since $TC = TVC + TFC$

$\therefore\ d(TC) = d(TVC) + d(TFC)$ and since $d(TFC) = 0$

$\therefore\ d(TC) = d(TVC)$

$\therefore\ \dfrac{TC \cdot d(TVP)}{TVP \cdot d(TC)} = \dfrac{TC \cdot d(TVP)}{TVP \cdot d(TVC)} = 1$

Implications of Definitions and Restrictions

Condition (6) implies that the same output can be produced for a lower cost and that a higher output can be produced for the same cost; thus, it implies the existence of inequality I in four (1) or (2) and, provided that the proportions of X_i and X_j can, in actuality be varied, so that the inequality can be removed, then there exists a new state more efficient than the existing state.

Condition (7) implies that a larger total value of output can be produced at the same cost to an industry, if adjustments can be made between firms that permit those having higher $MPP_{x_i(Y)}$'s to use more X_i and/or those having lower $MPP_{x_i(Y)}$'s to use less X_i. Thus the existence of (7) for any pair of firms in an industry, represents an inefficient state, if its removal is an actual possibility.

The ramifications of the implications of inequality (8) are somewhat more subtle. Condition (8) implies that, $\frac{V_b}{C_b}$ can be increased by increasing or decreasing level of input depending on whether $\frac{d(TVP)}{d(TC)} \cdot \frac{TC}{TVP} > 1$ or < 1. It is important to note that criterion (8) is inadequate to discriminate between different points on the same function which have the same elasticity. Consideration of criterion (8) in juxtaposition with the first order profit maximizing, or loss minimizing condition, as guaranteed by the law of diminishing returns throws considerable light on the relationship between profit maximization and efficiency. The profit maximizing criterion of $\frac{d(TVP)}{d(C_{x_i})} = 1$ is identical with the efficiency criterion, if and only if at least one

of two other conditions are met at the same time. These conditions are long run competitive equilibrium with profit maximized, and equal to zero or short run equilibrium, under conditions of vertical marginal cost above the intersection of the marginal cost curve, and the average total cost curve. Since neither a vertical marginal cost curve nor long run competitive equilibrium may be considered to be likely events in the real world, profit maximization can hardly be regarded as equivalent to maximum efficiency, except in the sense that it may be the highest possible in the short run situation. Though criterion 8 does not discriminate between the relative efficiencies of different production functions, the criteria presented next are capable of doing so.

In instances where more than one production function f_i produces the same product Y and their respective value to cost ratios are ordered as in relation 9

9. $$\frac{TVP_{f_1}}{TC_{f_1}} > \frac{TVP_{f_2}}{TC_{f_2}} > \cdots > \frac{TVP_{f_i}}{TC_{f_i}} > \cdots > \frac{TVP_{f_r}}{TC_{f_r}}$$

and for consecutive ratios, condition 1 or 2 or 3 hold or may be made to hold by multiplying either of the consecutive ratios by $\frac{q}{q}$ where q is a positive integer. If the resulting multiples of input and output are attainable, statements about the relative efficiency of any two production functions can be made as follows:

10. If for all levels of output $\frac{TVP_{f_i}}{TC_{f_i}} > \frac{TVP_{f_{i+1}}}{TC_{f_{i+1}}}$ then f_i will be said to be more efficient than f_{i+1}.

11. Furthermore, if for at least one level of output on f_i and for all levels of output on f_{i+1}, $\frac{TVP_{f_i}}{TC_{f_i}} > \frac{TVP_{f_{i+1}}}{TC_{f_{i+1}}}$ then f_i will be said to be more efficient than f_{i+1}.

12. If at the profit maximizing output on f_i, and at the profit maximizing output on f_{i+1}, $\frac{TVP_{f_i}}{TC_{f_i}} > \frac{TVP_{f_{i+1}}}{TC_{f_{i+1}}}$ then f_i will be said to be more efficient than f_{i+1}. However, if the profit maximizing output is for short run competitive equilibrium, it is unlikely to be the most efficient output as previously discussed under section 8.

13. Finally, if at the lowest average total cost of f_i and f_{i+1}, $\frac{TVP_{f_i}}{TC_{f_i}} > \frac{TVP_{f_{i+1}}}{TC_{f_{i+1}}}$ then f_i will be said to be more efficient than f_{i+1}. It should be noted that the lowest point on the average total cost curve corresponds to the equilibrium output under perfect long competition adjustment where profits are maximized and equal to zero.

Relation of Efficiency to the Problem of Farm Adjustment

The concepts and criteria of efficiency presented in this chapter will be applied to individual farm situations, to indicate the direction and nature of more efficient resource combinations in a later section of this thesis. This will be done in conjunction with estimates of the value productivity of different resource combinations for the farms studied. The amounts of credit required on individual farms to achieve

the relevant pattern of efficient adjustment will be compared with the amounts of credit available from the credit institutions serving the area. Differences between the amounts and forms of credit available, and those required to attain the patterns of adjustment considered to be more efficient than those extant will be used as one basis for making recommendations concerning changes in credit institutions. However, it would be counterfactual to assume that only criteria of efficiency are important when recommending changes in institutions, particularly when these changes usually involve interpersonal utility comparisons that are not capable of being handled by most economic theory. Consequently it seems appropriate to consider criteria that involve both economic and ethical considerations. With the end in view that appraisal of changes in credit institutions may be more complete than if these additional criteria were to be omitted.

Institutional Changes, Economic Theories, and Normative Judgments

When changes are made in the institutional framework of a society, the result may be regarded as consisting of infinite sequences of consequences extending into the future.[9] It is often impossible to determine the net effect of such a series of changes. A course of action which appears fruitful and practicable in this case, is to consider those consequences which appear to be important in the relatively near future to those influenced. Though it is almost undeniably true that the consequences of the more distant future, become of less and less importance for present generations, it may not be the case for the

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[9] See: Moore, G.E., Principia Ethica, Cambridge University Press, Cambridge, 1954, pp.152-153.

future generations affected. In any event, the present discussion will handle what the author considers most important when dealing with changes in economic institutions. This section will attempt to delineate some consequences that might result when economic institutions are changed. These consequences will be treated from the standpoint of means and of ends. Though the treatment is incomplete, it still seems worthwhile.

Before discussing the role of economics in appraising institutional change, it is necessary to point out some of the assumptions underlying the relevant portions of economic theory, and to indicate fairly explicitly how these affect their capacity to serve as criteria of institutional adjustment.

As the theories of welfare economics are closely related to the problem at hand, it is important to discuss the assumptions which underly them. Two of these assumptions are as follows:[10]

(1) asset ownership patterns are fixed and given

(2) utility functions of individuals are independent

In addition, interpersonally valid utility measurements do not exist. The restrictive nature of these two assumptions, and our inability to measure utility adequately, will be considered on an individual basis. The assumption of fixed asset ownership patterns, serves to simplify the problem of welfare economics, and eliminates changes requiring interpersonally valid utility measurements for evaluation.. Thus it is difficult to use welfare economics to judge the preferability of different asset ownership distributions. It is worthwhile to note that

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10 See: Reder, M.W., Studies in the Theory of Welfare Economics, Columbia University Press, New York, 1951, chapter I.

mere relaxation of the assumption of a fixed asset ownership distribution, would result in a wide range of asset distribution situations which could not be judged by the tools of welfare economics, so long as the problem of making valid interpersonal utility comparisons remained.

The second assumption of the independence of individual utility functions, restricts the capacity of welfare economics to evaluate changing institutions. Its inclusion in a sense absolves welfare economics from a consideration of the effects of jealousy, or desire for imitation, that may result when some people believe that they are made relatively worse off when others are made relatively better off in a "Pareto-better" sense.

What are the capacities of welfare economics then in judging institutional changes? Briefly, they appear to be of the following nature. When changes in the institutional matrix in which an economic system is imbedded are proposed, there are six possible classes of consequences for the persons involved. These possible resultant situations are as follows:

1. Situations in which some people are made better off and no one is made worse off.
2. Situations in which some people are made better off and some people are made worse off.
3. Situations in which no one is made better off and no one is made worse off.
4. Situations in which no one is made better off and someone is made worse off.
5. Situations in which everyone is made better off.
6. Situations in which everyone is made worse off.

Welfare economics discriminates among these situations, and the no change situations to which they are being compared as follows. In situation 1, welfare is said to be increased; the same is true for situation 5. In situation 4 and 6 welfare is said to be decreased. Welfare economics may be taken as regarding situation 3 as unchanged in terms of welfare from a previously existing state. However, case 2 is a different matter; here some people are made better off, and some people made worse off, and since interpersonally valid utility comparisons are not available, welfare economics cannot be used to discriminate between such a state and a previously existing one. Although by utilizing the "Compensation Principle" it may be possible to evaluate such a situation in terms of welfare economics. Thus a given economic reorganization results in increased, decreased, or unchanged welfare, if the algebraic sum of compensating taxes and bounties (levied on all affected persons) is respectively positive, negative or zero. However, even though it is possible to apply the welfare criterion unless it is actually applied, welfare economics cannot judge the reorganization.

It has been admitted that certain types of situations involving a conflict of interest cannot be resolved by welfare economics, nevertheless in general economics (not welfare economics) has an important place when it is used positivistically to describe the nature of conflicts at issue when economic institutions are changed, and to predict consequences of alternative institutional arrangements. When used in such a manner, it serves as a framework of analysis, for predicting consequences resulting from solutions reached with applications of other criteria to the problem at hand. Then, too, if a new type of asset ownership pattern for example is proposed, economics describes a new fairly non-controversial type of

optimality without which the full consequences of the ownership pattern advocated could not be determined.

The argument which follows, indicates that the optimality implied by economics, resembles in consequence if not in intent one of the results of applying Kantian ethics to problems of decision making for society. The "Pareto-better" optimality of welfare economics is held to exist when no one may be made better off without making someone worse off. Because of the absence of techniques for making valid interpersonal utility comparisons, states that involve making some persons better off and others worse off, are not yet capable of being handled by welfare economics. Kantian optimality would be similar in consequences to "Pareto-better" optimality but for a different reason. Kant[11] held that no individual should be treated as a means alone, since as a rational being he is an end in himself. Thus, application of Kantian ethics rejects proposals to make someone better off if another individual were to be used as a means alone (i.e. made worse off) of achieving this end.

The remaining portion of this section is devoted to a discussion of possible ways in which ethical systems can be used to bridge the gap between the feasible applications of welfare economics on one hand, and the more difficult problems involving interpersonal utility comparisons on the other. What is proposed is a discussion of Kant on consistency and humanity, Plato on value scaling and Bentham on consequences.

Before entering into the more detailed aspects of the problem, a few prefatory remarks of a more general nature are required. Although from an external vantage point economic theory may appear to involve the

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[11] For a brief discussion of Kantian Ethics see Leys, W.A.R., Ethics for Policy Decisions, Englewood Cliffs, New Jersey, Prentice Hall Inc., 1951, chapter 5. In the discussion that follows Leys' interpretation of Kantian ethics is used.

subsumption of certain ethical norms, it is primarily directed toward the instrumental questions of productivity and efficiency in attaining more ultimate ends. Hence in studies involving questions and considerations of a more ultimate normative nature, it is appropriate to move directly and explicitly into the area of ethics. This is not to say that ethics is capable of providing universally adequate answers to the complicated problems involved in institutional change,but rather that a consideration of questions raised by ethical systems may result in recommendations which are in the author's view,more consistent than those made without such considerations.

In choosing which ethical systems to use as criteria for the appraisal of an institutional change, it would appear reasonable that the relevant ethical systems should of themselves be capable of meeting certain conditions. Not that these conditions would stand as value systems for value systems,(except in a very restricted sense) but rather that they would serve to indicate the admissibility of practical applications to the problem situation at hand. These conditions which would have to be met would be clarity, consistency, and applicability. To be more explicit, the requirement of clarity is necessary to delineate, specifically and unambiguously, the range of human behavior or activity which is regarded as being the universe of discourse treated by the ethical system in question. Thus those sorts of behavior to be included and those to be excluded are to be clearly stated. With regard to the criterion of consistency,what is sought by the inclusion of this requirement,is the avoidence,within an ethical system of criteria,which in concerted application yield norms incapable of joint application. The third of these requirements for an ethical system is

that of the applicability of the ethical system, or its resultant norms to the problematic situation under consideration; thus an ethical system such as casuistry[12] would be inapplicable to many aspects of institutional change, since the basic idea of casuistry involves adherence to precedent for guidance in decision making. Situations involving changes without precedent could hardly be expected to yield to a casuistic approach. Nevertheless casuistry might be of use in determining the acceptable formal structure of such changes.

This incomplete consideration of ideas of Kant, Plato, and the Utilitarians, indicates that one of the important criteria developed by Kant[13] for determining whether a decision is good or not, was what might be called the consistency of the decision. Kant indicated that the way to test whether or not this criterion was being met, was to ask whether the decision was capable of being willed as a universal law for all people. In case it is not possible to so will it, then it is not regarded as good. Thus, Kant would have decried dishonesty for if it were willed to be universal then the original advantage (if there had been any) would be lost by its universal adoption. With respect to the operation of credit institutions, an application of the Kantian principle of consistency might be made to the practice of many lending agencies, of making loans if and only if the loan is so secured that were a disaster to occur the lending agency would not lose by it, and its depositors would be thereby protected. The Kantian question in this

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12 Where casuistry is defined as the art of applying authoritative rules and precedents to present cases.

13 Leys, W.A.R., op. cit., chapter 5. It should be emphasized that since only Leys' interpretation of Kantian ethics is used, the discussion is to be regarded as a paradigm of how Kantian ethics might be used rather than as an application of Kantian ethics.

instance might be that if the lenders are to be protected in such a situation why shouldn't the borrowers also be protected from loss? This becomes of particular relevance when the loss causing situation is external to the control of borrower and lender.

As previously noted toward the end of the first portion of this section, Kant also believed that people were ends in themselves and as such they should not be treated as means alone. It is interesting to apply this criterion to the situation obtaining in the usual contract curve indifference map diagram, between a single buyer and a single seller.[14] Adjustments of a "Pareto-better" type appear to be admitted by this type of criterion, but non "Pareto-better" adjustments along the contract curve are not, since at least one of the parties is treated as a means alone by the other. This situation might be particularly true if the bargainers were of unequal power.[15]

One characteristic which all systems of ethics appear to have in common is that they tend to raise questions rather than to provide neat answers to questions. The question of how a society scales or orders its values, is one of the important ones raised by platonic ethics.[16] The application of value scaling to a situation involving institutional change, would appear to yield a more consistent ordering of values than non reflective choice. Consequently some sort of deliberative value

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14 Stigler, G.J., op. cit., p.92.

15 Power itself may be regarded as a "status quo" asset not to be redistributed, which thus may complicate the problem further.

16 Jowett, B., The Dialogues of Plato, New York, New York Random House, 1937.

scaling helps obtain consistency. It should be noted however that this is not a recommendation that a value scale be determined empirically for society which will serve in all situations. Some of the problems that would arise out of an attempt to form such a value scale, appear to be insoluable to a large degree. The principle of value scaling like most forms of idealism can be of most practical use in solving problems that involve conflicts of values when the interested parties are of approximately equal bargaining strength.[17] This is held to be the case since the advantage of an appeal to abstract principle may otherwise be only unilaterally apparent. However, given that both sides of a dispute consent to such a procedure then a deliberative, considered scaling of values may result in the discovery of a mutually admissible principle of a higher order of abstraction than those in conflict, which may in turn be used to resolve the conflict in question.

Although utilitarians such as Bentham[18] are usually associated with a hedonic calculus of pleasure or pain, what is often overlooked is the simple fact that they were concerned with the consequences of actions, decisions, or changes as they affected the lives of human beings. Thus while the idealism of Kant or Plato seeks to determine the intrinsic merits of acts having moral implications, the utilitarian is concerned with its consequences for human welfare. And although utilitarinism is unlikely to resolve conflicts of interest in the way that idealism may be used, the idealistic solution can hardly be regarded as complete until the consequences of its application have been thought out.

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17 Leys, W.A.R., op. cit., chapter 5.

18 Bentham, J., An Introduction to the Principles of Morals and Legislation, Oxford, The Clarendom Press, 1907.

CHAPTER III

EMPIRICAL PROCEDURES AND CONSIDERATIONS

Selection of Analytical Techniques

As indicated at the onset, one of the principal objectives of this thesis is to determine whether or not Michigan dairy farms are currently able to make efficient adjustments using the formal credit institutions available to them. Several techniques of determining efficient farm organizations are available including functional analysis, budgeting, linear programming, and the techniques of traditional farm management. In the case of the present study functional and budgeting approaches were decided upon for several reasons.

Functional Analysis

First it seemed essential to consider at least two types of adjustment namely, adjustments on an existing production function, and adjustments involing a shift from one production function to another. Functional analysis is more adequate than some other techniques to handle the former type of adjustment while budgeting, linear programming, and traditional farm management techniques may be better suited to handling the latter type of adjustment. It must be borne in mind of course that each of the techniques may be used to handle both types of adjustment albeit with difficulty in some instances.

Second in selecting functional analysis to estimate intra-functional adjustments on the studied farms, the following considerations were regarded as being of special relevance. Several functional analyses of

selected groups of Michigan dairy farms have been completed[1] in recent years. These studies are available for comparison with similar intra-functional estimates derivable from this study. This is not to say that estimates using the other techniques would not be comparable, but rather that a more direct comparison of estimates of marginal value productivities could be accomplished. In addition, both linear programming and its less sophisticated, more forthright and realistic cousin, budgeting, require a priori determination of coefficients of productivity before the actual processes involved in the techniques can be undertaken. Consequently the resultant estimates of productivity are dependent upon coefficients of productivity derived independently of these techniques. In view of this consideration, such checks as to reasonableness of estimates of productivity must be external to the actual programming or budgeting procedures. This disadvantage is not possessed by functional analysis since an integral part of the procedure yields estimates of value productivity from data and further steps give some idea of their reliability. Although this latter problem has yet to be adequately resolved for functional analysis, it is rarely if ever even considered in budgeting and programming studies. Neither budgeting nor linear programming at their present levels of development are as capable as functional analysis of measuring the effects of interaction of different levels of inputs on their respective value productivities.

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[1] For example: Trant, Gerald I., A Technique of Adjusting Marginal Value Productivity Estimates for Changing Prices, unpublished M.S. Thesis, Department of Agricultural Economics, Michigan State College, 1954; and Wagley, Robert Vance, Marginal Productivities of Investments and Expenditures, Selected Ingham County Farms, 1952, unpublished M.S. Thesis, Department of Agricultural Economics, Michigan State College, 1953.

Budgeting

The reasons for selecting budgeting for indicating the nature of changes from an existing to a new production function, are in some ways similar to the reasons for selecting functional analysis to indicate the nature of intra-functional adjustments. Individual budgets possess the advantage over linear programs produced to date, in that they admit the analysis of fixed conditions for individual farms. In the present instance a series of general budgets for dairy farms in Southern Michigan were available from the work of Earl Fuller.[2] These budgets had been designed with the particular end in view of ascertaining effects of new labor saving technology on various sized dairy farm operations in Southern Michigan. As a result, they were almost ideally suited to the task of indicating the nature of adjustments from one production function to another for the studied farms. In a sense the budgeting procedure is similar in method to the comparative techniques in farm management analysis in that it often, but not necessarily, deals with residuals and averages. However, in the present study, budgeting was regarded as being preferable to the comparative technique of farm management since it subsumed new rather than old or existing technology.

This section has indicated the reasons for selecting functional analysis, and budgeting, as appropriate techniques to use in the determination of intra and inter-functional analysis. The following section treats some of the important considerations in selecting the specific functional form used in the analysis.

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[2] Fuller, Earl Inman, Some Michigan Dairy Farm Organizations Designed to Use Labor Efficiently, unpublished M.S. Thesis, Department of Agricultural Economics, Michigan State College, 1957.

The Selection of Functional Form

There have been many attempts to determine the nature of a mathematical function which would best estimate the relevant economic variables in empirical studies in economics. Up to the present, the main consensus appears to be that such functions have not been discovered. Consequently when undertaking an empirical economic study, it is necessary to choose among functional forms none of which have universal acceptability. Thus a strong element of arbitrariness is involved when selecting from a group of functions, each having some idiosyncratic characteristic which distinguishes it from the others but which does not affirm or deny its complete adequacy for the job at hand. With these remarks in mind, the nature of the problem involved in selecting a function may be more fully appreciated. In this study a Cobb-Douglas function was selected, because previous experience had indicated that it was fairly adequate for the purpose, in that it is capable of delineating interaction, and at the same time is easy to work with and modify. A further consideration of importance was, that the functional studies of the Michigan - dairy industry had employed the Cobb-Douglas function, and thus almost direct comparability of estimates of value productivity would be available for the various input categories studied.

Probably the most important weakness of the Cobb-Douglas function in the present study, is its inability to admit other than constant elasticity for single and multiple categories of inputs. Although if this were known to do serious damage, it may be easily avoided by using a modification of the function which destroys the constant elasticity.[3]

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[3] Carter, Harold O., Modification of the Cobb-Douglas Function to Destroy Constant Elasticity and Symmetry, unpublished M.S. Thesis, Department of Agricultural Economics, Michigan State College, 1955; and Halter, A.N., Carter, H.O., and Hocking, J.G., A Note on the Transcendental Production Function, Journal of Farm Economics, Vol.39, 1957, pp.966-974.

Further Empirical Considerations

The estimating problems of this study also involve ascertaining whether or not efficient adjustments could be made on the various farms in the sample. To do this required information about the amount of money the individual farm operators could borrow. It was decided after consultation with members of the Department of Agricultural Economics that several types of specific information would be acquired to answer this question. These included for each farm business:

1. net worth
2. percentage equity
3. sources of borrowed funds
4. interest rates, repayment schedules
5. form in which capital resources are held
6. farm operator's estimates of value productivity
7. non credit restrictions to borrowing
8. personal characteristics of farm operator
9. net farm income
10. farmers' estimates of internal credit rationing.

To estimate the amounts of credit available to individual farm businesses, complementary types of information were required about the lending policies of credit institutions. These included information on:

1. personal characteristics of borrower of relevance in making loans
2. collateral requirements of relevance in making loans
3. loan periods and interest rates for various types of loans
4. the relevance of net income of borrower in making loans
5. amounts that would be loaned to operators under various equity and net worth conditions

6. examples of loans which approached the maximum that agency would be willing to loan.

A field survey using two questionnaires was decided upon as the appropriate method of obtaining the information. One questionnaire which was used with the dairy farmers consisted of two parts. The first which has been discussed at length in the literature of agricultural economics, was designed for the purpose of getting data necessary for estimating value productivities of input categories;[4] the second portion dealt with considerations of credit as previously indicated. The other questionnaire was designed to be used in interviews with personnel of credit agencies. Since information on loans made is of a confidential nature and therefore difficult to secure for an individual borrower, a less direct method of getting the amounts of credit available was used. The schedule included questions on the amounts that each lending agency would be willing to loan on various classes of collateral, and the interest rates and periods for which they would be willing to make loans.

A series of six tables showing three different equity positions for each of six different sized dairy farms was also included. In each of the 18 situations the representative of the lending agency was requested to indicate the total amount that he would be willing to lend the farm operator. Additional questions concerning examples of maximum loans made by

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[4] See for example: Toon, Thomas, Marginal Value Productivities of Inputs, Investments and Expenditures on Upland Grayson County Farms During 1951, unpublished M.A. Thesis, University of Kentucky, 1952.
Drake, L.S., Problems and Results in the Use of Farm Account Records to Derive Cobb-Douglas Value Productivity Functions, unpublished Ph.D. Thesis, Department of Agricultural Economics, Michigan State College, 1953.
Bradford, Lawrence A. and Johnson, Glenn L., Farm Management Analysis, John Wiley and Sons, New York, New York, 1953, p.143.
Tintner, Gerhard and Brownlee, D.H., Production Functions Derived from Farm Records, Journal of Farm Economics, Vol.26, 1944.

the institution and notions of institutional adjustment, were also included. Both questionnaires are in appendix C of the thesis.

Location of Study

Sanilac County was selected for this study for several reasons. First, it has led the counties of Michigan in dairy-cow numbers and milk production for many years.[5] Second, it is totally within the Detroit fluid-milk market. Third, there are relatively few commercial banks serving the county; it is served by one Production Credit Association, one Federal Land Bank Office and one Farmers' Home Administration Office, and is fairly homogenous with respect to service from credit institutions. The credit problems encountered there can be regarded as symptomatic of the situation in an important segment of the Michigan Dairy industry.

Relevant Characteristics of Sanilac County

Sanilac County is the largest county in the southern peninsula of Michigan, it is located in the mid-eastern portion of the "thumb" (see map fig.1). The soils of Sanilac County are characteristically heavy clays. Surface and sub-surface drainage are required in most of the county, and crops generally respond favorably to tilling. Sanilac County is primarily agricultural, although some industry has located in Marlette in the south-western portion of the State. The topography is generally flat with some gently rolling land toward the south-western portion of the county.

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5 Michigan, United States Department of Agriculture, Agricultural Marketing Service Cooperating. Michigan Agricultural Statistics, Lansing, Michigan, 1950 and 1957.

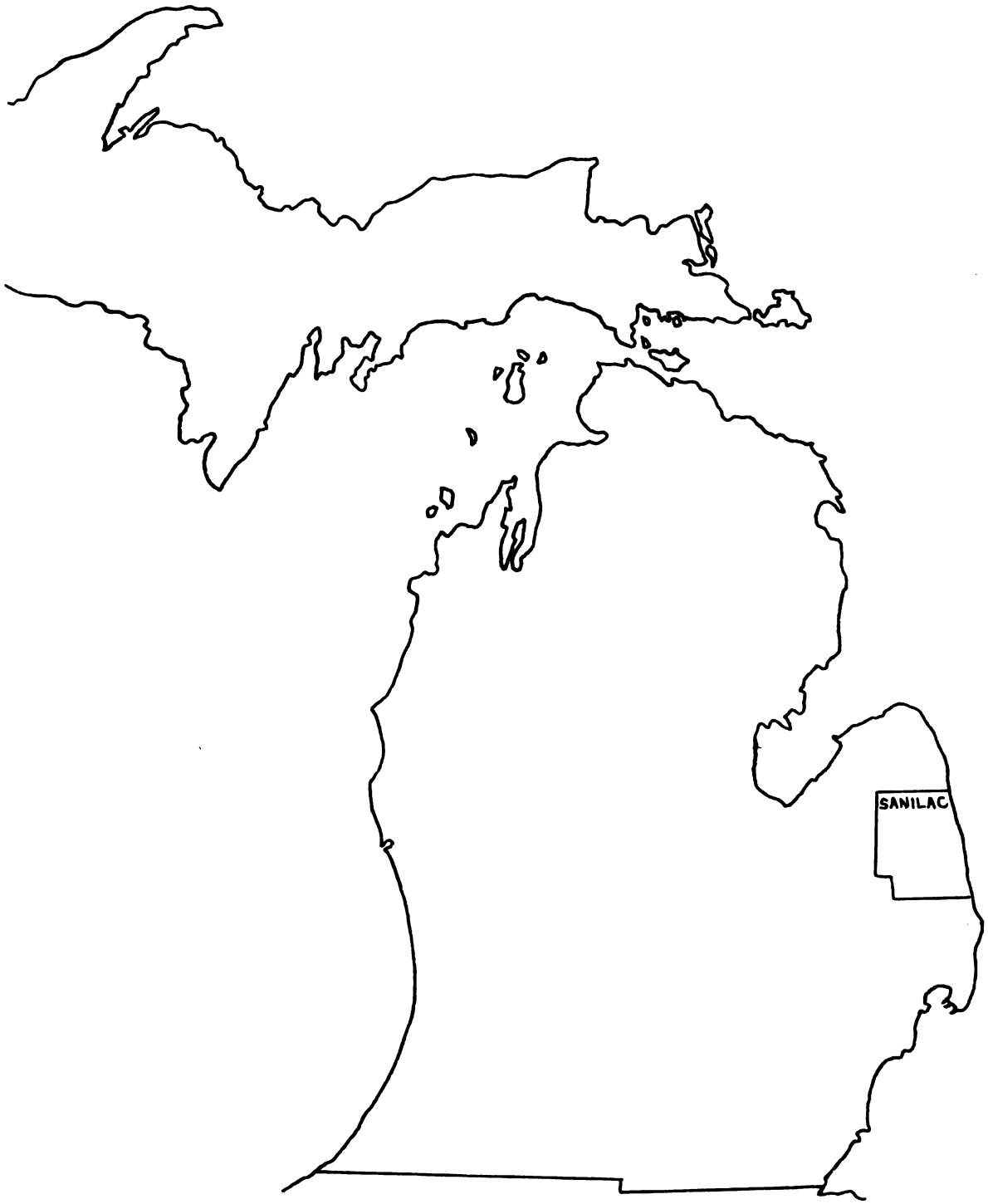

FIGURE 1. OUTLINE MAP OF MICHIGAN SHOWING LOCATION OF SANILAC COUNTY

The Samples

The problems encountered in designing samples for use in functional analysis have been discussed at some length in the work of Toon, Wagley, Johnson and others. Briefly, part of the critical problem to be solved is that of maximizing the precision of estimated coefficients of productivity, or the "b_i's" of the prediction equation. Although, unfortunately, it is not known whether this maximizes the precision of the estimates of the marginal value products, precise estimates of regression coefficients appear to be a necessary first step in obtaining precise estimates of marginal value productivities. Several techniques are available which may be used to increase the precision of these estimates. Since they are closely related to the formula[6] for the standard error of the regression coefficients, it seems worthwhile to include the formula at this point.

$$\sigma_{b_{12.34\ldots n}} = \sqrt{\frac{\bar{S}^2_{1.23\ldots n}}{n\sigma_2^2\,(1 - R^2_{2.34\ldots n})}}$$

An inspection of the right hand member of the formula shows the sorts of steps that may be undertaken empirically to reduce the magnitude of the standard errors of the regression coefficients. They are: increase the number of observations (n), increase the range over which observations for "independent" variable 2 are taken, reduce intercorrelation among "independent" variables $R^2_{2.34\ldots n}$ and reduce variation ($S^2_{1.23\ldots n}$) due to non random, non studied variables. As a consequence a "purposive" sample is more efficient than a representative non-stratified sample for

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6 Ezekiel, Mordecai, Methods of Correlation Analysis (2d ed.), New York, John Wiley and Sons, Inc., 1949, p.508.

obtaining estimates of regression coefficients.

In the present instance, the problem was further complicated by the conjoint requirements of wide variation, and low intercorrelation for input categories, and also a typical range of credit situations.

With the assistance of the county agents, farm businesses were selected which had the following characteristics:

1. Dairy products and sales of dairy cattle were their main sources of income.
2. All were shipping fluid grade A milk to the Detroit Market.
3. All were located on heavy Brookston type soil.
4. All were in Sanilac County.

Collectively, the farms represented a wide range of levels of inputs for each of the following input categories, tillable acres, months of labor, livestock-forage investment, productive cash expenses, machinery investment, and buildings. Partial control of climatic and price variation was achieved by collecting records for the calendar year 1957 only.

With reference to the sample of credit institutions the problem was somewhat less complicated. Representatives of commercial banks, governmental lending agencies, the Production Credit Association and Insurance companies were interviewed. One commercial bank in the area was not included, but since the largest bank in the area had been visited, and since there was considerable agreement among the commercial banking personnel interviewed, it is believed that the exclusion of the one bank does not change the results in any important way.

Field Techniques

The confidential nature of the information required in the study created certain field problems. To insure establishment of trust between

the enumerator and the farmers to be interviewed, the following procedure was adopted. Each farmer was contacted personally on a farm visit at which time the purpose and nature of the study was explained and a tentative appointment was scheduled. The farmer was requested to call the county agents office in Sandusky if unable to keep the appointment. If the farmer requested to see the questionnaire or wished to know more about the nature of the study, the information was given to him. At the time of the first visit and later during the schedule taking visit, the farmer to be interviewed was told that some of the information requested would be personal, but that his answers would be held in confidence, and that only a number would identify his schedule. Before undertaking the actual interview, the questionnaire was opened at the sections on credit used and net worth. The farmer being interviewed was then given a chance not to start the interview unless he believed he was willing to complete all parts of the questionnaire. None of the farmers contacted refused to give an interview, although a few changed the original time of their interview because of other commitments. The time for completing an interview ranged from 2 to 6 hours depending on whether the respondent had good farm records or not. Information elicited from banks and other credit agencies, supported the answers given by the farmers surveyed. Three out of three instances checked, gave almost direct confirmation. In no case was information received which did not substantiate answers given by farmers. It is the author's professional belief that the answers to the questions on credit used, and net worth, represent a true and accurate picture of the credit situation on these farms. An additional reason for believing this, stems from a comparison of the ratios of net worth to assets controlled by ownership obtained in his

study and in the Interstate Managerial Survey. In this study the proportion of higher debt to asset ratios was greater than in the Interstate Managerial Survey[7], which is consistent with the fact that the I.M.S. farms were smaller and involved more part-time farming, and with the conviction on the part of I.M.S. workers that the I.M.S. data on debts are biased downward. Hence it would seem reasonable to assume that the I.M.S. farmers would have a smaller average debt to asset ratio than the fairly large, full-time dairy farms studied in this thesis.

In appraising the data on credit institutions, the following consideration is relevant. The amounts of money that the various credit agencies would extend, under situations embodying unique interpersonal relationships between a borrower and a lender, have not been adequately measured; however, these types of situations are believed to be sufficiently unimportant that their exclusion will have no important effect on the general discussion and conclusions.

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[7] Epp, A.W., et.al., Progress and Problems in Decision Making Studies (with Reference to the North Central Farm Management Research Committee's Interstate Managerial Study), Journal of Farm Economics, Vol.37, 1955, pp. 1097-1125.

CHAPTER IV

FUNCTIONAL ESTIMATION OF VALUE PRODUCTIVITY OF INPUT CATEGORIES

As the literature contains many discussions of general techniques for using the Cobb-Douglas function for estimating value productivity of input categories on farms, the present section is limited to explanation of attempts to solve problems unique to this study. Six separate functions were fitted to the data obtained from thirty-one farms. In each instance, somewhat different estimates of value productivity resulted for the various categories of inputs, and each fit provided information that could be used in evaluating the overall picture of value productivity. For expository purposes, it seems most appropriate to discuss each fit separately pointing out the considerations indicating that more information is required.

The First Fit

The dependent variable was the logarithm of gross income, and the independent variables were the logarithms of tillable acres of land, man months of labour, dollars of machinery investment, dollars of livestock-forage investment, dollars of cash expenses, and buildings measured in animal units of housing capacity. The resultant regression coefficients, their standard errors, and associated estimates of marginal value productivities for these input categories at their geometric means appear in Table I.

Table I

Regression Coefficients (b_i's), Their Standard Errors (σ) and Associated MVP's at Geometric Mean Organization

Input Category	b_i	σb_i	Estimated MVP
Land	.177	.143	$14.51 / tillable acre
Labor	.247	.230	206.43 / man month
Machinery	.156	.113	.25 / dollar
Livestock-Forage	.083	.186	.113 / dollar
Cash Expenses	.306	.141	1.02 / dollar
Bldg. A. Units	.111	.122	27.58 / animal housing unit
Σb_i	.914		

It could be readily seen that the standard errors of the regression coefficients were fairly high. As has been noted previously, they are positive functions of the intercorrelation of input categories; hence it was necessary to inspect the simple correlations among the various input categories. These appear in Table II.

Table II

Simple Correlations Between Input Categories
(First Fit)

Input Category / Input Category	Land	Labor	Mach.	L.S. Forage	Expenses	A.U. Bldg.
Land	1	.66	.64	.65	.73	.59
Labor		1	.68	.75	.66	.70
Mach.			1	.66	.63	.58
L.S. Forage				1	.63	.56
Expenses					1	.57
Bldg. A.U.						1

The simple correlation between labor and livestock forage is fairly high, and as a result their respective standard errors may be expected to be high; an expectation borne out in Table I. In drawing inferences about the probable magnitude of the b_i's and their associated estimates of marginal value productivity, it is necessary to be extremely careful. Since both labor and livestock-forage investments are highly correlated, their regression coefficients may reasonably be expected to be in error and in opposite directions. Such would appear to be the case in the present study. The estimate of value productivity of labor appears to be high, and that associated with livestock-forage low, when both are compared with similar studies of the Michigan dairy industry. The problem with which one is confronted in such a situation, is the determination of methods or techniques which will extract a maximum of information from the data at hand, without being inconsistent with statistical practice,

economic theory, or external sources of evidence. Various lines of further investigation were open and were used in an attempt to derive more meaningful estimates of value productivity.

Procedures for Grouping Input Categories

The procedures adopted may be grouped into roughly two classes. The one type of procedure involved is, in essence, a process for combining highly correlated input categories. The argument in favour of such a technique is that standard errors of regression coefficients resulting were less than before; hence more faith may be placed in the resultant value productivity estimates for the combination. Further, information about the productivity of the separate input categories is not lost, since it is still available from the previous work. Though this technique of combining input categories was used in the fourth, fifth, and sixth fits attempted, its use was complicated by the fact that the various input categories were sometimes measured in different units. The following procedure was adopted to by-pass this hurdle.[1] Each item in the categories to be combined was converted to standard units by dividing it by its respective geometric mean quantity, and a new variable was constructed which consisted of the minimum standardized quantity of the input categories being combined. Thus in the case of the fourth fit, the new variable was the minimum or limiting standardized quantity of labor or livestock-forage. The estimate of marginal value productivity associated with this new variable, might be regarded

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[1] Brooke, M. David, Marginal Productivities of Inputs on Cash Crop Farms in the Thumb and Saginaw Valley Area of Michigan, unpublished M.S. Thesis, Department of Agricultural Economics, Michigan State University, 1958.

as the marginal value product of a month of labor and associated livestock-forage inputs.[2]

The other type of procedure adopted may be most charitably described as a re-evaluation of the data. Two similar but different procedures were used for the second and third fits. In the case of the second fit, milking cows were revalued according to their average production: A cow was priced at two hundred and fifty dollars if she produced ten thousand pounds of milk, and twenty-five dollars was added or subtracted for every thousand pounds of production over or under ten thousand pounds. This procedure was adopted because dairy cow prices varied widely during 1957 and it was the author's belief that farmers had not yet settled on a price for their dairy cattle. The disadvantage of using this technique however is fairly obvious since it uses a measure of output (production per cow) as a measure of input (livestock investment); furthermore, production per cow is also a function of feed fed, and forage investments which are included in other input categories. In the case of the third fit, productive cash expenses were broken down into two categories one being livestock expenses, the other crop expenses. The fifth fit was obtained by combining the more detailed inputs of the third fit with new input categories. The minimum of land, crop expenses, or machinery in standardized form became a new variable, which was used in the fifth fit, along with labor which was left unchanged, and a second new variable which was made up of the limiting factor of livestock-forage investment, livestock expenses, or animal housing units. The sixth fit was secured by taking the standardized value of the limiting factor of land, labor,

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[2] This would be the case if the b_i of the limiting factor multiplied by expected gross income is divided by the quantity of labor.

machinery, livestock-forage, production cash expenses, or building animal housing units. Discussion of the various functions fitted can best be undertaken in conjunction with reference to Tables III, IV, V, VI, VII, and VIII.

Evaluation of Fitted Functions

It may be noted by comparing the second fit with the results of the first,(Table I) that revaluing livestock served to render the b_i of livestock-forage positive; however, the standard errors of the b_i's of livestock-forage and labor remained high. It thus appeared that the problem of high intercorrelation had not yet been solved. The third adjusted fit obtained by separating productive cash expenses into two parts, livestock expenses and crop expenses, resulted in negative regression coefficients for both livestock-forage and labor, since a negative regression coefficient may be regarded as being meaningless in an economic sense[3] the third fit was considered to be less in accordance with reality in this respect than either of the two previous ones. Apparently, the problem arose from an attempt to extract more information than the data contained. The fourth fit was achieved by combining labor and livestock-forage investments into a new variable which consisted of the factor individually limiting in each farm as previously discussed in this section. Statistically the resulting fit appears superior to the first three in the sense that the standard error of the regression coefficient of the new labor-livestock-forage variable is a much smaller than the standard error range existing previously for them both (Table I and Table III) first, second and third fits. Although the fourth function

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[3] Tintner, G., and Brownlee, D.H., op. cit., p. 568.

Table III

Regression Coefficients (b_i's), Standard Errors (σb_i), Σb_i's, a values, and Associated MVP's at Geometric Mean Organization Five Adjusted Functions

Input Category		2nd Fit	3rd Fit	4th Fit	5th Fit	6th Fit
Land	b_i	.169	.345	.152		
	(σ)	(.139)	(.157)	(.141)		
	MVP	$14.13	$28.28	$12.46		
Labor	b_i	.201	.038		.093	
	(σ)	(.223)	(.218)		(.241)	
	MVP	$167.99			$77.72	
Machinery	b_i	.131	.177	.137		
	(σ)	(.122)	(.098)	(.109)		
	MVP	$.21	$.29	$.223		
Livestock Forage	b_i	.057	.195			
	(σ)	(.231)	(.172)			
	MVP	$.03				
Cash Expenses	b_i	.282		.301		
	(σ)	(.147)		(.136)		
	MVP	$.94		$1.01		
Building A. Units	b_i	.097	.151	.127		
	(σ)	(.123)	(.120)	(.114)		
	MVP	$24.10	$37.53	$31.56		
Livestock Expenses	b_i		.286			
	(σ)		(.079)			
	MVP		$2.47			
Crop Expenses	b_i		.034			
	(σ)		(.127)			
	MVP		$.18			
Limiting Factor of Liv. Forage or Labor	b_i			.217		
	(σ)			(.200)		
	MVP			$181.36 *		
Limiting Factor of Land, Crop Expense or Machinery	b_i				.447	
	(σ)				(.140)	
	MVP				$36.64 **	
Limiting Factor of L.S. Forage, L.S. Expense or Bldgs.	b_i				.300	
	(σ)				(.155)	
	MVP				$.49 ***	
Limiting Factor of All Six	b_i					.830
	(σ)					(.103)
	MVP					$693.69 ****
Σb_i		.937	.760	.934	.840	.830
log a		1.593248	2.253076	1.992528	4.195250	4.34793981

* MVP of a month of labor and associated livestock-forage investment.

** MVP of an acre of tillable land and associated inputs of crop expense and machinery.

*** MVP of a dollar invested in livestock-forage and associated inputs of livestock expenses and buildings.

**** MVP of a month of labor and all associated inputs.

Table IV

Simple Correlations Between Input Categories
(Second Fit)

Input Category / Input Category	Land	Labor	Mach.	L.S. Forage	Exp.	Bldg. A.U.
Land	1	.66	.64	.68	.73	.59
Labor		1	.68	.80	.66	.70
Mach.			1	.79	.63	.58
L.S. Forage				1	.75	.70
Expenses					1	.57
Bldg. A.U.						1

Table V

Simple Correlations Between Input Categories
(Third Fit)

Input Category / Input Category	Land	Labor	Mach.	L.S. Forage	L. Exp.	C. Exp.	Bldg. A.U.
Land	1	.68	.65	.66	.43	.81	.60
Labor		1	.70	.75	.64	.58	.68
Mach.			1	.67	.52	.54	.59
L.S. Forage				1	.63	.47	.55
L. Exp.					1	.40	.38
C. Exp.						1	.58
Bldg. A.U.							1

Table VI

Simple Correlations Between Input Categories
(Fourth Fit)

Input Category / Input Category	Land	Limiting Factor of Labor or L.S. Forage	Mach.	Exp.	Bldg. A.U.
Land	1	.69	.65	.73	.60
Limiting Factor of Labor or L.S. Forage		1	.70	.67	.66
Mach.			1	.63	.58
Exp.				1	.57
Bldg. A.U.					1

Table VII

Simple Correlations Between Input Categories
(Fifth Fit)

Input Category / Input Category	Limiting Factor of Land, Crop Expenses or Machinery	Labor	Limiting Factor of L.S. Expenses, L.S. Forage, or Bldg. A.U.
Limiting Factor of Land, Crop Exp. or Mach.	1	.73	.69
Labor		1	.81
Limiting Factor of L.S. Expenses, L.S. Forage or Bldg.A.U.			1

yields little information about livestock-forage and labor, in terms of their separate value productivities, it seems open to question in view of the high simple correlation between them,[4] and the relatively large standard errors of the regression coefficients of livestock-forage and labor, whether the results of the first three fits provide a more adequate base for further inference about the separate value productivities of livestock-forage and labor.

In considering the fifth and sixth fits to the data, the following considerations seemed to be of relevance. When two new variables of the fifth function were constructed (one the limiting factor of land, crop expenses, or machinery the other the limiting factor of livestock-forage investment, livestock expenses or buildings), while labor was left unchanged, the standard errors of the regression coefficients were quite low for the new variables as might have been expected. However, a high simple correlation between the second new variable and labor may be considered as a cause of the high standard error of the regression coefficient of labor. Furthermore though the new variables have more precision than those previously fitted, a good deal of information about interaction between input categories is available from the other fits to use in the overall evaluation. However, it should be borne in mind that they serve in an important way as a check on the aggregative estimates derived from the other functions. The decision to combine all the input categories in the sixth function, was an attempt to extract more information about the aggregate value productivity of inputs, and in addition to ascertain whether or not a functional analysis was more

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[4] See Tables IV, V, VI, and VII.

appropriate than linear programming (as usually carried out) for analytical purposes. The regression coefficient for the limiting factor was significantly different from one (at the 10 percent level): this was interpreted as an indication that the assumption of linear relationships in programming would be inappropriate in the present study.

By combining the information resulting from the six fitted functions, the emergent pattern of value productivity was developed as follows. The aggregate earning capacity of all inputs was fairly low on the group of dairy-farms studied. This relationship may be inferred from a consideration of the sum of the regression coefficients of the various fitted functions which were found to be:

First fit	$\sum_{i=1}^{6} b_i$	=	.914
Second fit	$\sum_{i=1}^{6} b_i$	=	.937
Third fit	$\sum_{i=1}^{7} b_i$	=	.760
Fourth fit	$\sum_{i=1}^{5} b_i$	=	.934
Fifth fit	$\sum_{i=1}^{3} b_i$	=	.840
Sixth fit	b_1	=	.830

It was noted previously that the regression coefficient in the case of the sixth fit had a value estimated to be .830 and that it was found to be significantly different from one at the ten percent level of significance, using a one tailed "t test", which may be interpreted to mean that

there was only one chance in ten that it would not be different from one for similarly drawn samples from the same population. This result is slightly reinforced by the fact that the sums of the regression coefficients were found to be less than one for the other five functions fitted.

Aggregative Considerations

In evaluating the results obtained from fitting a regression equation to limiting factors that have been standardized by dividing individual items by their respective geometric mean quantities; certain possibilities of error of this technique have to be taken into account. It is assumed that the geometric mean quantities of the input categories are a close approximation of those considered to be optimal. In addition in combining inputs into categories, good complements are grouped in the same input category and the assumption is made that these good complements are combined in relatively fixed proportions. However, if such is not the case, and one input which is complementary with another is in excess of the proportions implied by the complementary relationship, the value productivity of such an input category will be estimated to be lower than that which would result if the optimal combinations obtained. In view of these considerations, it would seem reasonable to employ some caution in interpreting the meaning of the value assigned to the regression coefficient of limiting factors. In the present study the possibility of an underestimate of the regression coefficient of limiting factors has to be taken into consideration.

Since the aggregate earning capacity of the combined input categories was most probably low, high assigned earnings for individual categories of inputs could be achieved only if low values were imputed to the

other input categories. For example, if high earnings were attributed to labor a low earning would have to be assigned to capital investments. In the first and second fits, regression coefficients were tested against b_i's that would have been required to yield reservation price equivalence for their respective associated marginal value products. Using a "t test", there was no basis for rejecting the hypothesis of such regression coefficient equivalence up to the 50 percent level of significance for all input categories with the exception of livestock-forage, which was found to have a regression coefficient different from the "reservation price" regression coefficient at the 10 and 50 percent levels of significance for equations one and two respectively. If the reservation price regression coefficient were to be assigned to each input category,,(neglecting for the moment, the inappropriateness of doing this for livestock-forage investment) the resultant sum of regression coefficients would be found to equal 1.23 which is significantly different from the .830 computed as the regression coefficient of limiting factors. Thus it would appear that the restriction imposed by the low sum of regression coefficients would not admit the simultaneous assignment of reservation price value productivities to all input categories.

Assignment of Individual Value Productivity Estimates

Having dealt, at least partially, with the problem of the aggregate value of the regression coefficients, it seemed worthwhile to treat individual input categories in some detail, bearing in mind the nature of the aggregative restrictions on regression coefficients. In the case of land, four different estimates of value productivity resulted from the first four fits; however,the b_i's of the first, second and fourth

fits were not found to be significantly different from selected numbers equal to the values of the other regression coefficients. The associated estimates of value productivity from these three questions ranged from twelve and a half to fourteen and a half dollars approximately; at an assumed interest rate of five percent this would imply a range in land values of from about two-hundred and fifty to about two-hundred and ninety dollars per acre of bare tillable land, which would be fairly close to the author's personal experience with land values on Brookston soils in Sanilac county, when land taxes are taken into account. Within this range of values, the selection of one is somewhat arbitrary; however, a consideration of the third fit and its estimate for land value productivity indicated that the earnings of land tended to be high for this fit. Consequently the upper end of the range was selected and a regression coefficient of .177 was considered to be most reasonable for this input category. The comparatively high land values are also supported by the statements of farmers interviewed. Twenty out of thirty-one indicated that they would buy land under favourable credit situations.

The assignment of an estimate of value productivity for machinery presented a problem similar to that for the land productivity estimate. The range in estimated value productivity as indicated by the first four fitted equations was from 21 percent per dollar invested, to 29 percent per dollar invested. Again the highest estimate was associated with the third equation. In this instance the additional information available did not permit as much discrimination between the various regression coefficients. No b_i was found to be significantly different from arbitrarily assigned values equal to the other b_i's at the 50 percent level

of significance using a "t test". Equation five indicated that the combined input categories of land, crop expenses and machinery had a regression coefficient of .447. Since this estimate had a higher precision that the others separately, and agrees with the b_i breakdown of Table III unless equation 3 is taken into account, it was a useful, aggregate limit for the component b_i's. Considering that the estimated value productivity of crop expenses[5] was of a low order or precision, and that to a lesser extent the same was true of the estimated b_i of land, it seemed to be most appropriate to assign a value to the b_i of machinery that was consistent with the value productivity for machinery obtained from similar studies.[6] Consequently a value of .131 was assigned as the regression coefficient for machinery. At the geometric mean, this implied an MVP of $.20 per dollar invested in machinery.

The estimated value productivity of productive cash expenses was very close to $1.00 per dollar of expenses at the geometric mean. In each equation the regression coefficient of cash expenses (when tested against the b_i required to yield $1.00 per dollar of cash expenses) was not found to be significantly different from it. A regression coefficient of .301 was assigned to this input category. The decision to assign this value in this instance rather than another not significantly different from .301 was arbitrary, although equations 1, 3 and 4 yielded regression coefficients closer to this value than to the .282 of equation two.

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[5] It is interesting to note that the low regression coefficient of crop expenses is consistent with the estimated value productivity of livestock expenses and all cash expenses. Livestock expenses which are about one third of total cash expenses had an estimated value productivity of $2.47 for every dollar while crop expenses were estimated to earning $.18 on the dollar thus for every dollar of total cash expenses, livestock expenses would return about $.99 and other crop expenses about $.11 for a combined return of $1.10 per dollar of productive expenses.

[6] Wagley, Robert V., op. cit.

Special Problems Associated with Livestock-Forage Investments and Labor

At the onset of this section, the problem of assigning value productivity estimates to the separate input categories of livestock-forage and labor was brought out. To recapitulate, the high simple correlation among these input categories, combined with high standard errors for their respective regression coefficients to prevent inferences from being drawn concerning their individual earning capacities. Hence, it was decided to unite both categories to form a new variable. By calculation the corresponding regression coefficient is .217 which means, in terms of marginal value productivity, a return of $181 for each month of labor and associated livestock-forage investments or, viewed from the standpoint of livestock-forage, a marginal return of $.30 for every dollar invested in livestock-forage together with the associated labor. The low estimated return for livestock-forage was substantiated by equation five's third variable which was the limiting factor of livestock-forage livestock-expenses and animal housing units. The estimated MVP in this case was ascertained to be $.49 for every dollar invested in livestock-forage together with associated inputs of livestock expenses and buildings. When this estimate was examined in conjunction with individual estimates of value productivity for the associated quantities of building animal units and livestock expenses, the negative residual resulting for livestock-forage reinforced the low value productivity determined for it by the other equations (i.e. 1 and 2). Consequently it was concluded that there was insufficient evidence to warrent adjusting the estimate of value productivity for labor and livestock-forage upward.

It was stated at the beginning of this section, that equation six had yielded what might be regarded as an aggregative restriction on the

sum of the respective regression coefficients of the various input categories. In addition it was indicated that this implied that if high value productivities were assigned to some input categories, it would be necessary to assign lower values to another, if the aggregative restrictions were to be considered. In view of this situation and the fact that the regression coefficients for building animal housing units were not significantly different from assigned values equal to the other regression coefficients calculated for this variable, the lowest of the estimated b_i's was selected for animal housing units. Although this choice among the computed values for this regression coefficient was arbitrary it is nonetheless consistent with them and with the aggregative restriction.

Summary of Assigned Values of Regression Coefficients

In summary the regression coefficients and their respective marginal value productivities were assigned to the various input categories as follows:

Land..... $b_i = .177$, MVP = \$14.50 per acre

Labor-livestock forage ..... $b_i = .217$, MVP = \$181 per month of labor and (\$612) invested in livestock-forage)

Machinery ..... $b_i = .131$, MVP = \$.21 per dollar invested in machinery

Productive expenses ..... $b_i = .300$, MVP = \$1.01 per dollar of productive expenses

Building animal units ..... $b_i = .097$, MVP = \$24.10 per animal unit of housing capacity.

The sum of these regression coefficients was .922; thus it met the conditions of either diminishing, or constant returns and it was not significantly different from the regression coefficient of equation six,

furthermore did not appear to be significantly different from the sum of the regression coefficients of equations 1, 2, and 4 which were .914, .937, and .934 respectively. The "a" value was determined by setting gross income ($\hat{Y}$) and the x_is at their respective geometric mean values, and then solving the resultant equation for the constant term, which was determined to be 2.012574 in its logarithmic form.

A few further remarks of a qualitative nature may be made regarding the separate value productivities of labor, livestock-forage, crop expenses, and livestock expenses. It seems reasonable that the MVP of livestock-forage although low is most likely positive, possibly of the order .057. Livestock expenses are indicated to be the most profitable component of productive cash expenses,and a changed proportion of productive cash expenses in favour of livestock expenses would seem indicated for most of the farms studied.

CHAPTER V

CREDIT REQUIRED FOR EFFICIENT ADJUSTMENT

Types of Adjustments Considered

In the first chapter in the section on the criteria of efficiency, two distinct types of adjustment that could result in increased efficiency were indicated. The first group of adjustments were those involving changes in the levels of inputs on the same production function. The second group of adjustments were those that involved changes from one production function to another.

To handle both kinds of adjustments two analytical techniques were considered more adequate than one. Both types of adjustment were considered for each farm. Adjustments on the empirically determined production function were regarded as an appropriate basis for estimating credit required to attain an efficient farm organization,to a technology similar to that existing on the studied farms. Furthermore, it was decided that budgeting was a satisfactory technique to determine credit requirements involved in adjustments from one production function to another with a different technology. A series of budgets for labor efficient dairy-farms for Michigan conditions were available from the work of Earl Fuller.[1] These were singularly appropriate for the present study,in that he had stressed technological change when he designed his budgets. Therefore, they may be regarded as representing a technology different from that existing on the studied farms. Consequently budgeting was chosen in preference to linear programming. The procedures adopted in

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[1] Fuller, Earl, op. cit.

using both techniques are presented in the material which follows.

Functionally Estimated Efficiency

In functional analysis of the type carried out in the present study, each farm may be represented by a series of points on a many dimensioned production function. Under a given set of price conditions, and if no inputs are fixed, there is a single combination of inputs which may be regarded as the most profitable organization on that production function. The marginal relationships which obtain under such circumstances are:

$$\frac{MVP_{x_1}(Y)}{P_{x_1}} = \frac{MVP_{x_2}(Y)}{P_{x_2}} = \cdots = \frac{MVP_{x_n}(Y)}{P_{x_n}} = 1$$

When this relationship holds for all firms, its attainment simultaneously eliminates the two sorts of inefficiency which exist when conditions 6[2] and 7 are appropriate to characterize a situation. In fact, when dealing with a continuous production function, conforming to the law of diminishing returns all that is required to achieve a similar result is the equality $\frac{MVP_{x_i}(Y)}{P_{x_i}}$[3] for all X_i and all firms producing Y.[4]

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[2] Conditions 6 and 7 were respectively $\frac{MPP_{x_i}(Y)}{P_{x_i}} \neq \frac{MPP_{x_j}(Y)}{P_{x_j}}$ $i \neq j$, $i = 1,2,\ldots,n$, $j = 1,2,\ldots,n$

$MPP_{x_i}(Y)_k \neq MPP_{x_i}(Y)_{k+1}$ k = firm no k, $k = 1,2,\ldots, L$, $i = 1,2,\ldots,n$

[3] In those instances where inputs are fixed it is of interest to note that when the principle of opportunity costs and capitalized values are used $\frac{MVP_{x_i}(Y)}{P_{x_i}} = 1$ $i = 1,2,\ldots,n$ for all fixed inputs.

[4] Assumes stage 2.

So far, the discussion has dealt only with those instances where it was appropriate to assume that all inputs (i.e. input categories) were variable. If, however, the assumption of variability cannot reasonably be made for all factors of production, the foregoing discussion is inadequate to handle the situation. If a factor of production is fixed at some certain level for a given farm, the appropriate adjustment of input levels would have to take the input fixity into account.

When, as in the present study, a group of farms have been purposely selected for a wide range of imperfect adjustment, neither the assumption of the fixity of the same input at the same level for all farms, nor even the assumption of the fixity of the same input for all farms seems justified without testing its appropriateness. Consequently, it appeared necessary to determine which inputs were fixed for individual farms, and the nature of adjustments that would both increase efficiency and take account of input fixity.

The concept of input fixity as developed by Willet,[5] Johnson,[6] and Edwards,[7] and employed here, involves two limits, the salvage value, and the replacement cost of the services of an input. The MVP of a fixed input lies between these limits. In the present study, it appeared worthwhile to explore this concept further to include what was termed unilateral

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[5] In a statement G.L. Johnson of the Department of Agricultural Economics, Michigan State University, made to the author he indicated that he had received the idea of input or asset fixity from J. Willet, a student in one of his courses at the University of Kentucky.

[6] Johnson, G.L., and Hardin, L.S., Economics of Forage Evaluation, Station Bulletin 623, Purdue University, Lafayette, Indiana, pp.5-13.

[7] Edwards, Clark, Resource Fixity, Credit Availability and Agricultural Organization, unpublished Ph.D. Thesis, Department of Agricultural Economics, Michigan State University, 1958.

fixity of inputs. In the event there is a wide range between salvage value and replacement cost of an input, and the marginal value productivity of the input closely approaches either its replacement cost or its salvage value, the input will be considered to be fixed in one direction and variable in the opposite direction. Since unilateral input fixity is a less demanding restriction than input fixity, it is useful under more circumstances. Specifically, it may be impossible to determine whether an input category is fixed, but possible to ascertain whether or not it is unilaterally fixed. In the present study, the concept of unilateral fixity is used to deal with upward fixity of labor. In view of the fact that many non-monetary factors enter into the farm operator's decision to stay in farming, the lower limit may be more difficult to ascertain than the upper one.

The procedure adopted to determine whether or not the labor input was fixed upward on each farm was the following:

Labor was held fixed on each farm at the levels existing in 1957 as determined by the survey. At the same time, all other inputs on the farm were adjusted in accordance with the profit maximizing conditions of $\frac{MVP_{x_i}}{P_{x_i}} = 1 \quad i = 1,3,4,5,6.$[8] If at the profit maximizing level of other inputs the MVP of labor was less than its acquisition price, it was regarded as fixed and the optimal organization was considered to have been determined for the farm. However, if the estimated MVP for labor was found to be greater than its acquisition price at the most profitable level for other inputs, then the new optimum computed for the farm included

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[8] Labor it will be remembered was the second input and since its fixity is being tested does not enter into this particular computation.

varying labor until for all inputs $\frac{MVP_{x_i}}{P_{x_i}} = 1 \quad i = 1,2,3,4,5,6.$ It is to be noted that when reservation prices are the same as opportunity costs, the resultant of profit maximization is an efficient[9] adjustment within and between firms for those factors of production that are varied.

In working with the Cobb-Douglas function the technique for profit maximization may be carried out as follows:

$$\text{Since } MVP_{x_i} = \frac{\partial \hat{Y}}{\partial X_i}^{10} = \frac{b_i \hat{Y}}{X_i} \qquad \text{I}$$

and the profit maximizing condition is that

$$MVP_{x_i} - P_{x_i} = 0 \quad \text{i.e.} \quad \frac{b_i \hat{Y}}{X_i} - P_{x_i} = 0 \qquad \text{II}$$

and multiplying II by $\frac{X_i}{P_{x_i}}$ yields $\frac{b_i \hat{Y}}{P_{x_i}} - X_i = 0$ which on solving for X_i results in $X_i = \frac{b_i \hat{Y}}{P_{x_i}} = K_i \hat{Y}$ (where $K_i = \frac{b_i}{P_{x_i}}$) III

substituting this value in the original Cobb-Douglas production function $\hat{Y} = a x_i^{b_1} x_2^{b_2} \ldots x_n^{b_n}$ yields $\hat{Y} = a(K_1\hat{Y})^{b_1}(K_2\hat{Y})^{b_2} \ldots (K_n\hat{Y})^{b_n}$ which may be readily solved for $\hat{Y}$ at the profit maximizing level of output. $\hat{Y}$ may then be substituted in III which may be solved for x_i. Repeating the last step yields the profit maximizing level for all inputs. When an input was being tested for fixity a procedure similar to that just outlined was followed with the modification that A was substituted for the constant in the equation (where $A = a x_f^{b_f}$, and x_f is the input category

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[9] According to criteria 6 and 7 of Chapter II.

[10] $\hat{Y} = a x_1^{b_1} x_2^{b_2} \ldots x_n^{b_n}$ is assumed to be a value productivity function i.e. $\hat{Y}$ is predicted gross income.

being tested for fixity). The MVP of x_f was then computed at the profit maximizing level for all other inputs in the usual way.

Estimating credit requirements functionally involved the following steps. The combined category, labor and livestock-forage, was assumed fixed, and other input categories were adjusted in the manner indicated to maximize profit for each input category in relation to its reservation price. The marginal value productivity of labor and livestock forage for the resulting modified farm organizations was then computed. An alternative adjustment was also considered; it was based on a modification of the equation presented in the last chapter. The principal modifications in this equation were, (1) the separation of cash expenses into two components, livestock-expenses and crop expenses and, (2) the separation of labor-livestock-forage into the two categories labor and livestock-forage. In this instance, labor was assumed fixed and the profit maximizing adjustments were made for the other input categories. The marginal value productivity of labor was then calculated to determine the reasonableness of the assumption of upward fixity. Both the attempted adjustments indicated that the assumption of fixity was reasonable for labor and labor-livestock-forage, in the sense that their respective marginal value productivities remained below their acquisition prices.

The interesting result yielded by a consideration of the optimal farm organizations from both these equations, was that livestock-forage investments were forced downwards to levels beyond the range of the original data for most farms, while generally both machinery and land were forced upwards. The typical adjustment for buildings was an increase.[11] The new adjustment for most farms may be regarded as being

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[11] See appendix tables XII, XIII, XIV, and XV.

appropriate for cash cropping with a little dairying on the side. Certain of the results involved extrapolations beyond experience into physical impossibilities. For example, livestock expenses are high enough to imply that for many farms the optimal adjustment would be to feed cows at a level that is roughly equivalent to four times their capacity to consume. At the same time barns and storage space for more cows would be built, to provide superfluous housing capacity for non-existent cows. The results should be interpreted as follows.

The best adjustment on these farms was to shift out of dairying into a typical cash crop organization involving more land and machinery so long as only the existing technologies are employed. This conclusion is generally reinforced by the results obtained by other workers.[12]

Before accepting this dismal conclusion, however, it is necessary to consider adjustments involving new technologies. Still further the estimates indicate that emphasis should be placed on new labor saving technologies.

Budgeting and Inter-Functional Adjustment

It was noted at the beginning of this chapter that at least two types of adjustment that result in an increase in efficiency are possible for a given farm firm. Adjustments on a function were termed intra-functional, while those involving a shift from one production function to another were called inter-functional. In the preceding section the

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[12] Dean McKee of the Department of Agricultural Economics, Michigan State University, indicated in a statement to the author that results he had obtained from an unpublished linear programming study indicated that dairying would not, even under fairly favourable conditions, be capable of competing with cash crops in a similar area in Michigan.

nature of the intra-functional adjustments on the estimated production function were delineated. It was concluded that the type of adjustment which would admit a more efficient organization of the studied farms, would not, at the same time admit their continued existence as dairy farms.

Since this study is directed towards credit problems of dairy farms, qua dairy farms adjustments, implied by a consideration of the extant production function, were regarded as being inappropriate for the purpose at hand.[13] Consequently, a different approach to the problem of more efficient adjustment of the studied farms as dairy farms was decided upon.

An attempt was made to find for each farm a new organization, that was both a dairy organization, and superior in terms of efficiency, to the initial organization. The procedure followed to attain these ends, was that of working out an individual budget for each of the studied farms. A detailed description of the procedures follows.

Sources and Modifications of Data Used in Budgeting

The budgets carried out in this study were based on the work of Earl Fuller.[14] They involve organizations and technologies that do not exist in complete sets on the typical farm studied. They may be regarded as examples of the form of organization necessary for survival in the dairy industry in coming years. In general, the basis on which the individual budgets were built was the amount of full time operator and family labor

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[13] Although as pointed out previously in this thesis cash cropping may be the most efficient use of farming resources for this area.

[14] Fuller, Earl J., op. cit.

available on the individual farm under consideration. Those modifications of Fuller's assumptions which are of general applicability follow:

1. Land was assumed to have 1.1 times the productivity assumed by Fuller for corn, oats, and hay. This seemed to be appropriate in view of the high quality of the land in Sanilac county relative to that considered by Fuller.
2. Certain modifications in prices were also made, for instance. Cows producing 10,000 pounds of milk were valued at $250 per head instead of $200, with a $25 increase or decrease in price for every 1000 pounds of milk produced above or below the 10,000 pound mark. Cattle sold were given prices 50 percent above those assumed by Fuller, while cattle inventory increases were assumed to have a 25 percent greater value than in his budgets. These changes were believed to be necessary, to reflect accurately, the higher values of sales and inventory changes encountered on the farms studied in Sanilac county.
3. In addition to the changes mentioned above, one of two crop enterprises was included on some of the farm budgets presented here. Field beans were assumed to yield a net of $27 per acre, and sugar beets a net of $54 per acre; credit requirements equivalent to the non land costs of producing these crops, were assumed to be $54 and $104 for beans and sugar beets respectively.

Specific modifications for individual budgets were made on the basis of interviews and schedules taken, for example, where the farm operator was unable to obtain more land, or when a specific piece of land was available for purchase, the modified budget was adjusted to fit the circumstances. In the following section, the initial farm situation, the modification

and the credit required for adjustment, are included along with a commentary on conditions peculiar to the particular farm, and of relevance in making the budget. In some instances, it will be noted that a modified budget is not included; this implies that the farms as organized appeared to be as well, or better adjusted than those attainable with the budgeting procedure discussed above. The criterion of efficiency in this comparison between existing and budgeted states is different from that used in the previous section. For operational purposes, the ratio of value of total product to total costs for the initial farm organization is compared with the corresponding ratio for the modified budget. The larger of the two ratios is taken to indicate greater total short run efficiency. Since diminishing returns to scale were indicated for the farms as studied, it seemed reasonable to assume that movement along the production function, in the direction of increased output, would yield a smaller ratio of value of output to cost of input, while Fuller's work often involved linear relationships that prevented (as handled) changes in efficiency, as scale of enterprise was changed. In as much as the postulation of downward fixity seems a reasonable assumption for most farm inputs;[15] the operational criterion of efficiency suggested above would appear to be an appropriate empirical application of criterion 10 of Chapter III.

The credit required for efficient adjustment was determined by subtracting the investments,[16] and costs, for the original organizations of

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[15] The exception in the budgets is farm labor, which was determined to be fixed upward, and variable downward.

[16] The organization shown is assumed to be after one year's operation, hence no credit requirement is shown for additional feed and supplies that would be required. In some instances it might appear to the individual operator to be more profitable to buy these rather than to grow them, and then to purchase the additional livestock. In any event this method of handling the feed inventory probably underestimates the credit requirements.

a farm from investments, and costs, for budgeted reorganization for that farm. The initial organizations and modified budgets are presented, farm by farm, in the sections which follow.

Initial and Modified Budgets

Farm No.1	Initial	Modified
Number Full-Time Men	1	1
Number of Cows	22	40
Number of Tillable Acres	101	160
Land & Improvements	$14,000	$34,000
Dairy Cattle	8,650	13,520
Machines & Equipment	5,906	13,540
Feed Inventory	810	5,268
Cash & Liquid Assets	200	1,000
Total Investment	29,566	57,328
Total Expenses	4,820	11,525
Total Receipts	7,420	19,936
Net Income	2,600	8,411
Interest on Investment @ 5 percent/yr.	1,478	2,866
Labor & Mgt.Earnings	1,122	5,545
Salaries	4,800	4,800
Profits	-3,678	745
Credit Required		38,659

The principal changes here were an increase in land from 101 tillable acres to 160 tillable acres. This involved a purchase of 80 acres of tillable land since the operator originally owned only 80 tillable acres. Dairy cattle were increased by 18 head (for which there is housing already available). A crop enterprise (24 acres of beans) was also included in the new budget. In the event it would be possible to secure a long term rental contract,or lease,on the additional 80 acres of tillable land, the credit requirements could be reduced substantially on this farm reorganization plan. However, it is doubtful whether the operator would be willing to undertake other investments in livestock, machinery, and cows unless he had secure control of the additional land for several years.

Farm No.2	Initial	Modified
Number of Full-Time Men	1	1
Number of Cows	22	30
Number of Tillable Acres	97	97
Land & Improvements	$40,250	$41,250
Dairy Cattle	15,600	17,600
Machines & Equipment	7,365	11,885
Feed Inventory	1,017	5,268
Cash & Liquid Assets	2,000	1,000
Total Investment	68,582	77,003
Total Expenses	7,073	10,197
Total Receipts	14,100	17,933
Net Income	7,027	7,736
Interest on Investment @ 5 percent/yr.	3,429	3,852
Labor & Mgt.Earnings	3,598	3,884
Salaries	4,800	4,800
Profits	-1,202	-916
Credit Required		6,520

It is difficult to attain an efficient adjustment on this farm,since land in the adjacent area is not available for purchase or rental. Consequently increase in scale of operations in this case was considered to be restricted. The operator's present method of farming has involved the sale of considerable purebred livestock at better than average prices. The large amount of individual care per animal required would,most likely, serve as a further deterrent to increased size of operation. Credit problems on this farm are less important than land restrictions. Income and efficiency could be increased by the addition of a crop enterprise at some distance from the home farm; however, even this alternative seems unlikely to increase efficiency in view of the distance machines would have to travel on the road.

Farm No.3	Initial	Modified
Number of Full-Time Men	1	1
Number of Cows	22	40
Number of Tillable Acres	116	156
Land & Improvements	$20,000	$31,000
Dairy Cattle	7,300	12,700
Machines & Equipment	10,167	13,540
Feed Inventory	2,415	5,268
Cash & Liquid Assets	600	1,000
Total Investment	40,482	63,508
Total Expenses	6,384	11,773
Total Receipts	12,501	25,950
Net Income	6,117	14,177
Interest on Investment @ 5 percent/yr.	2,024	3,175
Labor & Mgt.Earnings	4,093	11,002
Salaries	4,800	4,800
Profits	-707	6,202
Credit Required		22,582

This farm as organized is fairly efficient. The modifications in the budget include an increase in cows from 22 to 40. Current production is 13,000 pounds. The budget assumes 12,000 pounds with 40 cows. Twenty acres of beans provide additional income. Both buildings and land investments have been increased. No particular restrictions appear to prevent the adjustment indicated.

Farm No.4	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	42	80
Number of Tillable Acres	165	300
Land & Improvements	$100,000	$140,500
Dairy Cattle	19,425	28,925
Machines & Equipment	15,762	17,255
Feed Inventory	2,918	10,931
Cash & Liquid Assets	1,600	2,000
Total Investment	139,705	199,611
Total Expenses	9,846	20,087
Total Receipts	16,973	37,423
Net Income	7,127	17,336
Interest on Investment @ 5 percent/yr.	6,985	9,980
Labor & Mgt.Earnings	142	7,356
Salaries	7,100	7,100
Profits	-6,958	256
Credit Required		58,531

The changes indicated on this farm appear to be more in the nature of changes in scale,than on most of the others. Increases are implied for land, livestock, and buildings. Salaries total $7,100 instead of the usual $9,600 for a two man farm, since $2,300 is what the operator is paying his hired man. No restrictions to change appear obvious in this case. The operator is currently getting 10,000 pound production from his cows. It is assumed that he would be able to maintain this level of production with the increased number of cows. The modified cropping program includes 27 acres of beans.

Farm No.5	Initial	Modified
Number of Full-Time Men	3	3
Number of Cows	30	120
Number of Tillable Acres	255	414
Land & Improvements	$30,000	$100,000
Dairy Cattle	16,000	43,000
Machines & Equipment	15,039	20,505
Feed Inventory	6,309	16,563
Cash & Liquid Assets	400	3,000
Total Investment	67,748	183,068
Total Expenses	11,846	27,955
Total Receipts	21,974	64,258
Net Income	10,128	36,303
Interest on Investment @ 5 percent/yr.	3,387	9,153
Labor & Mgt.Earnings	6,741	27,150
Salaries	12,169	12,169
Profits	-5,428	14,981
Credit Required		107,218

The modified budget indicates very heavy capital requirements necessary with new technology, to provide an adequate level of earnings for a three man dairy operation. The operator currently is milking 30 cows, producing an average of 13,000 pounds of milk per cow. The budget assumes a 12,000 pound average for 120 cows which may be optimistic. This budget does not include a separate cropping program in addition to that assumed sufficient to provide feed for the livestock.

Farm No.6	Initial	Modified
Number of Full-Time Men	1	
Number of Cows	40	
Number of Tillable Acres	204	
Land & Improvements	$45,000	
Dairy Cattle	10,300	
Machines & Equipment	11,529	
Feed Inventory	5,985	
Cash & Liquid Assets	600	
Total Investment	73,414	
Total Expenses	10,542	
Total Receipts	23,704	
Net Income	13,162	
Interest on Investment @ 5 percent/yr.	3,671	
Labor & Mgt.Earnings	9,491	
Salaries	4,800	
Profits	4,691	
Credit Required		none

As this farm is organized,it is more efficient than the budgeted modification for it would be. Cattle sales are greater than on the budgeted 40 cow farm as are cattle and crop inventory increases. A good portion of the buildings and equipment on this place are new,and of a labor saving type. Thus such a farm indicates that the budgeted modifications are attainable under some circumstances.[17]

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[17] This farm's gross income is 7,968 dollars above that predicted by the functional analyses which also indicates that it is on a production function superior to those for the typical farm studied.

Farm No.7	Initial	Modified
Numer of Full-Time Men	1	1
Number of Cows	30	40
Number of Tillable Acres	190	190
Land & Improvements	$30,540	$41,540
Dairy Cattle	8,903	13,520
Machines & Equipment	7,932	13,540
Feed Inventory	1,076	5,268
Cash & Liquid Assets	800	1,000
Total Investment	49,251	74,868
Total Expenses	7,437	12,696
Total Receipts	10,861	20,496
Net Income	3,424	7,800
Interest on Investment @ 5 percent/yr.	2,462	3,743
Labor & Mgt.Earnings	962	4,057
Salaries	4,800	4,800
Profits	-3,838	-743
Credit Required		26,835

This operation, as currently managed, is characterized by inadequate housing, storage and an almost complete lack of labor saving devices. The modification recommended here,includes a switch from a herd of 30 Jersey cows to a herd of 40 Holsteins. Milk production averages 6000 pounds per cow. With larger cows of greater productive capacity, the operator should be able to achieve 10,000 pounds of 3.6 percent milk per cow per year. Major investments in buildings and storage are indicated for this farm. Fifty-four acres of beans are included as a cash crop. In view of the low price of cull Jersey cows,the increase in inventory value of livestock was not modified upwards,as in the case of the other farms budgeted. This farm has serious technical and credit problems.

Farm No.8	Initial	Modified
Number of Full-Time Men	1	1
Number of Cows	36	40
Number of Tillable Acres	145	145
Land & Improvements	$22,000	$34,500
Dairy Cattle	8,385	9,385
Machines & Equipment	11,827	13,540
Feed Inventory	2,689	5,268
Cash & Liquid Assets		1,000
Total Investment	44,901	63,693
Total Expenses	7,025	11,845
Total Receipts	13,060	19,381
Net Income	6,035	7,536
Interest on Investment @ 5 percent/yr.	2,245	3,185
Labor & Mgt.Earnings	3,790	4,354
Salaries	4,800	4,800
Profits	-1,010	-446
Credit Required		20,711

The modifications indicated for this farm are similar to those suggested for farm 1. The purchase of 50 acres of tillable land is suggested for the same reasons,but might be omitted if suitable long term rental or leasing arrangements could be made. A greater increase in size of operation might be possible under improved management conditions; however, it is the author's personal opinion that this operator should continue on a small unit.

Farm No.9	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	33	80
Number of Tillable Acres	190	290
Land & Improvements	$45,278	$98,278
Dairy Cattle	11,450	23,200
Machines & Equipment	8,642	17,255
Feed Inventory	3,386	10,931
Cash & Liquid Assets	200	2,000
Total Investment	68,938	123,664
Total Expenses	10,362	21,903
Total Receipts	15,419	38,145
Net Income	5,093	16,242
Interest on Investment @ 5 percent/yr.	3,447	6,183
Labor & Mgt.Earnings	1,646	10,059
Salaries	9,600	9,600
Profits	-7,954	459
Credit Required		84,876

Large amounts of credit are required to attain an efficient combination of resources on this enterprise. The important changes in investment include increased land, buildings, and livestock. Serious breeding problems have been encountered on this farm,that have resulted in a drop in milk production of nearly 1500 pounds per cow. The modification includes a change of breeds to aleviate this problem. The first few years would probably be required to build up the herd to the 10,000 pound level used. Current production averages 8500 pounds,but the operator has demonstrated the capacity to handle high producing cows. A cash crop of 19 acres of beets are included,since the operator has the equipment available,and is experienced in growing them.

Farm No.10	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	53	100
Number of Tillable Acres	400	400
Land & Improvements	$100,000	$112,000
Dairy Cattle	24,000	35,750
Machines & Equipment	15,325	17,655
Feed Inventory	3,201	13,330
Cash & Liquid Assets	551	2,500
Total Investment	143,077	181,235
Total Expenses	12,768	23,937
Total Receipts	23,030	51,509
Net Income	10,262	27,572
Interest on Investment @ 5 percent/yr.	7,154	9,062
Labor & Mgt.Earnings	3,108	18,510
Salaries	9,600	9,600
Profits	-6,492	8,910
Credit Required		43,468

No particular obstacles appear to prevent the changes indicated in the modified budget from being initiated and completed. The modified budget includes a cash crop of 59 acres of beets. The 10,000 pound average production per cow at present,is assumed attainable for the increased herd. On this farm, as on most of the others studied, cash cropping is an important alternative to dairying.

Farm No.11	Initial	Modified
Number of Full-Time Men	1½	1½
Number of Cows	25	40
Number of Tillable Acres	301	301
Land & Improvements	$48,500	$48,500
Dairy Cattle	13,200	16,950
Machines & Equipment	11,571	13,540
Feed Inventory	3,229	5,268
Cash & Liquid Assets	500	1,000
Total Investment	77,000	85,258
Total Expenses	7,869	11,725
Total Receipts	17,435	25,889
Net Income	9,566	14,164
Interest on Investment @ 5 percent/yr,	3,850	4,263
Labor & Mgt.Earnings	5,716	9,901
Salaries	7,200	7,200
Profits	-1,484	2,701
Credit Required		14,549

The interview held with the operator of this farm indicated that he was not yet ready to expand fully his farming operations,but would rather wait until his sons decide whether or not they wish to farm. Consequently only a minimal livestock program is outlined in the modified budget while important emphasis is placed on cash crop production. Part of the land will remain in the soil bank program,while the remainder, not used for feed production, will be devoted to sugar beets. Milk production per cow is at the 9000 pound level; however, 10,000 pounds per cow is used in the modified budget.

Farm No.12	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	33	80
Number of Tillable Acres	268	348
Land & Improvements	$35,000	$42,500
Dairy Cattle	10,550	22,300
Machines & Equipment	8,956	17,255
Feed Inventory	2,190	10,931
Cash & Liquid Assets	2,000	2,000
Total Investment	58,696	94,986
Total Expenses	8,469	19,829
Total Receipts	18,600	42,278
Net Income	10,131	22,449
Interest on Investment @ 5 percent/yr.	2,935	4,749
Labor & Mgt.Earnings	7,196	17,700
Salaries	9,600	9,600
Profits	-2,404	8,100
Credit Required		39,801

Another 80 acres of bare land is available for purchase by the operator at $7,500. As currently operated, the farm includes important crop enterprises of cucumbers, wheat and beans. The modified budget would retain a cash cropping program,although less extensive than the original. Current average production per cow is better than 9700 pounds. 10,000 pounds is used in the modified budget.

Farm No.13	Initial	Modified
Number of Full-Time Men	1½	
Number of Cows	33	
Number of Tillable Acres	302	
Land & Improvements	$21,500	
Dairy Cattle	11,800	
Machines & Equipment	17,453	
Feed Inventory	8,152	
Cash & Liquid Assets	1,375	
Total Investment	60,280	
Total Expenses	10,108	
Total Receipts	22,093	
Net Income	11,985	
Interest on Investment @ 5 percent/yr.	3,014	
Labor & Mgt.Earnings	8,971	
Salaries	7,200	
Profits	1,771	
Credit Required		none

With 33 cows producing an average of 10,500 pounds of milk and a cash crop program, this farm has a superior organization to that attainable under a modified budget, assuming 12,000 pound production per cow and devoted exclusively to dairying.[18] No modifications were suggested for this enterprise.

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[18] Gross income is 2,991 dollars above the income predicted by the Cobb-Douglas function indicating that adjustment is currently superior to the typical farm studied.

Farm No.14	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	27	80
Number of Tillable Acres	255	255
Land & Improvements	$40,000	$49,600
Dairy Cattle	11,100	24,350
Machines & Equipment	9,588	17,255
Feed Inventory	5,078	10,931
Cash & Liquid Assets	7,500	2,000
Total Investment	73,266	104,136
Total Expenses	6,798	21,666
Total Receipts	14,667	37,802
Net Income	7,869	16,136
Interest on Investment @ 5 percent/yr.	3,663	5,206
Labor & Mgt.Earnings	4,206	10,930
Salaries	9,600	9,600
Profits	-5,394	1,330
Credit Required		37,375

Changes suggested in the modified budget, include the purchase of 120 acres of land now being rented for reasons similar to those discussed for farm 1 and 8. However, even though no cash crop enterprise is included for this farm business, not enough feed is produced to support the livestock carried. Consequently, additional feed is purchased. Major investment changes include adding 53 more cows and housing. Despite disease problems in the herd and attendant difficulties, production has been maintained at more than 10,000 pounds per cow and the 10,000 pound rate is continued in the modified budget.

Farm No.15	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	58	80
Number of Tillable Acres	295	295
Land & Improvements	$75,000	$82,000
Dairy Cattle	22,500	30,500
Machines & Equipment	39,136	39,136
Feed Inventory	9,826	10,931
Cash & Liquid Assets	7,000	2,000
Total Investment	153,462	164,567
Total Expenses	12,976	20,087
Total Receipts	26,941	40,220
Net Income	13,965	20,133
Interest on Investment @ 5 percent/yr.	7,673	8,228
Labor & Mgt.Earnings	6,292	11,905
Salaries	9,600	9,600
Profits	-3,308	2,305
Credit Required		14,836

Rapid changes have characterized the development of this farm enterprise during the past five years. The herd has been increased by 30 cows, new buildings, a pipeline milker, milking parlor and bulk tank have been purchased. The additional investments of the modified budget are comparatively small, the largest being for the purchase of 23 more cows. Current milk production is 9000 pounds per cow while the modification assumes a 10,000 pound rate of production. This enterprise appears very similar to that indicated by the Fuller budget for 80 cows.

Farm No.16	Initial	Modified
Number of Full-Time Men	1	
Numer of Cows	16	
Number of Tillable Acres	175	
Land & Improvements	$35,000	
Dairy Cattle	8,400	
Machines & Equipment	6,411	
Feed Inventory	2,718	
Cash & Liquid Assets	735	
Total Investment	53,264	
Total Expenses	4,645	
Total Receipts	13,530	
Net Income	8,885	
Interest on Investment @ 5 percent/yr.	2,663	
Labor & Mgt.Earnings	6,222	
Salaries	4,800	
Profits	1,422	
Credit Required		none

High producing cows (12,125 pound average) and a good cropping program, appear to be some of the reasons for a high gross income on this farm. As the operator buys all used machinery which he repairs himself, he is able to keep machinery investments and repairs low. Cattle are on controlled rotation grazing during the summer. The principal cash crops are wheat, beans, and pickles. The farm as currently organized, has profits comparable to those that might be expected from Fuller's 40 cow 12,000 pound budget modification, consequently no changes in this operation are suggested.[19]

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[19] The farm's gross income is 3,873 dollars above that predicted by functional analysis indicating an adjustment superior to the typical farm studied.

Farm No.17	Initial	Modified
Number of Full-Time Men	1	
Number of Cows	24	
Number of Tillable Acres	110	
Land & Improvements	rented	
Dairy Cattle	$ 7,050	
Machines & Equipment	3,677	
Feed Inventory	2,227	
Cash & Liquid Assets	100	
Total Investment	13,054	
Total Expenses[20]	3,872	
Total Receipts	10,343	
Net Income	6,471	
Interest on Investment @ 5 percent/yr.	653	
Labor & Mgt.Earnings	5,818	
Salaries	4,800	
Profits	1,018	
Credit Required		none

Although the total investment on this farm is comparatively modest, it is a more efficient operation than that attainable under the 40 cow 10,000 pound modified budget. No changes to increase efficiency on this operation were suggested. Fairly low milk yields (7525 pound average) are compensated for by a good cash crop program, and expenses are kept down to minimal levels. This operator has been producing beets for sale and buying forage with the beet receipts.[21]

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[20] Includes rental payment.

[21] The functionally predicted gross income of this farm is 530 dollars less than current gross income indicating a better than typical adjustment for this farm.

Farm No.18	Initial	Modified
Number of Full-Time Men	1	1
Number of Cows	21	40
Number of Tillable Acres	229	229
Land & Improvements	$50,000	$50,000
Dairy Cattle	7,175	11,925
Machines & Equipment	5,729	13,540
Feed Inventory	2,931	5,286
Cash & Liquid Assets	3,850	1,000
Total Investment	69,685	81,733
Total Expenses	7,151	11,396
Total Receipts	12,913	22,050
Net Income	5,762	10,654
Interest on Investment @ 5 percent/yr.	3,484	4,087
Labor & Mgt.Earnings	2,278	6,567
Salaries	4,800	4,800
Profits	-2,522	1,767
Credit Required		15,653

Adequate land and buildings to support a fairly large dairy enterprise are present on this farm. However, the operator indicated he was strongly considering cash crops as an important alternative to dairying. Consequently, the dairy program sketched out in the modified budget is a minimal one in relation to the land available. A fairly large cash crop program is included with it. Credit requirements to make the modification indicated are fairly modest.

Farm No.19	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	35	80
Number of Tillable Acres	200	280
Land & Improvements	$50,000	$ 5,800
Dairy Cattle	16,300	29,800
Machines & Equipment	19,511	19,511
Feed Inventory	4,140	10,931
Cash & Liquid Assets	1,985	2,000
Total Investment	91,936	120,242
Total Expenses	9,870	19,199
Total Receipts	21,515	38,433
Net Income	11,645	19,234
Interest on Investment @ 5 percent/yr.	4,597	6,012
Labor & Mgt.Earnings	7,048	13,222
Salaries	9,600	9,600
Profits	-2,552	3,622
Credit Required		29,671

Eighty acres of tillable land with a house are available to the operator of this farm at a price of $8,000. One member of the informal partnership proposes to retire within the next few years. Consequently the available 80 acres may be purchased as housing for a hired man. Machinery investment on this farm is high and most of the equipment is in good condition. Consequently the repair item in the modified budget was reduced from the usual level assumed for second hand machinery. With the increased livestock program there is still some land available for a cash crop of beans. However, this land might be put to better use in the production of emergency feed or pasture

Farm No.20	Initial	Modified
Number of Full-Time Men	3	
Number of Cows	75	
Number of Tillable Acres	367	
Land & Improvements	$100,000	
Dairy Cattle	26,412	
Machines & Equipment	26,376	
Feed Inventory	5,726	
Cash & Liquid Assets	5,000	
Total Investment	163,512	
Total Expenses	22,778	
Total Receipts	41,375	
Net Income	18,597	
Interest on Investment @ 5 percent/yr.	8,175	
Labor & Mgt.Earnings	10,422	
Salaries	8,307	
Profits	2,112	
Credit Required		none

As it is presently organized, this 75 cow dairy herd is as efficient as the organizations attainable under the modified budget for 80 cows that Fuller presents. Hired labor in this instance is receiving less than the $4,800 per man, assumed necessary by Fuller. If the same quality of labor were used on this farm used in the modified budgets, it would be underemployed and would yield a less efficient adjustment than that now existing.[22] Current milk production is 10,500 pounds per cow.

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[22] Functional analysis predicts a gross income for this farm 5,713 dollars less than its current gross income. This is evident to support the conclusion that current adjustment on this farm is superior to adjustment on the typical farm studied.

Farm No.21	Initial	Modified
Number of Full-Time Men	1	1
Number of Cows	21	40
Number of Tillable Acres	77	157
Land & Improvements	$20,000	$30,000
Dairy Cattle	5,900	10,650
Machines & Equipment	6,853	13,540
Feed Inventory	973	5,268
Cash & Liquid Assets	1,100	1,000
Total Investment	34,826	60,458
Total Expenses	3,892	11,525
Total Receipts	5,652	18,132
Net Income	1,760	6,607
Interest on Investment @ 5 percent/yr.	1,741	3,023
Labor & Mgt.Earnings	19	3,584
Salaries	4,800	4,800
Profits	-4,781	-1,216
Credit Required		27,972

There is some doubt whether the chief difficulty on this farm is a technical problem,or a shortage of resources. A relatively large increase in capital outlays and cash expenses,would not appear capable of making a much more efficient adjustment on this farm. Milk production currently is low, land appears to be less than adequate although 80 acres additional land are available. Operator is currently doing part time work away from the farm, it seems doubtful that an efficient adjustment can be readily attained on this farm.

Farm No.22	Initial	Modified
Number of Full-Time Men	1	1
Number of Cows	35	40
Number of Tillable Acres	220	220
Land & Improvements	$48,000	$48,000
Dairy Cattle	12,875	14,125
Machines & Equipment	16,398	16,398
Feed Inventory	4,606	5,268
Cash & Liquid Assets	2,100	1,000
Total Investment	83,977	84,791
Total Expenses	10,717	11,525
Total Receipts	12,527	21,406
Net Income	2,310	10,154
Interest on Investment @ 5 percent/yr.	4,199	4,240
Labor & Mgt.Earnings	-1,889	5,914
Salaries	4,800	4,800
Profits	-6,689	1,114
Credit Required		3,350

Seventeen cows were sold out of the herd on this farm during the accounting period used in this study. Disease control and rebuilding the herd appear to be the chief problems facing this operator. The change indicated in the modified budget are small, and may be construed as being of minor importance,relative to the disease control problem facing the operator.

Farm No.23	Initial	Modified
Number of Full-Time Men	1	
Number of Cows	22	
Number of Tillable Acres	144	
Land & Improvements	$25,000	
Dairy Cattle	8,000	
Machines & Equipment	10,436	
Feed Inventory	2,925	
Cash & Liquid Assets	3,000	
Total Investment	49,361	
Total Expenses	7,351	
Total Receipts	15,208	
Net Income	7,857	
Interest on Investment @ 5 percent/yr.	2,468	
Labor & Mgt.Earnings	5,389	
Salaries	4,800	
Profits	589	
Credit Required		none

By combining a high production per cow, (better than 13,000 pounds) with a fair sized cash crop enterprise, this operator has achieved an efficiency equivalent to that of a modified budget of 40 cows producing 10,000 pounds on the average. No modifications on this operation are suggested to increase its efficiency.[23]

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[23] Functional analysis predicts a gross income for this farm that is 2,066 dollars below that actually attained.

Farm No.24	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	51	81
Number of Tillable Acres	303	303
Land & Improvements	$61,800	$75,800
Dairy Cattle	17,475	24,725
Machines & Equipment	14,584	17,255
Feed Inventory	5,768	10,931
Cash & Liquid Assets	10,000	2,000
Total Investment	109,627	130,711
Total Expenses	13,301	19,093
Total Receipts	24,477	39,054
Net Income	11,176	19,093
Interest on Investment @ 5 percent/yr.	5,481	6,535
Labor & Mgt.Earnings	5,695	13,426
Salaries	9,600	9,600
Profits	-3,905	3,826
Credit Required		21,443

Despite the fact that this farm operation has a stanchion barn without a gutter cleaner, its overall efficiency of operation compares fairly favorably with that of the modified budget for 60 cows with limited land, although less well with the other budgets for 60 and 80 cow herds. The changes suggested to increase efficiency are as a consequence relatively small. Included in the modifications are 29 more cows, additional barn space, and some more machinery. Current milk production is better than 11,000 pounds per cow, and the modification assumes a 10,000 pound level of production. A minor cash crop program remains after the feed requirements of the livestock have been met.

Farm No.25	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	25	80
Number of Tillable Acres	320	320
Land & Improvements	$54,000	$60,000
Dairy Cattle	9,255	23,005
Machines & Equipment	18,277	18,277
Feed Inventory	4,213	10,931
Cash & Liquid Assets	12,940	2,000
Total Investment	98,685	114,213
Total Expenses	13,564	20,057
Total Receipts	22,333	40,782
Net Income	8,769	20,725
Interest on Investment @ 5 percent/yr.	4,934	5,710
Labor & Mgt.Earnings	3,883	15,015
Salaries	9,600	9,600
Profits	-5,767	5,415
Credit Required		19,121

Currently carrying on an extensive cash crop program,this farm has about the right size for a two man operation; however, if dairying is to be the main source of income, 55 more cows would have to be milked twice a day to bring this farm up to the organization implied by the 2 man 80 cow budget modification. Some fairly extensive changes would be required for housing the increased herd, but none are suggested for increasing machinery,which already is more than adequate for the size of operation.

Farm No.26	Initial	Modified
Number of Full-Time Men	1	
Number of Cows	56	
Number of Tillable Acres	275	
Land & Improvements	$90,000	
Dairy Cattle	17,450	
Machines & Equipment	26,934	
Feed Inventory	9,719	
Cash & Liquid Assets	1,680	
Total Investment	145,783	
Total Expenses	11,282	
Total Receipts	25,267	
Net Income	13,985	
Interest on Investment @ 5 percent/yr.	7,289	
Labor & Mgt.Earnings	6,696	
Salaries	4,800	
Profits	1,896	
Credit Required		none

This farm operation is almost identical in organization to the budget modification for a 60 cow herd, although only 56 cows are carried. No modification is suggested for this operation, however, it is interesting to note the way in which it substantiates the budgeted possibilities of a farm of similar size and organization.[24]

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[24] The superiority of the present adjustment on this farm relative to the adjustment for the typical farm studied, is indicated by a gross income at present that is 1,448 dollars above that predicted by functional analysis.

Farm No.27	Initial	Modified
Number of Full-Time Men	1	
Number of Cows	24	
Number of Tillable Acres	173	
Land & Improvements	$28,000	
Dairy Cattle	7,993	
Machines & Equipment	4,742	
Feed Inventory	3,034	
Cash & Liquid Assets	1,305	
Total Investment	45,074	
Total Expenses	10,109	
Total Receipts	17,850	
Net Income	7,741	
Interest on Investment @ 5 percent/yr.	2,253	
Labor & Mgt.Earnings	5,488	
Salaries	4,800	
Profits	688	
Credit Required		none

The comment on the preceding farm can be applied almost directly to this one. Although only 24 cows are being milked, additional enterprises on this farm including laying hens,and some cash crops combined with the dairy enterprise,to yield a more efficient operation than the 40 cow 10,000 pound modification.[25] Fairly old and inadequate buildings would most likely inhibit extensive expansion on this farm.

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[25] Gross income on this farm is 2,732 dollars more than the functionally estimated gross income for a typical farm studied. This result supports the superiority of the modified budget over that of the typically organized farm studied.

Farm No.28	Initial	Modified
Number of Full-Time Men	1	1
Number of Cows	23	40
Number of Tillable Acres	230	230
Land & Improvements	$50,000	$60,200
Dairy Cattle	9,400	14,500
Machines & Equipment	8,161	13,540
Feed Inventory	1,470	5,268
Cash & Liquid Assets	2,500	1,000
Total Investment	71,531	94,508
Total Expenses	7,659	11,388
Total Receipts	11,372	23,831
Net Income	3,731	12,443
Interest on Investment @ 5 percent/yr.	3,576	4,725
Labor & Mgt.Earnings	137	7,718
Salaries	4,800	4,800
Profits	-4,663	2,918
Credit Required		22,062

Currently this farm operator is producing better than 14,000 pounds of milk per cow from 23 cows. The modification assumes a 12,000 pound level of production, although this might be bettered under the particular circumstances on this farm. Included in the modified budget is a fairly large cash crop of beans.

Farm No.29	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	46	80
Number of Tillable Acres	302	302
Land & Improvements	$77,700	$77,700
Dairy Cattle	17,600	26,100
Machines & Equipment	11,466	17,255
Feed Inventory	1,775	10,931
Cash & Liquid Assets	2,400	2,000
Total Investment	110,941	133,986
Total Expenses	8,928	19,309
Total Receipts	15,915	35,496
Net Income	6,887	16,187
Interest on Investment @ 5 percent/yr.	5,547	6,699
Labor & Mgt.Earnings	1,340	9,488
Salaries	7,715	9,600
Profits	-6,375	-112
Credit Required		24,909

Even with nearly $25,000 of additional capital, adjustment on this enterprise still falls short of that attained on most of the other budget modifications. A 9000 pound level of production per cow is assumed in the budget, which exceeds the current rate of production by nearly 1500 pounds. Bang's disease, and the comparative inexperience of the operator, are partly the causes of the low level of production. The best current adjustment on this farm might well be an increased cropping program, to provide a learning period for the operator to acquire experience in the care and handling of a high producing herd of dairy cows.

Farm No.30	Initial	Modified
Number of Full-Time Men	2	2
Number of Cows	50	80
Number of Tillable Acres	362	362
Land & Improvements	$80,000	$80,000
Dairy Cattle	15,875	23,375
Machines & Equipment	14,459	17,255
Feed Inventory	3,048	10,931
Cash & Liquid Assets	5,250	2,000
Total Investment	118,632	133,561
Total Expenses	15,613	19,309
Total Receipts	19,781	37,089
Net Income	4,168	17,780
Interest on Investment @ 5 percent/yr.	5,931	6,678
Labor & Mgt.Earnings	-1,763	11,102
Salaries	9,600	9,600
Profits	-11,363	1,502
Credit Required		17,556

Quantitatively there is little difference between the initial and modified budgets on this farm. Qualitatively the difference is more pronounced. Current production per cow is at the 8000 pound level while in the modified budget a 9000 pound level is assumed. The principal difficulties of adjustment on this farm appear to be of a technical nature.

Farm No.31	Initial	Modified
Number of Full-Time Men	1	
Number of Cows	28	
Number of Tillable Acres	118	
Land & Improvements	$25,000	
Dairy Cattle	10,705	
Machines & Equipment	6,076	
Feed Inventory	2,193	
Cash & Liquid Assets	750	
Total Investment	44,724	
Total Expenses	5,509	
Total Receipts	12,250	
Net Income	5,509	
Interest on Investment @ 5 percent/yr.	2,236	
Labor & Mgt.Earnings	4,505	
Salaries	4,800	
Profits	-295	
Credit Required		none

Despite a fairly low level of production per cow of about 8000 pounds,this farm has achieved a more efficient adjustment than the modified budget for a 40 cow herd producing 10,000 pounds of milk. This has largely been achieved through thrift in keeping cash operating expenses down. Possible adjustments include purchase of higher producing cows.[26]

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[26] The gross income on this farm is 536 dollars less than that predicted for it by functional analysis.

Appraisal of Budget Estimated Credit Requirements

In appraising credit requirements as revealed by the above budgets, it is necessary to consider the nature and consequences of the assumptions and restrictions imposed in the budgets.

Initially, it was decided to work out budgets that would continue the farms in the dairy business. Thus, although minor cash crop enterprises were appended to many of the dairy-farm businesses in their respective modified budgets, the pure cash crop alternative was not thoroughly explored. Consequently, although the presented modified budgets are more efficient than the initial ones, it is not possible to conclude on this basis, that dairying is the most efficient type of production for the resources of these farms. The functional analysis as presented in the first part of this chapter, indicated that returns from dairy-livestock and forage investments, could be expected to be low for farms organized with old technology. Other workers have presented results that support a conclusion of a low level of productivity for dairy farms producing less than 12,000 pounds of milk at a price of $4.00 per cwt. A recent unpublished linear programming study, that included[27] dairying and cash crops as alternative enterprise, yielded no optimal input combination that included dairying. It would seem reasonable to infer from the evidence, that dairying for many of the farms studied, may not represent the most efficient long-run adjustment. However, in many cases because of the downward fixity of inputs, particularly those of a specialized nature, that are fixed for individual farms as well as for the dairy industry, many of the farms will most likely continue to

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[27] McKee, Dean, op. cit.

operate as dairy enterprises for some time to come.

There are other reasons which may be considered as important deterrents to movement out of the dairy industry. Some farmers are simply misled by erroneous reasoning of their own or of others. For many farm operators, dairying is part of a way of life they wish to pursue. The consequent subjective value that they attach to working with dairy livestock, in many cases outweighs the subjective value of higher expected money incomes, from other types of enterprises. Another consideration of importance in some farm situations, stems from the fact that if land resources are limited, cash cropping, even under the best known technology, may not yield an income high enough to satisfy the farm operator. In many cases, income may be increased by adding a livestock enterprise to the limited land available; farm no.2 of the presented budgets appears to be a case in point. In light of the foregoing, it seems worth-while to budget more efficient dairy farms, even though cash crop production might be the most efficient use of an uncomitted set of resources.

Certain other assumptions made, and procedures used in determining the credit requirements by budgeting, have to be considered prior to any general evaluation of the estimated credit requirements. As noted in the discussions of the various individual budgets, it was assumed that land could be acquired by outright purchase only. In many instances such may be the actual situation; however, in some instances, the possibility of securing long-term rental agreements, or land contracts, may exist which give the farm operator close to the security he would have as a direct owner. In any event, the assumption of outright ownership by purchase was made, because it was believed to be unlikely that farm

operators would make the associated changes in buildings, storage, livestock and machinery, unless they had secure tenure. To the extent that alternative ways of getting secure control of land, without direct purchase exist, the credit requirements indicated may be regarded as being overestimated.

A further source of upward bias in credit requirements resulted from the procedure of handling cash operating expenditure requirements. The aggregate estimate of annual cash operating expenses for the initial, and modified budgets, served as the basis for determining credit requirements for this category, but since many of the expense items would not be concurrent, the maximum operating credit required for any month for example, would probably be about a fifth or sixth of the total indicated. Both these tendencies to overestimate credit requirements were offset to a considerable degree, by the assumption of new technology in the modified budgets. One of the characteristics of the new labor saving technology in the dairy industry, is the complementarity of new labor saving technology with other new technology. Furthermore, the initiation of new technologies often make the value productivity of investments in the technology replaced almost zero. Consequently, a dollar invested in old technology in the initial budget, would substitute for considerably less than a dollar invested in the new technology, assumed in the modified budget. Thus, for most of the farms over- and underestimation of credit requirements tend to be compensatory.

In comparing the initial and modified budgets, it may be readily seen, that total expenses in the modified budgets are proportionately higher than for the initial budgets. Individual operators capable of keeping their operating expenses relatively low at present, should also

be able to reduce their operating expenses to a lower level than assumed in the modified budgets. Using the criterion of efficiency presented at the beginning of this section, this means that the efficiency of the modified budgets tends to be underestimated. Since, neither the initial nor the modified budgets include farm produced products for home use, this omission tends to underestimate the total value of receipts in both instances. However, it is not unreasonable to assume that roughly equivalent amounts would be produced in both instances and that, hence, their effects would cancel out.

On nine farms, the initial adjustment was considered to be as good or better than that attainable under a modified budget. An inspection of these farm budgets indicates several interesting relationships. Only two of these more efficient farms had more than one full time man, while fifteen of the thirty-one farms studied had more than one full time man. This would tend to support the hypothesis that not only are larger enterprises less readily adjusted than their smaller counterparts, but that it requires a level of management not frequently found, to make the management decisions on a larger enterprise. This indicates the existence of an upper limit on size of enterprise that can be efficiently operated, or alternatively, that the size of enterprise can be increased only by a large increase in wage payments. The assumption in this latter instance is, that more competent and efficient labor required on these farms could command a high wage elsewhere.

The source of efficiency on the nine farms mentioned above varied considerably, although all of the nine did have a supplementary cash crop enterprise that could have resulted in more efficient use of labor. In general, cash operating expenses on these nine farms were lower than those

occurring on other farms of similar size. High levels of milk production per cow were usually, though not always associated with these more efficient farms.

The following seem acceptable tentative conclusions that may be drawn from a consideration of the initial and modified budgets on the thirty-one farms studied. The increased efficiency indicated by the budget modifications for most of the farms studied, represent attainable goals, in the sense that nine of the thirty-one farms studied have demonstrated equivalent or superior adjustments. Although it should be borne in mind that the method of adjustment was different for many of the farms, the budgets support a hypothesis of low-managerial capacity of hired labor, relative to the managerial ability of owner operators. Consequently it may be tentatively concluded that the number of large increases in farm size, will be restricted by the lack of adequate sources of managerial ability on most of the farms studied, which is in accordance with the comparatively small increase in size of enterprise suggested by the modified budgets.

In the following chapter some of the important aggregate consequences of the modified budgets are considered, in addition to the main theme of admissibility of adjustment within the institutional restrictions on credit.

CHAPTER VI

ADJUSTMENT POSSIBILITIES

In the last chapter two types of efficient adjustment for dairy farms studied were explored. To recapitulate, the first type was that yielded by varying the quantities of the several input categories, to determine an efficient adjustment on a statistically estimated production function for each farm; the second type of adjustment was that obtained by shifting each farm from a place on the original production function, to one on a more efficient production function. In the latter instance budgeting was used to determine the adjustment for the individual farms studied. In the present chapter, adjustments on the statistical production function are not considered as the new organizations on the statistical production function were cash crop enterprises and not dairy farms. Since the central problem studied in this thesis, concerned efficient adjustment of dairy-farms within institutionally imposed credit restrictions, crop-farm types were not considered, although crop farming may be a more efficient long run adjustment for some of the farms in the area studied.[1]

From the standpoint of the level of living that they will permit, it is important to note that many of the budgeted modifications are of a minimal nature. Although they are superior in this regard to the

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[1] Justification for concentrating on "non-economic" dairy enterprise was presented in the last portion of the preceding chapter. However, until someone develops a value system for value systems the choice of what one should study, will contain an element of arbitrariness.

initial budgets presented, the problem of how many resources are required to produce levels of living, and working conditions, similar to those in industrial work, is beyond the scope of the present study. Nevertheless, if that is the direction in which agricultural policy makers wish to go, the present study indicates that much more resources are required than indicated in the modified budgets. Under such circumstances very large amounts of credit would also be required to make the adjustment. This general area of adjustment involving norms, is discussed in more detail in the concluding chapter of the thesis.

Determination of Institutionally Available Credit

The lending rules of the various institutions[2] were applied to the individual farm situations, to determine the amounts of credit that could be extended to the individual farm business. From the interviews with representatives of commercial banks, the Federal Land Bank, and insurance companies, the various amounts of new money that these entities would be willing to lend, on the basis of various classes of collateral were determined. In general, it was found that loans would be made up to fifty percent[3] of the current market value of land and buildings, machinery, and livestock. No agency interviewed indicated that it would make loans on the basis of feed and supplies on hand, since such assets would be consumed during the year and, hence, would be unsuitable as a basis for

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[2] At the onset of this thesis it was pointed out that the study upon which it is based, is only one of a set currently underway at the Department of Agricultural Economics of Michigan State University. Consequently its focus is narrower than might be reasonable under different circumstances. The author is well aware that other types of credit were, and are available to the farms studied. However, he believed that the study of credit from formal credit institutions to be a useful, important segment of the general credit problem.

[3] See Appendix B, Table XVI.

collateral. It was further determined, that the insurance company would lend up to sixty percent of the current market value of land and buildings, only if the loan was for more than $5,000, and the insurance company could get the first mortgage. Although the value of household equipment was estimated for each farm studied, it was not used as a basis for collateral. Thus with the exception noted above for land and buildings, the amount of new money borrowable by collateral, was found by subtracting the amount of money owed from fifty percent of the value of land and buildings, machinery and livestock. Stocks, bonds, paid up insurance, cash and accounts receivable were regarded as being equivalent in terms of borrowable funds to their face values.

In the case of production credit associations, and the Farmers' Home Administration, the amount of funds borrowable was determined in a different manner. These agencies do not consider collateral to be their principal criterion. The production credit association lends, in part, on the basis of the earning capacity of the borrower. Thus, generally speaking, the maximum amount borrowable from a production credit association, would be equivalent to from one, to five times the amount of the operators anticipated net income, as indicated by his past performance and present plans. In the case of heavy equipment or bulk milk tanks, the maximum loan period was found to be five years, for operating expenses one year and, for other machinery, livestock and equipment, with the exception of land and buildings, three years. Since most of the non land purchase expenditures indicated by the modified budgets, were a combination of these types of expenditure, the three year period was considered to be most appropriate, to indicate the amount of money available from the Production Credit Association. The actual calculation was made for the individual farms, by subtracting cash

expenses, including an estimate of family living costs from the cash receipts, and subsequently multiplying the resultant net income figure by three.

Since the Farmers' Home Administration makes loans primarily on the basis of the character, and ability of the individual farm operator, and not on the basis of available collateral, the problem of ascertaining the credit available to an individual dairy farm operator, in this instance could not readily be determined by applying general rules. This difficulty was handled by going over the individual farm situations with the local representative of the Farmers' Home Administration, and recording his opinion as to the amount of credit available to the individual farm operators, in addition to that available from the previously discussed sources. Thus, for each farm the amount of institutional credit available, was determined by taking the sum of the amounts of credit available, from the various collateral sources, and that available in addition from the non collateral sources.

Adjustment Possibilities

When the amounts of credit available, and credit required for adjustment, on the studied farms were compared, possibilities of more efficient adjustment were found to be the following, as shown on tables VIII, IX, X. Within the limitations of credit from institutions, 22 farms could achieve, or have already achieved an organization, as good as, or better, than that implied by their respective modified budgets. Of the remaining 9 farms, adjustment would not be possible with available institutional credit if all land had to be purchased; however, 3 of the 9 could attain efficient adjustment, if their additional land requirements

could be met by rental or land contract purchase. It seems fairly safe to assume, that the other 6 farms could not achieve efficient adjustment by using only the available institutional credit.

In appraising the adequacy of available credit, an incomplete picture results, if only institutional sources of credit in the area are considered. However, it appears reasonable to conclude that even without taking into account credit available from other sources, most dairy farmers in the group studied, are capable of making the type of adjustment indicated for their respective farm operations, as indicated in table X. When other sources of credit such as, elevator companies, feed dealers, machinery dealers, friends and families are also taken into consideration, there seems to be considerable reason to believe that for the large majority of the farms studied, (i.e. at least 25 out of 31)[4] available credit is not currently the important deterrent to more efficient adjustment.

Although it was mentioned earlier in this chapter that the problem of how many resources are required to produce earnings, and fringe benefits, from dairying that are comparable to those in industrial work, is beyond the scope of the present study, but it seems useful in the interest of completeness, to attempt an answer to the question at this juncture. However, it should be kept in mind that the statements of this section are of a very tentative nature, indicating direction of adjustment rather than amount. Initially an adjustment on the studied farms competitive with industry, would require a highly labor efficient technology, it seems

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[4] Two of the six operators not currently able to achieve efficient adjustment with institutional credit have good private sources available to them.

reasonable to assume that it would need to be more labor efficient, than the technology assumed in the modified budgets presented in the last chapter. In view of the rapid technological advances in the dairy industry during the past few years, it seems reasonable to expect that such a technology is an attainable goal. In appraising the credit requirements of such a technology, one is faced with the problem that it is as yet of an unknown cost. A very rough approximation of the credit required, might be obtained from Fuller's[5] work. He estimates that about 170,000 dollars would have to be invested in dairying, before earnings, and working conditions, could be made comparable to those attainable by labor in industry. If this figure is used as a "bench mark", then only 5 of the 31 farms studied would be able to make such an adjustment, if one prefers the 100,000 dollars mark, then thirteen farms would be capable of making the adjustment with credit from institutions.

Aggregate Consequences of Adjustment

Since there is a relatively large number of dairy farms in the Detroit milk-shed, (or in Sanilac county for that matter) recommendations for adjustment of an individual dairy-farm may be made almost without regard to their effect on aggregate production of milk. However, when such recommendations are applied to a large number of dairy farms, aggregate consequences of such adjustment become a vital part of the basis for making recommendations. Consequently it appears to the author to be

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[5] Fuller, Earl I., Some Labor Efficient Dairy Farm Organizations Designed for Michigan Conditions. Mimeograph 690, Department of Agricultural Economics, Michigan State University, 1957, p. 123.

useful to delineate fairly carefully some of aggregate changes in output and input that would result were the adjustments presented in the modified budgets of the preceding chapter to be initiated generally on the studied farms. Table XI summarizes certain adjustments in milk production, land utilization, and changes in cropping patterns that would be capable of initiation on the studied farms under various sets of assumptions.

For milk production the aggregate adjustment possibilities appear to be as follows. First, if all the adjustments indicated on the studied farms were to be initiated on all the 22 farms, where such adjustments were indicated, a 93 percent increase in milk production could be expected. Second, if adjustments permitted by available instituional credit and long term rental, were to be untertaken, a 57 percent increase in milk production would be the expected result. Third, institutional credit alone would currently permit adjustments that could increase milk production by 51 percent. Furthermore it is important to note that none of the three adjustment situations mentioned above include production increases on the 9 farms found to be more efficient than their respective budget modifications. Hence, it may be concluded that even larger increases in milk production than those enumerated above are possible in the farms studied. Even if land is held fixed for all farms at current levels, a 75 percent increase in total milk production could result, if the changes indicated by the modified budgets were initiated on the 22 farms, where they were considered to be relevant. Tillable acres of land would have to be increased by 11 percent, if all the adjustment possibilities budgeted are to be initiated.

Cash crop production as might be expected would also be affected by

Table VIII

Credit Available from Institutional Sources for Individual Farm Adjustment

Farm Number	Credit Available on Collateral from Institutions	Other Credit* Available from Institutions	Total Credit Available from Institutions
1	$ 9,200	$11,000 **	$20,200
2	38,000	---	38,000
3	15,200	19,000	34,200
4	59,700	--- **	59,700
5	20,700	--- **	20,700
6	10,300	22,000	32,300
7	none	none	none
8	7,600	10,000	17,600
9	7,000	6,000	13,000
10	79,000	--- **	79,000
11	22,800	--- **	22,800
12	none	none	none
13	1,300	15,000	16,300
14	40,900	--- **	40,900
15	48,500	--- **	48,500
16	19,600	--- **	19,600
17	1,100	--- **	1,100
18	13,500	6,000	19,500
19	17,800	6,000	23,800
20	81,900	--- **	81,900
21	1,000	21,000	22,000
22	43,900	--- **	43,900
23	22,400	--- **	22,400
24	49,900	--- **	49,900
25	53,700	--- **	53,700
26	44,900	--- **	44,900
27	6,585	--- **	6,585
28	33,630	--- **	33,630
29	none	none	none
30	38,600	--- **	38,600
31	8,700	20,000	28,700

* Includes credit available from Production Credit Association and Farmers' Home Administration.

** Money would be available to these operators in case of disaster, at present they are beyond the scope of the Farmers' Home Administration.

Table IX

Credit Available from Institutional Sources, Credit Required for More Efficient Adjustment of Farms, and Adjustment Possibilities

Farm Number	Total Credit Available from Institutions	Total Credit Needed for Adjustment	Adjustment Possibility	Remarks
1	$20,200	$58,659	no	- Could adjust with long
2	38,000	6,520	yes	term rental of land
3	34,200	22,582	yes	
4	59,700	58,531	yes	
5	20,700	107,218	no	
6	32,300	none *	yes	
7	none	26,835	no	
8	17,600	20,711	no	- Could adjust with long
9	13,000	84,876	no	term rental of land
10	79,000	43,468	yes	
11	22,800	14,549	yes	
12	none	59,801	no	
13	16,300	none *	yes	
14	40,900	37,375	yes	
15	48,500	14,836	yes	
16	14,600	none *	yes	
17	1,100	none *	yes	
18	19,500	15,653	yes	
19	23,800	29,671	no	
20	81,900	none *	yes	
21	22,000	27,972	no	- Could adjust with long
22	43,900	3,350	yes	term rental of land
23	22,400	none *	yes	
24	49,900	21,443	yes	
25	53,700	19,121	yes	
26	44,900	none *	yes	
27	6,585	none *	yes	
28	33,630	22,062	yes	
29	none	24,909	no	
30	38,600	17,556	yes	
31	28,700	none *	yes	

* These farms are already more efficienty organized than the budget modification would permit; consequently no further adjustment is suggested for them.

Table X

Summary of Adjustment Possibilities*

Adjustment Situation of Farms	Number of Farms
A. Already as efficient or more efficient than respective budget modifications	9
B. Not as efficient as respective budget modifications, but sufficient institutional credit available to permit more efficient adjustment	13
C. Not as efficient as respective budget modifications, but more efficient adjustment possible with long term rental of land, and credit available from institutions.	3
D. Not as efficient as respective budget modifications, and more efficient adjustment not possible with credit available from institutions.	6
Total number of farms	31

* This table summarized the results of tables VIII and IX.

Table XI

Summary of Initial and Modified Budgets

		Change
1. Milk Production (per year)		
a) (all farms)		
Initial: 8,811,000 lb.	Modified: 17,036,000 lb.	93 % increase
b) (includes modifications permitted by credit* and long term rental of land only)		
Initial: 8,811,000 lb.	Modified: 13,867,000 lb.	57 % increase
c) (includes modifications permitted by credit* only)		
Initial: 8,811,000 lb.	Modified: 13,339,000 lb.	51 % increase
d) (all farms) Change in milk production permitted when land is held fixed at initial level		75 % increase
2. Land Requirements to permit 93% increase in milk production		11 % increase
3. Cash Crop Production Change in crop production required to permit 93% increase in milk production		36 % decrease**
4. Gross Income***		
a) (all farms)		
Initial: $541,086	Modified: $899,113	66 % increase
b) (all farms, land fixed at initial level)		
Initial: $541,086	Modified: $812,655	50 % increase

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* Institutional credit only.

** Decrease in crop production is from initial position; it underestimates the reduction in land devoted to cash crop production, in the area studied, resulting from 11% increase in land, which may be partly in cash crops at present.

*** Modified gross income estimates do not include effects of price changes, resulting from production increases, and low price elasticity of demand.

proposed budget modifications. As table XI indicates a 36 percent decrease in cash crops could be expected, if milk production were to increase by the 93 percent indicated, by including modifications on all farms where budget modifications were suggested.

Before generalizing any of the results from the sample of farms studied, it is important to give special consideration to problems present when an attempt is made to generalize results from a purposive sample. It will be remembered that the studied farms were chosen in such a way, that they were typically on the same general production function, and typically out of adjustment. Furthermore, since the help of the county agent was used in selecting farms, it may be expected that they are above average in many respects. Hence, in view of these non-random elements, in sample selection the universe to which one can generalize these results would be to similarly selected farms from the same population. Nevertheless, to the extent that the population of similar farms represents a considerable portion of the Detroit milk-shed, it is useful to make such generalizations.

Several important consequences of the adjustment possibilities are almost immediately evident. The potential increase in milk production, under any of the situations enumerated in table XI could be expected to bring about reductions in milk prices, if they were made general in the studied area. The resultant decrease in milk prices[6] would cause

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[6] It is difficult to give an adequate appraisal of the quantative decline in milk price, that would result under such circumstances, in view of the fact that neither the price demand elasticity of milk, nor the total population from which the studied farms were drawn, are known with any degree of precision. However, if milk production were to be increased by 75 percent and the price demand elasticity of milk is assumed to be -.30 then the resultant price of milk would be negative, unless a large increase in elasticity is present in the lower segment of the relevant demand curve.

reductions in the relative efficiency of the studied farms and in many instances would impair or destroy their ability to survive.

Other consequences of initiating the proposed adjustments on the studied farms include a slight increase in land and a reduction in cash crop acreage. Both of these changes in turn would have the effect of increasing the marginal costs of milk production. Since both types of changes would increase the marginal factor costs of inputs used in milk production, the increased land would have to be bid away from its current use, and the decrease in cash crop production would serve to increase the opportunity cost of forage grown on the land taken over from crop production.

It is important to remember at this point that the changes in the budget situations from initial to modified positions included only changes that would result in increased efficiency, while it is equally important to consider other criteria in appraising the adequacy of such modifications. If for example levels of living and working conditions equivalent to those attainable from industrial production are considered the relevant criteria for appraising adjustment; then the changes indicated in the modified budgets are, in most cases, too small to permit the attainment of such levels of living and working conditions. In view of these considerations relative to the adjustment possibilities on the studied farms, additional analysis of the two problems of efficiency and income levels is required. In the chapter following such an appraisal is undertaken.

CHAPTER VII

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

There are several results of this study which appear to be important enough to consider in more detail than was done in preceding chapters. Although not all of those considered here deal directly with the adequacy of institutional credit and efficient adjustment of dairy farms, they are so closely related, that even a modest attempt at completeness requires their inclusion. The results are discussed at length subsequent to their initial listing which follows immediately.

Summary of Important Results and Conclusions

1. There appears to be enough institutional credit available to permit more efficient types of adjustment on most of the dairy farms studied.

2. Although enough credit for more efficient adjustment appears to be available, many farmers are unaware of the types of services and interest rates that are available from some credit institutions.

3. Most of the farms studied are faced with a low marginal value productivity for labor, and a rising marginal factor cost for it.

4. New technology is required for more efficient adjustment of the dairy farms studied.

5. Several of the existing farm organizations indicate that superior adjustments using new technology are possible.

6. Income levels on the studied farms were generally found to be low.

7. Cash cropping appears to be a very important alternative to dairying on many of the farms studied.

8. A large increase in milk production and the danger of price declines are implied by the modified budgets.

Appraisal of Conclusions

The initial item listed above is in essence, the answer to one of the first questions posed by this study. The results of the preceding chapters, especially chapter VI, do in fact indicate that enough institutional credit exists to permit more efficient adjustment on the large majority of the farms studied. Hence it is neither concluded nor recommended that additional credit be supplied by the institutions studied, when only the criteria of efficiency are used in judging the amount of credit required for the adjustment of the studied farms. In one way, the credit available for adjustment has been underestimated by the exclusion of non-institutional credit. As a result larger adjustments than those indicated would be attainable on most of the farms studied. Some of the further sources of credit for these additional adjustments would include land contracts with private individuals, dealer financing, and private loans.

Despite the conclusion that enough credit is available for more efficient adjustment on most of the farms studied[1], nevertheless many farm operators did appear to be facing credit problems. This situation appeared to stem from a lack of information on the part of the farm

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[1] It is important to note that the adequacy of institutional credit used here refers only to the credit required for more efficient adjustment of the studied farms. It is not concluded that enough credit is available to permit working conditions and earnings comparable to those attainable in industrial employment. Such adjustments would apparently require a new technology as yet unknown and of an unknown cost.

operators concerning credit and services available to them from existing credit institutions. Thus many operators were using higher cost dealer credit, when lower cost institutional credit was available to them. Although the amounts of dealer credit used were comparatively unimportant in some instances, in others they constituted the major portion of credit used and could have resulted in important losses to the operators concerned, if there had been only small reductions in debt repayment capacity. Another area of the credit picture that seemed to be unclear to many of the farm operators interviewed, concerned interest rates. Many of the farm operators did not know the interest rates that they were paying nor was it clearly marked on the credit instruments in many cases.

Item three in the summary points up one of the major problems facing the farm operators of most of the farms as they are currently organized. From a consideration of the functional analysis carried out, it would appear that the marginal value productivities of labor and of livestock are low, whether considered separately or in conjunction. At the same time industrial wage rates are high and might be expected to increase with the development of the St. Lawrence seaway and the consequent increase in industrial growth in the area studied and those areas adjacent to it. Farm operators wishing to enlarge their farms or keep their hired help, will, as a result, face serious organizational difficulties if they attempt to adjust their farms using extant technology. For whether they enlarge their scale of operations or not, so long as they have to employ hired help, they will be faced with the dilemma that its marginal value productivity is low, relative to its opportunity costs.

This problem of low value productivity for labor, in juxtaposition with a high marginal factor cost does not appear to admit solution on

the studied farms, so long as they remain on the same production function. Thus, as noted in item four of the summary, new and/or better technology than typically used appears necessary to achieve increased value productivity for labor. This conclusion is borne out by a consideration of the functionally estimated optima, in conjunction with the presented budgets. It seems reasonable to infer from the budgets, that the average productivity of labor may be increased by the application of large amounts of labor saving technology, in conjunction with highly efficient farm labor. There does not appear to be available at present a technology which would permit efficient adjustment in the dairy business, with only average or low quality farm labor. As a consequence, adjustments on many of the studied farms would involve a shift to higher quality labor. The type of adjustment involving existing labor on many farms, would consequently involve costs as yet unknown. A priori consideration would tend to support the hypothesis that both competent labor, and labor saving technology, are required for the attainment of reasonably competitive levels of productivity for labor, on dairy farms in Michigan. It will be remembered, that one of the more important reasons for basing the modified budgets in this study on the work by Earl Fuller, stemmed from the fact that in his development he stressed new labor saving technology. It is of fundamental importance to note that the budgets assume the joint attainment of new technology and highly productive well paid labor.

One difficulty that exists in any budgeting procedure, prior to translation into corresponding reality, is that there usually exists some doubt as to the practibility of the physical relationships implied by the budget. This is of special concern when the implied organization represents a type of organization and technology that is relatively new. In

the present study, considerable justification for believing the modified budgets to represent attainable reality exists. Several of the farms indicated organizations that were as efficient, or more efficient than their respective modified budgets. The sixth farm budgeted is of particular interest in this regard, since it is almost a pure dairy enterprise on which large numbers of technical labor saving innovations have been made. Furthermore, the organization of farm six as indicated by its initial budget implies that an organization much superior to its modified budget in terms of efficiency has already been attained on this farm. It is concluded therefore, as noted in item five of the summary, that the budget modifications do in fact indicate an attainable reality on some of the farms studied.

Despite the fact that the modified budgets, in those cases where they are relevant, indicate a higher level of income than that included in the initial budgets, it seems safe to say that the level of incomes indicated is still low on most of the studied farms. This is particularly true when they are considered in relation to industrial wage rates, that include fringe benefits in addition to cash wages. Fuller has noted that he estimates for dairy farms in Southern Michigan that it would require an investment in excess of $100,000[2] to achieve wages comparable to those in industry, and that at the same time most fringe benefits would still not be included.

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[2] This scale of adjustment would not be permitted by the institutionally available credit on the majority of the studied farms. Furthermore it is a moot point whether any of the studied farms could, within the restrictions of institutional credit, make adjustments that would provide wages and fringe benefits comparable to those available in industry.

Although the cash crop alternative to dairying has only been partly explored in this study, there appears to be supporting evidence from external sources to indicate the tentative conclusion that for many of the farms studied, cash cropping may represent more efficient use of resources than dairying. (This of course involves relaxing the assumption that only dairy enterprises are to be considered).

Possible Implications

Up to the present point, the discussion in this chapter has dealt largely with factual results and conclusions that have support in the body of the thesis, as yet little has been said concerning the implications or consequences of this factual material. The present section represents an attempt to remedy this situation. In the summary at the beginning of this chapter the last item stated that the modified budgets implied a considerable increase in milk production over the initial situation obtaining in the unmodified or initial budgets. Furthermore, it was pointed out in the last chapter, that the consequence of such a large increase in milk production would, if made general in the Detroit milk-shed, have a seriously depressing influence on milk price. However, these are not the only prices that would be affected by such an increase in milk production, for securing the additional inputs required for the additional production indicated would involve bidding up the prices of factors of production such as cows, forage, and feed grains, since before the transfer from current to alternative use can rationally be made the alternative must indicate some return in excess of that from current use. The nature of some of the changes that would be required to make the adjustments on the studied farms would include the following. An increase in the production of forage, an increase in the production of corn for

ensiling and for grain, an increase in oat production, and an increase in numbers of heifers held for breeding purposes. The changes in the use of land resources would result in reduced acreage available for cash crops, such as beans, beets, and wheat. A result which might reasonably be expected to raise cash crop prices, and consequently require, through the working of the principle of opportunity costs, further factor price increases for the dairy industry. Hence it seems, that were the indicated adjustments on the studied farms to be generally initiated, decreasing profitability as a result of increases in factor prices and decreases in product prices, would initially be a more effective deterrent to completing the adjustment than a shortage of credit.[3] What is implied by the foregoing analysis is, that generalized applications of the individual recommendations for more efficient adjustment of dairy farms, is a self defeating program if it does not also embody some sort of production control. The summary of aggregate adjustment possibilities presented in the preceding chapter supports such a conclusion. In table XI it was shown that increases in milk production ranging from 51 to 93 percent, were implied by the modified budgets, depending upon the restrictions assumed. This matter will be discussed at length in the last section of this chapter, where it is proposed to treat in some detail questions of recommendations.

It has been mentioned previously in this chapter, that generally speaking the income levels on the studied farms, whether considered in

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[3] Although the impact of such a decrease in the earning capacity of dairy enterprises would doubtless reduce the amounts of credit that institutions would be willing to lend to borrowers engaged in the dairy business. However, it seems reasonable to believe that the decline in profitability would precede any such action on the part of institutional lenders.

their initial states or as they are represented by the modified budgets, are low, relative to the earnings of industrial labor. This is the case despite the fact that the modified budgets embody new and labor saving technology. It was mentioned before that Fuller has estimated that it would require an investment in excess of $100,000 and the use of new technology, to yield wages comparable to those of industry and at the same time provide something like equivalent working conditions. Even with such an investment it would still not be possible to provide the fringe benefits of industrial work. To the best of the author's knowledge there does not yet exist a technology directly applicable to the Michigan dairy industry, which would permit the earnings of dairy farm labor to compete with industrial working conditions, and wage rates that include fringe benefits when low price elasticities of demand are considered. This implies that if the Michigan dairy industry is going to attain and maintain the ability to compete with industrial concerns for high quality labor, a great deal of rapid technological advance will have to be made, and applied on Michigan dairy farms.

Recommendations

Several criteria that might be used in appraising modifications in farm firm organizations and changes in institutional adjustments were delineated in the second chapter of this thesis. It was noted at the time, that the use of efficiency as sole criterion of adjustment, would result in recommendations which might, most charitably, be regarded as incomplete. To avoid this incompleteness a section sketching out what the author regarded as being some important ethical criteria was included in chapter II. Up to the present only the criterion of efficiency has been used to indicate the nature of adjustments on the studied farm firms.

The purpose of this section is to bring both economic and ethical criteria to bear upon problems of dairy-farm adjustment.

For expository reasons, it appears to be useful to recapitulate the consequences implied by the rapid simultaneous initiation of the modifications required for more efficient adjustment of dairy-farms.

1. Milk production would be substantially increased.
2. As a consequence of increased milk production and low demand elasticities, important decreases in milk prices could be expected.
3. The acquisition of the additional inputs to make the initial adjustment would raise the price of these inputs.
4. The consequences of item 2 and 3 would be to reduce the efficiency of the adjustment indicated in the modified budgets, and at the same time reduce the income of the farm families involved.

If the adjustments indicated were carried out the consequences could yield a lowered price of dairy-products for consumers, and an unimproved level of living for dairy-farmers. Under such circumstances the dairy-farmers might well be considered as being treated as a means[4] alone, of increasing the real level of living of consumers. As indicated previously in the second chapter of this thesis, a situation, where one group of persons is made better off and another group is made worse off, is not capable of being handled in terms of welfare economics, but rather must be treated as an ethical problem.

What is proposed is to ask some of the relevant questions raised by

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[4] The situation engendered would not yield treatment of farmers as means alone, to the extent that they are also consumers of dairy products; however, it would closely approximate treatment as a means alone, unless it were possible to apply the principle of compensation.

Immanuel Kant,[5] about the consequences of the adjustments indicated. Among the questions he raised the following seem to be applicable to the present situation.

1. Is any person being treated as a means alone and not as an end in himself?

2. Is it possible to will that the maxim should be applied to all men?

Kant maintained that an undesirable situation obtained, if the first question were to be answered in the affirmative, or the second in the negative. Application of the first question to the adjustments indicated and their resultant consequences, indicates that the situation would not admit a negative answer to the first Kantian question, since dairy-farmers would in fact be treated very nearly as a means alone and not as ends in themselves. What sort of situation would yield the preferred answer to this question and at the same time maintain connotations of efficiency? Although a very large number of types of means and mechanisms for attaining an adjustment that would yield both the preferred answer the question above, and at the same time maintain connotations of efficiency could be explored, only one means and one mechanism are treated in the following section.

In brief a hypothetical means of attaining such a preferred adjustment of dairy farms might involve a program that includes following conditions.

1. Technical advice would be provided to farmers concerning labor saving technology in the dairy industry.

2. Credit would be provided under the same program that would permit dairy-farm operators to: (a) shift into a more efficient labor saving technology, and (b) develop a scale of enterprise such that earnings of

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[5] Leys, W.A.R., op. cit., Chapter 5. Once more it seems worthwhile to point out that Leys' interpretation of Kantian ethics is being used as a paradigm of what might be done.

labor in conjunction with new technology, would be comparable to earnings of industrial workers of similar capacities.

3. Production controls would be instituted to counteract the price depressing effects that could result from a generalized increase in scale of individual dairy[6] enterprises.

The inclusion of the first recommendation stems as a logical consequence from the body of the thesis, where it has been demonstrated that efficient marginal adjustments on the extant production function are not capable of attainment in conjunction with maintaining the farms as dairy enterprises. At the same time it was demonstrated that greater efficiency (in an average sense) was attainable by shifting the farms onto a production function, that subsumed a labor efficient technology. Thus it appears that new labor efficient technology is a necessary condition to increase the efficiency of these farms. The first item in the recommendations indicates one of the ways in which farmers may be made aware of the nature of these technical developments. It would seem that this is a required step in making such adjustments, since there is little reason to believe that farmers will make efficient adjustment unless they are first made aware of the nature of these adjustments.

In order to initiate changes implied by the technical advice aspect of the program, it seems necessary to combine both the technical and credit aspects, so that efficient complementary sets of inputs are purchased. Such joint handling of technical and credit problems may be expected to

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[6] General problems of adjustment in the Michigan dairy industry are presently being studied at Michigan State University by James Bonnen, and Dean McKee as their contribution to the Lake States Dairy Adjustment Study.

provide efficient combinations of inputs, and at the same time avoid the problems associated with purchases that alone are neither cost reducing nor income increasing. But perhaps a more important service which could be provided by the credit portion of the program, would be the rapid build up of the farms on a new technical production function, and on a scale that would permit earnings of agricultural workers to be competitive with earnings of industrial workers. This would provide a set of conditions that would more nearly yield an affirmative answer to the second Kantian question, in the sense that similar groups of people would be receiving similar remuneration for comparable work. Further, neither group would then be treated as a means alone.

However in order that the gains in efficiency and income levels are not all squandered in a price depressing flood of excess milk, some type of production control is required to take care of the aggregate effects on increases in scale and efficiency of enterprise. In view of the fact that increases in milk production are (under an existing new technology) requisite to the attainment of earning levels comparable to those in industry short run adjustments would require a reduction in number of dairy-farm enterprises. This reduction in the number of dairy-farm enterprises represents one of the more critical ethical and economic aspects of the proposed program. From the standpoint of increasing earnings of farm labor to levels comparable with industry, it is as essential as the shift to a new technology. However the problem of deciding which persons should be allowed to continue in or enter the dairy business does not readily admit of solution. One possibility that seems worth considering would be to make a random selection among farm operators that have indicated the capacity

and willingness to adopt new technology in the dairy business.[7] These randomly selected operators would then develop their farms under the program. The remainder could be given compensatory payments that would be similar to those received by property owners during a condemnation procedure. They could then continue farming if they so wished but in some other enterprise. Entry into the dairy business could then be undertaken by permitting a random selection from those capable of handling technological and managerial problems involved. Rate of entry would be governed by the rate of change in demand for milk.

One of the important features of this program is, that it permits a high proportion of increases in labor efficiency to be translated into income for the dairy-farmers. Milk prices could at the same time be reduced to levels that would compensate consumer tax payers for the cost of initiating the program. The principle of random selection of operators, from a group capable and willing to make tecnological and managerial adjustments, has an even handed justice in it and compensatory payments, if adequate, could avoid the problem of treating anyone as a means alone.

Whether or not such a program would in fact be capable of meeting the criteria of efficiency, and even handed justice for all, would depend upon the quantitive and value relationships involved in making the proposed changes.

Other recommendations, of a less comprehensive nature than the foregoing hypothetical proposal, but which nevertheless appear of importance

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[7] Such a random selection has been accepted fairly generally in the United States, as an equitable method of selecting people to serve in the armed forces. From a casuistic standpoint then, it has a precedent in a situation where much more than the selection of a type of work may be at stake for the individual involved.

as fruitful lines of investigation of problems related to the efficient adjustment of the dairy-farm studied in this thesis, include the following:

1. The development of more labor efficient technology for the dairy industry.
2. The study and analysis of the comparative advantage of cash crops and dairying in the area.
3. The development of a labor saving technology that complements old technology in the dairy industry.
4. The establishment of better communication between lending agencies and potential farmer users of credit.

Again the word technology and what it may imply for the dairy industry enters the discussion. As indicated previously on several occasions, labor efficient technology and its application on dairy farms appears to be a necessary condition for any increase in efficiency in the dairy-industry. Despite the fact that the modified budgets subsumed new and labor saving technology, it was pointed out that even with such modifications, working conditions and earnings comparable to those of industry were not attainable on the studied farms. However, these modifications involving new labor saving technology did represent a move in that direction. Consequently it seems reasonable to assume and important to state that further technological development in the dairy industry is a must, if its labor is to achieve and maintain equality with industrial labor. In a very real sense this may be regarded as being one of the most important recommendations of this thesis. Along with the development of this new technology that has been advocated, there also appears to be an important place for the parallel development of technology that is complementary with the extant set of productive resources. Such

developments could provide a way of increasing the efficiency of farms incapable of making the set of purchases required when only a self complementary new technology is available.

Any analysis of the dairy-farm business which claims to be complete must include a fairly close evaluation of the alternative opportunities available in the area under study. In this study the comparative advantages of cash crops and dairying have been explored at a minimal level. The indications appear to be that cash cropping has an important place on many dairy-farms, and in fact that on the existing production function a cash crop adjustment is more efficient and profitable than dairying. With regard to efficient adjustment between dairying and cash cropping, it seems that further study is needed of the current and new technologies as they influence the comparative advantage of those two systems of enterprises. It is the author's personal belief that technological advances will do more to enhance the advantage of crops over dairying in the studied area for some time to come. If comprehensive adjustments of the dairy industry are to be made a necessary first step must include a study of the comparative advantage present and future of crops and dairy.

APPENDIX A

Table XII

Profit Maximizing Organization of Studied Farms,* Labor and Livestock-forage Fixed at Initial Level for Each Farm, with MVP of Labor-livestock-forage Computed at Profit Maximizing Level of Other Inputs

Farm Number	Acres of Land	Dollars of Machinery Investment	Dollars of Cash Expenses	Animal Unit Capacity of Buildings	MVP of Labor & Livestock-forage
1	131	12937	4444	68	$189
2	143	14144	4859	75	207
3	114	11281	3875	60	224
4	167	16523	5676	87	196
5	196	19315	6635	102	133
6	122	12028	4131	64	187
7	115	11346	3898	60	224
8	117	11519	3957	61	187
9	156	15433	5301	82	160
10	185	18228	6262	96	189
11	145	14294	4910	76	187
12	157	15524	5333	82	161
13	167	16523	5676	87	196
14	185	18228	6267	96	189
15	220	21743	7469	115	177
16	111	10946	3760	58	226
17	119	11731	4030	62	182
18	124	12221	4198	65	179
19	170	16764	5759	89	158
20	265	26153	8984	138	162
21	107	10544	3622	56	177
22	137	13527	4647	72	210
23	132	13041	4480	69	191
24	218	21480	7379	114	178
25	141	13887	4770	73	128
26	182	17979	6176	95	179
27	124	12188	4187	64	189
28	140	13837	4753	73	208
29	185	18228	6262	96	189
30	212	20949	7196	111	180
31	143	14144	4859	75	297

* Prediction equation was: $\text{Log } \hat{Y} = 2.012574 + .217\ X_2 + .177\ (\frac{.177}{\log 20} + \log \hat{Y}) + .300\ (\frac{.300}{\log 1.00} + \log \hat{Y}) + .097\ (\frac{.097}{\log 21} + \log \hat{Y})$

where: X_2 = limiting factor of labor and livestock-forage on each farm; X_1 = acres of land = $\frac{.177}{20}\hat{Y}$; X_3 = dollars of machinery = $\frac{.131}{.15}\hat{Y}$; X_4 = dollars of cash expenses = $\frac{.300}{1.00}\hat{Y}$; X_5 = animal units of housing capacity = $\frac{.097}{21}\hat{Y}$; $\hat{Y}$ = gross income

Table XIII

Profit Maximizing Organization of Studied Farms,* Labor and Livestock-forage Fixed at Initial Level for Each Farm, with MVP of Labor-livestock-forage Computed at Profit Maximizing Level of Other Inputs

Farm Number	Acres of Land	Dollars of Machinery Investment	Dollars of Cash Expenses	Animal Unit Capacity of Buildings	MVP of Labor & Livestock-forage
1	232	16024	5504	85	$234
2	254	17519	6018	93	256
3	202	13972	4800	74	278
4	296	20466	7031	108	242
5	346	23924	8218	127	165
6	216	14899	5118	79	231
7	203	14054	4828	74	277
8	207	14268	4906	75	232
9	277	19117	6567	101	198
10	327	22578	7756	119	234
11	256	17705	6082	94	232
12	278	19229	6605	102	199
13	296	20466	7031	108	242
14	327	22578	7756	119	234
15	390	26932	9251	142	219
16	196	13559	4658	72	281
17	210	14531	4992	77	226
18	219	15137	5200	80	221
19	300	20764	7133	110	196
20	469	32394	11128	171	201
21	189	13061	4487	69	219
22	243	16756	5756	89	260
23	234	16153	5549	85	236
24	385	26606	9140	141	220
25	249	17200	5909	91	158
26	322	22270	7650	118	221
27	219	15096	5186	80	234
28	248	17139	5888	91	258
29	327	22578	7756	119	234
30	376	25949	8914	137	222
31	254	17519	6018	93	256

* Prediction equation was: $\text{Log } \hat{Y} = 2.012574 + .217\, X_2 + .177 \left(\log \frac{.177}{14} + \log \hat{Y}\right) + .131 \left(\log \frac{.131}{.15} + \log \hat{Y}\right) + .300 \left(\log \frac{.300}{1.00} + \log \hat{Y}\right) + .097 \left(\log \frac{.097}{21} + \log \hat{Y}\right)$

where the X_i's are the same as in the preceding table with the exception of X_1 which has a value of $\frac{.177}{14} \hat{Y}$.

Table XIV

Profit Maximizing Organization of Studied Farms,* Labor Fixed at Initial Level for Each Farm with MVP of Labor Computed at Profit Maximizing Level of Other Inputs

Farm Number	Acres of Land	Dollars of Machinery Investment	Dollars of Livestock-forage Investment	Dollars of Livestock Expenses	Dollars of Crop Expenses	Animal unit Capacity of Buildings	MVP of 2 month of Labor
1	130	12848	2096	3089	1206	68	$173
2	130	12848	2096	3089	1206	68	173
3	106	9994	1630	2403	938	53	184
4	155	15271	2491	3672	1433	81	167
5	240	23721	3879	5703	2227	125	151
6	124	12228	1995	2940	1148	65	175
7	102	10059	1641	2418	944	53	183
8	119	11788	1923	2834	1106	62	177
9	173	17030	2778	4095	1599	90	163
10	173	17030	2778	4095	1599	90	163
11	143	14071	2296	3383	1321	74	170
12	173	17030	2778	4095	1599	90	163
13	155	15271	2491	3672	1433	81	167
14	173	17030	2778	4095	1599	90	163
15	210	20714	3379	4980	1944	110	156
16	98	9667	1577	2324	907	51	185
17	124	12228	1995	2940	1148	65	175
18	130	13848	2096	3089	1206	68	173
19	186	18352	2994	4412	1723	97	160
20	262	25851	4218	6216	2427	137	148
21	116	11473	1872	2758	1077	61	178
22	124	12228	1995	2940	1148	65	175
23	130	12848	2096	3089	1206	68	173
24	207	20436	3334	4914	1918	108	156
25	190	18750	3059	4508	1760	99	159
26	178	17609	2873	4234	1654	93	162
27	124	12228	1995	2940	1148	65	175
28	127	12538	2045	3015	1177	66	174
29	173	17030	2778	4095	1599	90	163
30	201	19879	3243	4780	1866	105	157
31	130	12848	2096	3089	1206	68	173

* Prediction equation was: $\log \hat{Y} = 1.65520 + .201 X_2 + .177 (\log \frac{.177}{20} + \log \hat{Y}) + .131 (\log \frac{.131}{.15} + \log \hat{Y}) + .057 (\log \frac{.057}{.40} + \log \hat{Y}) + .210 (\log \frac{.210}{1.00} + \log \hat{Y}) + .082 (\log \frac{.082}{1.00} + \log \hat{Y}) + .097 (\log \frac{.097}{21} + \log \hat{Y})$ where X_2 = labor on each farm; X_1 = acres of land = $\frac{.177}{20} \hat{Y}$; X_3 = machinery investment = $\frac{.131}{.15} \hat{Y}$; X_4 = livestock-forage investment = $\frac{.057}{.40} \hat{Y}$; X_5 = livestock expenses = $\frac{.210}{1.00} \hat{Y}$; X_6 = crop expenses = $\frac{.082}{1.00} \hat{Y}$; X_7 = animal units of housing capacity = $\frac{.097}{21} \hat{Y}$; $\hat{Y}$ = gross income.

Table XV

Profit Maximizing Organization of Studied Farms,* Labor Fixed at Initial Level for Each Farm with MVP of Labor Computed at Profit Maximizing Level of Other Inputs

Farm Number	Acres of Land	Dollars of Machinery Investment	Dollars of Livestock-forage Investment	Dollars of Livestock Expenses	Dollars of Crop Expenses	Animal Unit Capacity of Buildings	MVP of 2 month of Labor
1	240	16604	2709	3992	1559	88	$224
2	240	16604	2709	3992	1559	88	224
3	187	12918	2107	3106	1212	68	237
4	286	19739	3220	4746	1853	104	216
5	444	30661	5002	7372	2878	162	196
6	229	15806	2579	3800	1484	83	227
7	188	13003	2121	3126	1220	69	237
8	221	15238	2486	3664	1430	81	229
9	319	22013	3591	5293	2066	116	211
10	319	22013	3591	5293	2066	116	211
11	263	18189	2967	4373	1707	96	220
12	319	22013	3591	5293	2066	116	211
13	286	19739	3220	4746	1853	104	216
14	319	22013	3591	5293	2066	116	216
15	388	26775	4368	6438	2514	142	202
16	181	12496	1038	3004	1173	66	239
17	229	15806	2579	3800	1484	84	227
18	240	16604	2709	3992	1559	88	224
19	343	23722	3870	5704	2227	125	207
20	484	33415	5452	8035	3137	177	192
21	215	14830	2419	3566	1392	78	230
22	229	15806	2579	3800	1484	84	227
23	240	16604	2709	3992	1559	88	224
24	382	26416	4310	6351	2480	140	202
25	351	24237	3954	5827	2275	128	206
26	330	22762	3714	5473	2137	120	209
27	229	15806	2579	3800	1484	84	227
28	235	16207	2644	3897	1521	86	226
29	319	22013	3591	5293	2066	116	211
30	372	25694	4192	6178	2412	136	203
31	240	16604	2709	3992	1559	88	224

* Prediction equation was the same as in preceding table with the exception that the third item in the right hand member of the equation is .177 ($\log \frac{.177}{14} + \log \hat{Y}$). X_i's are also the same with the exception of X_1 which is $\frac{.177}{14} \hat{Y}$.

APPENDIX B

Table XVI

Summary of Credit Sources and Conditions for Making Loans

Type of Agency	Class of Collateral	Loan would be made up to this Percent of Current Market Price	Interest Rate Percent per Year	Maximum Period of Loan	Maximum Total Credit this Agency would lend to any Farm Business	Loan Size	Special Conditions	Servicing Charges
Bank	Machinery	50	6 simple	36 months	$30,000	$30,000	Loan to be amortized	none
		50	6 simple	36 months		>$ 500*	full time farmer	none
		50	5 add on	36 months		<$ 1,500**	part time farmer	none
		50	4 simple	36 months		<$ 500	full time farmer	none
	Cattle	50	6 simple	36 months				
	Land & Buildings	50 of banks estimate or 50 sale price whichever is the smaller	6 simple	10 years maximum amortized				search of title & abstract
	Crops	no loans at present or contemplated						
Bank	Machinery	50	4 add on or 7 simple	3 years	$20,000	<$ 1,000		
			7 simple			>$ 1,000 and<$ 4,000		
			6 simple			>$ 4,000 and<$ 8,000		
			5½ simple			>$ 8,000 and<$15,000		
			5 simple			>$15,000		
			5 for almost any size loan for very good customers					

Type of Agency	Class of Collateral	Loan would be made up to this Percent of Current Market Price	Interest Rate Percent per Year	Maximum Period of Loan	Maximum Total Credit this Agency would lend to any Farm Business	Loan Size	Special Conditions	Servicing Charges
	Dairy Cattle	50	as above	3 years	amortized			
	Land	50	as above	10 years	amortized			
	Crops	90	as above	90 days				
Bank	Machinery	up to 66	7 simple up to $100 6 > $100 5 or 6 add on where loan is doubtful or close to max. of collateral	6 months with renewal up to 4 yrs. maximum	$30,000 (although one loan made for more than this amount)			
	Cattle	up to 50	same as machinery					none
	Land		7 simple <$1,000 6 simple >$1,000	10 years			amortized	
	Crops (in field)	up to 50	same as machinery	1 year				
	Crops (in storage)	up to 80	same as machinery	1 year				
Federal Land Bank	Machinery Cattle Crops	no loans made						
	Land	45	5 simple	35 yrs. $20,000 30 yrs. $3,000 to $20,000 25 yrs. $2,000 to $3,000 15 yrs. <$2,000	$200,000		Required to buy 5% stock (i.e. 5 percent of value of loan)	

Type of Agency	Class of Collateral	Loan would be made up to this Percent of Current Market Price	Interest Rate Percent per Year	Maximum Period of Loan	Maximum Total Credit this Agency would lend to any Farm Business	Loan Size	Special Conditions	Servicing Charges
Bank	Machinery	50	7 simple <$3,000 6 to 7 >$3,000	18 months	$20,000	<$3,000 >$3,000		none
	Dairy Cattle	50	as above	2 years if interim payments made				
	Land	40	5 simple >$10,000 5 to 6 simple <$10,000	5 years amortized at 10 yr. rate usually renewed		>$10,000 <$10,000		
	Crops (in storage)	70					should be insured and in good storage	
Insurance Company	Machinery	no loans					A full line of equipment and livestock would be required before loan would be made on land & buildings	
	Livestock	no loans						
	Crops	no loans						
	Land	up to 60	5½ simple	maximum 40 years minimum 5 years	no maximum if secured adequately no loans made for <$5,000		only first security on land is accepted	$25 closing fee
F.H.A.	Machinery	up to 100	5 for all chattels	7 year maximum	on a chattel county $10,000 state $15,000 natl. $20,000			
	Dairy Cattle	up to $100/cow	5	7 year maximum				
	Land & Buildings	usually 70						

Type of Agency	Class of Collateral	Loan would be made up to this Percent of Current Market Price	Interest Rate Percent per Year	Maximum Period of Loan	Maximum Total Credit this Agency would lend to any Farm Business	Loan Size	Special Conditions	Servicing Charges
	Farm purchase loans	90 appraised value (non veteran) 100 (veteran)	4½	40 years	$27,900			
	Farm housing (incl.buildings)	up to 100	4	33 years				
	Soil & water conservationloans		4½	20 years				
	Crops	no loans made on the basis of this collateral	loans made up to $20,000 to buy seed, gas, feed and family living					
P.C.A.	Machinery	50 in general up to 100 in cases of new heavy equipment	6½ simple	1 year with operating loans 5 yrs. for heavy new equipment; in general loans may be renewed	no restriction here but this is governed by repayment ability		5 percent stock must be bought in addition to loan	$6.25 first 1,00 .25/100 1,000 to 5.000 .10/100 >5,000
	Cattle	up to 65		up to 3 years with about equal yearly repayments			in general loans made up to 3 or 5 times net farm income minus family living	
	Land	in general no loan but a second mortgage may be "picked up" in an emergency situation						
	Crop	up to 100					must be in satisfactory storage	

* > greater than. ** < less than.

APPENDIX C

CONFIDENTAL Farm No. _____

SIZE OF FARM

Total Acres _____ Owned _____ Rented _____

Tillable Acres _____ Owned _____ Rented _____

Woodlot Acres _____ Soil type _____

Crop	Acres	Total Yield	Method of Harvest

LABOR: MONTHS ON FARM

Operator _____ Months

Family _____ Months

Hired _____ Months

GROSS INCOME

Date	Quantity	Price	Amount Received
Livestock and livestock products sold:			
Milk			
Other dairy products			
Eggs			
Cattle			
Hogs			
Sheep			
Poultry			
Other livestock			
Other livestock income (wool, breeding fees, etc.)			
Crops sold:			
Wheat			
Oats			
Corn			
Sugar beets			
Hay			
Seed			
Other			
Custom work or machinery rented			
Land and pasture rent			
Other income from farm sources (inc.PMA)			
Other income			
		TOTAL CASH INCOME	

GROSS INCOME (CONT'D)

VALUE OF FAMILY LIVING FURNISHED BY FARM

Farm Product	Amount	Price	Total Value
Milk		$	$
Butter			
Eggs (doz.)			
Poultry (lbs. or number)			
Beef			
Pork			
Mutton			
Fruit			
Vegetables			
Wood			
Other			

Total Value of Family Living Furnished by Farm $ _____

Total Cash Income from page 136 _____

Livestock Inventory Increase or Decrease (from page 141) _____

Feed & Seed Inventory Increase or Decrease (from page 140) _____

TOTAL GROSS INCOME $_____

Milk production per cow _____lbs.

FERTILIZER AND LIME

Kind	Use	Amount	Price	Cost
			$	$

_____Check for FARMS MAKING MAJOR LIME AND FERTILIZER INVESTMENTS

			Residual Value
N, Total lbs.	_____ x ___% = _____ x ___¢ =		$ _____
P_2O_5, Total lbs.	_____ x ___% = _____ x ___¢ =		_____
K_2O, Total lbs.	_____ x ___% = _____ x ___¢ =		_____
	TOTAL RESIDUAL VALUE		$ _____
Total cost of fertilizer from which residual is computed			$ _____
	Minus residual value		_____
	CURRENT FERTILIZER COST		_____
	. . . . .		
Residual fertilizer value			$ _____
Total lime cost			_____
Total cost of fertilizer applied to grasses, legumes, and other perennials seeded during year.			_____
	TOTAL FERTILIZER INVESTMENT		$ _____

SEEDS AND PLANTS

Used in 1957 — Perennial seed and plants (grasses, legumes, fruit)				Purchased in 1957 — Annual seed and plants (corn, small grain, beets, cover crops, garden etc.)		
Kind	lbs. seeded	Acres seeded	Cost or value	Kind	Amount	Cost or value
				Garden seeds		
Total						
(Carry total to perennial plant inventory)				(Carry total to other expenses)		

Beginning Inventory of Perennial Plants

Hay and Pasture

Kind	Acres	Age and condition	Value per acre	Total Value	Date destroyed	Prop. credit
Totals						

Fruit

Kind	Acres	Value per acre	Total value
Totals			

Total beginning value of perennials		
Minus proportionate credit of perennials destroyed		
Plus machinery hired for land reclamation		
Plus cost or value of perennial seed purchased & used		
Plus total fertilizer investment		
Total investment		

OTHER EXPENSES

Item	Quantity	Cost
Custom work or machinery hired		$
Labor		
Gas and oil for farm use (less refund)		
Livestock expense:		
Feed		
Spray		
Veterinary and medicine		
Breeding fees (less patronage refund)		
Feeders purchased:		
Cattle		
Hogs		
Lambs		
Baby chicks purchased		
Automobile operation (farm share)		
Electricity (farm share)		
Telephone (farm share)		
Supplies (baling wire, sacks, strainer pads, etc.)		

Beginning inventory of feeder animals	
Beginning inventory of broilers	
Annual seed and plants purchased	
Perennials destroyed during year (value)	
Other expenses	
Total expenses	

FEED AND SEED INVENTORY

Kind	Beginning inventory Quantity	Beginning inventory Value	Ending inventory Quantity	Ending inventory Value
		$		$
Grain				
Corn				
Oats				
Wheat				
Hay				
Straw				
Commercial feeds				
Annual seed				
Wheat seeding				
Perennial grass & legume seed				
Total				

Inventory increase $ _____

Inventory decrease $ _____

LIVESTOCK INVENTORY

Kind	Beg. inventory		Add		Subtract		End. inventory	
	No.	Value	No. born	No. bought	No. sold and butchered	No. died	No.	Value
Dairy								
Cows								
Bred heifers								
Unbred heifers								
Calves								
Bulls								
Beef								
Cows								
Bred heifers								
Unbred heifers								
Bulls								
Feeders								
Calves								
—								
Hogs								
Sows								
Boars								
Pigs								
Feeders								
Litters farrow								
Sheep								
Ewes								
Rams								
Lambs								
Feeders								
Poultry								
Hens & roosters								
Broilers								
Other poultry								
Other								
Total								

Beginning inventory:
- Breeding stock _____
- Feeders _____
- Broilers _____

Ending inventory: (total) _____
- Breeding stock
  - Value of purchases _____
  - Beginning inventory _____
  - Increase or decrease _____

LIVESTOCK INVESTMENT (DOLLARS)

Breeding Stock Bought During Year				Breeding Stock Sold During Year			
Date	What bought	Cost	Prop. cost	Date	What sold	Rc'vd.	Prop.credit
		Total	______			Total	______

Beginning Inventory (Breeding Stock) ______
Plus Total Proportionate Cost ______
______
Minus Proportionate Credit ______
Total Breeding Livestock Investment ______

MACHINERY AND EQUIPMENT INVESTMENT
(Inventory beginning of year)

Item	Number	Value
Tractor and outfit		
Machinery & equipment not included in tractor outfit		
Automobile (Farm share)		
Truck		
Trailer and wagons		
Tillage Equipment		
Plows		
Harrows (spring & spike tooth)		
Disks		
Cultipacker or roller		
Cultivator		
Planting Equipment		
Grain drill		
Seeder		
Seeder (Hand)		
Corn planter		
Harvesting Equipment		
Hay rake		
Mower		
Hay loader		
Binder		
Combine		
Field chopper		
Hay baler		
Hay forks or slings		
Mow dryer		
Corn picker		
Ensilage cutter (stationary)		
Lime spreader		
Manure spreader		
Barn cleaner		
Feed grinders		
Elevators		
Blower		
Engines and motors		
Welder		
Milk cans		
Milk coolers		
Bulk tank		
Cream separator		
Milking machine		
Wash tank, can rack, & other milk house equipment		
Water heater (milk house)		
General farm tools (forks, shovels, carpenter shop, fence)		
Gas tank		
Irrigation equipment		
Others		
Total		$

MACHINERY AND EQUIPMENT INVESTMENT (continued)

Purchases				Sales			
Date	Item	Total cost	Prop.add.	Date	Item	Total value	Prop.ded.
		$	$			$	$

Beginning inventory $ _____
Prop. add. _____
Prop. ded. _____
Total machinery investment _____

IMPROVEMENT INVESTMENT

Item and description	Capacity	
	Animal	Cash crop storage
Dairy barn (type)		
Stanchion milking parlor		
Other		
Other barns		
Hog house (farrowing, "A" type, etc.)		
Poultry houses (laying, broiler, brooder range, shelters, etc.		
Granary		
Corn crib		
Silo type and size		
Other		

RECORD OF LIABILITIES AT END OF 1957

Type	Year Made	Source of funds	Orig. amt.	Int. rate	Amt. Rec'd	Repay. method	Annual payt.	Balance due	Purpose	Security
Real estate mortgages:										
Chattel mortgages:										
Secured notes:										
Unsecured notes:										
Open book accounts:										
Installment purchases:										
Land Contracts:										
Other:										
Taxes due										
Insurance due										
Rent due										

CREDIT USED IN 1957-58

Kind of Credit		Amount of Loan (Actual)	Date Funds Borrowed	Amount Actually Received	Date Due	Repay-ment Date	Source of Funds for Repayment	Amount of Interest Paid	Security Given	Source of Loan	Why this Source of Credit?
Fert.	57										
	58										
Seed	57										
	58										
Other crop expense	57										
	58										
Feed	57										
	58										
Other (Specify)	57										
	58										
Cattle	57										
	58										
Other livestock	57										
	58										
Machinery	57										
	58										
	57										
	58										
	57										
	58										
	57										
	58										
Buildings (Specify)	57										
	58										
	57										
	58										
	57										
	58										
	57										
	58										
	57										
	58										

NET WORTH STATEMENT
(As of December 31, 1957)

Assets		Liabilities	
Land	$_____	Farm mortgage	$_____
Buildings	_____	Other mortgages	_____
Machinery	_____	Bank notes	_____
Livestock	_____	Personal notes	_____
Feed, seed, supplies	_____	Other notes	_____
Household equipment	_____	Accounts payable	_____
Stocks, bonds	_____	Taxes, rent, ins. due	_____
Cash on hand	_____	Other debts	_____
Cash in bank	_____		
		Total	$_____
Accounts receivable	_____		
		Net Worth	_____
Total	$_____		
		Total	$_____

FARMING EXPERIENCE

Years on this place _____; years operated for yourself _____

Years of experience in dairy business _____

Age of operator _____ Age of son or sons if operator is planning or has a father-son agreement _____

Health of operator: Good _____ Fair _____ Poor _____ (check one)

Insurance carried (a) Life _____; (b) property _____;

(c) farm liability _____ (d) other insurance _____

Do you plan on making any adjustments in your farm operations this year that you think would change the amount of farm products that your farm produces? _____

_____

_____

or

Any that would not change production but which might lower your costs? _____

_____

or

Would both change the amount of products produced and at the same time reduce your costs of production or do you propose to make any other changes? _____

_____

_____

What are the changes that you would make? In each case specify (a) the nature of the change in what kind of thing; (b) how much; (c) expected cost or price; (d) expected result on a firms cost structure.

_____

_____

_____

_____

_____

_____

If planned purchases are indicated in the previous question, what method of payment do you plan on using?

1. Pay cash
2. Mortgage
3. Installment
4. Dealer credit
5. Get cash from bank
6. " " " P.C.A.
7. " " " F.H.A.
8. " " " Federal Land Bank
9. " " " friends
10. Other -- Be specific

Have you made any major changes in your farm operations in the last five years?

Labor _____

Land _____

Machinery _____

Livestock _____

Forage _____

Buildings _____

Labor (how much, what kind, wage, expected result) _____

_____

_____

_____

Land and land improvements except portable irrigation (how much, what kind, where, buy?, rent?, other, what price, expected result)

_____

_____

_____

_____

_____

_____

_____

Machinery and equipment (what kinds, how much, prices?, purpose, expected result)

Buildings and permanent improvements to buildings (what kind, how much (capacities), prices, purpose, expected result)

Cash operating expenses (include here feed, fertilizer, fuel, etc.)

Livestock (include number, quality, and way to be obtained, price, etc.)

Changes in scale of operations involving more than one input category (include here proportions of various categories, expected cost of making the changes and expected results in terms of income and cost change)

So far, we have talked about changes that you might make if you were given the right conditions. To help us in this study, we need to know what conditions, if any, you think actually prevent you from making part or all of these changes?

(a) Satisfied with present income

(b) Prices are uncertain (i.e.)

(c) Not possible to get the kind of land wanted

(d) Not possible to get kind of livestock wanted

(e) Not going to stay in farming much longer

(f) Non-farm investments are more profitable

(g) Need more information before making a decision and taking action

(h) Labor not available at rate operator is willing to pay

(i) Change may be too risky

(j) Prices too high at present

(k) Cash not available

(l) Don't want to use credit under any circumstances

(m) Cost of borrowing money is too high

(n) Present debt repayment schedule already high relative to income

(o) Other reasons -- specify

Of the reasons that have been listed for not making changes in a farm business, which do you consider to be the limiting ones in your case? (a) Most important _____; (b) next important _____; (c) least important _____.

If respondent has indicated that he will make input changes, then continue with this one.

You have indicated that you plan on making certain investments, now suppose you could borrow all the money that you wanted to at the following rates of interest, could you give an estimate of how you would change your investment in:

Land - If you could borrow all that you wanted to at the following rates of interest, assuming that the repayment schedule could be adjusted to your convenience.

Interest Rate	Amount	Period Required	Expected return of Investment
0 %			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Labor & Operating Expenses - If you could borrow all that you wanted to at the following rates of interest, assuming that the repayment schedule be adjusted to your convenience.

Interest Rate	Amount	Period Required	Expected return of Investment
0 %			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Livestock & Machinery - If you could borrow all that you wanted to at the following rates of interest, assuming that the repayment schedule could be adjusted to your convenience.

Interest Rate	Amount	Period Required	Expected return of Investment
0 %			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Now interest isn't the only thing that you think about when you borrow money. Let's see what percent you would change your estimate of the total amount of money you would borrow if you had to renew your note at

Change in Land Purchase Estimate

Maturity Period	Loan to be renewed at terms agreed upon when loan made	Loan to be reappraised by lender before renewal
90 days		
1 yr.		
2 yrs.		
3 yrs.		
4 yrs.		
5 yrs.		
6 yrs.		
7 yrs.		
8 yrs.		
9 yrs.		
10 yrs.		
15 yrs.		
25 yrs.		
30 yrs.		
40 yrs.		

Change in Labor and Operating Capital Purchases

Maturity Period	Loan to be renewed at terms agreed upon when loan made	Loan to be reappraised by lender before renewal
90 days		
1 yr.		
2 yrs.		
3 yrs.		
4 yrs.		
5 yrs.		
6 yrs.		
7 yrs.		
8 yrs.		
9 yrs.		
10 yrs.		
15 yrs.		
20 yrs.		
25 yrs.		
30 yrs.		
40 yrs.		

Change in Livestock & Machinery Purchase Estimates

Maturity Period	Loan to be renewed at terms agreed upon when loan made	Loan to be reappraised by lender before renewal
90 days		
1 yr.		
2 yrs.		
3 yrs.		
4 yrs.		
5 yrs.		
6 yrs.		
7 yrs.		
8 yrs.		
9 yrs.		
10 yrs.		
15 yrs.		
20 yrs.		
25 yrs.		
30 yrs.		
40 yrs.		

What is the largest proportion of your current income that you would be willing to use for debt repayment? _____ Do you think that this proportion would remain constant as your income changes? _____

_____

Do you believe that you should keep your debts in a fairly fixed ratio to your assets? _____ Why, and in what ratio? _____

_____

What proportion of the total resources that you use in farming do you think that you should own outright? _____

If you were able to secure a long term rental contract for your farm that would give you the same security of tenure that you have as an owner, would you be willing to rent your farm instead of owning it? If this would mean that you might be able to operate a larger enterprise than you do at present? Yes _____; No _____; Why? _____

Can you recall any important purchases that you would have made but were not able to make during the last five years because you were not able to get the credit you wanted? GET AS COMPLETE AN ANSWER HERE AS POSSIBLE INCLUDING: causes, interest rates, terms, etc.

CONFIDENTIAL Schedule No. _____

Location _____

Name and type of lending agency _____

_____

_____

1. Experience of lending agency with agricultural loans

   What percent are ag. loans of total value of loans made? _____
   What percent are ag. loans of total number of loans made? _____

2. Do you have an agricultural specialist to handle technical aspects of farm loans made by this institution? _____

3. Aside from collateral, what information about a potential borrower would you consider essential before making a loan to him? _____

   _____

   _____

   _____

   _____

4. In what way, if any, would you regard the following characteristics of farms or farm operators as important to have information about before making a loan to the farm operator

   a. Age _____

   _____

   _____

   b. Health _____

   _____

   _____

   c. Martial status _____

   _____

   _____

   d. Experience in farming _____

   _____

   _____

4. e. Time lived in this area _____

f. Credit rating _____

g. Established plan for making a change in farming operations _____

h. Loan experience of lending agency with borrower _____

i. Net cash income and net inventory changes _____

j. Insurance (life and property) _____

k. Off farm job held by farm operator _____

l. Potential cosigners _____

4. m. Purpose of loan _____

n. Type of farming _____

o. Soil productivity _____

p. Other considerations _____

5. Following are a series of questions about hypothetical situations that you might meet in making loans to farmers.

Class of Collateral	Farm Operator's Equity as a Percent of Current Market Value										
MACHINERY at current market prices	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
Would you make a loan to this farm enterprise on the basis of this collateral?											
Up to what percent of total current market value would you lend money											
What is the maximum size of loan that you would make to one farm business?											
What interest rate would you charge for the (a) maximum size loan (b) 2/3 maximum size loan (c) 1/2 maximum size loan as the percent of the operator's equity changes?											
Would you require any special conditions before making a loan at these various equities?											
Servicing charges											
Time period of loan maximum											
2/3											
1/2											
$1000											

Class of Collateral	Farm Operator's Equity as a Percent of Current Market Value										
LIVESTOCK at current market prices	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
Would you make a loan to this farm enterprise on the basis of this collateral?											
Up to what percent of total current market value would you lend money?											
What is the maximum size of loan that you would make to one farm business?											
What interest rate would you charge for the (a) maximum size loan (b) 2/3 maximum size loan (c) 1/2 maximum size loan as the percent of the operator's equity changes?											
Would you require any special conditions before making a loan at these various equities?											
Time period of loan maximum											
2/3											
1/2											
$1000											

Class of Collateral	Farm Operator's Equity as a Percent of Current Market Value										
LAND & BUILDINGS at current market prices	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
Would you make a loan to this farm enterprise on the basis of this collateral?											
Up to what percent of total current market value would you lend money?											
What is the maximum size of loan that you would make to one farm business?											
What interest rate would you charge for the (a) maximum size loan (b) 2/3 maximum size loan (c) 1/2 maximum size loan as the percent of the operator's equity changes?											
Would you require any special conditions before making a loan at these various equities?											
Time period of loan maximum											
2/3											
1/2											
$1000											

Class of Collateral	Farm Operator's Equity as a Percent of Current Market Value										
CROPS at current market prices	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
Would you make a loan to this farm enterprise on the basis of this collateral?											
Up to what percent of total current market value would you lend money?											
What is the maximum size of loan that you would make to one farm business?											
What interest rate would you charge for the (a) maximum size loan (b) 2/3 maximum size loan (c) 1/2 maximum size loan as the percent of the operator's equity changes?											
Would you require any special conditions before making a loan at these various equities?											
Time period of loan maximum											
2/3											
1/2											
$1000											

Farm No. I (Dairy)

INVESTMENTS		A	Operator's Equity B (70%)	C (57%)
Land	$10,000	100%	$4,000	$8,000
Cattle	4,000	100%	4,000	2,000
Machinery	7,000	100%	6,000	2,100
Feed & Supplies	2,000	100%	2,000	1,000
Total	$23,000	100%	$16,000	$13,100
Net Income	$3,500		$3,000	$2,700

How much would you lend this operator given that his equity is:

Situation A _____

Situation B _____

Situation C _____

Farm No. II (Dairy)

INVESTMENTS		Operator's Equity A	B (73%)	C (58%)
Land	$20,000	100%	$ 8,000	$16,000
Cattle	10,000	100%	10,000	5,000
Machinery	14,000	100%	12,000	4,200
Feed & Supplies	7,000	100%	7,000	3,500
Total	$51,000	100%	$37,000	$29,700
Net Income	$4,900		$4,000	$3,500

How much would you lend this operator given that his equity is:

Situation A _____

Situation B _____

Situation C _____

Farm No. III (Dairy)

INVESTMENTS		Operator's Equity A	B (56%)	C (59%)
Land	$30,000	100%	$12,000	$24,000
Cattle	16,000	100%	6,000	8,000
Machinery	13,000	100%	10,000	3,900
Feed & Supplies	11,000	100%	11,000	5,500
Total	$70,000		$39,000	$41,400
Net Income	$7,000		$5,100	$5,000

How much would you lend this operator given that his equity is:

Situation A _____

Situation B _____

Situation C _____

Farm No. IV (Dairy)

INVESTMENTS		Operator's Equity A	B (71%)	C (60%)
Land	$50,000	100%	$20,000	$40,000
Cattle	16,000	100%	16,000	8,000
Machinery	15,000	100%	13,000	4,500
Feed & Supplies	11,000	100%	11,000	5,500
Total	$92,000		$60,000	$58,000
Net Income	$12,000		$10,000	$9,000

How much would you lend this operator given that his equity is:

Situation A _____

Situation B _____

Situation C _____

Farm No. V (Dairy)

INVESTMENTS		Operator's Equity A	B (71%)	C (60%)
Land	$60,000	100%	$24,000	$48,000
Cattle	33,000	100%	33,000	16,500
Machinery	20,000	100%	17,000	6,000
Feed & Supplies	22,000	100%	22,000	11,000
Total	$135,000	100%	$96,000	$81,000
Net Income	$26,000		$23,600	$22,000

How much would you lend this operator given that his equity is:

Situation A _____

Situation B _____

Situation C _____

Farm No. VI (Dairy) Operator's Equity

INVESTMENTS

Land	$300,000	100%	$120,000	$240,000
Cattle	100,000	100%	100,000	50,000
Machinery	50,000	100%	42,000	15,000
Feed & Supplies	60,000	100%	60,000	30,000
Total	$510,000		$322,000	$335,000
Net Income	$90,000		$79,000	$77,000

How much would you lend this operator given that his equity is:

Situation A _____

Situation B _____

Situation C _____

Could you outline the history of 4 or 5 loans that your institution has made to dairy farmers in the last two years in which the amounts of the loans made were close to or at the maximum that you would lend?

(i)

a. Amount of loan _____

b. Period of maturity _____

c. Interest rate _____

d. Purpose of loan _____

_____

_____

e. Security_____

f. Net income _____

g. Personal characteristics of borrower of relevance in making this loan ___

_____

_____

h. Why do you consider that this loan was close to the maximum that you would lend this operator?

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Could you outline the history of 4 or 5 loans that your institution has made to dairy farmers in the last two years in which the amounts of the loans made were close to or at the maximum that you would lend?

(ii)

a. Amount of loan _____

b. Period of maturity _____

c. Interest rate _____

d. Purpose of loan _____

_____

_____

e. Security _____

f. Net income _____

g. Personal characteristics of borrower of relevance in making this loan ___

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h. Why do you consider that this loan was close to the maximum that you would lend this operator?

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Could you outline the history of 4 or 5 loans that your institution has made to dairy farmers in the last two years in which the amounts of the loans made were close to or at the maximum that you would lend?

(iii)

a. Amount of loan _____

b. Period of maturity _____

c. Interest rate _____

d. Purpose of loan _____

_____

_____

e. Security _____

f. Net income _____

g. Personal characteristics of borrower of relevance in making this loan ____

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h. Why do you consider that this loan was close to the maximum that you would lend this operator?

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Could you outline the history of 4 or 5 loans that your institution has made to dairy farmers in the last two years in which the amounts of the loans made were close to or at the maximum that you would lend?

(iv)

a. Amount of loan _____

b. Period of maturity _____

c. Interest rate _____

d. Purpose of loan _____

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_____

e. Security _____

f. Net income _____

g. Personal characteristics of borrower of relevance in making this loan ____

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h. Why do you consider that this loan was close to the maximum that you would lend this operator?

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Could you outline the history of 4 or 5 loans that your institution has made to dairy farmers in the last two years in which the amounts of the loans made were close to or at the maximum that you would lend?

(v)

a. Amount of loan _____

b. Period of maturity _____

c. Interest rate _____

d. Purpose of loan _____

_____

_____

e. Security _____

f. Net income _____

g. Personal characteristics of borrower of relevance in making this loan __

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h. Why do you consider that this loan was close to the maximum that you would lend this operator?

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Do you believe that your institution could profitably and safely loan more money under certain circumstances to individual farmers than it is presently able to do because of restrictions imposed which are in addition to its own regulations?

What are some of these restrictions? _____

What do you believe would be more appropriate regulations? _____

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