

THE UNIVERSITY OF MANITOBA

THE IMPACT OF AGRICULTURAL CREDIT USE
ON THE FINANCIAL PROGRESS OF THE FARM FIRM
IN WESTERN MANITOBA 1961-69

by

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ABSTRACT

This was a study on the impact of agricultural credit use on the financial progress of the farm firm. The analysis was made on the data obtained from the business record of twenty-seven charter members of the Western Manitoba Farm Business Association. These farms had kept fairly accurate records of their farm business for the years 1961-69 consecutively.

The objective of the study was to examine and evaluate some of the factors influencing the financial progress of the farm firms and to suggest guidelines for better credit use by farmers and for policy makers in their efforts to reduce the rate of decline in the number of farm firms in Western Manitoba.

An econometric model was constructed for evaluating the factors that influence financial progress and capital investment. Farm assets and gross profits were the dependent variables in the regression equations. Beginning farm assets, amount of credit used, number of improved acres farmed, level of investment in livestock, level of investment for machinery and equipment and investments in crops and farm building were the independent variables. The financial progress function and investment function were quantified using the ordinary least squares regression technique. The parameters or regression coefficients indicated the magnitude of the influence that the specific factors had on the financial progress of the farm firms.

Results of the analysis of the data from the farms in Western Manitoba indicated that there was considerable advancement in the financial

progress of the farm firms throughout the study period 1961-69. The farm firms were found to have increased their assets considerably through increased use of credit. Additional investments in improved acreage and crop enterprise were found to have increased farm profits significantly.

The econometric results indicated that additional use of non-equity capital increased the rate of financial progress. The results also indicated that family consumption did not constitute a significant factor in the growth process of the farm firms. Investment in machinery and equipment, availability of credit and the average number of improved acres farmed were found to be significant factors influencing the financial progress of the farm firms. Initial farm assets and livestock production were not found to be significant variables in the growth process of the family farm business.

In general, the analysis indicated that there is a high correlation between farm earnings and size of the farm business so that managerial ability of the operator as expressed in the efficient allocation of resources between farm enterprises become crucial to the growth process. While it is apparent that adequate non-equity capital should be readily available in sufficient amounts to farm operators, it is also obvious that availability of adequate credit alone may not ensure the success of farm enterprises. The rate of decline in the number of family farms in Western Manitoba may be reduced much more effectively by programmes designed to eliminate credit rationing barriers at both institutional and individual farm levels. More importantly, an educational programme aimed specifically at improving the managerial ability of farm operators should be accorded some priority in farm development programmes.

CHAPTER I

INTRODUCTION

Agriculture is a major component of Manitoba's economy. This fact is recognized by the government as demonstrated by several policies being formulated to prevent the contributory capacity of the agricultural sector of Manitoba's economy from declining. Many research projects have been undertaken over the past several years in an effort to help farmers improve their allocation of resources. Economic growth of the province depends to a large extent on how well resources are utilized. Credit availability plays a crucial role in determining the flexibility and mobility of resources for increasing productivity and raising levels of living. Agricultural development, an essential component of Manitoba's economic growth, depends considerably on the credit facilities available to farm firms.

To meet the growing need for increased capital investment in agriculture, credit agencies have been set up to cater to farm firms at both the national and provincial levels. Commercial lenders such as banks as well as non-commercial lending agencies such as merchants and dealers have all extended more credit to the farm firms during the past decade than in previous decades.¹ Over these years, although more credit has been made available to farm firms, there has been a gradual but steady decline in the number of farm firms in Manitoba, (this is also the case in other provinces). It might then

¹ Federal Farm Credit and Related Statistics, 1971, 1972, also Mooney, F.A.R.S. Rust, An Investigation of Farm Credit on Commercial Farms, Dept. of Ag. '68.

be asked, has the amount of credit available been adequate? Have the financing limitations deterred farm firms from attaining an economically viable organization?

THE PROBLEM

There have been many structural changes in farming over time. While forces pushing toward changes come from many directions, they all tend to indicate increased capital requirements by farm firms. Changes in the technology of production and in the non-farm economy have imposed a need for major adjustments on the farm firm. The dominating changes resulting from technology have been increases in mechanization and in the use of non-farm resources of fertilizer and other inputs, all of which have led to increased capital requirements by the farm firm. In the non-farm economy, inflation has increased the price of farm inputs but has failed to increase commensurably the price of farm products.² The rising costs of farm inputs (land, labour, capital) have caused the average farm size to increase in order to reduce unit costs of output.

Although farm cash receipts increased by 6 percent per year during the 1961-68 period, only 4 percent of the increase was real growth.³ During the same period, farm operating expenses increased by 6.7 percent per year, the largest part of which, 4.6 percent, was due to price increases.⁴ Also in 1961, the average capital investment per farm was \$27,363 but this soared

²Baker, C.B., G.D. Irwin, Effects of Borrowing on Farm Organization, Bulletin 671, University of Illinois Agricultural Experiment Station, 1961, p. 2.

³Brake, John R., Future Capital and Credit Needs of Canadian Agriculture, Dept. of Agricultural Economics, University of Guelph, No. AE70/3, p. 8.

⁴Ibid., p. 9.

to \$54,422 in 1968 and it is expected to be about \$111,100 by 1980.⁵

Under these conditions of a high level of competition within agricultural industry (survival of the fittest), rapid innovation and falling farm income, the farm firm should find it necessary to look for ways to reduce costs, not just to increase profits but also to stay in business.

Successful farming, in light of increasing input costs, necessitates the use of resources -- management, labour, land and capital in the best possible combination. To attain maximum profit, resources should be combined to the point where the ratio of the marginal value productivity (MVP) of input K to the marginal factor cost (MFC) of input K is equal to the same ratios for all resources

$$\frac{MVP_K}{MFC_K} = \frac{MVP_L}{MFC_L} = \dots = \frac{MVP_N}{MFC_N}$$

It is unlikely that this optimum combination of resources exists on the majority of the farm firms in Manitoba.

In 1961, there were 33,522 commercial farms in Manitoba but in 1966, the number was down to 27,372 and it declined further to 25,336 by 1971.⁶ This trend is expected to continue. For the farm firm to survive as a way of life, it is necessary that some labour-saving or output-increasing

⁵Ibid., p. 12.

⁶Dominion Bureau of Statistics, Census of Canada, 1961, '66 and '71. In the 1966 census, a commercial farm is defined as ". . . a holding of one or more acres with a value of sales of agricultural products, in the 12 months prior to the census, of \$2,500 or more . . .". No such definition was given in the 1971 census but farms are classified by type based on 51 percent value of sales from an enterprise.

items be purchased, either of which require considerable amounts of capital outlay. Such high capital requirements indicate that the economic survival of the farm firm will be dependent to a considerable extent on the amount of non-equity capital (credit) available for use in the farm business. Assuming a profit maximization behaviour, the function of agricultural credit is to help the farmer attain an optimum combination of resources which otherwise would be out of reach financially.

More specifically, some of the main functions of credit used by the farm firm may be distinguished, singularly or in combination as:

1. To increase output -- credit enables a farmer with limited capital resources of his own to acquire more productive assets than otherwise possible. This allows him to achieve a better combination of resources permitting greater production efficiency either through intensification of the existing unit or by extensification of the farm business.
2. To reduce unit costs -- because credit enables the farmer to have control over more resources (by expanding the size of the farm firm), the income stream can be increased. This enables or facilitates the purchase of additional machinery and/or buildings, which have the potential to reduce labour costs or other operating costs.
3. To reduce risk and uncertainty -- farmers are often averse to risk-taking and may use credit to reduce the risk element in farm operations. For example, additional credit for the purchase of larger harvesting equipment reduces the risk of crop loss due to weather by increasing harvesting capacity. It may be argued that there may be no financial improvement attributable to the extra credit in normal years, but substantial benefits may accrue in

unfavourable years. Thus the additional credit provides a form of insurance. Direct crop insurance is available to farmers but this too requires additional capital.

4. To improve working conditions -- additional credit could be used to improve working conditions so that more leisure time is available to the farm operator although there may be no increase in real productivity.

Thus a viable farm firm appears to be highly dependent on a continuous adjustment process which favours increased capital utilization for land, buildings, livestock and more sophisticated labour saving machinery. At the farm level, three sources of capital are possible⁷ -- net farm income, non-farm income and credit, of these, credit use in one form or another appears to be the most viable source of capital for the farm firm.

This situation is recognized by both the private lending agencies and government credit institutions which have increased the limits of credit extended to the farm firm in recent years. Manitoba's farmers who sought credit and were found qualified, received an average of \$25,586 in credit extended per year during the period 1969 to 1972 from the Farm Credit Corporation alone.⁸ At the same time however, the number of farm firms has continued to decline indicating a trend toward fewer but larger farms.

Having established the necessity for the availability of adequate credit to the farm firm and the appropriate measures taken by the lending institutions in that direction, it becomes readily apparent that successes

⁷ Parvin, Robert G., Credit Used by New York State Dairymen, Dept. of Agric. Economics, Cornell University, Ithaca, New York 1965, p. 7.

⁸ Federal Farm Credit and Related Statistics, 1972, p. 38.

and failures of farm financial management involve more than just credit extension. The advent of capital intensive agriculture has necessitated the treatment of the production, investment, and financial decisions as an integrated process. Production decision requiring the purchase of additional inputs must be based not only on input productivity but on a factor's capacity to repay and the availability of credit for such purchases.⁹ It is obvious that there are other factors besides availability of credit that are related to the success or failure of the farm firm. An examination of these factors would be useful in pinpointing some of the factors responsible for the rapid rate of decline in the number of farm firms in the province.

OBJECTIVES OF THE STUDY

The general objective of this study was to develop a quantitative model to evaluate the impact of credit-use on the growth of selected farm firms in Western Manitoba during the period 1961 to 1969. Specifically, the following objectives were pursued:

1. To identify factors which influence the financial success of selected farm firms using credit during the period of study.
2. To study the structure of resource allocation at the individual farm level by examining the sources of capital, allocation of the capital within the farm firm and the effects on the farm firm's productivity and growth.
3. To evaluate the level of non-equity capital investment (i.e. credit use) in relations to output and then determine the relationship

⁹Johnson, R.B., "Agricultural Loan Evaluation with Discriminant Analysis", (Unpublished Ph.D. Thesis, University of Missouri, 1969), p. 6.

between credit use and growth of the farm firm.

4. To suggest means or develop guidelines for an effective and desirable credit policy.

Hypotheses

This study is based on the following hypotheses:

1. That all farmers face some credit rationing. The implication of this hypothesis is that farmers face both external and internal credit rationing. This situation exists when the institutional constraints prevent the farmer from borrowing or limit the amount he can borrow. Specifically, external credit rationing is said to exist when the borrower has exhausted all sources of loanable funds but still finds the marginal value product of borrowing to exceed the marginal cost of borrowing (i.e. both interest and non-interest costs). However, underinvestment could also be due to internal credit rationing. It means that the farmer has decided to limit the investments on his farm to the existing level even though financial resources are available to him for additional investments. Such financial resources could be from farm earnings or may be from external sources -- credit lending agencies. This attitude may be attributable to the following reasons: (a) he may find it more profitable to invest his funds in activities other than farm production, (b) he might consider that the risk associated with additional investment outweighs the expected return, and (c) he might be psychologically averse to borrowing.

2. Growth of the farm firm is positively related to the amount of credit used. Growth in productivity of resources occurs through the

adoption of modern inputs like improved seed, modern machinery and improved practices. Use of these inputs is assumed to result in increased expenditures -- both operating expenses and fixed costs. The inability of the farm firm to use credit for the purchase of an optimum level of inputs either due to risk aversion or uneconomic management decisions, acts as a constraint on the growth of the farm firm.

3. Capital accumulation is positively related to the beginning farm assets. Traditionally, most financial institutions have made agricultural loans on the basis of the "three C's" of credit -- character, collateral, and capacity to repay. However, emphasis has usually been placed on the security of the loan (good collateral). Thus a high equity/capital ratio places the farmer at an advantage compared to another farmer with low equity/capital ratio in the farm business.

Also, in periods of favourable market conditions, the farm firm with large capital assets can take advantage of high prices due to existing productive capacity. Productive capacity will act as a constraint on the amount of income that can accrue to the farm firm with relatively small working assets.

The above three hypotheses will be tested using the technique of multiple regression analysis to analyze the effects of beginning assets, acreage, operating expenses and the amount of credit used, on growth.

The following chapter will review some studies of farm growth in North America. Theoretical considerations relevant to the growth of the farm firm will also be discussed. Chapter III will examine the physical characteristics of Western Manitoba and the economic conditions of the farms

during the study period. Chapter IV will deal with the model to be used in analyzing the data. Chapter V will be devoted to the interpretation of the regression analysis. The final chapter will include a summary, conclusions and implications of the results.

CHAPTER II

CONCEPTUAL FRAMEWORK

Review of Literature

Growth of the farm firm measured in terms of capital accumulation as a result of the impact of credit use on the farm organization is the essence of this study. This implies a growth process resulting from the optimum use of credit.

Gillis (1972)¹

In a capital accumulation study of Carman area of Manitoba, Gillis found that the farm firms have grown remarkably throughout the period 1957-67. In a regression model, using the Cobb-Douglas production function, it was found that there was a 240 percent increase in the value of gross output over the period of study. Parameters were estimated for the relationship between net income and capital inputs, labour, managerial ability and technology. A close association was found to exist between the gross value of production and net farm income which was directly related to level of living. The study indicated that the farm firms sampled had an average growth of 4.3 percent in equity capital during the period of study. Solow's model was used to estimate the two and three stage production function in the analysis of the impact of technological change on the growth process. Availability of credit, current farm earnings and the net worth position at the base period were some of the important factors in the acquisition of

¹Gillis, R.J., "Growth of the Family Farm Business in Carman Area of Manitoba", Unpublished M.Sc. Thesis, University of Manitoba, 1972.

capital. A one dollar increase in each of credit, savings and previous net worth were found to increase capital investment by \$.94, \$1.57 and \$.55 respectively. There was however no attempt to quantify the influence of managerial ability on the growth process.

Kulshreshtha and McGlaughlin²

An economic evaluation of Prairie farms under longterm credit situation was made in the study covering a four year period. The data used in the study consisted of 692 farms selected from a list of Federal Credit Corporation borrowers. The sample was stratified into four sub-groups for reduction of heterogeneity within the sample.

Viz

- I. Province
- II. Province - Economic Class (initial assets level)
- III. Province - Enterprise - Economic Class
- IV. Province - off-farm income

Manitoba farms were further stratified into four asset level categories:

	No.
Less than \angle \$40,000	23
\$40-50,000	27
\$55-70,000	20
\$70,000 +	30

Capital accumulation during the period of study was found to be determined by many factors --

² Kulshreshtha, Surenda N., Glen R. McGlaughlin, Financial Performance of Prairie Farms, Technical Bulletin BL: 72-12 Department of Agricultural Economics, University of Saskatchewan, 1972.

$$F = f(\text{FAS}_{t_1}, \text{IOA}_t, \text{LS}_t, \text{ACR}_t, \text{OWA}_t, \text{PORT}_{t_1}, \text{OFI}_t, \text{NPDT}_t, \text{LVR}_t)$$

where: F = change in the adjusted net worth of farm during t_1 and t_2 from internal sources.

FAS_{t_1} = Beginning farm assets (at time period t_1)

IOA_t = An average index of opportunity to accumulate

LS_t = Average value of livestock on farm

OWA_t = Average proportion of area owned to total area (cultivated plus other) of the farm

PORT_{t_1} = Potential returns per dollar of capital at time t_1

OFI_t = Average off-farm income as proportion to total family income (farm and off-farm)

NPDT_t = Non-productive debt as a proportion to total debt

LVR_t = Modified financial leverage ratio --

-- the ratio of farm debts to total assets (equity/ k ratio) average of the two periods.

The regression analysis indicated that beginning farm assets, index of opportunity to accumulate, value of livestock, acreage and owned land resources all have positive relationship with the financial performance. The impact of a unit change in initial farm assets increased the financial performance of the farm as the level of resources increased. However, this impact declined substantially for farms over \$70,000 asset levels. The debt-asset ratio's contribution was positive for farms with assets below \$40,000 but as assets grew, a negative relation was estimated. It was found that for small

farms with limited resources to grow, a non-productive loan (non-asset generating) becomes a liability and tends to retard the growth of the farm firm. It was found that managerial ability of the operator was equally important as credit in the growth process.

Gilchrist³

A capital accumulation study of Oregon farms was carried out using a regression model. Parameters were estimated for the relationship between net income and capital inputs, between living costs and net income and finally between living costs, net income and family size. The study indicated that capital inputs explained only 39 percent of the variability in net income and the net income accounted for 33 percent of the variation in living costs. Net income and family size accounted for 64 percent of the variability in living costs. The resulting regression model with the estimated parameters was used to project future capital accumulation over a specified planning period. An iterative process was used to project capital accumulation, however, the model could be adapted for direct estimation of the accumulated capital in any particular future year without iterative process. The capital accumulation model was then tested on various simulated credit conditions to determine their impact on future growth of the farm firm. In general, the approach used in this study was primarily oriented towards the future projection of capital accumulation for the farm firm.

³Gilchrist, V., "Projecting Capital Accumulation for the Agricultural Firm-Household", Canadian Journal of Agricultural Economics, Vol. XIV 50-60, 1966.

Baker and Irwin⁴

A study was made to compare quantities of resources that maximize farm profits with limits of commercial lenders in financing purchases of such resources in both the livestock and cash grain areas of east and west central Illinois respectively. It was assumed that the financial condition of the low-income farmer makes his situation more sensitive to lender decisions at low loan levels so that only farms with less than \$5,000 as returns to capital and management were selected for the analysis. Two samples of 140 cash-grain farms and 85 livestock farms were made from the two areas.

A multiple regression equation was fitted relating the level of farm output to the amounts of inputs used (on annual basis) and diminishing marginal productivities for all inputs was assumed. Optimum quantities of inputs were determined and compared with actual use. It was found that there was capital overuse on buildings, livestock and machinery while sub-optimal levels of resources were used for fertilizer and operating expenses. In general, the actual use of resources in the livestock area was closer to an optimum organization than in the grain area. This was ascribed to the fact that credit lenders were found to be more concerned with the proposed use of the loans and decisions tended to favour asset-generating loans (cattle-feeder operations) than non-asset creating loans, except in cases where the borrower has collateral to be able to borrow on an unsecured note.

All the studies reviewed above considered the impact of agricultural credit use in the growth process of the farm firm and credit was a significant factor in the financial progress of the farm business.

⁴Baker, C.B., G.D. Irwin, Effects of Borrowing From Commercial Lenders on Farm Organization, Bulletin 671, University of Illinois Agricultural Experimental Station, 1961.

THEORY AND USE OF AGRICULTURAL CREDIT

Credit in the Agricultural Industry

Credit has long been recognized as an important factor in the financial progress of the farm business. The capital requirements in economic farming continue to increase. We see this in the trend toward fewer but larger farms, rising land values, and increased mechanization. While new techniques provide more efficient ways of operating the farm business, they also require more capital. The consequences of the increased capital requirements may result in a situation where the ownership of a viable economic farm, is, in general, beyond the capital forming capacity of the farm firm within a family generation.

For the agricultural industry as a whole, the roles of credit could be summed up as follows:⁵

1. to raise per farm and per worker productivity.
2. to facilitate desirable public goals in the transfer of land and in land tenure arrangements.
3. to facilitate resource development and use -- clearing, and breaking, regrassing and erosion control, irrigation, technological changes.
4. to alleviate disaster or emergency situations -- natural hazards, and marketing problems.

Credit in the Financial Performance of the Farm Firm

While there are many possible types of operating arrangements for the farm firm, the single proprietorship appears to be the predominant type

⁵Royal Commission on Agriculture and Rural Life, Report No. 3, Agricultural Credit, 1955, pp. 1-2.

of business organization. This means that ownership and management control as well as most of the labour required in the operation of the farm business are identified with one person or family.⁶ The rapidly increasing capital requirements of the farm business have placed a tremendous burden on the farmer-operator and his family to accumulate adequate savings during their lifetime to finance the business operation. In general, farmers as a group continue to be psychologically disposed to owning all their assets by the time of retirement. Economic viability of the farm firm requires much more than the reinvestment possibilities from forced savings hence a conflict exists between economic efficiency in terms of the productive capacity of the farm firm and the goals of the operator.

Human behaviour is goal oriented.⁷ A farm operator and his family ususally have specific goals which they are striving to achieve. An individual does not strive solely for the satisfaction of a single goal; rather, he is positively oriented toward the attainment of a number of goals simultaneously. Sometimes these goals may be competitive, complementary or independent but none is mutually exclusive to the growth process.⁸ Often there may be conflict, either in the goals themselves or in the relative importance attached to them by the farm operator and other members of his family. The goals appear to form a multivariate objective function against which the expected outcomes of the various possibilities are evaluated. These goals must therefore be considered in any investigation of the growth process of the farm firm. The attainment of these goals either independently or

⁶Task Force, 1969, p. 341.

⁷Patrick, George F., Ludwig M. Eisgruber, "The Impact of Managerial Ability and Capital Structure on Growth of the Farm Firm", American Journal of Agricultural Economics, Vol. 50, 1968, p. 491.

⁸Ibid., p. 492.

simultaneously, require considerable income which may not possibly be accumulated as savings from farm income within the "biological cycle" of the operator.⁹ Income is forthcoming in adequate amount only if capital goods (land, buildings, equipment and livestock) are combined with variable inputs (labour, fertilizer, seed) with appropriate management decision to produce economic output (livestock, field crops, and other farm products). Given the market conditions and the existence of economy of scale in agriculture, the size of net income earned will reflect the total value of capital investment as well as the rate of interest on borrowed capital and term of the loan.

As mentioned above, the farm operator's basic objective is to own the entire amount of capital comprising the farm firm by the time of retirement. Such an objective imposes the burden of "forced savings trap" on the farm firm while at the same time, it prevents the achievement of least cost inputs or economic efficiency in the organization of the farm firm, i.e. the allocation of resources is less than optimum since costs could be further reduced by increased use of credit which will again accelerate the rate of growth of the farm firm.

Patrick and Eisgruber point out that while credit is one of the major factors influencing the amount of income generated by the farm business, not all the income is available in its entirety for reinvestment in the farm business.¹⁰ However successful or otherwise the farm business may be, at least a minimum amount of the income must go for family consumption. Consumption expenditures of the farm family increase as income increases,

⁹Task Force, op. cit.

¹⁰Patrick, et al, op. cit., p. 495.

family size and age of the operator also affect consumption significantly.¹¹ Brake also emphasizes that the income tax constitute significant cash withdrawal with prior claim over investment.¹² Loan limits and managerial ability of the farm operator also constitute important variables which significantly affect the growth process of the farm firm.

The growth process of the farm firm may be illustrated by starting with the investment and savings problems of the typical farmer following him through credit use over a period of time. The situation is illustrated in Figure I.¹³

The three short run average cost (SAC) curves represent three different levels of capital investment in the farm business. A farm firm operating with OA as capital has SAC₁ as the unit cost. The unit cost could be reduced by borrowing to expand output to the amount associated with point G, the minimum point on SAC₁ which can be attained without necessarily increasing the size of business. This size of business most likely would be associated with either the early stages of the farm business or with the farm firm managed by a risk averter.

With an initial amount of capital investment, OA, given the external loan limits, the farmer should be able to obtain credit to increase his investment by AB so that the business organization is now represented by SAC₂ which is a further reduction in the average costs of production. The farm firm would operate at point I and lower his unit cost by EF. The SAC₂ curve could be characteristic of the size of business of a farm firm which

¹¹Ibid., p. 496.

¹²Brake, John R., "Firm Growth Models Often Neglect Important Cash Withdrawals", American Journal of Agricultural Economics, Vol. 50, No. 3, Aug. 1968.

¹³Gilson, J.C., "Agricultural Capital and Credit in Canada", (Unpublished Manuscript, University of Manitoba, (n.d.)), Chap. 6, pp. 1-7.

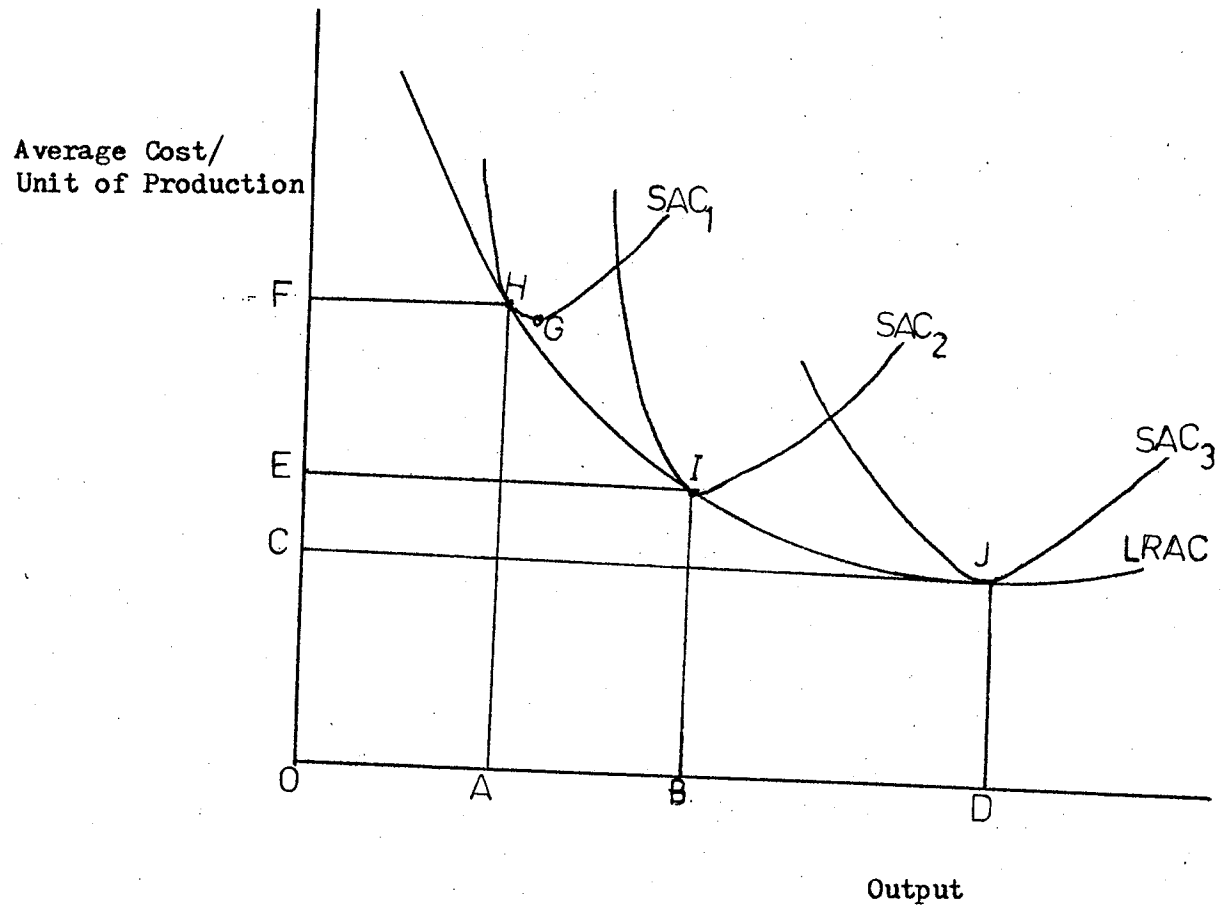


Figure 1. The Relationship between Average Cost and Credit Use

started with OA as beginning assets but obtained credit to expand his business by AB to OB.

The long-run average cost, LAC, curve is a locus of points showing the cost of producing the output at different levels of capital investment. Depending on his personal goals and objective, the entrepreneur will choose the appropriate level of capital investment and work toward its attainment. To remain as a business, the farm firm has to be competitive and to ensure the generation of adequate income for the operator to "live rich and die rich", capital investment should be at the level OD. As the growth process proceeds, there is a change in the relative factor proportions for the farm firm, due to changes in relative factor prices as the cost of capital relative to labour falls and to changes in the nature of the production function which makes use of capital more profitable. Greater use of capital inputs and the effect of technology increase fixed costs but also increase the optimal farm size as determined by the minimum point on the average cost curves. Assuming profit maximization behaviour, farm firms should gravitate toward the optimal size.¹⁴

The extent of credit rationing (either internal or external) may influence the growth of the farm firm so that neither the optimal size nor the lowest average costs are attained in the farm organization. Regardless of the level of capital investment, (owned or borrowed) consumption takes priority over reinvestment so that the farm income has to be proportionately higher if reinvestment is to be achieved as consumption increases. The consumption and investment processes involved in agriculture are illustrated in Figure 2.¹⁵

¹⁴Huang, Yukon, "On Some Determinants of Farm Size Across Countries", American Journal of Agricultural Economics, Vol. 55, Feb. 1973, pp. 89-92.

¹⁵Gilson, op. cit., Chap. 6.

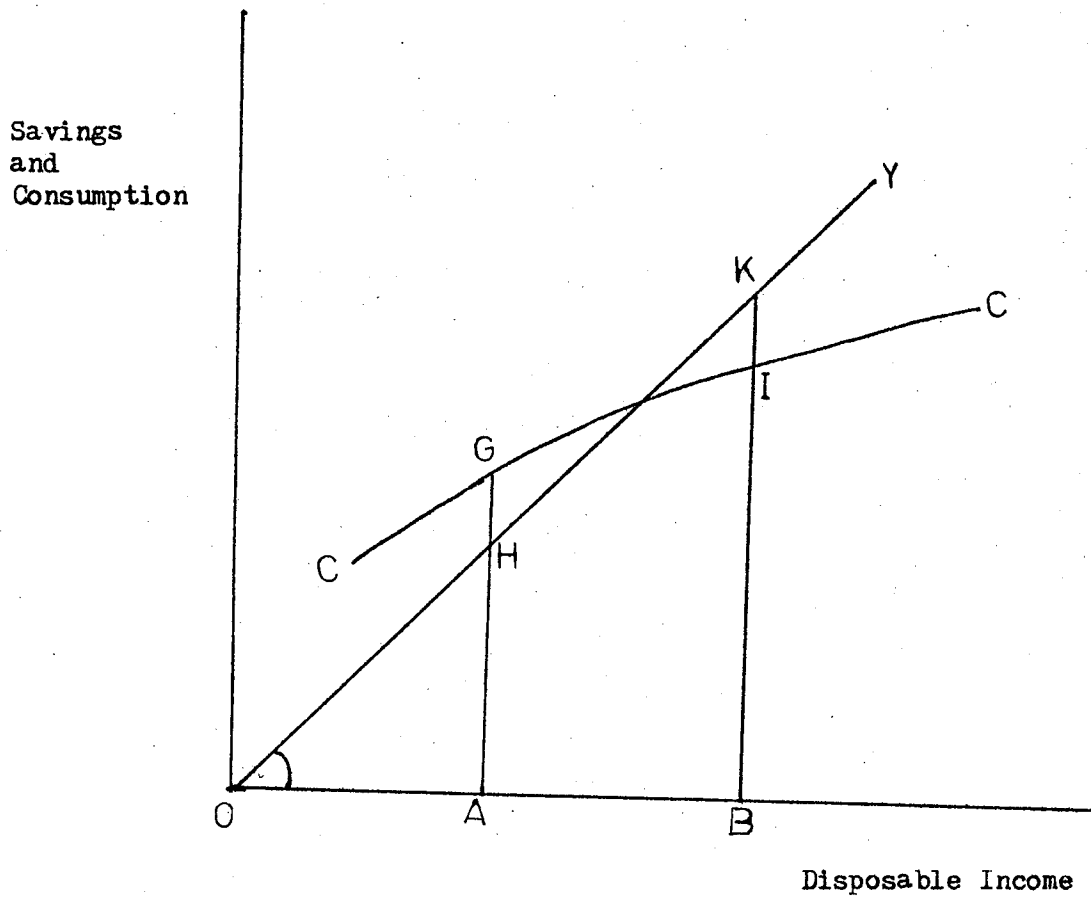


Figure 2. Consumption and Savings at Different Income Levels

The curved line CC designates the quantity consumed at different levels of disposable income. The gap between curve CC and the straight line OY indicates savings (or dissavings) available for new investment. A farmer with high equity capital ratio in the farm business but operating at sub-optimal level has an income OA with dissavings of HG. A farmer of equal managerial ability, might borrow funds (credit) to increase his income to OB so that IK amount of savings is available for re-investment in the business. The additional investment will generate a larger disposable income and greater savings.

The amount of capital investment in the farm firm at any point in time, is a cumulative result of previous management decisions and the farm firm's ability to generate further income rests heavily on the efficient use of this capital base. The efficient use of income generated and rate of capital accumulation depend, among other factors, on the allocation of farm earnings between consumption and re-investment. Conventional economic theory holds that consumption depends on the size of disposable income. In recent years, there has been a tendency not only to extend the Keynesian consumption function but also to modify it significantly as evidenced by the "new" theories of consumption function. Dynamic factors have been emphasized so as to more accurately simulate reality. Family size and age as well as the goals of the family will influence consumption hence the amount of income available for re-investment in the farm business.¹⁶

¹⁶Gillis, R.J., "Growth of the Family Farm Business in the Carman Area of Manitoba. 1957-1967". (Unpublished Masters Thesis, University of Manitoba, 1972. pp. 10-12.

Other Economic Factors

In an effort to measure the impact of agricultural credit use on the growth of the farm firm, consideration should be given to the inter-relationship existing between the key determinants involved in the use of credit. The level of family living standard (after loan repayment) varies with the operator's equity in the business, the size of loan, the repayment term, rate of interest on the loan, and the income possibilities offered by use of the loan. This relationship may be expressed as:¹⁷

$$A = (E+C) R - C \left[\frac{i}{1 - \left(\frac{1}{1+i}\right)^n} \right]$$

where

A = family living standard after loan repayment (principal & interest)

R = return to labour and investment (net farm income as percent of total capital)

E = operator's equity in the farm business

C = amount of credit used

i = rate of interest on loan

n = term of loan in years

Using hypothetical data, the relationship could be expressed as follows --

with A = \$3,500

R = 0.62

i = 0.08

n = 20 years or 30 years and C = \$50,000

¹⁷McRorie, Howard H., "Intensification Credit as an Adjustment Vehicle for the Low-income Farmer", (Unpublished M.Sc. Thesis, University of Saskatchewan, 1965), p. 55.

The relationship between the operator's equity and the term of the loan may be calculated from three equations:¹⁸

$$E = A + C \frac{\left[\frac{i}{1 - \left(\frac{1}{1+i}\right)^n} \right] - RC}{R}$$

The calculations indicated that as the term of the loan increased from 20 to 30 years, the required operator's equity was found to decline as percent of total capital.

The relationship between operator's equity and the size of the loan may also be calculated using the equation

$$C = \frac{A - RE}{R - \left[\frac{i}{1 + \left(\frac{1}{1+i}\right)^n} \right]}$$

all variables remain the same
and E = \$50,000 and \$100,000

It was found that increasing the operator's equity from \$50,000 to \$100,000 indicated a reduction in the amount of credit required for the farm family to maintain a minimum living standard of \$3,500. Using the same equation, it can be demonstrated that increasing the interest rate (e.g. from 8 percent to 12 percent) places additional capital restraints on the operator since his equity in the farm business must increase substantially if he is to make loan repayments, maintain minimum family living standard and have a good return on investment. In the same way, market instability could be incorporated

¹⁸ Calculations are shown in Appendix I.

into the model by allowing alternative (various) rates of return of labour and investment (R) to exist. Increasing R from .62 to .65 as a result of favourable prices and good management decisions, a substantial decrease in the required equity of the operator in the farm business will be indicated. This situation is particularly favourable in that the farmer will now have higher collateral for credit so that more capital could be invested in the farm business provided there is no internal credit rationing.

Economic Implications

While the main purpose of this study was to measure the impact of agricultural credit on the growth of the farm firm, it has become obvious that several other variables also influence the financial performance of the farm firm. The effect of capital rationing has been discussed above. The interest rate does have a substantial effect on the amount of net worth accumulated (i.e. rate of growth), by the farm firm during any prolonged period. Its real influence appears to be on the ability of the farm business to survive the early years of operation. The interest rate exerts a double barreled influence on the farm firm. First, a low rate of interest reduces the interest and debt payments a farmer must make and, secondly, it permits the farm family to maintain a satisfactory level of consumption expenditures. It is suggested however that most of the additional income resulting from low interest rate is consumed and thus has less influence on growth than either managerial ability or loan limits.¹⁹

The initial situation or beginning assets of the farm firm is also

¹⁹Patrick, et al., op. cit., p. 503.

an important variable. A starting farmer, of unproven managerial ability, but with very high beginning assets (probably through inheritance), would be able to obtain larger amount of credit than a farmer starting with about half the assets, taking traditional loan limits as given. Such a situation may allow the farmer of low managerial ability to expand beyond his capacity to make debt and interest payments whereas a farmer of above average managerial ability but with low beginning assets (hence poor collateral and poor loan risk) may not even survive a major set back.

Managerial ability of the operator appears to be of significant importance in assessing the impact of credit on the rate of growth of the farm firm. High levels of technical efficiency (technical transformation rates) will result in high levels of income, net worth accumulation, and the possibility of higher levels of consumption. Although traditional economic theory has not developed quantitative measurements for it, it may be assumed that farmers of high managerial ability appear to have fewer forced sales and a more efficient use of resources than those with lower managerial ability. A farmer of high managerial ability takes cognizance of the relationships that exist between resource and product and proceeds to allocate his resources in a most efficient way, viz --

Resource - resource relationship:

Economic efficiency dictates that for profit to be maximized, cost must be at a minimum. "If two or more factors are employed in the production of a single product, cost is at a minimum when the ratio of factor prices is inversely equal to the marginal rate of substitution of the factors."²⁰ This

²⁰ Heady, E.O., Economics of Agricultural Production and Resource Use, Iowa State University Press, Ames, Iowa, 1962, p. 172.

is mathematically expressed as

$$MRS_{X_1 X_2} = \frac{PX_1}{PX_2}$$

where

$MRS_{X_1 X_2}$ = marginal rate of substitution of X_1 for X_2

PX_1 = price of X_1

PX_2 = price of X_2

This condition holds as long as the iso-cost line remain tangent to the iso-product curve. Figure 3 shows point "a" where the slope of iso-product curve $\left(\frac{dX_2}{dX_1}\right)$ is equal to the slope of the iso-cost curve (price ratio).

Cost is also minimum when

$$\frac{MPPX_1}{MPPX_2} = \frac{PX_1}{PX_2}$$

where

$MPPX_1$ = marginal physical product of X_1

$MPPX_2$ = marginal physical product of X_2

transposing, it becomes

$$\frac{MPPX_1}{PX_1} = \frac{MPPX_2}{PX_2}$$

The condition for least-cost combination can be extended for more than two factors as

$$\frac{MPPX_1}{PX_1} = \frac{MPPX_2}{PX_2} \dots \frac{MPPX_n}{PX_n}$$

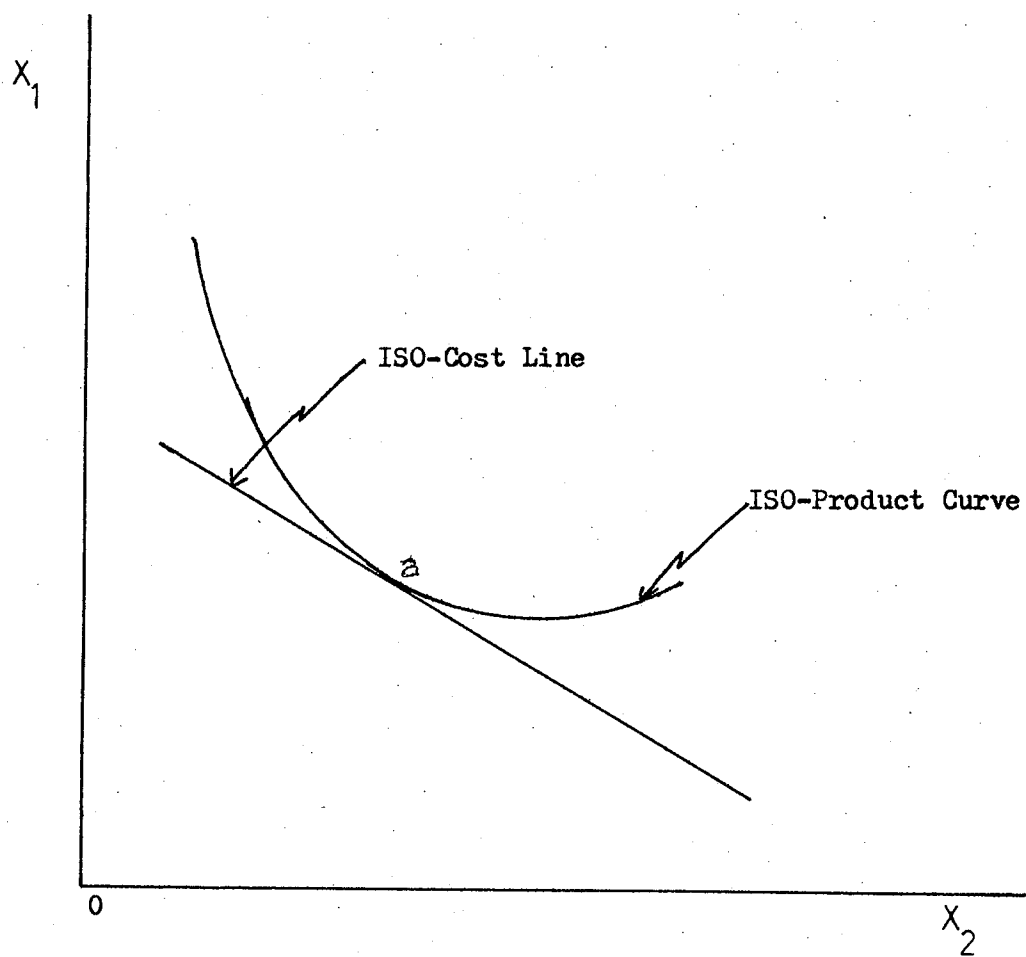


Figure 3. The Use of ISO-Cost Line and ISO-Product Curve to Indicate Minimum Costs

The farm family with high managerial ability will make intelligent management decisions that will maximize profit. Profit is maximized when resources are combined in the least-cost combination along the expansion path. The expansion path is derived by varying the level of output along the least-cost combination points as shown in Figure 4. The least-cost combination of resources is satisfied at points a, b and c along (line ag) the expansion path. The condition holds however if resources are limited. With one of the resources fixed the expansion path shifts to the left. If X_2 becomes fixed at X_2^0 , the expansion path now becomes a b c_1 g_1 rather than a b c g.

In the dynamic context, if at time t_1 the entrepreneur chose a_1 either due to low managerial ability or due to constraints on X_2 , the operator might be further constrained to choose b_1 combination of X_1 and X_2 due to fixed factor proportions. In such a situation the expansion path will deviate from the optimum to the sub-optimal a_1 b_1 c_1 g_{11} as shown in Figure 5.

Product - product relationship:

Maximization of profit under the product - product relationship dictates that, with costs or resources fixed in quantity, marginal rate of product substitution must be inversely equal to the product price ratio.²¹ This condition for profit maximization may be expressed mathematically as

$$MRS_{Y_2 \cdot Y_1} = \frac{PY_2}{PY_1}$$

²¹Ibid., p. 239.

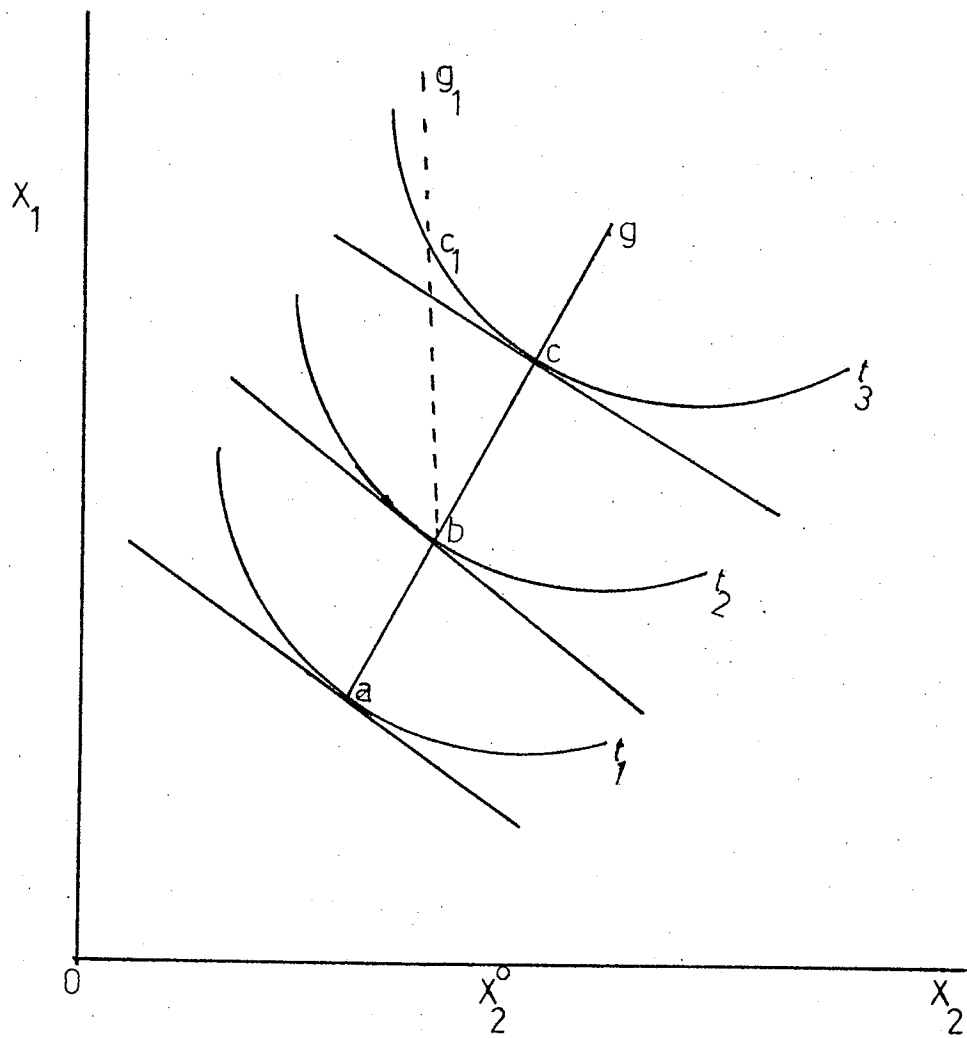


Figure 4. Expansion Paths

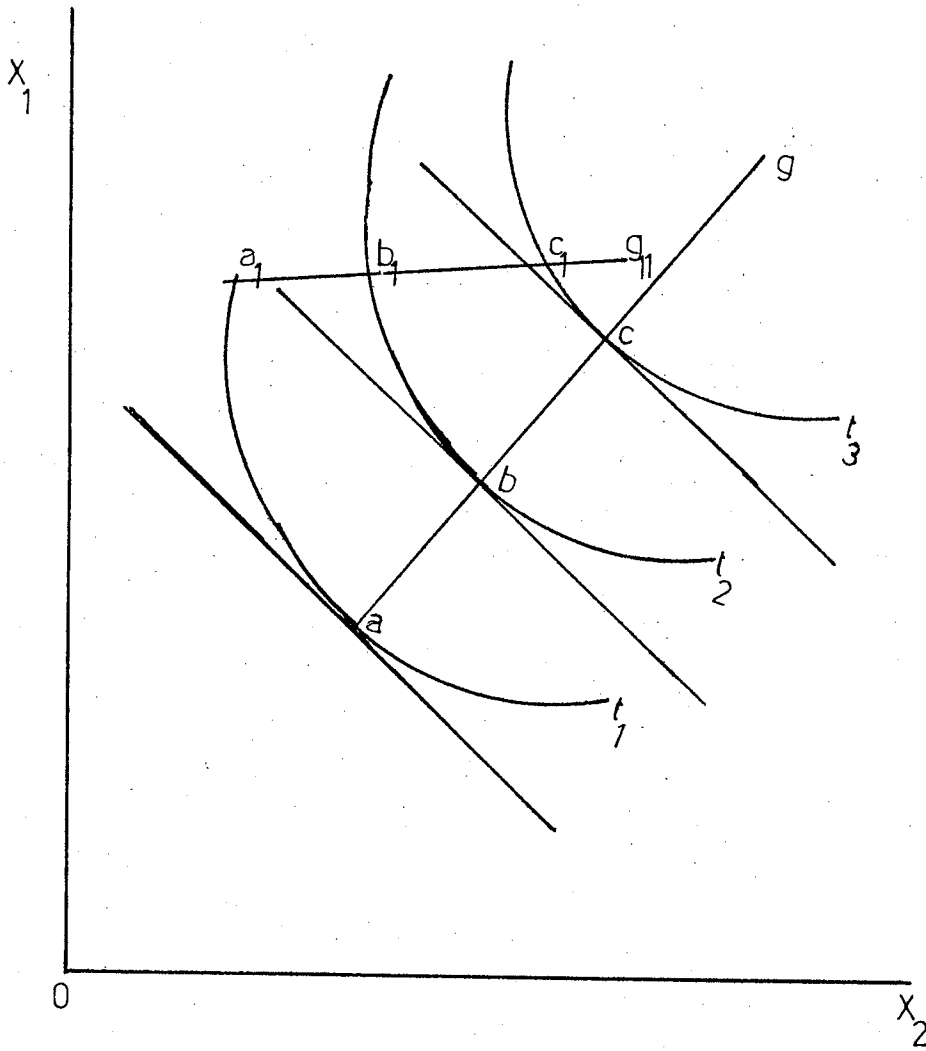


Figure 5. Expansion Path in Dynamic Context

where

$MRS_{Y_2 \cdot Y_1}$ = marginal rate of substitution of Y_2 for Y_1

P_{Y_1} = price of Y_1

P_{Y_2} = price of Y_2

The management decisions of the farm firm should aim at the equilibrium condition if maximum economic returns are to be obtained from capital investment in the farm business. This condition holds at the point where the iso-revenue line remains tangent to the production possibility curve, (point E = Figure 6).

Conversely, the profit maximization condition may be expressed as

$$\frac{MPPX_{1 \cdot Y_1}}{MPPX_{1 \cdot Y_2}} = \frac{P_{Y_1}}{P_{Y_2}}$$

transposing

$$\frac{MPPX_{1 \cdot Y_1}}{P_{Y_1}} = \frac{MPPX_{1 \cdot Y_2}}{P_{Y_2}}$$

This condition may be easily extended to cover any number of enterprises or products as

$$\frac{MPPX_{1 \cdot Y_1}}{P_{Y_1}} = \frac{MPPX_{1 \cdot Y_2}}{P_{Y_2}} = \dots = \frac{MPPX_{1 \cdot Y_n}}{P_{Y_n}}$$

The expansion path occurs along the optimum points obtained by the levels of investments (capital) in the production of Y_1 and Y_2 as shown in Figure 7. In a dynamic situation, the expansion path may be $a_1 b_1 c_1$, if at period t_1 , the operator has chosen a_1 combination of Y_1 and Y_2 rather than combination a , he may be constrained to choose b_1 in period t_2 due to fixed factor

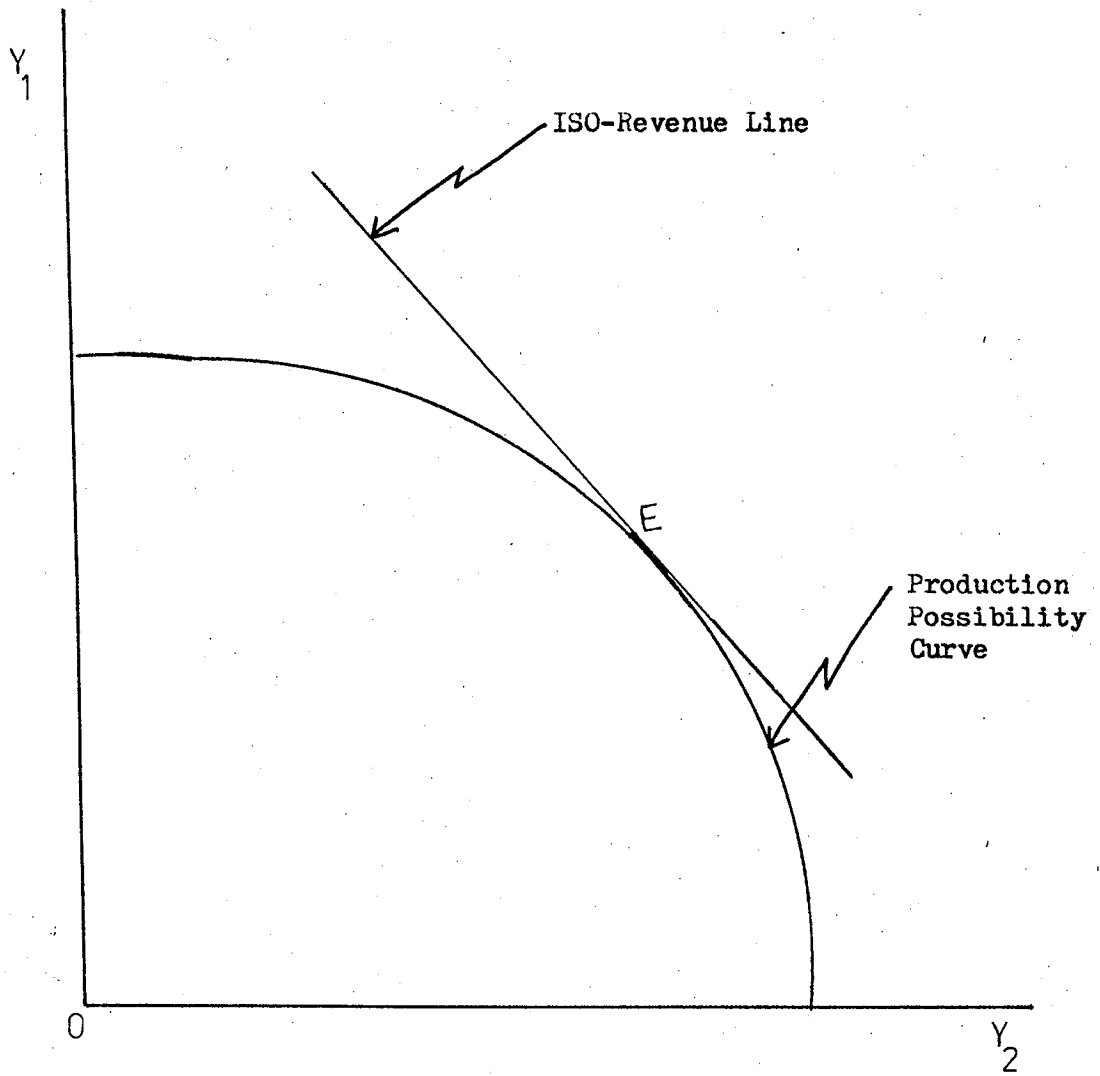


Figure 6. Profit Maximization Through Use of Production Possibility Curve and ISO-Revenue Line

proportions. This dynamic condition may not hold because less than optimum combination of resources or products in period t_1 affects the combination in period t_2 as well as in subsequent periods. Moreover, in this model, maximization of efficiency (net income) is required in production for each period independently of subsequent periods,²² which is inconsistent with conditions of maximum growth where net income is maximized over a long period of time and not independently for each period in time. Nevertheless, the model provides a good illustration for efficiency in use of resources and production.

While good managerial ability implies high technical transformation rates through the efficient use of production conditions stipulated by cost minimization and profit maximization principles, this is not often the case due to conflict in goals and attitude of the entrepreneur. In economic theory, the goals of the entrepreneur are implicit in the assumption of rational behaviour which in most cases implies profit maximization. But since profit maximization under a dynamic context may be interpreted in various ways, the resulting strategies for growth (capital accumulation) may be quite varied.²³ Lutz believes that there are at least four criteria for maximizing profits:²⁴ maximize the capitalized difference between the present value of future gross revenue and the present value of future cost,

²²Sahi, Ram K., "Economic Development of Newdale Clay Loam Soils Area", (Unpublished M.Sc. Thesis, University of Manitoba, 1968), p. 53.

²³Kulshreshtha et al, op. cit., p. 12.

²⁴Lutz, F.A., The Theory of Capital, MacMillan & Co. Ltd., London 1961, p. 16.

(2) maximize the ratio of the present value of future income over the present value of future costs, (3) maximize the internal rate of return on the total capital sum invested and (4) maximize the rate of return on equity capital.

It is more realistic to assume that the farm firm is somewhat unique in that it represents a composite unit of both business and family interests. The objective of profit maximization, while remaining very vital for the viability of the farm business, may not be regarded as the only relevant criterion by which the managerial decisions are made, as suggested by Heady:²⁵

No longer can it be said that the individual farmer uses his resources irrationally when he does not maximize profits in a single time period. Motivational forces behind the farm producing unit are consumption inspired as well as profit inspired.

The particular strategy adopted by the farm operator for the use of credit in the farm business would be determined not only by the hierarchy of goals but also by the financial circumstances that exist. A young farmer, starting out in business who intends to remain a farmer, may consider the survival of the farm firm in the short run so that his management decisions would be geared toward profit maximization. Also, an elderly farmer who will soon retire, would be more concerned with debt-free retirement so that his decisions would militate against any further risk-taking plans.²⁶ These considerations in fact determine the manner in which credit is sought and used in the farm business. Goals, values, and attitudes are therefore important in the overall performance of the farm business with regards to the impact

²⁵Heady, Earl O., op. cit., p. 416.

²⁶For more detailed analysis see Therrien, "Risk Attitudes, Values, Insurance Practices and their Contributions to Farm Business Development" (Unpublished M.Sc. Thesis, University of Manitoba, 1968).

of credit use on the growth process of the farm firm. They are however difficult to use as quantifiable variables in a model. Just as managerial ability (technical transformation rates) is crucial to the efficient use of resources by the farm firm, these variables can limit or enhance the possibilities for the achievement of optimum financial returns to the farm business. In this study, no attempt will be made to measure these characteristics but necessary recognition is given to their importance in the use of credit and growth process of the farm firm.

A risk-avoiding attitude may be a decisive factor in the use of credit by the farm firm. Farmers having excessive risk aversion, may limit the rate of growth of their farm units, because of non-use of available credit facilities which could have allowed the adoption of profitable but risky enterprises and technology. As pointed out by Hess and Miller,²⁷ "the decision not to borrow funds is conditioned largely by the operator's attitude toward assuming debt. This attitude arises from the feeling that assuming a debt means assuming risk of becoming insolvent in the short-run if conditions become too unfavourable". Thierrien also found that farmers with higher risk taking attitudes had greater financial progress (growth), than farmers with low risk taking attitudes.²⁸ It should be pointed out however that excessive risk taking may be detrimental to the growth of the farm firm since a significant error, controllable or uncontrollable may result in bankruptcy of the farm business.

²⁷Hess, C.V., L.F. Miller, Some Personal, Economic and Social Factors Influencing Dairymen Actions and Success, Pennsylvania Agric. Expt. Station Bulletin No. 577, 1964, p. 16.

²⁸Thierrien, op. cit., p. 178.

Bradford and Johnson suggested that the amount of risk the entrepreneur is willing to take depends upon such factors as (1) the amount of assets he has to lose (2) the status of his family (3) his age (4) the society in which he lives (5) the effect of possible gains and losses upon his social position and (6) his love of adventure.²⁹ These factors will affect individual farm firms variously and in varying degrees of importance so that it is difficult to find a general optimum condition under which certain of the factors must apply although Thierrien observed that younger farmers tend to have more aggressive risk taking attitudes than older ones³⁰ so that the impact of credit use might be expected to be greater on the growth of the farm firm operated by the young farmer than that operated by older farmer with no sons interested in farming.

The problems, the objectives and theoretical considerations have been delineated. The next chapter will examine the physical and economic characteristics of the study area as well as the adjustment process of the farms during the study period.

²⁹Bradford, L.A., G.L. Johnson, Farm Management Analysis, John Wiley & Sons, New York, 1966, p. 9.

³⁰Thierrien, op. cit., p. 180.

CHAPTER III

THE PHYSICAL CHARACTERISTICS OF THE AREA AND ADJUSTMENT PROCESS OF THE FAMILY FARMS IN WESTERN MANITOBA 1961-69.

THE PHYSICAL CHARACTERISTICS

Geographic factors are exogenous variables in the development process of an area since the possibilities and limitations, given existing technological conditions, are determined to a large extent by these geographic factors. The main physical factors influencing agricultural production in an area are:

- (i) Location in relation to existing markets.
- (ii) Climate - seasonal patterns as they affect crop and animal production.
- (iii) Soil capability.

Location

The agricultural area which constitutes the basis of this study is located in West central region of Manitoba. The farms are included within the area which extends from Township 10 to 22 and from Range 10W to 29W. Miniota, Hamiota, Shoal Lake, Langford and Clan-William are some of the towns within the study area which covers an area of about four million acres and twenty-five municipalities.¹ The area is shown in Figure 9.

¹D.B.S., 1966 Census of Canada - Agriculture, Manitoba, (Queens Printer: Ottawa).

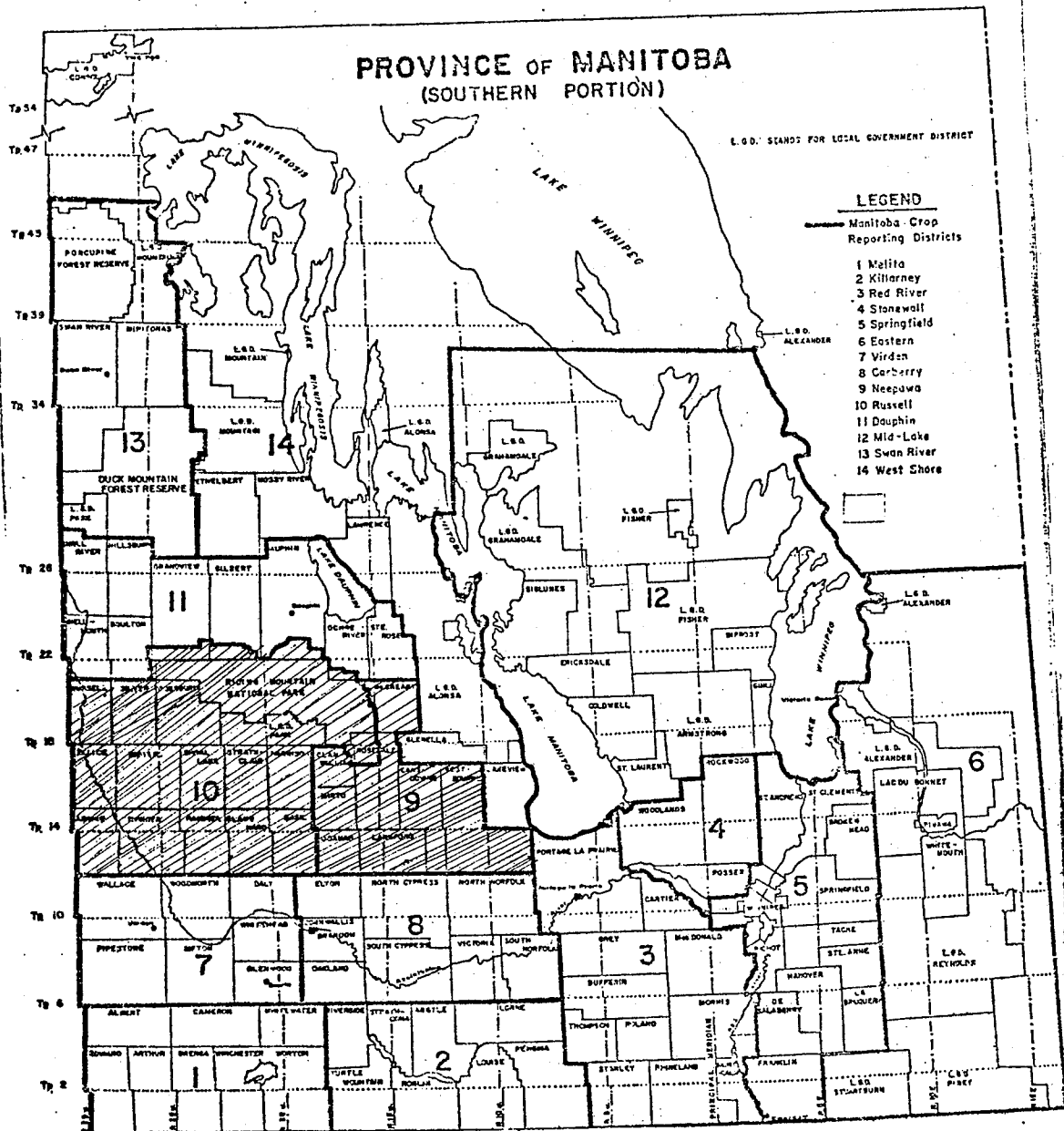


Figure 9. Map Showing Study Area (Shaded)

*Source: Manitoba Agricultural Yearbook, 1969.

Climate

The meteorological conditions -- precipitation and its distribution, temperature and wind, prevailing in the area are favourable for the cultivation of a large variety of grain crops. (Table 3.1)

TABLE 3.1
AVERAGE PRECIPITATION (INCHES) IN THE AREA

Location	Annual Average Precipitation	<u>Precipitation by Month</u>						
		April	May	June	July	August	Sept.	Oct.
Birtle	15.71	0.83	0.34	1.61	1.25	2.37	3.36	2.92
Hamiota	N.A.	2.45	0.22	1.14	1.22	2.00	N.A.	3.13
Russel	17.62	1.12	0.30	2.03	1.81	2.14	1.18	2.47

TABLE 3.2
TEMPERATURE (DEG. F.) IN THE AREA

Location	Annual Average Temperature	<u>Average of Daily Mean Temperature</u>						Aver. Temp. (May- Aug.)
		April	May	June	July	August	Sept.	
Birtle	36.8	37.4	50.5	58.9	65.3	64.2	53.1	60.2
Hamiota	35.4	38.7	50.9	59.8	66.5	64.3	53.4	60.6
Russel	34.9	37.1	50.3	58.2	63.6	62.5	52.7	59.4

N.A. = Data not available

Source: Department of Transport, Meteorological Branch, Monthly Record Meteorological Observations in Canada, Toronto, 1967.

The prevailing temperature during the months of May to August is critical to plant growth and crop growth may be adversely affected if the temperature should fall below 60.5° F. during the period.²

The frost-free days in the area range from 50 to 126 days with an average of 93 frost-free days between June 4 and September 6.³ The area has the maximum number of hail days in the province of Manitoba with a 10 year average of hail occurring every 2.7 days. Thus, the climate of the area creates some risk and uncertainty in crop production but permits cultivation of a variety of crops.⁴

Soils

The soils of the area are mainly black soils (some grey wooded) and are of glacial origin. Topography is undulating with undrained depressions scattered over the whole area although the organic matter content as well as water-holding capacity of the soils are quite high. The soils of the area are regarded as the most fertile in the province,⁵ the soils having been grouped into Class I (soils having no important limitations in use for crops) and Class II (soils having moderate limitations that reduce the choice of crops

²Principles and Practices of Commercial Farming, The Faculty of Agriculture, University of Manitoba, (1971), p. 16.

³Ackerman, Jerry, What Can You Expect From Farming, Dept. of Agricultural Economics, University of Manitoba, 1965, p. 2.

⁴Sahi, Ram K., "Economic Development of Newdale Clay Loam Soils Area", Unpublished M.Sc. Thesis, University of Manitoba, 1968, p. 91.

⁵Dept. of Industry and Commerce, Province of Manitoba, Economic Atlas of Manitoba, Winnipeg, Stovel-Advocate Press 1960, p. 13.

or requiring moderate conservation practices).⁶ Moreover, the soils are suitable for the cultivation of most of the crops grown in the region. Therefore, given the normal risks and uncertainties of weather, the soil conditions indicate that the area is endowed with a competitive potential for efficient organization of farm business.

THE ADJUSTMENT PROCESS 1961-69

The primary concern of this study is the observation of the factors influencing the growth of the farm firm in the long run with particular reference to credit use by Western Manitoba farmers.

The Western Manitoba Farm Business Association was formed in 1961 as a voluntary association of farmers in the Neepawa-Minnedosa-Hamiota area who were interested in improving their farm businesses and willing to provide information for research in farm management to the University of Manitoba.⁷

Characteristics of Association Members⁸

In 1961, the ages of charter members of the association range from 22 to 59 years, with 33 in their thirties, 16 in their fifties, the rest being in their twenties and forties. Also in 1961 two of the members were university graduates while 17 were Diploma Students. Forty-seven farmers owned all the land they operated, 30 rent part and five rented all the land they farm. Also, forty farms utilized family labour for all operations on the farms, 17 hired only occasional labour, 11 hired seasonal labour while 14 had full time hired labour. Grain and beef cattle were the most common farm enterprises.

⁶Dept. of Forest and Rural Development, Canada, The Canada Land Inventory Report No. 4 Land Capability Classification for Forestry, 1967, Queen's Printer, Ottawa, p. 28.

⁷Ackerman, Jerry, WMFBA Report 1966, p. 1.

⁸Ibid., p. 1.

TABLE 3.3

FARM FAMILY CHARACTERISTICS

Education	4-7 yrs.	8 or 9 yrs.	10 or 11 yrs.	12-15 yrs.
	2	20	37	23
Farming Experience	0-9 yrs.	10-19 yrs	20-29 yrs.	30-39 yrs.
	20	41	16	5
Size of Family	Single	0 or 1 child	2 or 3	4 or 5 or 8
	11	11	41	19

Source: WMFBA Report 1962.

Type of Farming

Wheat cultivation was the major specialty on Western Manitoba farms during the 1961 and 1966 census periods when 35.7 percent and 45.43 percent of the farms respectively specialized in wheat production while only 28.2 percent and 26.05 percent were in other small grains.

During the 1971 census period however, there was a sharp drop in wheat speciality as the emphasis shifted from wheat to small grains and cattle, hog, sheep production. The percentage of farms specializing in small grains production increased from 28.2 percent in 1961 and 26.05 percent in 1966 to 33.25 percent in 1971. This shift in emphasis was probably due to the quota

TABLE 3.4

CLASSIFICATION OF COMMERCIAL FARMS IN THE AREA BY PRODUCT TYPE⁹

Product Type	Distribution of Commercial Farms					
	1961		1966		1971	
	Number	Percent	Number	Percent	Number	Percent
Wheat	1895	35.7	2016	45.43	648	16.31
Small grains (excluding wheat)	1496	28.2	1156	26.05	1321	33.25
Field crops (other than small grains)	160	3.0	1	0.02	7	0.17
Dairy	86	1.6	34	0.76	41	2.29
Cattle, hogs and sheep (excluding dairy)	817	15.4	747	16.84	1535	38.65
Poultry	30	0.6	19	0.42	9	0.23
Livestock combination	670	12.6	321	7.23	236	5.94
Other combinations	153	2.9	99	2.23	109	2.74
Total Commercial Farms	5307		4437		3972	

⁹D.B.S. 1961, '66 and 1971 Census of Canada, Manitoba, Ottawa, 1973. The 1971 census classified farms into product type by sales of \$2500 or more from an enterprise.

system and low wheat prices during the 1961 and 1966 census period (Table 3.4).

Cattle, hogs and sheep production (excluding dairy) enjoyed the most significant increase on Western Manitoba farms during the study period. In 1961, 15.4 percent of the farms specialized in cattle, hogs and sheep production. This fraction increased to 16.84 percent in 1966 but the fraction was more than doubled during the 1971 census period when 38.65 percent of all farms in the study area had cattle, hogs and sheep production as major enterprises. The emphasis on cattle, hogs and sheep enterprises on a large proportion of the farms could have been due to favourable prices and government farm programs directed towards increased livestock production in the province.

It was mentioned above that there has been a decline in the number of commercial farms in the province of Manitoba. This situation is clearly shown in Table 3.4 where the number of commercial farms in the study area declined from a total of 5,307 in 1961 to 3,972 in 1971. At the same time, the capital outlay on the farms has increased dramatically during the study period from an average of \$25,938 per farm in 1961 to \$116,947 in 1969.¹⁰ Thus it has become increasingly difficult for the family farms to survive without additional credit facilities. Larger acreages planted to special crops indicated a more intensified use of land and other resources so that capital investment per farm continued to increase as farms become larger and more mechanized and also due to rise in the price level of land and machinery.

Farm Acreage

In 1961, per farm improved acreage was 310 acres in the study area while the study farms had 472 acres per farm. By 1966, the per farm improved

¹⁰ Manitoba Department of Agriculture, Farm Business Summary 1969, July 1970, p. 7.

acreage was 510 acres in the study area while the improved acreage on study farms increased from an average of 472 in 1961 to about 632 acres in 1969. It is obvious that acreage is a major factor in the growth of the farms since the predominant farm enterprise was grain production throughout the study period. 63.9 percent of the farms produced only grains in 1961 and the proportions were 71.5 percent and 50.0 percent in 1966 and 1971 respectively. During the same period the value of land increased from \$42.00 per acre in 1961 to about \$63.00 per acre in 1966 reaching a peak of \$88.00 in 1968 but leveled off to about \$74.00 per acre between 1969 and 1971. The growth in economic output could have been increased or limited by the amount of improved acres available for cultivation. The acquisition of additional land depends largely on the availability of additional capital by way of credit since it may be difficult for the farmer to finance the purchase of the average improved acreage of 632 acres strictly from internal sources. During the study period, the increase in improved acreage per farm has been substantial. The study farms together farmed 13,139 improved acres in 1961 but this had increased to 17,065 acres by 1969. This was 29.9 percent increase in total improved acres farmed. Also in 1961, only one farm had over one thousand acres of improved acres while 81.4 percent of the study farms farmed less than a section. By 1969, 15.1 percent of the farms farmed 1,000 acres or more while 74.1 percent of the farms were in the 540 to 1,000 acres size group. Such enlargement in physical dimensions of the farms should necessitate the use of additional capital for the introduction of new technology which will enable a farm to move downward on the long run average cost curve shown in Figure I. As a farm becomes more efficient in the use land resources, the per unit cost of

TABLE 3.5
CLASSIFICATION OF FARMS BY IMPROVED ACREAGE¹²

Size Group (acres)	1961		1966		1971	
	No. of farms	Percent	No. of farms	Percent	No. of farms	Percent
Under 239	2599	42.28	828	14.79	157	3.12
240-399	1965	31.97	1458	26.04	574	11.42
400-559	994	16.17	1151	20.56	1046	20.81
560-759	374	6.08	986	17.61	998	19.86
760-1119	170	2.76	777	13.87	879	17.49
1120-1599	28	0.45	287	5.12	854	16.99
1600-2239	16	0.26	82	1.46	364	7.24
2240-2879	-	-	8	0.14	24	0.47
2880+	-	-	21	0.37	19	0.38
Total Farms	6146		5598		5025	

¹²D.B.S. op. cit.

production declines. This results in increased net income thus resulting in additional savings and investment for the growth of the farm business.

With the rapid increase in per unit price of farm inputs and the declining farm prices, one would expect the capital investment to increase substantially for the farms not only to be more efficient but also to be able to survive. Table 3.6 classified the farms in the study area into different capital size groups.

In 1961, 57.8 percent of the farms in Western Manitoba had a capital investment of less than \$24,950 but this proportion had declined to 30.5 percent by 1966 and it declined further down to 22.8 percent by 1969. There was no farm in the \$149,950 - \$199,949 capital size group in 1961, where as there were seventy-five farms in this group by 1966 and one hundred and seventy-six farms were in this capital size group by 1969. A majority of the farms experienced fast movement from lower capital size group to a higher capital size group between 1961 and 1969 so that 33.5 percent of the farms had moved into the \$49,950 - \$99,949 capital size group by the end of 1969. The average capital investment per farm increased 72 percent or 14.4 percent a year between 1961 and 1966. The average increase for the period 1966 to 1969 was 163.6 percent or 41 percent per year while the average increase for the whole study period was 364 percent or 40.4 percent per year. Such phenomenal increase in capital investment can hardly be expected to come solely from savings from the farm business hence the importance of credit in the growth of the farm firm cannot be overemphasized. A close look at the components of capital investment in the study area will provide a better insight into the necessity of additional capital for the economic survival of the farm firms.

TABLE 3.6

CLASSIFICATION OF FARMS BY FARM CAPITAL INVESTMENT

Size Group	1961		1966		1969	
	No.	Percent	No.	Percent	No.	Percent
Less than 24,950	3,558	57.8	1,710	30.5	1,142	22.8
24,950-49,949	2,063	33.6	1,972	35.2	1,567	31.3
49,950-99,949	480	8.0	1,602	28.6	1,684	33.6
99,950-149,949	36	0.6	248	4.4	440	8.9
149,950-199,949	-	-	45	0.8	96	1.9
199,950 and over	-	-	30	0.5	76	1.5
Total Farms	6,146		5,598		5,025	

Source: D.B.S. op. cit.

Total capital investment in farms for the province was \$1,154,000,000 in 1961. By 1966, the investment has gone up appreciably to \$1,757,369,100 for the province. Ten percent of this amount or \$176,440,262 was invested by farms in the study area. Total capital investment by farms in the province had reached \$2,055,618,800 by 1969 and 14.1 percent or \$289,969,400 came from the study area. Of these amounts, a total of \$153,475,600 (13.0 percent) and \$189,079,000 (13.8 percent) was invested in land and farm buildings by the study area farms in 1966 and 1969 respectively. During the same period 15.4 percent of the provincial total investment in machinery was made by the farms in the study area. This proportion had gone up to 20.4 percent by 1969. Also, the investment in livestock and poultry was 10.1 percent and 14.4 percent of the provincial totals for 1966 and 1969 respectively. This shows that an appreciable proportion of provincial economic activities take place in Western Manitoba.

Table 3.7 points out that the increase in the value of land and buildings during the study period was quite substantial. The percentage increase in the value of land and buildings during the period was, except for machinery and equipment, higher than the percentage increase in the other components of capital investments by the farm firms. This change reflects the trend toward larger but fewer farms in the study area as well as in the province. Additional improved acreage in a grain production area could be a major determinant of growth of the farm firm especially if additional credit is available for such a purchase during periods of favourable market prices. Although some of the increase in the value of land could be attributed to capital gain, it is very unlikely that this constituted a substantial

TABLE 3.7
 CLASSIFICATION OF FARMS BY CAPITAL INVESTMENT
 (LAND AND BUILDINGS)

Size Group	1961		1966		1969	
	No.	%	No.	%	No.	%
Less than 14,950	2,206	56.7	1,582	28.3	1,072	21.3
14,950-19,949	405	10.4	594	10.9	429	8.5
19,950-24,949	521	13.4	631	11.3	509	10.1
24,950-49,949	587	15.1	1,865	33.3	1,705	33.9
49,950-99,949	143	3.6	846	15.1	1,079	21.5
99,950-124,949	28	0.7	100	1.8	122	2.5
124,950 and over	-	-	-	-	109	2.2
Total Investment	\$65,359,000		153,475,600		189,079,000	
Percent Change	-		134.8		23.2	

Source: D.B.S. op. cit.

proportion of the increase in value as the average acres per farm increased from 472 acres to 632 during the period.

Table 3.8 points out that the increase in the value of machinery and equipment was higher than the percentage increase in the value of land and buildings. The value of machinery and equipment increased 234.3 percent during 1961-69 period and was 133.1 percent higher in 1966 than in 1961. This change reflects substantial increases in both quantity and quality of the substitution of capital for labour in the farm business. These phenomenal increases in the capital investment on machinery and equipment together with the corresponding increases in per farm acres constitute augmenting factors in the growth process of the farm firms.

The investment in livestock and poultry increased (Table 3.9) 27.1 percent during 1961-66 period but increased 96.5 percent during 1966-69. Also in 1961, 91 percent of the farms had less than \$9,950 invested in livestock and poultry but this group had decreased to 52.5 percent by 1969. The grain market was good around 1966 hence the relatively small increase in livestock investment during 1961-66 but the 96.5 percent increase in livestock investment between 1966-69 could be attributed not so much to favourable market prices but mainly due to government diversification programs tying credit facilities to livestock production. The increase in livestock and poultry investment was however much less than the other components of capital investment and since gross output increased substantially during the study period, it is not certain whether livestock and poultry constituted a significant factor in the growth of the farm firms.

TABLE 3.8

CLASSIFICATION OF FARMS BY VALUE OF MACHINERY AND EQUIPMENT

Size Group	1961		1966		1969	
	No.	%	No.	%	No.	%
Less than \$9,950	3,627	82.5	3,276	58.5	2,526	51.7
9,950-14,949	456	10.4	992	17.7	879	17.9
14,950-19,949	125	2.8	470	8.4	596	12.1
19,950-24,949	130	2.9	503	8.9	344	7.0
24,950-37,449	57	0.1	357	6.4	400	8.2
37,450-49,949	-		-		78	0.2
49,950 and over	-		-		63	0.1
Total Investment	\$25,107,500		58,524,000		83,940,000	

Source: D.B.S. op. cit.

TABLE 3.9

CLASSIFICATION OF FARMS BY VALUE OF LIVESTOCK AND POULTRY

Size Group	1961		1966		1969	
	No.	%	No.	%	No.	%
Less than 9,950	3,023	91.0	4,783	85.4	2,120	52.5
9,950-14,949	191	5.8	487	8.7	552	13.6
14,950-19,949	35	1.1	104	1.9	646	15.9
19,950-24,949	40	1.2	140	2.5	309	7.6
24,950-37,449	30	0.9	85	1.5	176	4.3
37,450-49,949	-	-	-	-	204	5.0
49,950 and over	-	-	-	-	46	1.1
Total Investment	\$15,816,400		20,107,768		39,514,670	
Percent Change		-		27.1		96.5

Source: D.B.S. op. cit.

In Table 3.10 the farms are stratified by amount of borrowed capital employed in the farm business. In 1961 a total of \$220,479 credit was extended to the farms and the average credit use was \$8,166 per farm. 70.4 percent of the farms had total credits less than \$10,000 with 30 percent of these being in the less than \$5,000 classification. By 1966, the average credit use per farm had increased to \$26,238, a phenomenal 221.3 percent jump in credit-use over the base year period. Also, by 1966, 44.4 percent of the farms were using over \$30,000 worth of credits and 11 percent of the farms had over \$50,000 worth of credits in their farm operations while the total credits extended to the farms was \$708,410. By 1969, 51.9 percent of the farms were in the \$30,000 and over credit-use group with only 14.8 percent still remaining in the less than \$10,000 credit-use group. A total of \$1,034,062 worth of credit was being used by the farms in 1969 with a per farm average of \$38,299. This was 45.9 percent increase over the amount of credit being used for the 1961-66 period which was at a slower pace compared with that of the 1966-69 period. All the same over 30 percent of the farms were using more than \$50,000 worth of credit in 1969. Proper use of available credit is an integral part of decision making process in the farm business and it is crucial to the growth of the farm firm. The trend of economic growth in agriculture has been mainly in the development of sizes of farms either extensively or intensively aimed specifically at an effective utilization of modern technology. In order for the farm business operator to attain the economic size necessary for survival in view rising costs of inputs he must not only be able to obtain credit but must also be able to use the available credit effectively.

TABLE 3.10

CLASSIFICATION OF FARMS BY USE OF CREDITS

Size Group	1961		1966		1969	
	No.	%	No.	%	No.	%
Less than 5,000	8	29.6	2	7.4	-	-
5,000-9,999	11	40.8	3	11.1	4	14.8
10,000-14,999	5	18.5	6	22.2	2	7.4
15,000-19,999	-	-	2	7.4	2	7.4
20,000-24,999	2	7.4	-	-	2	7.4
25,000-29,999	1	3.7	2	7.4	4	14.8
30,000 and over	-	-	12	44.4	14	51.9
Average	\$8,166		26,238		38,299	
Percent Change		-		221.3		45.9

Source: WMFBA Records 1961-69.

Closely associated with growth of the farm firm is the value of gross production. The growth in unit output per unit input is an indication of the acquisition of additional land and other capital resources as well as increased efficiency in their use. The increased use of credit has been substantial. This vital enlargement of capital input into the farm operations has enabled farmers to achieve an increase in improved acres per farm, substitute more capital for labour through the acquisition of bigger machinery and equipment. Such enlargement in physical dimensions of the farm business requires higher managerial ability for the optimum combination of factors in the decision making process of the farm business. Table 3.11 shows classification of farms according to the value of farm production. 33 percent of the farms had less than \$10,000 as gross profit in 1961 with an average gross profit of \$14,662. In 1966, 52 percent of the farm had moved into the \$10,000 - \$19,999 gross profit range with an average gross profit of \$24,941. This was 70.1 percent increase in gross profit over the base year period. Also by 1966, 30 percent of the farms made a gross profit of \$30,000 and over with 11 percent of the farms in the over \$50,000 size group. By 1969, 25.9 percent of the farms had moved into the \$20,000 - \$29,999 production size group while 11.2 percent of the farm now produced \$50,000 worth of agricultural products. The average value of production was \$29,687 in 1969 which was only 19 percent increase over the average production for 1966. While value of farm production is greatly influenced by product prices, the low rate of increase for the 1966-69 period could be due to credit restrictions as the average capital investment for the same period was \$100,000.

TABLE 3.11

CLASSIFICATION OF FARMS BY VALUE OF FARM PRODUCTION

Class	1961		1966		1969	
	No.	%	No.	%	No.	%
Less than 5,000	2	7.4	-	-	-	-
5,000-9,999	7	25.9	1	3.7	2	7.4
10,000-19,999	12	44.5	14	51.8	10	37.0
20,000-29,999	4	14.8	4	14.8	7	25.9
30,000-49,999	2	7.4	5	18.5	5	18.5
50,000 and over	-		3	11.2	3	11.2
Average	\$14,662		24,941		29,687	
Percent Change		-		70.1		19.0

Source: WMFBA Records 1961-69.

Another factor influencing the growth of the farm firm is the consumption expenditures of the farm family. In Table 3.12 the farms are classified according to family expenditures. Looking at the table, it could be found that the average consumption was \$3,475 in 1961 and 52 percent of the farms spent \$2,000 - \$3,999 on consumption while only four percent of the farms had over \$8,000 in consumption expenditures. By 1966, the average consumption expenditure had more than doubled the 1961 level and 33 percent of the farms spent over \$8,000 living expenses. It could be observed that consumption increased by 106.6 percent during 1961-66 while value of farm production increased by only 70 percent during the same period. In 1969, 48 percent of the farms had moved to over \$8,000 level of consumption. As quite a substantial part of the consumption on the farms was found to be on non-farm investments and children education, it is hard to conclude that consumption would have a detrimental effect on growth although this may be the case in the short run.

Traditional economic theories fail to reflect the nature of the relationships that exist among the farm family and the physical and financial resources composing the farm firm. The family is not independent of the farm firm hence the behaviour and attitude of the family with regards to credit-use has direct relationship, complementary or competitive, with the growth of the farm firm. These factors constitute what may be termed 'non-conventional' inputs, some of which are personal experience, life cycle, goals and managerial ability of the operator (Table 3.3).

There appears to be some functional relationship between many of the variables examined. The econometric models, results and interpretation of this relationship is discussed in the next chapter.

TABLE 3.12
CLASSIFICATION OF FARMS BY CONSUMPTION EXPENDITURES

Size Group	1961		1966		1969	
	No.	%	No.	%	No.	%
Less than 2,000	5	18.5	3	11.2	-	-
2,000-3,999	14	51.9	4	14.8	4	14.8
4,000-5,999	5	18.5	11	40.7	5	18.5
6,000-7,999	2	7.4	-	-	5	18.5
8,000 and over	1	3.7	9	33.3	13	48.2
Average	\$3,475		7,182		8,253	
Percent Change	-		106.6		14.9	

Source: WMFBA Records 1961-69.

CHAPTER IV

METHODOLOGY

This chapter will outline the nature and source of data and the model used in analyzing the data.

Nature and Source of Data

The data for this study were obtained from the farm business records kept by members of the Western Manitoba Farm Business Association (WMFBA). The analysis will be based on annual records of twenty-seven farms for the period 1961-1969. These twenty-seven farms were selected because they provided complete records for the whole study period out of the 93 charter members of the WMFBA.

Charter members of the association are located all over crop districts 9 and 10 covering about 18 municipalities. The generalization of findings based upon the data is somewhat limited in that the number of farms studied (27) is very small compared with the number of commercial farms in the area (3,228).¹ Also, data collected from the selected charter members of WMFBA are not of random nature but may be regarded as case study method. Inferences based on such case studies, while they may not permit generalizations on the entire farm population in Western Manitoba, they nevertheless provide us with an insight into the impact of credit use on the growth of the farm firm in

¹Statistics Canada, 1971 Census of Canada.

Western Manitoba since the data used appear to be the most reliable because of the association with Department of Agricultural Economics of the University of Manitoba which have made the farm records available for research purposes.

THE FLOW CHART

Figure 8 is a flow chart of the major factors influencing the growth of the farm firm. The paths of major influence are shown by lines with arrows at their heads.

Growth of the farm firm requires that production of goods and services be in excess of consumption as well as the utilization of savings in future production processes (reinvestment). The level of consumption is primarily influenced by the propensity to consume which is again influenced by other factors such as goals of the entrepreneur, expected farm income, age, family size and past levels of consumption. The level of consumption has a direct effect on the amount of income available for savings or reinvestment hence the importance of consumption in the growth of the farm firm.

The level of income and subsequently the amount of savings available for reinvestment (growth) is a function of the amount of credit available together with other productive resources as well as the level of management necessary to organize these resources in an efficient and profitable manner. The level of management should be recognized as the most important contributing factor in the growth process of the farm firm. Because management by itself, is an embodiment of other factors such as attitude to risks, intelligence, goals, education and experience, a direct quantification is difficult to make.

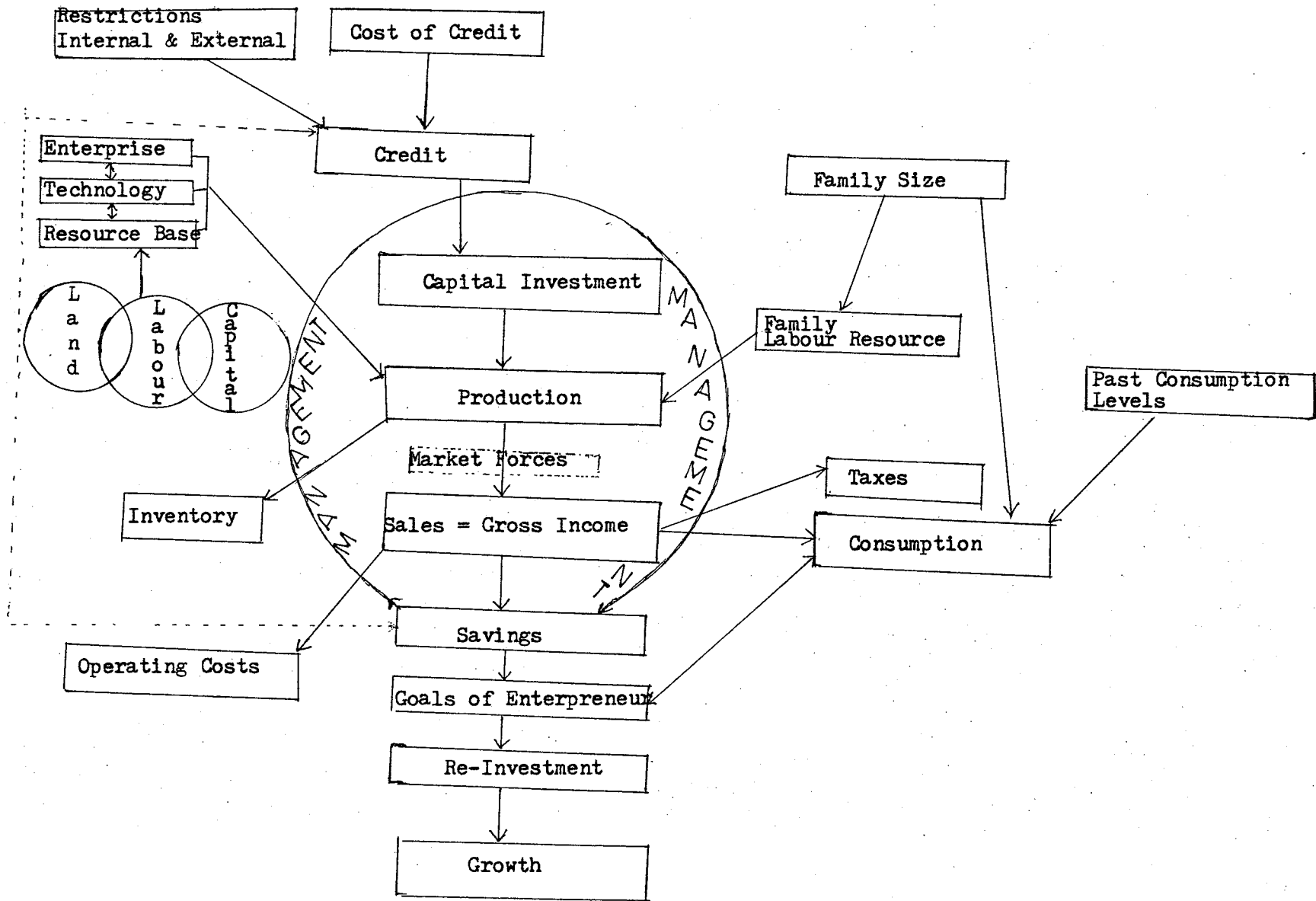


Figure 8. Major Factors Influencing Growth of the Farm Firm

The income generating capacity of the farm business is significantly influenced by both internal and external forces operating within and without the farm firm. The internal force has to do with the application of management principles in obtaining and combining the necessary inputs in appropriate quantities for the achievement of optimum organization for the survival of the farm business. The external forces include technology, market forces (level of prices and marketing volume), enterprise mix and weather. The magnitude of influence exerted by each of these factors varies between farms depending on the managerial ability of the operators hence different rates of growth will be observed among farm firms.

The initial resource base in the form of land, labour and capital, affect income generating potential of the farm business. Given adequate level of management, the presence (or absence) of some of the resources comprising the initial resource base will affect the ability of the farm firm to grow. A larger initial complement of resources should facilitate relatively greater growth over time than a smaller starting complement of resources. This assumption is based on the premise that for the farm firm with large resources, a greater residual after consumption will be available for further reinvestment in the farm business.

Equity in the farm business influences the potential growth since cost of credit (interest paid on non-equity capital) represents a drain on the potential savings of the farm firm. This is so because interests on debt must take precedence over further reinvestment in the business.

The size of the farm business is also an important factor in the growth analysis. Choosing a measure of farm size is somewhat arbitrary as

farm size can be measured in a variety of ways depending on the type of analysis being undertaken. Size can be measured in terms of area cultivated, gross farm income or total capital invested in the business.²

The type of enterprise being carried out on the farm is related to the efficient organization of the farm business. Depending on prevailing market forces, certain farm enterprise combinations may be more favourable at a given time than others. Knowing how and when to adjust to changing market forces is an integral part of managerial ability. The manager that makes the necessary adjustments in farm enterprise, is more likely to succeed and grow at a faster rate than those who are inclined to maintain the status quo either due to lack of managerial expertise or risk aversion.³

²The annual reports of the WMFBA has used both total capital invested and gross value of farm production as measures of farm sizes.

³It may be argued (Thompson, F.L., R.J. Foote, Agricultural Prices, McGraw-Hill Co., N.Y. 1952, pp. 2-8) that the degree of success or failure attained by a farm business is determined to a large extent by general price conditions which are usually beyond the operator's control. "That a farmer who purchase his land or incurred heavy debts for farm improvements shortly before or during long downward movement of prices started with a handicap almost impossible to overcome. As prices of farm products declined, fixed mortgage payments and taxes absorbed a constantly larger proportion of shrinking gross income until the farmer, in all too many cases is wiped out. For example a decline of hog prices during World War I required twice as many hogs to wipe out fixed costs as it did before taking the loan.

On the otherhand a farmer who happened to get started at periods of favourable prices found the value of his assets constantly rising. Even if he were such a poor farmer that he lost money each year, he could keep borrowing from the bank to make up the losses and still have a larger equity than when he started. As prices of farm products rose, it required constantly smaller proportion of farm's physical output to pay taxes and other fixed charges. This left money for the farmer for personal living expenses and for farm improvements and other investments. Thus a farmer with mediocre ability who happened to reach retirement age after such a period of rising prices was able to sell out with nice income for life."

While the above may be true to some extent, it is doubtful if management is not a crucial factor in the operator's ability to use market and management research information to the best advantage of the farm business. Although "a good market is better than a good steer", it should be pointed out that it takes good management to produce a good steer in the first instance.

The ability to acquire and utilize credit for optimum production is a crucial factor in the growth process of the farm business. Growth can only occur when the gross income generated from the farm business is large enough so that when total operating expenses, economic depreciation and interest on loans are subtracted the net income remaining will still be large enough to allow for reasonable allocation between consumption, income tax and savings for reinvestment purposes. For this situation to exist, capital investment must be adequate. An adequate level of capital investment is usually not available within the farm firm hence additional capital investment must be obtained through available credit facilities.

THE MODEL

Growth process is a highly complex phenomenon and many factors are considered responsible for the variation in growth rate of individual farm firms. These factors are generally of two types. The first type include forces which are external to the farm firm which, under normal conditions, are beyond the control of the operator. Some of these may be a result of the atomistic structure of the agricultural industry -- cobweb cycle, marketing opportunities, while others arise because they are beyond human control -- the biological nature of agricultural production, weather and its various attributes as they affect profitability of various enterprises.

The second set of factors may be termed the internal forces, and they are usually within the discretion and possible control of the entrepreneur. First among these factors constitute the goals and objective functions of

the entrepreneur as they affect the growth of the farm business through the use and combination of strategies of financial management. However, since traditional economics has no acceptable method of quantifying the explicit goals of the farm firm as it relates to the growth process, it will be assumed that all the sample farms which are charter members of the WMFBA are rational and homogenous with respect to their selection of enterprise and allocation of resources within the enterprise.

The second sub-set includes factors related to the productive capacity of the farm business. Land, equity and non-equity capital and land base and their various attributes. The third sub-set of factors are those that relate to management capability. The management resource, like growth itself, is complex and empirical measurement is rather difficult as it is interwoven into all aspects of the farm business.⁴

There are other factors besides those mentioned above which are also important in the growth process of the farm firm. These include rate of interest on loans, age of the operator, level of education, years of farming and size of the family as well as the relative importance of the standard of living goal.

An empirical model must of necessity, take into account, a combination of all factors, those which are both within and without the possible control of the operator. These external and internal factors exert varying degree of influence on the growth process of the farm business. Beginning farm assets of the operator has influence on the amount of income generated by the farm business over time, given adequate level of managerial ability.

⁴Patrick and Eisgruber (op. cit.) believe that the rate of growth of the farm firm could be an indication of managerial ability.

The level of net income and the ability of the operator to combine all farm resources efficiently over time constitute the major determinants of the growth process. Growth can however be achieved in some other instances as a result of inheritance, windfall or supplemental off-farm income.

Factors related to the impact of credit use on the growth of the farm firm which will be included in this analysis are: beginning farm assets, level of non-equity capital (credit), improved acreage, value of livestock, consumption, operating expenses and total capital investment. Some other factors which should be included are weather and commodity price cycles, savings but no sufficient data were available and their effects will be picked up by the error term.

Measurement of Growth Process

The dependent variable used in this analysis was the amount of capital a farm operator has been able to add to his beginning farm assets during the period under study. This variable can be considered as a measure of the growth of the farm firm in the longer run.⁵ The amount of growth of the farm business was measured both as the change in farm assets and change in net worth (adjusted for price changes) over the observation period. Appropriate price deflators were used to express the value in constant dollar terms to allow for the external influences of change in price of assets.

The measure of growth can be further described as follows:

$$(1) \text{ Growth} = \text{Total Farm Assets}_{t_2} - \text{Total Farm Assets}_{t_1}$$

⁵Johnson, S.R. et al., "Stochastic Linear Programming and Feasibility Problems in Farm Growth Analysis", JFE: 49, No. 4, p. 908.

$$(2) \text{ Growth} = \text{Net Worth}_{t_2} - \text{Net Worth}_{t_1}$$

$$\text{Net Worth}_{t_i} = \text{Total Farm Assets}_{t_i} - \text{Total Liabilities}_{t_i}$$

$$(i = 1, 2)$$

Total Assets = summation of:

- (i) Farm real estate (land and buildings)
- (ii) Livestock
- (iii) Equipment
- (iv) Other farm assets
- (v) Non-farm assets

Total Liabilities = summation of all types of debts ranging from convenience credit to long term loans.

Total Farm Assets = total assets less non-farm assets.

The Structural Model

Variations in the magnitude of growth achieved by individual farms during the study period can be explained using two alternative types of approaches -- the single equation approach and the simultaneous equation approach. A single equation approach explains these variations using a hypothesized set of exogenous variables. Such a model is represented as

$$Y_t = a + b_1 X_{1t} + b_2 X_{2t} \dots b_n X_{nt} + U_t$$

where

Y_t is the dependent variable and the subscript t stands for observations, and

X_{1t}, \dots, X_{nt} are the independent variables hypothesized to be related to Y_t .

The term 'a' is the parameter indicating the intercept of the linear

function, and b_1, \dots, b_n are the unknown regression coefficients indicating the causal relationship between the dependent and the independent variables while

U_t is the unexplained variation of the stochastic disturbance terms.

A single equation model is the simplest form of econometric models in which there is only one dependent variable to be explained by one or more independent variables. The direction of causation is assumed known with certainty in which case, the variations in the dependent variable are hypothesized to be explained by the variations in the independent variables contained in the structural model.

There are however, certain characteristics of the growth process of the farm firms which suggest the use of single equation estimation techniques might be somewhat limited in view of the possible simultaneity among variables. It may be necessary to take explicit account of the system of relations in which the structural model is embedded and also to consider the extent of simultaneous dependence between some of the variables in the model. The growth process of the farm firm involves the interaction of some important variables where simultaneity may exist and therefore justify the use of the simultaneous equation approach. Growth may be hypothesized to be a function of the level of gross profits, production costs and family living expenditures. However, production costs are believed to be a function of prices of inputs and efficiency of use which is again related to the managerial ability of the operator. In addition, the level of living may be directly influenced by the amount of gross income generated given the goals or objective function of the operator. If these hypothesized relationships

are valid, then the simultaneous equation approach may warrant further consideration, although for this study, single equation approach is used.

Specification of the Model

It was mentioned above that there are certain characteristics of the growth process of the farm firm that suggest that there could be several other variables involved in the growth process. Most of these variables either could not be quantified or are very difficult to arrive at a precise system of measurement*. In this study the growth process was hypothesized to be determined, apart from nonquantifiable variables, by the following set of variables:

$$Y = F (X_1, X_2, X_3, X_4, X_5) \quad (3.1)$$

where

Y = Change in farm assets of the farm during t_1 and t_2

$t_1 = 1961$ and $t_2 = 1969$.

X_1 = Beginning farm assets at t_1 .

X_2 = Average amount of credit used during the observation period.

X_3 = Average improved acres cultivated during the observation period.

X_4 = Average value of livestock on the farm during the observation period.

X_5 = Average value of machinery and equipment employed in farm operation during the study period.

Expected b values

The variable X_1 is the initial resource base. A positive relationship is expected. The greater the beginning assets of the farm business,

*Some of these factors are managerial ability, psychological factors, aspirations and ego.

the greater the collateral for obtaining credit for the expansion of the farm business. It was hypothesized that initial resource base is closely related to the growth of the farm firm.

Variable X_2 is the average amount of credit used in the farm business during the study period.⁶ A positive relationship is expected here since the greater the capital available for investment the greater will be the returns to the farm business given economy of scale and adequate level of managerial ability. It was hypothesized that the greater the amount of credit used, the greater will be the farm income hence the faster the rate of growth of the farm business.

A positive relationship is also expected for variable X_3 - average acreage farmed. The sample area being in the prairies where grain production constitutes the major part of the agricultural industry, a sizeable amount of improved acreage is necessary for the viability of the farm business.

Variable X_4 is the value of livestock on the farm. To the extent that a supplementary relationship exists between grain production and livestock production in the sample farms, a positive sign is expected on the regression coefficient although a negative b value may result when there is competition between the livestock enterprise and cropping enterprise.

The variable X_5 is the average value of machinery on the farm. A positive sign is expected on the regression coefficient assuming that efficient use of machinery is made.

⁶ Credit is used to denote gross borrowings made during the period. No distinction is drawn between borrowings on the basis of source or by stated purpose or by duration of the loan. However, a major part of the credit came from institutional and merchant sources.

Investment Function

Marginal productivity analysis suggests the manner of employment of capital on farms in relation to the optimum point and gives an indication as to the scope of productive use of additional capital. Because of the variations between farms in managerial ability, use of additional capital provided through credit or gifts and inheritance may not be allocated efficiently resulting in non-optimum organization of the farm business. Optimum utilization of resources is indicated by equality between marginal factor cost and marginal efficiency of investment. If marginal efficiency of investment is higher (lower) than marginal factor cost it means under-utilization (over-utilization) of that factor. It is however possible that farmer's use and allocation of resources may be affected by institutional restraints as well as by psychological factors.

Model

The coefficients of the production function are estimated using least squares regression techniques, applied to the logarithms of the variables. Gross farm earning, used as the dependent variable, is regressed on the various input factors described below.⁷

$$G = f(X_1, X_2, X_3, X_4, X_5, X_6) \quad (3.2)$$

where

G = gross farm returns

⁷All variables are expressed in yearly averages for the study period.

X_1 = building expense

X_2 = crop expense

X_3 = livestock investment

X_4 = machinery investment

X_5 = improved acres farmed

X_6 = amount of credit used

Due to loss of degrees of freedom associated with a small sample size stratification of the farms was not attempted. However, it was thought necessary to take the cyclic price movements in farm prices into consideration so that separate regression analyses were run on (3.1) for two separate periods 1961-65 and 1966-69, since favourable prices (peaks) could have provided a better opportunity for growth of the farm business than the unfavourable periods (troughs).

Variables⁸

Gross Farm Returns (G) is the total value of farm production for the year calculated as sales of farm products adjusted for increases or decreases in inventory, plus value of produce used in the home, minus livestock purchases, minus value of purchased seed used on farm, minus grain and supplies purchased for resale, minus feed purchased. The gross farm returns was not measured in constant dollars in equation 3.2 because the objective was to determine the efficiency of allocation of resources within the farm business during the study period. Deflation could have been difficult

⁸The definition of most of these variables is taken from the Manitoba Farm Business Summary (1970) as well as the WMFBA Annual Reports prepared by T.J. Yudai and Dr. Jerry Ackerman.

if desired since gross farm returns has numerous components including grains and livestock and no appropriate deflator was available.

Credit was used in this study to represent gross borrowings made during the period (interest and principal payments included). As mentioned above, such borrowings could be from merchants, banks and other credit institutions as well as from private sources. No distinction was drawn between borrowings on the basis of source or by stated purpose or by duration of the loan. However, a major part of the credit were extended by institutions for short term and long term periods.

Operating Expenses are those costs attributable in their entirety to the production process during each year of farm operation. Under normal circumstances, it is assumed that there are no residual effects of the items covered by this cost. Operating expenses include the general categories of crop, machine, livestock, and hired labour expenses. Crop Expenses consist of the cost of fertilizer, crop insurance, marketing costs and costs of insecticides. Building Expense is that portion of operating costs charged for the upkeep, repair or addition to farm buildings. Livestock Expenses was comprised of purchased feed, livestock minerals, veterinary, medication and marketing costs but this was not clearly separated in the data used for this analysis. Moreover livestock did not constitute major farm enterprise in most of the sample farms during the period of study hence it was not included in the model as a separate variable.

Livestock Investment is the beginning value of livestock inventory plus purchase of livestock. It has been pointed out however, that this measure exaggerates the amount of capital involved in livestock investment

on farms engaged in short term feeding since the same capital investment may be used more than once a year.⁹

Machinery Investment is also the beginning value of machinery inventory plus purchase and/or hire of machinery during each year of operation with appropriate allowance for sales and trade-ins.

The data were used in estimating the coefficients of the models. The analysis and interpretation are given in the following chapter.

⁹Ackerman, G.E., WMFBA Report 1966, The University of Manitoba Report No. 26, June 1967, p. 2.

CHAPTER V

ECONOMETRIC RESULTS AND INTERPRETATION

The results of econometric analysis are examined and interpreted in this chapter. The interpretation is presented in two sections. The financial performance of the study farms for the period 1961-69 is examined in the first section. The performance in the periods 1961-65 and 66-69 are also examined in two sub-sections. The second section examines the investment function of the farms and the marginal value productivities of capital inputs.

THE FINANCIAL PROGRESS

The parameter estimates for the different periods are presented in Tables 5.1 to 5.3. An asterisk (*) indicates that the estimates are significantly different from zero at the level of .01, two asterisks (**) indicate significance at the level of .05, three asterisks (***) indicate significance at the level of .10 while four asterisks (****) indicate significance at the level of .25. The intercepts are presented in real values rather than logarithmic values for the regression equations. The figures in the third column are the standard errors of the regression coefficients. The F-ratio indicates the significance of the coefficient of multiple determination, R^2 , and the Von Neuman Ratio is used to test the presence of autocorrelation.

TABLE 5.1
REGRESSION COEFFICIENTS AND OTHER RELATED STATISTICS-GROWTH OF FARMS
(CHANGE IN ASSETS FROM 1961-69)
AS DEPENDENT VARIABLE¹

Independent Variables	Regression Coefficient	Standard Error	Elasticity
Beginning Assets - X_1	- 0.216 ****	(0.311)	- 0.091
Credit Used - X_2	1.383 *	(0.550)	0.320
Improved Acres - X_3	95.576 *	(26.298)	0.641
Value of Livestock - X_4	- 0.023 ^e	(0.784)	- 0.004
Value of Machinery - X_5	2.338 **	(1.714)	0.158
Sum			1.025
Constant	2288		
R^2	.79 *		
F-Ratio	16		
Von-Neuman	1.91		

*Coefficient is statistically significant at the level of .01.

**Coefficient is statistically significant at the level of .05.

***Coefficient is statistically significant at the level of .10.

****Coefficient is statistically significant at the level of .25.

^eCoefficient is not statistically different from zero.

¹The correlation matrix is shown in Appendix III.

For this analysis ordinary least squares regression was used. When the regression was ran in the logarithmic form there was no change in the significance levels of the regression coefficients but there was a reduction in the value of the coefficient of multiple determination from .795 to .722 with an indication of multicollinearity among the variables. The quadratic form gave an R^2 of .744 with an indication of multicollinearity and all the coefficients were statistically insignificant.

The regression coefficient for the value of livestock was not statistically significant. When the variable was excluded from the structural model, the significance levels for the other variables increased while the coefficient of multiple determination (R^2) decreased by .001. Thus the variable account for only 0.1 percent of the variations in the growth of the farm firms during the study period. It appears that livestock enterprise did not significantly affect the financial progress of the farm firms. Variations in farm machinery and equipment, amount of credit used and improved acres farmed account for 79.6 percent of the variations in the growth of the farm firms while variations in the amount of credit used and number of improved acres farmed account for 77 percent of the variations in the growth of the farm firms. The coefficients for the variables as a whole indicate constant returns for additional investment for farm business in Western Manitoba as a whole and a reduction in livestock enterprise would increase farm growth.

Beginning Farm Assets

The coefficient for beginning farm assets was statistically significant only at the 25 percent level of significance with an elasticity of - 0.091. Variations in beginning farm assets do not account for any of the variations

in growth of the farm firms throughout the study period. Such a relationship between the beginning farm assets and growth of the farm business could be explained by the fact that most of the farms sought credit from government credit institutions which placed emphasis on the farm firms' ability to repay rather than high level of collateral normally required by merchants and private lending agencies. It was hypothesized that beginning farm asset is positively related to the growth of the farm firm and that the larger the beginning farm assets the greater is the growth of the farm firm. The coefficient was not significant and variations in the variable do not account for any of the variations in the growth of the farms so that the hypothesis was not verified by the analysis. It is therefore inferred that beginning farm assets have no relationship with the growth of the farms and do not affect it one way or the other.

Amount of Credit Used

The increased use of credit was very beneficial to the financial progress of the farm business for Western Manitoba farms as a whole throughout the period. The coefficient was statistically significant at one percent level of significance. One unit increase in the amount of credit used result in an increase of 1.38 units of financial growth. The elasticity of production for credit was .32 indicating that a one percent change in credit use results in .32 percent change in financial growth. It was hypothesized that credit use has a positive relationship with the growth of the farm business and that the greater the amount of credit employed in the farm business the higher is the growth of the farm business. This hypothesis is verified by the analysis and it is indicated that correct attitude to credit use will

enhance the growth of the farm firm.

Improved Acres

The regression coefficient for average number of improved acres farmed during the study period was statistically significant at the one percent level of significance. The elasticity was .64 which indicate that a one percent change in the number of improved acres farmed by the farms as a whole will result in a .6 percent change in growth. Increasing the number of improved acres farmed appears to be the most profitable approach to increasing the growth of the farm firms. One unit increase in improved acres of the farm results in 95 units increase in growth of the farm business. This appears reasonable since grain production seems to be the main enterprise of the farms the output of which can only be increased through increased acreage and better management practices. Although no specific hypothesis was formulated about improved acres farmed, it is reasonable to assume that increasing the improved acres farmed either by purchase or rent requires additional capital in form of credit for the purchase or rental. At the same time, increasing the number of improved acres farmed is an expansion of the farm business so that the farm firm moves down along the LAC in Figure 1 to lower unit cost per unit of output. A farmer facing credit rationing either internal or external will not increase the size of his improved acres so that the cost per unit output remains the same and no growth is attained in the farm business.

Machinery and Equipment

The increased use of machinery and equipment was very beneficial throughout the period. An additional unit increase in investment in machinery would always have a positive effect on growth. One dollar increase in the

capital investment in machinery and equipment would result in \$2.3 increase in growth. The coefficient was significant at the 5 percent level of significance with an elasticity of .15. Again no specific hypothesis was formulated about the effect of machinery and equipment in the growth process but the impact of increased investment in machinery and equipment is rather obvious due to the predominant nature of grain production in the prairies. The cost of machinery and equipment went up by 21.2 percent between 1961 and 1969 while prices of farm products increased only 4 percent during the same period.² This indicates that for the investment in machinery and equipment to be effectively increased, additional capital is required in the form of credit. Moreover, the substantial increase in acreage required correspondingly high machinery investment for the farm business to be profitable.

Livestock

The coefficient for this variable was not significantly different from zero and the R^2 decreased by .001 when it was dropped from the structural model. The coefficient has a negative relationship with the growth process of the farms so that the farm firms in Western Manitoba could have higher growth by reducing livestock enterprise in the farm business. This could only be explained by the low prices for livestock products which existed for some time during the period. The situation could also arise from the fact that most of the farms have single proprietorship form of organization with little hired labour so that livestock enterprise which requires high labour input might be competing with other more profitable farm enterprises.

The time period was divided into two sub-periods which were analyzed

² Manitoba Agricultural Year Book 1972, Queens Printer, Manitoba, pp. 76-81.

separately. The results are presented in Tables 5.2 and 5.3. The regression for each sub-period was tried in both logarithmic and quadratic forms before it was decided to use the ordinary form which consistently gave better results³ than the other forms.

1961-65

The regression coefficient for beginning farm assets was positive but not significantly different from zero for the 1961-65 period as was the case for the 1961-69 period. This would indicate that beginning farm assets had no significant impact on growth of the farm firms during the sub-period. The hypothesis that the greater the beginning farm assets the greater the growth of the farm firms is once again not verified by the analysis.

The coefficient for credit was statistically significant at the 10 percent level of significance. The magnitude of the coefficient at 0.65 was medium indicating low amount of credit use in the farm business during the period 1961-65. The medium magnitude of the coefficient for credit during this period could be explained by the attitude of the farmers to the risks involved in reducing their capital-equity ratio. The same observation may be explained by the external credit rationing of the lending agencies since credit limit was quite low until the Agricultural Credit Act was amended in 1967. The Bank Act was also amended at the same time, removing the interest rate restrictions so as to allow banks to grant loans to other high risk areas of farming. Once again the hypothesis that credit use is positively related to growth of the farm firm is verified.

The coefficient for acreage was statistically significant at the 5

³Better results in terms of significance level, R^2 , F-Ratio and Von-Neuman Ratio as well as the standard error of the regression coefficient.

TABLE 5.2
REGRESSION COEFFICIENTS AND RELATED STATISTICS-GROWTH OF FARMS
(1961-65)
AS DEPENDENT VARIABLE³

Independent Variables	Regression Coefficient	Standard Error	Elasticity
Beginning Assets - X_1	0.080 ^e	(0.34)	0.071
Credit Used - X_2	0.656 ^{***}	(0.465)	0.181
Improved Acres - X_3	3.869 ^{**}	(1.915)	0.075
Value of Livestock - X_4	0.528 ^e	(1.109)	0.109
Value of Machinery - X_5	4.192 [*]	(1.292)	0.399
Sum			0.835
Constant	8004		
R^2	.55 [*]		
F-Ratio	5		
Von-Neuman	2.0		

*Coefficient is statistically significant at the level of .01.

**Coefficient is statistically significant at the level of .05.

***Coefficient is statistically significant at the level of .10.

^eCoefficient is not statistically different from zero.

³The correlation matrix is presented in Appendix III.

percent level of significance. The magnitude of the coefficient was quite large indicating intensive use of existing improved acreage on the farms as a whole during the period. The magnitude of the coefficient also indicate that the intensive use of the improved acreage had a high effect on farm growth during the period.

The coefficient for livestock was not statistically significant during the 1961-65 period as it was for the whole 1961-69 period. The coefficient was positive with small magnitude. Additional investment in livestock enterprise could not have added much to the growth of the farms.

The coefficient for machinery and equipment was statistically significant at the 1 percent level of significance during the period 1961-65. The magnitude was large and positive indicating profitable returns from the use of machinery and equipment during the period. The coefficient for both machinery and equipment was quite high indicating substitution of capital for labour in the working of improved acres. This situation could be explained by the necessity for increased production as well as more efficient use of resources if the farm firms were to survive.

1966-69

The results for the sub-period 1966-69 are presented in Table 5.3. The coefficient for beginning farm asset was negative with very small magnitude as was the case for the whole study period. It was also not statistically significant. During this period only the coefficients for credit and livestock were positive and statistically significant. The coefficient for credit was statistically significant at the 1 percent level of significance with large magnitude. The coefficient for livestock was positive with medium

TABLE 5.3
REGRESSION COEFFICIENTS AND RELATED STATISTICS-GROWTH OF FARMS
(1966-69)
AS DEPENDENT VARIABLE

Independent Variable	b - value	Standard Error	Elasticity
Beginning Assets - X_1	- 0.037 ^e	(0.13)	- 0.104
Credit Used - X_2	0.949 [*]	(0.18)	0.822
Improved Acres - X_3	- 0.123 ^e	(2.26)	- 0.003
Value of Livestock - X_4	0.429 ^{***}	(0.38)	0.125
Value of Machinery - X_5	- 0.141 ^e	(1.01)	- 0.032
Constant	6826		
R^2	.60 [*]		
F-Ratio	6		
Von-Neuman	1.90		

*Coefficient is statistically significant at the level of .01.

***Coefficient is statistically significant at the level of .10.

^eCoefficient is not statistically different from zero.

magnitude and it was statistically significant at the 10 percent level. The sign and the significance levels of these coefficients for the period indicate the liberalization of farm credit tied to livestock production during the period. These would tend to influence growth of the farms to a very large extent during the period.

It is however difficult to explain the negative sign, small magnitude and the statistical insignificance of the coefficients for acreage and machinery during this period. However, during this period, some farmers reduced their improved acreage by giving up rented lands thus cutting back their grain production, increasing their summer fallows, which also meant reduction in investment in machinery and equipment while concentrating on livestock production. During this period farm product prices were low especially for crops while livestock prices increased slightly. In this situation, the coefficients for credit and livestock would be expected to pick up the effect of the other variables on the growth process of the farm firms.

THE INVESTMENT FUNCTION

Improved efficiency in resource combination by the farm firm can be achieved through an increase in the size of operation or volume of farm business so as to take advantage of modern technology resulting from economy of scale. Higher profits would be expected from increased productivity resulting from both improved efficiency in the combination of factor inputs as well as the improvement in the quality of the resources employed. Increased

farm productivity results in increased value and higher profit margin given stable farm prices. Adequate capital investments in resource inputs would therefore increase profits which would enhance the growth rate of the farm business. The effect of such investments in the augmentation of the growth process was examined in the investment function.

Table 5.4 indicates the results of analysis of the investment model for the 1961-69 period.

The regression was in the logarithmic form⁴ which gave better results than either the natural or the quadratic form. Credit was excluded from the model when it was found that other variables were picking up all the effects of credit when it was included as a separate variable in the model. This could be explained by the fact that the investment in other variables utilize an appreciable amount of credit throughout the period.

The results of the analysis indicate that the coefficients for crop expense, livestock, machinery and improved acreage were statistically significant and positively related to profit throughout the period. The coefficients for machinery and crops have large magnitudes indicating that crop enterprise was profitable throughout the period. The coefficient for acreage was of small magnitude but this could be explained by the relatively large magnitudes of crops and machinery which tend to pick up the effect of acreage in the model.

During the 1961-65 period, investments in farm buildings, crops, machinery and improved acres were positively related to profit while investment in livestock enterprise actually reduced profits during the period. This corroborates the results of the analysis for the growth process of the

⁴The regression coefficients could be interpreted as elasticities.

TABLE 5.4

REGRESSION COEFFICIENTS AND RELATED STATISTICS-GROSS PROFIT
AS DEPENDENT VARIABLE, 1961-69⁵

Independent Variable	Elasticity	Standard Error	MVP
Building Expenses - X_1	0.012 ^e	(0.147)	
Crop Expenses - X_2	0.367*	(0.156)	\$2.88
Livestock Investment - X_3	0.179**	(0.114)	\$0.15
Machinery Investment - X_4	0.258***	(0.217)	\$0.20
Improved Acreage - X_5	0.072***	(0.268)	\$1.91
Sum	0.90		
Constant	1.029		
R^2	0.74*		
F-Ratio	11		
Von-Neuman	2.12		

*Coefficient is statistically significant at the level of .01.

**Coefficient is statistically significant at the level of .05.

***Coefficient is statistically significant at the level of .10.

^eCoefficient is not statistically different from zero.

⁵The correlation matrix is presented in Appendix III. The marginal value productivities were calculated at the geometric means. Since gross profit (G) was measured in dollars, the marginal productivities $\frac{\partial G}{\partial X}$ of the factor inputs are equivalent to marginal value productivities. If EX is the calculated elasticity of the factor input X, then the marginal value productivity of the factor is calculated as $\frac{\partial G}{\partial X} = Ex.G/X$.

farms which indicated that livestock enterprise did not contribute any significant addition to the growth of the farm firms. The coefficient for machinery was statistically significant at the 1 percent level of significance while the coefficients for farm buildings, crops and improved acreage were statistically significant at the 10 percent level of significance (Table 5.5). The coefficient for machinery was quite large indicating the high investment in farm machinery and equipment by Western Manitoba farms during this period. This shows that cropping enterprise was relatively more profitable than the livestock enterprise. The coefficient for livestock was negative and was not statistically significant during the period. It was probably negative because of low prices for livestock products in the market during the period which made farmers cut back their livestock enterprise as it was not profitable. Ten percent increase in livestock investment reduced profit by 0.7 percent while a ten percent increase in machinery investment resulted in 5 percent increase in profits during the period. Also during this period many farmers increased the number of improved acres farmed so as to make economic use of the machinery and equipment on the farms. It could also be expected that credit agencies would be reluctant to grant credit for livestock enterprise because of the prevailing low market prices for livestock products.

During the 1966-69 period investments in farm buildings, crops, livestock and improved acreage were positively related to farm profits. The coefficient for machinery was negatively related to farm profit but it was not statistically significant for the period. The relative magnitude of the regression coefficients indicate that both crops and livestock enterprises were very profitable so that additional investments in both augmented the

TABLE 5.5

REGRESSION COEFFICIENTS AND RELATED STATISTICS-GROSS PROFIT
AS DEPENDENT VARIABLE, 1961-65⁶

Independent Variable	Elasticity	Standard Error	MVP
Building Expenses - X_1	0.156**	(0.121)	\$1.73
Crops - X_2	0.080***	(0.081)	\$0.05
Livestock - X_3	- 0.077 ^e	(0.110)	
Machinery - X_4	0.571*	(0.189)	\$0.85
Improved Acreage - X_5	0.173***	(0.140)	\$7.45
Sum	0.91		
Constant	1.027		
R^2	.71*		
F-Ratio	10		
Von-Neuman	1.6		

*Coefficient is statistically significant at the level of .01.

**Coefficient is statistically significant at the level of .05.

***Coefficient is statistically significant at the level of .10.

^eCoefficient is not statistically different from zero.

⁶The correlation matrix is shown in Appendix III.

TABLE 5.6

REGRESSION COEFFICIENTS AND RELATED STATISTICS-GROSS PROFIT
AS DEPENDENT VARIABLE, 1966-69⁷

Independent Variable	Elasticity	Standard Error	MVP
Building Expense - X_1	0.092 ^{***}	(0.103)	\$12.32
Crops - X_2	0.500 [*]	(0.123)	\$00.99
Livestock - X_3	0.159 ^{**}	(0.083)	\$00.10
Machinery - X_4	- 0.030 ^e	(0.127)	
Improved Acreage - X_5	0.058 ^{***}	(0.046)	\$21.63
Sum	0.8		
Constant	1.726		
R^2	.70 [*]		
F-Ratio	10		
Von-Neuman	1.6		

*Coefficient is statistically significant at the level of .01.

**Coefficient is statistically significant at the level of .05.

***Coefficient is statistically significant at the level of .10.

^eCoefficient is not statistically different from zero.

⁷The correlation matrix is shown in Appendix III.

growth of the farm business significantly. This also means that the use of credit from non-government sources would be quite profitable and accelerate the growth process if invested in cropping and livestock enterprises. The negative sign of the coefficient for machinery during this period could possibly be an indication of surplus machinery which tied down some of the capital that could profitably be invested in other farm enterprises.

In both periods, the coefficients and marginal value productivities showed that investments in crops and improved acreage were consistently more profitable than the other inputs in the farm business. These variables were highly related to farm profit and therefore have an influence on the growth of farm firms. The coefficient for crops was small in magnitude in the first period but large in the second period while the coefficient for acreage was of higher magnitude in the first period than the second period indicating that rather than expanding at the extensive margin of grain production farmers found it more profitable to expand at the intensive margin by increasing fertilizer and other technological inputs for increased productivity. All these inputs require additional capital which were often not available within the farm business and had to be obtained from credit agencies. The elasticities indicate that a 10 percent increase in each of crops and livestock investment would increase profit by 5 percent and 1.5 percent respectively during the second period.

The above analysis and tests verify the hypotheses that the use of credit is a significant factor in the growth of farm firms and that the higher the amount of credit used in the business the higher is the growth of the farm firm. The hypothesis that the beginning farm assets constitute a

significant factor in the growth process was not supported by the analysis. Available credit, improved acres farmed, and the investment in machinery and equipment appear to be the significant factors generating the growth of the farm firms given an adequate level of managerial ability. It appears also that livestock enterprise, although slightly profitable during the second half of the period, did not contribute significantly to the growth process throughout the period. The elasticity for the variables as a whole is approximately one indicating constant returns for factor inputs so that ample scope exists for greater growth of the farm firms by increasing the size of the business through use of additional credit facilities (Table 5.1).

THE NATURE OF THE GROWTH PROCESS OF THE FARM FIRM

In this section the results of the time series study are presented in equation form. The value of the variables typical of the average farm in the area are incorporated in the model.

$$Y_t = 2288 - .216X_{1t} + 1.383X_{2t} + 95.576X_{3t} - .023X_{4t} + 2.338X_{5t} \quad (1)$$

$$G = 1.029 + .012X_{1t} + .367X_{2t} + .179X_{3t} + .258X_{4t} + .072X_{5t} \quad (2)$$

where the variables are as specified in Chapter III

$$\begin{aligned} Y_t &= 2288 - (.216)(43119) + (1.383)(21152) + (95.576)(632) - (.023)(9555) \\ &\quad + 2.338(19808) \\ &= 2288 - 9313 + 29,253 + 60404 - 220 + 46311 \\ &= \$128,723 \end{aligned}$$

For the first period 1961-65

$$\begin{aligned}
 Y_t &= 8004 + .08X_{1t} + .656X_{2t} + 3.869X_{3t} + .528X_{4t} + 4.192X_{5t} & (3) \\
 &= 8004 + (.08)(43119) + (.656)(13461) + (3.869)(945) + (.528)(10277) \\
 &\quad + (4.192)(4652) \\
 &= 8004 + 3449 + 8830 + 3656 + 5426 + 19501 \\
 &= \$48,866
 \end{aligned}$$

For the second period 1966-69

$$\begin{aligned}
 Y_t &= 6826 - .037X_{1t} + .949X_{2t} - .123X_{3t} + .429X_{4t} - .141X_{5t} & (4) \\
 &= 6826 - (.037)(97248) + (.949)(30424) - (.123)(1050) + (.429)(10261) \\
 &\quad - (.141)(8105) \\
 &= 6826 - 3598 + 28872 - 129 + 4401 - 1142 \\
 &= \$35,230
 \end{aligned}$$

The profit function for the whole period 1961-69

$$\begin{aligned}
 \text{Log}G_t &= \text{Log}a + b_1 \text{Log}X_{1t} + b_2 \text{Log}X_{2t} + b_3 \text{Log}X_{3t} + b_4 \text{Log}X_{4t} + b_5 \text{Log}X_{5t} & (5) \\
 G_t &= aX_{1t}^{b1} X_{2t}^{b2} X_{3t}^{b3} X_{4t}^{b4} X_{5t}^{b5} \\
 &= 1.029X_{1t}^{.01} X_{2t}^{.37} X_{3t}^{.18} X_{4t}^{.26} X_{5t}^{.07} \\
 &= \$21,509
 \end{aligned}$$

For the period 1961-65

$$\begin{aligned}
 \text{Log}G_t &= \text{Log}a + b_1 \text{Log}X_{1t} + b_2 \text{Log}X_{2t} + b_3 \text{Log}X_{3t} + b_4 \text{Log}X_{4t} + b_5 \text{Log}X_{5t} & (6) \\
 G_t &= 1.027X_{1t}^{.15} X_{2t}^{.08} X_{3t}^{.08} X_{4t}^{.57} X_{5t}^{.17} \\
 &= \$16,637
 \end{aligned}$$

For the period 1966-69

$$\text{Log}G_t = \text{Log}a + b_1 \text{Log}X_{1t} + b_2 \text{Log}X_{2t} + b_3 \text{Log}X_{3t} + b_4 \text{Log}X_{4t} + b_5 \text{Log}X_{5t} \quad (7)$$

$$G_t = 1.726X_{1t}^{.09} X_{2t}^{.50} X_{3t}^{.15} X_{4t}^{.03} X_{5t}^{.05}$$

$$= \$25,662$$

Throughout the study period the farm firms increased the value of their farm business substantially. There was an increase of 199 percent in total farm assets and 165 percent increase in the amount of credit used in the farm business during the period. During the same period, gross farm profits increased by 54 percent on the average. This was due to the low prices during the first period. Gross profits increased 30 percent between the first and second period while there was 44 percent increase in credit use during the same period. Growth of the farm firms appear to be highly related to credit use so also was gross profits. It should also be pointed out that the farm operators are expected to have improved their expertise in the use of resources.

During the study period, there was a substantial increase in the use of all farm inputs so that farmers have to increase their use of these inputs accordingly if they are to remain viable. Those who were unable to increase their inputs through the use of credit and those who are low in managerial ability left farming so that the size of farms increased substantially throughout the period. Such adjustments, resulting in increased farm size also require increased capital investment most of which have to come from non-farm resources and it is only those who are able to keep pace with these adjustments that will survive. Thus while most farms will experience substantial growth others will be phased out due to inefficient use of resources.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This study has investigated the financial progress of the farm firm resulting from the use of additional non-equity capital in the farm business. The results showed the relationship between growth of the farm business and the amount of non-equity capital used as well as how economically the non-equity capital was invested in the farm business.

An examination of the data on the farms in Western Manitoba indicated that a remarkable economic growth took place during the 1961-69 period. The average value of farm productions in 1969 was 102 percent higher than the average value for 1961 (Table 3.11). Also, there was a 369 percent increase in the average amount of credit used by the farms between 1961 and 1969 (Table 3.10), while the average size of improved acres farmed increased substantially during the same period. The average improved acres farmed in 1969 was 632 acres a 34 percent increase over the 472 acres in 1961. At the same time however, the number of farm firms declined 18 percent while the average value of machinery and equipment, livestock and farm buildings increased substantially during the period (Tables 3.5 - 3.8). These increases in farm capital investment appear to be growth-augmenting factors for the farm firms so that only the farms which were efficient in the use of these resources experienced rapid growth. The coefficients for beginning farm assets and livestock were not statistically significant for the years 1961 to 1969 inclusive so that these variables had no affect on growth during the period.

Although livestock production seemed to have inhibited financial progress to some extent during the study period in general (Table 5.1), all the same, it appeared to have been a significant factor in augmenting gross farm profits for the 1966-69 sub-period. During these years, the marginal returns to livestock were positive and statistically significant (Table 5.6).

Use of farm credit was beneficial throughout the years. Use of farm credit was more significant to the financial progress of the farm firms during the 1966-69 period than in the previous period, the elasticities being .82 and .18 for 1966-69 and 1961-65 respectively (Tables 5.2, 5.3). The significant impact of credit use on the financial progress of the farm business was recognized by the farmers and they increased their use of credit accordingly. The average credit used in 1969, \$38,299 represented an increase of 369 percent over the average amount of credit used in 1961 (Table 3.10). The use of credit permitted the operators to take advantage of technological innovations by substituting capital for labour. A farmer's ability to use credit successfully by making appropriate decisions which allow efficient allocation of resources within the farm business has to do with managerial ability. The most likely reason for substantial financial progress of the farm firms during the period was probably the increase in the level of managerial ability gained from membership of Western Manitoba Farm Business Association.

The increased managerial ability was apparent in the investment decisions. Additional investments in grain productions - increased use of fertilizer, pesticides and weed control together with increased use of machinery were significant factors in increasing gross farm profits throughout

the period. Additional investment in farm buildings was profitable but did not result in any significant addition to farm profits. Investment in livestock was not profitable during the years 1961-65 but became profitable during the 1966-69 sub-period. Additional investment in machinery and equipment on the other hand was profitable throughout the period but seemed to depress profits during the later part of the period (Table 5.6). The rationale for this could be that the farmers should have increased the use of existing complement of machinery and equipment, which normally carry high fixed costs, rather than invest in new ones especially so since there was only about 25 percent increase in improved acreage during the period.

Apart from credit use, investment in improved acreage was found to be the most significant factor augmenting the financial progress of the farm firms throughout the period. The most likely reason for this would be the increased diversification of the farms which made the use of improved acreage more intensive so as to meet both grain production and livestock feed requirements (Table 3.4). Given this situation, there seems to be a trend towards larger sized farms in terms of both acreage and capital investment.

Consumption expenditure was not a significant factor affecting the financial progress of the farm firms throughout the period. For this reason, consumption was dropped as one of the independent variables in the models. There was substantial increase in farm earnings during the period but as income increases the farm family's consumption level changed rather slowly. The low marginal propensity to consume among the farm families probably accounted for the statistical insignificance of the consumption variable so that the amount of income withdrawn by the household from the business was low enough so as

not to affect financial progress significantly.

The analysis also indicated that the level of initial resources available to the farm business did not constitute an effective augmentation or constraint to the financial progress of the farm firm. This is because additional resources could be borrowed or rented with relative ease more so now that government credit assistance programmes have been liberalized to a considerable extent.

The farm firm is a rather complex system with many interdependent variables some of which cannot be easily isolated. Financial progress of the farm firm is dependent on additional capital in the form of credit available to the farm business for investments in machinery and equipment, livestock and improved acreage. The results of the analysis indicated that as the available non-equity capital increases so also does the financial progress. Therefore the operator must make decisions based on economic and physical relationship of farm production. Inefficient allocation of resources results in loss of farm income and a reduction of the rate of financial progress of the farm business. Efficient allocation of resources is however influenced by managerial ability which is often influenced by the goals of the entrepreneur. It is however reasonable to assume that there was no significant conflict between the goals of the farm operators and the level of managerial ability, as the farms of Western Manitoba achieved considerable financial progress throughout the period.

IMPLICATIONS OF THE RESULTS

The objective of the study was to identify the factors influencing the financial progress of the farm firms and evaluate the relationship between credit use and farm productivity, also to suggest guidelines for an effective and desirable credit policy. The analysis showed that farm earnings would increase substantially if adequate capital were available to increase the scale of operation. An increase in scale of operation however requires an increase in the level of management so as not to inhibit optimum production. Optimum level of output exists only within the context of price so that effective marketing system is also necessary for price stabilization.

The analysis indicated constant returns to scale for the investments in the farm business so that an increased use of credit would increase the rate of financial progress of the farm business. The average capital requirement necessary to achieve optimum organization of the farm business could not possibly be obtained from internal sources so that credit limits have to be modified often to reflect an increasing rate of capital requirement for efficient and viable farm business.

The analysis also indicated that there was under investment in both acreage and cropping enterprises while the allocation of resources with respect to livestock and machinery was more nearly optimum. Thus while the farms experienced a substantial amount of financial progress the returns on overall investment were less than optimum. To achieve an optimum allocation of resources within the farm firm, the level of managerial ability of farm operators should be improved. Efforts should therefore be made to improve

the managerial ability of farm operators through formal training in financial management. A group therapy approach to managerial improvement could be adopted in the form of local farm business associations with some time spent in study sessions sponsored by the University Department of Agriculture during winter periods. Such exposures to formal training in the techniques of efficient use of resources and accurate record keeping could go a long way in improving the level of management on the farms so that the farms would not only be viable but would also be competitively efficient.

The grain enterprise appears to be highly profitable in the area so that farmers should be able to consolidate their farm business by specializing in grain production. Some farmers may also wish to have a combination of livestock and grain production even though this may be less profitable as indicated by the analysis but granting of government credit specifically for livestock could divert the enthusiasm of farmers who are more inclined to grain production.

Credit institutions should give priority to granting dynamic credit as opposed to static credit to farmers. While it is important for loans to be repaid, it is equally important that farmers should be able to improve their net worth position as a result of credit use. Credit is regarded as static when no significant increase occurs in the assets of the farmer after repayment while credit is regarded as dynamic when there is a significant increase in farmer's asset position after repayment. Credit can become dynamic only after it is sought, obtained in adequate amount and used efficiently. Results of previous studies indicated that farmers face some internal credit rationing. This calls for considerable efforts at the farm

level aimed at getting the farmers better informed about availability of credit. Credit information to farmers is necessary but it is not a sufficient condition for achieving a satisfactory rate of financial progress.

To be sufficient, government policies should be directed at programmes aimed at educating farmers in financial management methods. As mentioned above, the educational programme should have a combination of aims - emphasizing the importance of credit use, as well as the best allocation of farm resources. Also, farm subsidies should be geared towards offsetting unfavourable market forces so that farmers will be sure of a fair chance of remaining viable in the face of seemingly ever tightening cost-price squeeze although more research may be necessary to determine the impact of farm subsidies on windfall losses in farm production.

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APPENDIX I

THE RELATIONSHIP BETWEEN CREDIT USE, RATE OF INTEREST
AND REPAYMENT TERM

Since the major concern of this study was to evaluate the impact of agricultural credit use on the financial progress of the farm firms, a consideration of the relationship between rate of interest on loans, term of loan repayment, living standard of the farm family, operator's equity in the farm business and the amount of non-equity capital used in the farm business will be quite appropriate. As shown in the Flow Chart (Figure 8), the amount of credit used is affected by the cost of credit. During periods of high interest rates, farmers are likely to use their savings for re-investment purposes rather than obtain credit. In most cases however, savings and cash balances are relatively small so that the effects of such re-investments are likely to be low and at least, not effective enough to keep the farm business viable.

(a) This relationship may be expressed as:

$$A = (E + C) R - C \left[\frac{i}{1 - \left(\frac{1}{1+i}\right)^n} \right]$$

where

A = family living standard after loan repayment

R = return to labour and investment (net farm income as percent of total capital)

E = operator's equity in the farm business

C = amount of credit used

i = rate of interest on loan

n = term of loan in years

with

$$A = \$3,500$$

$$R = 0.62$$

$$i = 0.08$$

$$n = 20 \text{ years}$$

$$C = \$50,000$$

An operator who has obtained a \$50,000 loan at 8 percent interest with a 30 years amortization plan, requires certain level of equity in the farm business if he is to meet this loan repayment and maintain the same level of living.

$$E = A + C \frac{\left[\frac{i}{1 - \left(\frac{1}{1+i}\right)^n} \right] - RC}{R}$$

when $n = 20$ years

$$E = \frac{3500 + 50,000 (.10133) - 31,000}{.62} = - \$41,256$$

when $n = 30$ years

$$E = \frac{3500 + 50,000 (.08932) - 31,000}{.62} = - \$42,292$$

As shown above, a \$50,000 credit with 20 years amortization schedule to a farm firm with a relatively high managerial ability and a family living allowance of \$3500 per annum, can be conveniently repaid even when there is a loss of up to \$41,256 in equity capital. Increasing the term of the loan from 20 years reduces the flexibility of the equity capital up to \$42,292. Doubling the family living allowance to \$7,000 a year does not

have any remarkable effect on the operator's repayment ability. For a 20 years amortization schedule the \$50,000 can still be repaid even when the operators reduces his equity capital position by up to \$40,684 by reducing his equity-farm capital ratio.

The implication of the above is that more emphasis should be placed on the farm firm's ability to repay rather than on equity position. This view is supported by the results of the analysis when beginning farm assets was found not to be statistically significant in augmenting the financial progress of the farm firms.

(b) The relationship between operator's equity and the size of the loan can be determined using the basic equation expressed in terms of the amount of credit use as follows:

$$C = A - RE$$

$$R = \frac{i}{1 + \left(\frac{1}{1+i}\right)^n}$$

where

$$A = \$9,000$$

$$R = .15$$

$$i = .08$$

$$n = 20 \text{ years}$$

$$E = \$50,000 \text{ and } \$100,000$$

$$C = \frac{\$9,000 - 7500}{.08 - \left(\frac{.08}{1 + .20}\right)} = \$150,000$$

where

$$E = \$100,000$$

$$C = \frac{\$9,000 - 15000}{.01} = - \$60,000$$

Increasing the operator's equity from \$50,000 to \$100,000 indicated a 60 percent decrease in the amount of credit required for the farm family to be able to maintain a satisfactory living standard of \$9,000 per year after loan repayment. An equity of \$50,000 in the farm business showed that an amount of \$150,000 in non-equity capital was required for the farm family to maintain a satisfactory level of living.

(c) The relationship between the operator's equity and the amount of credit at alternative rates of interest may be represented by the basic equation

$$E = A + C \frac{\left[\frac{i}{1 - \left(\frac{1}{1+i}\right)^n} \right]}{R} - RC$$

where

$$A = \$9000$$

$$R = .15$$

$$i = .08 \text{ and } .12$$

$$n = 20 \text{ years}$$

$$C = \$50,000$$

$$E = \frac{9,000 + 50,000 (.09) - 7500}{.15} = \$40,000$$

where

$$i = .12$$

$$E = \frac{9000 + 50,000 (.12) - 7500}{.15} = \$50,000$$

Increasing the interest rate from 8 percent to 12 percent was found to result in an increase in the required operator's equity in the farm business if loan repayments are to be completed while maintaining a satisfactory level of living. A reduction in the level of living from \$9,000 to \$7,000 reduces the required operator's equity to \$26,600 at 8 percent interest rate and \$36,000 for a \$50,000 loan at 12 percent interest rate.

APPENDIX II

THE MEASUREMENT OF FINANCIAL PROGRESS

This section attempts to describe the method used in calculating the adjusted change in the values of the variables during study period. In order to express the total farm assets for period t_2 at t_1 prices, appropriate price index deflators were used. A brief description of how the assets and other parameters in the models were adjusted is given below.

Farm Assets

In order to minimize the margin of error in the measurement of farm assets as described above, the value was expressed in 1961 prices using an index of the change in the price level for farm products. For the sub-periods 1961-65 and 1966-69 values were also expressed in constant prices.

The index values of farm products in Manitoba are listed as follows:¹

<u>Year</u>	<u>Index Value (1961=100)</u>
1961	100
1962	106
1963	103
1964	100
1965	104
1966	111
1967	110
1968	105
1969	103

¹Manitoba Agriculture Year Book 1970, Manitoba Department of Agriculture, Winnipeg, p. 81.

The adjusted value of farm assets for 1969 expressed in 1961 prices was computed as follows:

$$\text{Adjusted 1969 value of farm assets} = \text{Actual 1969 value} \times \frac{\text{1961 Index}}{\text{1969 Index}}$$

For the sub-period 1961-65 the adjusted 1965 value of assets was also calculated in the same way but with a change in index ratio.

$$\text{Adjusted 1965 value of farm assets} = \text{Actual 1965 value} \times \frac{\text{1961 Index}}{\text{1965 Index}}$$

The adjusted value of farm assets for the sub-period 1966-69 was calculated as

$$\text{Adjusted 1969 value of farm assets} = \text{Actual 1969 value} \times \frac{\text{1966 Index}}{\text{1969 Index}}$$

Machinery and Equipment

The 1969 value for farm machinery and equipment was expressed in 1961, 1965 and 1966 prices for the total period and for each of the two sub-periods respectively

(a)

$$\text{Adjusted 1969 value of machinery and equipment} = \text{Actual 1969 value} \times \frac{\text{1961 Index}}{\text{1969 Index}}$$

(b)

$$\text{Adjusted 1965 value of machinery and equipment} = \text{Actual 1965 value} \times \frac{\text{1961 Index}}{\text{1965 Index}}$$

(c)

$$\text{Adjusted 1969 value of machinery and equipment} = \text{Actual 1969 value} \times \frac{\text{1966 Index}}{\text{1969 Index}}$$

Livestock

The same indices shown above for the years 1961-69 were used to adjust the value of livestock for the total period 1961-69 and also for the sub-periods 1961-65 and 1966-69.

(a)
Adjusted 1969 value for livestock = Actual 1969 value x $\frac{1961 \text{ Index}}{1969 \text{ Index}}$

(b)
Adjusted 1965 value for livestock = Actual 1965 value x $\frac{1961 \text{ Index}}{1965 \text{ Index}}$

(c)
Adjusted 1969 value for livestock = Actual 1969 value x $\frac{1966 \text{ Index}}{1969 \text{ Index}}$

The adjusted values for farm assets, machinery and equipment, livestock for the total period and each sub-period were used in the regression equations. The values for gross profits and credit were not adjusted as no appropriate deflators were available.

APPENDIX III

THE INTERCORRELATION COEFFICIENTS

TABLE I

THE INTERCORRELATION COEFFICIENTS BETWEEN THE
VARIABLES OF THE GROWTH FUNCTION USING AGGREGATED
VALUES FOR THE TOTAL PERIOD, 1961-69.

	1	2	3	4	5	6
1.	1.0000					
2.	0.2381	1.0000				
3.	0.7322	0.0553	1.0000			
4.	0.8233	0.3643	0.5771	1.0000		
5.	0.6586	0.4235	0.4733	0.7612	1.0000	
6.	0.4248	0.4936	0.3294	0.3107	0.4447	1.0000

TABLE II

THE INTERCORRELATION COEFFICIENTS BETWEEN THE
VARIABLES OF THE GROWTH FUNCTION USING AGGREGATED
VALUES FOR THE SUB-PERIOD, 1961-65.

	1	2	3	4	5	6
1.	1.0000					
2.	0.4681	1.0000				
3.	0.4303	0.4046	1.0000			
4.	0.1116	-0.0764	-0.1818	1.0000		
5.	0.3472	0.8420	0.2872	-0.1240	1.0000	
6.	0.6110	0.3873	0.3381	-0.2460	0.2266	1.0000

TABLE III

THE INTERCORRELATION COEFFICIENTS BETWEEN THE
VARIABLES OF THE GROWTH FUNCTION USING AGGREGATED
VALUES FOR THE SUB-PERIOD, 1966-69.

	1	2	3	4	5	6
1.	1.0000					
2.	0.2406	1.0000				
3.	0.7563	0.3240	1.0000			
4.	0.0254	0.1368	0.0469	1.0000		
5.	0.3155	0.4943	0.2334	0.0082	1.0000	
6.	0.1181	0.6812	0.2062	-0.2312	0.2189	1.0000

TABLE IV

THE INTERCORRELATION COEFFICIENTS BETWEEN THE
VARIABLES OF THE PROFIT FUNCTION USING AGGREGATED
VALUES FOR THE TOTAL PERIOD, 1961-69.

	1	2	3	4	5	6
1.	1.0000					
2.	0.5819	1.0000				
3.	0.6920	0.5067	1.0000			
4.	0.3837	0.7473	0.1655	1.0000		
5.	0.6647	0.7865	0.6486	0.6092	1.0000	
6.	0.6927	0.6198	0.8895	0.2909	0.7612	1.0000

TABLE V

THE INTERCORRELATION COEFFICIENTS BETWEEN THE
VARIABLES OF THE PROFIT FUNCTION USING AGGREGATED
VALUES FOR THE SUB-PERIOD, 1961-65.

	1	2	3	4	5	6
1.	1.0000					
2.	0.5027	1.0000				
3.	0.0674	-0.0727	1.0000			
4.	0.5256	0.4189	0.0691	1.0000		
5.	0.7288	0.6169	0.0948	0.8032	1.0000	
6.	0.3947	0.1243	-0.0179	0.2222	0.2724	1.0000

TABLE VI

THE INTERCORRELATION COEFFICIENTS BETWEEN THE
VARIABLES OF THE PROFIT FUNCTION USING AGGREGATED
VALUES FOR THE SUB-PERIOD, 1966-69.

	1	2	3	4	5	6
1.	1.0000					
2.	0.6838	1.0000				
3.	0.7355	0.5193	1.0000			
4.	0.4452	0.5171	0.2147	1.0000		
5.	0.7348	0.7272	0.7939	0.5429	1.0000	
6.	0.8148	0.5603	0.8576	0.4347	0.8418	1.0000