A COMPARATIVE ANALYSIS OF FINANCING REQUIREMENTS OF SELECTED TYPES OF FARM OPERATIONS IN THE EASTERN CORN BELT FOR 1980

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Richard Arthur Benson

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This is to certify that the

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ABSTRACT

A COMPARATIVE ANALYSIS OF FINANCING REQUIREMENTS OF SELECTED TYPES OF FARM OPERATIONS IN THE EASTERN CORN BELT FOR 1980

by

Richard Arthur Benson

Tremendous changes have occurred in the agricultural sector of the U.S. economy in the last few years. All indications are that the transformation processes working on the structure of farm firms are only in the embryonic stages of development. By 1980, structural changes will have greatly altered the capital and credit needs of many U.S. farmers.

The rapidly changing farm environment raises many serious questions. (1) What sizes and types of farming units may be important by 1980? (2) What might be the magnitudes of the investments on large, highly specialized farming units by 1980? (3) What will be the probable income generating ability of these units? (4) What size loan requests might reasonably be expected? (5) Will these units have sufficient repayment capacity if various sizes and types of loans are extended? (6) What are the expected risks involved in financing large, specialized farming units in 1980? The current study was aimed at providing answers to these and similar questions.

From a financing point of view, this was a micro-demand study with implications for micro-supply. Hypothetical farming units were constructed that were believed to represent sizes and types of farming operations that will be important by 1980. These included 1-, 2-, and greater

than 2-man operations for dairy, cash grain, and feeder cattle. The farming units employed the most advanced technology projected for 1980, provided the given technology was economically feasible for the unit being considered. Capital was substituted for labor on the synthesized farming units to allow a high level of labor efficiency. Further, the management ability of the operators was assumed to be well above average. The 1980 hypothetical units could be thought of as "target" combinations of resources for the specific sizes and types of farming operations considered.

The numerous coefficients estimated in this study were developed for one purpose—to provide realistic reference units to be used in analyzing certain characteristics of financing specialized types of farm firms in 1980. The analysis was conducted along the lines of the familiar Three R's of Credit—returns, repayment capacity, and risk-bearing ability. Each size and type of farm analyzed had unique characteristics regarding such items as flow of funds, collateral, and need for land, buildings, equipment, livestock, and machinery. These varying characteristics created fundamental differences in the absolute amount of financing needed, the length of amortization periods required, and the access to, as well as the alternative methods of external financing. All of these characteristics, in turn, significantly affected the returns, repayment capacity, and risk-bearing ability of farming operations. By using this framework to analyze target 1980 units, it was expected that this would suggest implications for farmers and lenders as they formulated plans for operating and financing farming units in the future.

All of the 1980 dairy operations analyzed appeared to have strong profit potential. With reasonable lengths of repayment on machinery than 2-man operations for dairy, cash grain, and feeder cattle. The farming units employed the most advanced technology projected for 1980, provided the given technology was economically feasible for the unit being considered. Capital was substituted for labor on the synthesized farming units to allow a high level of labor efficiency. Further, the management ability of the operators was assumed to be well above average. The 1980 hypothetical units could be thought of as "target" combinations of resources for the specific sizes and types of farming operations considered.

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All of the 1980 dairy operations analyzed appeared to have strong profit potential. With reasonable lengths of repayment on machinery and dairy facilities, these units had the potential to support heavy debt loads on a low-equity basis and, at the same time, generated a high return on investment for the farm operators. A potential problem area on large-scale dairy farms by 1980 may be the tremendous investments required for highly specialized dairy facilities. Obtaining sufficient amounts of intermediate-term financing without having it fall under the umbrella of long-term land financing may be the most difficult financial problem facing dairy farmers by 1980.

Because costs are expected to increase at a more rapid rate than yields and prices, cash grain farms by 1980 could be the epitome of farming units affected by the price-cost squeeze. Cash grain farmers may be faced with a serious dilemma by 1980—small profit margins may force them to expand on the one hand but limit their expansion on the other. To obtain units large enough to provide an adequate level of family living, cash grain farmers may be forced to expand. But expansion may require a heavy debt load, and repayment capacity may not be sufficient to meet the annual repayment obligations implied by large amounts of external financing. Large-scale expansion via the ownership route may not be possible for cash grain farmers by 1980 because all payments on land must come from net income, and if net income is low, land will not generate its own repayment. Limited repayment capacity coupled with high price and biological risks made it difficult to build a strong argument for more liberal financing terms for cash grain farmers in 1980.

The biggest barrier to operating and financing large beef feeding operations in 1980 may be price risk. The 6000-head unit considered, for instance, had strong repayment capacity and could support a heavy debt load when cattle prices were $30 per hundredweight. At $35 per hundredweight, the operation generated a before tax return on investment of 63.8 percent. But with cattle prices at $25 per hundredweight, the operation fell $163,000 short of covering variable costs. The highly efficient, high investment, controlled environment units considered in this study appeared to have more potential for older, established operators who wanted to add to the size of their present setups and increase labor efficiency rather than for young operators who wanted to get more volume from their limited equity.

In summary, many of the units considered in this study will require more financing, more services, and more liberal credit terms by 1980 than most farm lenders are currently offering. And the responses of credit institutions to the changing needs of farm operators may have a very profound effect on the structure of farm firms in the Eastern Corn Belt in 1980.

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CHAPTER I

INTRODUCTION

1.1 The Problem Situation

The characteristics of 20th Century agriculture can be epitomized by one phrase—tremendous structural change. The small, diversified, self-sufficient, and labor intensive farming operations are giving way to large, specialized, highly integrated, and capital-intensive farming units. These structural changes have greatly altered the capital and credit needs of many U.S. farmers.

With many Class I farms requiring multimillion dollar investments in 1980, legitimate loan requests of one quarter to one half million dollars or more may be common. Most farm lenders are presently not geared for making loans of this magnitude. As one author put it, these units may be "too small to go directly to financial markets with corporate stocks and too large for the traditional refinancing each generation by existing credit institutions" [26, p. 812].1/ There is evidence, however, that some lenders recognize the rapidly increasing demand for large loans as a potential problem and are initiating projects to study this area. For example, the Federal Intermediate Credit Bank (FICB) executive committee recently assigned a project team to a study of the problems surrounding large and giant loans.2/ The feeling among FICB

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

2/ A large loan is defined as a loan with a peak amount outstanding (or anticipated) equal to or exceeding 35 percent of the PCA's net worth, whichever is less. A giant loan is defined as a loan with a peak amount outstanding (or anticipated) equal to one million dollars or 50 percent of the PCA's net worth, whichever is less.

leaders was that present loan analysis and servicing procedures were ill-equipped for handling the problems and challenges presented by the ever-increasing number of requests for large loans. The project team recommended ten procedures that were later adopted by the FICB loan committee. Among these were requirements that all large or giant loan requests be accompanied by a minimum of three years financial and operating statements, and that the PCA involved in a giant loan submit written plans for loan servicing and control and also monthly or quarterly field reports to the FICB loan committee. These and other procedures recommended by the project team reflect the feeling that because of the high concentration of risk, loan analysis and servicing must necessarily be more thorough for large and giant loans if risk is to be minimized [51, p. 4-5].

Commercial banks, insurance companies, and other agricultural lenders are also concerned with the potential problems presented by large loans. Some of these lenders can and do make large loans. But few, if any, have sufficient practical experience with large loans to handle an agricultural loan portfolio dominated by one quarter of a million dollar or larger loans to farm operators. In the past, large agricultural loans have been the exception rather than the rule, so in general, there has been little incentive for lenders to gear their loan policies and procedures to the financing need of this small minority. However, as large agricultural loan requests become increasingly common, there is an urgent need for research dealing with the financing needs of these larger units.

By 1980, large farming units (and large loan requests) may actually be the rule rather than the exception. The current study is aimed at providing answers for some commonly asked questions: (1) What size and type of farming units may be important by 1980? (2) What might be the magnitudes of the investments involved? (3) What will be the probable income generating ability of these units? (4) What size loan requests might reasonably be expected? (5) Will these units have sufficient repayment capacity if various sizes and types of loans are extended? (6) What are the risks involved? These and similar questions are being asked with increasing frequency, but as yet little research has been done at the micro or firm level. From a financing point of view, this project can be thought of as a micro-demand study with implications for micro-supply. In other words, by doing a detailed study of certain sizes and types of farms that may be increasingly important by 1980, it is anticipated that this will suggest implications for lenders as they plan their lending strategies for the '70s.

1.2 The Objectives

The basic objectives of this study are as follows:

1. Determine the probable financial and production structure of selected types of farm firms in 1980, and estimate their ability to generate income.

2. Estimate the financing needs and repayment capacity of these synthesized units assuming various resource control arrangements, various equity positions, various down payment requirements, and various amortization periods.

3. Suggest implications of the results for lending institutions as they plan their lending strategies for the '70s.

The accomplishment of these objectives would enhance our understanding of the types of financing problems U.S. farmers in general, and Eastern Corn Belt farmers in particular, may be experiencing in the next decade. Further, the analysis should provide insight for lenders as they adjust and alter their policies and procedures in an attempt to adequately service the rapidly increasing demand for large loans.

1.3 Previous Research

Only a small percentage of the research in agricultural finance has addressed itself to the problems of financing individual farm firms.3/ In a 1960 study, Nelson [44] synthetically constructed a representative 1975 40-cow dairy farm to study the future repayment capacity and risk-bearing ability of the individual firm. He concluded that credit probably will be used to a relatively greater extent in 1975 than in 1960 due to farms being larger and having the repayment capacity and risk-bearing ability to safely use more credit.

A study by Baker and Irwin [3] in 1961 estimated the optimum combination of resources on two specific farms—one in a grain area and one in a livestock area of Illinois. They then obtained estimates of the amount of money that could be borrowed for resources on each farm, and compared this estimate with the most profitable amount for the farms. They found that the amount of money that could be borrowed varied widely among purposes, and that in many cases, lender behavior had a significant effect on farm organization.

A similar study by Irwin and Baker [37] constructed hypothetical farm firms to study the effects of lender decisions on farm financial planning. They found that optimal planning by a farmer as well as his level of income were affected by lender limits.

Another area of research closely related to this study is firm growth. Numerous projects have been initiated recently employing

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3/ The author wishes to express an intellectual debt to Professor Brake who, in a series of speeches over the last two years, has identified numerous financial problems individual farm operators have experienced, or will likely be experiencing in the next few years. It was these initial probings, coupled with personal interactions with Professor Brake, that led to the selection of the current topic.

techniques such as simulation, recursive programming, and polyperiod programming to study the processes and pains of growth [36]. A 1970 thesis by Duvick [27], for instance, employed polyperiod programming to study how such factors as down payment requirements on loans, length of amortization periods, goals of farm operators, minimum and marginal rates of consumption, appreciation in land values, interest rates, and initial cash positions affected such items as net worth, consumption, farm organization, and the level and structure of debt assumed. In another less technical study, the author [4] studied a group of expanding dairy farmers for a 6-year period to identify and analyze some of the financial problems of expanding to large-scale dairy farming.

1.4 Method of Procedure

The analysis of this study is conducted in three steps. First, the basic forces affecting the structure of farm firms are discussed and evaluated. This information is used along with Project '80 estimates 4/, farm account data from operators using advanced technology, and information from personal interviews with specialists to synthetically construct representative 1980 farm operations. These include 1-, 2-, and greater than 2-man operations for dairy, cash grain, and feeder cattle. Three types of farms are analyzed because it is difficult to generalize when discussing the problems of financing agriculture

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4/ Project '80 is a study launched in 1964 by the College of Agriculture of Michigan State University to encourage and assist the people of rural Michigan in long-range planning. The study, culminated with the publication of 16 reports, provides answers to the important question of "What will rural Michigan be like in 1980, in the natural course of events?"

in 1980. Specific types of farms vary significantly concerning the problems facing them. Each type of farming operation has unique characteristics regarding its flow of funds which affect both the capital needs and access to external capital sources. A dairy farmer, for instance, has a monthly stream of income which can provide capital internally and also provide a basis for servicing debt. A cattle feeder, on the other hand, may have receipts only once or twice a year. Similarly, a cash grain farmer receives income at a limited number of times a year. These differences in flows of funds produce different needs for external capital and require different debt repayment plans. Differences by types of farms also exist regarding collateral. Cash grain farms depend heavily on inputs such as fertilizer and chemicals which are used up in the production process and, hence, cannot serve as collateral. A cattle feeder, on the other hand, has collateral in the form of livestock that generally increases in value during the production process and serves as good loan collateral. Dairy cows can also serve as collateral but generally depreciate in value over time. Similarly, each type of farming operation differs in its need for land, buildings, equipment, livestock, and machinery; hence, differences in length of terms needed in financing and in alternative methods of financing. Land is more commonly available for lease than are buildings or livestock. Similarly, machine services can be more readily obtained from custom operators than the other categories of inputs.

Second, using appropriate budgeting techniques, the ability of these specific types of 1980 farm firms to service debt is estimated. Various combinations of equity levels and amortization periods for machinery, buildings (includes buildings, livestock equipment, and feed storage), and land are analyzed to determine their effect on repayment capacity. This section also provides a comparative analysis of how down payment schedules affect net worth requirements on each type of farm. Further, insight is provided into the absolute amount of net worth required to assemble the combinations of resources represented by the synthetically constructed firms, given the various down payment requirements and resource control arrangements. Also, the short-term debt load (debt for operating capital) represented by the individual firms is estimated and analyzed.

Finally, the question of "What are the implications of this study for farm operators and lenders as they plan their strategies for the '70s?" is explicitly treated. Will young farmers be able to gain control of efficient sized agricultural production units by 1980? Are current policies and procedures of lending institutions suitable in an agricultural environment typified by relatively large-scale units similar to the ones considered in this study? Are there realistic changes in policies that lenders could initiate that would alleviate some of the problems of financing large farm operations? This study is aimed at providing insight into answers for these and similar questions.

CHAPTER II

STRUCTURAL CHANGES OCCURRING IN THE AGRICULTURAL SECTOR

Tremendous changes have occurred in the agricultural sector of the U.S. economy in the last few years. All indications are that the transformation processes working on the structure of farm firms are only in the embryonic stages of development. Therefore, to synthetically construct realistic 1980 farm operations which can be used as reference units when studying future financing needs, it is necessary that the forces working to alter the basic structure of farm firms be considered in detail.

2.1 Basic Forces Catalyzing Structural Change

The changing structure of agriculture has played an integral part in altering the financing needs of U.S. farmers in the last few years. Immense amounts of finance capital are now required to assemble efficient, viable operations. At least three major forces have contributed to the structural change [5].

1. Changes in technology
2. Changes in markets
3. Changes in institutions

These categories are by necessity extremely broad. But they do provide a basic organizational framework for studying the factors influencing structural change in the agricultural sector of the United States economy. They also provide insight into the types of farm operations that will be important in 1980.

2.1.1 Changes in technology

Cochrane [21] has referred to technological advance as the "engine of the farm economy." In other words, it is the driving force behind the tremendous changes that have occurred in the agricultural sector of the economy.

New technologies may appear in numerous forms. A new or improved machine may lower the price of capital relative to labor and encourage capital-labor substitution. A new input such as an herbicide may eliminate mechanical weeding of field crops, or a new crop variety may be developed that thrives in dense population and virtually smothers out weeds.

New technologies are usually output increasing at least in the short run. This is true because the new developments push average and marginal cost curves downward and to the right. Since the short-run supply curve of farmers is the marginal cost curve above the average variable cost curve, the supply curve would be pushed to the right by the new technology. Given the relatively inelastic demand for farm products, the prices farmers receive would decrease in the short run, ceteris paribus. In the long run, the prices of farm products are held down because of the ubiquitous incentive to adapt new technologies. But while farm product prices are decreasing or remaining constant, input prices are constantly increasing. This leads to what is often referred to as the price-cost squeeze and forces farmers to expand the size of their operations in order to maintain an adequate level of family income.

New technologies may also appear in the form of improvements in human capital. Improved management potential on today's farms has

made it possible for numerous structural changes to occur. Prudent businessmen, well-educated in the science of technical agriculture, have demonstrated the ability to handle highly complex, sophisticated farming operations. Without this skilled leadership, farming units could never have reached the scale and efficiency that currently exists on an ever-increasing number of U.S. farms. All indications are that farms of tomorrow will put an even larger premium on management ability, so farmers are faced with the never-ending struggle to improve their management potential at a rate that is at least as rapid as the rate of improvement in nonhuman capital.

The enormous effect a new technology could have on the structure of agriculture can be illustrated by an example [5]. Consider the impact of a new variety of corn (1) with varying length maturities (2) which could be broadcast seeded by helicoptor on minimally tilled land and (3) with plants structured so that it could be combined by machines with 20-foot heads. This development would clearly alter the organizational pattern of Corn Belt agriculture as we know it today. In general, similar technological breakthroughs have had and will continue to have very substantial effects on the structure of U.S. agriculture.

2.1.2 Changes in markets

The significant modifications that have taken place in the markets for farm products have contributed greatly to the changing structure of agriculture. As a result of new technological developments, there have been some very profound changes occurring in the production and processing sectors of our economy. In many respects, conventional markets no longer meet the needs and requirements of these sectors.

Both farmers and processors have found that, in many cases, the performance of a vertically coordinated and integrated system is superior to the performance of conventional markets. A vertically coordinated system usually ties the producer and processors together with some type of contract that sets forth such things as product specifications, time of delivery, and price determination clause. The contract may also include provisions calling for the processor to provide technical advice or specific inputs such as feed. Vertical integration, on the other hand, implies that two or more stages of production are joined together under one ownership. A beef packing company that owns a cattle feeding setup is an example of vertical integration.

Farmers may favor vertical coordination for at least four reasons. First, they want to reduce the risk and uncertainty facing them. With the high stakes involved, farmers cannot afford to operate in an economic environment characterized by price risk, biological risk, and the risk of technical obsolescence. Second, for similar reasons, a farmer must be certain that he has a market for his products. In one county in Michigan, for instance, farmers could only find buyers for about 20 percent of their 1969 cling peach crop. The remaining 80 percent fell to the ground and rotted. For an operator with a large investment and a large volume, this could be disastrous from a financial standpoint. Third, to obtain a farming unit large enough to be efficient, it often requires tremendous amounts of capital. Farmers may not be able to accumulate sufficient owned, borrowed, or rented capital to reach an efficient scale without the help of the firm that processes their products. Finally, farmers may favor a vertically coordinated system because it may provide them with increased bargaining power and

an improved market position. Since farmers generally operate in an environment of atomistic competition where they are "price takers," improving their relative power in the market place is very important.

Processors also stand to gain from vertical coordination or integration. Plants cannot operate at peak efficiency unless they have a flow of raw materials from the production sector that is free of fluctuation in both quantity and quality. The plants are set up to handle a certain daily volume, and significant deviation from this amount may substantially increase per unit costs. Also, the costs of selling and distribution may be reduced if processing plants have an even flow of a uniform quality product from the farming sector. Finally, it may be profitable for processing firms to integrate backwards to take advantage of complementary or supplementary stages of production.

In conclusion, there are numerous economic forces at work at both the production and processing levels, and these forces are causing a threat to conventional markets. The changes that are taking place in conventional markets are substantially affecting the present production structure of certain commodities, and in the future, the impacts of changing markets on the structure of agriculture may be even more noticeable.

2.1.3 Changes in institutions

Institutions, broadly defined as social controls over individual action, may include such conventional items as taxation, credit, organizational forms (leases, partnerships, corporations, etc.), and government programs. Also, they may include such unconventional things as family living styles, labor preferences, and pollution controls [5].

The dynamic social, political, and economic elements in our complex

society leave our laws, customs, and standard operating procedures, etc. (i.e. our institutions) in a constant state of flux. Shaffer [52, p. 246] has argued "...that changes in technology, extent of the market, operating procedures, etc. create new patterns of external effects requiring constant institutional adjustment to direct individual efforts to socially desirable ends." But the notion that societies' major problems are the result of institutional lag to technological possibilities is somewhat misleading. Institutions are not always a passive element in the network of interacting forces. For instance, technology is just as much a product of institutional organization as institutional organization is a product of technology [52, p. 247]. The point to be made is that institutions are often a leading element in our dynamic system, and changing institutions have had and will continue to have a rather pervasive effect on the structure of U.S. agriculture.

Two examples are helpful in illustrating the extensive effects institutions, and changes in institutions, can have on the basic structure of agriculture. First, consider the agricultural corporation. A 1968 farm survey identified six reasons (listed in order of decreasing importance) why farmers incorporate [39].

1. Ease of transfer
2. Perpetual life of business
3. Tax savings
4. Limited liability
5. Capital procurement
6. Prestige

Assiduous study of these points leads to a significant conclusion--

the corporate form of organization was institutionally created, and further, corporations are being perpetuated by existing institutions. More specifically, the first four points are advantages for corporations only because of currently prevailing laws (i.e. institutions). It is not difficult to imagine how laws could be changed to strangle the corporate form of organization, should society decide corporations are undesirable.

Even advantages 5 and 6 can be traced to institutions. If existing financial institutions were capable of completely handling the financing requirements of sole proprietorships and partnerships, there would be no advantages in capital procurements for a corporation. Similarly, under prevailing social institutions, the word corporation connotes glamour and prestige. But these institutions could change and the connotation of the word corporation could be quite different. Consider for instance, the evolution of the connotation of another organizational form—the syndicate.

Another example demonstrates the effects a change in institutions could have on the structure of agriculture. Assume that because of pollution considerations, all inorganic fertilizer, all herbicides, and all insecticides were banned from the market. Numerous volumes could be written on the changes that would take place in the agricultural production sector of the U.S. economy. For a specialized cash crop farmer, for instance, most parameters of an optimizing model would be altered. Crop rotations would once again be popular. General crop-livestock farms would replace many highly specialized farming units. Price relationships would change. Land prices would fall. In general, this profound institutional change would throw the structure of agriculture into a state of complete chaos.

From a purely financial point of view, suppose financial institutions failed to adjust their policies and procedures to meet the constantly changing financing needs of farm operators. Would this necessarily mean that progress in agriculture would be curtailed? Probably not, because in all probability, farm operators would find new ways to finance their operations. But the family farm type, open market structure that dominates agricultural production in the Eastern Corn Belt today may be substantially altered. There would be a greater separation of ownership and control of resources. Absentee ownership, renting, leasing, etc. would become increasingly important. Capital acquisition problems may be alleviated by a shift to highly integrated, corporate type systems.

In essence, what this means is that the responsiveness of credit institutions to the changing financing needs of agriculture will have very profound effects on the future structure of the agricultural production sector of the U.S. economy. Some policy makers have argued that a substantial deviation (e.g. the domination of agricultural production by highly integrated, corporate units) from the "family farm" structure of agriculture would be detrimental to society. Others have argued that society would gain from an evolution away from the "family farm." This is a serious question and now is the time when public decision makers should be coming to grips with the problem. Future use of potentially powerful institutional tools, both legal and financial, will be instrumental in determining the future structure of agricultural production units.

In conclusion, institutions and changes in institutions significantly

affect the structure of agriculture. Further, they must be considered in any futuristic study dealing with agricultural structure, and changes in that structure.

2.2 Implications for Synthesized 1980 Farm Firms

How do the basic forces catalyzing structural change relate to the 1980 farm firms synthesized in this study? Of primary conceptual importance to this study is the idea of enterprise specificity. Careful analysis of the network of interacting forces working to change the structure of agriculture indicates that these forces have quite diverse effects on different types of farm firms. In other words, they are enterprise specific [5, p. 3]. For example, the forces that have converted broiler production from an open market system to an integrated system have not had the same effect on corn production—and chances are they never will. It may be necessary to take a macro-oriented approach when studying the basic forces affecting the structure of the agriculture industry. However, when attempting to analyze the effects these forces have on the production and financial structure of specialized types of individual farm firms, these global generalizations are no longer sufficient. One must address himself to individual commodities and enterprises. As Blase puts it, "To talk about it in general is an exercise in futility" [5, p. 3].

2.3 Possible Organization Paths

Economists seldom agree on the most important factors influencing structural change in agriculture. Even if they do agree, they often interpret the end result of these influencing factors quite differently. For instance, Breimyer [19, p. 938] has argued as follows:

> There are three possible directions of change in the organization and control of farm production and marketing. One is to multiple units or super farms, probably accomplished by nonfarm capital and under nonfarm control. Another is to establish integrated relationship between farms and their markets. Finally the traditional system might be retained but modified.

In essence, this view paints a rather dismal picture for the future of the family farm.

A substantially different view is expressed by Nikolitch [46, p. 88] when he argues as follows:

> The immense economic and technological progress in recent years has not changed two basic structural characteristics of American agriculture. Contrary to what has happened in other industries, farms continue to be relatively small businesses. And second, the traditional dominance of family farms continues to be as notable as ever.
>
> Adequate family farms were, and still are, the mainstay of the American farm economy. Moreover, the evidence indicates that this dominance of family farms is increasing. It also shows that farm production is rapidly concentrating on adequate family farms.

This paper, unlike Breimyer's, makes a rather convincing argument that family farms have a bright future in the U.S.

Rhodes has presented another interpretation of the direction that agriculture is tending. His approach is somewhat in between the previously cited views. This view closely parallels the philosophy employed in the current study in that combinations of family farms, integrated units, and corporations are envisioned. The relative importance of each depends on the size and type of farming operation being considered. Rhodes [50] suggests four possible organization paths that agriculture may follow.

1. Family farm-open market agriculture
2. Family farm-collective bargaining agriculture

3. Corporate-integratee agriculture

4. Corporate-farmhand agriculture

2.3.1 Family farm-open market agriculture

Family farm-open market agriculture would be very similar to the type of organization that exists on the majority of U.S. farms today. The independent farmer would continue to choose among competitive sellers of inputs and among competing buyers for his products. Also, the farmer and his family would provide the land, capital, management, and the majority of the labor. The major nonmarket force would be government, or more specifically, a package of farm programs aimed at adding stability to farm product prices. The 1980 hypothetical cash-grain farms constructed in this study are examples of this type of organization.

2.3.2 Family farm-collective bargaining agriculture

The characteristics of production units organized along the family farm-collective bargaining lines would be quite similar in many respects to the farms discussed in the previous section. The major difference of this organization would be the presence of strong bargaining groups organized to combat power with power in the major markets for agricultural products. Dairy farms, for instance, seem to be following this path.

Several requirements must be met before bargaining groups can be effective. The bargaining organization must accomplish the following [6].

1. Represent sufficient volume of a commodity

2. Have disciplinary power over its members and cohesion among them

3. Obtain recognition by processors of its ability to inflict losses

4. Have a membership willing and able to bear the cost of withholding if necessary

5. Be able to tailor marketings to demands at desired prices on a continuing basis

Usually, to meet these requirements, a bargaining group must be organized on a farm-by-farm, territory-by-territory, or commodity-by-commodity basis [20]. The most successful bargaining groups of the past have consisted of producer members who are highly specialized and who have quite localized production. Therefore, the bargaining approach is probably not the answer to the problems of the Midwest corn producer or the wheat farmers of the Great Plains. But for the Michigan dairy farmer, the bargaining approach may be quite effective.

With the help of state and federal marketing orders and agreements, a National Farm Bargaining Board, etc., certain commodity groups may be able to reap substantial benefits from collective bargaining. If an increasing number of groups are successful in improving their positions in the market place, this would greatly reduce risk and uncertainty and could significantly alter the future production structure of many agricultural firms.

2.3.3 Corporate-integratee agriculture

Perhaps the most far-reaching and dramatic changes that will occur in the agricultural sector in the next few years will be the result of the corporate-integratee type of organization. As was mentioned earlier, there are numerous economic incentives for both farmers and processors to push toward a system of coordinated and integrated markets. As the economic pressures increase, the resulting reorganization could have a significant effect on the structure of U.S. agriculture.

In this system, the farmer could evolve as one of many specialists in the corporate heirarchy. He may own some land, physical facilities, and equipment, but in all probability, other stages of the system would provide and own the variable inputs. All production would be planned and coordinated by a computer to take advantage of all economies to be gained from the system.

There are various degrees of coordination, ranging all the way from informal contracts to a totally integrated system. The degree of future coordination depends, to a large extent, on the particular type of farm being considered. Broiler production, for instance, has already been vertically integrated to the point that an open market for broilers no longer exists. It is doubtful that cash grain farms will ever be integrated to this degree.

Beef feeding operations, however, are already responding to pressures of vertical coordination. And by 1980, many beef feeding units will be highly integrated. It is possible that beef feeding could follow an evolutionary path similar to the one followed in the poultry industry. If this happens, a 500-head per year independent beef feeder could be eliminated simply because an open market for his product does not exist.

It is doubtful, however, that vertical coordination will completely dominate beef production by 1980. Numerous independent producers will still be important. But in all probability, they will reduce price risk via a forward contract or the futures market. The beef feeding operations in this study were purposely constructed to represent production units without vertical ties. But the analysis of the capital requirements, repayment capacity, and risk-bearing ability of these operations may suggest implications for future developments along the line of vertical integration.

2.3.4 Corporate-farmhand agriculture

The fourth possible organizational form suggested by Rhodes is not explicitly apparent in the structure of the hypothetical 1980 operations used for analysis in this study. In this system, a huge corporation would be the sole provider of land, capital, and management. Also the corporation would hire labor to perform the physical tasks of producing food and fiber just as General Motors hires labor to produce and assemble automobiles. Although it is difficult to envision such dramatic changes in the Eastern Corn Belt in 10 short years, the direction suggested by this path deserves consideration. As farms become larger, an increasing proportion of the farm labor force may have to be hired. This trend has some serious implications. To obtain sufficient quantities of qualified labor, more attractive wage-fringe benefit packages will have to be worked out. Bonus payments or other types of incentives to encourage laborers to take pride in their work may have to be developed. Also, for a production system dominated by hired labor to be efficient, it may require that labor's functions be specialized just as labor's functions are specialized on an automobile assembly line. In general, this type of organization would put a premium on the owner-manager who has insight and imagination in the area of labor management. The success or failure of many of the hypothetical 1980 farms considered in the current study will be dependent on the manager's ability to secure and manage qualified hired labor.

2.4 Relative Importance of Larger Operations in 1980

Although it is apparent from the previous discussion that students of structural change in agriculture often disagree, they are unanimous on one point—farms will continue to increase in size. The three basic categories of forces influencing structural change suggested by Blase [5] are, in almost all cases, working to increase the size of farm production units.1/ Further, the net pressure for expansion is quite different depending on the size and type of farm being considered. With these considerations in mind, various projections concerning the expected sizes of 1980 farming operations are presented.

Daly [25, p. 420] has estimated that by 1980, farms with over $40,000 gross sales (Class I farms) will account for about 23 percent of all commercial farms (over $2500 gross sales) in the United States. Further, he projects that the average gross income per farm on these larger units will be approximately $110,000, and that farms with over $40,000 gross sales will account for almost 65 percent of the gross income from all commercial farms.

In another study, Mayer and Heady [40, p. 412] have estimated that total capital per farm will average $122,576 in the United States by 1980. This compares with a projected average capitalization of $90,822 per farm in the Lake states, $104,444 per farm in the Northeast, and $123,744 per farm in the Corn Belt. In all cases, this is almost double the 1965 average investments.

Another study by Brake [12, p. 1536] has projected a balance sheet

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1/ There are some examples where institutional factors would tend to suppress expansion. For instance, pollution laws may be a deterent to massive livestock operations.

for agriculture in 1980 (Table 2.1). Brake estimates that an average farm in the U.S. in 1980 will have assets totaling $168,800, an increase of over $75,000 from 1968. Also, Brake estimates that average debt per farm will be $48,000 in 1980, an increase of 190 percent over 1968.

Brake's projections indicate a substantial increase in the average farm size in the U.S. by 1980. But these averages are pulled downward considerably because they include noncommercial farms (i.e. those farms with gross sales of under $2500). These noncommercial farms accounted for about 42 percent of all farms in 1968. By combining information from numerous sources, these noncommercial farms were eliminated from the balance sheet figures for 1968, and also from the projected balance sheet for 1980. The results show that the value of assets on an average commercial farm in 1968 was about $142,000 and would increase to nearly $227,000 by 1980. Similarly, average debt per commercial farm was approximately $24,500 in 1968 and is expected to increase to almost $64,500 by 1980.

Michigan trends are similar to those projected for the total United States. Wright [61] has estimated that by 1980, 41.6 percent of total farm sales in Michigan will come from farms with over $40,000 sales. Professor Wright suspects that if data from 1969 Census of Agriculture were available to update this projection, it would show Class I farms accounting for close to 50 percent of total sales by 1980.

Rapid changes are taking place on dairy farms in Michigan. The 1964 Census of Agriculture showed 33,176 dairy herds in Michigan in 1964. It is estimated that by 1980, there will be only about 8000 dairy farms in the state. Herds of over 50 cows (average of 104 cows) are expected to contribute more than 55 percent of the total milk

Table 2.1 A comparative balance sheet for U.S. agriculture, 1968 and projected 1980

	Total		Average farm[c]	
	1968[a]	Projected[b] 1980	1968	Projected 1980
Assets	-Billions of dollars-		-Dollars-	
Real estate	193.7	249	63,529	119,400
Nonreal estate				
Livestock	18.7	23	6,133	11,000
Machinery and motor vehicles	31.0	36	10,167	17,300
Crops, stored	9.5	11	3,116	5,300
Household furniture and equipment	8.5	9	2,788	4,300
Financial assets	22.1	24	7,248	11,500
Total	283.5	352	92,981	168,800
Claims				
Real estate debt	25.5	59	8,363	28,300
Nonreal estate debt	24.9	41	8,167	19,700
Total	50.4	100	16,530	48,000
Proprietor's equities	233.1	252	76,451	120,800
Total	283.5	352	92,981	168,800

[a] The Balance Sheet of Agriculture, 1968, USDA, ERS, Ag. Info. Bul. 334, January 1969, p. 1.

[b] Estimated by Brake [12, p. 1541].

[c] Obtained by dividing the total by an estimated 3,049,000 farms in 1968 and by an estimated 2,085,000 farms in 1980.

produced by 1980 [42].

Pressures to increase size may be more intensive for cattle feeders in the next ten years than for any other commodity or enterprise group. In 1965 the average size of beef operations in Michigan was 60 head per feeder. But by 1980 the average feeder is expected to average 300 head. Further, it is expected that over 100 operations in Michigan will be feeding in excess of 1000 head by 1980 [28, p. 41].

Although Project '80 projections did not explicitly deal with the size of cash grain farms in 1980, all indications are that these operations will continue to expand. Since profit margins per acre and per bushel are expected to decrease by 1980, cash grain farmers will be forced to expand in order to maintain even the same level of living they enjoy today.

Numerous other economic forces point to a continuing pressure to expand. It has been estimated [49, p. 3] that even in the late '60s, if a farmer could make full use of all scientific knowledge and had unlimited access to capital, he could operate 620 acres by himself using 6-row equipment. Similarly, a 2-man operation could handle 1470 crop acres using 8-row equipment.

Project '80 estimates suggest that by 1980 there will be about 300 farms in Michigan over 1000 acres. Similarly, there will be about 4100 farms between 500 and 1000 acres in 1980 [61, p. 24]. In all probability, a high percentage of these farms with large acreage will be cash grain farms.

Although the projections cited deal with the U.S. in general, and Michigan in particular, similar trends will be realized in the Eastern Corn Belt. All indications are that the movement toward the larger

units is proceeding at a rate much more rapid than most experts anticipated.

2.5 Overview of Chapter

Two points in this chapter are fundamental to the development of the remainder of the thesis. First, the forces affecting the structure of agriculture generally assert pressures to increase farm size. By 1980 these pressures will greatly increase the amount of capital and credit needed to assemble an efficient, viable farming unit. All indications are that adjustments in basic lending policies and procedures will be needed if the demand for borrowed capital of this ever-increased number of larger units is to be met.

A closely related second point is that forces affecting structural change are enterprise specific and have quite diverse effects on different enterprise and commodity groups. This, coupled with the fact that different types of farms vary substantially concerning their flow of funds, collateral, etc., dictates that a study of the future financing needs of farmers must be micro in nature and concentrate on individual sizes and types of farm firms. It is anticipated that studying the individual types of farm firms that may be important in 1980, provided they can obtain adequate financing, will suggest implications for farm lenders and farm operators as they plan their strategies for the '70s.

CHAPTER III

ASSUMPTIONS AND INFORMATION USED IN CONSTRUCTING BUDGETS

3.1 Synthetically Constructed Operations

It is impossible to explicitly identify all of the influences that led to the final selection of the sizes and types of farm operations that are used for analysis in this study. The impressions that led to the selection of these specific farms were developed over a three-year period. They came from reading voluminous accounts of what the agricultural production sector will look like in 1980. They came from conversations with extension and research people in universities. They came from numerous informal interviews with research and sales people from agricultural input supply industries. And finally, the impressions came from visits in Michigan and other adjoining states to farms now in operation that are using the latest in advanced technologies.

After assimilating the information gained from the numerous sources mentioned above, hypothetical farming units were constructed that are believed to represent sizes and types of farming operations that will be important by 1980. These units employ the most advanced technology projected for 1980, provided the given technology is economically feasible for the farming unit being considered. Capital is substituted for labor on the hypothetical farms to allow a high level of labor efficiency. Further, the management ability of the operators on the synthesized units is assumed to be well above average. The 1980 hypothetical units could be thought of as "target" combinations of resources for the specific sizes and types of farming operations

being considered. Finally, it is assumed that the livestock farms specialized in producing livestock and livestock products. Therefore, on the synthesized livestock units that produce their own feed, the size of the various crop acreages is determined exclusively by the livestock program.

It is extremely important that the reader keep in mind that any conclusions drawn from the analysis of the synthesized 1980 units can only be interpreted in light of the assumptions used. Relatively small deviations from the assumed prices, yields, etc. could substantially alter the basic conclusions concerning profitability and the ability of various farming units to service debt.

Finally, an overriding impression gained by the author when studying possible future developments in the agricultural sector will be apparent in all of the projections that are made and used in this study---changes occurring in agricultural production in the next ten years will be evolutionary rather than revolutionary. Everyone at all interested in the future production structure of agriculture has seen pictures and heard accounts of the farmer in his white shirt and tie sitting at the console of his computer milking his cows or planting his corn. And by the 21st Century, these seemingly far-out projections will no doubt be realized and probably surpassed. But that doesn't mean this type of technology will be the dominant force in 1980. Farms similar to the ones projected in this study can be observed in operation today. The machines they are using may not be quite as efficient as the ones projected for 1980, but the basic appearance of the operation may be very much like some of the most advanced operations of 1970.

3.2 Assumptions Used That Affect Profitability of Budgeted Farms

The relative profitability of the synthetically constructed farms depends on numerous factors, the most important of which are the following.

1. Product prices
2. Prices paid for inputs
3. Level of technology
4. Yield per acre on crops, milk production per cow, and rate of gain on feeder steers
5. Machine, labor, and feed efficiency
6. Size and investments of the various operations

3.2.1 Assumptions concerning farm product prices

Researchers seldom agree on the level of farm product prices one year in the future, let alone ten years in the future. There are so many interacting forces involved that price projections are, at best, educated guesses. The prices assumed in this study will be explicitly stated, and the results must be interpreted in light of these price assumptions.

It is assumed that dairymen in the Eastern Corn Belt will be receiving an average blend price of $6.00 per hundredweight for milk in 1980. If one looks at price increases in the last ten years and projects this same trend to the next ten years, $6.00 per hundredweight would seem low. But the '60s were a decade when strong bargaining cooperatives such as Michigan Milk Producer's Association and Great Lakes Federation made substantial gains. With per capita consumption of milk decreasing at an average rate of 10 pounds per year and with the threat of nondairy substitutes lingering on the horizon, it seems unlikely that farm cooperatives can increase milk price by $1.30 per hundredweight in the '70s, the price increase realized in the '60s. It is my opinion that $6.00 per hundredweight, a modest increase of less than $.50 per hundredweight, is all that the "traffic will bear."

Corn and soybean prices may be even more difficult to project than milk prices. For instance, a study conducted by Mayer and Heady [40] in 1969 projected the 1980 price of corn and soybeans assuming alternative farm programs and various levels of export demand in 1980. The results showed the average projected price of corn in the Lake States varied between $.57 per bushel and $2.42 per bushel depending on the assumptions used. Similarly, the average projected price for soybeans varied from $.93 per bushel to $6.02 per bushel depending on assumptions.

The assumed prices for this study are $1.00 per bushel for corn and $2.25 per bushel for soybeans. This assumes a continuation of price support programs not substantially different from present programs. Given the wide variety of possible alternative programs, this assumption seems as tenable as any.

Farm prices for choice steers in the '60s showed substantial short-run price fluctuations, but a long-run trend is not apparent [30]. For instance, the average Chicago price of choice 900-1100 pound steers was $29.74 per hundredweight in November of 1962, but it was 1969 before prices reached this level again. In the interim, the average price was as low as $20.67 per hundredweight which occurred in May of 1964. The highest average price was $34.07 per hundredweight in June of 1969. There will continue to be short-run fluctuations in the '70s, but with per capita consumption of beef on the uptrend, average annual

prices should average higher than in the '60s. As a result, an average annual price of $30.00 per hundredweight is assumed in this study.

3.2.2 Assumptions concerning input prices

The budgets contained in the appendix identify the prices of inputs assumed in this study. In general, the basic inputs were assumed to increase in price at a compounded rate of 3 percent per year, but there are exceptions to this rule. For instance, the recent trend in fertilizer prices has been downward, so a quite different price projection technique was employed to arrive at a 1980 price for the various fertilizer nutrients.

A recent study by Kyle [38, p. 34] has shown that large farmers often receive quantity discounts on many of the inputs they purchase. To reflect this, it was assumed that farms large enough to justify 8-row equipment received a 10 percent discount on seed, fertilizer, herbicides, insecticides, and custom rates for applying fertilizer. Similarly, farms large enough to justify 12-row equipment were assumed to receive 20 percent discounts on these items.

The major inputs of land, buildings, and machinery were all inflated at a compounded rate of 3 percent per year. If only information from the last two years were used, this rate would seem low for buildings and machinery, and high for land. But most economists would argue that the last two years have been far from "normal." They suggest that our economy is geared for a "normal" rate of inflation of around 1-1 1/2 percent per year. However, with labor unions and other elements applying constant upward pressures on the price level, all indications are that government will be unable and perhaps even unwilling to hold inflation at this level. Given these factors, a 3 percent average rate of inflation for machinery, land, and buildings over the next 10 years seems quite tenable.

1980 prices for labor are difficult to project for two reasons. First, few people agree on what the average price for farm labor is in 1970. Second, with labor unions becoming increasingly strong and negotiating for very substantial hourly increases, one can't help but wonder how far these increases can go.

The latest USDA report on farm labor shows that the average hourly wage for farm workers in the East North Central region for 1969 was \$1.62. This compares with \$1.65 per hour in Michigan. Many farmers and extension people say this figure is low given the skills required on many technically advanced farming units of today. Therefore, a base hourly rate of \$2.50 per hour was assumed for 1970 and then inflated at 3 percent per year to get a 1980 rate of \$3.35 per hour. Also, it was assumed that large units requiring substantial amounts of hourly labor from one area would need to pay a premium. This rate was assumed to be \$4.00 per hour. The \$4.00 per hour rate was also used for full-time hired men. More highly skilled laborers such as milkers were assumed to be paid \$5.00 per hour. Similarly, it was assumed that the managers of the units in 1980 are paid \$11,000 per year for their labor contributions. This corresponds to a withdrawal for family living. Finally, it was assumed that secretarial help could be hired for \$6600 per year in 1980.

3.2.3 Adoption of new technology

This study assumes the adoption of the most advanced technologies in 1980, provided they are economically feasible. For instance, the 80-cow dairy operation will employ an advanced milking system to enable

3.2.5 Machine, labor, and feed efficiency

Machine efficiency has been increasing not only because of changes in machine size, but also because of improvements in the quality of given sizes of machinery. A compounded rate of 1 percent per year increase in efficiency resulting from quality improvements was assumed. In other words, if a certain field operation with a given size machine required 5.0 hours in 1970, it would require 4.53 hours in 1980.

The labor requirements, including both direct and indirect labor, of producing various crops using various sizes of equipment are presented in Appendix Table C.1. Similarly, the estimated variable costs (excluding labor and interest) of producing various crops in 1980 are also presented in Appendix B. Two studies, one by Connor [24] and one by VanArsdall [59], were used extensively as guides when making these estimates. Also, the author participated in the preparation of crop budgets for the 1970 National Economic Model 1/, and some of the estimates made in these budgets were also used. Finally, information obtained from interviews with researchers, engineers, and sales people of a major supplier of farm machinery were used when developing these estimates.

Before arriving at labor coefficients for selected dairy and beef operations, interviews were conducted with industry people involved in producing labor-saving equipment for livestock farms. These included interviews with researchers and engineers from a major

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manufacturer of milking equipment and parlors, and also interviews with engineering and sales people from a major supplier of automated feeding systems. Benchmark labor figures for dairy were obtained from work done by Speicher and others [53], [34]. Similarly, labor coefficients developed by VanArsdall [58] were used as a guide for beef feeding.

Based on the above information, it was assumed that the total annual labor requirements for a cow and replacement in 1980 will be 34.2 hours, 32.4 hours, and 30.0 hours for an 80-cow operation, a 200-cow operation, and a 1000-cow operation respectively. Similarly, it was assumed that a beef steer in 1980 will require 2.5 hours per year in the specified 375-head total confinement unit, 2.75 hours per year in the 900-head operation, and 2.0 hours per year in the 6000-head unit. It should be noted that the 900-head operation has slightly poorer labor efficiency than the 375-head unit because the former is a combination of open lot, total confinement while the latter is completely mechanized with total confinement.

The basic feed ration used for dairy was developed from work done by Hoglund [32] (Appendix Table A.2). It includes corn silage in the winter and haylage in the summer. The roughage is supplemented with shelled corn, soybean oil meal, and urea. For beef, a ration developed by Henderson [31] was used as a guide (Appendix Table A.3). It includes corn silage, shelled corn, and a 64 percent protein supplement.

Telfarm records were used as a guide when the various variable costs (e.g. veterinary medicine, utilities, etc.) associated with producing beef and milk in 1980 were estimated. Also Henderson's study [31] and work done by VanArsdall [60] were used for beef.

3.2.6 Size and investments

Table 3.1 summarizes some of the important characteristics of the selected types of farming operations used in this study. The 1- and 2-man units represent what are expected to be target combinations of resources for these sizes of operations by 1980. The greater than 2-man units represent what is expected to be a 1980 target combination of resources for the particular sizes selected. The sizes of these larger units were selected because they represent a size category that is expected to be important in 1980. But they should not be thought of as size units that hit the minimum point on the long-run average total cost curve. In other words, there may be larger units that are just as efficient, or perhaps even more efficient, than the greater than 2-man units selected for this study.

Investment figures for this study were obtained from numerous sources. For machinery, interviews with machinery dealers and a price guidebook [47] provided the bulk of the information used. The cost of drying and storage equipment for cash grain farms was obtained from a local dealer.

The previously mentioned study conducted by Kyle [38] revealed that most farmers receive a discount of approximately 10 percent off list price when they buy machinery. Therefore, the estimated 1970 investments for machinery on the synthetically constructed farms reflect this discount. The survey also showed that large farmers often receive discounts substantially higher than 10 percent. To reflect this, the larger operations were assumed to receive either 15 or 20 percent depending on the amount they purchased. The percentage discount assumed for each farm is explicitly stated on the budgets in the appendix.

Table 3.1 Summary of some important characteristics of selected 1980 farm operations

Characteristics	1-man cash grain	2-man cash grain	Greater than 2-man cash grain	1-man dairy
Size of cropping enterprise	640 acres, 600 acres tillable	1680 acres, 1600 acres tillable	4160 acres, 4000 acres tillable	240 acres, 222 acres tillable
Size of livestock enterprise	---	---	---	80 cows plus replacements
Crop technology	6-row equipment	8-row equipment	12-row equipment	4-row equipment
Livestock technology	---	---	---	Cold-covered housing, liquid manure, automatic feeding, tower silos, double-4 herringbone parlor.
1980 investment	$564,096	$1,463,556	$3,479,774	$314,752

Table 3.1 (cont'd.)

Characteristics	2-man dairy	Greater than 2-man dairy	1-man beef	2-man beef	Greater than 2-man beef
Size of cropping enterprise	600 acres, 554 acres tillable	3000 acres, 2769 acres tillable	200 acres, 192 acres tillable	480 acres, 461 acres tillable	Buy all feed
Size of livestock enterprise	200 cows plus replacements	1000 cows plus replacements	375 head marketed/ yr, 250 head at one time	900 head marketed/ yr, 600 head at one time	6000 head marketed/ yr, 4000 head at one time
Crop technology	6-row equipment	8-row equipment	4-row equipment	6-row equipment	---
Livestock technology	Cold-covered housing, liquid manure, automatic feeding, tower silos, double-8 herringbone parlor.	Open lot housing, conventional manure, fence-line feeding, bunker silos, 2 double-8 herringbone parlors.	Total confinement housing, liquid manure, automatic feeding, tower silos.	Combination of total confinement and open lot housing, combination of liquid and conventional manure, combination of fence-line and automatic feeding, tower silos.	Open lot housing, conventional manure, fence-line feeding, bunker silos.
1980 investment	$680,154	$2,590,875	$275,293	$594,474	$730,124

Costs of buildings, equipment, and feed storage for dairy farms were obtained from the Michigan Farm Management Handbook [41] and from research conducted by Hoglund and others [33], [34]. For beef, this information was obtained from the Michigan Farm Management Handbook [41], from records of a farm operator who recently erected a new system, and from work done by VanArsdall [60], [57].

Land constitutes an important part of the investments on the synthetically constructed farm operations in this study. The land used for growing feed on the dairy operations was valued at $350 per acre in 1970. Compounded at 3 percent per year for ten years, this means an investment of approximately $470 per acre in 1980. It should be noted that the buildings on these farms are listed separately, so the cost per acre of purchasing the entire units would be considerably higher than the price quoted for land alone. For beef, since the ration used requires more row-crops, the value per acre was assumed to be $450 per acre, or approximately $605 per acre in 1980. Since the cash grain farms in this study require all row-crops and are assumed to produce higher yields, the land on these farms was valued at $550 per acre, or approximately $740 per acre in 1980.

For purposes of computing investment, a cow and her replacement are valued at $500 in both 1970 and 1980. This assumes a cow is worth $400 and her average replacement is worth $100.

Finally, to compute 1980 income taxes for the synthesized units, a program developed by extension personnel in the Department of Agricultural Economics at Michigan State University was used. The program simultaneously computes the total income taxes a farmer would pay if he were taxed under nine different arrangements. The arrangements include a wide variety of alternatives such as partnership, tenant corporation taxed as a partnership, two corporations with and without dividends, and so on. Tax rates in 1980 are assumed to be the same as in 1970. It is assumed that dependency exemptions will be $750 per person in 1980, and that the standard deduction will be raised to 15 percent with a maximum of $2000. Further, it is assumed that social security will be paid on the first $9600 at a rate of 7.8 percent for self-employed and 5.8 percent for employers. Workmen's compensation, franchise fees, etc. are assumed to be the same as in 1970.

3.3 Analysis: The Three Credit R's

The numerous coefficients estimated in this study were developed for one purpose—to provide realistic reference units that can be used in analyzing certain characteristics of financing specialized types of farm firms in 1980. The analysis is conducted along the lines of the familiar Three R's of Credit—returns, repayment capacity, and risk-bearing ability [43]. Each size and type of farm analyzed has unique characteristics regarding such items as flow of funds, collateral, and need for land, buildings, equipment, livestock, and machinery. These varying characteristics create fundamental differences in the absolute amount of financing needed, the length of amortization periods required, and the access to, as well as the alternative methods of external financing. All of these characteristics, in turn, significantly affect the returns, repayment capacity, and risk-bearing ability of farming operations. By using this framework to analyze target 1980 units, it is expected that this will suggest implications for farmers and lenders as they formulate plans for operating and financing farming units of the future.

3.3.1 Returns

The returns for (e.g. Will it pay to borrow the money?) the synthesized 1980 units are analyzed using total rather than partial budgeting. In other words, attention is focused on the returns realized by the total operation and no attempt is made to isolate the return from individual investments.

The income and expense statements for the synthesized units are presented in Appendix E. The expenses include an $11,000 deduction for each partner for family living, and even after deducting this item the synthesized 1980 farming units show a profit. It should be kept in mind, however, that the returns presented in Appendix E assume complete ownership of all resources and no allowance has been made for opportunity cost on investment.

3.3.2 Repayment capacity

Repayment capacity (Will the farm operator have sufficient funds to meet payment obligations, given the terms of his loan(s)?) is analyzed in detail because it appears to be one of the most important financial constraints for large-scale operations of the future. As was mentioned before, the commercial units considered are generally quite profitable. But profitability is often misconstrued to mean that no difficulty will be experienced in repaying a loan. Contrary to this belief, profitability is a necessary, but not a sufficient condition to assure adequate repayment capacity. A simplified example will help to clarify this point. Suppose a farmer purchases a tractor solely for the purpose of doing custom work. He pays $10,000 for the tractor with $1000 down payment and the remainder amortized over a three-year period. At 8 percent interest, the annual payment is $3492.

Assume that the tractor produces a gross return of $5000 and that expenses, including labor, are $2000. Further, assume the tractor will last eight years and has a $2000 salvage value at the end of this time period. This means an annual depreciation of $1000. In this situation, gross return minus expenses minus depreciation equals $2000 or a return of 20 percent. Even though this investment is highly profitable, it does not generate its own repayment. Two thousand dollars profit plus $1000 depreciation is available to repay the loan, but this is $492 less than the annual amount required. Situations similar to the one presented in this example are often a problem in large operations that require tremendous investments in (and financing for) machinery, equipment, and buildings. Loan terms often require repayment at a rate substantially more rapid than the rate at which the capital items are "used up" in the production process. This leads to a repayment problem that is often the limiting factor in financing large operations, even though the units are highly profitable.

An even more critical situation from a repayment standpoint occurs when farming units require large investments in (and large loans for) land. Since land is not "used up" (i.e. depreciated or completely consumed) in the production process, all principal payments must come out of net income. This is quite different from operating expenses which, if they are profitable, are self-liquidating since repayment comes out of gross income. At an extreme, a profitable operation that has all self-liquidating loans (i.e. could be completely repaid from gross income) would never experience repayment problems. Unfortunately, this is seldom the situation, so repayment capacity is of primary importance to a farm operator and his lender, especially when the farmer

is carrying a heavy debt load.

The repayment capacity of a farm firm is significantly influenced by two other factors--the operator's equity position, and the repayment schedules set up by lenders. Given two equally profitable firms, one with 40 percent equity and the other with 90 percent equity, the latter would in all likelihood experience the least difficulty repaying loans. As farm operations become larger, however, it may be unrealistic to expect farmers to own outright 90 or even 50 percent of all the assets required for an efficient, viable operation. Therefore, even though equity is not a variable for individual farmers, by studying various equity levels and the corresponding repayment capacity on the 9 synthesized farms, it is expected that this will provide insight into the feasibility of low-equity financing in the future. Further, the analysis may suggest ways of stretching existing equity as far as possible to obtain efficient combinations of resources.

Amortization periods set up by lenders also affect the repayment capacity of farmers. As was demonstrated by the example used earlier, if lenders require that a farmer pay for a tractor in 3 years, even though it lasts for 8 years, such an arrangement can severely tax the repayment capacity of the farm operator. By analyzing various lengths of repayment periods in combination with equity requirements on the synthesized farm operations, this may provide insight into the strength of lengthened amortization periods as a tool for alleviating some of the financial problems of large-scale operations.

3.3.3 Risk-bearing ability

Although the static analysis used in this study treats prices and yields as certain, this is certainly not the situation in the real

world. The price of choice steers, for instance, may vary $10 per hundredweight in any given year. Similarly, lack of moisture, hail, insects, disease, or other natural forces may reduce yields substantially in any given year. These and similar situations can be disastrous for a low-equity farmer who has used up all of his excess borrowing capacity. Therefore, when analyzing 1980 operations, risk-bearing ability must be considered. For large, heavily financed operations, the cost of a "bad" year may be so great that certain financial and production structures will not be feasible without various contracts and insurance agreements to reduce price and biological risks.

3.4 Growth Vs. Static Analysis

Either a growth or static model can be used as a tool for studying farm finance. A growth model would start with a 1970 farming operation and study in detail the factors that influence the ability of the farm operator to gain control of resources through time. A 1970 thesis by Duvick [27], for instance, used polyperiod programming to analyze how financial factors such as beginning equity, down payment requirements, and length of repayment terms affected the ability of a dairy farm to grow. By running the model for ten years, this would give insight into how the farmer moved from his 1970 organization to his 1980 organization. This is a very useful approach in that by varying the assumptions and restraints of the model, one can study how these factors affect the growth of a firm through time. There is a problem with this approach, however, when emphasis is focused on 1980 farming operations. The model uses the 1970 rather than the 1980 organization as a base. As a result, the coefficients used throughout the ten years are developed for 1970, not 1980 firms. Also, there are

almost an infinite number of starting positions and paths that could be followed, so the results are more useful as a guide to the importance of factors that affect growth than as an indication of what farms will look like in 1980.

Another approach, and the one employed in this study, is to construct target farm operations for 1980 based on the best information available concerning the changes that will occur in agricultural production in the next ten years. This analysis is static in that it treats growth as an implicit assumption rather than an explicit variable. In other words, the assumptions made concerning the financial positions of the 1980 operations imply a growth path, but the growth path is not considered in detail. Justification for this approach is as follows. From the point of view of financing a dairy farm operator in 1980 who has 200 cows and an investment of $680,000 with 40 percent equity, it makes little difference what his farm organization looked like in 1970 or the growth path he followed. He could have followed almost an infinite number of paths to get to the organization specified. The important question is whether a sufficient number of farm operators can get to the resource organizations specified to merit studying these types of farming units. Based on Project '80 work and other projections cited earlier, the answer to this question appears to be yes. Therefore, even though it is recognized that an analysis of possible growth paths is very important, the old adage that "you can't have your cake and eat it too" becomes relevant in this study. In order to allow sufficient time and space to focus on and analyze target 1980 units, it is necessary to abstract from a detailed analysis of growth and concentrate on the particular units specified.

One problem that occurs when timing of investments is not considered is that there is no easy method to take account of the fact that some items in the resource package will be partially depreciated. The current study values all assets at new price to arrive at 1980 investments, equity positions, and repayment schedules. This approach is not as critical as it first appears because, in effect, the main thing it does is to overestimate the owner's equity position. The older, partially depreciated items are included in the farmer's equity, but they are included at new rather than depreciated value.

The stage has now been set for the analysis of the synthesized 1980 units. It should be kept in mind that it was necessary to employ numerous assumptions when constructing the 1980 units, and the results of the forthcoming analysis can only be interpreted in light of the assumptions made.

CHAPTER IV

THE 1980 DAIRY FARMS

4.1 Introduction

Dairy farms in general have many unique characteristics that either add to or alleviate financial problems. On the positive side, dairy farmers have a somewhat constant flow of income throughout the year which keeps short term credit needs at a minimum. Second, relatively stable milk prices make it easier to estimate the expected income stream. Third, dairy operations are not heavily land intensive. For instance, an adequate one-man dairy operation may require only one third as much land as a one-man cash grain operation. This is important because of the large investments required for land, and also because all funds for land repayment must come from net income.

On the negative side, dairy operations require large investments in buildings and equipment. Since these items are specialized and somewhat stationary, they provide poor loan collateral unless they are financed with the land. Farm operators, however, often require more financing for buildings and equipment than long-term lenders will provide. Further, since intermediate-term credit often requires repayment in 5-7 years, an operator's repayment capacity may be taxed to the point where it would not be feasible for him to use this type of credit even if security were no problem. Another problem with dairy operations is that they are quite labor intensive. By 1980, dairy farms will require larger labor expenditures for three reasons. First, wages for qualified labor are expected to increase about 35 percent in the next 10 years. Second, dairy farmers are becoming increasingly unwilling to put in 12 hours 365 days of the year. Therefore, a larger proportion of the labor will be hired. Finally, as dairy farms become larger, the trend is in the direction of hiring larger proportions of the total labor required on dairy farms, even if owners continue to work long hours. These increasing expenditures for labor can cause financial problems because they put a substantial drain on cash flows. These are but a few of the important characteristics that will become apparent as the individual operations are analyzed.

4.2 80-Cow Dairy Operation

The 80-cow dairy operation synthesized for 1980 assumes cold-covered housing, double-4 herringbone parlor, liquid manure, tower silo feed storage, and mechanized feeding. Further, it is assumed that the operator produces all grain and roughage for the dairy herd. Detailed budgets including labor requirements, investments, and annual incomes and expenses are contained in Appendix Tables C.2, D.1, and E.1 respectively.

The unit requires a total 1980 investment of $314,752 or over $3900 per cow. Almost two thirds of this investment is in dairy facilities, machinery, and cows. The after tax income is $11,709. This is over and above the $11,000 deducted for family living but assumes complete ownership of all assets in the operation.

4.2.1 Probable growth paths

It is very unlikely that farmers who are milking 10-20 cows today will be milking 80 cows in 1980. If they haven't moved by now, chances are that their income and security goals prohibit expansion. Therefore, they have but one way to go—out of dairying. It is also unlikely

that older farmers with 40-50 cows today will expand unless they have family help. They often own a large proportion of the assets and can make a comfortable living without expanding. They would just as soon avoid having to hire full-time labor and don't care to have more to do than they already have.

The logical source of 80-cow dairy operations in 1980 is young farmers presently milking around 40 cows, who have the management ability and aspiration to modernize and expand. This group may also include older operators who are now milking around 40 cows, but who have a son that will be taking over the operation. The 80-cow unit will probably not be large enough to support two families by 1980, but father-son partnerships may be important as a transitional device. The father may want to retire and the son may be pressing to expand the operation to an adequate sized unit.

4.2.2 Financing needs

The financing needs of any operation depend, of course, on the financial position of the particular operator in question. Since no two operators would likely have the same financial positions, various possibilities and combinations of possibilities will be examined.

As was mentioned earlier, dairy farms seldom require large amounts of operating capital during normal years. This assumes that items such as machinery and cows are financed by intermediate credit as they should be in most cases. The 80-cow unit would use approximately $7000 for crop expenses and the credit would be outstanding for a period of about 6 months. These expenses would generate their own repayment through the sale of milk, and since the operation is profitable, repayment of short-term credit is not expected to be a problem.

Intermediate-term credit is a potential problem area on this farm for three reasons. First, a large proportion of the investments on the 80-cow dairy operation are of the intermediate-term variety. Second, given present lending policies, intermediate term usually means 3-7 years, which is often not long enough for low-equity operators. Third, it would be reasonable to set new dairy facilities up on a 15-year repayment plan, but loans of this duration are often only available on land. If an operator has substantial equity built up in land, he may be able to refinance to include new dairy facilities. Even then, however, financing may be a problem. Consider, for instance, an operator who has built up 80 percent equity in the 240 acres but has an obsolete dairy facility that would be useful only for calf and dry cow housing with a modern system. If he were to build and finance the entire new dairy facility, it would cost $97,555 and reduce his equity position on the land mortgage to 43 percent. From the farmer's point of view, the value of his land and improvements have increased from $470 per acre to over $875 per acre. But a lender such as the Federal Land Bank that specializes in long-term land mortgages would probably not appraise the land including the new facility at anywhere near $875 per acre. If this were the case, financing could still be a problem even though the operator started with substantial equity in his land.

Before proceeding further, the question of the ability of this dairy unit to generate repayment should be treated. There has been considerable discussion recently concerning low-equity financing. Will it be feasible on an 80-cow dairy operation in 1980? A total of $31,254 of net income and depreciation is available every year to repay interest and principal on debt. Table 4.1 presents the annual repayment requirements, given various combinations of down payment requirements and amortization periods on machinery, buildings, and land. An 8 percent interest rate is assumed for machinery and buildings and a 7 percent rate for land. The results indicate that low-equity financing is quite feasible on this unit. In the situation being analyzed, a farmer with only $65,234 equity plus livestock (38 percent equity including $40,000 for livestock) could meet the repayment requirements with realistic amortization periods of 5, 15, and 30 years respectively on machinery, buildings, and land. This means that if a farmer completely owned his own cows, he could finance 90 percent of the machinery, 75 percent of the buildings, and 90 percent of the land and still meet the annual payments of $31,232. This is somewhat unrealistic since perfect certainty is assumed, but it does illustrate that what is often considered extremely low equity today is actually feasible from a repayment standpoint.

This analysis also illustrates how down payment requirements and length of amortization affect annual repayment obligations. Twelve of sixteen combinations presented in Table 4.1 are feasible from a repayment standpoint in this perfect certainty situation. There is some degree of trade-off between down payment and amortization period from a repayment standpoint. For instance, the annual payment is approximately the same for an operator who has 10, 25, and 10 percent down payment and 7, 15, and infinity years repayment period on machinery, buildings, and land respectively as for an operator with 50, 50, and 50 percent down payment and 3, 7, and 20 years amortization periods. It is interesting to note, however, that once amortization periods get sufficiently

Table 4.1 Analysis of annual repayment requirements for 80-cow dairy operation assuming various combinations of down payment and amortization periods

Down payment		Total Financing	Total Equity 1/	Years to repay 3-7-20	5-15-30	7-30-30	7-15-00
0 - 0 - 0	M	64,308	0	24,953	16,107	12,352	12,352
	B	97,555	0	18,737	11,397	8,666	11,397
	L	112,889	0	10,656	9,098	9,098	7,902
	T	274,752	0	54,346	36,602	30,116	31,651
10-25-10	M	57,877	6,431	22,458	14,496	11,116	11,116
	B	73,166	19,292	14,053	8,548	6,499	8,548
	L	101,600	39,511	9,590	8,188	8,188	7,112
	T	232,643	65,234	46,101	31,232	25,803	26,776
30-35-35	M	45,016	19,292	17,468	11,275	8,646	8,646
	B	63,416	34,139	12,180	7,409	5,633	7,409
	L	73,378	39,511	6,926	5,914	5,914	5,136
	T	181,810	92,942	36,574	24,598	20,193	21,191
50-50-50	M	32,154	32,154	12,477	8,053	6,176	6,176
	B	48,777	48,777	9,369	5,699	4,333	5,699
	L	56,444	56,444	5,328	4,549	4,549	3,951
	T	137,375	137,375	27,174	18,301	15,058	15,826

1/ Not including livestock.

Notes:
1. The number sequences across the top of the table refer to the number of years for repayment on machinery, dairy facilities and land in that order.
2. The number sequences along the left hand side of the table refer to percentage down payment requirements on machinery, dairy facilities and land in that order.
3. The abbreviations M, B, L, and T refer to machinery, buildings, land and total respectively.

long, little is gained by lengthening them further. For instance, with zero down payment, going from 30 years to infinity (pay only interest) on land makes only $1195 difference in annual payment, while going from 20 to 30 years makes $1445 difference.

To further analyze the expected repayment potential of an 80-cow dairy operation in 1980, consider the situation presented earlier where an operator had built up 80 percent equity in 240 acres of land. To modernize and expand his 40-cow operation, he needs a completely new dairy facility costing $97,555. Also, he needs to purchase new machinery equal to 50 percent of the machinery complement presented in Appendix Table D.1. This means another $32,154. Also, since he wants to expand in one step, he needs to purchase 40 cows at $400 per head or $16,000. Finally, he will still have 20 percent of land to finance or $22,578. Assume the operator can obtain financing for all of the items mentioned above. He pays 7 percent interest for land and 8 percent on all other loans. Further, assume he finances the items with realistic amortization periods as follows: dairy facility for 15 years, machinery for 7 years, land for 30 years, and cows for 4 years.

Would the above situation be feasible from a repayment point of view? To begin with, aggregating the sum of the repayments indicates that total annual repayment of principal and interest would be $24,224. There is $11,709 net income and $19,545 of depreciation to be used for repayment purposes. Further, since the operator will be in about the 30 percent tax bracket and interest is tax deductible, he will reduce his tax bill by 30 percent of $8374 or by $2512.1/ This is also available for repayment purposes. The sum of net income, depreciation, and tax savings equals $33,766. This is $9542 more than the annual payments required.

Is $9542 a sufficient positive margin to cover risk? If production of the principle salable commodity--milk--fell 20 percent below expectations, gross income would be reduced by $14,400. Net income would fall only about $11,000 because of reduced income taxes. But the operator would still be about $1500 short in terms of meeting fixed repayment obligation. If he could cut family living from $11,000 to $9500, this would allow him to make his payments. Therefore, in terms of risk, this particular arrangement has considerable strength.

What are the implications of the above analysis for lenders who might be financing similar operations in 1980? The total amount of debt outstanding is $168,287, which may seem large for a one-man operation by today's standards. This represents less than 39 percent equity in the total business, assuming new prices for everything. In reality, the equity position would be considerably lower than this because of partially depreciated items. Yet with reasonable amortization periods, the operator would be able to meet his annual repayment obligations. If terms of 3, 7, and 20 years on machinery, dairy facilities, and land respectively would have been required, there is no way an operator with this kind of financial position could have met annual payments.

1/ This assumes an average annual interest payment. In early years of the amortization period, interest will be considerably higher than $2512. But in later years, it will be lower. The annual payment, of course, will be constant throughout the amortization period.

This analysis is particularly relevant for young farm operators who have demonstrated outstanding management ability but who lack the financial muscle to assemble an efficient unit without considerable outside financing. Once an operator attains an efficient unit, each ensuing year will be easier from a financial point of view. Within a few years, the operator could be on his feet financially, and in many cases, would be ready to begin the expansion process all over again to provide a unit sufficiently large to include his son in the operation.

4.3 200-Cow Dairy Operation

The 200-cow dairy operation is similar in many respects to the 80-cow unit. An important difference is that the former is well suited for a two-man partnership in 1980, while the latter will probably not be large enough for a partnership arrangement. This is important because by 1980 there will likely be fewer farmers who will be willing to "marry" themselves to a dairy herd. With a partnership, one partner can get away every now and then without disrupting the operation. From a financial standpoint, the synthesized 200-cow operation produces substantially more volume per operator with only a slightly higher investment per partner. Also, crop acreage is large enough on the 200-cow unit to justify larger, more efficient machinery.

The 200-cow unit synthesized for 1980 assumes cold-covered housing, liquid manure, a double-8 herringbone parlor, tower silos, and automated feeding. All feed for the cows and their replacements is grown on 600 acres of land using 6-row equipment. Detailed figures on labor requirements, investments, and annual incomes and expenses are contained in Appendix Tables C.3, D.2, and E.1 respectively.

All of the impressions gained by the author in studying this area in the last two years have led to the following conclusion—2-man dairy farms similar to the above unit, having approximately 100 cows per man, will be a mainstay in milk production for Michigan and other major milk producing states in the Eastern Corn Belt by 1980. This unit will be large enough to take advantage of the latest technologies, yet small enough that the farm operators do not have to be millionaires to assemble this combination of resources. Further, the unit is capable of producing a high level of income for two partners and their families.

4.3.1 Possible growth paths

The most logical source of two-man, 200-cow dairy operations in 1980 will be dairy farmers currently milking 40 or more cows. Many younger dairy farmers may have a son they would like to include in the business, but to have an adequate unit for two families, they may be forced to expand and modernize. Other older farmers currently milking 40 or more cows may have two sons who would like to form a partnership and gradually take over the business. Also, there may be an increase in the number of nonfamily partnerships by 1980. Two neighbors may decide that a merger arrangement could be worked out that would be mutually beneficial to both concerns. Finally, there will be a substantial number of farm operations that are currently milking 150-200 cows that may be modernizing but will not be expanded substantially between now and 1980.

The number of 200-cow units that are in operation by 1980 will depend on numerous factors. Two particularly important determining elements will be the 1980 price of milk and the types of financing arrangements that will be available to operators in the next ten years.

The latter, of course, is of primary concern in the current study. As Duvick's growth study [27] so vividly demonstrated, beginning equity is not a variable to an individual farmer, but in many respects, liberal down payment requirements and lengthened amortization periods are good substitutes for beginning equity for an expanding farm operator. In other words, the policies and procedures of the lending institutions servicing farmers in the next ten years will be instrumental in determining who can expand to 200 cows by 1980 and who can't.

4.3.2 Financing needs

To avoid redundancy, points that were illustrated in one example will not be dwelled upon in the next example except when they are absolutely essential for an understanding of possible financing problems. Therefore, the analysis of the possible financing needs of the 200-cow unit will not be as thorough as it was for the 80-cow unit. There will be carryover from one operating unit to the next and only the characteristics that make one farm operation different from the ones previously analyzed will be treated in detail.

Short-term operating credit should not be a problem on the 200-cow unit but intermediate-term credit could again be a real problem area, especially for low-equity operators. Investments in dairy facilities and machinery are $297,931 or about 106 percent of the investment in land. The dairy facility alone requires almost $200,000. When financing an investment of this magnitude for relatively low-equity farm operators, neither of the two often used approaches of setting the loan up on a seven-year basis or of attaching it to a real estate loan on a 25-30-year repayment may be acceptable. In the first case, the partners may be hard pressed to meet the annual obligations because the amortization period is unrealistically short. In the second case, the repayment period is too long in that the facility may be worn out or obsolete in 15-20 years. The point is that when improvements such as a new dairy facility account for a large percentage of the total assets of a farm operation, there is need for a set of lending policies and procedures that are tailor-made to meet the "long-intermediate-term" or the "short-long-term" financing needs of farm operators. It may be acceptable in many cases to tie an improvement loan in with land financing, but there are many cases when this practice would be imprudent or impossible. More dairy operations by 1980 will specialize in producing milk, letting other farmers produce the concentrates and perhaps even the roughage for the dairy herd. Also, as dairy farms get larger, farm operators may find it necessary to rent a large proportion of the land needed for feed production. In either case, attaching intermediate-term loans to long-term real estate loans may not be possible.

Table 4.2 shows annual repayment requirements for the 200-cow unit assuming various combinations of length of repayment and down payment requirements. Depreciation on this unit is $38,134 annually and $37,153 of net income is generated. This means $75,287 is available for repayment before accounting for income tax savings from interest deductions. As the analysis shows, this unit has very strong repayment potential. All but two of the various combinations considered in Table 4.2 are feasible from a repayment standpoint. An interesting example of the repayment potential of the 200-cow unit is provided by

Table 4.2 Analysis of annual repayment requirements for 200-cow dairy operation assuming various combinations of down payment and amortization periods

Down payment		Total Financing	Total Equity 1/	Years to repay 3-7-20	5-15-30	7-30-30	7-15-00
0 - 0 - 0	M	98,829	0	38,349	24,753	18,982	18,982
	B	199,102	0	38,242	23,261	17,686	23,261
	L	282,223	0	26,639	22,744	22,744	19,756
	T	580,154	0	103,230	70,758	59,412	61,999
10-25-10	M	88,946	9,883	34,514	22,277	17,084	17,084
	B	149,326	49,776	28,681	17,446	13,265	17,446
	L	254,001	28,222	23,975	20,470	20,470	17,780
	T	492,273	87,881	87,170	60,193	50,819	52,310
30-35-35	M	69,180	29,649	26,844	17,327	13,287	13,287
	B	129,416	69,686	24,857	15,120	11,496	15,120
	L	183,445	98,778	17,315	14,784	14,784	12,841
	T	382,041	198,113	69,016	47,231	39,567	41,248
50-50-50	M	49,414	49,414	19,174	12,376	9,491	9,491
	B	99,551	99,551	19,121	11,631	8,843	11,631
	L	141,111	141,111	13,319	11,372	11,372	9,878
	T	290,076	290,076	51,614	35,379	29,706	31,000

1/ Not including livestock.

Notes:
1. The number sequences across the top of the table refer to the number of years for repayment on machinery, dairy facilities and land in that order.
2. The number sequences along the left hand side of the table refer to percentage down payment requirements on machinery, dairy facilities and land in that order.
3. The abbreviations M, B, L, and T refer to machinery, buildings, land and total respectively.

the hypothetical situation where the operators had zero down payment. With amortization periods of 5, 15, and 30 years on machinery, dairy facilities, and land respectively, the partners could meet annual repayment requirements with almost $5000 to spare. This means that if the operators completely owned the 200 cows and their replacements, they could finance the entire remainder of $580,154 and still meet annual payments. That's an example of only 15 percent equity and illustrates that even when sufficient margins for risk are required, low-equity financing is indeed feasible on this type of unit.

The potential for substantially decreasing total investment by renting rather than owning land is not as great for this unit as it will be for some of the farming operations to be analyzed later. This is generally true for highly specialized livestock operations because they are not heavily land intensive. For instance, by renting 400 of the 600 acres required by the 200-cow unit for feed production, total investment would be decreased by $188,000. But this still leaves almost a one-half million dollar investment. Further, it would mean that if financing for the dairy facility was tied in with land financing, a lender would be faced with an investment in land and improvements of $1466 per acre compared with about $800 per acre if 600 acres were owned. From a financing point of view, this may be significant.

In summary, the 200-cow unit synthesized for 1980 is a prime example of a highly efficient and profitable farming unit organized on a family farm type basis. It is the author's opinion that units organized in a similar fashion can compete with any size or type of farming unit in 1980. The important question is whether they can get to this particular type of organization. This depends on numerous factors such as

goals of farm operators, their attitudes concerning risk, the management ability as demonstrated by their ability to generate internal earnings, and finally, the type of financing available. The analysis has shown that once an individual farm operator or two partners reach 200 cows, this unit has extremely strong repayment capacity. But repayment capacity is irrelevant if an operation never reaches a resource organization similar to the one demonstrated by the synthesized unit.

4.4 1000-Cow Dairy Operation

The 1000-cow dairy operation synthesized for 1980 is assumed to be operated as a three-man partnership. It is organized as a tenant corporation with regular taxation because this is the organization that minimizes taxes.

Detailed budgets including labor requirements, investments, and annual incomes and expenses are presented in Appendix Tables C.4, D.3, and E.1 respectively. A total investment of almost 2.6 million dollars is involved, with gross sales approaching 1 million dollars. The dairy facility consists of open lot housing with fence-line feeding. The milking parlor is equipped with two double-8 herringbones. Roughage is stored in horizontal silos while high moisture corn is stored in upright silos. Feed for the herd is produced on 3000 acres of land using 8-row equipment.

4.4.1 Possible growth paths

One of the most difficult questions to deal with in this entire study is what will be the source of the very large units such as the 1000-cow dairy operation. How many dairy farmers have a set of goals and values that would motivate them to strive for a 1000-cow operation?

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How many dairy farmers (or groups of dairy farmers) would have the management ability to handle such a unit if it were assembled? How will the expansion be financed? Or will these types of units be built in one step rather than evolving from a smaller operation?

The answers to these and similar questions are far from obvious. To the author's knowledge, there are presently only two dairy operations of 1000 cows or more in the entire Midwest. One is Green Meadow Farms at Elsie, Michigan. This is a three-man operation--a father and two sons. The operation started in 1922 with 250 acres of land. Now there are 2700 acres in the operation. Until 1960, the Green's milked about 200 cows. Now they have around 1100 and are contemplating further expansion. This is a prime example of an operation that was grown, not built.

The other 1000-cow-plus operation in the Midwest is Lampkinland Farm located at Watson, Illinois. This unit was built, not grown. The owner is a wealthy individual who had made his money by selling a patent on a coupler for railroad cars and then invested the money in the stock market. He built the operation about two years ago and purchased first calf heifers to get the unit operating. This unit, unlike Green's, is run by hired management.

A third unit, although not in the Midwest, has implications when considering possible growth paths. It is located at Conway, Arkansas, and has the capacity for 5000 cows. The important point is that it is a joint venture between Ralston-Purina and the Dean Milk Company. In other words, it is integrated both backward and forward in the production process.

In all probability, all three of these paths will lead to 1000-cow dairy operations by 1980. But only the first will have implications

for financial institutions as they prepare to finance these types of units in 1980. The other two units discussed have built-in financing and will require very little or no external financing.

4.4.2 Financing needs

It would be an understatement to say that this unit has repayment capacity. Assuming various combinations of down payment requirements as was done for the operations analyzed previously, the 1000-cow unit can meet annual payment requirements under 11 of the 12 combinations specified in Table 4.3. Repayment capacity, however, may not be the limiting factor for this size of operation.

The real problem may be the sheer magnitude of the investment involved. Suppose the three partners each had one quarter of a million dollar net worths. This would account for only about 29 percent of the total investment required for the 1000-cow unit. Even if the three farmers were quite wealthy (i.e. individual net worths of $250,000), establishing the unit would still require low-equity financing.

To illustrate the strengths and weaknesses of the 1000-cow dairy operation, consider a situation where three enterprising dairymen pool their assets to enable them to provide 25 percent of the total assets required for the 1000-cow operation. Further, assume they are able to obtain financing for the remainder from a group of individuals, insurance company, commercial bank or some other source. Land is financed for 30 years, the dairy facility for 10 years, and the machinery for 5 years. The interest rate is 7 percent on land and 8 percent on all other investments. Finally, for comparative purposes, assume another operation identical to the first except that the three partners completely own all assets with no debts outstanding.

Table 4.3 Analysis of annual repayment requirements for 1000-head dairy operation assuming various combinations of down payment and amortization periods

Down payment		Total Financing	Total Equity 1/	Years to repay 3-7-20	5-15-30	7-30-30	7-15-00
0 - 0 - 0	M	204,683	0	79,423	51,265	39,313	39,313
	B	475,076	0	91,248	55,503	42,201	55,503
	L	1,411,116	0	133,195	113,722	113,722	98,778
	T	2,090,875	0	303,866	220,490	195,236	193,594
10-25-10	M	184,215	20,468	71,481	46,138	35,382	35,382
	B	356,307	118,769	68,436	41,627	31,651	41,627
	L	1,270,004	141,112	119,876	102,350	102,350	88,900
	T	1,810,526	280,349	259,793	190,115	169,383	165,908
30-35-35	M	143,278	61,405	55,596	35,885	27,519	27,519
	B	308,799	166,277	59,311	36,077	27,431	36,077
	L	917,225	493,891	86,577	73,919	73,919	64,206
	T	1,369,302	721,573	201,484	145,881	128,899	127,802
50-50-50	M	102,341	102,341	39,711	25,632	19,657	19,657
	B	237,538	237,538	45,624	27,752	21,101	27,752
	L	705,558	705,558	66,598	56,861	56,861	49,389
	T	1,045,437	1,045,437	151,933	110,245	97,619	96,798

1/ Not including livestock.

Notes:
1. The number sequences across the top of the table refer to the number of years for repayment on machinery, dairy facilities and land in that order.
2. The number sequences along the left hand side of the table refer to percentage down payment requirements on machinery, dairy facilities and land in that order.
3. The abbreviations M, B, L, and T refer to machinery, buildings, land and total respectively.

The results of the analysis of returns for the two operations are presented in Table 4.4. First, observe the situation when milk prices are $6.00 per hundredweight and the cows are producing 15,000 pounds per head annually. Both operations produce the same gross income and net income before interest is deducted. After deducting interest, the full-equity operation has a substantially higher net income as would be expected. But from the standpoint of rate of return on owned capital, the highly leveraged operation has a 30.8 percent return to only 13.3 percent for the full-equity situation. Further, after taxes, the low-equity operation produces a 16 percent return on owned capital compared with only 6.9 percent for the fully owned unit. Moreover, after deducting a 6 percent return for owned capital, returns to management are $64,846 for the highly leveraged unit and only $23,590 for the operation with no debt.

The 25 percent equity operation appears to be quite profitable. Can it meet annual repayment obligations, given the terms specified? With 25 percent equity in everything and amortization periods of 4, 5, 10, and 30 years on cows, machinery, dairy facilities, and land respectively, the operators could meet all payments and still have $78,291 remaining to plow back in the business. From the standpoint of profitability and ability to repay, the 1000-cow highly leveraged unit appears to be exceptionally strong.

Unfortunately, it is possible that there may be another side to the story. What if the price falls to $4.50 per hundredweight and production per cow falls below expectations by 20 percent or 3000 pounds per cow? In this case, as would be expected, the highly leveraged operation is extremely vulnerable. The partners would lose almost

Table 4.4 Analysis of returns for 1000-cow dairy operation assuming two equity positions and two milk price-production combinations

	$6.00/cwt 15,000 lb/cow		$4.50/cwt 12,000 lb/cow	
	25% equity	100% equity	25% equity	100% equity
Gross income	990,600	990,600	630,600	630,600
Variable expense (excluding interest on borrowed capital)	526,517	526,517	526,517	526,517
Net before depreciation and interest	464,083	464,083	104,083	104,083
Depreciation	119,772	119,772	119,772	119,772
Net before interest	344,311	344,311	-15,689	-15,689
Interest on borrowed capital (7% for land, 8% for all other)	144,870	0	144,870	0
Net after interest	199,441	344,311	-160,559	-15,689
Rate of return on owned capital before taxes (%)	30.8	13.3	-24.8	-.6
Taxes (48% rate)	95,732	165,269	0	0
Net after taxes	103,709	179,042	-160,559	-15,689
Rate of return on owned capital after taxes (%)	16.0	6.9	-24.8	-.6
Deduction of 6% for returns to owned capital	38,863	155,452	38,863	155,452
Returns to management	64,846	23,590	-199,422	-171,141

twenty-five percent of their equity, while in the full-equity case, the operators would lose only .6 of one percent on their owned capital. Even more important, the operators for the low-equity unit could not come close to meeting their annual payment obligations and could possibly lose everything.

The above example illustrates an important point. Leverage can be a valuable tool to increase an individual's income, but it can also multiply losses in case of bad times. Technically, this situation is known as the principle of increasing risk.

Turning to the positive side once again, all indications are that the 1000-cow unit of 1980 will be highly profitable. With strong bargaining cooperatives, $6.00 milk should be well within reason and with highly qualified management, 15,000 pounds of milk per cow should not be out of line. Therefore, private partnerships that can obtain adequate financing will be able to reap substantial gains. If traditional credit sources cannot provide the money, farm operators may be able to convince a group of doctors, lawyers, etc. of the potential of the operation and then give them a share of the profits in return for the financing.

CHAPTER V

THE 1980 CASH GRAIN FARMS

5.1 Introduction

Expensive land, expensive machinery, increased variable input prices, and increased real estate taxes coupled with relatively low product prices could seriously limit profit potential on cash grain farms by 1980. Without profit potential, it is very difficult to make a convincing argument for more liberal financing terms.

In contrast to the projected 1980 dairy farms, the synthesized 1980 cash grain farms show possible deficiencies in all of the three financial considerations—returns, repayment capacity, and risk. All synthesized farms show positive net returns even after deducting $11,000 for family living for each partner. It should be kept in mind, however, that the incomes and expenses presented in Appendix Table E.2 assume complete ownership of all resources. The smallest operation considered has over one-half million dollars of investments, and if farm operators borrow for part of these assets, interest deductions alone could rapidly lead to negative net incomes.

Repayment capacity is seriously limited mainly because of two factors. First, as was mentioned above, high profit potential is lacking. Second, cash grain farms are very land intensive. In other words, a large percentage of the total investment on these farms is in land. Since good land does not depreciate, all principal payments must come out of net income. If net income is low, repayment potential can be severely limited.

There is considerable risk connected with cash grain farming because

gross income is very sensitive to two factors—crop yields and product prices. New technological developments in fertilizers, pesticides, and drought and disease resistant plant varieties will reduce the probability of having a "bad" year by 1980, but cash grain operators will continue to experience some degree of fluctuation in yields because of natural and biological factors. Unless the government completely controls the price of cash grains by 1980, there will continue to be significant price fluctuations. The fluctuation is inevitable because of the relatively inelastic demand for cash grains. Small fluctuations in quantity produced cause relatively large variations in price. Farmers do not have perfect knowledge concerning future outputs and prices. Per acre yield variations, coupled with the relative ease with which farmers can switch from the production of one crop to another, leads to a situation where cash grain prices are in a state of constant disequilibrium. Public policy pressures seem to be in the direction of less, rather than more control over farm output and prices. Therefore, all indications are that cash grain farmers will continue to experience significant year-to-year fluctuations in income in 1980. This fluctuation, in turn, increases the risk connected with financing cash grain operations.

The format for analyzing the financial strengths and weaknesses of future cash grain farms must by necessity be different from the format used for dairy farms. Emphasis must be on how a farmer can accumulate sufficient resources to meet annual repayment obligations, given various financing terms, rather than on how farmers can obtain liberal financing terms, given that they have strong repayment capacity even when a large proportion of their assets is borrowed. Using the same combinations of down payment requirements and lengths of repayment periods that were used on dairy farms, few, if any of the combinations were feasible from a repayment standpoint. This is in contrast to the synthesized 1980 dairy farms where most combinations were feasible.

5.2 640-Acre Cash Grain Farm

The synthesized 1980 one-man cash grain farm assumes 600 tillable acres, three quarters of which are planted to corn and the other one quarter to soybeans. Six-row equipment is assumed.

Appendix Tables C.5, D.4, and E.2 contain detailed accounts of labor requirements, investments, and income and expense statements respectively. Land is valued at approximately $740 per acre. Corn is assumed to sell for $1.00 per bushel with production per acre being 125 bushels of number two corn. Similarly, it is assumed that soybeans sell for $2.25 per bushel with yields of 40 bushels per acre. The total investment is $564,096, about 84 percent of which is in land.

5.2.1 Possible growth paths

There may be at least three important sources of approximately 640-acre cash grain farms in 1980. First, many older farmers who have built up a land base over a number of years will have in the neighborhood of 640 acres by 1980. They may have been dairymen or livestock feeders in the past but will have eliminated these enterprises in favor of cash grain by 1980. This group of farmers may be typical of farmers who "live poor and die rich," as the old adage goes. Land may have been purchased at a relatively low price, and to pay for the land many farmers were forced to cut family living to a bare minimum. With significant appreciation in land values each year, their net worths could continue to grow even though cash grain farming is not highly profitable.

Another source of this size of cash grain farm in 1980 will be younger farmers who may own some land but rent (or operate on a crop share lease) the majority of the land they work. Some of the farmers in this group will be sons of older farmers who have accumulated large tracts of land over a number of years. Through inheritance, the latter group could also accumulate a substantial net worth even though the profit from farming provides no more than a comfortable living.

Finally, there will be an ever-increasing number of 500-1000-acre cash grain farms by 1980 that are owned by doctors, lawyers, etc. and are operated on a custom basis. Many professionals with or without previous agrarian ties are turning to land as an outlet for excess investment capital. One incentive for this trend revolves around income tax advantages which are often difficult to identify. Public policy makers are currently expressing concern over "tax-loss-farming" and legal changes over the next ten years could significantly affect the number of nonfarm interests that are purchasing land.

5.2.2 Financing needs

To illustrate the possible financial problems of a farming unit similar to the synthesized 1980 one-man cash grain farm, consider an example where an individual has accumulated 320 acres of land debt free over a number of years. The individual is considering adding another 320 acres using the original land as loan collateral. To handle the larger operation, he will need to purchase one half of the machinery complement presented in Appendix Table D.4 at a cost of $33,242.

Further, he will need to invest $18,647 in drying and storage equipment to handle the larger volume.

If land, drying and storage facilities, and machinery were set up on 30, 15, and 5 years respectively, could the farmer meet annual repayment obligations? Assuming 7 percent interest on land and 8 percent on all other items, the annual repayment requirement would be $29,567. An operator with 100 percent equity in this operation would have $12,526 net income before taxes. But the operator being considered would not have 100 percent equity. Rather, he would have approximately 50 percent equity. Interest payments alone in the first transition year would be $20,708. It should be kept in mind that the $12,526 net income mentioned previously does not include the $11,000 allocated to the operator for family living. Adding full ownership net income and the funds allocated for family living and subtracting interest would leave $2818. Since there would be no income tax on this amount for a family of 4, there would be $2818 left for family living which will be well below subsistence levels by 1980.

One's first impression is that the return from such an operation does not hold considerable promise for farm operators in 1980. But upon careful analysis, the picture does not appear quite so dismal. For seven months of the year, the operator could hold an outside job to earn money that would bring funds for family living up to a reasonable level. Further, with land values appreciating at 3 percent per year, the operator could increase his net worth by $162,695 over a 10-year period. In essence, what this analysis shows is that if an established farmer is willing to work off the farm in slack months and sacrifice in terms of family living, he can increase his net worth rather

substantially over a relatively short period of time. It should be kept in mind, however, that the operator started with over one quarter of a million dollars in completely owned assets which is a luxury that most young farmers do not have.

To illustrate how sensitive the profitability of the 640-acre unit is to yield and price variability, assume that realized yields on corn are actually 150 bushels per acre rather than 125. Gross income would increase by over $11,000 and net income would increase by almost this amount. Of course, if the realized yield was 100 bushels per acre rather than 125, incomes would decrease by the same amount and the farm operator in the situation analyzed above would be forced to either seek additional credit or default on payments. Similarly, with 125 bushels per acre yields, a 25 cent rise or decrease in corn prices would either increase or decrease gross income by over $14,000. At an extreme, the annual gross income for the 640-acre operation would be about $50,600 higher with yields of 150 bushels per acre and a price of $1.25 per bushel than it would be with yields of 100 bushels per acre and a price of 75 cents per bushel. Moreover, both of these extremes are well within the realm of possibility in any given year.

Normally, an operator who used credit for all operating expenses on a 640-acre unit would need a short-term line of credit of approximately $25,000 to $30,000. The operating inputs are used up in the production process so they provide poor security for an operating loan. But with reasonable prices and yields, they generate their own repayment which is a definite positive point from a lender's point of view. It is only when yields and/or prices are unfavorable that repayment of operating credit can be a problem. In unfavorable years, farmers often use short-term credit to meet payment obligations on land, machinery, etc. which can also lead to repayment problems.

The operating credit area is an area where merchant and dealer credit could be extremely important in the future. If the fertilizer experience of the last few years is any indication of the types of credit terms available on inputs in the next few years, farmers may be able to purchase seed, fertilizer, pesticides, etc. on terms of six months, the same as cash. Similar arrangements could spread risk without impairing an operator's repayment capacity.

The 640-acre units in 1980 that are owned and operated by older farmers who have a high percentage equity in their businesses will have little need for lending policies and procedures that are substantially different from what exists today. Similarly, the 1980 units owned by doctors, lawyers, etc., who farm them on a custom basis will not tax lending arrangements even if these arrangements do not change substantially over the next ten years. But young, low-equity cash grain operators could cause serious problems for lenders by 1980. If young operators are attempting to purchase most of the land needed for an adequate sized unit, repayment capacity could be limiting. If young operators attempt to gain a viable unit via cash renting or crop share leasing, yield and price risk could be a real problem because the operators do not have land to fall back on for security.

In summary, repayment capacity and risk could be severely limiting for low-equity operators of one-man cash grain farms in 1980. As a result, unless price relationships change or potential yields increase, liberalizing financing arrangements will do little to alleviate the financial problems of one-man cash grain farmers in 1980.

5.3 1680-Acre Cash Grain Farms

The synthesized 1980 two-man, 1680-acre cash grain operation is assumed to be organized as a tenant corporation with regular taxation because this is the organization that minimizes taxes. The unit grows 1200 acres of corn and 400 acres of soybeans using 8-row equipment. Detailed budgets including labor requirements, investments, and income and expense statements are contained in Appendix Tables C.6, D.5, and E.2 respectively.

The two-man cash grain farm is somewhat more profitable than the one-man unit because the former can economically employ larger, more efficient machinery. Further, the two-man unit spreads machinery cost over more acres; therefore, machinery costs per acre are less than on the one-man unit. Finally, the 1680-acre unit is sufficiently large to obtain substantial quantity discounts on such items as machinery and fertilizers. These cost savings may not seem very high when viewed on a per acre basis, but when they are multiplied by 1600 to reflect the number of acres under consideration, the savings can be substantial.

5.3.1 Possible growth paths

Few partnerships will own 1680 acres of land in 1980 that are capable of continually producing high yields with virtually 100 percent row-crops. The investment is simply too high for two men to accumulate unless they either acquired it over a long period of time or inherited it. Therefore, it is expected that a large proportion of the land on 1000-2000-acre cash grain farms in 1980 will be rented. Actually, a large proportion of the high priced land in predominantly cash grain areas such as central Illinois is currently owned by absentee owners. As land values continue to increase, the trend will be even more skewed in this direction.

With absentee ownership predominating, the constraints limiting the amount of resources that can be controlled (not owned) by one man or one partnership are substantially changed. Many enterprising young farmers may be able to grow from a relatively small unit to a large unit in one season. This assumes, of course, that they can find large quantities of land to rent and, further, that they can obtain sufficient amounts of financing for machinery and operating expenses. At any rate, the natural barriers to large-scale cash grain farming will not be nearly as limiting as they are for large-scale dairy farming in 1980. The biggest obstacle to growth may be finding sufficient quantities of land for rent within a reasonably small area.

5.3.2 Financing needs

The financial problems of attempting to attain an adequate sized cash grain operation via ownership of all resources was treated when the synthesized one-man cash grain farm was analyzed. The same types of problems—only larger—would apply for the two-man unit so the analysis will not be repeated. Rather, a polar situation where all resources are rented will be considered. Developing detailed coefficients for such an analysis would be a study in itself, but by using "ball park" figures, some relevant points from a financing point of view can be illustrated.

When all investment capital, including machinery, is rented, the sole criterion determining feasibility is profit. All costs are in the form of annual operating expenses and are self-liquidating if the operation is profitable. There are no overhead costs or depreciation schedules and no land appreciation to fall back on if the operation is not

profitable. As unusual as this operation may seem, there may be many cash grain operations by 1980 that are gaining control of resources at least partially via this route.

To illustrate, suppose two brothers, both with farm backgrounds and B.S. degrees from the College of Agriculture at Michigan State University, decide to pool their $50,000 cash in 1980 and go into farming in a big way. They are able to rent 1680 acres, 1600 of which are tillable, for $40 per acre. Further, they have talked to a machinery dealer who is willing to rent them the entire complement of machinery presented in Appendix Table D.5. The machinery is rented on a 3-year basis at an annual rate equal to 25 percent of the new cost. Crop and hourly labor expenses are as shown in Appendix Table E.2. Drying costs per bushel of corn are 10 cents using rented equipment. Storage facilities for the grain are available on the farms being rented. From an income standpoint, assume the land produces 150 bushels of corn and 40 bushels of soybeans per acre. Corn is sold for $1.00 per bushel and soybeans at $2.25 per bushel. Finally, using their $50,000 cash as a cushion for risk, the partners obtain a short-term line of credit of approximately $125,000 which is outstanding for about six months on the average. The annual rate of interest on the short-term credit is 8 percent.

Using the assumptions developed above, gross income on this hypothetical operation is $216,000 with expenses of $188,002. This leaves a net income before taxes of $27,998 which is a reasonable return for two partners with only a total of $50,000 invested.

The important point of this analysis is not the returns, because they depend to such a large degree on prices and yields assumed. Rather, the analysis illustrates the use of leverage at an extreme. The partners were able to control almost 1.5 million dollars of resources with an investment of only $50,000. As land, machinery, etc. become more expensive, more and more farm operators will be forced to follow a similar route. To gain control of an adequate sized cash grain unit, assuming capital is limited, ownership goals may have to be abandoned.

The example may suggest a possible problem area for lenders in 1980. The unit required $125,000 of operating credit that was completely used up in the production process. From one standpoint, this loan would be ideal because, given that the inputs are profitable, they would completely generate their own repayment. But if because of natural or market forces the inputs are not profitable, there is absolutely nothing for the operators or the lender to fall back on. Few lenders have had experience with this type of situation when relatively large amounts of credit are involved. Perhaps the development of a more comprehensive federal yield insurance program coupled with a wider use of hedging in the grain futures markets would eliminate much of the risk involved and make such a venture more feasible from the standpoint of both lenders and farm operators by 1980.

5.4 <u>4160-Acre Cash Grain Farm</u>

Detailed budgets for the full ownership, 4160-acre cash grain operation including labor requirements, investments, and annual incomes and expenses are included in Appendix Tables C.7, D.6, and E.2 respectively. The unit assumes a three-man partnership set up as a tenant corporation with regular taxation. The total investment for this operation is $3,479,774 and is higher than any other 1980 operation synthesized. As with the other cash grain farms, the bulk of the

investment (88 percent) is in land.

The synthesized three-man 1980 cash grain operation is more profitable than the cash grain operations analyzed previously. This is in part due to the fact that with over 4000 acres, larger, more efficient machinery is economically justified. Further, machinery is used on more acres and machinery investment per acre is smaller than for the previously analyzed units with less acreages. Finally, the three-man operations can obtain substantially higher quantity discounts than the smaller units on such items as machinery and fertilizer. With smaller profit margins per bushel or per acre expected by 1980, size economies could mean the difference between profit and loss. Even with size economies, however, the return on investment for the fully owned unit is only about 4.5 percent before taxes and about 2.5 percent after taxes. Needless to say, this is not a very high return, given the risks involved.

5.4.1 Possible growth paths

A large percentage of the land in cash grain farms of over 4000 acres by 1980 will be rented. There will undoubtedly be a few individuals or partners who can acquire sufficient assets through inheritance or through outside income sources to control the specified combination of resources completely via the ownership route by 1980. Full ownership, however, will be the exception rather than the rule. The range will be from little or no owned land to the complete ownership situation mentioned above. Crop share leases will be important in 1980 but many large operators would prefer to obtain control of the land on a cash rent basis. To find sufficient land available for rent, large operators will be forced to overcome spacial limitations.

Land may be spread over counties or even states which could raise costs substantially unless field operations are carefully planned.

With the nonownership route predominating, it is extremely difficult to trace out logical growth paths operators could follow as they expand to operations of over 4000 acres by 1980. Part of the problem revolves around a lack of information concerning economies of size. If the economies are substantial, enterprising partners may be able to offer premiums to landowners as a means of obtaining control of large quantities of land in a relatively short period of time. Following this path, 4000-acre units could literally spring up overnight. But again, the feasibility of such a route depends on the profitability of cash grain farming in general, and on the degree of size economies in particular.

Although the incentives for integration do not appear as strong for cash grain farms as they do for some other types, there may still be some degree of integration on large cash grain farms by 1980. For instance, one can envision substantial economies for the 4000-acre cash grain operator who also owns a machinery dealership and a grain elevator. With large volumes and small profit margins, any arrangement that is potentially cost saving will be explored and utilized.

Another group of 4000-acre-plus cash grain farms in 1980 could stem from custom farming. Does an individual who operates over 4000 acres on a custom basis qualify as a 4000-acre cash grain farmer? Technically, he does not control the resources but he does perform all farming operations on the land. There may be numerous custom operators approaching this size of operation or larger by 1980. Even though this type of arrangement may be only "quasi-farming," custom operators could become an important element in cash grain farming by 1980 and, therefore, cannot be ignored.

5.4.2 Financing needs

The problems of financing 1980 cash grain farms were previously analyzed assuming complete ownership, partial ownership, and complete rental of all resources. The conclusions of these analyses will, in general, still hold for the synthesized 4160-acre unit. Costs will be lower on the larger units, but not enough lower to substantially alter the basic conclusions. The main contribution of the synthesized 4000-acre-plus operation is that it illustrates the tremendous investments that will be involved in large-scale cash grain farming by 1980. Further, it illustrates that except in rare circumstances, there must be separation of ownership and control if farm operations are to grow to 4000 acres or more by 1980.

Large-scale farming on a custom basis may be quite popular by 1980. There are indications that land holdings that are small enough to be owned by one individual by 1980 may not be large enough to justify large, efficient machinery. Therefore, more "farmers" may be content to have a full-time nonfarm job and leave the manual field operations to custom operators. The owner would still be the manager and make the major production decisions so, in many respects, he would continue to maintain his ties with farming.

From the custom operator's standpoint, his decision to custom farm on a large-scale basis may in part revolve around quantity discounts on machinery. For instance, he may be able to purchase four $20,000 machines at a price that is substantially less per machine than it would be if he purchased only one. Also, the custom operator may be able to extend his services one step further than is normally the case today. By serving as purchasing and distributing agent for such items as seed, fertilizer, and pesticides, the custom operator could gain substantial quantity discounts that could, in turn, be passed on to landowners as a further incentive to employ his services.

A trend toward cash grain farming on a custom basis could affect the financing needs of the farming sector by 1980. Rather than financing small complements of machinery for a large number of marginal farmers in a community, lenders may be asked to participate in the financing of much larger custom operators. The machinery complement on the synthesized 4160-acre unit, for instance, requires an investment of almost one quarter of a million dollars. Repayment should not be a problem for a custom operator, however, provided he has firm contracts on the land he will custom farm. In essence, what the custom trend could accomplish is the transfer of machinery financing from small marginal operators to large operators who can use the financing on a profitable basis. Further, following this route could free many smaller farm operators for full-time off farm employment and strengthen their overall financial positions.

In summary, all indications are that the price-cost squeeze will have a very detrimental effect on the profitability of all sizes of cash grain farms by 1980. With small margins and the possibility of substantial size economies, cash grain farmers will be forced to expand by 1980. Analysis of the synthesized 1980 farming units, however, has suggested that the possibility of expansion via the ownership route is extremely limited. Repayment capacity will simply not be adequate to support a heavy debt load on land. The lack of repayment capacity coupled with the risks involved in cash grain farming makes it difficult to argue for more liberal financing arrangements for cash grain farmers in 1980. Again, however, it should be stressed that developments such as yield breakthroughs, higher product prices, lower land prices, etc. could substantially alter these basic conclusions.

CHAPTER VI

1980 BEEF FEEDING OPERATIONS

6.1 Introduction

The beef feeding operations synthesized for 1980 range from a 375-head per year operation that grows all feed to a 6000-head per year unit that buys all feed. Like the dairy operations analyzed previously, the beef farms require large investments in livestock housing and feeding equipment. The timing of cash flows on beef feeding units, however, resembles cash grain rather than dairy farms. Also, because of the large investments required for feeder livestock, short-term credit needs are considerably larger than those required on the dairy and cash grain units previously analyzed.

In terms of expected profitability, the synthesized 1980 beef farms fall in between the dairy and the cash grain farms. Profitability on beef feeding operations, however, is very sensitive to changes in both feeder and fat cattle prices. If prices were $25 and $27 per hundredweight on fat cattle and feeders respectively rather than $30 and $32 as was assumed in this study, the results with respect to profitability would be quite different.

The synthesized beef farms, like the dairy farms, are not heavily land intensive. As was demonstrated in the analysis of the cash grain farms, this characteristic is extremely important from the standpoint of repayment capacity.

The synthesized dairy and cash grain units analyzed for 1980 reflected change which in some cases was quite substantial. In beef feeding, however, because of two potentially strong forces lingering on the horizon, the change in the next ten years could possibly be revolutionary rather than evolutionary. The two forces in question are (1) competition from huge feedlots in the Southwest and West, and (2) forces at work that could push beef feeding in the direction of a completely integrated system.

Can operators in the Midwest who are feeding 300 head of cattle per year compete with operators in the Southwest who are feeding 300 acres of cattle per year? Can operators in the Midwest who have a $200 or more capital investment per head compete with operators in the Southwest who have a capital investment of only $30-$40 per head? These and similar questions have not been completely answered even though a considerable research effort has been directed at them in the last few years. Most studies, however, have concluded that those who are ready to write the epitaph for Midwest beef feeders are too hasty in their judgement. One study, for instance, concludes that, "Concerning the ability of existing feedlots to compete, the results indicate that top level farm feeders in the Corn Belt can withstand as much or more of a price squeeze than can their competitors further south before leaving a feedlot stand empty because of failure to cover variable costs" [29]. The current study, of course, assumes that there will still be large numbers of cattle fed in the Eastern Corn Belt by 1980. Nevertheless, the competitive pressures from the South should be kept in mind when interpreting the results of the synthesized 1980 beef feeding units.

The second force mentioned above concerns integration. Many individuals have observed poultry production progress from a back yard sideline enterprise to a completely integrated system in a few

short years and are predicting a similar path for beef. If in the next ten years beef feeding does, in fact, evolve to a completely integrated system, it would make little sense to think of a nonintegrated one-man unit in 1980 because a market for the output of the operation would not exist. After considerable study, however, it is the author's conclusion that integration in beef feeding will be important in the Eastern Corn Belt by 1980, but a considerable amount of the beef will continue to be produced by individual farm operators. They may have forward contracts and, also, a portion of the inputs they employ may be owned by feed companies or packers, but for the most part, management of the firms will still be in the hands of the farmer. More light will be shed on this area as the synthesized 1980 beef feeding operations are analyzed.

6.2 375-Head Beef Feeding Operation

The synthesized one-man beef operation is an example of what could be the ultimate in the substitution of capital for labor in the production of beef by 1980. Cattle are fed in a controlled environment building that includes a highly sophisticated ventilation system and liquid manure with slatted floors. Feeding is all automatic and silage and concentrates are stored in upright silos. All feed is grown using 4-row equipment. Detailed budgets including labor requirements, investments, and annual incomes and expenses are presented in Appendix Tables C.8, D.7, and E.3 respectively.

The unit involves an expected 1980 investment of over $275,000. Advocates of this type of system suggest that higher rates of gain and higher feed efficiency, coupled with lower labor requirements, will more than offset the tremendous investment involved in this type of an operation. As yet, there are too few total confinement beef feeding units in operation to either prove or disprove these claims. The current study assumes equal rates of gain and feed efficiency on all operations considered, so if, in fact, there are advantages of total confinement in these areas, they will not be reflected in the budgets in the appendix of this study.

It is not the intent of this study to present a detailed comparative analysis of the economic advantages and disadvantages of various types of beef feeding systems. But in all fairness to advocates of controlled environment buildings, an example may illustrate how the increased investment could be justified. The investment on a 375-head per year controlled environment building with slatted floors and liquid manure would be about $150 per head capacity (not per head per year) higher than an open lot system with conventional manure. On an annual basis, with interest at 8 percent and depreciation over 15 years, the costs would be $23 per head higher on the controlled environment setup than on conventional building. Suppose average gains in the controlled system were .25 pounds per head per day higher and that every hundred pounds of gain required .5 bushel less corn than in a conventional system.1/ At $30 per hundredweight cattle and $1 per bushel corn, the savings per head per year would be over $31, which more than covers the $23 added costs. If the controlled environment system also requires less labor, the argument in favor of this type of a setup would be even stronger.

1/ These figures correspond to what sales people for controlled environment systems suggest are conservative estimates of increased efficiency stemming from a controlled environment.

6.2.1 Possible growth paths

With margins getting smaller, farm operators who depend on beef feeding for their living will be forced to expand by 1980. It is unlikely, however, that farm operators who are feeding 50 head of steers at the present time have aspirations to expand to a 375-head per year unit. If they were thinking of expanding, chances are that they would have already taken the first step. Their logical next step is out of beef feeding. Many farmers who are currently feeding over 100 head will be feeding 375 head or more by 1980. This may be the minimum sized unit if beef feeding is the primary, rather than a supplemental source of income for farmers in 1980. All indications are that the biggest growth will be in units of 500 head or more, but well managed, highly efficient units of less than 500 will still be important.

6.2.2 Financing needs

The financing required on a 375-head one-man unit in 1980 will depend to a large extent on the type of technology being employed. If cattle are being fed on a dirt lot with no housing and self-feeding bunker silos, the bulk of the financing needs of an operator with limited equity would be for cattle. However, if cattle are being fed in completely automated, controlled environment buildings such as the one being analyzed in this study, operators could require large amounts of intermediate-term financing.

Given a total environment system with no better than average expected rates of gain and feed efficiency, the profit potential of 375-head units in 1980 could be seriously limiting. After deducting $11,000 for family living and $2684 for income taxes, only $302 is left as a return to capital and management. Needless to say, this amount will support little payment of principal and interest. The bulk of the load for repaying any debt would have to come from depreciation. Based on these calculations, feeding 375 head of cattle per year in a controlled environment system in 1980 would almost have to be classified as "hobby farming."

Suppose, however, that controlled environment systems do, in fact, have advantages in rate of gain and feed efficiency. Assume all other things remain the same, except that average daily rate of gain is 2.5 pounds rather than 2.25 pounds and that one hundred pounds of gain requires 4.5 rather than 5 bushels of corn grain. The conclusions of the analysis are now completely different. Net income before taxes would increase by about $11,800. If an individual farm operator had 50 percent equity in his land and machinery (i.e. net worth of $84,171), he could borrow another $106,950 for the new beef feeding system and still meet annual repayment obligations. This assumes an interest rate of 8 percent on machinery and buildings and 7 percent on land. Further, it assumes amortization periods of 5, 15, and 30 years on machinery, buildings, and land respectively.

From a lender's standpoint, this relatively small operation would have debt outstanding on capital items of over $191,000. Further, the operation could require a short-term line of credit of over $50,000 for feeders and crop and livestock expenses. This is an extreme in debt carrying capacity and has not taken risk into account. But it does illustrate that reasonable loan requests of over $200,000 can be expected from "small" beef feeders by 1980, assuming the high investment type systems prove to be profitable.

6.3 900-Head Beef Feeding Operation

The synthesized 900-head per year, two-man beef feeding operation represents a combination of open lot and total confinement housing. Calves are fed in an open lot system for approximately the first 120 days of the feeding period and are then transferred to a controlled environment building for finishing. This arrangement reduces investment per head from what it would be if a completely controlled environment system were employed. Further, it has the advantage of having cattle in a controlled environment during the stage of their growth cycle when environment may be most crucial to performance.

The investment per head in buildings and feed storage on this unit is about $225 per head fed per year. This is still high by today's standards, but to construct a highly efficient beef feeding unit by 1980 will require this size of investment. The total investment on the two-man unit is almost $600,000. This includes 480 acres of land to produce feed for the 900 head, and also a full complement of 6-row equipment. Complete budgets including labor requirements, investments, and income and expense statements are included in Appendix Tables C.9, D.8, and E.3 respectively.

Assuming no gain or feed efficiency advantages for the controlled environment unit, return on investment for the full ownership situation is only a little over 1 percent. If controlled environment systems do prove to substantially increase rates of gain and feed efficiency by 1980, the expected return on investment could be much more in line with the risks involved.

6.3.1 Possible growth paths

A logical source of approximately 900-head beef units in 1980 will be operations currently feeding 250 or more head. Older operators may have sons who have a desire to join the business. To provide an operation large enough to support two families, they may be forced to modernize and expand. The highly efficient 900-head unit may be ideal for a father-son partnership arrangement because the son could handle over three-quarters of the work load except in peak labor months. Other types of family and nonfamily partnerships will also be important.

If individuals can obtain sufficient funds to assemble a 900-head capital intensive unit in 1980, many will be operated as sole proprietorships. By hiring one full-time man plus some part-time labor, a farmer may still have sufficient time to perform the management functions. By 1980, however, management tasks such as buying and selling will be so important to the success or failure of the business that more time will have to be spent in this capacity.

Finally, many nonfarm individuals will likely assemble 500-1500-head beef feeding operations by 1980. Labor and management will all be hired. It's difficult to analyze the motives of nonfarm individuals who enter into farming—often in an ultramodern fashion. Beef feeding may be the easiest livestock enterprise in 1980 to operate completely with hired labor and management. Also, high capital investments in depreciable items that can be written off rather rapidly for tax purposes, coupled with other more subtle tax advantages, may explain in part why many wealthy businessmen may choose beef feeding as an outlet for their excess funds. Many wealthy nonfarm people feel that an investment portfolio is not complete unless it includes land, and having a modern beef feeding setup on the land makes the investment even more intriguing and satisfying.

6.3.2 Financing needs

Building a case for extending liberal financing terms to an operator with demonstrated management ability but limited equity is difficult on the synthesized 900-head unit, just as it was on the 375-head unit. The profit potential is simply too limiting. The risks involved in (1) beef feeding and (2) an operation of any type with a highly leveraged financial structure are prohibitive unless the operations demonstrate a well above average profit potential. In all probability, top management of many large nonfarm businesses would reject an investment proposal with similar risks unless the expected returns from the investment were at least 20 percent. Net return before income taxes would have to increase about $117 per head fed per year to provide a before tax return on investment of 20 percent for the full-equity unit. Needless to say, such an increase in net return under any circumstances appears impossible for beef feeders in 1980.

The point to be made is that there appears to be no place in high investment beef feeding for low-equity operators in 1980. That doesn't mean, however, that few farmers will be feeding cattle in systems similar in size and structure to the 900-head beef operation synthesized in this study. On the contrary, many established beef feeders will continue to expand and modernize even though expected returns may sometimes appear quite low. They may have considerable assets that are fixed in the sense that the return from these assets in the business is higher than their salvage value. By expanding and modernizing, farm operators may increase the return to these fixed assets and at the same time increase net income to a level that will provide sufficient income

for family living. Therefore, the marginal decision to expand may be a prudent one for many farm operators.

From a lender's point of view, modernization and expansion by established beef feeders could amount to loan requests of substantial magnitude by 1980. Suppose, for instance, that a completely debt free operator has been feeding 450 head per year in an open lot system. He owns 500 acres of land and all the machinery to work it. To provide a unit large enough so that his son can join the business, he builds a new controlled environment setup that will tie in with his old unit and allow him to feed 900 head per year. For additional feed storage, he also builds two new 30-foot by 70-foot silos. The total new investment would be over $125,000. Further, if the operator used short-term credit for feeders and other operating expenses, he would need almost $150,000 on a short-term basis alone. In conclusion, even though this operator has substantial financial muscle and should not have difficulty repaying the loan, the sheer magnitude of the financing required could create problems for some lenders. By 1980, situations similar to the one described above will be common. They will not require liberal credit terms. They will not be high risk loans. They will simply be loans in excess of one quarter of a million dollars to one individual which, by itself, could cause serious problems for lenders in 1980.

6.4 6000-Head Beef Feeding Operation

The real expansion in beef feeding in the next ten years may come from units organized in a similar fashion to the 6000-head operation synthesized in this study. The future units may be 1000, 10,000, or even 100,000 or more head. They may be aptly classified as beef factories that specialize in producing beef and leave the production of

feed to other members of the farm economy.

The 1980 synthesized 6000-head unit has a total investment of about $730,000 which is less than 20 percent higher than the 900-head operation discussed previously. All feed, including corn silage, is purchased. The operation has the capacity to produce a high sales volume in relation to the investment involved. For instance, the 6000-head unit has adjusted gross sales (gross sales minus purchased feeders) of over one and one quarter times the total investment. This is in contrast to the 375-head analyzed previously where annual adjusted gross sales were only about 20 percent of the total investment involved.

The 6000-head operation is an open lot operation with fence-line feeding. Roughage is stored in horizontal silos and concentrates are purchased on a weekly basis and stored in bins in a feed distribution center. The machinery complement consists of only feeding, manure handling, and forage harvesting equipment. Detailed budgets including labor requirements, investments, and income and expense statements are included in Appendix Tables C.10, D.9, and E.3 respectively.

6.4.1 Possible growth paths

There may be at least four sources of 6000-head or larger beef feeding operations in 1980. First, many individual farmers or partnerships that have fed cattle on a smaller scale for years may be building these types of units by 1980. The importance of this group will depend on many factors, the most important of which is the availability of satisfactory forward contracts. As will be demonstrated in the analysis, the risk involved in feeding cattle in a system similar to the synthesized 1980 6000-head operation is simply too great for individual operators unless a market and a price can be assured in advance.

A second source of this type of operation may be nonfarm businessmen or groups of businessmen who enjoy being connected in some way with a farming enterprise. This group could be substantially more important by 1980, especially if the profit potential of large-scale beef feeding appears to be promising. Ownership will be on an absentee basis with all management and labor being hired. A slight deviation from this arrangement could involve farm operators who have included nonfarm businessmen in their beef feeding operations as a source of financial backing.

A third source of 6000-head or larger beef feeding operations in 1980 will be feedlots that feed cattle almost exclusively on a custom basis. Custom feeding has been important in the Southwest for some time, but as yet, it has not been developed on a large-scale basis in the Midwest. With effective promotion, this type of arrangement could become important by 1980. It could provide more people, both farm and nonfarm, with a "piece of the action," thereby spreading the risks involved in cattle feeding.

Last, but certainly not least, many beef feeding operations of 6000 or more head by 1980 will be owned and operated by feed and packing companies that have integrated either forward or backward (or both) in the production process. It is almost certain that this group will be an important source of fed cattle in the Midwest by 1980—the biggest unanswered question concerns just how important. If independent beef feeders fail to find effective means short of integration for combating the risk involved in large-scale, high investment beef feeding, a large share of the cattle in the Eastern Corn Belt could be fed by large, integrated companies by 1980.

6.4.2 Financing needs

When discussing the possible financing needs of 6000-head beef feeding units in 1980, it will be assumed that the unit is owned and operated by three partners who had been previously feeding cattle on a small-scale basis. They are forced to expand, and rather than increasing the size of their existing independent operations, they have agreed to sell out, pool their assets, and build a modern 6000-head feedlot. Further, assume they have negotiated a contract with a large packer that specifies that the operators will supply the packer with 500 head per month of medium choice steers averaging approximately 1000 pounds per head. No less than 100 head, but no more than 125 head will be delivered to the packer every Friday morning before 8:00 a.m. Penalties are established for not fulfilling the terms of the contract. Finally, the contract specifies that the packer must quote a monthly price nine months in advance which the feeder can either accept or reject. Since the feeder would know the price he would receive for each lot of cattle before he put them on feed, he could avoid situations where the return from the cattle would not be sufficient to cover variable costs. The variable costs in the situation budgeted are $24.22 per hundredweight which includes an allowance for death loss. This figure does not, however, take into account the fact that the price of feeder cattle may be higher than the price of fed steers. A $2 negative margin would add another $9 to the variable cost per head if 450-pound calves are being fed.

With an average annual price for 1000-pound steers of $30 per hundredweight, the 6000-head operation has good profit potential. At this price, the before tax return on investment is about 11.8 percent. Net

income and, therefore, return on investment is very sensitive to changes in the price of beef. Every $1 deviation from the $30 average price means $60,000 to the operation. For instance, if fat cattle were $35 per hundredweight, and everything else remained constant, the return on investment would be 63.8 percent. Likewise, if fat cattle were $25 per hundredweight, the operation would fall over $163,000 short of covering variable costs. When the profits are this sensitive to relatively small changes in beef prices, some method of assuring a price in advance must be employed if a substantial number of individual farm operators are to feed cattle on this type of a unit in 1980.

This beef feeding operation would have a need for a short-term line of credit approaching one million dollars. About $650,000 of feeders would be in the lot at all times. From a lender's point of view, financing the feeder livestock on this operation would be quite different from financing cattle for farm operators who grow their own feed. In the latter case, because of weight gain, the cattle increase in value even though the price may decrease substantially. But when large amounts of financing are needed for feed also, the risk involved in the short-term credit is much higher. If lenders were to require that the operators have sufficient cash to cover expenses other than cattle, this could require up to one quarter of a million in cash which few partnerships could handle. With forward contracts, however, lenders could know in advance whether receipts would cover variable costs, and could reduce risk by having contract payments assigned directly to them.

What size of intermediate-term financing requirements might a 6000-head beef feeding operation have in 1980? This, of course, depends on the financial positions of the individuals who own the operation.

In general, the unit has good repayment capacity as long as cattle prices stay around $30 per hundredweight. Table 6.1 shows an analysis of annual repayment requirements assuming various combinations of down payment and amortization periods. With lengths of repayment of 7 years on machinery and 15 years on the feeding facility (including land on which it was built), the partners could meet annual repayment requirements even if they financed the entire investment of $730,124. With the same lengths of repayment, depreciation alone would cover the annual payment if the operators had a 50 percent down payment.

Annual repayment obligations, assuming various financing arrangements, have been plotted in Figure 6.1. This illustrates the relationships and trade-offs between length of repayment and equity from the standpoint of annual repayment on the 6000-head unit. First, the graph shows that as equity increases, liberalizing lengths of repayment has a smaller and smaller effect on the absolute annual payment. For instance, with 50 percent equity, going from a 3- and 7-year to a 10- and 20-year repayment schedule for machinery and feeding facilities respectively, decreases the annual payment by less than $40,000. In the same situation, only with zero percent equity, liberalizing the repayment terms means almost $80,000. The trade-offs are also illustrated by the fact that partners with no equity, but terms of 10 and 20 years on machinery and feeding facilities respectively, would have almost the same annual payment obligation as a situation with 50 percent equity but only 3 and 7 years respectively on machinery and feeding facilities.

The point to be made here is that, if price risks can be controlled within reasonable limits by 1980, many independent farm operators and

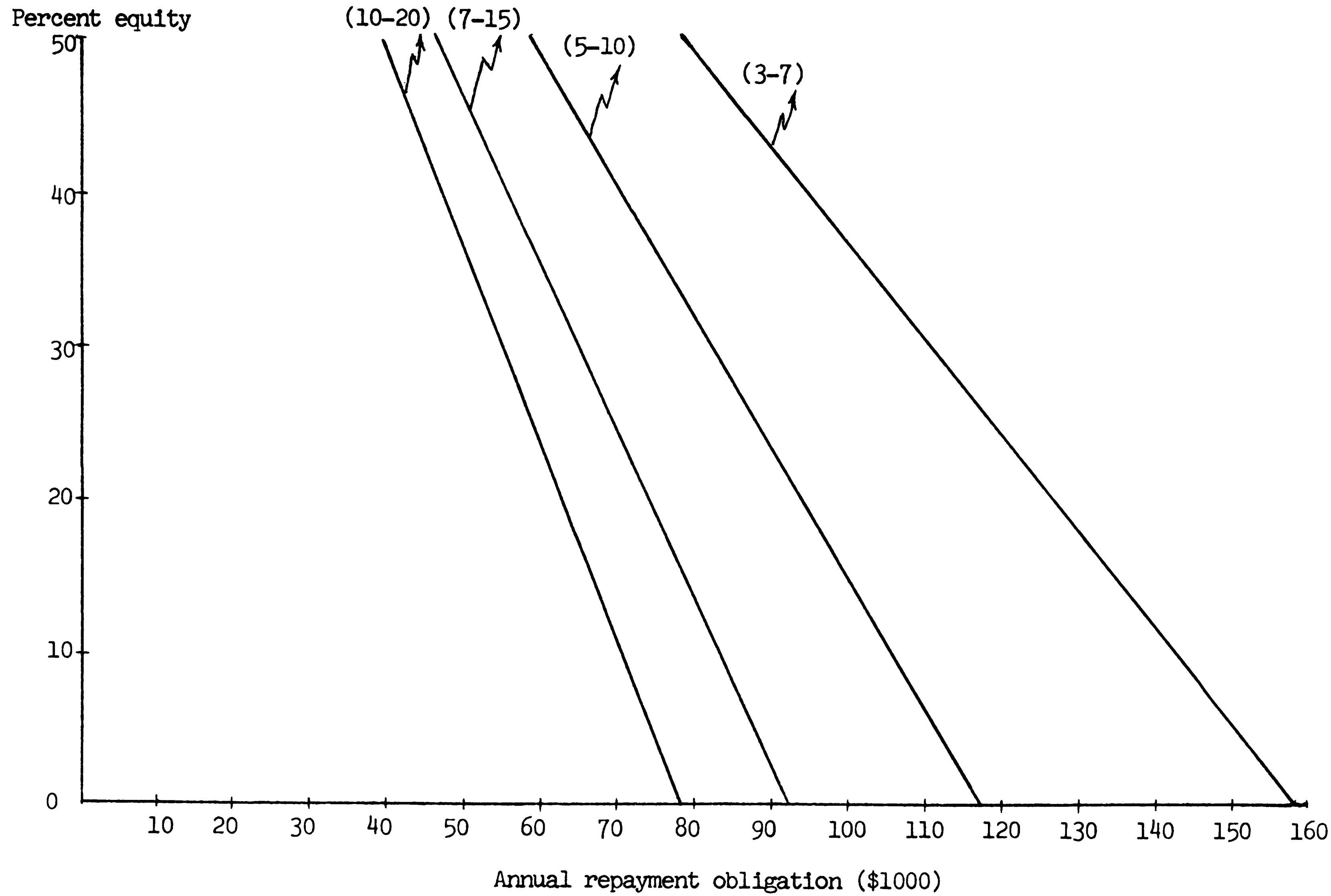
Table 6.1 Analysis of annual repayment requirements for 6000-head beef feeding operation assuming various combinations of down payment and amortization periods

Down payment		Total Financing	Total Equity 1/	Years to repay 3 - 7	5 - 10	7 - 15	10 - 20
	M	91,090	0	35,346	22,814	17,496	13,575
0 - 0	F	639,034	0	122,739	95,235	74,658	65,086
	T	730,124	0	158,085	118,049	92,154	78,661
	M	81,981	9,109	31,811	20,533	15,746	12,218
10-10	F	575,131	63,903	110,465	85,712	67,193	58,577
	T	657,112	73,012	142,276	106,245	82,939	70,795
	M	59,209	31,881	22,975	14,829	11,372	8,824
35-35	F	415,372	223,662	79,780	61,903	48,528	42,306
	T	474,581	255,543	102,755	76,732	59,900	51,130
	M	45,545	45,545	17,673	11,407	8,748	6,788
50-50	F	319,517	319,517	61,370	47,618	37,329	32,543
	T	365,062	365,062	79,043	59,025	46,077	39,331

1/ Not including livestock.

Notes:
1. The number seuqences across the top of the table refer to the number of years for repayment on machinery and beef feeding facilities in that order.
2. The number sequences along the left hand side of the table refer to percentage down payment requirements on machinery and beef feeding facilities in that order.
3. The abbreviations M, F, and T refer to machinery, beef feeding facilities and total respectively.

Figure 6.1 Trade-off between length of repayment and equity with respect to annual repayment obligation on 6000-head beef feeding operation



Note: Numbers in parentheses refer to number of years for repayment on machinery and beef feeding facilities respectively.

partnerships could establish operations similar to the 6000-head unit analyzed above. The equity requirements will not be prohibitive if lenders will allow operators to repay loans over a period that is at least close to the expected life of the item being financed. Further, it may be mutually beneficial to both the lenders and farm operators if a repayment arrangement could be worked out that was based on average cattle prices in a given year. In years when cattle prices averaged $35 per hundredweight, the arrangement could call for an annual payment of 200 percent of normal established amount. Similarly, with prices below $30 per hundredweight, farmers would pay somewhat less than 100 percent of the normal annual payment. This type of arrangement could become much more feasible by 1980 if, through forward contracts, wide fluctuations in cattle prices can be eliminated.

In summary, the profit potential for a highly leveraged operator on a 6000-head beef operation could be tremendous by 1980. Moreover, with $30 per hundredweight cattle and reasonable repayment terms, the unit can generate sufficient repayment capacity to handle a very low-equity situation. But the big question still remains--can risks be controlled sufficiently well by 1980 to make such an operation feasible? Given conditions in cattle feeding today, one bad year could bankrupt a cattle feeder on a 6000-head unit that purchases all feed, even though he may have substantial equity in his business. If this environment is not changed by 1980, large-scale cattle feeding in the Midwest will shift from individual operators to large integrated firms that have a more effective means of coping with risk.

CHAPTER VII

IMPLICATIONS OF SYNTHESIZED 1980 UNITS FOR FARMERS AND LENDERS

7.1 1980 Dairy Farms

The analysis of the synthesized 1980 dairy operations leads to one conclusion--properly organized 1980 dairy units have tremendous profit potential. *A priori*, economic reasoning would lead one to conclude that with this kind of profit potential, more units will enter dairying by 1980 and drive milk prices downward. To a certain degree, such a conclusion may be valid. But there are at least two reasons why it was assumed in this study that milk prices will show a modest increase rather than a decrease between 1970 and 1980. First, dairy farmer cooperatives such as Michigan Milk Producers have gained considerable bargaining power in the last few years and all indications are that they will be even stronger by 1980. Should it become necessary, these organizations may have the power to initiate production controls or use other means to assure that milk prices remain favorable. Second, and perhaps more fundamental, there are many natural barriers to entering the dairy business. How many farmers aspire to enter dairying in a big way even if it is profitable? How many individuals have the ability to manage a highly complex 1000- or even an 80-cow dairy operation? How many individuals interested in dairying have the financial resources to establish a large, highly efficient dairy operation even if low-equity financing is available? On the negative side, dairy products will face increased competition from nondairy substitutes by 1980. The competitive pressures from synthetic substitutes, however, appear to serve more as a deterrent to substantial price increases than as a force that will

lower future milk prices.

New technologies have probably decreased supply response or, in other words, decreased the elasticity of the supply curve for milk. In the past, it was not a major decision for a dairyman to keep or cull 4 or 5 extra cows, depending on whether the price looked favorable or unfavorable. Modern, highly specialized units, however, are not conducive to expanding or contracting a few cows at a time. The alternatives facing an operator contemplating expansion may consist of either expanding by 50 cows or not expanding at all. This is no longer a minor decision; therefore, the "in" and "out" aspect of dairying is rapidly becoming a thing of the past.

The fact that a modern dairy operation requires expansion in lumps rather than a few cows at a time has implications for lenders in 1970 and may have even more serious implications for lenders in the future. At present, there are many dairy systems where it would be uneconomical to add facilities for less than 50 cows at a time. In the twenty-first century (or before, according to some individuals) when computers are milking cows, the 50-cow minimum expansion may have increased to 500. This is important because expansion in large jumps requires substantially more external financing than growing a few cows at a time.

For an operator who now has 100 cows but who wants to be milking 1000 cows in 1980, is expanding in 50-cow units an optimal expansion path? An argument could be made that there are substantial economies to be gained from expanding all in one step. Financial constraints, however, often prohibit such a path even if there are substantial economies to be gained from such a move. Could the financial constraints be loosened? The financial analysis of 1980 dairy farms has shown that

a low-equity dairy operation is feasible if lenders will only provide financing with realistic repayment periods. This means setting up amortization periods that correspond more closely with the expected life of the capital item being financed. Further, the notion that farm operators should follow a path that will make them debt free at some point in their lives may have to be abandoned. Many large manufacturing concerns use perpetual debt, why shouldn't farmers?

When financing rapidly expanding dairy farms in 1980, two problems may be particularly crucial to lenders. First, a lender observes an individual or partners doing an excellent job of managing a 200-cow dairy operation. Does this mean they will do an equally commendable job of managing a 1000-cow herd? The Peter Principle [48], which suggests that every manager ultimately rises to his level of incompetence, may apply here. Operators are often expanding to units that are larger than they have ever managed before. Given the high cost of a mistake for large, highly leveraged dairy operations, evaluating an operator's management ability before a unit is in operation can be a real problem for lenders.

A second problem for lenders contemplating financing large dairy operations in the future is the problem of large investments in highly specialized intermediate-term capital. A dairy facility may account for one third of the total investment on a specialized dairy farm when an operator owns sufficient land to produce all of the feed for his herd. If a large proportion of the land is rented, the dairy facility may account for an even larger proportion of the total investment. The problem arises because the facility assumed on the 200-cow dairy operation, for instance, may be worth $200,000 to the partners building it.

But what is the facility worth if the partners were to default? With land, if an individual defaults, there is seldom a problem of selling the land to salvage the full amount of the loan. A highly specialized dairy facility, however, may have few buyers and as a result, salvage value in case of difficulty may be only a fraction of the original cost.

As was mentioned earlier, lenders currently prefer to tie the financing for dairy facilities in with long-term land financing. This may be an acceptable arrangement if an operator has substantial equity built up in land. In 1980, however, financing for dairy facilities may have to stand on its own. To attain an efficient sized dairy unit with limited equity, farmers may be forced to purchase more of their land on contract. Further, they may rent large proportions of their land or even buy all feed rather than use their limited equity on land and machinery. These alternatives would be more feasible if arrangements could be worked out so that dairy facility financing would not have to come under the umbrella of land financing.

Lenders cannot be criticized for not providing 90 percent financing on a facility that could possibly be salvaged for only 50 percent of new cost one week after it's built. Would some sort of federal mortgage insurance similar to that provided by the Federal Housing Administration be feasible for highly specialized capital investments? Given the profit potential of 1980 dairy operations, the incidence of failure would probably be small so the cost of such a program could be kept at a minimum. From a lender's standpoint, risk is concentrated when large loans are involved, so even though the probability of failure is low, the cost of one mistake may be too high to take the chance. A federally administered insurance program would have the potential to

spread risk at a cost that would not be prohibitive to farm operators.

A source of financing for large dairy operations that was not considered in the previous analysis is merchant and dealer credit. Risk could be spread by having the silo dealer finance the silos, the construction company finance the dairy housing, the local dealer finance the milking equipment, and so on. Some companies are convinced that to sell their products to farmers in the future, they may be forced to provide large amounts of financing. This approach has many advantages, but it also has one large disadvantage. Who will coordinate the efforts of each of these sources of credit? If each acted individually, the end result on a low-equity operation would be a hodgepodge of credit terms that no one, including the farm operator, could live with. But if a banker, for instance, were given authority to administer and coordinate the terms provided by the various sources, perhaps a package could be worked out that would spread risk and still be within the limits of a farmer's repayment capacity. Without such a coordination effort, a "split-line-of-credit" holds little promise as a tool to allow a farm operator to take full advantage of his limited equity.

The analysis of the synthesized 1980 dairy units also has implications for farm operators. The investments involved in even the 80-cow herd are larger than the average investment of most individually owned nonfarm businesses. Dairying in 1980 will be big business, and it must be operated accordingly. To obtain financing similar to the liberal arrangements analyzed on the synthesized units, farm operators will be forced to relinquish part of their independence and accept closer supervision. Detailed records are a necessity, and further, monthly progress reports may be essential on some highly leveraged operations. The days of "I'm too busy in the field to bother with records this month" will definitely be a thing of the past by 1980.

Farm operators must realize and be willing to accept the risks involved in a large, highly leveraged dairy operation. Not all farm operators are equipped to handle the pressures of a heavy debt load. Expanding to a modern 1000-, 200-, or even 80-cow dairy operation is a big and somewhat irreversible step. It is imperative that farmers recognize the implications of such a move before taking action.

Finally, an exogenous factor—namely pollution control—could seriously affect large dairy farmers by 1980. What if laws are enacted in the next ten years requiring all dairy operations of over 200 head to have manure drying facilities? Such an event could raise costs considerably and serve as an important deterrent to large-scale dairy farming by 1980. In short, as dairy farmers plan their expansion strategies for the '70s, they must be aware of possible exogenous factors that could seriously affect the profitability of their businesses.

7.2 1980 Cash Grain Farms

The analysis of the synthesized 1980 cash grain farms presents a rather dismal outlook for cash grain farmers of the future. Because costs are expected to increase at a more rapid rate than yields and prices, cash grain farming by 1980 could be the epitome of farming units affected by the price-cost squeeze. It should be kept in mind, however, that the conclusions of this analysis are very sensitive to the assumptions employed. The assumptions concerning 1980 prices, yields, etc. are based on the best information available at the present time. But ten years is a long time in the future, and many unanticipated events could substantially alter the situation by 1980. If, for instance, top-notch cash grain farmers in 1980 can average 150 bushels of corn per acre rather than the 125 bushels assumed in this study, the conclusions would be quite different. Similarly, $1.25 per bushel rather than $1.00 per bushel corn or $500 per acre rather than $740 per acre land could also alter the conclusions.

Cash grain farmers may be faced with a serious dilemma by 1980—small profit margins may force them to expand on the one hand but limit their expansion on the other. To obtain a unit large enough to provide an adequate level of family living, cash grain farmers may be forced to expand. But expansion may require a heavy debt load, and the repayment capacity of cash grain farms may not be sufficient to meet the annual repayment obligations implied by large amounts of external financing.

One conclusion of this analysis is that most cash grain farmers of the future will not be able to expand on a large-scale basis via the ownership route. Given the economic relationships assumed, the cash grain farmers are simply not able to generate sufficient repayment to service large debt loads on a low-equity basis. One of the reasons for poor repayment capacity is a low return on investment. The second reason revolves around the fact that a large proportion of total investment on cash grain farms is in land. All payments on land must come from net income, and if net income is low, land will not generate its own repayment.

An example will illustrate the problems involved in repaying large loans on land. Suppose a 1980 farm operator is able to borrow money

to buy 320 acres of good cash grain land at $740 per acre. At 7 percent interest and a 30-year amortization period, the annual payment would amount to $19,084. Real estate taxes would run another $9.25 per acre or $2960 per year. To repay taxes, principal, and interest without using outside income, an operator would have to net almost $69 per acre which will be almost impossible, given the prices and yields projected for 1980. Taking the analysis one step further, suppose cash grain farming could be expected to net only $25 per acre after all taxes in 1980. Further, suppose the above operator needs $11,000 for family living, and that all other loans he has outstanding are self-liquidating. In this case, just to repay principal and interest on the 320 acres and provide for family living, he would need a total of over 1200 acres. In other words, the operator would need to own 880 acres of land free and clear. His equity in land alone would amount to over $650,000. This example is an oversimplification because it ignores the fact that there are more ways to supplement income than just owning land. But it does illustrate the type of problems facing farm operators who attempt to buy land in 1980. An outside source of income may be essential in order to meet annual principal and interest payments if (1) land is purchased on a low-equity basis and (2) land prices continue to appreciate.

The analysis of the synthesized 1980 cash grain farms indicates that, in all probability, absentee ownership will be the dominant tenure arrangement on cash grain farms in the future. Most farm operators cannot possibly own all of the land needed for an efficient sized operation. This brings up a serious question: who will own land by 1980? The bulk of the land in 1980 will be owned by older farmers who have accumulated it through time or by younger farmers who have inherited it. Also, some land will be owned by nonfarm people who have either inherited it or purchased it using nonfarm income. There may be some problems involved in transferring control of the land resource from those who can afford it to those who can operate it efficiently by 1980. Custom farming, crop share leasing, and cash renting will all be important tools in this transfer process.

From a lender's standpoint, considerably more financing will be needed by operators who own little or no land by 1980. Requests for operating loans of $100,000 and larger may be common by 1980. There may also be many machinery loans of up to one-quarter million dollars. The important point is that many of these large loan requests will not be backed by large equities in land.

The argument that long-term lenders such as Federal Land Banks could help farmers by offering 90 rather than 60 percent loans on land is not borne out by analysis of the synthesized 1980 cash grain farms. Rather, the analysis has shown that, in many cases, even a 60 percent loan may tax an operator's repayment capacity. Changes such as higher product prices, higher yields, lower land prices, or lower interest rates could substantially alter this conclusion, however.

One can't help but wonder about the macro adjustment implications of the synthesized 1980 cash grain farms. Given the low returns realized on these synthesized units, will land prices continue to increase at 3 percent or more per year? Farmers often think of return on investment in terms of what they paid for the land rather than what it is worth. Using this somewhat misleading approach, returns can appear reasonable. But as land is transferred at a higher price, the return a buyer can expect from an investment in land may be very low. Perhaps the recent slackening of land prices is more than a short-term response to high interest rates.

If appreciation in land values were to cease, there would be even less incentive to own land. Farmers would no longer "live poor and die rich"—rather they would "live poor and die poor." Most people have come to the point of accepting appreciation in land values as a fact of life. If this trend were to cease or be reversed, it could have serious implications for farming in 1980.

Some policy makers are talking in terms of 65 cent corn by 1980. Based on the results of the synthesized farms of this study, cash grain farmers could simply not make a living at this price. Even at $1.00 per bushel, expected returns are relatively low.

From the standpoint of a young operator who is considering entering cash grain farming in the next ten years, do the expected returns justify the risks involved? Using financial leverage in land as a means of rapid growth does not appear to be feasible for cash grain farmers. Repayment capacity will likely be limiting. The best strategy for young farmers may be to use their limited equity to purchase machinery and forget about owning land. Then they can either rent large quantities of land or farm completely on a custom basis.

7.3 1980 Beef Feeding Operations

Three interdependent uncertainties make it extremely difficult to analyze the possible financial strengths and weaknesses of beef feeding operations in the Eastern Corn Belt by 1980. They are (1) competition, (2) integration, and (3) risk. Will Midwest feeders in general, and Eastern Corn Belt feeders in particular, be able to compete with the huge feedlots in the Southwest by 1980? Will large packing, feed, or retailing firms integrate into the production stage on a large-scale basis in the Eastern Corn Belt by 1980? Will independent beef feeders in 1980 be able to eliminate or at least control price risk via forward contracts? Any conclusions arrived at concerning the financing of 1980 beef feeding operations must be tempered by these three considerations.

Most studies have shown that Midwest beef feeders will be able to compete with their cousins from the Southwest. One can't help but wonder, however, how operations feeding 300 head of cattle can compete with operations feeding 300 acres of cattle. Similarly, the $200 per head versus the $40 per head capital investment raises serious questions. No matter what the studies show, the competition from the Southwest and West will have a noticeable effect on beef feeding in the Corn Belt in the next ten years. Many farmers may follow the old adage that "if you can't beat them, join them." This may lead to many units of 1000 or 5000 or more head fed per year. Investments in housing and feeding equipment per head may be considerably lower than the $200 mentioned above. Further, to lower total investments requirement, feed may be purchased rather than grown.

There are definite economic incentives for market coordination in cattle feeding which were discussed in an earlier chapter of this study. As yet, however, it has not been determined whether forward contracts that specify such things as timing, quantity, quality, and price represent sufficient market coordination to capture most of the economic advantages stemming from coordination. If forward contracts are sufficient, independent cattle feeders will be an important source of beef in the Midwest for some time to come. If not, integration may prevail in cattle feeding with the production, processing, distribution, and perhaps retailing stages all under the ownership and control of one management. At an extreme, the beef feeding industry could become integrated to the point that no open market for live beef would exist. If this happens, the problem of financing cattle feeding will be handled on Wall Street, not at the local bank, PCA, FLB, or insurance company.

Finally, independent beef feeders in the Corn Belt must find effective ways of coping with price risk if they are to feed cattle on a large-scale basis in 1980. When a price drop of $5 per hundred can make a $300,000 difference in net income as it does on the 6000-head unit synthesized in this study, risk must be the primary consideration. Farmers may be faced with a dilemma in the next ten years. They need to expand in order to provide a satisfactory income for their families. Yet, to expand may mean exposing themselves to a situation where a $5 per hundredweight drop in cattle prices could wipe them out financially. This type of dilemma could force many independent operators out of cattle feeding and many integrated units into cattle feeding in the next ten years.

The high investment, highly efficient 375- and 900-head per year operations do not appear to be the answer for young, low-equity beef feeders in 1980. The investment in relation to sales volume is simply too limiting. These units will have to show substantial advantages in rate of gain, feed efficiency, and labor requirements if they are to become important by 1980.

Even established operators who build these highly capital-intensive

beef feeding units in 1980 could cause problems from a lender's standpoint. Lines of credit, including short term, ranging from $100,000 to $300,000 could be common. Loans of this magnitude, even though they may be relatively secure, must necessarily be treated differently from an equally secure $20,000 loan.

Provided price risks can be controlled, the real expansion in cattle feeding in the Eastern Corn Belt in the next ten years could come from units organized in a similar fashion to the 6000-head operation analyzed in this study. This unit has tremendous profit potential and repayment capacity with favorable cattle prices. Further, the unit has a considerably smaller investment per head and a much more rapid turn over than the smaller units previously analyzed. On the negative side, however, changes in pollution control laws could adversely affect the trend toward large cattle feeding operations.

From a lender's standpoint, the trend toward these types of units could have serious implications. How many Corn Belt lenders have had experience with feeder cattle loans of over one million dollars? How many have financed large numbers of cattle when the feed is purchased rather than raised? Analyzing a loan request for a 6000-head operation may require a team of experts all trained in different aspects of establishing a beef feeding firm. Few, if any, lenders in the Corn Belt currently have access to such a team of experts.

In short, if the risks of cattle feeding can be reduced by any means short of complete integration, independent farm operators could be feeding cattle in a big way in the Eastern Corn Belt in 1980. They would require substantial financing, different in both type and volume from what is common today. However, if price risk cannot be reduced,

independent farm operators will likely be unable to expand to large-scale beef feedlots by 1980. Numerous smaller operators may continue to feed cattle but the problems of building and financing large-scale feedlots may fall on Wall Street.

7.4 General Implications

The analysis of individual sizes and types of farming operations that may be important by 1980 has some general implications for farm lenders as they plan their strategies for the '70s. First, the "broad brush" approach to establishing lending policies and procedures will not work on 1980 farms. Each size and type of farming unit will have characteristics that are unique from a financing point of view. A common policy, for instance, of 50 percent down on land may be too liberal for some cash grain farms in 1980 but too restrictive on many dairy farms.

The sheer magnitude of expected loan requests may substantially alter the traditional financing picture by 1980. For instance, it may be ridiculous to study how country banks will alter their policies and procedures to finance low-equity 1000-cow dairy or 4000-acre cash grain operations in 1980. Even if there were no legal barriers, the first obligation of these banks is to the safety of their depositors' money. To engage in a loan that could close the bank's doors in case of default would not be prudent.

This does not mean that large-scale farm operators will not be able to obtain financing from commercial banks in 1980. Rather, a small number of large banks—perhaps only 10 or 15 in the entire state of Michigan—will engage in large, low-equity agricultural loans. These banks will employ highly trained specialists who are qualified not only to analyze large loan requests, but also to advise and supervise farmers who have large loans outstanding. Further, these specialists may provide technical and financial counseling to farmers who are contemplating large-scale expansion.

Where do country banks fit into the financing picture in 1980? Actually, country banks can continue to provide a useful and worthwhile service to farming communities without becoming involved in huge loans. Financing modern and highly efficient units such as the one- and two-man units considered in this study could be a highly profitable venture for country banks in 1980. These units, however, will likely require more financing, more liberal terms, and more services than most country banks currently offer. For instance, to provide sufficient financing for an operator who is considering expanding from an 80-cow to a 200-cow operation, country banks may have to seek outside assistance. One possibility is to solicit participation by a city correspondent. Another may be for country banks to work out arrangements among themselves to pool risks when relatively large loans are involved.

Country banks will also need to reconsider their policies and procedures concerning equity requirements and lengths of amortization periods. With many 1- and 2-man operations requiring investments of around one quarter of a million dollars by 1980, it may be unrealistic for lenders to expect 80 or even 50 percent equity. On operations with strong repayment capacity, low-equity loans may be quite feasible. When farmers are operating in a low-equity situation, however, it is very important from a repayment standpoint that amortization periods are based on the expected life of the item being financed. Requiring dairy farmers, for instance, to repay machinery loans in 3 years and dairy facility loans in 7 years may be too restrictive. Extending the terms to 7 years and 15 years on machinery and dairy facilities respectively may be more realistic.

Finally, the days of analyzing, extending, and servicing loans from behind a desk are rapidly passing for country bankers. A team of experts may be needed to adequately analyze and service relatively large loans on 1- and 2-man operations. Since few country banks can afford to hire such a team on a full-time basis, perhaps they should consider hiring specialized consultants on a case-by-case basis. By 1980, access to such a team may be an absolute necessity rather than a luxury.

One other area where banks could provide an invaluable service to farmers in the future is financial consulting. For instance, even though a country bank may be unable to provide financing for a 1000-cow dairy unit or a 6000-head beef feeding operation, the banker may know of a group of enterprising businessmen who would be interested in such a venture. The banker could coordinate the effort for a fee and also may be able to profit by providing a source of operating capital for the operation. Along this same line, bankers may also know of land for sale or rent in a community that farmers are not aware of.

In short, country bank administrators have a decision to make in the next ten years. They can continue to provide financing for high-equity operators, many of which have marginal sized units, or they can be aggressive and progressive and finance operators who have all of the prerequisites for a highly successful operation except equity. The position taken by the majority of country bankers could have a substantial effect on the structure of farming in the Eastern Corn Belt in 1980.

The trend toward large, highly specialized farming units also has many implications for changes in the Farm Credit System in the next ten years. FLBA's, PCA's, etc. will be facing requests for larger loans, more liberal financing terms, and more services than is currently the case. Perhaps as many as one half of the branch offices will be closed by 1980. Many PCA and FLBA offices may be combined to provide farmers with one stop credit. Finally, perhaps the FHA's policies of liberal financing terms with close supervision can be extended to large commercial farming operations as well as marginal units.

The analysis of the synthesized 1980 farming operations has suggested that, in many cases, 1980 farms will be able to support heavy debt loads on a low-equity basis. Lenders, however, cannot be expected to provide liberal terms without some form of compensation for the additional risks involved. Large, low-equity farm operators in 1980 will not be getting money for 7 or 8 percent interest if other large businesses are paying 10 percent. Also, an increasing number of lenders will require compensating balances from farm operators who have large loans outstanding. Further, an increasing number of lenders will be requesting a "share of the action" by 1980. In other words, lenders may extend low-equity loans if, and only if, they can participate in a share of the profits from the farming operation. This would provide lenders with an additional return to cover the added risk involved.

The size and complexity of anticipated 1980 farming units suggests another area that will be very important from a financial point of view—estate planning. Lenders of the future will be reluctant to make long-term commitments on large farming operations unless detailed

arrangements have been made to transfer the going concerns from one generation to the next. Farming units are simply becoming too large for every generation to think of starting over again. Without proper planning, however, inheritance taxes could be so severe that a farming unit would have to be liquidated in order to pay the taxes. Lenders with a large stake in the future of a farming operation will be forced to put increasing emphasis on detailed plans to expedite transfer and insure the farming operation remains intact from one generation to the next.

Finally, the research has demonstrated the importance of controlling risk on large, highly leveraged operations. If individual farm operators are to remain as the dominant producers of food and fiber in the United States, new and improved methods of controlling price and biological risks must be employed. More extensive use of futures markets, forward contracts, and more imaginative formal insurance schemes will all be important tools aimed at alleviating the problems of risk on large farming operations in 1980.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

8.1 Review of Method and Procedure

Nine farming operations were synthetically constructed to study the possible financing needs of typical farm operators in 1980. The specific operations were selected based on information gained from reading voluminous accounts of what the agricultural production sector will look like in 1980, from conversations with extension and research people in universities concerning future changes in the farming sector, from numerous informal interviews with research and sales people from agricultural input supply industries concerning how they envision agriculture in 1980, and finally, from visiting numerous farm operations in the Corn Belt that are currently using the latest in advanced technology. The hypothetical farming units represent what are believed to be sizes and types of farming operations that will be important in the Eastern Corn Belt by 1980. They employ the most advanced technology projected for 1980, provided it is economically feasible. Capital is substituted for labor on the hypothetical farms to allow a high level of labor efficiency. Also, the management ability of the operators on the synthesized units is assumed to be well above average. In essence, the 1980 synthesized units can be thought of as "target" combinations of resources for the sizes and types of farming operations being considered.

To anticipate and study possible financing problems and needs of the farming sector in 1980, a micro or firm level approach was employed. Each size and type of unit constructed had certain characteristics that made it somewhat unique from a financing point of view. Some had even flows of funds throughout the year which lowered their operating credit needs. Others had income only once a year which led to a situation where tremendous amounts of short-term financing were needed. Some firms required large investments in intermediate-term items such as livestock handling facilities and machinery, but relatively small investments in land. Others were highly land intensive, but did not require large investments in buildings. Some required large quantities of inputs that were used up in the production process and therefore served as poor collateral. Others had collateral in a form that was actually increased in value in the production process. Access to resources via renting or leasing was more feasible on some operations than on others. In short, the multitude of factors unique to each size and type of unit significantly affected their expected financing needs in 1980.

From a financing point of view, this was a micro-demand study with implications for micro-supply. Using realistic assumptions concerning growth paths and operator equity positions, each 1980 unit was analyzed in terms of its returns, repayment capacity, and risk-bearing ability. Emphasis was given to the total investment involved on the various synthesized farming units. The proportion of the investment that could be realistically financed was studied using various combinations of down payment requirements and lengths of repayment periods. The three factors of returns, repayment capacity, and risk-bearing ability served as constraints to the amount of leverage that could be employed on each type of operation.

It should be kept in mind that the conclusions of this analysis

are only valid in light of the assumptions employed. The assumptions concerning prices, yields, labor coefficients, etc. are based on the best information available at the present time with regard to agriculture in the Eastern Corn Belt in 1980. But ten years is a long time into the future, especially with respect to price predictions. Therefore, it is extremely important that the reader be cognizant of the assumptions employed before interpreting the conclusions.

8.2 Summary of Primary Results

1. The synthesized 80-cow dairy operation required an investment of almost $315,000, over two thirds of which was in dairy facilities. The biggest problem that farm operators expanding to this type of operation in 1980 may encounter is obtaining large amounts of intermediate-term financing on a length of term that corresponds to a realistic estimate of the life of the capital investment. With reasonable lengths of repayment on machinery and dairy facilities, this unit has the potential to support a heavy debt load and, at the same time, generate a high return on investment for the farm operators.

2. The 200-cow synthesized dairy unit may be ideally suited for partnership arrangements in 1980. The unit produces substantially more volume per operator with only a slightly higher investment per man than the 80-cow unit. Potential repayment capacity is strong even with low equity and a heavy debt load. As a result, this unit could be the epitome of highly efficient and profitable farming units that are organized on a family farm basis by 1980.

3. The 1000-cow dairy operation synthesized in this study requires a 1980 investment of about 2.6 million dollars and generates gross sales approaching 1 million dollars. With $6.00 milk and average production

of 15,000 pounds per cow, the 1000-cow unit is extremely profitable. It would provide three partners who had only 25 percent equity with $11,000 family living per partner plus a before tax return of 30.8 percent on their owned capital. Further, with realistic amortization periods, repayment capacity would not be a constraint to operating this unit on a low-equity basis. On the negative side, exogenous factors such as new and improved nondairy substitutes and more restrictive pollution laws could be quite detrimental to this type of operation in 1980.

4. The synthesized one-man cash grain farm has 640 acres and involves an investment of $564,096, 84 percent of which is in land. Operators who aspire to grow to this size unit by 1980 via the ownership route would need substantial equity. Low-equity financing on this unit does not appear to be feasible because repayment capacity is limiting. By having off-farm jobs and by sacrificing in terms of family living, many operators will accumulate this size of unit by 1980. Because of appreciation in land values, these operators may be typical of the often referred to farm operators who "live poor and die rich."

5. The two-man, 1680-acre synthesized cash grain unit suffers from many of the same shortcomings as the one-man operation. The investment involved approaches 1.5 million dollars and low-equity financing does not appear to be feasible because of repayment limitations. Young operators with limited equity will be forced to use renting and leasing extensively if they hope to assemble and control this combination of resources. An example was presented that showed how two enterprising operators with only $50,000 cash could control 1.5 million dollars of resources by renting all land and leasing all machinery.

6. Assembling a cash grain farm in excess of 4000 acres, such as the one synthesized in this study, will require substantial separation of ownership and control by 1980. The package of resources will require an investment of almost 3.5 million dollars which, in itself, is prohibitive for all but a select group of wealthy individuals. With profit margins narrowing, farm operators may be forced to move toward this size of unit to capture substantial size economies. Quantity discounts and other size economies may mean the difference between profit and loss on cash grain farms by 1980. These large units will involve transferring the land resource from those who can afford it to those who can use it efficiently. By 1980, custom farming, crop share leasing, and cash renting will all be important tools in this transfer process. These tools, rather than liberal financing terms, may be the key to farm operators who are expanding to large-scale cash grain operations in the next ten years.

7. The synthesized 375-head beef unit is an example of what could be the ultimate in the substitution of capital for labor in beef feeding by 1980. The unit requires total investment of over $275,000 with about $107,000 in the beef feeding facility alone. With $30 per hundredweight cattle, the facility has very little capacity to service debt. However, if the controlled environment systems do prove to have substantial advantages in rate of gain, feed efficiency, and labor efficiency, the profit potential on these units could be substantially higher. Even then, however, the investment on this facility appears to be too high to be considered by young farm operators with limited equity who are trying to expand to an adequate sized beef feeding unit.

8. The 900-head beef feeding operation synthesized in this study

employs a combination of controlled environment and open lot housing. The total investment is almost $600,000. Assuming $30 cattle and no advantage from the controlled environment system in terms of rate of gain and feed efficiency, the return on investment is only slightly over one percent. The low profit potential limits repayment capacity and makes it very difficult to build a strong case for more liberal financing terms on this type of an operation by 1980. As a result, this type of unit may be more important for older, established operators who want to add to the size of their present setups and increase labor efficiency rather than for young operators who want to get the most volume from their limited equity.

9. The real expansion in beef feeding in the next ten years may come from units organized in a similar fashion to the 6000-head unit synthesized in this study. The 1980 investment is about $730,000, which is less than 20 percent higher than the 900-head unit discussed previously. With fed cattle selling for $30 per hundredweight, the 6000-head unit has strong profit and repayment potential. In fact, with 7- and 15-year amortization periods on machinery and feeding facilities respectively, operators could finance the total investment involved and still meet annual payment obligations. The limiting factor on this operation, however, may be risk. If cattle prices drop to $25 per hundredweight, for instance, the operation would fall $163,000 short of covering variable costs and could be bankrupt in one year. On the other hand, with $35 cattle, before tax return on investment would be 63.8 percent and an operator could pay for the facility in a relatively short period of time. On this type of operation, as with all large livestock operations, more stringent pollution laws could raise costs by 1980.

8.3 Suggestions for Further Research

The current study combined numerous sources of information to synthetically construct sizes and types of farming units that are expected to be important by 1980. However, the particular routes that operators could follow to reach these target units were not considered in detail. Information could be gained by a study aimed at bridging the gap between where farmers are in 1970 and where they are expected to be in 1980.

The study could begin with the resource organizations specified in the current study. Using some type of firm growth model, a researcher could analyze in detail the factors that either accelerate or retard the progress of a farm operator attempting to expand to the 1980 operation specified. The study would provide insight into how various types of financing arrangements affect firm growth, and also would provide additional information concerning the importance of various sizes and types of resource organizations by 1980.

A shortcoming of this study revolves around the fact that 1980 prices were projected on an independent rather than a simultaneous basis. Can $1.00 corn, $6.00 milk, and $30 cattle all exist at the same time in 1980? Or will farm operators shift from one enterprise to another causing price readjustment? There is a need for more futuristic research dealing with regional and national supply response to answer these and similar questions.

Several other closely related macro adjustment questions are suggested by the current study. Will farm operators continue to abandon dairy and livestock feeding operations in favor of cash grain even though the future expected return from the latter may be extremely low?

Can land prices continue to appreciate even if the expected return from land is decreasing? Will there be sufficient economic incentives to transfer control of the land resource from those who can afford it to those who can operate it efficiently by 1980? Similarly, how can this transfer process be facilitated?

Another area of research where additional information is needed concerns quantity discounts. What type of discounts can large operators expect to receive on such items as fertilizer and machinery by 1980? With profit margins narrowing, these types of savings could be the difference between profit and loss for some types of farms. Therefore, if the discounts gained by large operations in the future are substantial, the trend toward "superfarms" may progress at a much faster rate than most experts have predicted.

What are the implications for farm input suppliers of operating in an atmosphere dominated by operations such as the large, specialized units synthesized in this study? Similarly, what are the implications for agricultural marketing firms? Both farm input suppliers and agricultural marketing firms will, by necessity, be undergoing change in the next ten years. But the direction of this change is not well understood.

Considerable research is needed in the area of new and improved methods of controlling the risks facing farm operators. Can formal insurance schemes be worked out to insure machinery and equipment loans to large, highly leveraged farm operators by 1980? Can a more widely accepted crop insurance program be established as a means of combating risks? Will the trend toward more forward contracts be an effective means of controlling price risk?

Finally, there is a pressing need for more imaginative research concerning improved methods of financing farm firms of the future. How can existing credit institutions make themselves more responsive to the changing needs of farm operators? Are new and different institutions needed for financing farm operations of the future? The next few years will be very challenging for farm lenders. Their responsiveness to the changing needs of a changing farm environment will have a very profound effect on the structure of agriculture in the Eastern Corn Belt by 1980.

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APPENDICES

APPENDIX A

Price and Feed Input Assumptions

Appendix Table A.1 Price assumptions used in budgeting 1980 farm operations

Item	Price
Sell corn	1.00/bu.
Buy corn	1.05/bu.
Soybeans	2.25/bu.
Milking cow	400.00/head
Cull cow	200.00/head
2-day-old dairy calves	30.00/head
Urea	110.00/ton
450# choice steer calves	32.00/cwt.
1000# choice steers	30.00/cwt.
64 percent beef supplement	120.00/cwt.
SBOM	100.00/ton
Buy corn silage (in field)	6.00/ton
Milk	6.00/cwt.

Appendix Table A.2 Daily and annual feed inputs/cow and replacement assuming 15,000 pounds milk sales/cow using corn silage in winter and haylage in summer

Feed input	Feed requirements (approximate)	80-cow herd	Acres needed 1/	200-cow herd	Acres needed 1/	1000-cow herd	Acres needed 1/
Daily							
Summer (150 days)							
Haylage (lb)	104						
Shelled corn (lb)	12						
Winter (215 days)							
Corn silage (lb)	150						
Shelled corn (lb)	14						
SBOM (lb)	2.4						
Annual							
Haylage (T)	7.8	624	82	1,560	204	7,800	1,020
Corn silage (T)	16.0	1,280	71	3,200	178	16,000	889
Shelled corn (bu)	86.0	6,880	69	17,200	172	86,000	860
Urea (lb) 3/	160.0	12,800	---	32,000	---	160,000	---
SBOM (lb)	510.0	40,800	---	102,000	---	510,000	---
Total acres			222		554		2,769

1/ Assuming yields of 100 bu. corn, 18 T corn silage, and 7.65 T of haylage/acre.

Source: Hoglund [32] and other unpublished work by Hoglund.

Appendix Table A.3 Feed input for choice steers using corn silage, shelled corn, and 64% protein supplement (starting with 450 lb. feeder and selling 1000 lb. choice steer)

Feed inputs	Per cwt of gain	375 hd/yr operation			900 hd/yr operation			6000 hd/yr operation		
		cwt produced	feed required	acres required	cwt produced	feed required	acres required	cwt produced	feed required	acres required
Corn silage	1550 lb	2062.5	1598 T	89	4950	3836 T	213	33000	25575 T	1421
Shelled corn	5 bu	2062.5	10312 bu	103	4950	24750 bu	248	33000	165000 bu	1650
64% protein supplement	55 lb	2062.5	57 T	---	4950	136 T	---	33000	908 T	---
Total acres				192			461			3021

Source: Henderson [31].

APPENDIX B

Basic Crop Budgets

Note: Numerous sources were used as benchmarks when constructing the 1980 crop budgets contained in this appendix. Two studies used extensively were Connor [24] and VanArsdall [59].

Appendix Table B.1 Variable cost (excluding labor and interest) of producing corn using 4-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre
Seed	bu.	20.00	.25	5.00
Fertilizer				
Anhydrous ammonia	lb.	.035	140	4.90
60% Muriate of potash	lb.	.025	125	3.13
46% Superphosphate	lb.	.0375	165	6.19
Lime	acre	1.00	1	1.00
Herbicide	lb.	3.00	2	6.00
Insecticide	lb.	.30	5	1.50
Power and machinery repair	acre	2.00	1	2.00
Fuel, grease, oil	acre	2.21	1	2.21
Custom hire				
Apply anhydrous ammonia	acre	2.00	1	2.00
Apply other fertilizers	acre	1.50	1	1.50
Hauling	bu.	.05	125	6.25
Total				41.68

Appendix Table B.2 Variable cost (excluding labor and interest) of producing corn using 6-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre
Seed	bu.	20.00	.25	5.00
Fertilizer				
Anhydrous ammonia	lb.	.035	140	4.90
60% Muriate of potash	lb.	.025	125	3.13
46% Superphosphate	lb.	.0375	165	6.19
Lime	acre	1.00	1	1.00
Herbicide	lb.	3.00	2	6.00
Insecticide	lb.	.30	5	1.50
Power and machinery repair	acre	2.02	1	2.02
Fuel, grease, oil	acre	2.56	1	2.56
Custom hire				
Apply Anhydrous ammonia	acre	2.00	1	2.00
Apply other fertilizer	acre	1.50	1	1.50
Hauling	bu.	.05	125	6.25
Total				42.05

Appendix Table B.2 Variable cost (excluding labor and interest) of producing corn using 6-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre
Seed	bu.	20.00	.25	5.00
Fertilizer				
Anhydrous ammonia	lb.	.035	140	4.90
60% Muriate of potash	lb.	.025	125	3.13
46% Superphosphate	lb.	.0375	165	6.19
Lime	acre	1.00	1	1.00
Herbicide	lb.	3.00	2	6.00
Insecticide	lb.	.30	5	1.50
Power and machinery repair	acre	2.02	1	2.02
Fuel, grease, oil	acre	2.56	1	2.56
Custom hire				
Apply Anhydrous ammonia	acre	2.00	1	2.00
Apply other fertilizer	acre	1.50	1	1.50
Hauling	bu.	.05	125	6.25
Total				42.05

Appendix Table B.3 Variable cost (excluding labor and interest) of producing corn using 8-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre	With 10% Discount 1/
Seed	bu.	20.00	.25	5.00	4.50
Fertilizer					
Anhydrous ammonia	lb.	.035	140	4.90	4.41
60% Muriate of potash	lb.	.025	125	3.13	2.82
46% Superphosphate	lb.	.0375	165	6.19	5.57
Lime	acre	1.00	1	1.00	.90
Herbicide	lb.	3.00	2	6.00	5.40
Insecticide	lb.	.30	5	1.50	1.35
Power and machinery repair	acre	2.09	1	2.09	2.09
Fuel, grease, oil	acre	2.35	1	2.35	2.35
Custom hire					
Apply anhydrous ammonia	acre	2.00	1	2.00	1.80
Apply other fertilizer	acre	1.50	1	1.50	1.35
Hauling 2/	acre	2.50	1	2.50	2.50
Total				38.16	35.04

1/ 10% quantity discount on seed, fertilizer, herbicide, and insecticide, and also on custom rates for applying fertilizers.

2/ Includes variable costs of running own equipment (labor, fuel, grease, oil, repairs).

Appendix Table B.4 Variable cost (excluding labor and interest) of producing corn using 12-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre	With 20% Discount 1/
Seed	bu.	20.00	.25	5.00	4.00
Fertilizer					
Anhydrous ammonia	lb.	.035	140	4.90	3.92
60% Muriate of potash	lb.	.025	125	3.13	2.50
46% Superphosphate	lb.	.0375	165	6.19	4.95
Lime	acre	1.00	1	1.00	.80
Herbicide	lb.	3.00	2	6.00	4.80
Insecticide	lb.	.30	5	1.50	1.20
Power and machinery repair	acre	2.11	1	2.11	2.11
Fuel, grease, oil	acre	2.70	1	2.70	2.70
Custom hire					
Apply anhydrous ammonia	acre	2.00	1	2.00	1.60
Apply other fertilizers	acre	1.50	1	1.50	1.20
Hauling 2/	acre	2.50	1	2.50	2.50
Total				38.53	32.28

1/ 20% quantity discount on seed, fertilizer, herbicide, insecticide, and also, on custom rates for applying fertilizer.

2/ Includes variable costs of running own equipment (labor, fuel, grease, oil, repairs).

Appendix Table B.5 Variable cost (excluding labor and interest) of producing corn silage with 4-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre
Seed	bu.	20.00	.25	5.00
Fertilizer				
Anhydrous ammonia	lb.	.035	140	4.90
60% Muriate of potash	lb.	.025	125	3.13
46% Superphosphate	lb.	.0375	165	6.19
Lime	acre			
Herbicide	lb.	3.00	2	6.00
Insecticide	lb.	.30	5	1.50
Power and machinery repair	acre	4.22	1	4.22
Fuel, grease, oil	acre	4.78	1	4.78
Custom hire				
Applying anhydrous ammonia	acre	2.00	1	2.00
Applying other fertilizer	acre	1.50	1	1.50
Total				39.22

Appendix Table B.6 Variable cost (excluding labor and interest) of producing corn silage with 6-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre
Seed	bu.	20.00	.25	5.00
Fertilizer				
Anhydrous ammonia	lb.	.035	140	4.90
60% Muriate of potash	lb.	.025	125	3.13
46% Superphosphate	lb.	.0375	165	6.19
Lime	acre	1.00	1	1.00
Herbicide	lb.	3.00	2	6.00
Insecticide	lb.	.30	5	1.50
Power and machinery repair	acre	3.94	1	3.94
Fuel, oil, grease	acre	5.14	1	5.14
Custom hire				
Applying anhydrous ammonia	acre	2.00	1	2.00
Applying other fertilizer	acre	1.50	1	1.50
Total				40.30

Appendix Table B.7 Variable cost (excluding labor and interest) of producing corn silage with 8-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre	With 10% discount 1/
Seed	bu.	20.00	.25	5.00	4.50
Fertilizer					
Anhydrous ammonia	lb.	.035	140	4.90	4.41
60% Muriate of potash	lb.	.025	125	3.13	2.82
46% Superphosphate	lb.	.0375	165	6.19	5.57
Lime	acre	1.00	1	1.00	.90
Herbicide	lb.	3.00	2	6.00	5.40
Insecticide	lb.	.30	5	1.50	1.35
Power and machinery repair	acre		1	4.23	4.23
Fuel, oil, grease	acre		1	5.30	5.30
Custom hire					
Applying anhydrous ammonia	acre	2.00	1	2.00	1.80
Applying other fertilizer	acre	1.50	1	1.50	1.35
Total				40.75	37.63

1/ 10% quantity discount on seed, fertilizer, herbicides, and insecticides, and also on custom rates for applying fertilizers.

Appendix Table B.8 Variable cost (excluding labor and interest) of producing soybeans with 6-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre
Seed	bu.	6.00	1	6.00
Fertilizer				
60% Muriate of potash	lb.	.025	125	3.13
46% Superphosphate	lb.	.0375	110	4.13
Lime	acre	1.00	1	1.00
Herbicide	lb.	5.50	1	5.50
Power and machinery repair	acre	1.78	1	1.78
Fuel, oil, grease	acre	2.71	1	2.71
Innoculation	acre	.75	1	.75
Custon Hire				
Applying fertilizer	acre	1.50	1	1.50
Hauling	bu.	.05	40	2.00
Total				28.50

Appendix Table B.9 Variable cost (excluding labor and interest) of producing soybeans with 8-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre	With 10% discount 1/
Seed	bu.	6.00	1	6.00	5.40
Fertilizer					
60% Muriate of potash	lb.	.025	125	3.13	2.82
46% Superphosphate	lb.	.0375	110	4.13	3.72
Lime	acre	1.00	1	1.00	.90
Herbicide	lb.	5.50	1	5.50	4.95
Power and machinery repair	acre	1.94	1	1.94	1.94
Fuel, oil, grease	acre	2.83	1	2.83	2.83
Innoculation	acre	.75	1	.75	.75
Custom hire					
Applying fertilizer	acre	1.00	1	1.00	.90
Hauling 2/	acre	.85	1	.85	.85
Total				27.13	25.06

1/ 10% quantity discount on seed, fertilizer, herbicides, and insecticides, and also on custom rates for applying fertilizer.

2/ Includes variable costs of running own equipment (labor, fuel, grease, oil, repairs).

Appendix Table B.10 Variable cost (excluding labor and interest) of producing soybeans with 12-row equipment

Item	Unit	Cost/unit	Quantity	Cost/acre	With 20% discount 1/
Seed	bu.	6.00	1	6.00	4.80
Fertilizer					
60% Muriate of potash	lb.	.025	125	3.13	2.50
46% Superphosphate	lb.	.0375	110	4.13	3.30
Lime	acre	1.00	1	1.00	.80
Herbicide	lb.	5.50	1	5.50	4.40
Power and machinery repair	acre	1.97	1	1.97	1.97
Fuel, oil, grease	acre	3.14		3.14	3.14
Innoculation	acre	.75	1	.75	.75
Custom hire					
Applying fertilizer	acre	1.00	1	1.00	.80
Hauling 2/	acre	.85	1	.85	.85
Total				27.47	23.31

1/ 20% quantity discount on seed, fertilizer, herbicides, and insecticides, and also on custom rates for applying fertilizer.

2/ Includes variable costs of running own equipment (labor, fuel, grease, oil, repairs).

Appendix Table B.11 Variable cost (excluding labor and interest) of producing haylage

Item	Unit	Cost/unit	Quantity	Cost/acre
Seed	lb.	.70	2.7 1/	1.89
Fertilizer				
60% Muriate of potash	lb.	.025	165	4.13
46% Superphosphate	lb.	.0375	110	4.13
Lime	acre	1.00	1	1.00
Power and machinery repair 2/	acre	2.22	1	2.22
Fuel, oil, grease 2/	acre	2.94	1	2.94
Custom hire				
Applying fertilizer	acre	1.50	1	1.50
Total				17.81

1/ Cost of seed prorated over 3 years.

2/ Cost of plowing, discing, and drilling prorated over 3-year period.

APPENDIX C

Labor Requirements

Appendix Table C.1 Estimated 1980 labor requirements per acre per month for specified crops using various sizes of equipment

Crop and equipment size	Total hour per acre	J	F	M	A	M	J	J	A	S	O	N	D
Corn													
4 row	4.80	---	---	.05	.91	1.54	.67	---	---	---	.67	.96	---
6 row	3.92	---	---	.04	.75	1.25	.55	---	---	---	.55	.78	---
8 row	3.09	---	---	.03	.59	.99	.43	---	---	---	.43	.62	---
12 row	2.58	---	---	.03	.49	.82	.36	---	---	---	.36	.52	---
Corn silage													
4 row	6.84	---	---	.05	.91	1.54	.67	---	---	3.52	.15	---	---
6 row	6.24	---	---	.04	.75	1.25	.55	---	---	3.40	.25	---	---
8 row	5.34	---	---	.03	.59	.99	.43	---	---	3.12	.18	---	---
Soybeans													
6 row	3.53	---	---	---	.49	1.02	.47	.57	---	.49	.49	---	---
8 row	2.78	---	---	---	.39	.81	.36	.44	---	.39	.39	---	---
12 row	2.32	---	---	---	.32	.67	.30	.37	---	.33	.33	---	---
Haylage													
12 ft. swather	7.14	---	---	---	.52	1.46	.98	1.31	.88	1.16	.83	---	---
14 ft. swather	6.86	---	---	---	.42	1.43	.95	1.28	.85	1.13	.80	---	---
16 ft. swather	6.67	---	---	---	.38	1.40	.93	1.25	.83	1.10	.78	---	---

Source: Connor [24] and Van Arsdall [59].

Appendix Table C.2 Labor requirements and costs for 80-cow dairy operation

Item	Acres or cows	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn grain	69	330	---	---	3	63	106	46	---	---	---	46	66	---
Corn silage	71	487	---	---	4	65	109	48	---	---	250	11	---	---
Haylage	82	585	---	---	---	43	120	80	107	72	95	68	---	---
Dairy herd 1/	80	2736	228	228	228	228	228	228	228	228	228	228	228	228
Total		4138	228	228	235	399	563	402	335	300	573	353	294	228
Milker 2/			52	52	52	52	52	52	52	52	52	52	52	52
Remainder			176	176	183	347	511	350	283	248	521	301	242	176
Operator 3/						250	250	250	250		250	250		
Remainder to be hired						97	261	100	33		271	51		
		-dollars-												
Labor costs														
Operator 4/		11000	917	917	916	917	917	916	917	917	916	917	917	916
Milker 5/		3120	260	260	260	260	260	260	260	260	260	260	260	260
Part-time labor 6/		2724	---	---	---	325	874	335	111	---	908	171	---	---
Total		16844	1177	1177	1176	1502	2051	1511	1288	1177	2084	1348	1177	1176

(See next page for footnotes.)

Appendix Table C.2 (cont'd.)

1/ Based on total labor requirement of 34.2 hrs/cow and replacement/yr.

2/ Milker is hired for 2 hrs in morning 22 days/month and for 4 hrs on Sunday 2 wkends/month.

3/ Maximum of 250 hrs/month.

4/ $11,000/yr for family living.

5/ $5.00/hr.

6/ $3.35/hr.

Source: Appendix Table C.1, Hoglund, et. al. [34] and Speicher, et. al. [53].

Appendix Table C.3 Labor requirements and costs for 200-cow dairy operation

Item	Acres or cows	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn grain	172	675	---	---	7	129	215	95	---	---	---	95	134	---
Corn silage	178	1110	---	---	7	133	223	98	---	---	605	44	---	---
Haylage	204	1400	---	---	---	86	292	194	261	173	231	163	---	---
Dairy herd 1/	200	6480	540	540	540	540	540	540	540	540	540	540	540	540
Total		9665	540	540	554	888	1270	927	801	713	1376	842	674	540
Milker 2/		2496	208	208	208	208	208	208	208	208	208	208	208	208
Remainder			332	332	346	680	1062	719	593	505	1168	634	466	332
2 partners 3/						500	500	500	500	500	500	500		
Remainder to be hired						180	562	219	93	5	668	134		
		-dollars-												
Labor costs														
2 partners 4/		22000	1833	1833	1834	1833	1833	1834	1833	1833	1834	1833	1833	1834
Milker 5/		12480	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040
Part-time labor 6/		6236				603	1883	734	312	17	2238	449		
Total		40716	2873	2873	2874	3476	4756	3608	3185	2890	5112	3322	2873	2874

(See next page for footnotes.)

Appendix Table C.3 (cont'd.)

1/ Based on total labor requirement of 32.4 hrs/cow and replacement/yr.

2/ Works 8 hrs/day in split shift (6:00 a.m. to 10:00 a.m. and 3:00 p.m. to 7:00 p.m.) 6 days/wk.

3/ Maximum of 250 hrs/operator/month.

4/ $11,000/yr for family living.

5/ $5.00/hr.

6/ $3.35/hr.

Source: Appendix Table C.1, Hoglund, et. al. [34] and Speicher, et. al. [53].

Appendix Table C.4 Labor requirements and costs for 1000-cow dairy herd

Item	Acres or cows	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn grain	860	2657	---	---	26	507	851	370	---	---	---	370	533	---
Corn silage	889	4748	---	---	27	525	880	382	---	---	2774	160	---	---
Haylage	1020	6805	---	---	---	388	1428	949	1275	847	1122	796	---	---
Subtotal		14210	0	0	53	1420	3159	1701	1275	847	3896	1326	533	0
Dairy herd 1/	1000	30000	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Total		44210	2500	2500	2553	3920	5659	4201	3775	3347	6396	3826	3033	2500
Dairy														
8 milkers 2/		23358	1946	1947	1946	1947	1946	1947	1946	1947	1946	1947	1946	1947
2 full-time men 3/		4008	334	334	334	334	334	334	334	334	334	334	334	334
Remainder 4/			2280	2281	2280	2281	2280	2281	2280	2281	2280	2281	2280	2281
Feed growing			220	219	220	219	220	219	220	219	220	219	220	219
1 partner 5/						150	150	150	150		150	150		
4 full-time men 6/						1000	1000	1000	1000		1000	1000		
Remainder to be hired						270	2009	551	125		2746	176		
		-dollars-												
Labor costs														
3 partners 7/		33000	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750
8 milkers 8/		116790	9732	9733	9732	9733	9732	9733	9732	9733	9732	9733	9732	9733
6 full-time men 9/		49920	4160	4160	4160	4160	4160	4160	4160	4160	4160	4160	4160	4160

Appendix Table C.4 (cont'd.)

Item	Acres or cows	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
Part-time labor (crops) 10/		23508				1080	8036	2204	500		10984	704		
2 secretaries 11/		13200	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Total		236418	17742	17743	17742	18823	25778	15539	18242	17743	28726	18447	17742	17743

1/ Based on total labor requirement of 30.0 hrs/cow and replacement/yr.

2/ 2 8-hr shifts of 4 milkers 7 days/wk (this includes relief milkers when regular workers have time off).

3/ Put in 40-hr weeks.

4/ The remainder is performed by 2 partners in charge of the dairy operation and by excess crop labor.

5/ Puts in up to 150 hrs/month in a nonmanagement capacity in busy months.

6/ These men expected to put in up to 250 hrs/ month in busy months and to assist with dairy on a part-time basis during winter months.

7/ $11,000 per partner/yr for family living.

8/ $5.00/hr.

9/ $8320/yr.

Appendix Table C.4 (cont'd.)

10/ $4.00/hr.

11/ $6600/yr.

Source: Appendix Table C.1, Hoglund, et. al. [34] and Speicher, et. al. [53].

Appendix Table C.5 Labor requirements and costs for 640-acre cash grain farm

Item	Acres	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn	450	1764	---	---	18	337	563	247	---	---	---	248	351	---
Soybeans	150	529	---	---	---	74	153	71	85	---	---	73	73	---
Total	600	2293			18	411	716	318	85			321	424	
Operator labor 1/						250	250	250				250	250	
Remainder to be hired						161	466	68				71	174	
		-dollars-												
Labor costs														
Operator 2/		11000	917	917	916	917	917	916	917	917	916	917	917	916
Part-time labor 3/		3149				539	1561	228				238	583	
Total		14149	917	917	916	1456	2478	1144	917	917	916	1155	1500	916

1/ Maximum of 250 hrs/month.

2/ $11,000/yr for family living.

3/ $3.35/hr.

Source: Appendix Table C.1.

Appendix Table C.6 Labor requirements and costs for 1600-acre cash grain farm

Item	Acres	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn	1200	3708	—	—	36	708	1188	516	—	—	—	516	744	—
Soybeans	400	1112	—	—	—	156	324	144	176	—	156	156	—	—
Total	1600	4820			36	864	1512	660	176		156	672	744	
Operator labor 1/						500	500	500				500	500	
Remainder to be hired						364	1012	160				172	244	
		-dollars-												
Labor costs														
2 partners 2/		22000	1834	1834	1832	1834	1834	1832	1834	1834	1832	1834	1834	1832
Part-time hired 3/		6538				1219	3390	536				576	817	
Total		28538	1834	1834	1832	3053	5224	2368	1834	1834	1832	2410	2651	1832

1/ Maximum of 250 hrs/month.

2/ $11,000/partner/year for family living.

3/ $3.35/hr.

Source: Appendix Table C.1.

Appendix Table C.7 Labor requirements and costs for 4000-acre cash grain farm

Item	Acres	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn	3000	7740	—	—	90	1470	2460	1080	—	—	—	1080	1560	—
Soybeans	1000	2320	—	—	—	320	670	300	370	—	330	330	—	—
Total	4000	10060			90	1790	3130	1380	370		330	1410	1560	
2 full-time hired men 1/						500	500	500				500	500	
Remainder						1290	2630	880				910	1060	
3 partners labor 2/						450	450	450				450	450	
Remainder to be hired						840	2180	430				460	610	
		-dollars-												
Labor costs														
3 partners 3/		33000	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750
2 full-time men 4/		16640	1387	1387	1386	1387	1387	1386	1387	1387	1386	1387	1387	1386
Part-time labor 5/		18080				3360	8720	1720				1840	2440	
Secretary 6/		6600	550	550	550	550	550	550	550	550	550	550	550	550
Total		74320	4687	4687	4686	8047	13407	6406	4687	4687	4686	6527	7127	4686

(See next page for footnotes.)

Appendix Table C.7 (cont'd.)

1/ It is assumed that this size of operation needs 1 full-time hired man/2000 acres even though they may not be able to keep busy some months. In busy months, they are assumed to put in a maximum of 250 hrs/month.

2/ Much of the partners' time will be used performing management tasks; but during the busy months each partner can put in 150 hours doing manual labor.

3/ $11,000/partner/year for family living expenses.

4/ $8320/man/year.

5/ $4.00/hr.

6/ $6600/year.

Source: Appendix Table C.1.

Appendix Table C.8 Labor requirements and costs for 375-head beef feeding operation

Item	Acres or head	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn grain	103	495	—	—	5	94	159	69	—	—	—	69	99	—
Corn silage	89	608	—	—	4	81	137	60	—	—	313	13	—	—
Producing beef 1/	375	936	78	78	78	78	78	78	78	78	78	78	78	78
Total		2039	78	78	87	253	374	207	78	78	391	160	177	78
Operator labor 2/ (max. of 250 hrs/mo)						250	250				250			
Remainder to be hired						3	124				141			
		-dollars-												
Labor costs														
Operator 3/		11000	917	917	916	917	917	916	917	917	916	917	917	916
Part-time labor 4/		897				10	415				472			
Total		11897	917	917	916	927	1332	916	917	917	1388	917	917	916

1/ 2.5 hrs/head marketed/yr.

2/ Maximum of 250 hrs/month.

3/ $11,000/year for family living.

4/ $3.35/hour.

Source: Appendix Table C.1, Van Arsdall [58] and Henderson [31].

Appendix Table C.9 Labor requirements and costs for 900-head beef feeding operation

Item	Acres or head	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn grain	248	971	—	—	10	186	310	136	—	—	—	136	193	—
Corn silage	213	1329	—	—	9	160	266	117	—	—	724	53	—	—
Beef 1/	900	2472	206	206	206	206	206	206	206	206	206	206	206	206
Total		4772	206	206	225	552	782	459	206	206	930	395	399	206
Operator's labor 2/						500	500				500			
Remainder to be hired						52	282				430			
		-dollars-												
Labor costs														
Operator 3/		22000	1833	1833	1834	1833	1833	1834	1833	1833	1834	1833	1833	1834
Part-time labor 4/		2559				174	945				1440			
Total		24559	1833	1833	1834	2007	2778	1834	1833	1833	3274	1833	1833	1834

1/ 2.75 hrs/head marketed/yr.

2/ Maximum of 250 hrs/month.

3/ $11,000/yr/partner for family living expenses.

4/ $3.35/hr.

Source: Appendix Table C.1, Van Arsdall [58] and Henderson [31].

Appendix Table C.10 Labor requirements and costs for 6000 head beef feeding operation

Item	Acres or head	Total hours or dollars/yr	J	F	M	A	M	J	J	A	S	O	N	D
		-hours-												
Labor requirements														
Corn silage	1421	4690	—	—	—	—	—	—	—	—	4434	256	—	—
Beef 1/	6000	12000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Total		16690	1000	1000	1000	1000	1000	1000	1000	1000	5434	1256	1000	1000
4 full-time men 2/			668	668	668	668	668	668	668	668	668	668	668	668
Remainder			332	332	332	332	332	332	332	332	4766	588	332	332
3 partners 3/			332	332	332	332	332	332	332	332	450	450	332	332
Remainder to be hired			0	0	0	0	0	0	0	0	4316	138	0	0
		-dollars-												
Labor costs														
3 partners 4/		33000	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750
4 full-time men 5/		33280	2773	2773	2774	2773	2773	2774	2773	2773	2774	2773	2773	2774
Part-time hired or overtime 6/		17816									17264	552		
1 secretary 7/		6600	550	550	550	550	550	550	550	550	550	550	550	550
Total		90696	6073	6073	6074	6073	6073	6074	6073	6073	23338	6625	6073	6074

(See next page for footnotes.)

Appendix Table C.10 (cont'd.)

1/ 2.0 hrs/head marketed/yr.

2/ Put in 40 hrs/wk, 50 wks/yr.

3/ Much of the time spent by the 3 partners is allocated to performance of the management function. But they provide 332 hours of manual labor per month during regular months and 450 hours during September and October.

4/ $11,000/yr/partner for family living expenses.

5/ $8320/man/yr.

6/ $4.00/hr.

7/ $6600/yr.

Source: Appendix Table C.1, Van Arsdall [58] and Henderson [31].

APPENDIX D

Investments and Annual Costs

Appendix Table D.1 Investments and annual costs for synthesized 80-cow dairy operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Cold-covered unit with free stalls and mechanical feeding	20,500	27,550	15	1,838	69	344
Milking parlor and equipment including bulk tank (double-4 herringbone)	22,600	30,373	15	2,026	76	380
Liquid manure system (storage tanks, pump, and agitator)	7,200	9,676	15	645	24	121
Feed storage						
2 24x60 concrete silos	18,030	24,231	15	1,616	61	303
1 18x40 concrete silo	4,260	5,725	15	382	14	71
(above silos include roof but not unloader)						
Subtotal	72,590	97,555		6,507	244	1,219
Machinery 1/						
Tractor (60 DBHP)	6,750					
Tractor (45 DBHP)	4,950					
Stalk chopper (2-row)	810					

Appendix Table D.1 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Plow (4 - 14")	1,530					
Disc (13')	1,260					
Harrow (2 14' sections)	648					
Planter (4-row w/attachments)	1,800					
Cultivator (4-row)	855					
Rotary hoe (4-row)	463					
Sprayer (4-row)	558					
Field cultivator (12 1/2')	630					
2 grain-silage wagons (220 bu)	3,060					
Windrower (12' w/conditioner)	4,500					
Chopper (w/2-row corn head)	3,240					
Blower	625					
Mounted picker-sheller (2-row)	3,150					
Alley scraper	3,780					
Solid manure spreader	900					
Liquid manure spreader	1,530					
1 18' silo unloader	1,422					
1 24' silo unloader	2,016					
Alfalfa drill (10')	765					
Tools and miscellaneous	450					
1/2 ton pickup	2,160					
Subtotal	47,852	64,308	8	8,038	161	---

Appendix Table D.1 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Land - 240 acres ($350/acre) 69 acres corn grain 82 acres corn silage 71 acres haylage 222 acres tillable	84,000	112,889	—	—	—	1,411
Dairy herd (valuing 1 cow and replacement at $500)	40,000	40,000	4	5,000	100	
Total	244,442	314,752		19,545	505	2,630

1/ Reflects a discount of 10% off list price on machinery.

Source: Hoglund, et. al. [33], Hoglund, et. al. [34], Connor, et. al. [41], Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.2 Investment and annual costs for synthesized 200-cow dairy operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Cold-covered unit with free stalls and mechanical feeding	50,500	67,868	15	4,527	170	848
Milking parlor and equipment including bulk tank (double-8 herringbone)	33,800	45,424	15	3,030	114	568
Liquid manure system (storage tanks, pump, and agitator)	15,700	21,100	15	1,407	53	264
Feed storage						
4 24x70 concrete silos	39,400	52,950		3,532	132	662
1 24x60 concrete silo	8,750	11,760		784	30	147
(above silos include roof but not unloader)						
Subtotal	148,150	199,102		13,280	162	2,489
Machinery 1/						
Tractor (75 DBHP)	7,200					
Tractor (60 DBHP)	6,750					
Tractor (45 DBHP)	4,950					

Appendix Table D.2 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Stalk chopper (3-row)	1,080					
Plow (5 - 14")	1,800					
Disc (19')	1,980					
Harrow (2 20' sections)	1,008					
Planter (6-row w/attachments)	2,340					
Cultivator (6-row)	1,350					
Rotary hoe (6-row)	864					
Sprayer (6-row)	720					
Field cultivator (20')	1,485					
3 grain-silage wagons (220 bu)	4,590					
Windrower (14' w/conditioner)	6,750					
Mounted picker-sheller (2-row)	3,510					
Blower	625					
S.P. chopper w/2-row corn head	9,324					
Alley scraper	4,320					
Solid manure spreader	1,152					
Liquid manure spreader	1,620					
3 silo unloaders (24')	6,048					
Alfalfa drill (12')	832					
Pickup truck (1 ton)	2,520					
Tools and miscellaneous	720					
Subtotal	73,538	98,829	8	12,354	247	---

Appendix Table D.2 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Land - 600 acres ($350/acre) 172 acres corn grain 178 acres corn silage 204 acres haylage 554 tillable acres	210,000	282,223	—	—	—	3,528
Dairy herd (valuing 1 cow and replacement at $500)	100,000	100,000	4	12,500	250	—
Total	531,688	680,154		38,134	996	6,017

1/ Reflects a discount of 10% off list price on machinery.

Source: Hoglund, et. al. [33], Hoglund, et. al. [34], Connor, et. al. [41], Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.3 Investment and annual costs for synthesized 1000-cow dairy operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Pole barns of galvanized steel w/concrete lot, free stalls, fence-line bunks, waterer, all-weather road	179,000	240,562	15	16,045	601	3,007
Milking facility (including bulk tanks)	90,000	120,953	15	8,068	302	1,512
Feed storage						
Horizontal silos ($3/ton)	48,000	64,508	15	4,303	161	806
5 24x50 concrete silos w/roofs	36,500	49,053	15	3,272	123	613
Subtotal	353,500	475,076		31,688	1,187	5,938
Machinery 1/						
Tractor (120 DBHP)	11,390					
Tractor (100 DBHP)	9,860					
Tractor (60 DBHP)	6,375					
2 tractors (45 DBHP)	9,350					
Plow (7 14")	2,338					
Plow (8 14")	2,550					
Disc (28')	2,423					
2 field cultivators (20')	2,805					
Harrow (3 15' sections)	880					

Appendix Table D.3 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Planter (8-row w/attachments)	2,550					
2 cultivators (8-row)	3,400					
Rotary hoe (8-row)	1,012					
Sprayer (8-row)	876					
2 combines (4-row head)	36,380					
2 grain-silage trucks (3 ton w/400 bu capacity)	9,350					
6 grain-silage wagons (220 bu)	8,670					
2 pickup trucks (3/4 ton)	4,760					
Chopper (self-propelled w/6' pickup)	8,245					
Windrower (16' w/conditioner)	6,375					
4-row corn head for chopper	2,125					
Blower	591					
2 self-unloading boxes for trucks	3,740					
Tractor (45 hp w/loader)	5,610					
3 manure spreaders (220 bu)	5,508					
Tractor unloader for horizontal silo	1,020					
Alfalfa drill (16')	978					
2 manure loaders	1,870					
Tools and miscellaneous	1,275					
Subtotal	152,303	204,683	8	25,584	512	---

Appendix Table D.3 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Land - 3000 acres ($350/acre)	1,050,000	1,411,116	--	---	---	17,639
860 acres corn grain						
889 acres corn silage						
1020 acres haylage						
2769 tillable acres						
Dairy herd (valuing 1 cow and replacement at $500)	500,000	500,000	4	62,500	1,250	---
Total	2,055,803	2,590,875		119,772	1,699	23,577

1/ Reflects a discount of 15% off list price for machinery.

Source: Hoglund, et. al. [33], Hoglund, et. al. [34], Connor, et. al. [41], Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.4 Investment and annual costs for synthesized 640-acre cash grain operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Grain drying and storage						
Leg (1200 bu/hr)	2,000					
Pit	1,000					
Wet storage hopper bin (1500 bu)	750					
Continuous flow dryer (300 bu/hr when removing 5% moisture)	6,000					
Storage (45,000 bu)	18,000					
Subtotal	27,750	37,294	15	2,486	93	466
Machinery 1/						
Tractor (85 DBHP)	8,190					
Tractor (60 DBHP)	6,750					
Stalk chopper (4-row)	1,260					
Plow (6 14")	2,070					
Disc (19')	1,980					
Field cultivator (20')	1,485					
Harrow (2 20' sections)	1,008					
Planter (6-row w/attachments)	2,340					
Cultivator (6-row)	1,350					
Rotary hoe (6-row)	864					
Sprayer (6-row)	720					
Combine (13')	13,050					

Appendix Table D.4 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Corn head (3-row)	2,790					
Elevator (60')	787					
3 gravity grain boxes (300 bu)	2,484					
Pickup truck (1/2 ton)	2,160					
Tools and miscellaneous	450					
Subtotal	49,738	66,485	8	8,356	167	---
Land - 640 acres ($550/acre)	352,000	473,060	--	---	---	3,162
450 acres corn						
150 acres soybeans						
600 acres tillable						
Total	429,488	564,096		10,842	260	3,628

1/ Reflects a discount of 10% off list price for machinery.

Source: Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.5 Investment and annual costs for synthesized 1680-acre cash grain operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Grain drying and storage						
Leg (2000 bu/hr)	4,000					
Pit	1,500					
Wet storage hopper bin (4000 bu)	2,000					
Continuous flow dryer (700 bu/hr when removing 5% moisture)	12,000					
Storage (125,000 bu)	43,750					
Subtotal	63,250	85,003	15	5,670	213	1,063
Machinery 1/						
Tractor (120 DBHP)	11,390					
Tractor (100 DBHP)	9,860					
2 tractors (60 DBHP)	12,750					
Plow (7 14")	2,338					
Plow (8 14")	2,805					
Disc (28')	2,423					
2 field cultivators (20')	2,805					
Harrow (3 15' sections)	880					
Planter (8-row 2/attachments)	2,550					
2 cultivators (8-row)	2,550					
Rotary hoe (8-row)	3,400					
Sprayer (8-row)	1,012					
2 combines (14')	29,240					

Appendix Table D.5 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
2 corn heads (4-row)	7,140					
Elevator (60')	744					
5 gravity flow grain wagons (300 bu)	3,910					
Grain truck (3 ton w/400 bu capacity)	4,675					
Pickup truck (3/4 ton)	2,295					
Tools and miscellaneous	680					
Subtotal	101,770	136,771	8	17,113	342	---
Land - 1680 acres ($550/acre)	924,000	1,241,782	---	---	---	15,522
1200 acres corn						
400 acres soybeans						
1600 tillable acres						
Total	1,089,020	1,463,556		22,783	555	16,585

1/ Reflects a discount of 15% off list price for machinery.

Source: Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.6 Investment and annual costs for synthesized 4160-acre cash grain operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Grain drying and storage						
2 legs (3000 bu/hr each)	12,000					
Pit	2,000					
Wet storage hopper bin (10,000 bu)	5,000					
2 continuous flow dryers (700 bu/hr each taking out 5%)	24,000					
Storage (300,000 bu)	90,000					
Subtotal	133,000	178,741	15	11,922	447	2,234
Machinery 1/						
2 tractors (120 DBHP)	21,440					
2 tractors (100 DBHP)	18,560					
2 tractors (60 DBHP)	12,000					
2 plows (8 14")	5,280					
2 plows (7 14")	4,400					
2 discs (28')	4,560					
Harrow (4 15' sections)	1,056					
2 planters (12-row)	8,960					
2 cultivators (12-row)	4,800					
Rotary hoe (12-row)	2,760					
2 sprayers (12-row)	1,720					
3 combines (16')	41,280					

Appendix Table D.6 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
3 corn heads (6-row)	14,640					
3 grain trucks (3 ton w/400 bu capacity)	13,200					
6 gravity flow grain wagons (300 bu)	4,416					
2 pickup trucks (1 ton)	4,480					
2 field cultivators (30')	3,520					
Tools and miscellaneous	1,200					
Subtotal	168,272	226,144	8	28,268	565	—
Land - 4160 acres ($550/acre)	2,288,000	3,074,889	—	—	—	38,436
3000 acres corn						
1000 acres soybeans						
4000 tillable acres						
Total	2,589,272	3,479,774		40,190	1,012	40,670

1/ Reflects a discount of 20% off list price.

Source: Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.7 Investment and annual costs for synthesized 375 head/yr beef-feeding operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Controlled environment building including ventillation, liquid manure, water system and mechanization (250 head capacity)	53,500	71,900	15	4,796	180	899
Feed storage						
2 24x70 concrete silos	20,300	27,282	15	1,819	68	341
1 20x50 concrete silo	5,800	7,795	15	519	20	97
(above silos include roof but not unloader)						
Subtotal	79,600	106,977		7,134	268	1,337
Machinery 1/						
Tractor (60 DBHP)	6,750					
Tractor (45 DBHP)	4,950					
Stalk chopper (2-row)	810					
Plow (4 14")	1,530					
Disc (13')	1,260					
Harrow (2 14' sections)	648					
Planter (4-row w/attachments)	1,800					
Cultivator (4-row)	855					
Rotary hoe (4-row)	464					
Sprayer (4-row)	558					
Silo unloader (24')	2,016					

Appendix Table D.7 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Silo unloader (20')	1,476					
2 grain silage wagons (220 bu)	3,060					
Chopper (w/2-row head)	3,240					
Blower	626					
Liquid manure spreader	1,530					
Solid manure spreader	900					
Field cultivator (13')	630					
Pickup truck (1/2 ton)	2,160					
Tools and miscellaneous						
Subtotal	35,263	47,390	8	5,924	118	---
Land - 200 acres ($450/acre)	90,000	120,953	---	---	---	1,512
103 acres corn grain						
89 acres corn silage						
192 acres tillable						
Total	204,863	275,320		13,058	386	2,849

1/ Reflects a discount of 10% off list price for machinery.

Source: Van Arsdall [57 and 60], Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.8 Investment and annual costs for synthesized 900 head/yr beef-feeding operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Galvanized steel pole barn (open front) w/concrete lot, fence-line bunks, water system (300 head capacity)	27,300	36,689	15	2,447	92	459
Controlled environment building including ventilation, liquid manure, water system, mechanization (300 head capacity)	63,000	84,667	15	5,647	212	1,058
Feed storage						
3 30x70 concrete silos	47,850	64,307	15	4,289	161	804
2 20x60 concrete silos	12,750	17,135	15	1,143	43	214
(above silos include roofs but not unloader)						
Subtotal	150,900	202,798		13,526	508	2,535
Machinery 1/						
Tractor (75 DBHP)	7,200					
Tractor (60 DBHP)	6,750					
2 tractors (45 DBHP)	9,900					
Manure loader	990					

Appendix Table D.8 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Stalk chopper (4-row)	1,260					
Plow (5 14")	1,800					
Disc (19')	1,980					
Harrow (2 20' sections)	1,008					
Planter (6-row w/attachments)	2,340					
Cultivator (6-row)	1,350					
Sprayer (6-row)	720					
4 grain-silage wagons						
(220 bu, feeding & hauling)	4,590					
Field cultivator (20')	1,485					
Chopper (2-row head)	3,510					
Blower	626					
Combine w/3-row corn head	15,390					
Liquid manure spreader	1,620					
2 solid manure spreaders						
(220 bu)	3,888					
Silo unloader (30')	2,160					
Silo unloader (20')	1,476					
Pickup truck (1/2 ton)	2,160					
Pickup truck (1 ton)	2,520					
Tools and miscellaneous	720					
Subtotal	75,443	101,390	8	12,674	253	—

Appendix Table D.8 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Land - 480 acres ($450/acre) 248 acres corn grain 213 acres corn silage 461 acres tillable	216,000	290,287				3,629
Total	442,343	594,474		26,200	761	6,164

1/ Reflects a discount of 10% off list price for machinery.

Source: Van Arsdall [57 and 60], Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

Appendix Table D.9 Investment and annual costs for synthesized 6000-head/year beef-feeding operation

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Galvanized steel pole barns w/concrete lot, water system, fence-line bunks	364,000	489,187	15	32,629	1,223	6,115
Feed storage						
Horizontal silo ($2.50/ton)	63,900	85,876	15	5,728	215	1,073
Feed room plus 1 week corn and supplement storage	7,600	10,214	15	681	25	128
Subtotal	435,500	585,277		39,038	1,463	7,316
Machinery 1/						
2 tractors (60 DBHP)	12,750					
2 tractors (45 DBHP)	9,350					
2 manure loaders	1,870					
2 grain-silage trucks (3 ton w/400 bu capacity)	9,350					
2 self-unloading trucks (2 ton, 220 bu, feeding and hauling)	10,200					
S.P. chopper w/4-row head	9,860					
4 manure spreaders (220 bu)	7,344					
Horizontal silo unloader	1,020					
2 pickup trucks (1 ton)	4,760					
Tools and miscellaneous	1,275					
Subtotal	67,779	91,090	8	11,386	228	---

Appendix Table D.9 (cont'd.)

Item	Approximate 1970 investment	Estimated 1980 investment	Estimated life	Annual depreciation	Insurance (.25%/$ valuation)	Real estate tax ($1.25/$100 valuation)
Land (including improved roads) 40 acres $1000/acre	40,000	53,757	--	---	---	672
Total	543,279	730,124		50,424	1,691	7,988

1/ Reflects a discount of 15% off list price for machinery.

Source: Van Arsdall [57 and 60], Official Guide, Tractors and Farm Equipment [47], and price lists from input suppliers.

APPENDIX E

Income and Expense Statements for Synthesized Units

Appendix Table E.1 Income and expense statements for synthesized dairy operations

Item	80 cow	200 cow	1000 cow
Gross income			
Milk sales (15,000 lb/cow/yr at $6/cwt)	72,000	180,000	900,000
Cull cows (25% cull rate) $200/hd	4,000	10,000	50,000
2-yr olds ($200/hd)	600	1,600	8,000
Yearlings ($160/hd)	1,440	3,520	17,600
Calves ($30/hd)	1,200	3,000	15,000
Total	$79,240	$198,120	$990,600
Purchased feed			
SBOM ($100/ton)	2,040	5,100	25,500
Urea ($110/ton)	704	1,760	8,800
Total	$2,744	$6,860	$34,300
Dairy expenses			
Breeding ($12/cow/yr)	960	2,400	12,000
Veterinary medicine ($14/cow/yr)	1,120	2,800	14,000
Utilities ($13/cow/yr)	1,040	2,600	13,000
Dairy supplies ($6/cow/yr)	480	1,200	6,000
Milk testing ($7/cow/yr)	560	1,400	7,000
Bedding ($5/cow/yr)	400	1,000	5,000
Dairy equipment expense ($3/cow/yr)	240	600	3,000
Feed handling ($7/cow/yr)	560	1,400	7,000
Manure handling ($6.50/cow/yr)	520	1,300	6,500
Milk and cow marketing expense ($65/cow/yr)	5,200	13,000	65,000
Building maintenance ($7/cow/yr)	560	1,400	7,000
Total	$11,640	$29,100	$145,500

Appendix Table E.1 (cont'd.)

Item	80 cow	200 cow	1000 cow
Crop expense			
Haylage	1,460	3,633	18,166
Corn silage	2,785	7,173	33,453
Corn grain	2,876	7,233	30,134
Total	$7,121	$18,039	$81,753
Hired labor			
Partners	11,000	22,000	33,000
Milkers	3,120	12,480	116,790
General full-time			49,920
Hourly labor	2,724	6,236	23,508
Secretarial			13,200
Total	$16,844	$40,716	$236,418
Insurance	505	996	1,699
Taxes	2,630	6,017	23,577
Interest on operating capital (8% on variable crop costs for 6 mos.)	285	722	3,270
Total variable expense	41,769	102,450	526,517
Net before depreciation	37,471	95,670	464,083
Depreciation	19,545	38,134	119,772

Appendix Table E.1 (cont'd.)

Item	80 cow	200 cow	1000 cow
Net before income taxes	17,926	57,536	344,311
Taxes 1/	6,217	20,383	165,338
Net after taxes	11,709	37,153	178,973

1/ Includes Federal and State taxes, workmen's compensation, franchise fees, and social security payments.

Appendix Table E.2 Income and expense statements for synthesized cash grain operations

Item	640 acre operation	1680 acre operation	4160 acre operation
Gross income			
Corn ($1/bu, 125 bu/acre yield)	56,250	150,000	375,000
Soybeans ($2.25/bu, 40 bu/acre yield)	13,500	36,000	90,000
Total	$69,750	$186,000	$465,000
Crop expense			
Corn	18,922	42,048	96,840
Soybeans	4,275	10,024	23,310
Total	$23,197	$52,072	$120,150
Drying expense (7¢/bu for corn)	3,937	10,500	26,250
Hired labor			
Partners	11,000	22,000	33,000
General full-time			16,640
Hourly	3,149	6,538	18,080
Secretarial			6,600
Total	$14,149	$28,538	$74,320
Insurance	260	555	1,012
Taxes	3,628	16,585	40,670
Interest on operating capital (8%)			
Crop expense (ave. 6 mos.)	928	2,083	4,810
Hired labor (ave. 3 mos.)	283	571	1,486
Total	$1,211	$2,654	$6,296

Appendix Table E.2 (cont'd.)

Item	640 acre operation	1680 acre operation	4160 acre operation
Total variable expense	46,382	110,904	268,698
Net before depreciation	23,368	75,096	196,302
Depreciation	10,842	22,783	40,190
Net before income tax	12,526	52,313	156,112
Taxes 1/	5,270	20,080	68,702
Net after taxes	7,256	32,233	87,410

1/ Includes Federal and State taxes, workmen's compensation, franchise fees, and social security payments.

Appendix Table E.3 Income and expense statements for synthesized beef-feeding operations

Item	375 head operation	900 head operation	6000 head operation
Gross income			
Sale of 1000 lb steers ($30/cwt)	112,500	270,000	1,800,000
Minus death loss (1% purchase price of feeders)	540	1,296	8,640
Minus purchase of 450 lb feeders ($32/cwt)	54,000	129,600	864,000
Adjusted gross income	$57,960	$139,104	$927,360
Purchased feed			
Corn grain ($1.05/bu)			173,250
Corn silage ($6/ton in field)			153,450
64% protein supplement ($120/cwt)	6,840	16,320	108,960
Total	$6,840	$16,320	$435,660
Beef expense			
Veterinary medicine ($3.50/hd/yr)	1,312	3,150	21,000
Utilities ($4/hd/yr)	1,500	3,600	24,000
Bedding ($8/hd/yr if have open-lot housing)	—	3,600	48,000
Feed handling ($5.50/hd/yr)	2,063	4,950	33,000
Manure handling ($4.50/hd/yr)	1,688	4,050	27,000
Freight ($3/hd/yr)	1,125	2,700	18,000
Building maintenance ($1.50/hd/yr)	562	1,350	9,000
Total	$8,250	$23,400	$180,000

Appendix Table E.3 (cont'd.)

Item	375 head operation	900 head operation	6000 head operation
Crop expense			
Corn grain	4,293	10,428	---
Corn silage	3,491	8,584	---
Harvesting corn silage (if buy silage in field, have $6.50/acre expense for repairs, fuel, oil, grease)	---	---	9,236
Total	$7,784	$19,012	$9,236
Hired labor			
Partners	11,000	22,000	33,000
Full-time labor	---	---	33,280
Part-time labor	897	2,559	17,816
Secretarial	---	---	6,600
Total	$11,897	$24,559	$90,696
Insurance	386	761	1,691
Taxes	2,849	6,164	7,988
Interest on operating capital (8%)			
Feeders (ave. 8 mos.)	2,878	6,908	46,051
Purchased feed (ave. 4 mos.)	183	436	11,632
Beef operating expense (ave. 4 mos.)	220	625	4,806
Crop expense (ave. 6 mos.)	311	760	369
Hired labor (ave. 4 mos.)	318	655	2,419
Total	$3,910	$9,384	$65,277

Appendix Table E.3 (cont'd.)

Item	375 head operation	900 head operation	6000 head operation
Total variable expense	41,916	99,600	790,548
Net before depreciation	16,044	39,504	136,812
Depreciation	13,058	26,200	50,424
Net before income taxes	2,986	13,304	86,388
Taxes 1/	2,684	7,174	34,464
Net after taxes	302	6,130	51,924

1/ Includes Federal and State taxes, workmen's compensation, franchise fees, and social security payments.