AN EVALUATION OF THE BRITISH COLUMBIA FINANCIAL MANAGEMENT TRAINING PROJECT

by

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ABSTRACT

The objective of this thesis is to assess the effectiveness of a financial management extension program offered to farmers in British Columbia. This assessment is done with two objectives in mind. Firstly, it could permit an improvement and revision of the course format, material and presentation. Secondly, the assessment provides information to policymakers as to the value of courses and support that should be given to this form of agricultural training.

After reviewing the literature on various methods used in the evaluation of extension methods, a profit function approach was chosen as an appropriate conceptual model. Profit is defined as a function of output prices, variable input prices and fixed inputs. Variable inputs in the production process include hired labor and non-labor inputs such as fertilizer, chemicals, feed and custom work. The data gathering component of the work involved completion of a questionnaire by 73 farmers. This sample of farm operators represented different types of producers: dairy producers, beef producers, grain, nursery, orchardists, bee producers and other mixed enterprises. Data availability restricted the empirical model to a selected number of important variables: hired labor wage rate, aggregate capital (deeded and rented land, buildings, machinery and
equipment and livestock), operator's labor on the farm, education, and financial management skills.

A Cobb-Douglas functional form was used for the estimation of the parameters. Because of the diverse nature of the producers some aggregation problems were encountered. Attempts to alleviate this problem involved the use of dummy variables for selected homogeneous commodity groups in the samples. The most successful strategy relied on pooling of all observations.

Results indicate that on average the financial management input is important in production. The estimated marginal return to financial management is $968. At the farm level 56 farmers out of a sample of 73 have a positive marginal value product to financial management. In order to assess the impact of the program ex-ante, an evaluation was carried out through a prediction equation. The expected impact of the program is positive for 51 farmers out of a population of 73. The expected average change in variable profit through participation in the course is $2089 per year, representing a 3% percent improvement in their profits.
TABLE OF CONTENTS

Chapter

I INTRODUCTION.............................................. 1

1.1 History of Financial Management Programmes in British Columbia .......... 5

1.2 The Objective of The Study ................. 10

1.3 Organization of the Thesis............... 12

II THEORETICAL FRAMEWORK FOR ASSESSING RETURNS TO HUMAN CAPITAL ........... 14

2.1 Literature Review................................. 14

2.2 The Economic Model............................. 21

2.2.1 Optimal Combination of Resources . 22

2.2.1a The constrained Output Situation . 22

2.2.1b The Constrained Cost Situation ... 23

2.2.1c Profit Maximization ..................... 24

2.3 Choice and Derivation of the Conceptual Model ..................... 25

2.4 Summary........................................... 29

III ECONOMIC MODEL, DATA AND FUNCTIONAL FORM........ 30

3.1 The Economic Model ......................... 30

3.2 Data Sources .................................. 34

3.2.1 Variable Inputs Costs ...................... 36

3.2.2 Prices and Costs........................... 37

3.2.3 Family Labor................................. 38

3.2.4 Education .................................. 38

3.2.5 Financial Management Abilities ... 39

3.2.5a Cash Flow Management Skills........ 40

3.2.5b Tax Planning Management Skills ... 41

3.2.6 Total Receipts.................. 42

3.2.7 Capital Stock ...................... 43

3.2.7a Capital Services .................. 44

3.2.8 Data Collection Problems ................. 46

3.3 Functional Forms .............................. 49

3.3.1 Linear Form ................................. 51

3.3.2 Constant Elasticity of Substitution ... 51
3.3.3 Cobb-Douglas .......................... 52
3.3.4 Flexible Functional Forms ........... 52
3.3.4a Generalized Leontief Profit ........ 53
3.3.4b Variable Profit Function .......... 53

3.4 Implication for Estimation .......... 54
3.4.1 Variation in Input Levels .......... 55
3.4.2 Multicollinearity of Inputs ......... 56
3.4.3 Specification Bias .................. 56
3.4.4 Left Out Variables ................. 57
3.4.5 Non-Response Errors ............... 59
3.5 Summary ............................... 59

IV ESTIMATING THE RETURNS TO EDUCATION AND
FINANCIAL MANAGEMENT..................... 61

4.1 The Estimation of Returns to Education... 62
4.1.1 Estimating Strategy.................. 65
4.1.2 Results of Revenue and Profit
Equations ............................... 67

4.2 Estimation of Returns to Financial
Management ................................ 75
4.2.1 Results of Financial Management.... 76
4.2.2 The Marginal Value Product
Per Farm .................................. 86
4.2.3 Predicting Expected Changes in
Profits ................................... 88

V SUMMARY, CONCLUSIONS AND IMPLICATIONS FOR
FUTURE RESEARCH............................ 94

5.1 Summary ................................ 94
5.2 Conclusions .............................. 98
5.3 Implications for Future Research ...... 99

BIBLIOGRAPHY ................................. 105
APPENDIX A ................................. 111
APPENDIX B ................................. 113
APPENDIX C ................................. 115
LIST OF TABLES

3.1 Location, Commodity Type and Number of Farmers Attending Financial Management Workshops .................................................. 35
3.3 Single Questions of Financial Management - Cash Flow and Tax Planning: Prior to and After the Course - Pooled Sample .................. 41
3.4 Total Revenue, Profit and Capital (000's $) ................................................. 43
4.1 Revenue Function to Measure the Marginal Productivity of Education .......................................................... 69
4.2 Variable Profit Function to Measure the Marginal Productivity of Education .................................................. 70
4.3 Estimates of the Marginal Value Products for the Total Revenue Model .................................................. 72
4.4 Estimates of the Marginal Value Products for the Variable Profit Model .................................................. 72
4.5 Variable Profit Function to Measure the Marginal Productivity of Financial Management .................................................. 79
4.6 Estimates of the Marginal Returns - Profit Equation with Financial Management Variable ............. 81
4.7 Huffman's Estimates of Returns to Extension in the U. S. A. .................................................. 83
4.8 Huffman's New Estimates of Returns to Extension in the U. S. A. - 1964 Data Set .................................................. 84
4.9 Summary Statistics on Marginal Return per Farm by Variable Profit Group .................................................. 88
4.10 Summary Statistics on Test Scores and Variable Profit Groups .................................................. 92
4.11 Summary Statistics on Expected Profit due to the Program .................................................. 93

LIST OF APPENDICES

B.1 Profit, Capital Flows and Wage Rate - 1980 Data in 1981 Dollar Value .................................................. 114
C.1 Marginal Return per Farm $300-$9000 Group .................................................. 116
C.2 Marginal Return per Farm $10000-$20000 Group .................................................. 117
C.3 Marginal Return per Farm $30000-$40000 Group .................................................. 117
C.4 Marginal Return per Farm $50000-$90000 Group .................................................. 118
C.5 Marginal Return per Farm $100000-$400000 Group .................................................. 118
D.1 Expected Change in Profit Due to Training Program $300-$9000 Group .................................................. 120
D.2 Expected Change in Profit due to Training Program $10000-$20000 Group .................................................. 121
D.3 Expected Change in Profit due to Training
Program $30000-$20000 Group.........................121
D.4 Expected Change in Profit due to Training
Program $50000-$90000 Group.........................122
D.5 Expected Change in Profit due to Training
Program $100000-$400000 Group.......................122
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CHAPTER I
INTRODUCTION

Traditionally, economic growth models have been built on the assumption that output is a function of aggregate quantities of capital and labor used in production. In the Harrow-Domar (1940) growth model, for example, equilibrium growth simply requires that both labor and capital stock (measured in aggregate quantities) be fully employed as the economy grows. However, in the early 1950's empirical results based on United States data indicated that capital and labor inputs, as they were currently being measured, explained little of the change in productivity. In recognition of this fact, the unexplained changes in total factor productivity have been given such labels as "the residual" or "the measure of ignorance." Some of these studies that attempt to measure factor productivity are discussed below.

Solow (1958) introduced into the production function a time variable as a proxy for technical change. This variable accounted for slowdowns and speedups of the economy, improvements in the education of the labor force, and other factors. Solow applied the model to United States data for the years 1909-49 and concluded that gross output per worker hour doubled over that interval, with 87.5 percent of the increase being attributable to technical change or advance in knowledge. The remaining 12.5 percent was attributable to an increase in the level of capital used.
Jorgenson and Griliches (1963), using 1945-65 data for the United States economy, concluded that increased input use initially explains 52.4 per cent of the rate of growth of output. However, after correcting for quality changes in the labor and capital stock, the rate of growth of input use explained 96.7 per cent of the rate of growth of output change and changes in total factor productivity explains the rest. In the same year, Kendrick and Sato (1963) concluded that the observed decline in the saving ratio for the United States economy, between 1919-60, holds only if the definition of savings is limited to tangible capital. They argued that if the savings associated with intangible investments in research and development and in persons - particularly for health, education and training - are included with conventionally defined saving and investment, then it is doubtful that the net saving ratio fell at all. Their conclusion was based on the fact that, despite the decline in the net tangible investment ratio after 1919, the acceleration in productivity advance after 1919 is indirectly confirmed by the intangible investment ratio which grew substantially after 1919.

Nelson (1964) in a critical review of past work, looked at the sources of interaction between education, technical change and improved allocation decisions. Nelson argued that the effects upon GNP of the three principal contributors to growth - technological change, improved
Educational standards and levels, and improved allocative efficiency—should not be viewed as independent. He writes,¹

Educated people, principally scientists and engineers, are critical input to the research and development process; thus the rate at which technological understanding is increased is strongly related to the number of educated people applied to that purpose.... New technological developments need to be evaluated by people in management who can understand them and who can understand the nature of the market for them. Information about new products needs to be communicated from the firm that develops them to the potential market by salesmen who can describe the product and its uses and can answer questions. In the earlier stages of production before the techniques become routinized, highly trained people are required to deal with the problems that invariably arise.... Finally, to close the circle, one of the important lessons we have learned from experience with depressed areas and industries and with training and retraining programs is that basic literacy is almost a prerequisite for both learning of a new job and learning to do a new job.

Denison (1967) studied the growth of the United States economy for the periods of 1909-57. He also applied the same technique of analysis to nine countries in the 1950-62 period and 1950-55 and 1955-62 subperiods. Denison's findings indicate that an increase in the education of the labor force raised the average quality of labor enough to contribute 50 percentage points to the

United States growth rate from 1950 to 1962, the amount was 40 percent in Belgium and Italy, 30 percent in France and the United Kingdom, 20 percent in the Netherlands and Norway, and only 10 percent in Denmark and Germany.

A general conclusion that follows from these studies is that the effect of input use on output growth includes the effect of physical quantities of inputs and all qualities. Quality changes come from the existence of technical progress in the form of improvements in management, improvements in capital goods, and improvements in labor due to education.

For the purpose of the present study, we are also concerned with improvements in the labor force which may come about as a result of education through an extension program. This improvement in technical and allocative efficiency will affect choices farmers make. Evidence from the seminal work on agricultural research and extension productivity by Griliches (1958) on hybrid corn in the U.S.A., indicates that there are payoffs associated with extension programs to farmers and to consumers. In general, the value of agricultural extension includes direct benefits, such as increased yield, reduced costs of production and improved quality. In addition, higher incomes are earned by some farmers and consumers face lower food prices. Many countries around the world today devote a large part of their developmental efforts to providing extension services of different types and forms to
different groups or sectors of their economies. Expenditures on agricultural extension programs in Canada, were 21.6 million (US$) in 1959, 36.0 million dollars in 1971 and 36.6 million dollars in 1974.

1.1 History of Financial Management Programmes in British Columbia

The history of the financial management training program to be evaluated in this study dates to 1974 when Canada and the province of British Columbia signed a General Development Agreement. The federal and provincial governments agreed on a new development program that would include selected agriculture and rural development programs thereby improving the economic potential of rural regions in British Columbia. As a result of the agreement there has been in British Columbia, for the past five years (1979-83), a specialized course in the basic principles of financial management. This Financial Management Training Project, which is especially designed for those farmers with limited skills in financial management, has been delivered through the auspices of the Ministry of Agriculture and Food to farmers, as part of what is known

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2 Boyce and Evenson, Table 1.1, 1.2, 2.1, and 2.2 in W. E. Huffman, "Returns to Extension: An Assessment," Research and Extension Productivity in Agriculture, ed. A. A. Araji, pp. 101-140. Moscow: University of Idaho, 1980
3 Ministry of Agriculture, Agriculture and Rural Development (Canada - British Columbia, July 8, 1977) p. 2
4 Ministry of Agriculture and Food, 1982 Annual Report (Province of British Columbia), p. 15
as a Subsidiary Agreement on Agriculture and Rural Development (ARSDA) funded Farm Management Training Project. The project is the responsibility of a management committee represented by members of the University of British Columbia, the British Columbia Federation of Agriculture and the Ministry of Agriculture and Food and others. There is a mandate to evaluate the effectiveness of this extension program.

The need for a project of this nature is noted by Scott in his "Notes on Financial Management for Agricultural Producers". He writes,

These workshops on financial management recognize the changes that have taken place in agriculture in the last 40 years, and the necessity for the farmers to have a high degree of skill in financial management. Since 1940, the average investment in farms has increased forty to fifty times. This fact requires farmers to borrow huge amounts of capital to invest in the farm business. Originally this money could be borrowed on the basis of security but that is not sufficient anymore. Now a borrower also requires a demonstrated ability to manage debt and produce a profit from owners investment with backing of the lender. Farmers today generate a lot of cash but inputs are expensive and net profit from the sales dollar has shrunk from 65% to about 18% or less in 1979. Because of the narrow margins farmers must prepare accurate budgets, control costs and control the flow of cash.

At the federal and provincial levels, the objectives of the ARDSA agreement are to:

(a) identify, research, plan and pursue new or unexploited projects related to the development opportunity;
(b) expand employment in those existing aspects of the agriculture industry and food processing industry in British Columbia which demonstrate production and market potential, and
(c) improve the viability of the existing industries to sustain growth

Under this agreement, the province of British Columbia is to undertake:

(a) research, planning, training and market promotion to help identify and develop new opportunities for the province's agricultural and food-oriented industries
(b) coordinate resource management - with the co-operation of other resource users - to develop the grazing potential of Crown rangelands which are best suited for livestock
(c) primary resource development with funds being allocated for irrigation and drainage projects and other projects
(d) support services and community developments to assist secondary food processors and assist in agricultural support services
which are needed to improve rural economic
stability and to create jobs

In terms of the objectives of the project, Scott
in his "Notes on Financial Management for Agricultural
Producers"⁶ writes about the program in the following way:

The objective of the [Financial
Management Training Project] is to give
a general understanding of the purpose
of financial management and what is
involved in that function for owner-
operated farm business. In doing so,
[the course conveys the necessary]
information required for financial
management purposes and how this
information is assembled into
statements that permit the manager to:
make better investment decisions;
monitor and control operations for
profit; manage cash; determine effect
ahead of time on profit and cash flow
of changes in operations, financing or
investment portfolio; analyze the
business for strengths and weakness;
and analyze the business for growth in
assets and equity.

The project consists of courses of two to four
days in duration offered on a commodity basis at three
different levels: beginning, intermediate and advanced
levels of understanding. These enable a farm manager to
progress from an introductory level, dealing with the
basics of financial management, to an intermediate level
concerned with the application of financial management
tools and an advanced level which covers more specific
topics in detail such as investment analysis, farm business
analysis, business organization alternatives and marketing.

⁶ Ibid., p. 1
Unlike other extension programs, which are often based on a visit system, the present extension effort is being delivered in a classroom situation. A skills test prior to and after the training is given to each participant. Another important feature of the project is the scheduling of courses throughout the province of British Columbia, often at remote locations. In this 4-day course at level I, which is the interest of the present study, farmers are taught techniques of keeping costs of production worksheets, income and expense statements, cash flow statements, balance sheets, net worth statements, partial budgeting, and tax and estate planning.

According to experts in the farm management area additional income benefits to producers are likely to result from the increased use of cash flow, and tax and estate planning concepts. In order to make effective decisions the financial manager or farmer needs a flow of accurate information pertaining to the financial position and activities of their business. This flow of information will assist them in evaluating the firm's financial position relative to its objectives, it will allow them to assess the economic performance of the farm and control the daily routine of operation of farm, and evaluate alternative strategies for controlling resources. Tax and estate planning techniques, on the other hand, are extremely important in assisting a producer's choice of business organization in order to receive maximum benefits
from existing tax and estate transfer laws.

1.2 The Objective of the Study

The objective of the present study is to assess the effectiveness of the financial management extension program on farm production and incomes for those who have taken the course and more generally for farmers in British Columbia.

There are two reasons for the evaluation exercise: First, the assessment of the course could encourage an improvement and revision of the course format, material and presentation. Secondly, the benefits from production oriented extension activities are in most cases measured through changes in agricultural productivity and since such activities use scarce resources, policy makers are keen to know whether it pays to invest in extension activities. Therefore, another aspect of the evaluation exercise is to provide information to policy makers as to the value of such courses and how much support should be given to this present form of agricultural training program. If the present training program proves to yield satisfactory rates of return, then additional funding to such activities would prove profitable to society and lessons learned from this program can then be generalized. This is particularly important when, within the Agricultural Ministry, extension budgets have to compete with other programs such as agricultural price subsidies.
and other services. Outside agriculture these allocations must compete with other budgetary categories such as highways, transportation, tourism, forestry, education, health services and social welfare.

In the light of the above discussion, the following hypothesis is postulated: skills in financial management have a significant effect on production, incomes and profits of the farmers in British Columbia. More specifically, these skills may be learnt through extension programmes and their skill level may be judged prior to and after a financial management training programme.

Statistically, the null hypothesis may be stated as

\[ H_0 : \beta = 0 \]

where \( \beta \) is a parameter measuring the effect of the financial management skill on profit. In other words, the null hypothesis is that financial management skills do not have any significant effect on production and incomes. The alternative hypothesis becomes

\[ H_a : \beta > 0; \]

which is equivalent to saying that financial management skills do have a significant effect on production and incomes. In the analysis that follows the significance of this parameter is judged.
1.3 Organization of the Thesis

In the present chapter we have attempted to define the purpose of this thesis by discussing improvements in the labor force which may come about as a result of being better educated through an extension program. These improvements in education will lead to improvements in productive efficiency by affecting the technology which farmers select. The origins and objectives of the training programs in general and of the Farm Financial Management Training in particular in British Columbia are noted. The economic importance of a training program in financial management was also noted. In Chapter 2 a review of the literature on evaluation methods of education and extension programs is presented. A review of the theory of production provides a basis for the conceptual model to be derived. In Chapter 3, data used in this study are presented in terms of its source, collection problems and the measurement of variables. In subsequent sections, the possible choice of functional forms for the theoretical model developed in Chapter 2 are discussed and the implications for estimation are considered. In Chapter 4, the technical and allocative effects of education on profits are measured and the results compared with past studies. In this chapter the results on formal education are derived for two different data sets. The data are also pooled in an attempt to derive more reliable estimates and the empirical model is extended to incorporate the
financial management variable. The results obtained are then used in projecting the expected effect of the present training in financial management on farm profits in British Columbia. In Chapter 5 a summary of findings and recommendations is provided.
CHAPTER II
THE THEORETICAL FRAMEWORK FOR ASSESSING RETURNS TO HUMAN CAPITAL

The purpose of the present chapter is to develop a general framework for assessing returns to investment in human capital either in the form of formal education or non-formal education such as extension activities or on-the-job-training. The first section of this chapter reviews the literature on attempts to evaluate education and extension. The second section, in order to highlight the general nature of the production process, reviews briefly some aspects of the theory of production and discusses producer behaviour in the light of output maximization, cost minimization and profit maximization objectives. Finally, a conceptual model to suit the purpose of this study is derived.

2.1 Literature Review

Formal educational programs and extension type education programs may both be viewed as a form of learning and as such expected to improve the skills of a participant in these programs. As such they are complementary to each other and the effectiveness of some of these programs are examined in this section.

Models assessing the impact of education and extension programs abound and will certainly differ
depending on the type, form of extension, evaluation objectives and to a large extent on the availability of suitable data for empirical analysis. Such models range from the simplest to highly sophisticated approaches.

Probably the most traditional approach to assessing extension programs is the 'follow-up' approach. This consists of finding out whether certain approved practices (e.g. adoption of certain technologies) are being adopted by the farmers after a certain lapse of time between the extension activity and the evaluation. This procedure has been implemented by many researchers. Brunner et. al. (1949); Phipps et. al. (1954); and Benor et. al. (1977) followed this approach through observation, and without the use of questionnaires. Opare (1976) correlated production patterns with the adoption of recommended practices. Smith et. al. (1982) used questionnaires after dissemination of extension news, and Arnott (1982) concentrated on Bennett's (1977) hierarchy of evaluation. His evaluation concentrated on the reactions, knowledge and the skill levels.

Within the context of developing countries, Harker (1974) reports on a few case studies by investigators, such as A. S. Murphy, who reported a zero-order correlation of 0.36 between the number of years of schooling completed and the adoption of new practices among 180 Indian farmers in West Godavary. Prodipo et. al. reported the same correlation of 0.36 for 680 Indian
farmers. In a study of 222 farmers from three villages in the Union Territory of Delhi, V. S. Sanharan Potty found that the village with the lowest proportion of illiterate farmers and the highest proportion of farmers with primary or higher schooling was the most adoptive of new practices. Shiva Nath Singh's work reports the same results in 1969 for 90 Indian farmers from six villages in the Union Territory of Delhi. His results showed a very strong relationship between education and adoption.

Another method frequently used is to count and correlate, or use a frequency distribution table between the number of contacts that farmers have had with extension agents (Akinbode, 1969; Asmar, 1975) and relate this contact to production. An alternative method is to evaluate both the clientele and the extension staff simultaneously through questionnaires. Responses to particular questions are rated. Uwakah (1975) evaluated agricultural extension staff using group means, standard deviations, t-tests and other correlation techniques. Opeke (1977) assessed the effectiveness of the extension agents through their clientele using descriptive statistics and correlational analysis to assess factors affecting production. Oakley (1981) assessed extension staff through conversation and observation and Ojoko (1979) assessed the extension staff and the program through questionnaires submitted to both extension staff and the clientele. Mean scores on the ratings by each group were compared through analysis of
variance. Kanter (1982) and Young (1977) carried out their analysis by comparing the mean scores on ratings of the program by both the extension staff and the clientele; and Hagle (1972) evaluated both clientele and the agencies involved in the extension program through ranking techniques.

In examining the B. C. Financial Management Training Project Cahill (1981), using the scores obtained from tests given to farmers prior to and after the extension course, tested for significance of change in skills in financial management as reflected by the change in the test scores. Haddow (1979) used a cost and benefit analysis approach in attempting to evaluate the British Columbia Financial Management Training Project. He was able to quantify the direct costs of carrying out the extension program but his study was handicapped by the fact that he could not quantify the expected long-run benefits of the project.

Ajari (1980) applied cost and benefit analysis in an attempt to estimate the returns to investment in current and future research and extension programs for several agricultural commodities (sheep, vegetables, potatoes, and cotton) and analyzed the impact of cooperative extension on research effectiveness in the Western Region of the United States. Ajari concluded that the payoffs from research without extension are lower than those with extension.

An alternative method of assessing the effects of
education and extension is the introduction of an education variable as another input of a production function. Huffman (1977), Fane (1975) and Khaldi (1975) have followed a two-step procedure. First, a production function is estimated to determine the optimum input and/or cost levels. Then, in a second stage, the effect of education in reducing the discrepancy between optimum and observed levels is measured.

Huffman (1974), in his study of U.S.A. Corn Belt, concluded that extension (days, average for 1958 and 1960, allocated to crops by agents doing primarily agricultural work) and education are substitutes to nitrogen fertilizer in hybrid corn production. He also (Huffman, 1976) arrived at the conclusion that extension agent days allocated 3 years earlier to crops and livestock activities by agents doing primarily agricultural work, contributed significantly to the level of agricultural production. Huffman (1980) reports several studies that have used a production function approach and have measured the extension variable in dollar expenditure per extension activity, time expenditure per extension activity, number of contacts with extension agents or dummy variables. These are reviewed below.

Patrick et. al. (1973) conducted a study in Eastern Brazil and concluded that extension, number of direct contacts of farmers with extension agents during the steady year, had political but generally not a
statistically significant effect on value added in farm production. Evenson et al. (1973), in India, found that extension and the index of maturity of the extension program contributes significantly to agricultural productivity change only through interaction with research programs. Mooch (1976, 1978), in a study in Kenya, found that extension contacts with farm operators during the year contributed significantly to corn yields; that extension and education are substitutes, and that extension interacts positively with the rate of nitrogen fertilizer application on farms. Halim (1977), in the Philippines, found that an index of extension contact with the farmer, derived by weighting frequency of contact over previous 5 years, contributed positively and significantly to agricultural production, with an implied relatively high marginal return. The effect of schooling was substituted by the extension efforts in the less developed barrios, while in the developed barrios, schooling and extension were found to complement each other in increasing rice production. Finally, also using a production function approach, Chaudhuri (1974) found that 65 to 75 percent variation in output in Indian agriculture is explained by education alone.

In reviewing the literature on education and extension evaluation it is noted that the procedures range from simple "follow-up" techniques, correlation analysis, cost and benefit analysis to the use of production
functions. Each technique has advantages and disadvantages. For example, the "follow-up" technique may not require collection of hard data. The simultaneous evaluation of both extension staff and the clientele is commendable because it acknowledges the fact that the success of an extension program does not only depend on the clientele but also the staff that plans and implements the program. The use of cost and benefit analysis could be useful because it incorporates the direct costs incurred in the extension activities, such as salaries, and capital outlays and also some social costs and benefits incurred. The use of production functions can be useful because a function can be fitted without the explicit inclusion of research or extension as an independent variable. In doing so it has been assumed that the unexplained residual captures the impact of extension. However, the following criticism applies to some of these studies: to the extent that an extension program may complement or substitute for the existing knowledge of the farmers, none of these studies, except Cahill (1981), attempts to measure the effect of an extension program through an index of accumulation of human capital due to training. The approach adopted in this study uses test scores on financial management skills and these test scores are correlated with production and incomes for a sample of farmers. The parameters will be tested for significance. Hence, we want to investigate the possible effect of financial management skills prior to and after
the training on farmers' production and incomes.

2.2 The Economic Model

Any production process requires a variety of inputs such as labor, materials and capital. Some of these inputs are variable and others are fixed. It is usually assumed then that the variable inputs can be combined in different proportions with the fixed inputs to produce various quantities of output.

By definition, fixed inputs are those whose quantities cannot readily be changed in response to a certain desired level of output. The assumption of fixed inputs recognizes that, in the short run, it is not economic for a number of reasons to change the level of their use. Buildings, machinery and equipment, and managerial personnel generally fall into this category. On the other hand, variable inputs are those whose quantity, in the short-run, may be changed at low cost in response to desired changes. Examples of these are many types of labor services and material inputs.

In the present study it is assumed that the producers, who constitute our sample, are concerned with short-run decisions, thus combining different quantities of variable inputs with a specific quantity of fixed input in order to produce various quantities of agricultural output. In production theory, a producer is assumed to operate in
stage two of the three distinct stages of production. In the first stage, the marginal physical product of fixed inputs is negative while that of the variable input is positive and increasing. In the second stage, the marginal physical products of both fixed and variable inputs are positive but decreasing. In the third stage, the marginal physical product of the variable inputs is negative. Thus, the only efficient economic region is the second stage. In this study it is assumed successful producers operate in the second stage, inefficient producers may operate in stages one, two or three.

2.2.1 Optimal Combination of Resources

In this subsection we briefly discuss the optimal manner in which an individual producer should combine resources. A producer to achieve an optimal resource use may: (1) maximize output for a given cost, (2) minimize cost subject to a given output, (3) maximize profits.

2.2.1a The Constrained Output Situation

A producer maximizing output subject to a given cost faces the following problem:

\[
\max F(K,L) - \lambda(rK + wL - C)
\]  \hspace{1cm} (2.1)
where \( F(K,L) \) is the production function with capital \( K \) and labor \( L \) as inputs and \( C \) is a given cost expenditure, \( r \) is the price of capital and \( w \) the wage rate. Maximum output is attained when the equilibrium first-order conditions are being met:

\[
\frac{\partial F}{\partial L} \div \frac{\partial F}{\partial K} = \frac{w}{r}. \quad (2.2)
\]

In other words, in equilibrium, the necessary conditions require that the marginal product per dollar's worth of input must be the same for each input. The sufficient conditions require that the quadratic form associated with the Hessian determinant \( (i = 1, \ldots, 1) \)

\[
\begin{vmatrix}
0 & F_k & F_l \\
F_k & F_{kk} & F_{kl} \\
F_l & F_{kl} & F_{ll}
\end{vmatrix}
\]  

be negative definite.

2.2.1b The Constrained Cost Situation

If the objective of the producer is to minimize cost subject to a given level of production then the problem becomes:

\[
\min rK + wL - \lambda (F(K,L) - Q) \quad (2.4)
\]
To meet this goal, the requirements are the same as in the case of maximizing output subject to a given cost.

2.2.1c Profit Maximization

For profit maximization, consider the general case where \( P = f(Q) \) is the demand function facing the producers, \( Qf(Q) \) is the total revenue, and \( C = A + g(Q) \) the total cost function. Profit, \( (\pi) \), is therefore defined as

\[
\pi = Qf(Q) - A - g(Q).
\] (2.5)

Profit is maximized when

\[
\frac{\partial \pi}{\partial Q} = f(Q) - g'(Q) = 0
\] (2.6)

and the second order conditions require that

\[
\frac{\partial^2 \pi}{\partial Q^2} = -g''(Q) < 0.
\] (2.7)

In other words, profits are maximized when marginal revenue equals marginal cost, and the sufficient conditions require a positively sloped marginal cost curve. These conditions may be evaluated in the empirical work where the marginal value product of various inputs and its relation to input costs are examined. In the present study, it is assumed that in organizing production the producers in our sample are attempting to be profit maximizers yet are constrained
by many factors.

2.3 Choice and Derivation of the Conceptual Model

On theoretical and empirical grounds a restricted or variable profit function is chosen for use in this study. The advantages of using a profit function for a study of this nature are many. Welch (1970) has shown that the marginal product of education on a value added function (gross sales minus total variable expenses) consists of three important components, the first part thereof being the "own" value of the marginal product of education (he terms this the worker effect), the second component refers to gains from allocating factors (education, supplied inputs and purchased inputs) effectively between competing uses, and the last component to "allocative gains" from selecting the 'right' quantity of purchased inputs. In other words, the gross sales less expenditure on purchased variable inputs no longer includes the level of purchased inputs as independent variables and hence measures the returns to schooling including the 'worker' effect and the gains to be made from choosing the optimum level of purchased inputs. But, in the case of a production function, the effect of education on selecting the appropriate level of this input would be lost. In other words, a production function with gross revenue as the dependent variable includes only the 'worker' effect and the effect of allocating factors between competing uses but the effect of selecting the right quantities of other
inputs is lost.

An advantage of using a profit function (Yotopoulos et. al., 1972) is that through Shepard's Lemma we can derive a system of supply and factor demand functions without having recourse to an explicitly specified production function. The system is derived under the assumption that profit maximization occurs under perfect competition. The independent variables in the system of supply and derived demand functions are exogenous to the behaviour of the farm firms because they are determined by market forces and the simultaneous equations bias problem that is usually associated with production functions does not arise.

In deriving a profit function model for the present study, we note that agriculture is a multiproduct industry and that farms are often multiproduct firms. Thus, start by letting $Y$ be a vector of $1 \geq 1$ final products, $X$ be a vector of $m \geq 1$ variable inputs and $Z$ be a vector of fixed inputs or endowments, including human capital variables. A multiproduct transformation function is defined as:

$$G(Y_1, \ldots, Y_L; X_1, \ldots, X_m; Z_1, \ldots, Z_n) = 0 \quad (2.8)$$

This transformation function may be used to describe the general relationship between inputs, extension and final products. For estimation purposes, however, the production
function must be separable (Hall; 1973), in the sense that the implicit production function can be separated into two parts:

\[ H(Y_1, \ldots, Y_L) = F(X_1, \ldots, X_m; Z_1, \ldots, Z_n) \] (2.9)

where \( H \) is a function of final products, and \( F \) a function of variable inputs and other fixed inputs.

Since our intention is to focus on a technology in which some inputs are fixed in the short run, \( F \) is assumed to satisfy the regularity conditions (Diewert; 1973). In other words, \( F \) is assumed to exhibit diminishing marginal rates of transformation of outputs for inputs, increasing marginal rates of substitution of outputs for outputs, and diminishing marginal rates of substitution of inputs for inputs. \( F \) is a continuous from above function and a proper concave function. On the assumption that the typical producer of our sample is a competitive profit maximizer, then for a given vector of prices of variable inputs (while other inputs are fixed), the producer is assumed to choose a feasible production plan which maximizes profits. The resulting maximum profit depends not only on the vector of variable input and output prices but also on the vector of fixed inputs. These results however are obtainable only if the profit function is (1) linear homogeneous in prices, (2) is convex and continuous in prices, (3) is nonincreasing in fixed inputs for every
fixed price and (4) is concave and continuous in fixed inputs for every fixed price and assumes linear homogeneity in fixed inputs. In other words it is assumed, as MacFadden (1971) has shown, that there is a one-to-one correspondence between the set of concave production functions and the set of convex profit functions. Or, as Diewert (1973) has shown, if \( G(.) \) is well behaved and farm firms face exogenous prices and maximize profits, then by duality a well behaved profit function exists that relates maximized profit to the prices of input choices and the fixed factors.

In the light of the above considerations, profit (defined as revenues less total variable costs) can be written as

\[
\pi = PF(X_1, \ldots, X_m; Z_1, \ldots, Z_n) - \sum C_j X_j \quad (2.10)
\]

where \( P \) is a vector of output prices, and \( C \) the unit price of variable input \( j \). Assume that the marginal conditions are being met as given by

\[
p(\partial F(X; Z)/\partial X_j) = C_j, \ j = 1, \ldots, m \quad (2.11)
\]

Equation (2.11) can be solved for the optimal quantities of variable inputs, \( X^* \), as a function of the prices of variable inputs and the quantities of fixed inputs,

\[
X_j^* = F^*(C, Z) \ j = 1, \ldots, m \quad (2.12)
\]
By substituting (2.12) into (2.10) we obtain a profit function

\[ \pi^* = \Omega^*(P_1, \ldots, P_n; C_1, \ldots, C_m; Z_1, \ldots, Z_n) \] (2.13)

Since profit functions are linear homogeneous in prices, a normalized profit function can be obtained by dividing profit and all prices of variable inputs including the price of output by a single price. This single price can either be an output price or a price of one of the variable inputs (Lau, 1976).

2.4 Summary

In this chapter, we have reviewed the literature on education and extension on the assumption that education and extension play a common role in production. A brief review of the theory of production and producer's behaviour has been carried out in order to make a choice of the most appropriate conceptual model that meets the goal of this study. In this process, a profit function was chosen.
CHAPTER III
ECONOMIC MODEL, DATA AND FUNCTIONAL FORM

The first section of this chapter expands upon the economic model. The second section discusses data sources used in this study and discusses the conceptual and empirical measurement of variables. The problems associated with the collection of data are noted. Various functional forms for the empirical model are discussed and on this basis a choice regarding form is made. Some of the implications of this form for estimation are discussed.

3.1 The Economic Model

The economic model developed in Chapter 2 allows one to define variables to be included in the empirical model. In this section this economic model is discussed in more detail and consequently some of the data needs of the model are noted. In section 3.2 the procedure followed in collecting this data is examined.

In Chapter 2 a profit function model was chosen as the appropriate approach to be used in this study. Since agriculture is a multiproduct industry and farms are often multiproduct firms a multiproduct transformation function was defined as function of variable inputs and fixed inputs or endowments, including human capital variables. For a given vector of input prices (while other inputs are fixed) the typical producer is assumed to choose a feasible
production plan which maximizes profits. The conceptual model is therefore defined as

$$\pi = \Omega(P, C; Z) \quad (3.1)$$

where

$$\pi = \text{profit}$$
$$P = \text{vector of output prices}$$
$$C = \text{vector of variable input prices}$$
$$Z = \text{vector of fixed inputs}.$$  

Profit is defined as the difference between current revenue less current total variable costs. Receipts from sales of crops and livestock are required and variable costs include expenditures on labor and other inputs. Other inputs include hay, grain, mixed feeds, concentrates, breeding fees, fertilizer, chemicals, custom work, etc. Feeding of livestock is necessary for the growth and fertility of livestock.

Although these inputs are treated as "variable", only some are truly operating decision variables. For example, taxes on farm property often shown under annual expenditures, yet it is not an operating decision variable. Only those variables considered to be operating decision variables will be retained. These include fertilizer, chemicals, feed, custom work and hired labor expenses.

Theoretically, this model includes output and variable input prices. Because of the perfect competition
assumption farmers in the sample are assumed to face the same price for a given commodity in a single production period. Our sample, being cross sectional, does not always offer output price variability across farms. The model further assumes that farm firms are multiproduct producers and a vector of prices for different commodities is required. Unfortunately, output prices are generally difficult to obtain since products are sold at different time periods and vary by quality. An attempt to generate output prices was discontinued because of lack of sufficient information on the physical amount sold in many situations. The same difficulty arose for prices of other inputs and hence the only price variable is that of hired agricultural labor. A wage rate for both unskilled and skilled labor is used.

Capital as a fixed input often includes land, buildings, machinery, equipment and livestock. Land availability often becomes a limiting factor to the size of the operation and may determine the size of livestock on a farm and the amount of crops produced. Livestock capital, as an input, also has the ability to produce offspring that increase the size of livestock inventory for dairy and beef producers. Data on land is in the form of deeded or rented land and acres cultivated. Both deeded and rented lands are measured in dollar terms since this measure is considered to be better than acres. This measure has the ability to capture other soil characteristics, such as fertility,
through its market values. Machinery, building and equipment and livestock capital are in dollar units.

Other fixed inputs considered include years of education, the experience of the farm operator in farm operation and the age of the operator, spouse and children. Often farm operators are not the only decision makers. A spouse may complement or act as substitute for the operator's role. The role of education on productivity has already been discussed in the previous chapters. On-farm work represents the time an operator puts into the daily work on the farm. Experience gained is assumed to affect decisions that farm operators make. Farm operators who start as poor managers may often improve their skills through their work experience. Collinearity between an operator's characteristics (education, age and on-farm work) and those of the spouse is expected and therefore only the operator is considered in the empirical model. In addition, there is the operator's financial management skills variable. This variable is probably the most important to be included in the estimating model. It is expected to capture the ability of the operator to make a good investment decisions, to control operations, to control debt and to make profit and proper tax decisions. Data on this variable consist of test scores on questions of cash flow and tax planning management.

In summary, the empirical model to be presented will retain the following variables: hired labor wage rate,
capital, operator's education, labor and financial management skills.

3.2 Data Sources

Two sets of data are used in the present study (Table 3.1). A sample of 31 observations pertaining to the 1980 production year was collected through a take-home questionnaire given to farmers attending workshops on financial management. In 1982, a new sample of 54 observations for the 1981 production year was also collected. Farmers participating provide two basic sets of information, one pertaining to their business and its operating characteristics and another is a skill test pertaining to their financial management and tax management abilities. Copies of the production information questionnaire used and skill questions on financial management are presented in the Appendices C and D. The 1981 questionnaire is intended to be an improvement upon that of 1980 as far as format and presentation are concerned.

It is worth noting that these observations do not cover all the attendants at a particular course nor all courses offered during a given year. Some observations were excluded because of the difficulties in matching the production data questionnaire and financial management skills tests for certain farmers. Also excluded were those who attended but were just beginning to farm and those who
did not complete a questionnaire satisfactorily.

These workshops were attended by several different types of farm producers: bee, mushroom, vegetable, beef, grain, dairy, orchards, nursing, cattle and egg producers. Workshops were held in Vernon, Saanich, Pemberton, Cecil Lake, Montney, Cloverdale, Summerland, Pit Meadows, Abbotsford, Vanderhoof, Kelowna and Okanagan (Table 3.1). These items are expanded when in the sections that follow.

Table 3.1: Location, Commodity Type and Number of Farmers Attending Financial Management Workshops

<table>
<thead>
<tr>
<th>Region</th>
<th>Main Commodity</th>
<th>Number of Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980: Vernon</td>
<td>bee</td>
<td>8</td>
</tr>
<tr>
<td>Saanich</td>
<td>mushroom and vegetable</td>
<td>7</td>
</tr>
<tr>
<td>Pemberton</td>
<td>beef</td>
<td>5</td>
</tr>
<tr>
<td>Cecil Lake</td>
<td>beef and grain</td>
<td>7</td>
</tr>
<tr>
<td>Montney</td>
<td>grain</td>
<td>6</td>
</tr>
<tr>
<td>1981: Cloverdale</td>
<td>dairy</td>
<td>5</td>
</tr>
<tr>
<td>Cloverdale</td>
<td>bee</td>
<td>5</td>
</tr>
<tr>
<td>Summerland</td>
<td>orchards</td>
<td>5</td>
</tr>
<tr>
<td>Cloverdale</td>
<td>nursing</td>
<td>5</td>
</tr>
<tr>
<td>Pit Meadows</td>
<td>dairy</td>
<td>7</td>
</tr>
<tr>
<td>Abbotsford</td>
<td>dairy</td>
<td>6</td>
</tr>
<tr>
<td>Vanderhoof</td>
<td>cattle</td>
<td>4</td>
</tr>
<tr>
<td>Kelowna</td>
<td>orchards</td>
<td>4</td>
</tr>
<tr>
<td>Okanagan</td>
<td>cattle</td>
<td>3</td>
</tr>
<tr>
<td>Abbotsford</td>
<td>egg</td>
<td>6</td>
</tr>
</tbody>
</table>
Data on land use (both deeded and rented), farm buildings, machinery and equipment and livestock capital, expenditures on hired agricultural labor and non-labor inputs, hired agricultural wage rate (for both skilled and unskilled), family labor and schooling (operator, spouse and children) and gross receipts were collected. Financial management skills were evaluated through a test given prior to and after the workshops. The test is divided into two sections: section one has 6 questions on cash flow management skills and section two has 7 questions on tax and estate planning management skills. These data are discussed in the section that follows. The mean and standard deviation of these variables are noted and their measurement discussed.

3.2.1 Variable Input Costs

Variable inputs are crucial to the operation of a farm since these allow the operator-manager to either expand or contract production. Variable inputs measured include cash wage paid to hired agricultural labor and expenditures on non-labor inputs. Non-labor inputs include feed purchases, breeding fees, veterinary and medicine, bedding, custom or contract work, commercial fertilizer, agricultural chemicals such as insecticides, herbicides and fungicides, disinfectants and pesticides and crop expenses such as seed, baler and twine. The average expenditure on
hired labor is about $6700 per year, that on non-labor expenses amounts to $35600 per year for the pooled data (Table 3.2).

Table 3.2: Hired Labor Wage Rates, Hired Labor Expenditures, Non-labor Expenditures and Operator's Education, Labor and Financial Management Skills

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Education (yrs.)</td>
<td>11.6</td>
<td>1.7</td>
<td>11.6</td>
<td>3.0</td>
<td>11.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Op. Labor (000's hrs/yr)</td>
<td>1.6</td>
<td>0.7</td>
<td>1.7</td>
<td>1.0</td>
<td>1.7</td>
<td>0.9</td>
</tr>
<tr>
<td>Wage rate ($/day)</td>
<td>36.0</td>
<td>7.0</td>
<td>38.0</td>
<td>9.0</td>
<td>42.4</td>
<td>8.9</td>
</tr>
<tr>
<td>Lab. Expend. (000's $/yr)</td>
<td>3.0</td>
<td>6.1</td>
<td>8.8</td>
<td>12.5</td>
<td>6.7</td>
<td>11.0</td>
</tr>
<tr>
<td>Non-L. Exp. (000's $/yr.)</td>
<td>13.0</td>
<td>17.5</td>
<td>48.1</td>
<td>67.7</td>
<td>35.6</td>
<td>57.6</td>
</tr>
<tr>
<td>Cash Flow Sc.**</td>
<td>5.0</td>
<td>2.4</td>
<td>4.6</td>
<td>1.5</td>
<td>4.8</td>
<td>1.9</td>
</tr>
<tr>
<td>Tax Plan Sc.</td>
<td>4.9</td>
<td>1.9</td>
<td>5.2</td>
<td>1.8</td>
<td>5.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Total Scores</td>
<td>10.0</td>
<td>3.3</td>
<td>9.9</td>
<td>2.6</td>
<td>10.0</td>
<td>2.9</td>
</tr>
</tbody>
</table>

* The pooled data are in 1981 dollar value  
** Financial Management test scores before the Course

3.2.2 Prices and Costs

It was noted earlier that the only input for which a price could be derived was that for the wage rate paid to hired labor. The average wage rate is about $36 per day for the 1980 sample, $38 per day for the 1981 sample (Table 3.2). It is assumed in this study that there is enough variation in wages between different farmers in British Columbia to allow for a satisfactory measure of this variable. This lack of price data will cause
misspecification problems which should be addressed if this work is to be carried further.

3.2.3 Family Labor

Aside from hired labor, family labor is another source of on-farm labor. The amount of on-farm family labor supplied is dependent upon the amount of work required on the farm and upon off-farm job opportunities. Farm operators may seek off-farm opportunities when the off-farm wage rate is greater than the agricultural wage rate and vice versa. In general however, family labor is an important component of farm labor for operation and management.

Two sets of data on family labor are available in this study. Family labor is measured as hours worked per week, and weeks worked per year. Alternatively on the assumption that farmers work a maximum of 300 days per year, the operator's labor may be defined as the difference between 300 days and the days of off-farm work. This latter measure was not very satisfactory and the first measure was adopted (Table 3.2).

3.2.4 Education

In measuring education three components are important: (1) whose education is being measured, (2) the education measure itself and (3) how the measure is
expressed. It is possible to measure the educational level for the production unit by measuring the education level of the operator alone or measure an aggregate for all family members, or an aggregate of the education level of all farm workers. Since our interest is in the operator's performance, the operator's education alone is considered, although these other components are of importance. The quantity of education is defined as the sum of the highest grade achieved at secondary school plus years of post secondary training. As indicated in Table 3.2 11 years represent an average for the pooled data.

3.2.5 Financial Management Abilities

Management may be considered as an ability to perceive conditions and make proper decisions. This reasoning process generates skills that, when combined with other information, results in better decisions. An abilities test score may serve as an instrument for measurement of these management skills.

Tests may take many different forms, for example, essay type, objective (short-answer, true-false and multiple choice) and the matching type. An essay type test may measure skills but also the ability to organize, relate and communicate. An objective test has the advantage of allowing wider sampling of material because it takes less time to answer. The matching test is a combination of both true-false and multiple choice. In this study measurement
of the financial management variable was carried out through an objective test combining true-false and multiple choice types of questions. The weights of individual questions are discussed below.

3.2.5a Cash Flow Management Skills

Cash flow as a concept is important for making effective financial decisions. It entails, among other things, the control of daily flow of cash in the business, debt servicing, budgeting and the assessment of investment costs. The sample statistics for this variable are reported in Table 3.3.

For financial management skill variables, there are six questions on cash flow management skills. The first question on debt servicing is worth 4 points. The second question which is on costs incurred through investment in machinery is worth 1.5 points. The third question on budgeting techniques to determine the break even cost per unit of saleable product is worth 1.5 points, the fourth on financial statements (1 point), the fifth on income and expense statements as they relate to tax purposes (1 point) and the last on preparation of budgets required for an operating loan is worth 2 points. The average total score obtained was about 4.8 points prior to taking the course and 5.2 points after the course was taken.
Table 3.3: Single Questions of Financial Management - Cash Flow and Tax Planning: Prior to and After the Course - Pooled Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>CASH FLOW TEST SCORES Before</th>
<th></th>
<th>CASH FLOW TEST SCORES After</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Question 1</td>
<td>1.0</td>
<td>1.3</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Question 2</td>
<td>0.6</td>
<td>0.3</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Question 3</td>
<td>0.9</td>
<td>0.5</td>
<td>0.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Question 4</td>
<td>0.5</td>
<td>0.1</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Question 5</td>
<td>0.6</td>
<td>0.5</td>
<td>0.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Question 6</td>
<td>1.0</td>
<td>0.5</td>
<td>1.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>4.8</td>
<td>1.9</td>
<td>5.2</td>
<td>2.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TAX PLANNING TEST SCORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
</tr>
<tr>
<td>Question 2</td>
</tr>
<tr>
<td>Question 3</td>
</tr>
<tr>
<td>Question 4</td>
</tr>
<tr>
<td>Question 5</td>
</tr>
<tr>
<td>Question 6</td>
</tr>
<tr>
<td>Question 7</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

3.2.5b Tax Planning Management Skills

Tax planning is concerned with business organization in order to receive maximum benefit from existing tax laws. It involves, among other things, knowledge of tax rates and strategies for minimizing tax
incidence on taxable income. For tax planning skills question one relates to marginal tax rates (1 point). Question two on taxable capital gains carries 1 point. Question three on the validity of a will which is not properly witnessed in British Columbia is worth 1 point. Question four is on recaptured capital cost allowance (1 point). Question five is on assets that can be rolled over to a child from a farmer who is actively engaged in farming (3 points) and question six on the differences between depreciation and capital gains is worth 1 point. Question seven on the possible amount that can be taken out of capital cost allowance each year weights 1 point. The average total score was before the course 5.1 and 6.9 after the course.

3.2.6 Total Receipts

Farm receipts may be in cash or kind. Cash receipts include income from sale of agricultural products, from off-farm employment and government support programmes. This study only includes cash receipts from sale of agricultural products and government subsidies. Crop sales include wheat, barley, oats, oilseeds, Canadian Wheat Board Payments received, hay, other fodder crops, potatoes, seed crops, vegetable, and vegetable seeds, tree fruits, greenhouse and nursery, cut flowers and Government crop payments such as Crop Insurance Payments, Farm Income Assurance and other small items. Livestock and poultry
sales include proceeds from dairy, hogs, sheep and lambs including wool, broilers and other poultry, eggs, milk and cream, other agricultural products such as honey and government livestock payments such as Farm Income Insurance. Average total receipts amount to $100800 per year for the pooled data (Table 3.4).

3.2.7 Capital Stock

Total investment on a farm is an aggregate of its investment in land, building, machinery, equipment, and livestock. Land investment is measured in terms of current market value and buildings (excluding the value of the farm house) are also measured in dollar values. Machinery

Table 3.4: Total Revenue, Profit and Capital (000's $)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>56.8</td>
<td>61.6</td>
<td>125.2</td>
<td>144.6</td>
<td>100.8</td>
<td>125.6</td>
</tr>
<tr>
<td>Profit</td>
<td>40.7</td>
<td>47.2</td>
<td>68.2</td>
<td>84.4</td>
<td>60.2</td>
<td>75.2</td>
</tr>
<tr>
<td>Land: inv.</td>
<td>446.7</td>
<td>457.7</td>
<td>497.5</td>
<td>871.0</td>
<td>499.3</td>
<td>759.4</td>
</tr>
<tr>
<td></td>
<td>8.4</td>
<td>8.6</td>
<td>9.3</td>
<td>16.4</td>
<td>9.4</td>
<td>14.3</td>
</tr>
<tr>
<td>Land: flow</td>
<td>25.4</td>
<td>29.4</td>
<td>104.3</td>
<td>113.1</td>
<td>77.3</td>
<td>99.4</td>
</tr>
<tr>
<td></td>
<td>2.4</td>
<td>2.7</td>
<td>10.3</td>
<td>11.2</td>
<td>7.6</td>
<td>9.8</td>
</tr>
<tr>
<td>Bldg: inv.</td>
<td>85.1</td>
<td>144.0</td>
<td>64.8</td>
<td>54.1</td>
<td>75.8</td>
<td>88.3</td>
</tr>
<tr>
<td></td>
<td>15.2</td>
<td>20.4</td>
<td>11.6</td>
<td>9.7</td>
<td>13.5</td>
<td>15.8</td>
</tr>
<tr>
<td>Bldg: flow</td>
<td>14.5</td>
<td>26.4</td>
<td>65.9</td>
<td>82.7</td>
<td>48.3</td>
<td>72.4</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>2.4</td>
<td>6.2</td>
<td>7.8</td>
<td>4.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Total: inv.</td>
<td>57.1</td>
<td>57.8</td>
<td>73.3</td>
<td>981.0</td>
<td>700.8</td>
<td>874.0</td>
</tr>
<tr>
<td></td>
<td>27.4</td>
<td>30.3</td>
<td>37.0</td>
<td>34.5</td>
<td>35.2</td>
<td>34.6</td>
</tr>
</tbody>
</table>

* The pooled data are in 1981 dollar value
includes the current value of motorized machinery, tillage and seeding machinery, harvesting machinery and other specialized equipment such as milking equipment, honey extracting equipment, and so forth. Livestock capital measures the dollar value of the number of females in the breeding herd. The average capital investment is $700800 per year for the pooled observations (Table 3.4).

3.2.7a Capital Services

One measure of capital and labor services is to assume that capital and labor services are proportional to stocks of labor and capital, respectively. However, since capital goods are bought in one period and used over time, this stock measure of capital does not provide a direct measurement of the flow of service.

In view of the above argument, an alternative measure of capital services is the rental rate which takes into account the rate of utilization of capital. There are three components which constitute the rental rate of capital good to its owner in each period of the life of that capital good. There is the interest cost of the capital good, which is the opportunity cost incurred by tying up funds. There is the amount the good depreciates in each period, or alternatively appreciates in each period. Thus the most appropriate approach is to translate these stock values into service flows. Following Jenkins (1972) who analyzed rates of return from capital in Canada, a real
interest rate of 6 percent was used. Given the prevailing income tax allowances in Canada (Farmer's Income Tax Guide, 1980-81) on depreciation rates, the service flow from capital or machinery was calculated at 18 percent of its stock value; the service flow from livestock at 9 percent of its stock value; that of land at 2 percent of its stock value and that of buildings at 9 percent of its stock value.

Any rate of appreciation was subtracted from the real interest rate and the depreciation rate was added to the real interest rate. For machinery, a zero rate of appreciation and 13 percent depreciation rate were assumed. For livestock, a 4 percent rate derived as a difference between appreciation and depreciation rates were assumed. For buildings, a zero rate of appreciation and 4 percent depreciation rate were assumed. For land, a zero rate of depreciation and 4 percent appreciation rates were assumed. The formula used in these calculations was

\[ \xi = \left[ r - \rho + \delta / (1+r) \right] K \]  \hspace{1cm} (3.2)

where \( \xi \) is service flow, \( \rho \) is the appreciation rate of the asset, \( \delta \) is the depreciation rate of the asset and \( K \) is capital stock.

Finally, following Griliches (1957), on the assumption that the underlying profit function is of the form of the Cobb-Douglas function, we have chosen, in order
to minimize bias, geometric sums (e.g. products) in aggregating the capital components. Thus, logarithms of each capital component were summed to arrive at the aggregated capital service flow variable.

3.2.8 Data Collection Problems

There are, however, problems associated with this data and the manner in which it was collected. More missing information in the 1981 (vis a vis 1980) production data questionnaire was noted. In 22 cases out of 54 neither schooling or family labor information was reported. This was particularly true of children's education and operator's labor. Some of the missing information had to be inputed. To give the reader a better insight into the problem, in 1980 the question on schooling, as phrased in the questionnaires, consisted of two parts: (1) "The highest grade achieved at an elementary or secondary school." (2) "Years of university, college or institute of technology attended." But, in 1981 this question was rephrased to read: "Years of schooling." This allows respondents to include repeated years at school (due to year failure) in addition to the highest grade achieved. This situation can cause noise.

With regard to family labor, the 1981 questionnaire is more detailed than that of 1980. The 1981 questionnaire asks for hours worked per week and weeks worked per year for both regular and summer schedules. In
addition to this, there is a question on the number of off-farm week days. Since more detail was required respondents did not always provide this information. One of the reasons could simply be that they did not keep records of time or that people cannot afford the time required to fill out a long questionnaire. Some observations were excluded from the sample for this reason.

Another problem associated with the data is the likelihood of having children attend workshops and take the financial management skill tests, as if they were the operator. There are at least seven cases that fall in this category for the 1981 data. This also resulted in some respondents being excluded.

Another aspect that could be a problem in both data sets, given the present support programs in Canadian agriculture, or in particular in B.C. through the Farm Income Assurance Program, may be that some farm prices are determined in part by some definition of farm costs. There may be some incentive to overstate costs which may result in higher prices. This situation may also bias our results. Those completing the questionnaire were assured that their answers would be used for this research only.

Another aspect as far as aggregation and choice of functional forms are concerned, is the fact that our samples are not homogenous with respect to commodity type. A bee producer and a grain producer will use different technologies and yet, our empirical model, as applied in
this study, is developed as if all farmers in our sample face the same technology. During estimation, attempts were made to distinguish between dairy and livestock producers using a dummy variable. A grouping into vegetable and livestock producers was also tried as well as that of pooling the whole sample. Complications which may arise from aggregating gross income regardless of enterprise or from aggregating inputs and investments is evidenced by a study of 34 multiple enterprise farms by Johnson (1969). Johnson included tobacco, popcorn, and livestock farmers in the sample. Coefficients were inconsistent with estimates for other livestock farms and with a general knowledge of agriculture in the area. Trant (1952) found that Cobb-Douglas functions fitted to multiple-enterprise farms gave unreasonable results. His land and labor coefficients were negative while other coefficients were unreliable in relation to each other and after multiple-enterprise farms were discarded from the sample more reasonable results were obtained. Huffman (1980), in a study of 276 counties in Iowa, North Carolina and Oklahoma, has recently noted the sensitivity of marginal value products of multiproduct functions. Huffman obtained marginal value products for extension programs ranging between $2000 and $8000 per day.

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8 Ibid.
of extension activities.

Sample selectivity is another problem. Through advertisement of the financial management course farmers with an interest in updating their skills register for the course. Both samples were collected from this group. However, there was a limit of twelve participants for a particular course. Courses below five were cancelled. This limit on the number of participants per course is plausible on grounds of efficiency of handling small classes but limits our sample size.

In pooling the data two different periods are considered. One possibility is to pool the data under the assumption of stable parameters between years. An alternative is to pool the data but to test for possible differences in the two sets. These results are noted later.

With these shortcomings in mind, the results should be interpreted accordingly.

3.3 Functional Forms

In searching for a functional form, the guiding principle is that to every profit function there is an underlying technology. Consider the case of a Cobb-Douglas technology, and assume that the producers in our sample could be maximizing profits subject to a Cobb-Douglas technology. Assume the farm is operating with two inputs, $X_1$ and $X_2$, and factor $X_2$ is constrained in the short run at
level K. The restricted profit function can be found by solving the following problem:

$$\text{max } pQ - (w_1x_1 + w_2K)$$  \hspace{1cm} (3.3)

subject to $$x_1^a x_2^{1-a} = Q$$

Substituting the Cobb-Douglas constraint into the profit equation the problem becomes equivalent to:

$$\text{max } px_1^{a(1-a)} x_2^{-a} - w_1 x_1 - w_2 K$$  \hspace{1cm} (3.4)

Assuming that the producers in our sample are satisfying the first order conditions, then

$$a^{-1} \frac{\partial x_1}{\partial x_1} - w_1 = 0$$  \hspace{1cm} (3.5)

This result can be solved in terms of demand for factor $$x_1$$ as

$$x_1 = \left[ \frac{w_1}{a.p} \right] K$$  \hspace{1cm} (3.6)

When the demand function is substituted back into the profit equation, a Cobb-Douglas profit function is defined.

Using the same technique, depending on the actual technology being used by the producers, functional forms
for profit functions may be derived. Other possible technologies are the linear production function, the constant elasticity of substitution production function and the Leontief production function. Their merits and demerits are considered below.

3.3.1 Linear Form

This form in the case of two inputs may be represented as

\[ Q = aX_1 + bX_2 \]  \hspace{1cm} (3.7)

There are some theoretical drawbacks associated with this form. Its marginal products are constant and therefore it does not allow for diminishing returns. Being a fixed-coefficient function, this form precludes any interaction between inputs. On account of these drawbacks, this function is not considered.

3.3.2 Constant Elasticity of Substitution

In the case of two variables this function has the following form,

\[ Q = g[ax_1 + (1-a)x_2] \]  \hspace{1cm} (3.8)

The main drawback of this form is in the difficulty in
including more than one independent variable. In addition, the function does not linearize when transformed logarithmically and an approximation must be used when estimating it. On account of these difficulties it was not considered.

3.3.3 Cobb-Douglas

This form, although very popular among researchers, has been criticized on the grounds of restrictions placed on the parameters, plus the fact that it does not allow for second order approximation of a function. The function however is generally well accepted as a functional form for evaluating farm productivity (Yotopoulos, 1972). One of the virtues of this function is that it is simple and practical. It is also probably the best function that allows the researcher to see how the collected data behave in terms of multicollinearity and other problems. On this basis, the form is considered to have many advantages.

3.3.4 Flexible Functional Forms

The technologies discussed above, however, are theoretically suited to handle cases of single, homogeneous output only. Diewert (1973), in turn, has specified a series of flexible functional forms that can handle multiple output situations. Flexible functional forms are
also supposed to better handle the jointness of the inputs through the interaction terms since it allows for second order approximation of a function. An obvious difficulty, however, is that they require much data and may pose multicollinearity problems because of the interaction terms when the function is estimated directly.

The theoretical preference for flexible functional forms stems from the fact that they do not impose any a priori restrictions in our model. Hence no restrictions on homotheticity, separability and elasticity of substitution. Several members of the flexible family are reviewed below:

3.3.4a Generalized Leontief Profit. These functions take the form of:

\[ \pi(q) = \sum \sum B_{ij} Q_i^{1/2} Q_j^{1/2}, \quad B_{ij} \]  

(3.9)

where \( Q_m \) = price of output \( m \) for \( m = 1, 2, \ldots, M \) and \( \pi_n \) = price of input \( n \) for \( n = 1, 2, \ldots, N \). This form requires prices of several outputs and inputs. Since our data is not rich enough to satisfy these requirements the function is not suitable. It is also not a variable profit function.

3.3.4b Variable Profit Function. Among the variable profit functions the most popular is the translog. It takes the form of
\[ \ln \pi(p, x) = A_0 + \sum A_i \ln P_i + 1/2 \sum B_{ih} \ln P_i \]
\[ + \sum C_{ij} \ln P_i \ln P_j + \sum D_j \ln X_j \]
\[ + 1/2 \sum G_{jk} \ln X_j \ln X_k \]  \hspace{1cm} (3.10)

where \( B_{ih} = B_{hi} \) and \( G_{jk} = G_{kj} \). Since this function seems to be the most used of flexible forms, it is considered as candidate. Another possible candidate for a variable profit function is

\[ \pi(p, v) = \sum \sum \sum (A_{ih} + B_{jk}) (1/2 P_i P_j) \]
\[ + 1/2 P_i P_h 1/2 (-V_j) 1/2 (-V_k) + \sum C_{ij} P_i (-V_j); A_{ih} = A_{hi}; B_{jk} = B_{kj}; A_{ii} = 0; \]
\[ B_{jj} = 0. \]  \hspace{1cm} (3.11)

where \( p = (P_1, \ldots, P_i) \) denote a vector of positive prices for variable outputs and inputs, and \( v = (V_1, \ldots, V_j) \) denote a vector of nonpositive fixed inputs.

In our analysis two functional forms were considered and attempted: the translog and the Cobb-Douglas. The Cobb-Douglas seemed to respond fairly well to the data and was therefore chosen. Thus, the theoretical model derived in Chapter 2 was estimated as a log-linear variable profit function.

3.4 Implications for Estimation

In our economic model a number of assumptions concerning producer's behaviour were made. The producer was
assumed to be or attempting to operate at the most efficient economic point with respect to variable inputs. In so doing however, bias into the production parameters may occur due to lack of variation in input levels, high multicollinearity and simultaneity of inputs. These problems are noted in the following sections.

3.4.1 Variation in Input Levels

Despite the profit maximization assumption it is recognized that producers' economic resources are scarce and limited. Thus even though each input will be used to its optimum level, enough variation should exist to allow for estimation. Another reason for input variation under equilibrium conditions concerns product and input price variations between different regions. In this study, for example, workshops were held in 15 different regions. It is expected that lack of sufficient information on prices across these regions generates certain price differentials. Also, because of different price expectations among farmers, farmers will tend to vary their input levels. Tables 3.2 and 3.4 show considerable variation in some of these input levels. Another reason may relate to a lack of knowledge of the marginal product of certain inputs, a problem compounded by the large number of variables influencing production.
3.4.2 Multicollinearity of Inputs

Given the nature of a production process, it is also expected that some degree of collinearity will exist between certain variables. This may occur between capital and labor variables since the size of capital could influence the amount of labor needed and vice-versa. There also could be a relationship between education and labor. Highly educated farm operators may supply less labor to the farm operation because of off-farm job opportunities and consequently hire more labor.

3.4.3 Specification Bias

Studies that have used a single equation estimation procedure with a Cobb-Douglas technology assume that the input decisions are based on an anticipated output level. Hock (1958, 1962) assumes that input decisions are based on the maximization of the mathematical expectation of profit. The implication of such an assumption is that production inputs are chosen as a part of a one-period decision problem. In agriculture however, both short run and long run production decisions are often a multiperiod, dynamic optimization problem because inputs are not all chosen or utilized simultaneously (Antle, 1983). For example, in the first stage of production, a producer may choose the amount of labor to be used, and during that stage the crop is planted and grown. Random events such as weather change
occur during plant growth. The first-stage output is the mature, unharvested crop. In the second production stage the crop is harvested using other inputs. Adverse weather may affect harvest and final output is a function of these disturbances and input decisions at all stages. In other words, decision makers may feed back information about early stage production to later input decisions. Despite these complications, in the present study it is assumed that decision makers do not feed back information about early stages' production to later input decisions. It is assumed the errors in the efficiency are due to climatic variations, divergence of the expected output price from the actual output price, and due to imperfect knowledge of the technical efficiency parameter of the farm.

3.4.4 Left Out Variables

In applied econometrics, if two independent variables interact and one of them is left out, the coefficients of the included variable will be biased. The bias will be upward if the two variables interact positively and vice versa. Some variables are excluded because a correct measure of that variable may be difficult to obtain. A proxy variable may sometimes suffice. A variable known to cause possible bias in production analysis is, for example, the management input because it is difficult to measure. Since better managers make better economic decisions, better managers obtain higher marginal
returns from inputs and therefore use more of them in order to maximize profit. As a result there is a positive interaction between management levels and the levels of other inputs. A bias will be imparted to other coefficients if management is left out in the estimating equation.

In this study an important left out variable is ability. According to Griliches (1977), ability "is an observed latent variable that drives people to get relatively more schooling and earn more income, given schooling, and perhaps also enables and motivates people to score better on various tests." In other words, ability may have an independent positive effect on earnings and beyond its effect on the amount of schooling. Ideally it is most appropriate to attempt to measure ability by an IQ test or a similar test score measure developed by psychologists. This was not done in this study for lack of facilities and data. Since the estimating equation used in this thesis uses education of the farm operator and financial management test scores as independent variables without the inclusion of ability, an upward bias to the coefficients of education and financial management skills variables is expected. Other left out variables that may have some repercussion on the estimated parameters could involve the spouse's and children's labor and education. These variables were not included in the estimating

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3.4.5 Non-response Errors

In this study, we also face a situation in which non-response is a problem. Some editing for consistency and imputation of the missing values has been necessary. This was done, for example, on operator's education for 1981 production data, family labor, receipts, costs of production and some other information. This imputation exercise has problems and as a consequence estimates may be biased and inconsistent (Johnston, 1960). We, therefore, expect some bias could arise through inputting missing information.

3.5 Summary

In this chapter the economic model is presented. Data sources, data collection problems and the measurement of basic variables are discussed. Given our data the empirical model is restricted to a number of selected variables. Several functional forms were reviewed and the Cobb-Douglas chosen as being suitable. Possible estimation problems due to lack of variation in input levels, high multicollinearity, simultaneity of inputs, left out variables and non-response errors are noted. The next chapter deals with the empirical model. The presentation and interpretation focus on the effects of education and
financial management skills on variable profits.
CHAPTER IV
ESTIMATING THE RETURNS TO EDUCATION AND FINANCIAL MANAGEMENT

The underlying theme of this study is that the British Columbia financial management training project is a form of education. Unlike other extension programs which are often based on a visit system, the financial management training program is delivered in a classroom situation. A test prior to and after training is given to each participant. Thus as a prelude to estimation of returns to financial management skills learnt in this course, the present chapter attempts first to estimate returns to formal education alone under alternative specifications. In a subsequent section of this chapter the benefits of the financial management training program and its substitute relationship to formal education are measured. Increased education may simply permit a worker to accomplish more with the resources at hand (Welch, 1970). This is sometimes known as the "worker effect". Increased education may also enhance a worker's ability to acquire and decode information about costs and productive characteristics of other inputs (Welch, 1980). The latter is known as the "allocative effect" of education on production (Schultz, 1975). Increased education is also expected to induce faster adjustments in the allocation of resources due to any changes in prices or other changes which generate disequilibria conditions. The effect of education increases
the producer's speed to adapt to changing economic conditions. This ability to deal with disequilibria has been investigated and found to be economically important by Fane (1975); Khaldi (1975); Huffman (1977) and Petzel (1978).

The first section of this chapter presents the estimating equations, a production function and a variable profit function. The second section discusses the estimating strategy adopted. In the third section the results of the production function and variable profit equations are discussed. This basic model (profit function) is extended to incorporate the financial management variable. Results of the financial management prior to training are discussed. In the last section, an estimate of the expected changes in the profits by farmers who attended the program is provided.

4.1 The Estimation of Returns to Education

Firstly, a Cobb-Douglas total revenue function is estimated as:

\[ \ln Y = \ln A + \alpha \ln K + \beta \ln H + \gamma \ln N + \phi \ln L + \theta \ln S + u \quad (4.1) \]

where

\[ Y = \text{gross value of agricultural products sold}; \]
K = service flow flow capital which is equal to
\[ \ln(0.01887 \times \text{value of land}) + \ln(0.0943 \times \text{value of building}) + \ln(0.09434 \times \text{value of livestock}) + \ln(0.1792 \times \text{value of machinery and equipment}); \]

H = hired labor measured in '000 $;

N = purchased variable inputs (fertilizer, chemical, feed and custom work; measured in '000 $);

L = farm operator's labor measured in hours per year;

S = years of schooling of the farm operator measured as primary, secondary and university education.

Secondly, the theoretical model (2.13) specified in Chapter 2 is estimated as log-linear variable profit function:

\[ \ln \pi = \ln B + \alpha \ln W + \beta \ln K + \gamma \ln L + \phi \ln S + u \quad (4.2) \]

where

\( \pi \) = variable profit defined as gross value of agricultural products sold less expenditures on purchased variable inputs which includes fertilizer, chemicals, feed, and custom work less expenditure on hired labor;

\( W \) = wage rate paid per day to hired agricultural labor which includes skilled and unskilled
labor;

\( K = \text{service flow from capital which is equal to} \)
\[ \ln(0.01887*\text{value of land}) + \ln(0.0943*\text{value of building}) + \ln(0.09434*\text{value of livestock}) + \ln(0.1792*\text{value of machinery and equipment}); \]

\( L = \text{farm operator's labor measured in hours per year;} \)

\( S = \text{years of schooling of the farm operator.} \)

A priori, one would expect the signs to education, operator's labor, capital, hired labor and non-hired labor expenditures to be positive on total revenue and profit. Hired labor wage rate, being an input price, is expected to have a negative sign.

The estimated parameters of these equations are elasticities or percentage changes in the profit for a one percentage change in the independent variable. Thus, for example, the marginal productivity of schooling is obtained by partially differentiating equation (4.2) as

\[ \frac{\partial \pi}{\partial S} = \phi \left( \pi/S \right) \]  

(4.3)

and evaluated at the geometric means of profits and education.
4.1.1 Estimating Strategy

As a estimating strategy efforts were made to derive results for both the 1980 and 1981 sample data. Many problems arose during the initial stages of this estimation exercise. A persistently wrong sign to the education parameter for the 1981 data set was obtained. Disaggregated capital components had wrong signs to land and buildings, and livestock and parameters were generally insignificant. In an attempt to circumvent some of these problems a dummy variable was tried for livestock producers in the samples in an effort to capture the effects for the most homogeneous commodity group. Similarly, an attempt was made to identify dairy producers only and to use extraneous information on the education parameter. Also, an attempt was made to aggregate the capital variable by grouping machinery and equipment and livestock. Since most of these strategies proved unsatisfactory they were discontinued. An alternative strategy that gave promising results consisted of aggregating all the capital components and pooling both samples and grouping both samples into two somewhat homogeneous commodity types: horticultural producers and livestock and grain producers. The latter approach was not as satisfactory as pooling the whole sample. Thus, the results reported in this study are mainly concerned with the pooled data.

Pooling of the two samples is an attempt to obtain more reliable estimates. In pooling data however
common relationships for the entire data can be established if and only if such relationships are stable; that is, the coefficients are stable over the periods in which the data were collected. Thus the null hypothesis is that there is no marked difference in the coefficients of the relationship. In other words, the relationship is stable. The alternative hypothesis is that there is difference in the relationship; that is, the relationship is unstable. The Chow test was used to test for stability of the coefficients across both sets of data. The calculated F statistic\(^{10}\) was obtained from the following formula:

\[
F = \frac{\left( \text{RRSS} - \text{URSS} \right)/k + 1}{\text{URSS}/(N_1 + N_2 - 2k - 2)} \tag{4.4}
\]

where

- \(\text{RRSS} = \) the restricted residual sum of squares obtained from the pooled data;
- \(\text{URSS} = \) sum of the unrestricted residual sum of squares of both years;
- \(k = \) number of estimated parameters;
- \(N_1 = \) 1980 sample size;
- \(N_2 = \) 1981 sample size.

The calculated F statistic was 0.82. From the F table the 5

\(^{10}\) See Appendix A for calculations
percent significance point was 2.00. Thus the calculated value of F is not significant at the 5 percent level. Therefore the null hypothesis that the relationship is stable can not be rejected.

4.1.2 Results of Revenue and Profit Equations

Since education, operator's labor and capital variables are common variables in both the revenue and variable profit models, their results are noted initially. First, the regression coefficients\(^\text{11}\) (elasticities) are discussed. Table 4.1 deals with revenue equation and Table 4.2 with profit equation. Next, the estimated marginal value products are discussed. Table 4.3 deals with the estimated marginal value products for the revenue equation and table 4.4 with those of the profit equation. Since the data were pooled in order to obtain more reliable estimates the discussion that follows stresses these results.

Results for education, operator's labor and the capital variables are consistent with a priori expectations. Education has a positive effect on both revenue and profit. In the revenue equation (Table 4.1) a 1% improvement in education results in a 0.53% increase in revenues. In the profit equation (Table 4.2) a 1% improvement in education results in a 0.40% increase in

\(^{11}\) The 1980 data were converted into 1981 dollar values. See Appendix C for sample statistics of some variables.
profit. These results imply that the responsiveness of either gross revenue or profit to improvement in education and their elasticities is less than one (inelastic). The significance of this variable, although weak in both samples, tended to improve in the pooled sample. One possible explanation for the weak level of significance could be a multicollinearity problem between education and other independent variables in the sample equations. Education affects the amount of the operator's labor on the farm in that the more educated may become involved in off-farm work or activities and it could also affect the size of one's capital stock.

Operator's labor and capital have strong and positive effects on revenue and profit. Their effect is much stronger than that of education. In the case of operator's labor for the pooled sample a 1% increase in the amount of labor used will result in a 0.54% increase in gross sales (Table 4.1) and a 0.77% increase in profits (Table 4.2). Capital exhibits an extremely low elasticity (0.05 to 0.09). It is suspected that information about capital stocks is a difficult question for farmers to answer and the aggregation procedure adopted for the capital components may also partly have a bearing on these results.
Table 4.1: Revenue Function to Measure the Marginal Productivity of Education (t-statistics in parentheses)

<table>
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<th>Independent Variable</th>
<th>Unit of Measure</th>
<th>1980 Data</th>
<th>1981 Data</th>
<th>Pooled Data</th>
</tr>
</thead>
<tbody>
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<td>Operator's Education</td>
<td>yrs</td>
<td>1.23</td>
<td>0.44</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.94)</td>
<td>(0.96)</td>
<td>(1.20)</td>
</tr>
<tr>
<td>Operator's Labor</td>
<td>$/ hour</td>
<td>0.42</td>
<td>0.55</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.49)</td>
<td>(2.83)</td>
<td>(3.57)</td>
</tr>
<tr>
<td>Aggregate Capital</td>
<td>$/ flow</td>
<td>0.03</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.92)</td>
<td>(1.54)</td>
<td>(2.74)</td>
</tr>
<tr>
<td>Hired Labor Expenditure</td>
<td>$</td>
<td>0.12</td>
<td>0.08</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.25)</td>
<td>(2.34)</td>
<td>(3.58)</td>
</tr>
<tr>
<td>Non-Labor Expenditure</td>
<td>$</td>
<td>0.14</td>
<td>0.33</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.81)</td>
<td>(4.65)</td>
<td>(4.61)</td>
</tr>
<tr>
<td>Intercept</td>
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<td>-2.85</td>
<td>-3.14</td>
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<tr>
<td></td>
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<td>(-0.78)</td>
<td>(-1.85)</td>
<td>(-2.16)</td>
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<td>R²</td>
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<td>0.81</td>
<td>0.74</td>
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<td>F</td>
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<td>41.4</td>
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<td>47</td>
<td>73</td>
</tr>
</tbody>
</table>
Table 4.2: Variable Profit Function to Measure the Marginal Productivity of Education (t-statistics in parentheses)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>1980 Data</th>
<th>1981 Data</th>
<th>Pooled Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator's Education</td>
<td>1.79</td>
<td>0.04</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>(1.21)</td>
<td>(0.06)</td>
<td>(0.67)</td>
</tr>
<tr>
<td>Operator's Labor</td>
<td>0.59</td>
<td>0.87</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>(1.87)</td>
<td>(3.24)</td>
<td>(4.03)</td>
</tr>
<tr>
<td>Aggregate Capital</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>(2.31)</td>
<td>(3.30)</td>
<td>(4.72)</td>
</tr>
<tr>
<td>Hired Labor Wage Rate</td>
<td>1.14</td>
<td>0.47</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>(0.83)</td>
<td>(0.52)</td>
<td>(1.05)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-5.87</td>
<td>-0.95</td>
<td>-2.35</td>
</tr>
<tr>
<td></td>
<td>(-0.78)</td>
<td>(-0.19)</td>
<td>(-0.59)</td>
</tr>
<tr>
<td>R²</td>
<td>0.25</td>
<td>0.59</td>
<td>0.53</td>
</tr>
<tr>
<td>F</td>
<td>3.11</td>
<td>17.35</td>
<td>21.0</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>26</td>
<td>47</td>
<td>73</td>
</tr>
</tbody>
</table>

In the revenue equation (Table 4.3) the marginal return to a year's schooling (education) for the pooled sample averages $4659. In the variable profit equation (Table 4.4) the return to education for the pooled sample averages $2101. Several points may be noted about the estimated parameter for education. An important aspect of the specification used in this exercise concerns the aggregation of capital variables. Although aggregation was necessary in order to minimize the degree of multicollinearity in the equation, this aggregation of the capital inputs could allow the schooling coefficient to
include the effect of optimizing the levels of each component of capital, given the total service flow.\textsuperscript{12} Since most of the dynamics of technical change are expected to be embodied in these capital items, we would expect a considerable increment in the marginal productivity of schooling if this effect could be isolated. Also, the possibility of bias is not ruled out. The omission of the ability variable, according to Griliches (1977), can introduce an upward bias into the measured school parameter. In addition, since the returns to school are measured in a ceteris paribus sense, any returns to education from optimizing the levels of inputs such as total capital and the input of family labor are not captured. Finally, the problem of aggregation of receipts irrespective of the commodity groups has already been discussed in the previous chapter.

Table 4.3: Estimates of the Marginal Value Products for the Total Revenue Model

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>1980 Unit Data</th>
<th>1981 Unit Data</th>
<th>Pooled Unit Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator's Education</td>
<td>$/ yr. 6735.00</td>
<td>$/ yr. 4666.00</td>
<td>$/ yr. 4659.00</td>
</tr>
<tr>
<td>Operator's Labor</td>
<td>$/ hr. 16.00</td>
<td>$/ hr. 39.00</td>
<td>$/ hr. 31.00</td>
</tr>
<tr>
<td>Aggregate Capital</td>
<td>$ flow 0.07</td>
<td>$ flow 0.11</td>
<td>$ flow 0.14</td>
</tr>
<tr>
<td>Hired Labor Expenditure</td>
<td>$ 2.26</td>
<td>$ 1.13</td>
<td>$ 1.49</td>
</tr>
<tr>
<td>Non-Labor Expenditure</td>
<td>$ 0.61</td>
<td>$ 0.86</td>
<td>$ 0.66</td>
</tr>
</tbody>
</table>

Table 4.4: Estimates of the Marginal Value Products for the Variable Profit Model

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>1980 Unit Data</th>
<th>1981 Unit Data</th>
<th>Pooled Unit Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator's Education</td>
<td>$/ yr. 7035.00</td>
<td>$/ yr. 231.00</td>
<td>$/ yr. 2101.00</td>
</tr>
<tr>
<td>Operator's Labor</td>
<td>$/ hr. 16.00</td>
<td>$/ hr. 34.00</td>
<td>$/ hr. 26.00</td>
</tr>
<tr>
<td>Aggregate Capital</td>
<td>$ flow 0.13</td>
<td>$ flow 0.16</td>
<td>$ flow 0.15</td>
</tr>
<tr>
<td>Hired Labor Wage Rate</td>
<td>$ N.A.*</td>
<td>$ N.A.</td>
<td>$ N.A.</td>
</tr>
</tbody>
</table>

* Not applicable because of wrong sign on parameter

The return to operator's labor (revenue equation) is $31 per hour for the pooled data. In terms of profits, the return to operator's labor is $26 per hour for the pooled data. By way of comparison, rates charged by
tradesmen and professionals may be used as a standard. These results confirm the hypothesis that the value of farm operator in a management situation is reasonable.

The returns to capital are low. In terms of revenue, capital has a return of 14 cents in the pooled sample, 15 cents in the pooled sample in the profit equation. From a farm management point of view these results are disturbing. For every dollar spent on capital flows a farmer gets flow return less than a dollar. Some possible causes of this problem are noted. Historically, Canadian data seem to show an increase in productivity to both labor and capital because of improved technology and skill. Because of a slower rate of growth in hours worked, the amount of capital has been growing at a faster rate than labor and hence each laborer has more capital goods to work with. Thus, the return per unit of capital may be less than costs because each capital unit has less labor to complement it. In addition, the physical capacity of an operator limits the amount of work they can handle. Operators may over invest for this reason. Another possible cause may be the reported dollar value of capital stock. Since farmers were asked to value their own capital stocks they may tend to over value their assets. This introduces an "error-in-variables" measure and introduces a bias in the capital parameter (Kmenta, 1971).

---

Hired labor and non-labor expenditures show strong returns in production. Returns to hired labor are $1.49 per $1 paid in wages in the pooled sample. Non-labor inputs have a return of $0.66 per $1. The problem of low returns to non-labor inputs could be one of overuse. Farmers could be overusing fertilizer, animal feed and other inputs because of ever changing technologies. On the other hand production takes place in an uncertain environment and this may influence the outcome.

The hired labor wage rate variable in the profit equation has the wrong sign. Being the only price available in the model the wrong sign to this variable could probably be due to left out variables such as prices of other inputs. Another source of the problem could be lack of enough variation on the variable itself. Some of the data on this wage rate had to be inputed by using a provincial average wage rate.

In summary, some marginal value products are not equal to resource prices although an efficient allocation of resources is assumed. From the standpoint of good farm management and economic policy more resources should be channeled in the direction of family labor and hired labor and less to capital and non-labor inputs. As regards education, this study shows education to be productive input.
4.2 Estimation of Returns to Financial Management Skills

The aim of the present section is to estimate the returns to financial management skills so as to allow for an ex-ante evaluation of the present extension program. The empirical model specified is more complete than that discussed in the previous section. A human capital variable, M, is included in order to incorporate the test scores of financial management abilities. An operator's financial management abilities may be measured prior to and after their participation in the course. The measure prior to their participation is intended to be a reference score and through participation in the course financial management skills and test scores are improved and this will also result in increased sales and profits provided such training is beneficial. There is, of course, a degree of complementarity between years of schooling and the skill variable (financial management skills) and so it may be difficult to distinguish between the benefits from formal education and these skills. However, an improvement in the financial management test score through participation in the course is hypothesized to have an effect on the efficiency of the operator because these skills are associated with variables that measure this efficiency. Thus, the estimating model becomes

\[ \ln \pi = \ln A + \alpha \ln W + \beta \ln K + \gamma \ln L + \phi \ln S + \theta \ln M + \omega \ln M \ln S + u \]
where every other variable remains as defined in section 4.1. The M term stands for an index of financial management skills. An interaction effect between education and financial management skills is also allowed (M&S) for. The per unit effect of financial management skills prior to training on production is obtained by differentiating the logarithmic equation, holding everything constant, as

\[
\frac{\partial \pi}{\partial M} = [ \theta + \omega \ln S ] \cdot \left[ \frac{\pi}{M} \right]
\]

(4.6)

and evaluated at the geometric means of profits and financial management.

4.2.1 Results of Financial Management

The results of this estimation procedure which includes an aggregated financial management test score are reported in Tables 4.5 and 4.6. Table 4.5 deals with the regression equations and Table 4.6 with the estimated marginal value products. In the earlier stages of estimation, individual test answers to individual questions on financial management were treated as separate variables and entered the profit function as independent variables. This procedure posed two problems. Many questions acquired unexpected signs and other questions resulted in a non-
singular matrix. Another procedure followed was to evaluate the total score on cash flow skills and the total score from tax and estate planning skills as separate variables in the equation. As noted earlier these two components comprise the skill test and the financial management variable is defined as an aggregated sum of cash flow test scores and tax planning test scores.

An attempt to group data into horticulture and livestock producers did not give satisfactory results. The horticulture equation had the wrong sign to education and financial management variables, although not significant. The livestock equation, on the other hand, had right signs for the above mentioned variables, but the marginal value product of education was negative while the marginal value product of financial management variable was extremely large. Another attempt was made to estimate the horticulture equation without the interaction term but these efforts did not improve the results. For livestock equation the financial management parameter retained its size and sign of 0.68 but the education parameter changed in size and became insignificant. Thus, as for earlier results, this section relies on the results from the pooled sample. These are reported in Tables 4.5 and 4.6.

Results for education and labor variables, and capital have been discussed in the previous sections and, in general, conclusions remain the same. Needless to say, the operator's labor and capital variable consistently show
strong effects on production and income. The introduction of the financial management variable does not affect the parameters of most of the variables significantly except for the education variable. Without the financial management variable, the elasticity of operator's labor was 0.77 (Table 4.2) and the corresponding marginal value product was $26 (Table 4.4). With the financial management variable included this parameter and its estimated marginal product became 0.81 (Table 4.5) and $27 (Table 4.6) respectively. Hence, we may conclude that a 1% percent increase in operator's labor (represented by hours) will result in variable profit being increased from 0.77 (Table 4.2) to 0.81 percent. As noted earlier the marginal value product of operator's labor of approximately $26 per hour represents an opportunity cost that appears reasonable. The capital parameter also retains its size of 0.09.

The elasticity of education estimated as

$$\frac{\partial \pi}{\partial S} \cdot \frac{S}{\pi} = \phi + \omega \ln M$$

(4.7)

at the geometric mean is 0.32. This result is derived from Table 4.5 after allowing for the interaction parameter shown as -1.95 for the pooled sample. This result is still in line with the previous result of 0.40 (Table 4.2); that is, the responsiveness of profits to changes in education is less than one (inelastic). The value has decreased because of the interaction effect between education and
financial management skills. Thus, a 1% improvement in education may be viewed as approximately causing a change of 0.32 percent in the variable profit. The wage rate variable continues to have the wrong sign.

Table 4.5: Variable Profit Function to Measure the Marginal Productivity of Financial Management (t-statistics in parentheses)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit of Measure</th>
<th>1980 Data</th>
<th>1981 Data</th>
<th>Pooled Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator's Education</td>
<td>yrs.</td>
<td>7.54</td>
<td>-5.62</td>
<td>4.71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.17)</td>
<td>(-0.85)</td>
<td>(1.20)</td>
</tr>
<tr>
<td>Operator's Labor $/hour</td>
<td></td>
<td>0.61</td>
<td>0.70</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.03)</td>
<td>(2.34)</td>
<td>(4.15)</td>
</tr>
<tr>
<td>Aggregate Capital $/flow</td>
<td></td>
<td>0.09</td>
<td>0.10</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.49)</td>
<td>(3.52)</td>
<td>(4.58)</td>
</tr>
<tr>
<td>Hired Labor Wage Rate $/day</td>
<td></td>
<td>0.89</td>
<td>0.50</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.68)</td>
<td>(0.53)</td>
<td>(0.82)</td>
</tr>
<tr>
<td>Financial Management points</td>
<td></td>
<td>7.39</td>
<td>-7.11</td>
<td>4.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.11)</td>
<td>(-0.96)</td>
<td>(1.21)</td>
</tr>
<tr>
<td>Financial Management and Education</td>
<td></td>
<td>-2.90</td>
<td>2.57</td>
<td>-1.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-1.00)</td>
<td>(0.88)</td>
<td>(-1.14)</td>
</tr>
<tr>
<td>Intercept</td>
<td></td>
<td>-19.64</td>
<td>15.51</td>
<td>-12.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-1.21)</td>
<td>(0.92)</td>
<td>(-1.36)</td>
</tr>
<tr>
<td>$^{2}</td>
<td></td>
<td>0.33</td>
<td>0.58</td>
<td>0.53</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td>3.09</td>
<td>11.79</td>
<td>14.40</td>
</tr>
<tr>
<td>Number of Observations</td>
<td></td>
<td>26</td>
<td>47</td>
<td>73</td>
</tr>
</tbody>
</table>

Financial management skills show positive effects on profit and interact with education as a substitute in the pooled sample. The elasticity of the financial
management variable was estimated using relation (4.7) to be 0.16, which is fairly inelastic. Theoretically and empirically, the results of regression equations with an interaction effect depend very much on the magnitude of the interaction effect. When a negative cross effect outweighs the own-effect of a variable, the marginal value product of that variable becomes negative. Similarly, when a negative own-effect outweighs the cross effect, the marginal product of that variable becomes negative.

The return to a formal education or schooling averaged $1672 per year, that of financial management skills to $968 per unit of skill. The result on education is the return to a year of schooling on profit. This estimate does not appear to be too out of line with returns measured in other studies. Fane (1972) reported a marginal value product of $321 per year from 1964 county data for four U.S. Corn Belt States. Barichello (1977) using the 1971 census data for Canada estimated an annual marginal product of schooling of $286 per year for all Canada. After allowing for adjustments in the rates of inflation over the years, the return to education of $1672 in 1981 dollars is somewhat higher.
Table 4.6: Estimates of the Marginal Returns - Profit Equation with Financial Management

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Unit</th>
<th>1980 Data</th>
<th>1981 Data</th>
<th>Pooled Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator's Education</td>
<td>$/ yr.</td>
<td>4426.00</td>
<td>1785.00</td>
<td>1672.00</td>
</tr>
<tr>
<td>Operator's Labor</td>
<td>$/ hr.</td>
<td>17.00</td>
<td>27.00</td>
<td>27.00</td>
</tr>
<tr>
<td>Aggregate Capital</td>
<td>$/ flow</td>
<td>0.13</td>
<td>0.19</td>
<td>0.15</td>
</tr>
<tr>
<td>Hired Labor Wage Rate</td>
<td>$/ day</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Financial Management</td>
<td>$/ point</td>
<td>1339.00</td>
<td>-5815.00</td>
<td>968.00</td>
</tr>
</tbody>
</table>

As for financial management, the nature of the questions on cash flow and tax planning have been discussed in Chapter 3. Questions on cash flow centered around debt servicing, costs incurred through investment in machinery, budgeting techniques, financial statements, types of income and expense statements. On the other hand, questions on tax planning revolve around problems of marginal tax rates, taxable capital gains, validity of a will, recaptured capital cost allowance, assets that can be rolled to a child, differences between depreciation and capital gains. In interpreting the results on financial management it is assumed that most of these tests adequately represent important aspects of financial management (Aiken, 1971). The $968 is then the return, on average, to a one unit increase in the skill level of financial management abilities. It
is the return to a farmer for every right decision they make in handling cash flow problems and strategies for minimizing tax incidence on taxable income. One may expect returns to correct decisions of this nature to be high.

In terms of cost of the course and returns, farmers who attended the course paid $13 dollars. This fee is, of course, a subsidized fee for it does not include the expenses incurred by the Ministry in offering the course. A cost estimate per farmer may be provided by examining the allocated budget for this project.

By comparison with other studies on returns to extension, Huffman (1974, 1976, 1977) has published several estimates of marginal value products (Table 4.7) to extensions. He estimated a marginal return of $4.48 per hour of extension time allocated to crops for the 1954-64 Corn Belt data in the U. S. A. and a return of $600 per day of extension time allocated to crops (1959-64 Corn Belt data). Using 1964 data for Iowa, North Carolina and Oklahoma, Huffman estimated a marginal value product of $1000-$3000 per day of extension time allocated to crops and livestock activities.
Table 4.7: Huffman's Estimates of Returns to Extension in the U.S.A

<table>
<thead>
<tr>
<th>Study</th>
<th>Data Set</th>
<th>Marginal Value Product of Extension ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>Corn Belt 1954 - 64</td>
<td>$4.48 per hour of extension time allocated to crops</td>
</tr>
<tr>
<td>1976</td>
<td>Iowa, N. Carolina, Oklahoma, 1964</td>
<td>$1000-$3000 per day of extension time allocated to crops and livestock activities</td>
</tr>
<tr>
<td>1977</td>
<td>Corn Belt 1959 - 64</td>
<td>$600 per day of extension time allocated to crops</td>
</tr>
</tbody>
</table>

Very recently Huffman (1980) has attempted to reestimate the marginal return to extension for Iowa, North Carolina and Oklahoma (Table 4.8). His estimates lie between $564 and $8000 per day of extension activities. An important aspect of Huffman's results is the sensitivity of his results to output mix. On the other hand, Sim and Gardner (1980) report a summary of four studies (by Griliches, Duncan, Peterson and Fitzharris and Lu and Cline) that generate a combined internal rate of return to research and extension. These are reported below.
Table 4.8: Huffman's New Estimates of Returns to Extension in the U. S. A. -1964 Data Set

<table>
<thead>
<tr>
<th>Data Set</th>
<th>Marginal Value Product of Extension ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa</td>
<td>$2357 per day of extension allocated to crops, livestock.</td>
</tr>
<tr>
<td>North Carolina</td>
<td>Negative</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>$564 per day of extension allocated to crops, livestock.</td>
</tr>
<tr>
<td>Iowa</td>
<td>$8000 per day of extension allocated to crops</td>
</tr>
<tr>
<td>North C.</td>
<td>Negative</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>$2058 per day of extension allocated to crops</td>
</tr>
</tbody>
</table>

Griliches (1958) estimated an annual internal rate of return between 20 to 40 per cent for hybrid corn and hybrid sorghum. Peterson and Fitzharris (1975) using four data sets (1937-42; 1947-52; 1957-62; and 1967-72) derived an annual internal rate of return of 0.34 and 0.51 percent. Lu and Cline (1976) for the U. S. A. (1938-48; 1949-59; 1959-69 and 1969-79) estimated an annual internal rate of return between 23.5 and 30.5 percent. Duncan (1972) derived an annual internal rate of return in pasture improvement in Australia ranging between 58.0 and 60.0 percent. Our estimate of $968 marginal return per unit of skill in financial management does seem to fall within the bounds of most of these studies.

Policy implications that may be drawn for these
financial management training workshops may be summarized as: Firstly, skills in financial management are an important input in production. Secondly, on basis of these results, it should be expected that an extension program that improves these skills will also increase the profitability of the farms. Thirdly, the estimated marginal return of $968 per unit change in skills is far greater than the cost of this course ($13) to the farmer and given the large number of participants it is also probably higher than the cost to the funding agency. From a social point of view, the $968 return per unit of score seem to justify the expenses incurred by the Ministry in offering the course per farm. Fourthly, the return to financial management skill is second only to education in its effect in the estimating equation. It is of course realized that the unit of inputs are different. Thus, given these advantages, more farmers should become aware of the gains that can be made from improving their financial management skills.

Another aspect of this result concerns the relationship between education and financial management. This study seems to suggest that these variables interact as substitutes for each other. The policy implication of this result is that an extension program of this nature could be beneficial as an alternative form of education. For example, a concentration of extension efforts on less educated farmers could probably help even out the unequal distribution of returns among farmers.
These results do not detail the effect of course participation for individual producers. Our sample statistics and parameters are those for the mean of the pooled sample. In the final analysis these results as they affect different groups of farmers are examined.

4.2.2 The Marginal Value Product Per Farm

The marginal value product of the financial management input and other variables has been computed at the sample means for profit and financial management test skills (Table 4.6). Hereafter, these results are referred to as at the "sample means". Estimation of the marginal value product at these points does not allow one to examine the effects of financial management skills for each individual farmer in the sample. In the remaining part of this section the marginal value products for a grouping of farmers into various sizes is reported. These results were obtained by evaluating expression (4.6) at every data point. In other words, expression

\[
\frac{\partial \pi}{\partial M} = [ \theta + \omega \ln S ] [ \pi/M ]
\]  (4.6.1)

was evaluated for each farmer's profit and financial management skill level. These results are referred to as "farm level" situation. In order to make the presentation of these results possible farmers were grouped by size of
their profits (independent variable). These sample statistics are presented in Table 4.9. Information on individual farmers with negative (or positive) marginal value products may be obtained from Appendix C.

At the farm level the range of the marginal value products for each income group ranges from negative to positive. The maximum returns observed in any one income group lies between $1416 and $43832 per farm, and the minimum values lie between -$14037 and -$159. The mean performance of each group is positive and there is a considerable degree of dispersion around the group means as indicated by their standard deviations. Farmers falling into the lowest variable profit group ($300-$9000) are expected to benefit by $147 through an improvement in their skills, those in the highest group ($100000 to $400000) by $4551. Fifty six farmers out of a population of 73 have a positive marginal value product for this variable and 17 have a negative marginal value product.
Table 4.9: Summary Statistics on marginal Return per Farm by Variable Profit Group

<table>
<thead>
<tr>
<th>Variable Profit ($)</th>
<th>Number of Farmers</th>
<th>Mean</th>
<th>S.D.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-9000</td>
<td>17</td>
<td>147</td>
<td>370</td>
<td>-159</td>
<td>1416</td>
</tr>
<tr>
<td>10000-20000</td>
<td>14</td>
<td>422</td>
<td>1154</td>
<td>-2192</td>
<td>2490</td>
</tr>
<tr>
<td>30000-40000</td>
<td>14</td>
<td>254</td>
<td>804</td>
<td>-969</td>
<td>1633</td>
</tr>
<tr>
<td>50000-90000</td>
<td>13</td>
<td>1831</td>
<td>3875</td>
<td>-4223</td>
<td>7735</td>
</tr>
<tr>
<td>100000-400000</td>
<td>15</td>
<td>4551</td>
<td>14614</td>
<td>-14037</td>
<td>43832</td>
</tr>
<tr>
<td>Average for the Sample</td>
<td>73</td>
<td>1425</td>
<td>6880</td>
<td>-14037</td>
<td>43832</td>
</tr>
</tbody>
</table>

A conclusion that emerges from this analysis is that, on average, and even without participation in the course, financial management skills have an effect on production and profit. One may also conclude that if these skills are improved then an improvement in the operating efficiency of farmers is also possible.

4.2.3 Predicting Expected Changes in Profits

We have, so far, attempted to show the effect of the financial management input on production. This was done at the sample means of the variables (profit and financial management skills, section 4.2.1) and at the farm level (section 4.2.2). On the basis of the marginal value product obtained at the sample means, an attempt is made to predict the effect of the British Columbia financial
management project on profits of the farmers who have taken the training in financial management. In other words, relation

\[ \frac{\partial \pi}{\partial M} = [ \theta + \omega \ln S ], [ \pi/M ] \] (4.6.2)

becomes our point of departure.

Suppose that in period t the effect of financial management skills on profit is represented by the following equation:

\[ \pi_t = A + \theta M_t + U_t \] (4.8)

where A is a constant and \( \theta \) is the marginal effect of a unit change in financial management on profit without the course in period t. Suppose in period t+, the same conditions as period t prevail with the only exception that financial management skills(M) are expected to assume a new level due to the course taken during that period. In other words, the slope (not necessarily the intercept) remains unchanged. The problem at hand is to predict the effect on profit of the new level of financial management skills in period t+. Mathematically this is equivalent to finding the expected value of relation (4.8) in period t+, given as:

\[ E [ \pi_{t+} ] = E [ A + \theta M_{t+} + U_{t+} ] \] (4.9)
Hence, we wish to estimate the effect of a change in financial management skills due to the course on profits. Subtracting equation (4.8) from (4.9) the change in profit due to a change in financial management is given as:

\[
\pi_{t+1} - \pi_t = \theta [ M_{t+1} - M_t ]
\]

or

\[
\Delta \pi = \theta \Delta M
\]  \hspace{1cm} (4.10)

where \( \Delta \pi \) is the change in profit, \( \theta \) in this case is the marginal value product of financial management skills (\$968) prior to the course and \( \Delta M \) is the change in financial management skill due to the course. Relation (4.10) therefore becomes our prediction equation.

In the previous section an argument was made about the performance of an individual farm. In this section, too, it is recognized that not all farmers who attended financial management workshops expect positive benefits. Some farmers too show negative changes between test scores prior to and after training. It may be argued that given the element of chance in every test score, a decrease in test scores may not necessarily mean dislearning because of random errors. This study however assumes that test scores reflect true knowledge and changes in test scores reflect a change in financial management skills.

In order to present these results on the expected benefits from the program, farmers were grouped by size of
their profits. In Table 4.10 the average test scores before the course, the average change in test scores because of the course, the average profit level before the course and the average expected change in profit due to the course for specific income groups and for the entire sample are presented. Before the training sessions the average test score obtained was 10.0. After the course this score was improved to 12.2, a change of 2.2 points. The average change in test scores for individual groups lies between 1.7 and 2 point scores except for one group with an average change of 3 points. The percent improvement in profit defined as the ratio of the average expected change in profit due to the course to the average profit before the course, for different income groups, indicates that the small farmers (17 farmers with income between $300 and $9000) expect a 54% percent improvement in their profits. This result decreases as the income base increases. For example, for the largest group this change in profits is only 1%. However, even for this group there is a net increase in profits of $1968. For the entire sample, the expected average change in profits is $2089. This is equivalent to a 3% percent improvement.
Table 4.10: Summary Statistics on Test Scores and Variable Profit Groups

<table>
<thead>
<tr>
<th>Number of Farmer</th>
<th>Test Scores Change</th>
<th>Average Profit Change</th>
<th>Improve ment %</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>10.2</td>
<td>1.7</td>
<td>3083</td>
</tr>
<tr>
<td>14</td>
<td>10.5</td>
<td>3.0</td>
<td>19650</td>
</tr>
<tr>
<td>14</td>
<td>9.7</td>
<td>2.4</td>
<td>38882</td>
</tr>
<tr>
<td>13</td>
<td>10.5</td>
<td>1.7</td>
<td>71632</td>
</tr>
<tr>
<td>15</td>
<td>9.3</td>
<td>2.0</td>
<td>173010</td>
</tr>
<tr>
<td>Average for the Sample</td>
<td>10.0</td>
<td>2.2</td>
<td>60250</td>
</tr>
</tbody>
</table>

Tables 4.10, 4.11 and Appendix D may be combined. In Table 4.11 the mean change in profit due to the course, standard deviations, and maximum and minimum values for specific income groups are presented. Appendix D may be used to detail the number of farmers who expect negative (or positive) changes in profit. The maximum, expected change in profit due to training by income groups ranges between $7744 and $10648, the minimum change lies between $11132 and $1936. There is a high degree of variability around these group means with the exception of the $10000 and $20000 income group. This group has a mean of $2939 and a standard deviation of $2913. This income group has only one case of where expected change in profit is negative.
Table 4.11: Summary Statistics on Expected Profit due to the Program

<table>
<thead>
<tr>
<th>Variable Profit ($)</th>
<th>Number of Farmers</th>
<th>Mean</th>
<th>S.D.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-9000</td>
<td>17</td>
<td>1680</td>
<td>3545</td>
<td>-3388</td>
<td>10648</td>
</tr>
<tr>
<td>10000-20000</td>
<td>14</td>
<td>2939</td>
<td>2913</td>
<td>-1936</td>
<td>8228</td>
</tr>
<tr>
<td>30000-40000</td>
<td>14</td>
<td>2316</td>
<td>4754</td>
<td>-9196</td>
<td>9196</td>
</tr>
<tr>
<td>50000-90000</td>
<td>13</td>
<td>1601</td>
<td>4825</td>
<td>-11132</td>
<td>7260</td>
</tr>
<tr>
<td>100000-400000</td>
<td>15</td>
<td>1968</td>
<td>4931</td>
<td>-9680</td>
<td>7744</td>
</tr>
<tr>
<td>Average for the Sample</td>
<td>73</td>
<td>2089</td>
<td>4153</td>
<td>-11132</td>
<td>10648</td>
</tr>
</tbody>
</table>

In Appendix C it is shown that at least 51 (almost 2/3) out of a population of 73 farmers are expected to have positive changes in their profits due to training.

In conclusion, results indicate that the majority of farmers expect positive changes in profits. The number of farmers expecting negative changes due to poor performance in the test after the training is relatively small in relation to those expecting otherwise. It is recognized that expected negative changes could be the result of random errors in the test scores. At the farm level situation, most farmers have a positive marginal return to financial management decisions. Also financial management skills act as a substitute for education and vice-versa.
CHAPTER V
SUMMARY, CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

This chapter consists of a brief summary on the content of the research undertaken in this thesis and outlines some of the conclusions derived from the empirical results. Implications for future research are discussed based on some of the problems encountered in work.

5.1 Summary

In the introductory chapter of this thesis an attempt was made to rationalize the role of education in production. It is recognized that qualities of physical inputs are in themselves important inputs in production. It was argued that if education improves the quality of the labor force, then there are expected benefits from the present extension program in financial management in British Columbia. But, because extension activities use scarce budget resources, there is a need to develop an appropriate methodology for evaluating the benefits of the financial management program.

Since the ultimate goal of an agricultural extension program is to improve farmers' income, the primary objective of this thesis was to try to relate extension to this income. In order to do this the first step of this thesis, was (1) to review the literature on extension evaluation (2) and to review the theory of production and costs in order to arrive at a conceptual
model that would best suit the purpose of this evaluation exercise. In this process, a profit function was chosen for its ability to capture the total effect of physical inputs and their qualities on production and income. The data needs, conceptual and measured variables and their implications on estimation were discussed. It was noted that some bias may be expected in the results due to problems encountered in attempting to measure variables correctly and due to lack of price data on inputs and outputs. Another potential source of bias considered is a possible lack of variation in some input levels. The next step was to review functional forms in order to choose the most viable one for this study. The Cobb-Douglas seemed to respond fairly well to the data and other needs and was therefore chosen.

Empirically, the first step was to show the effect of formal education on production and profit without considering the effect of financial management aptitude. This was set as a prelude to show the technical, allocative and dynamic effects of education. The estimated parameters are all less than one, implying an inelastic response of gross sales and profit to changes in the independent variables. The elasticities of gross sales and profit with respect to education lie between 0.40 and 0.53 percent; those with respect to operator's labor between 0.54 and 0.77 percent and with respect to capital 0.05 percent for both specifications.
The estimated returns to a year of schooling (education) on gross sales and profit are $4659 and $2101, respectively. The returns to operator's labor on gross sales and profits are $31 and $26 per hour, respectively. These results are comparable with the rate charged by tradesmen and some professionals. The return to capital, which is low, is 14 cents on gross sales and 15 cents on profits. The estimated return to hired labor is $1.49 and to non-labor inputs $0.66 cents. In the profit equation the wage rate has the wrong sign.

On the assumption that education and financial management training are substitutes the next step involved including a financial management variable in the estimated relationship in order to assess the effects of the extension or economic performance. The financial management variable and tax management scores were aggregated in order to minimize multicollinearity problems. By relating the financial management skills to past profits, this study attempts, in an ex-ante sense, to predict the expected effect of the present extension on future profits. Most parameters are robust with the introduction of the financial management variable.

The operator's labor parameter changes slightly from 0.77 to 0.81 and the marginal return on profit changes from $26 to $27. The capital parameter retains its previous size of 0.09. The education parameter changed from 0.40 to 0.32 but a decrease in this parameter reflects the
interaction effect between education and financial management skills. The wage variable continues to show its wrong sign. The estimated elasticity parameter of the financial management input is 0.16, quite inelastic. The estimated return to a year of schooling (education) averages $1672 and that of financial management skills amounts to $968 per unit score. These results compare reasonably well with most studies on education and extension in Canada and elsewhere.

Policy implications to be drawn include: (1) the importance of the financial management input in production is recognized, (2) given the findings of this study, similar workshops could enhance the profitability of most farms, (3) the estimated marginal return of $968 to financial management justifies the expense incurred by the ministry in delivering the course per farm. Given the cost of the course ($13 to an individual farmer) more farmers should be acquainted with the benefits forthcoming from an improvement in financial management skills.

Results show that not all farmers have a positive marginal value product to financial management skills. The estimated marginal value products lie between -$14037 and $43832. Larger farms have larger marginal value products than small farmers. The average marginal value product for farmers falling in the lowest variable profit group ($300-$9000) is $147, that of the highest group ($100000 to $400000) is $4551. Fifty six farmers out of a population of
73 have positive marginal value products to financial management skills. The next exercise was to predict ex-ante the effect of the course on profits. Not all farmers are expected to gain from the course since some farmers have negative changes in their test scores. The average change in test score for the whole sample was 2.2 points. The range of this expected change in profit per farm lies between -$11132 and $10648. The expected, average change in profits, for the entire sample, is $2089, which is equivalent to a 3 percent improvement.

5.2 Conclusions

The conclusions that follow from this study are

(1) the marginal value product of financial management skills are positive and significant in increasing production and incomes of the farmers in British Columbia,

(2) education and financial management skills are found to be substitutes to each other in influencing production and incomes of the farmers. The substitution effect is estimated by differentiating equation (4.5) twice: first, with respect to financial management and then with respect to education as

\[ \frac{\partial^2 \pi}{\partial M \partial S} = [-1.95][1/MS] \] (5.1)

and evaluated at the sample means of financial management(M) and schooling(S).
Since financial management skills could substitute for the effect of schooling, this leaves one with the question as to what group of farmers extension efforts should concentrate on. According to Roger's (1962) diffusion of innovation theory, under non-peasant farming situations, extension efforts should be directed to the more progressive farmers, on the assumption that the adoption of innovation would "trickle" down to the majority of farmers; that is, the less progressive ones. In our case, there is evidence on the substitution effect between education and financial management skills.

5.3 Implications for Future Research

This study like many other studies has its shortcomings. The shortcomings encountered are in the area of the questionnaire design, the skill test itself, the collected data and to a certain extent the methodology. In this section some of the problems are discussed and suggestions are made for future research.

It is suggested that the questions on the financial management skills be revised not only by financial management experts but also by experts in educational testing. This study recognizes that skill tests used should satisfy two basic psychometric properties, that of reliability and validity (Walter et. al., 1971). In other words, for reliability a test needs to be
administered twice to see whether the obtained score is a stable indication of the participants performance and an accurate indication of their "real ability". In this study, the skills test was administered only once. For validity, a test should measure real knowledge (American Psychological Association, Standards for Educational and Psychological Test and Manuals, 1966). In this study, the validity of the test is also questionable. Most questions seem to deal with simple recall knowledge, which can measure a low level of learning. Few questions allow the participants to reason in order to show skills necessary to handle financial management. These considerations will ensure that future tests be reliable and reflect actual knowledge and have proper weights assigned to different aspects of a test. In addition, there should be restrictions on those responding such that only farm operators or managers or the actual farm operator be included. This will eliminate situations where non-farm operators or decision makers attend workshops and take tests or where at home others may fill in the questionnaire. Instead of a "take-home" type, farmers should be interviewed by the researcher and records of all receipts and expenses used. Of course, this requires time but there are pay-offs associated with this approach if reliable estimates are obtained.

There is a need for better information on output and variable input prices. For fertilizer, chemicals and feed, for example, the price per pound would suffice. If
this is not possible, questions on the quantity of these items bought and the expenditure on them are needed. This would allow researchers to compute prices and aggregate as required.

Capital stock estimates are always difficult to derive. It is rational to expect farmers to value their assets highly but an assessment by an independent authority with a knowledge of land and other asset markets may be more desirable.

Some of the items on the questionnaire need to be revised, for example, the expenditure items. If a method of obtaining expenditure information on an enterprise basis is derived the analysis could be carried out in terms of homogeneous commodity groups. Estimated marginal products for different output mixes may be examined.

The question on hired agricultural labor should probably include the amount of hired skilled and unskilled labor so that when a wage rate is not reported, the wage rate could be calculated. Under family labor, in order to get the operator's labor, probably a question on off-farm employment measured in number of days would suffice.

The question on years of schooling should be rephrased to read: (1) "The highest grade achieved at elementary or secondary school" and (2) "Years of university, college or institute of technology attended". In this instance it may also be feasible to consider an aggregation procedure that will attach different weights to
secondary school education versus university, college or institute training. As regards methodology, three quantitative models are suggested for consideration and these are discussed below.

Share equations, for example, provide more information than the profit function when estimated directly. The approach allows for more structural restrictions and gives more information on input and output responses.

The conceptual model used in this study may also be considered within a benefit cost framework. This study has attempted to find the expected impact of the training course on production and income. The results however do not examine whether farmers who attended the course will apply what they learned. In addition, there is evidence to show that extension knowledge tends to become obsolete with time (Sim et. al., 1980). Thus, the expected impact of the course may be discounted over a certain period of time with the probability of adoption of what is learned from the course taken into account. Two measures of benefit can be obtained with this procedure. One is the benefit-cost ratio. Another measure is the internal rate of return.

The distributional effect of the course may also perhaps be evaluated through assessing producer and consumer benefits and costs. The benefits of any agricultural extension ultimately affect consumer and producer through implementation of what is learnt from the
extension. Improvements in the financial management skills may reduce marginal costs of production and, at the industry level under perfect competition, increase the quantity of a good produced and reduce the market price. There is a shift in the supply curve. In an ex-post sense, it is possible to estimate consumers' and producers' surpluses following Akino and Hayami's (1975) approach.

Another consideration involves examining the demand for this course. Following Duncan's (1972) evaluation of return to research in pasture improvement, if improvements in financial management are expected to increase productivity, then there will be a demand function for the course. The estimated benefits may be compared with the costs of the course by means of the internal rate of return, necessary to generate a return to the course expenditures.

Another shortcoming of this study is the ex-ante approach it followed, when there is the likelihood of changes in the conditions upon which the future is predicted. This study has no way of telling which farmers are likely to adopt that which they have learned. This study hopes, however, that future researchers would be able to conduct an ex-post evaluation of this project by distinguishing between performance of those who attended the current training in financial management versus those who did not. In addition, the results obtained from this study are evaluated from a private point of view, and yet
the funds to support these extension activities are public. A more complete framework, perhaps, should consider the project's social cost and social benefits.

Finally, this study has probably established a new approach in attempting to assess extension programs. A test score is used. The results obtained seem to be in line with other studies. Among other advantages, this procedure avoids the use of dummy variables (which in most cases is done ex-post) and the measurement of intangibles like answers to a happiness questionnaire. It also allows for an ex-ante evaluation of the extension program.
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APPENDIX A

Calculation of the F-statistics for the Chow Test
Calculations

The standard error of estimate for 1980 and 1981 samples are 0.94932 and 0.80430 respectively. The unrestricted residual sum of squares for 1980 data equals

\[(0.94934)(0.94934)20 = 18.09\]

This has 20 degrees of freedom. For 1981 sample the unrestricted residual sum of squares equals

\[(0.80430)(0.80430)41 = 26.52\]

This has 41 degrees of freedom. The sum of the unrestricted residual sum of squares of both years adds to 44.61. The standard error of estimate of the pooled sample equals

\[(0.85502)(0.85502)67 = 48.98\].

This has 67 degrees of freedom.

The sum of the unrestricted residual sum of squares of both years has degrees of freedom equal to

\[(n_1 - k - 1) + (n_2 - k - 1)\]

There are \(k + 1\) linear restrictions. Hence,

\[F = [(48.98-44.61)/7] / [44.61/59] = 0.82\]

---

1 The 1980 and 1981 samples have 26 and 47 observations respectively.
APPENDIX B

1980 Data Sample Statistics in 1981 Dollar Value
Table B.1: Profit, Capital Flows and Wage Rate- 1980 Data in 1981

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>63914.0</td>
</tr>
<tr>
<td>Profit</td>
<td>45878.0</td>
</tr>
<tr>
<td>Capital Flow</td>
<td>31019.0</td>
</tr>
<tr>
<td>Hired Labor Wage Rate</td>
<td>40.5</td>
</tr>
<tr>
<td>Hired Labor Expenditure</td>
<td>3390.0</td>
</tr>
<tr>
<td>Non-Labor Expenditure</td>
<td>14647.0</td>
</tr>
</tbody>
</table>
APPENDIX C

Marginal Return per Farm
Within the $300-$9000 income group six farms have negative marginal value products. Eleven have positive marginal value products (Table C.1). Being a small income group, their individual marginal value products are relatively small. The range of positive values is $3 and $1416. Most of these have marginal value products of size $100, $200 and $400. Negative values fall within -$6 and -$159.

Table C.1: Marginal Return per Farm $300-$9000 Group

<table>
<thead>
<tr>
<th>Farm Group</th>
<th>1416</th>
<th>421</th>
<th>3</th>
<th>123</th>
<th>-17</th>
<th>-115</th>
<th>278</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-75</td>
<td>76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>405</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-158</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-159</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the $10000-$20000 income group there are two cases in the negative range (-$659 and $2192). Twelve are in the positive range (Table C.2). Out of these twelve three farmers have marginal value products as high as $1040, $1630 and $2490. Except for one case with a marginal value product worth $698, the remaining have marginal value products of about $71 and $83, $102 and $157.
Table C.2: Marginal Return per Farm
$10000-$20000 Group

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>689</td>
<td>205</td>
</tr>
<tr>
<td>1630</td>
<td>-2192</td>
</tr>
<tr>
<td>1040</td>
<td>138</td>
</tr>
<tr>
<td>147</td>
<td>2490</td>
</tr>
<tr>
<td>102</td>
<td>83</td>
</tr>
<tr>
<td>2005</td>
<td>157</td>
</tr>
<tr>
<td>-659</td>
<td>71</td>
</tr>
</tbody>
</table>

In the $30000-$40000 income group, five farmers out of fourteen have negative marginal value products ranging from -$969 to -$254. The rest of the group has marginal value products as low as $279 and as high as $1633 (Table C.3).

Table C.3: Marginal Return per Farm
$30000-$40000 Group

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-254</td>
<td>1592</td>
</tr>
<tr>
<td>311</td>
<td>-604</td>
</tr>
<tr>
<td>-969</td>
<td>362</td>
</tr>
<tr>
<td>483</td>
<td>258</td>
</tr>
<tr>
<td>279</td>
<td>1633</td>
</tr>
<tr>
<td>739</td>
<td>-852</td>
</tr>
<tr>
<td>-295</td>
<td>878</td>
</tr>
</tbody>
</table>

The $50000-$90000 income group has nine cases out of thirteen with positive marginal value products (Table C.4). The lowest of these values is $367 and the highest $6494. Three cases average to about $6000. Two cases show $3890 and $4223 each. Four have values between $367 and $480. The rest of this group has negative marginal value products: -$4223, -$359, -$3403 and -$37.
Table C.4: Marginal Return per Farm
$50000-$90000 Group

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>480</td>
<td>3890</td>
<td>4223</td>
</tr>
<tr>
<td>6494</td>
<td>-4223</td>
<td></td>
</tr>
<tr>
<td>7735</td>
<td>-359</td>
<td></td>
</tr>
<tr>
<td>7640</td>
<td>-3403</td>
<td></td>
</tr>
<tr>
<td>399</td>
<td>-37</td>
<td></td>
</tr>
<tr>
<td>608</td>
<td>367</td>
<td></td>
</tr>
</tbody>
</table>

The $100000-$400000 income group, being a group of large incomes, has the largest individual marginal value products (Table C.5). Positive cases range between $553 and $43832. Negative cases are: -$14037, -$6485 and -$6622.

Table C.5: Marginal Return per Farm
$100000-$400000 Group

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-9562</td>
<td>1411</td>
<td>43832</td>
</tr>
<tr>
<td>879</td>
<td>4687</td>
<td></td>
</tr>
<tr>
<td>12849</td>
<td>-14037</td>
<td></td>
</tr>
<tr>
<td>5636</td>
<td>-6485</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>5712</td>
<td></td>
</tr>
<tr>
<td>5636</td>
<td>-6622</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>1358</td>
<td></td>
</tr>
<tr>
<td>27352</td>
<td>533</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D

Expected Change in Profit due to Training
In the $300-$9000 income group six farmers expect negative changes in profit (Table D.1). These negative changes vary between $484 and $3000. On the other end of the scale, ten farmers expect positive profits. The highest profit in this group of ten is $10648 followed by $6776. The remaining of cases expect profits between $484 and $3872.

Table D.1: Expected Change in Profit Due to Training Program
$300-$9000 Group

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>484</td>
<td>1936</td>
<td>6676</td>
</tr>
<tr>
<td>-1936</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2420</td>
<td>2904</td>
<td></td>
</tr>
<tr>
<td>-3388</td>
<td>10648</td>
<td></td>
</tr>
<tr>
<td>-1452</td>
<td>-1936</td>
<td></td>
</tr>
<tr>
<td>-484</td>
<td>3872</td>
<td></td>
</tr>
<tr>
<td>4356</td>
<td>3872</td>
<td></td>
</tr>
<tr>
<td>-484</td>
<td>968</td>
<td></td>
</tr>
</tbody>
</table>

The $10000-$20000 income group only has one case of expected, negative profit(-$1936) (Table D.2). The highest expected changes are $7744 and $8228. The lowest are between $968 and $1936. In between extremes the range of these changes is $2904 and $4840.
In terms of group averages the $10000-$20000 income group compares very well with the $30000-$40000 income group (Table D.3). The latter has six cases out of twelve whose expected changes in profits vary between $1452 and $4356. The other six expect profits between $5808 and $9196.

The $50000-$90000 income group, which is comparable only with the $300-$9000 group in terms of group averages, has four cases with expected negative profits (Table D.4). The remaining, with the exception of two
cases with $968 and $484, expect profits between $2904 and $7260.

Table D.4: Expected Change in Profit due to Training Program

<table>
<thead>
<tr>
<th>$50000-$90000 Group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-11132</td>
<td>3388</td>
</tr>
<tr>
<td></td>
<td>5808</td>
<td>484</td>
</tr>
<tr>
<td></td>
<td>5324</td>
<td>-968</td>
</tr>
<tr>
<td></td>
<td>4356</td>
<td>-968</td>
</tr>
<tr>
<td></td>
<td>968</td>
<td>5324</td>
</tr>
<tr>
<td></td>
<td>-1936</td>
<td>2904</td>
</tr>
</tbody>
</table>

Finally, the highest income group of $100000-$400000 has three cases of expected negative changes (Table D.5). These range between -$9680 and -$484. The expected, positive changes, on the other hand, range between $968 and $1936; $3872 and $4840; $5808 and $7740.

Table D.5: Expected Change in Profit due to Training Program

<table>
<thead>
<tr>
<th>$100000-$400000 Group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4840</td>
<td>5808</td>
</tr>
<tr>
<td></td>
<td>-484</td>
<td>-7260</td>
</tr>
<tr>
<td></td>
<td>3872</td>
<td>5080</td>
</tr>
<tr>
<td></td>
<td>1936</td>
<td>7740</td>
</tr>
<tr>
<td></td>
<td>1936</td>
<td>2420</td>
</tr>
<tr>
<td></td>
<td>-9680</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>7260</td>
<td>4356</td>
</tr>
</tbody>
</table>
APPENDIX E

Financial Management Training Questionnaire
FINANCIAL MANAGEMENT TRAINING

QUESTIONNAIRE

Note that these questionnaires are completely confidential. No names or addresses are required and your response will be anonymous. To preserve this anonymity the evaluation is being done by a third party.

1982-83 Course Year
Objective

This questionnaire is being used to collect information from all participants so that the financial management training project can be evaluated. There are two aspects to the evaluation. First, we wish to obtain test scores and your assessment of the course to permit continued improvement and revision of the course format, material, and presentation. Secondly, if the project is to be continued, there must be evidence that it is having a positive effect on farm production and incomes and is reaching a wide array of producers. To meet this second end we need some detailed information about your farm operation, such as gross receipts, asset levels, time allocation and expenditures.

Thank you in advance for completing the questionnaires. Just as the cooperation of the last year's participants has improved the courses for your benefit, your cooperation will help future participants. As well, your response will help provide the basis for continuity of the project.

Note: If you wish to take this questionnaire home to fill it in feel free to do so. Please bring it back with you tomorrow.
<table>
<thead>
<tr>
<th>Course Location</th>
<th>Farm Type</th>
<th>Date</th>
</tr>
</thead>
</table>

**LAND**

<table>
<thead>
<tr>
<th></th>
<th>Total Acres</th>
<th>Acres Cultivated</th>
<th>Current Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deeded Land</td>
<td></td>
<td></td>
<td>$/Acre</td>
</tr>
<tr>
<td>Rented Land</td>
<td></td>
<td></td>
<td>Rental Price $/Acre</td>
</tr>
<tr>
<td>Leased Grazed Land</td>
<td>a.u.m's</td>
<td></td>
<td>Current Value $</td>
</tr>
</tbody>
</table>

**BUILDINGS**

Market Value Of All Farm Buildings (excluding value of farm house) $
### LIVESTOCK

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Current Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females in the breeding herd (e.g. sows, dairy cows, beef cows, yearlings if backgrounding)</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>Bee Hives</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td><strong>TOTAL VALUE OF ALL LIVESTOCK</strong></td>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>

### MARKETING QUOTA

<table>
<thead>
<tr>
<th>Description</th>
<th>Cases</th>
<th>Pounds</th>
<th>Daily Liters</th>
<th>Annual Kg. Of Butterfat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broilers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid Milk Quota</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing Sharing Quota (MSQ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Machinery and Equipment

<table>
<thead>
<tr>
<th>Category</th>
<th>Current Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorized Machinery</td>
<td>$</td>
</tr>
<tr>
<td>Tillage And Seeding Machinery</td>
<td>$</td>
</tr>
<tr>
<td>Harvesting Machinery</td>
<td>$</td>
</tr>
<tr>
<td>Spraying Equipment</td>
<td>$</td>
</tr>
<tr>
<td>Fertilizing Equipment</td>
<td>$</td>
</tr>
<tr>
<td>Irrigation Equipment</td>
<td>$</td>
</tr>
<tr>
<td>Other Specialized Equipment (e.g. milk equipment, honey extracting equipment, etc.; please specify)</td>
<td>$</td>
</tr>
<tr>
<td>Shop Tools</td>
<td>$</td>
</tr>
<tr>
<td><strong>Total Value of All Farm Machinery and Equipment</strong></td>
<td>$</td>
</tr>
<tr>
<td>EXPENDITURES FOR 1981</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>Cash Wages Paid To Hired Agricultural labor</td>
<td>$</td>
</tr>
<tr>
<td>Taxes Levied On Your Agricultural Property</td>
<td>$</td>
</tr>
<tr>
<td>Feed Purchases (Hay, Grain, Mixed Feeds, Concentrates, Supplements Calf Feed, etc.)</td>
<td>$</td>
</tr>
<tr>
<td>Breeding Fees</td>
<td>$</td>
</tr>
<tr>
<td>Veterinary And Medicine</td>
<td>$</td>
</tr>
<tr>
<td>Bedding</td>
<td>$</td>
</tr>
<tr>
<td>Replacement Animals</td>
<td>$</td>
</tr>
<tr>
<td>Fuel And Oil Used For Farm Purposes (Tractors, Trucks, Combines, etc.)</td>
<td>$</td>
</tr>
<tr>
<td>Machine Rental Custom Or Contract Work</td>
<td>$</td>
</tr>
<tr>
<td>Repair And Maintenance For Machinery, Buildings, Drainage And Fencing</td>
<td>$</td>
</tr>
<tr>
<td>Commercial Fertilizer And Agricultural Chemicals (Insecticides, Herbicides, Fungicides, Disinfectants Pesticides)</td>
<td>$</td>
</tr>
<tr>
<td>Crop Expenses (Seed, Baler, Twine, etc.)</td>
<td>$</td>
</tr>
<tr>
<td>Interest On Operating Capital</td>
<td>$</td>
</tr>
<tr>
<td>General Supplies And Overhead</td>
<td>$</td>
</tr>
<tr>
<td>Other Expenses (e.g. Beekeeping Expenses)</td>
<td>$</td>
</tr>
</tbody>
</table>
## HIRED AGRICULTURAL LABOR

<table>
<thead>
<tr>
<th>Time Worked</th>
<th>Wage Rate (Include All Benefits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hrs/Wk</td>
<td>Wks/Yr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skilled Farm Labor</th>
<th>$/Day</th>
<th>$/Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casual Farm Labor</td>
<td>$/Day</td>
<td>$/Month</td>
</tr>
</tbody>
</table>

## FAMILY LABOR

<table>
<thead>
<tr>
<th>Operator</th>
<th>Spouse</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>15 yrs+</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years Of Schooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years Of Experience Managing A Farm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### FAMILY LABOR (continued)

<table>
<thead>
<tr>
<th>Regular schedule in 1981</th>
<th>Operator</th>
<th>Spouse</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>hrs/wk</td>
<td></td>
<td></td>
<td>15 yrs+</td>
</tr>
<tr>
<td>wks/yr</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summer Schedule in 1981</th>
<th>Operator</th>
<th>Spouse</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>hrs/wk</td>
<td></td>
<td></td>
<td>15 yrs+</td>
</tr>
<tr>
<td>wks/yr</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Off-Farm Employment if Applicable</th>
<th>Operator</th>
<th>Spouse</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Of Days</td>
<td></td>
<td></td>
<td>15 yrs+</td>
</tr>
<tr>
<td>Wage Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$/hr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$/mo</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agricultural Financial Extension Courses Attended In The Past Three Years</th>
<th>Operator</th>
<th>Spouse</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>--yes</td>
<td>--yes</td>
<td>--yes</td>
</tr>
<tr>
<td></td>
<td>--no</td>
<td>--no</td>
<td>--no</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Courses</th>
<th>Operator</th>
<th>Spouse</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>--yes</td>
<td>--yes</td>
<td>--yes</td>
</tr>
<tr>
<td></td>
<td>--no</td>
<td>--no</td>
<td>--no</td>
</tr>
</tbody>
</table>
GROSS RECEIPTS (continued)

LIVESTOCK AND POULTRY PRODUCTS SOLD:
- Cattle (including dairy)
- Hogs
- Sheep and Lambs (including wool)
- Broilers and Other Poultry
- Eggs
- Milk And Cream
- Other Agricultural Products (Honey, etc.)
- Gov’t. Livestock Payments (such as Farm Income Assurance, etc.)

<table>
<thead>
<tr>
<th></th>
<th>1979 Quantity</th>
<th>Receipts $</th>
<th>1980 Quantity</th>
<th>Receipts $</th>
<th>1981 Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hogs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broilers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gov’t. Payments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL VALUE OF AGRICULTURAL PRODUCTS SOLD
APPENDIX F

Skill Questions
SKILL QUESTIONS

Course: ________________________  Location: ________________________

1. For your kind of farm business ( ) which dollar figure represents the debt per unit closest to that which your business could handle:
   a) at 12% interest? Please indicate your answer with a check mark.
      $400  $500  $600  $700  $1,000  $1,500  
      $2,000  $3,000  $5,000  $7,000
   b) at 22% interest? Give your answer in approximate dollars.
      $

2. A larger-than-necessary investment in machinery and facilities raises costs because: Please indicate with a check mark which statement(s) apply.
   a) maintenance costs are lower
   b) interest costs will be higher
   c) depreciation allowances will be higher

3. Which of the following budget(s) are normally used to determine the break-even cost per unit of saleable product? Please indicate your answer(s) with a check mark.
   a) net worth
   b) cost of production
   c) cash flow
   d) partial budget
   e) income and expense

4. Which of the following financial statements reveal the true profit or loss from the farm operation? Please indicate your answer with a check mark.
   a) Cash flow
   b) Tax statement of cash income and expense
   c) Accrual type income and expense statement

5. For tax purposes, which type of income and expense statement do you feel would be most advantageous for you to complete? Please indicate your answer with a check mark.
   a) Accrual type
   b) Cash type
6. Which of the following budgets would you use to determine your needs for an operating loan? Please indicate your answer with a check mark.

   a) Partial budget
   b) Loan worksheet
   c) Income and expense budget
   d) Cash flow budget

TAX PLANNING QUIZ

1. In the highest tax bracket, the percentage marginal tax rate for an individual is over 50%.
   True __________  False __________  Undecided __________

2. A farmer bought land for $100,000 in 1973 and sold it in 1980 for $200,000 with a capital gain of $100,000. Is the taxable capital gain: (circle one answer)
   (a) $100,000  (b) $50,000  (c) $0  (d) $200,000  (e) Don't Know

3. Is a will which is not properly witnessed valid in British Columbia?
   Yes __________  No __________  Undecided __________

4. Recaptured capital cost allowance is:
   fully taxable __________  half taxable __________  not taxable __________

5. Which of the following types of assets can be rolled over to a child from a farmer who is actively engaged in farming?
   Farm land  Yes _____  No ____
   Farm machinery  Yes _____  No ____
   Shares in a farm corporation  Yes _____  No ____

6. Are depreciation and capital cost allowance the same thing?
   Yes __________  No __________  Uncertain __________

7. Do you have to take the full amount of capital cost allowance allowed each year?
   Yes __________  No __________  Don't Know __________