THE CONTRIBUTION
OF SCHOOLING
TO CANADIAN FARM INCOME

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE

in

THE FACULTY OF GRADUATE STUDIES
Department of Agricultural Economics

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA
April, 1979

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ABSTRACT

The basic objectives of this thesis are to build an earnings function for farm incomes of Canadian farm operators, and estimate the rate of return to schooling. It is hypothesized that the low levels of farm income are related to the low investment in education by farm operators. If reasonable estimates of positive returns to schooling are found, they will be useful for policy makers in considering the improvement of the quality of farm operator labour via schooling, as an alternative measure to increase farm income.

To achieve the goals of this study, an earnings function is built for the group of entrepreneurs, in particular the farm operators. As a test of functional form a digression is made and a value added approach discussed and utilized as an alternative way of computing the contribution of schooling to farm income.

Although both methods yielded significant estimates of the return to schooling comparable to previous studies, the value added approach was found to be a better specified formulation with respect to estimating the productivity of schooling in farm production. The estimate of the marginal product of schooling using the earnings function approach was found to be higher as we concentrated on the full-time farmers. For the value added approach, the estimates differed as we varied the input specification, being higher as we decrease the number of decision variables in the estimating equation. Estimates for
both models however have their respective biases and shortcomings attributable mainly to the variables omitted in both specifications. These estimates could be improved with the availability of better specified variables and use of an alternative analytical procedure.

In addition to providing strong evidence that schooling is a significant determinant of farm incomes, this study also led to another important conclusion. Using a transformed labour variable in the value added function at the census division level led to an important finding that a similar output-input relationship exists in the agricultural sectors of both the U.S. and Canada. Specifically the relationship was identical for the elasticities of output with respect to labour, with respect to education (schooling), and with respect to the weighted labour variable (product of labour and schooling) values of selected years.
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ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to Dr. Rick Barichello, my thesis advisor for his guidance in the undertaking of this research. The organization and presentation of the final manuscript has been greatly improved by his suggestions. I would also like to thank the members of my thesis committee, Dr. George Kennedy, Dr. Peter Chinloy and Dr. J. MacMillan for their helpful suggestions and comments which led to substantial improvements in this thesis.

Thanks are extended to the Department of Agricultural Economics at U.B.C. for provision of financial support and Statistics Canada for providing the data used in this study.
The role of education in productivity has been the subject of research for the past two decades. Studies concerned with growth accounting indicated that a large portion of growth remains unaccounted for after conventional economic factors are considered. Griliches (1963) and Welch (1966) tried to explain this residual through a human capital framework of which education is a major component. These studies indicate that the economic growth was accompanied by a substantial increase in the educational level of the labour force. This study is interested in establishing the contribution of education on the labour earnings of a particular sector of the Canadian farm population, the farm operators.

Early investigation of education-income relationships based the analysis on a skill creation framework. Education is an investment which provides knowledge, improves skills and is undertaken by individuals with the expectation of increased earnings in the future. As with any other investment, it is important to measure the rate of return from such an investment.

An important study by Mincer (1958) was one of the first to apply human capital concepts directly to the personal distribution of earnings. Several studies have dealt with computations of the return to education using either wage differential methods (comparison of earnings of two groups with different school completion levels) and the use of regression analysis to directly compute the rate of return to
education (via formal schooling). The latter, referred to in the literature as an earnings function is an equation with earnings as the dependent variable, regressed on schooling and other variables. All of these were organized by Becker (1964) into a coherent theoretical model which single out individual investment behavior as the basic factor in the heterogeneity of labor incomes.

This study will focus on the role of schooling on the farm income of Canadian farm operators. Two methods have thus far been utilized to measure rate of return to education in agriculture. One approach considers education as one of several inputs in an aggregate agricultural production function, with the objective of testing if the input education has a significantly positive marginal product. An alternative method is to construct an earnings function for farm operators supplemented by factors important in production theory. Although the production function approach has been more extensively used Griliches (1964), Khaldi (1975), Huffman (1974) and Fane (1975), this study will utilize the earnings function approach.

1.1 Problem Setting

The most striking discrepancy in income levels in the Canadian economy is not so much between provinces as between the agricultural sector and non agricultural sector in all parts of the country. A recent study by Shaw (1977) showed that in 1970, per capita cash income in Canada's farm sector
was only about one half that of Canada's urban sector, and with an adjustment for income in kind, the per capita farm: non farm income ratio increases to about 0.62.

The relatively lower levels of farm income have been the concern of policy makers for a long time. Due to large farm outmigration, policy makers have been concerned with improving the economic well-being of the remaining farm population and insuring the efficient utilization of agricultural resources. Government policies to increase farm income are in the form of subsidies for farm output and some selected inputs. These measures (wholly concerned with the physical input and output components of the production process) are effective in transferring resources from the urban sector to the rural farm sector. However such wealth redistribution may not be the most efficient method of narrowing the income gap between these two groups and in most cases such measures benefit the well to-do farmers at the expense of small time farmers.

It can be argued that the low incomes from farming are influenced by the low investment in education by farmers. Indeed, a look at the rural farm - urban percentages of schooling completed shows that urban residents are more schooled (Appendix Table A.1). It is also apparent from the figures that there has been substantial improvement in schooling achievement for both the urban and rural farm population for the ten year period (1961-1971). Closer examination reveals that the rural farm population has made greater relative progress so that the gap in achievement rates between
the two groups has narrowed. In 1961, proportions with a secondary or higher education in urban and rural farm areas were 58.7% and 36.5% respectively, a difference of 22.2 percentage points. In 1971 the respective proportions have risen to 66.3% and 49.7%, a reduction of the difference to 16.6 percentage points. Looking at the ratios of farm family cash income to urban family cash income (Appendix Table A.2), we note an increasing trend between the 1958 and 1970 figures. This implies that the differential between farm family incomes and urban family incomes has also narrowed during the 12 year period. This raises the question of how schooling as an investment contributes to farm income, the issue which is the main concern of this study. If we are to arrive at a reasonable estimate of the contribution of schooling to farm income, then we might be able to recommend policy alternatives to raise farm incomes.

This possible relation between low educational attainment and relative poverty has been discussed in a report by the Canadian Council on Rural Development (Rural Canada, 1970: Prospects and Problems). They stated that the changing nature of the labor force demand requires a major change in the Canadian economy, specifically to raise the level of educational attainment in rural areas. If rural Canadians are to move towards parity with urban Canadians, the report continued, improvements in the overall quality of education available to them is essential. The same observation was made by the Federal Task Force on Agriculture (Canadian Agriculture in the
Seventies, 1969), which recommended short term measures to solve the problem (mobile manpower clinics in rural areas).

1.2 Objectives of the Study

The primary objective of this study is to determine the contribution of schooling to Canadian farm operators. There has been only one other study undertaken with Canadian data on this topic, although the research dealt more on the level and distribution of farm income and how it compares with non-farm income (Shaw, 1977). This study will focus on the earnings of one particular factor of production, labour, and will build a model to explain the determinants of labour earnings along the lines of human capital theory and production function theory. The model starts with the earnings function adapted to the non-agricultural sector, which will be developed into a working model taking into account the characteristics of the farm sector. As a digression and test of functional form, a value added function will be utilized and estimates of return to education (via years of schooling) will be computed for both models.

The specific objectives of this study are:

1. to build an earnings function for farm incomes of Canadian farm operators

2. to estimate, using the above model the rate of return to schooling.

To attain the above objectives, there will be two approaches taken, one using an earnings function and as a test of
functional form, a value added function. The latter approach was initiated by Welch (1970) and later applied by Haller (1972) in his study on rural development in Columbia. A discussion of the relation of the earnings function and value added function will be made and consequent transformations of the available data to fit both models will be discussed in detail in the following chapters.

1.3 Importance of the Study

The issue of the contribution of schooling to farm income is an important one for various reasons. Firstly, if reasonable estimates of positive returns to schooling are found, they will be useful for policy makers in considering the improvement of the quality of farm operator labour via schooling, as an alternative measure to increase farm income. Secondly, a recent study by Shaw (1977) suggests that schooling has an ambiguous effect on farm income, an issue which this study will attempt to clarify.

This study is also important in that it applies recent developments in human capital theory (Welch (1970) and Mincer (1974)) to the study of agricultural incomes and it utilizes more detailed data than previously used. Specifically it will embody developments in the Mincer (1974) work and include the variables "weeks worked" and "labour market experience".

As with other forms of investment, it is important to measure the monetary pay-off from education. If we can have a satisfactory measure of the rate of return to education, we
can compare this with rates of return to other investments like physical capital. These estimates can also be compared with the results of previous studies, particularly those which utilized U.S. data to find out if the same earnings-schooling relationship exists in the farm sector of the two countries.

1.4 Guide to Thesis

The theoretical model is discussed in Chapter II. It starts with a discussion of the human capital approach to income distribution and the early literature pertaining to the development of the earnings function. The development of the model based on an earlier study follows. The earnings function is then evaluated in the light of previous empirical evidence and a number of theoretical considerations.

Chapter III deals with a discussion of the application of the earnings function to entrepreneurs, in particular, farm operators. The discussion leads to a working equation which is similar to a value added function. For comparative purposes and as a test of functional form, the value added approach as an alternative method of estimating the contribution of schooling to farm income is pursued.

The next chapter considers the working models for both the earnings function and the value added function, and the data transformations to various variables which are available for this study. Both the earnings function and the value added function are applied to different data sets to test the effect on the estimated contribution of schooling to farm
income, and the results are presented in Chapter V. Reasonable estimates of return to schooling using both models, are found. In Chapter VI the main findings of the study are summarized and the biases of the estimates are discussed. Implications of the importance of the results are stressed as well as suggestions for further study.
CHAPTER II  THEORETICAL MODEL

2.1 The Human Capital Approach to Income Distribution

Education is among the factors often cited in efforts to explain current wage and income levels. This study will focus on education (specifically formal schooling) and its effect on farm income of Canadian farm operators.

In general as people acquire more schooling or training, their incomes tend to increase as productivity rises and they become more aware of and qualified for better paying jobs. Education can also effect income through increased mobility and through an increased ability of the more highly educated persons to adopt new technological innovations (Nelson and Phelps, 1966).

To explain the income-education relationship, take the case of an individual. The basic assumption is that the individual invests in education with the basic expectation of an increase in income in his labour income in the future. An increase in his income is expected as the increase in education leads to a greater human capital stock. Realization of the increase in income may lead to increased opportunity to participate in further investments in education. This relationship is shown in Figure 1, where the flow of an individual's income in time t is related to his stock of education in time t-1. Time periods are presented to show the non-simultaneous nature of the system and the fact that a time frame exists.
\[ \Delta E_{t-1} \xrightarrow{\Delta H C_{t-1}} \Delta Y_t \xrightarrow{\Delta O P_t} \Delta E_{t+m} \]

**Time Scale**

- \( \Delta E \) = change in stock of education
- \( \Delta H C \) = change in human capital stock
- \( \Delta Y \) = change in labour income
- \( \Delta O P \) = change in opportunity for educational experiences
- \( t \) = time period
- \( m \) = 1, 2 ... k

\[ \implies \] implies
\[ \implies \] may lead to

**Figure 1. How Education (E) Affects Income (Y)**
Human capital models single out individual investment behavior as the basic factor in the heterogeneity of labour incomes. The model is formulated in terms of training periods which are completed before earnings begin and applies strictly to schooling, rather than to all occupational training. Although it is recognized that factors like ability and family background are essential variables to consider as determinants of income, this study will focus on a single deterministic model which focuses on investment, in particular, schooling. Individuals are assumed to be interested in maximizing the present value of their incomes, and earnings per unit of time over the working life are assumed to be constant.

Illustrated in the next section is the development of the model (after Chiswick and Mincer, 1972) which will be the basis of the earnings function we will modify later to relate schooling to farm income.

2.2 Development of the Model

The theoretical basis of the earnings function is the human capital model formulated by Becker (1964) and modified later by Chiswick and Mincer (1972). The starting point is the basic relation between gross earnings and investment in human capital which could be written for an individual i in year j as:
where: \( E_{ji} \) = gross earnings
\( E_{oi} \) = "original" endowment (earnings in the absence of investment)
\( C_{ti} \) = previous investment
\( r_{ti} \) = rate or return to investment in the \( t^{th} \) year

Alternatively, we can express \( C_{ti} \) as a fraction of earnings (i.e. \( C_{ti} = k_{ti} E_{ti} \)). If the original endowment \( (E_{oi}) \) is assumed constant across years and individuals, we can write:

\[
E_{ji} = E_{oi} + \sum_{t=1}^{j-1} r_{ti} k_{ti} E_{ti}
\]

or:

\[
E_{ji} = E_{oi} \prod_{t=1}^{j-1} (1 + r_{ti} k_{ti})
\]

By taking the natural logarithm of both sides of equation (3) we obtain:

\[
\ln(E_{ji}) = \ln(E_{oi}) + \sum_{t=1}^{j-1} \ln(1 + r_{ti} k_{ti})
\]

Using the relation that the natural log of one plus a small number is approximately equal to that small number \( \{\ln(1+r_{ti} k_{ti}) \approx r_{ti} k_{ti}\} \):

\[
\ln(E_{ji}) = \ln(E_{oi}) + \sum_{t=1}^{j-1} r_{ti} k_{ti}
\]
The number of periods of investment in training \((j-1)\) can be decomposed into \(S\) years of schooling and \((j-S-1)\) years of labour market experience. We further assume that the direct costs of schooling are equal to the potential earnings of students at that level, implying that \(k_{ji} = 1\) for the schooling years. This assumption was used and defended by Hanoch (1967). Incorporating these assumptions, equation (5) reduces to:

\[
\ln E_{ji} = \ln E_0 + r_i S_i + \sum_{t=S+1}^{j-1} r_{ti} k_{ti}
\]

At this point the model assumes full employment of the worker during the year. Actual "net earnings" are lower than "net full employment earnings" by the amount he loses when he is unemployed, or for that matter, underemployed. Mincer has suggested that weeks worked was an appropriate standardizing variable to control for transitory fluctuation in unemployment. If we assume that \(E_{i}'\) = weekly earnings and \(E_i\) = annual earnings,

\[
E_i = E_{i}' \cdot (W_i)^\gamma
\]

where \(W_i\) = number of weeks worked, and \(\gamma\) is the elasticity of earnings w.r.t. weeks worked. With these modifications, the earnings function becomes:

\[
\ln E_{ji} = \ln E_0 + r_i S_i + \sum_{t=S+1}^{j-1} r_{ti} k_{ti} + \gamma \ln W_i
\]

To evaluate \(r_{ti} k_{ti}\), certain assumptions are needed. Rate of return on investment, \(r_{ti}\), is assumed constant \((r_{ti} = r_i^*)\),
and the fraction of gross earnings invested, $k_t$, is assumed to decline over time. The assumption of this constant rate of return to investment, is supported empirically by Mincer (1974). The second assumption is supported by the contention that since opportunity cost of time invested in experience rises with additional experience, the profitability of additional investment decreases. Also, additional experience reduces the length of the remaining working life, and consequently, the profitability of investment. We assume that $k_t$ decreases linearly w.r.t. time and therefore $E_{ri}*k_t$ is a parabolic function of experience ($T$).  

The preceding functions utilize gross earnings as the dependent variables. However, net or observed earnings are more readily available and hence if $E_j = $ gross earnings, net earnings of $Y_j = E_j(1 - k_j)$. Taking the logarithm of both sides,

$$\ln Y_j = \ln E_j + \ln (1 - k_j)$$

Evaluating $\ln(1 - k_j)$ by using a Taylor expansion around $T^*$ taken to the 3rd term,

$$\ln (1 - k_j) = -k_0(1 - k_0/2) + (k_0/T^*)(1 - k_0) T$$
$$+ (-k_0^2/2T^2) T^2$$

Incorporating the net earnings relation and the linear decline in the experience term, equation (7) reduces to:

\[ \int_{T_i}^{T_i*} r_i* k_{ti}dT = r_i* k_0 T_i - (r_i* k_0/2T^*) T_i^2 \]

---

1 If $k_{ti} = k_0 (1 - T_i/T^*)$ for $j \geq s + 1$, where $T^*$ is the number of years of positive net postschool investment, converting to continuous time:
\( \ln Y_{ji} = \{\ln E_0 - k_0 (1 + k_0 /2)\} + r_i S_i + \{r_i k_0 \\ + k_0 /T*(1 + k_o)\} T_i - \{(r_i k_o T^* + k_o^2) /2(T^*)^2\} T_i^2 \\
+ \ln (W_i) + \mu_i \)

The residual \( \mu_i \) reflects individual differences in earnings for given levels of schooling and age and employment. It also includes effects of discrimination, differences in nonpecuniary aspects of jobs, nonlabour income (if this is included in the income concept), and errors of measurement.

The assumption that an individual is continuously acquiring experience in the labour market after leaving school, means that this formulation of the model is more relevant for analysing incomes of males than incomes of females. This is so because a number of the latter group frequently have long periods of absence from the labour force.

Finally, it will be assumed that across individuals the coefficients of schooling and experience in equation (8) are random variables independent of schooling (S) and experience (T). There are theoretical reasons to support this assumption. Utilizing the model for the supply and demand for funds for investment in human capital (developed by Becker (1967)), those with higher marginal rates of return for a given level of schooling (with wealth held constant), have a greater incentive to invest. In this case, there is a positive correlation between schooling level and rate of return. For a given level of ability, however, those with greater wealth have a lower discount rate and therefore invest more and receive a lower rate
of return. This implies a negative correlation between schooling and rate of return. Hence, the sign of the correlation between the return to schooling rate to an individual, and his schooling level, is ambiguous. This ambiguity has been empirically supported by Mincer (1974), when he showed that the rate of return from schooling is uncorrelated with the individual's level of schooling (holding experience and weeks worked in the year, constant).

With these assumptions and modifications, equation (8) reduces to:

\[
\ln Y_i = x + r_{i1} S_i + r_{i2} T + \delta T^2 + \gamma (\ln W_i) + \mu_i
\]

where: \(\ln Y_i\) = natural logarithm of annual net earnings of individual \(i\)

\(x\) = constant intercept

\(r_{i1}\) = rate of return to schooling

\(S_i\) = years of schooling

\(T\) = years of labour market experience

\(W_i\) = weeks worked during the year

\(\mu_i\) = residual term assumed to be a random variable

Heckman and Polachek (1974) presented empirical evidence on the correct functional form of the regression relationship between earnings as the regressand and schooling and experience as the regressors. They found that among simple transformations, the natural logarithm of the dependent variable exhibited the best fit, using the Box and Tidwell method.
They also showed, somewhat less clearly, that the above schooling and experience model is generally preferable to other formulations with the only potential quibbles being on the use of weeks worked rather than the logarithm of weeks worked as the regressor. There is also some ambiguity across the data sets in preferring a linear and quadratic experience variable to the natural logarithm of the experience term.

2.3 Evaluation of the Earnings Function

Treated in a single regression context across the population studied, estimated values of the regression coefficients are interpreted as interpersonal averages in the residual term. This is an important assumption of the model, for if we recognize that differences among persons exist, we are saying that the earnings function is not a structural relation, because it is marginal values that determine behavior, not averages, and the fitted function only summarizes observed equilibrium points. Also the average rate of return for each person is affected by his own ability and financial constraints, which in turn affect investment. In other words, both $r_i$ and $S_i$ in the above equation are not distributed independently of each other. Consequently, $S_i$ is not distributed independently of the error term in a cross sectional regression, biasing the estimate of the population
average rate of return.

Unbiased estimates of the rate of return are obtained when \( S_i \) and \( \mu_i \) from equation (9) are uncorrelated, that is, when schooling and the omitted variables are uncorrelated and there are no errors of measurement. There is evidence to believe, however, that other variables whose effects are impounded in the residual, may be correlated with the schooling variable. A person's investments in health and migration has been found to be positively correlated with his level of schooling (Grossman, 1972 and Fein, 1965). This implies that a positive correlation between schooling and the component of the error term reflecting the return from these investments exists, since it is not likely that their rate of return are sufficiently negatively correlated with the level of schooling (Chiswick, 1974). We also could expect that family wealth may be positively correlated with schooling.

Another component in the error term is differential ability. Chiswick (1974) discusses this residual component, as reflected in differences in the rate of return from investments in schooling. Assuming that \( \mu_i \) in equation (9) is equal to \( (d_S S_i + \mu' S_i) \) where \( d_S = (\bar{r}_i - \bar{r}) \) is the difference between the rate of return received by the \( i^{th} \) person and the average rate of return \( \bar{r} \). Since the expected value of \( d_S \) is zero, \( S \) and \( d_S S \) would be uncorrelated and there would be no bias from this source, if \( S \) and \( d_S \) were independent of each
The bias of the rate of return to schooling when ability is omitted in the earnings function has been the subject of many studies. Gintis (1971), in reviewing nine different studies found that with an ability correction, the schooling coefficient was reduced by 4% to 35% (or an average of 10%). Hanuschek (1973) using an AFQT (Armed Forces Qualification Test) score as an ability measure for a sample of U.S. Armed Forces workers, found an overall reduction of 14%, when this test score was included in the earnings function. In almost all of these studies, direct measures of ability in the earnings function indicated a relatively small direct contribution of the ability variable to the explanation of earnings. At the same time the reduction in the schooling coefficient (due to an ability correction) was likewise small. Griliches (1977) however found that if schooling is tested symmetrically with ability measures (that is, allowing schooling to be subject to errors of measurement and to be correlated to the disturbance in the earnings function), the implied net ability

---

2Chiswick (1974, p. 44) argues that it is not sufficient for $S$ and $dS$ to be uncorrelated - i.e. if $\bar{S}$ is uncorrelated with $S_i$, $\text{Cov}(d_s, S) = 0$. We know that $E(d_s) = 0$. Then $\text{Cov}(d_s, S) = E\{d_s(S - \bar{S})\} = E(d_s, S) = 0$. Thus, $\text{Cov}(S, d_s S) = E\{(S - \bar{S})(d_s S)\} = E(d_s S^2) - S E(d_s S) = E(d_s S^2)$. Hence, $\text{Cov}(S, d_s S) = 0$ if $\text{Cov}(d_s S^2) = 0$, which necessarily holds when $d_s$ and $S$ are independent.
bias is either nil or negative, instead of positive. These results raise the question of what ability really measures and what kind of measurements would be desirable to get closer to a human capital concept. This has led recent investigation to abandon direct measurement of ability altogether and adapt statistical methods suitable for the purpose: unobserved variance components and factor analysis (Griliches, 1974).

Another problem with simple least squares estimates of earnings functions is the case of simultaneous equation bias. Some of the independent variables may be part of a simultaneous system of equations and are therefore endogeneous (like schooling and weeks worked). The amount of time spent working \( W_i \) is a decision made by the farm operator and as such, is an endogeneous variable. One way to overcome this bias is to retain weeks worked as an explanatory variable, but use a predicted value in its place (two-stage least squares procedure with weeks worked as an instrument).

Schooling is the result, at least in part of the optimizing behaviour by the individuals and their families. This behaviour is based on some anticipated earnings function. The seriousness of the bias resulting from this depends on how close individuals are to predicting their own future and to what extent their actions could be interpreted as optimizing. The bias may not be so serious because of the effect of unanticipated events on earnings and the influence of the family background and socio-economic factors on the educational level of the individual. In this case only a small part of
the school achievement can be attributed to the individual's own optimizing behaviour.

In cross section data, bias due to vintage effects occurs because individuals with different levels of experience must also, when observed at a point of time, differ in the date of entry into the labour force. Due to accumulation of knowledge it is likely that different opportunities and thus investment decisions are associated with individuals of different vintages. A regression of the log of earnings on years of schooling in which all age groups are pooled, therefore results in a downward biased estimate of the slope coefficient of schooling. The downward bias would not be fully eliminated by restricting the regression to specified age groups. For a given age, an additional year of schooling implies one year less of experience. Since years of schooling and experience are negatively correlated in the cross section, the omission of experience from the earnings function results in a downward bias in the schooling coefficient.

To summarize, it appears that wealth, migration and health are positively correlated with earnings (with schooling held constant) and positively correlated with schooling. Omission of these variables therefore biases the estimate of the return to schooling upwards. The effect, however, of omitting the ability variable and errors of measurement is not clear.

In a cross-sectional earnings function, some simultaneous equation bias is implied because some of the independent
variables (like weeks worked and schooling level) may be part of a simultaneous system of equations. A two stage least squares procedure could be used to correct for the endogeneity of weeks worked. The bias arising from the endogeneity of the schooling level, however is assumed not to be so serious because of the large influence of other factors (family background and socio-economic variables) on the individual's schooling level.

Empirically, there is no variable which would strictly satisfy all the requirements imposed by the theory. No variable is truly exogenous, is uncorrelated with the residuals of the earnings, and is not subject to any degree of choice by the individual. This implies that in a cross-sectional earnings function, one must be aware of the benefits and shortcomings of including each set of variables and keep these in mind in interpreting the resulting coefficients of such an equation.
CHAPTER III  APPLICATION OF THE MODEL TO
THE AGRICULTURAL SECTOR

3.1  Modified Earnings Function for Farm Operators

The earnings function, which is based on a permanent income hypothesis, is not directly applicable to farm income. Cross-sectional data on farm income contains many transitory factors providing a wide divergence from permanent income. An earnings function cannot account for this due to the unknown extent and distribution of transitory factors. In particular, variation in weather conditions has an important influence on net self-employment income from farming, and depending on the timing of a particular census or survey, the resulting data for any region or farm may be highly unrepresentative of the long term situation.

Net farm income is the return to unpaid family (including operator) labour and farm-owned capital. Since the earnings function is defined for labour earnings, we are interested in the return to the operators' labour or the shadow price of his farm employment. This is not directly observable, because the return to owned capital is also included in the reported farm income variable. An additional source of bias is a possible underreporting due either to capital reinvestment decisions or to tax-related matters.

If we were to ignore the transitory nature of farm income, we could attempt to estimate an earnings function for farm income as long as a correction could be made to separate
the return to non-operator labour inputs. By using net farm income as the "earnings" variable and adding right-hand side variables to account for other (non-operator labour) farm inputs, we arrive at a type of earnings function for entrepreneurs, specifically, farm operators.

In the formulation of the earnings function in Chapter II (eq. 9) all the other factors not presently included in the model were all impounded in the residual term \( \mu_i \). One of these residual components is nonlabour income (if included in the income concept, as in this case). For an entrepreneur therefore a better specified earnings function should include factors to measure the effect of these omitted non-operator labour factors, on his income. Specifically, these factors are farm capital and unpaid family labour in the case of farm operators. Equation (9) is therefore modified accordingly to fit the group under study, the entrepreneurs, specifically, the farm operators.

\[
\ln Y_i = x + r_i S_i + r_i ' T + \beta T^2 + \gamma (\ln W_i) + \alpha (\ln FC_i) + \omega (\ln UFL_i) + \mu_i
\]

where:

- \( \ln Y_i \) = natural log of farm earnings of farm operator \( i \)
- \( x \) = constant term
- \( r_i \) = return to schooling
- \( S_i \) = years of schooling
- \( T \) = years of experience
\[
W_i = \text{weeks worked during the year}
\]
\[
FC_i = \text{farm capital}
\]
\[
UFL_i = \text{unpaid family labour}
\]
\[
\mu_i = \text{residual term}
\]

3.2 **Digression: Value Added Approach**

It will be noted that if schooling \((S)\) were in log instead of linear form and the experience term \((T)\) were omitted from equation (10), we have a special form of value added function or profit function. In the study of the contribution of schooling to farm income we could either use the earnings function (transformed to fit entrepreneurs as discussed above) or a production function approach (Gisser (1965), Huffman (1974)). For comparative purposes and as a test of functional form, we will discuss the value added formulation.

In estimating rates of return to schooling using a production function framework, we need first of all to discuss how schooling affects productivity or output. This question of how education influences productivity has been the subject of many studies. Nelson and Phelps (1966) suggested a way in which education might affect productivity and diffusion of technology, when they pointed to the likelihood that at any given time, there will exist a gap between the technology available and the technology already in use. They suggested that if education changes the ability of an individual to adjust to changing conditions, then the contribution of
education to productivity will be related to the rate of technological change and to the size of the discrepancy between actual and optimum use of inputs.

There are a number of studies focusing on the influence of education on farm productivity. Gisser (1965) found that additional schooling encouraged farm outmigration but at the same time increased the productivity of those who stayed on the farms. Welch (1970) worked with the determinants of the productivity (measured by wage ratios) of more relative to less schooled individuals in the U.S. farm population. Huffman (1974) focused on a single dimension of allocative efficiency: the adjustment of farmers to the change in the optimum quantity of a single input, nitrogen fertilizer in corn production. The rate of adjustment to disequilibrium in nitrogen usage was found to be positively related to the level of education of farmers, the availability of information (extension) and the scale incentive to be informed (acres of corn).

3.3 The Productive Value of Education

The past studies stressed the importance of education as a factor of production and have been included often as an adjustment for quality of labour. Welch distinguished two distinct contributions of education on productivity. The starting point of his analysis is to question whether education's contribution to productivity is totally direct in nature. It may be indirect since part of its value could be
derived from effects on the use of other inputs. If this is the case, the marginal product of education should be measured to include such indirect productivity effects. Welch designates the direct effect of education on productivity as the "worker effect" and the indirect effect that education has on productivity operating through the use of other factors of production, as the "allocative effect". Allocative skills reflect a capability to economize under conditions of uncertain and imperfect knowledge of both technical and economic parameters of the production processes. The isolation of these effects can be seen, using the following value added production function (taken directly from Welch (1970) pp. 44-45):

\[ Q = p_1 q_1 (x_1 z_1 E_1) + p_2 q_2 (x_2 z_2 E_2) - p_x X \]

where:

\[ q_1 q_2 = \text{two different products} \]
\[ p_1 p_2 = \text{the prices of these two products} \]
\[ X = \text{purchased inputs with price } p_x \]
\[ Z = \text{other farm-supplied inputs} \]
\[ E = \text{education} \]

and where:

\[ E = E_1 + E_2 \quad z^0 = z_1 + z_2 \quad x = x_1 + x_2 \]
\[ l = dE_1/dE + dE_2/dE \quad 0 = dz_1/dE + dz_2/dE \]
\[ dX/dE = dx_1/dE + dx_2/dE \]
If value added is taken as a function of the total quantities of education and supplied inputs,

$$Q = f(E, z^0),$$

the marginal product of education is;

$$\frac{\partial f}{\partial E} = p_2 \left( \frac{\partial q_2}{\partial E} \right) + \left\{ p_1 \left( \frac{\partial q_1}{\partial E} \right) - p_2 \left( \frac{\partial q_2}{\partial E} \right) \right\} \frac{dE_1}{dE} +$$

$$\left\{ p_1 \left( \frac{\partial q_1}{\partial z} \right) - p_2 \left( \frac{\partial q_2}{\partial z} \right) \right\} \frac{dz_1}{dE} +$$

$$\left\{ p_1 \left( \frac{\partial q_1}{\partial x} \right) - p_2 \left( \frac{\partial q_2}{\partial x} \right) \right\} \frac{dx_1}{dE} + \left\{ p_2 \left( \frac{\partial q_2}{\partial x} \right) - p_x \right\} \frac{dx}{dE}.$$

In the preceding equation, the first term is the pure worker effect and the next three terms refer to gains from allocating the respective factors of education, supplied inputs and purchased inputs effectively between competing uses. The last term refers to the allocative gain from selecting the "right" quantity of purchased inputs.

The concept of the value added function is similar to the variable profit function suggested by Yotopoulos and Nugent (1976) for the analysis of production to overcome the simultaneous equation bias in the production function. Variable profit is defined as gross returns less expenditure on variable (purchased) inputs and is a function of owned inputs (farm capital and family labour in the case of agriculture).

Since we are interested in measuring the productivity of schooling, we would want to hold constant as few right hand side variables as possible. This will allow fewer constraints on the avenues by which schooling can operate to improve
productivity. Use of the value added function no longer includes the level of variable (purchased) inputs on the right hand side and hence the resulting returns to schooling includes the gains from choosing the optimum levels of purchased inputs and hired labour.

Another way of reducing the number of right hand side variables is to aggregate inputs and this is possible with the capital variable components. By utilizing an aggregated capital variable we are allowing the schooling coefficient to pick up any returns to the farm operator from re-allocating among these capital components. The marginal product of schooling should reflect this when the capital components are aggregated into one variable.

In the formulation of the value added function we are left with the quantities of "owned" inputs (family labour and capital) as the determinants of value added or variable profit. Since the level of value added is dependent on the level of purchased inputs, profit maximizing behavior in the input market suggests the importance of the prices of the variable inputs to the value added function. Ideally the value added function should be formulated with the following right hand side variables: schooling of the farm operator, the quantity of farm family labour, the quantity of capital, the price of purchased variable inputs and the price of hired labour.

The Cobb-Douglas form will be used in the value-added function, because with its simple functional form, it yields statistically significant estimates of the coefficients without
imposing excessive data requirements. Some properties of the Cobb-Douglas function are consistent with some a priori notions of economic theory, like the positive but declining marginal products, variable returns to scale, the inverse relation between the marginal rate of substitution and factor proportions. The property which would seem unrealistic, however, is the unitary elasticity of substitution among factors, which becomes limiting when there are more than two factors of production, because the property of unitary elasticity of substitution must hold for each and every pair of factors.

The problem of aggregating inputs has been discussed by Griliches (1957) who stated that in using the Cobb-Douglas framework, use of geometric sums (summation of the log values of the capital flow components) instead of arithmetic sum (logarithm of the sum of the capital flow variables) in aggregating inputs will minimize bias.
4.1 Data Sources

In the computation of both the earnings function and the value added function, we will utilize the 1971 Agriculture-Population Linkage Data which is the computerized linkage of the independently enumerated 1971 Census of Population and Census of Agriculture (for a definition of terms used, please refer to Appendix B). The data also allows us to utilize micro-data (90,000 individual farm records) for both the earnings function and the value added function. We will also use census division averages (242 census divisions for Canada) in order to correct for the endogeneity of one of the variables in our equation (by using a two stage least squares procedure, a statistical package not available at the micro level). The results at the census division level are also important for comparison with earlier research.

We have observations only for one year, 1970, and we cannot say that it was a "typical" and normal year for agriculture, particularly for wheat farming. It was the year when wheat farmers, due to accumulation of unsold stocks of wheat, were engaged in a federal scheme of reduction of wheat plantings by about 15% (22 million acres). Their total receipts from wheat sales that year was considerably lower (38% lower than the 1961-71 average for Canada) than other years (refer to Appendix Table C.1). Wheat farmers in 1971
comprised 10% of the total farm operators and contributed 14% of total farm cash receipts from sale of products in Canada. Since this study will use cross-sectional data for all farms, regardless of farm commodity produced, the effect (if any) of this wheat acreage reduction and dramatic fall in gross receipts in our analysis cannot be measured.

4.2 Earnings Function

4.2.1. Data Requirements

The theoretical model for the earnings function will be utilized for farm operators and the role of schooling will be analyzed. The model regresses log of farm income on schooling level (S), experience (T), \((T^2)\), log of days worked (DAYSON), log of unpaid family labour (UFL), and log of farm capital (FC). A description of the data available and the transformation of some variables are discussed below:

a. "Farm employment income" (FEI)

There is a reason to believe that there is some measurement error from some underreporting bias on the process of collecting the data. The net farm income figures were taken from the income question of the Population Census (refer to Appendix D for the actual question) of the same year, but not counterchecked with the operators' sales and expenses figures (both declared in the Agriculture Census). In the Population Census income question, no specific instructions were given to the farm operator, as to what expenses to consider and what
depreciation rate to use in the computation of his net farm income (defined in the questionnaire as value of agricultural products sold minus operating expenses minus depreciation). Hence, unless the farmer referred to his records (e.g. his taxable income reported in April of the same year; the census was taken June 1) which may be underreported in any case, the difference between this census measure and the "true" net farm income value might be substantial.

To test this possible bias from underreporting, the declared values (reported farm income) were compared with "computed" net farm income (using the census definition above) that is possible from reported census data. Using a depreciation rate of 15% of the value of machinery and equipment (according to the Farmer's and Fisherman's Income Tax Guide (1977) this rate is more of an upper limit, but used in this case to compensate for any cost underestimation, if our expenditure data is incomplete) comparison of the declared and computed farm income figures showed that the declared values were considerably lower than the computed values (refer to Appendix Table C.2). The farm operator may not deliberately underreport his income, but unknowingly overstate his operating expenses (i.e. covering legitimate operating costs and depreciation costs as well as costs of capital deepening).

This finding leads us to prefer construction of a net farm income variable from the census sales and expenses data, a measure that is less subject to the measurement errors discussed above compared to the declared farm income values.
To distinguish this measure from the census (declared) net farm income value, we shall call it net farm employment income (FEI).

b. Schooling (S)

Years of schooling of the farm operator (S) is available from the linkage data. The variable years of schooling is equivalent to actual years spent in school, or the highest grade attained plus years spent in post secondary school (if applicable). Since the interest of this study is to measure the management ability of the farm operator via his education, and the available data is years spent in school, another measure, schooling unit (SU) will be used to represent the "education" that a farm operator possesses. The variable schooling unit (SU) was formulated by Welch (1966) and represents the years of schooling weighted by average income. This measure was also utilized by Huffman (1974).

c. Experience (T)

Actual years spent in farming (experience) is not available from the Census data. This poses a problem especially because the farm operator may be engaged in both farm and non-farm activities, and farm experience is likely to be quite different from non-farm experience. In this case we have the alternative of considering a proxy measure for the experience variable. By assuming that the individual invests in experience each year after leaving school, experience could be measured as age minus schooling years minus 5 (T = Age − S − 5). This definition for experience has also been utilized by Chiswick.
and Mincer (1972) and Mincer (1974). By the definition of the sample we are interested in, we are, by virtue of the experience variable attributing all the years spent after schooling, to work experience, regardless of whether it was farm or non-farm work. We are in effect, using a variable which is not specified properly, but we are left with the choice of including it, with the knowledge of its limitations, or omitting an experience variable altogether. The bias resulting from excluding a measure of experience was discussed in the preceding chapter.

However, the assumption (that an individual is continuously engaged in acquiring experience in the labour market after finishing school) made in Chapter II that the model is more relevant to males than to females is especially fitting for our sample because female farm operators comprise only 3% of the total sample.

d. Days worked on Farm (DAYSON)

The time spent working is available in days instead of weeks worked, and is on the operator's off farm employment. By assuming a fixed leisure demand of 65 days, or equivalently a fixed total work time of 6 days per week for 50 weeks in a year, the number of days worked on the farm (DAYSON) is proxied by \((300 - \text{DAYSOFF})\); where \(\text{DAYSOFF}\) is the number of days worked off-farm). A similar approximation for the labour days worked (family and hired) was utilized by Griliches (1964).
e. Farm Capital (FC)

For the capital variable, we have stock values of land and buildings, the value of machinery and equipment, and the value of livestock. Capital inputs are measured by service flow units, that is, by depreciation and interest computed as percentages of the value of various stocks of inputs. The service flow of capital stock values are computed using a real interest rate of 6%\(^1\). On the basis of assumed depreciation rates, the service flow from machinery and equipment was computed at 17% of its stock value and the service flow from livestock was calculated as 10% of its stock value (Khaldi, 1975). The value of land and buildings was converted into a service flow variable, by computing 3% of its stock value (refers to a competitive rate of return of 6% and 3% rate of appreciation of real estate values). It is recognized however that there are regional differences in the rate of appreciation values but we do not have the data for each region. Rather we are limited to an average value calculated for Canada. Hence we may be overestimating the land input for farms nearest to urban areas and underestimating it for those in the rural areas.

To best capture the returns to schooling we could aggregate the components of the farm capital stock into one capital variable. A problem arising from this procedure is that in restricting all the components of the capital stock

to carry the same coefficient, a misspecification of the model results. However, this also allows the schooling coefficient to pick up any returns to the operator from re-allocating among these capital components. The return to schooling is estimated holding constant the level of total capital, allowing the capital components to vary. Since agriculture is a technically dynamic industry, the new developments in capital inputs like machinery and equipment could be expected to result in a considerable degree of disequilibrium in these input markets. The coefficient of schooling should reflect this by being larger when the capital components are aggregated to one variable. Use of geometric sums (summation of the log values of the capital flow components) instead of arithmetic sums (logarithm of the sum of the capital flow components) in aggregating inputs will minimize bias (Griliches, 1957).

f. Unpaid Family Labour (UFL)

The Census data unfortunately does not have any direct measure of the time spent working on the farm by the unpaid family members. We are therefore left with the alternative of using measures of potentially available farm labour, like spouse's level of schooling (SSYOS) and number of children (NUMCH). However, a preliminary correlation analysis (at the census division level) showed a high degree of correlation between operator's level of schooling and the spouse's level of schooling (SSYOS). Since we are basically interested in
a measure of unpaid family labour we are then left with the proxy variable, number of children (NUMCH). Limiting the proxy variable for unpaid family labour to one variable also reduces the number of right-hand-side determinants in the equation.

Another point to consider is the question of the relevant sector of the farm population to analyze. Statistics Canada's definition of a census farm is an agricultural holding of at least an acre, and sales of $50 or more during the preceding 12 months. The resulting population of farm operators then included both the full-time or commercial farmers and those who are simply backyard gardeners. Since this study is interested in the contribution of schooling to farm income, we will focus our attention to the sample who are engaged in farming on a full-time basis. Exclusion of hobby farmers (e.g. backyard gardeners) is preferrable and one way to do this is to consider the sample of farm operators with sales of at least $2500. In addition to this, separation of full-time farmers from the hobby farmers could be done by using the "occupation stated" (during census week) criteria (i.e. "farmer" and "other than farmer"). Another method is to segregate farm operators by days worked off-farm (DAYSOFF) with the assumption that those who spend less time working off-farm (and consequently spend more time in farming), are the more full-time, commercial farmers.

There are many factors left out in our model, like ability and school quality, for example, to make it a satisfactory
microdata model. It is not unreasonable to assume that as a first approximation many of the factors wash out with aggregation. Grouping of farmers according to occupation or days worked, for example isolates any difference between them. Within group variance of coefficients is nonzero but may be expected to be smaller than the variance of the whole population.

4.2.2. Empirical Model

Based on the data requirements of the theoretical model, the data available and data transformations needed, we come up with a working equation for the commercial farm operators (those with sales of at least $2500) using individual farm operators as the unit of observation:

\[
(10) \quad \ln FEI = a + b S + c T + d (T)^2 + e \ln DAYSON + f \ln FC + g \ln NUMCH
\]

where:

\[
\begin{align*}
\ln FEI &= \text{natural log of farm employment income} \\
&= \text{(Sales - VIN - HLP - fuel and oil expenses - rent paid); VIN = cost of purchased chemicals, feed, fertilizers and custom machine rental; HLP = cost of hired labour} \\
S &= \text{years of schooling of farm operator} \\
T &= \text{years of experience (T = Age - S - 5)} \\
\ln DAYSON &= \text{natural log of days worked on farm (DAYSON = 300 - DAYSOFF); where DAYSOFF = number of days worked off farm} \\
\ln FC &= \text{natural log of the aggregated flow of capital services (log (3\%\ VLB) + log (10\%\ VL) + log (17\%\ VME)) where VLB = value of land and buildings; VL = value of livestock; and VME = value of machinery and equipment}
\end{align*}
\]
In NUMCH = natural log of the number of children, aged 13-18.

In order to separate the commercial farmers from the rest of the population, separate regression runs of equation (10) should be done (in addition to the sales restriction criteria) for the following data sets:

1. occupation criteria; for comparative purposes
   earnings function will be computed separately for:
   a. all farm operators
   b. farm operators who stated their occupation (during census week) as "farmer" or "farm manager"
   c. farm operators who stated their occupation (during census week) as "other than farmer or farm manager"

2. days worked off-farm (DAYSOFF) criteria; for comparative purposes earnings function will be computed separately for:
   a. farm operators who do not work off the farm (DAYSOFF = 0); this implies that farm operator works full time on his farm and could be considered as a commercial farmer.
   b. farm operators who work off the farm, but not more than 50 days (1 \leq DAYSOFF \leq 50)
   c. farm operators who work off the farm at least 150 days (DAYSOFF > 149).
4.3 Value Added Function

4.3.1. Data Requirements

In the formulation of the value added function discussed in the previous chapter, value added is regressed on owned inputs, price of purchased inputs and price of hired labour. The definition of value added in this case is similar to our definition of farm employment income (FEI) in our earnings function. Owned inputs namely, the schooling level of the farm operator, quantity of family labour and amount of farm capital are the same variables appearing in the right hand side of the transformed earnings function for entrepreneurs (equation 10). The experience (T) term however will not be included in the value added formulation. Although experience could be considered an "owned" input or a labour quality index, the available measure for it is not a good proxy variable.

Unfortunately even if we have a rich data source, no data is available for price of purchased inputs. Our value added function therefore takes a form similar to the working equation for the earnings function, with experience excluded and all variables in logs because we are using the Cobb-Douglas form.

4.3.2. Empirical Model

With the data considerations discussed in the preceding section the working equation for the value added function is as follows:
\[ \ln VA = a + b \ln S + c \ln \text{DAYSON} + d \ln \text{FC} + e \ln \text{NUMCH} \]

where:

- \( \ln VA \) = natural log of value added (Sales - VIN - HLP - fuel & oil expenses - rent paid);
- VIN = cost of purchased chemicals, feed, fertilizers and custom machine rental;
- HLP = cost of hired labour.

- \( \ln S \) = natural log of schooling of farm operator.

- \( \ln \text{DAYSON} \) = natural log of days worked on farm \((\text{DAYSON} = 300 - \text{DAYSOFF})\) where \( \text{DAYSOFF} \) = number of days worked off-farm.

- \( \ln \text{FC} \) = natural log of the aggregated flow of capital services \( \log (3\% \ VLB) + \log (10\% \ VL) + \log (17\% \ VME) \) where \( \text{VL} \) = value of land and buildings; \( \text{VL} = \) value of livestock; and \( \text{VME} = \) value of machinery and equipment.

- \( \ln \text{NUMCH} \) = natural log of the number of children, aged 13-18.

It will be noted that the definition of value added is identical to how we defined farm employment income (FEI) in equation (10). This is done for ease of comparison of the results of the two equations in the next chapter.

Since we are interested in measuring the productivity of schooling we shall again focus on the full-time farmer, using the sales restriction \((\text{Sales of at least } \$2500)\). We discussed earlier the rationale for aggregating the capital components into one variable and we shall try to prove this empirically by modifying equation (11). We shall compute, for the same sample a value added function with the three capital variable components entering the equation as separate variables:
\[(11a) \quad \ln VA = a + b \ln S + c \ln \text{DAYSON} + d \ln \text{FLB} + e \ln FL + f \ln \text{FME} + g \ln \text{NUMCH} \]

where all the variables are defined as in equation (11) with the addition of:

\[
\begin{align*}
\ln \text{FLB} & = \log (3\% \text{ VLB}) \text{ where VLB = value of land and buildings} \\
\ln \text{FL} & = \log (10\% \text{ VL}) \text{ where VL = value of livestock} \\
\ln \text{FME} & = \log (17\% \text{ VME}) \text{ where VME = value of machinery and equipment}
\end{align*}
\]

Results of equation (11a) will be compared with those of equation (11) for the same sample of farm operators. We expect that the returns to schooling from equation (11) will be higher relative to the corresponding measure from equation (11a). This is because the schooling coefficient in equation (11) picks up the gains from re-allocating among the three components of capital (value of land and buildings; value of livestock and value of machinery and equipment) within the aggregate measure of farm capital (\(\ln FC\)).

Another method we could use to show the allocative gains picked up by the schooling variable via input specification, is to compare equation (11) with an equation where hired labour cost is a determinant of value added and appears on the right hand side of the equation:

\[(11b) \quad \ln VA_1 = a + b \ln S + c \ln \text{DAYSON} + d \ln \text{FC} + e \ln \text{NUMCH} + f \ln \text{HLP} \]

where the dependent variable, as a result of the labour cost input appearing on the right hand side, is redefined as:
\( \ln \text{VAL} = \text{natural log of VAL where } \text{VAL} = (\text{Sales} - \text{VIN} - \text{fuel and oil expenses} - \text{rent paid}); \) and \( \text{VIN} = \text{cost of purchased chemicals, feed, fertilizers and custom machine rental.} \)

and where all the variables are defined as in equation (11) with the addition of:

\( \ln \text{HLP} = \text{natural log of hired labour cost} \) (HLP)

The VAL formulation measures the effect of schooling, given the level of hired labour expenditure. The schooling coefficient is expected to be lower (compared to the schooling coefficient in equation (11)) because it excludes the gains from choosing the optimum level of hired labour.

All the above formulations have the implicit assumption that labour (measured by days worked) is homogeneous throughout the population. One farmer operator's labour input is assumed to be as productive as his neighbor's labour input. Labour quality in this case is measured by human capital investment in the form of school attainment of the farm operator, schooling being treated as a separate input of production. Another method to incorporate labour quality in the value added function is to use it as a weighting factor for the labour input - that is, to consider a schooling-labour product as the labour input (corrected for labour quality in this case). This procedure (also tested by Griliches (1964)), could be tested by redefining our labour input as (Schooling x DAYSON) or SDAYS:

\[(11c) \quad \ln \text{VA} = a + b \ln \text{SDAYS} + c \ln \text{FC} + d \ln \text{NUMCH} \]

Results of equation (11c) will be compared to those of equation
(11) to see if this formulation is a better formulation of the value added function. For comparative purposes, equation (11c) will also be run utilizing census division averages and the results compared with Griliches (1964) work which was based on aggregate data (state averages).

4.4 Census Division

In order to correct for the endogeneity of the variable weeks worked, a two-stage least squares procedure will be used with weeks worked as an instrument. In other words, weeks worked (or in this particular population, days worked) will be regressed on a number of variables and the resulting predicted value of days worked will in turn be utilized in the earnings function. Unfortunately, this method is not feasible with the micro data because the existing Statistics Canada regression packages do not permit such two-step procedures. We can, however, use the census division averages and proceed to correct for the endogeneity of days worked. We will do this using the following equations:

\[(10a) \quad \ln \text{FEI} = a + bS + cT + d(T)^2 + e \ln \text{DAYSON}^* + f \ln \text{FC} + g \ln \text{NUMCH}\]

where all the variables are defined as in equation (10) using \(\text{DAYSON}^*\) instead of \(\text{DAYSON}\), and where \(\text{DAYSON}^* = (300 - \text{DAYSOFF}^*)\), with \(\text{DAYSON}^*\) defined as:

\[\text{DAYSOFF}^* = a + bS + cFC + d\text{NUMCH} + eWWAGE + fUER + gURBY + hDUER + iDURBY\]
where DAYSOFF* is the predicted value of days worked off farm regressed on variables most of which were defined before with the addition of:

\[
\begin{align*}
\text{WWAGE} &= \text{proxy measure for hired labour (weekly wage rate)}. \\
\text{UER} &= \text{unemployment rate for males aged 24-44 years, with schooling level not greater than high school graduation and greater than or equal to grade 8}. \\
\text{URBY} &= \text{average labour earnings for males aged 24-44 years, with schooling level not greater than high school graduation and greater than or equal to grade 8 (values for 65 cities utilized, with the value of urban earnings of the nearest city chosen for a particular census division)}. \\
\text{DUER} &= \text{UER} \times \text{DCITY where DCITY is the distance from the nearest city}. \\
\text{DURBY} &= \text{URBY} \times \text{DCITY}.
\end{align*}
\]

All of the above variables are assumed to affect the amount of time a farm operator spends working off-farm. The last two variables (DUER and DURBY) were added to correct for the degree of urbanization of the census division concerned which may influence the demand for the off-farm labour of farm operators.

We expect the regression coefficients to differ, using the two data sets (micro data vs. census division averages) because of the difference in the level of aggregation. Using census division averages, we allow schooling to capture the gains from allocating resources between competing uses and it is clear that agriculture at the census division level is much more diversified than at the micro or individual farm level, via the commodities produced. Hence the census division aggregation allows more room for allocative ability than the
micro level, and the schooling coefficient should capture this by being larger.
CHAPTER V  RESULTS AND DISCUSSION

5.1  Micro data level

5.1.1. Earnings function

We will discuss the results of the modified earnings function using micro data, for the farm operators. Table 1 shows the regression estimates of the modified earnings function for all farm operators (data set A). The rate of return to schooling is positive and significant, with a marginal product of $132. We could test the type of farm population with respect to full time farming by using an "occupation stated" (during census week) criteria. The "farmer and farm manager" group (data set B) shows the highest rate of return to schooling and the corresponding marginal product of schooling ($\text{MP}_s = \text{rate of return to schooling} \times \text{average earnings (FEI)}$) is $173$ (vs. $132$ for all farms and $50$ for the "other than farmer" group (C)). In other words the returns to schooling in farm production increases as the individual specializes in farming or is engaged in it on a full-time basis. The corresponding average farm employment income figures also follow this pattern.

---

1the squared experience term ($T^2$) was dropped from estimating equation (10) because of multicollinearity problems (between $T$ and $T^2$) invalidating the resulting coefficients.

2use of schooling units (SU) instead of schooling years (S) in both the earnings function and value added function did not exhibit any significant difference in the resulting regression coefficients.

3$6470, 7229$ and $4379$ for all farms (A), farmer and farm managers (B) and the non-farmer group (C), respectively.
Table 1. Regression estimates\(^a\) of the modified earnings function for farm operators with Sales of at least $2500, farm employment income (FEI)>0, and days worked on farm (DAYSON)\(\geq1.0\) by occupation stated. Canada. 1971.

<table>
<thead>
<tr>
<th>Data Set</th>
<th>All Farm Operators (A)</th>
<th>Farmers and Farm Managers (B)</th>
<th>Other than (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>88,472</td>
<td>68,709</td>
<td>19,763</td>
</tr>
<tr>
<td>(S)</td>
<td>.020 (36.46)</td>
<td>.023 (37.45)</td>
<td>.011 (10.04)</td>
</tr>
<tr>
<td>(T)</td>
<td>-.002 (14.34)</td>
<td>-.002 (16.04)</td>
<td>-.004 (1.64)</td>
</tr>
<tr>
<td>ln (\text{DAYSON})</td>
<td>.166 (43.64)</td>
<td>.123 (16.83)</td>
<td>.100 (18.89)</td>
</tr>
<tr>
<td>ln (\text{FC})</td>
<td>.112 (119.05)</td>
<td>.113 (105.41)</td>
<td>.085 (42.53)</td>
</tr>
<tr>
<td>ln (\text{NUMCH})</td>
<td>.031 (15.45)</td>
<td>.043 (20.09)</td>
<td>-.012 (2.58)</td>
</tr>
<tr>
<td>(\bar{R}^2)</td>
<td>.20</td>
<td>.21</td>
<td>.11</td>
</tr>
<tr>
<td>Reg. F</td>
<td>4490</td>
<td>3609</td>
<td>481</td>
</tr>
<tr>
<td>(\text{MP}_S)^b</td>
<td>$132</td>
<td>$173</td>
<td>$50</td>
</tr>
</tbody>
</table>


\(^a\)regression coefficient (t-statistic)

\(^b\)\(\text{MP}_S\) = marginal product of schooling
The coefficient of farm capital (FC) is highly significant for all data sets and is highest for the full-time farmers (B). For the days worked (DAYSON), and unpaid family labour variable (NUMCH), the corresponding coefficients for the farmer group (B) are consistently higher than the other than farmer group, group (C), implying that the function is better fitted (as the $R^2$ also indicates) and better specified for the group of farm operators who are more seriously engaged in farming than those who are not.

Another means of illustrating this pattern it to use the days worked criteria to separate different farm operators and compare the resulting coefficients. Using equation (10), Table (2) shows the results by considering three groups and the more specialized commercial farmers are represented by those who worked full-time on their farms, or did not work off-farm (DAYSOFF = 0). The resulting marginal product of schooling is again highest for the full-time commercial farmers ($166$ vs. $154$ and $24$ for those who worked (1-50) days and those who worked at least 150 days off the farm, respectively).

As the results of equations in Tables 1 and 2 show, grouping of farm operators according to the "occupation stated" or the "days worked" criteria is an effective means of focusing on the full-time farmers for whom the earnings function model was specified for.

In both tables (1 and 2), we note that the experience (T) term was significant in all data sets but negative in sign. The experience variable we are using is not well
Table 2. Regression estimates\(^\text{a}\) of the modified earnings function for farm operators with Sales of at least $2500, farm employment income (FEI)>0, by days worked off-farm (DAYSOFF) groups. Canada. 1971

<table>
<thead>
<tr>
<th>Data Set</th>
<th>DAYSOFF = 0</th>
<th>1≤DAYSOFF≤50</th>
<th>DAYSOFF&gt;150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>64,079</td>
<td>8,169</td>
<td>9,702</td>
</tr>
<tr>
<td>S</td>
<td>.023</td>
<td>.023</td>
<td>.007</td>
</tr>
<tr>
<td></td>
<td>(35.60)</td>
<td>(13.25)</td>
<td>(3.75)</td>
</tr>
<tr>
<td>T</td>
<td>-.002</td>
<td>-.001</td>
<td>-.001</td>
</tr>
<tr>
<td></td>
<td>(18.84)</td>
<td>(2.96)</td>
<td>(2.35)</td>
</tr>
<tr>
<td>ln DAYSON</td>
<td></td>
<td>1.27</td>
<td>-.014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.25)</td>
<td>(2.08)</td>
</tr>
<tr>
<td>ln FC</td>
<td>.112</td>
<td>.120</td>
<td>.069</td>
</tr>
<tr>
<td></td>
<td>(103.02)</td>
<td>(39.62)</td>
<td>(22.84)</td>
</tr>
<tr>
<td>ln NUMCH</td>
<td>.042</td>
<td>.026</td>
<td>-.005</td>
</tr>
<tr>
<td></td>
<td>(13.31)</td>
<td>(4.28)</td>
<td>(0.69)</td>
</tr>
<tr>
<td>R(^2)</td>
<td>.21</td>
<td>.22</td>
<td>.05</td>
</tr>
<tr>
<td>Reg. F</td>
<td>4322</td>
<td>449</td>
<td>112</td>
</tr>
<tr>
<td>MP(_S)(^b)</td>
<td>$166</td>
<td>$154</td>
<td>$24</td>
</tr>
</tbody>
</table>


\(^a\)regression coefficient (t-statistic)

\(^b\)MP\(_S\) = marginal product of schooling
specified, as discussed earlier. In interpreting the experience coefficient, we hold constant all other variables, including the schooling variable. Due to the definition of experience \((T = \text{Age} - \text{Schooling} - 5)\), we may be measuring, instead, an age variable or vintage effect. The younger farm operators tend to be more schooled than the older operators (as evidenced by the relative increase in the educational level of the farm population during the 1961-71 period, referenced on page 3, and also due to the negative correlation between schooling and experience \((-0.48)\) of this data set). This negative correlation between schooling and experience, and the negative relation (correlation of \(-0.22\)) between experience and the dependent variable farm employment income (FEI) makes interpretation of the coefficient of experience difficult. Even if we had a reasonable measure of the experience variable to start with, interpretation of the experience coefficient necessitates certain values for \(k_0\) and \(T^*\) (see page 15 above).

5.2.2. Value added function

We now discuss the results of estimating rates of return to schooling using the value added function at the micro data level. Specification A in Table 3 shows the regression coefficients using our estimating value added equation (11). We note that all the coefficients are significant and the marginal product of schooling is $260, a return higher than our modified earnings function result of $173.

We hypothesized earlier that the return to schooling from
a specification with an aggregated farm capital value will be higher relative to the schooling coefficient of a specification using disaggregated capital values (value of land and buildings, value of livestock and value of machinery and equipment entering the equation separately). This is supported by data on Table 3 when we compare the coefficient of schooling in specification A with the corresponding coefficient of specification B. The difference (.366 vs. .123, or correspondingly, marginal products of $260 and $87 respectively) is attributable to the gains that the schooling coefficient picks up from re-allocating among the three components of capital within the aggregate measure farm capital (FC).

Specification C in Table 3 shows another method to illustrate the allocative gains picked up by the schooling variable via input specification. Since specification C includes HLP (hired labour cost) as an input cost in the right hand side of the value added function, the schooling coefficient of this specification is as expected, lower compared to the specification A coefficient (with a marginal product of $212 vs. $260) because it loses the gains from better decision making in choosing optimum levels of hired labour.

Table 3 also compares the regression estimates of equation (11) in specification A with the results of equation (11c) using the same data set. In specification D, the weighted labour variable (SDAYS) exhibited a significant coefficient (.183) with a value between the separate schooling
Table 3. Regression estimates\textsuperscript{a} of the value added function for farm operators with Sales of at least $2500, and days worked on farm (DAYSON) \geq 1.0 for different specifications, (n=88,473). Canada. 1971.

<table>
<thead>
<tr>
<th>Specification</th>
<th>A\textsuperscript{b}</th>
<th>B\textsuperscript{b}</th>
<th>C\textsuperscript{c}</th>
<th>D\textsuperscript{b}</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln Schooling</td>
<td>.366 (42.21)</td>
<td>.123 (15.06)</td>
<td>.279 (36.15)</td>
<td></td>
</tr>
<tr>
<td>ln DAYSON</td>
<td>.154 (40.68)</td>
<td>.141 (40.34)</td>
<td>.141 (42.08)</td>
<td></td>
</tr>
<tr>
<td>ln NUMCH</td>
<td>.029 (14.98)</td>
<td>.035 (19.16)</td>
<td>.026 (15.28)</td>
<td>.029 (14.74)</td>
</tr>
<tr>
<td>ln FC</td>
<td>.113 (120.75)</td>
<td></td>
<td>.114 (121.20)</td>
<td></td>
</tr>
<tr>
<td>ln FLB</td>
<td></td>
<td>.478 (128.77)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln FME</td>
<td></td>
<td>.139 (52.90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln FL</td>
<td></td>
<td>.053 (50.21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln HLP</td>
<td></td>
<td>.169 (138.48)</td>
<td>.183 (50.68)</td>
<td></td>
</tr>
<tr>
<td>ln SDAYS\textsuperscript{d}</td>
<td>.20</td>
<td>.32</td>
<td>.34</td>
<td>.19</td>
</tr>
<tr>
<td>$R^2$</td>
<td>5369</td>
<td>6954</td>
<td>9148</td>
<td>6936</td>
</tr>
<tr>
<td>$MP_s$</td>
<td>$260$</td>
<td>$87$</td>
<td>$212$</td>
<td></td>
</tr>
</tbody>
</table>


\textsuperscript{a}Regression coefficient (t-statistic)

\textsuperscript{b}Dependent variable = VA = (Sales - VIN - rent paid - fuel and oil expenses - HLP); where VIN = cost of purchased chemicals, feed, fertilizer and custom machine rental; HLP = cost of hired labour.

\textsuperscript{c}Dependent variable = VA\textsubscript{1} = (Sales - VIN - rent paid - fuel and oil expenses).

\textsuperscript{d}ln SDAYS = log (Schooling \times DAYSON).

\textsuperscript{e}$MP_s$ = marginal product of schooling.
coefficient (.366) and labour coefficient (.154) of specification (A). The other variables changed only slightly and insignificantly, with the change in the labour variable specification. But since our main interest in this study is to estimate the returns to schooling, the results of specification D, which lacks a separate measure for return to schooling (since it is restricted to the same coefficient as DAYSON) could not be really compared with the results of the first data set, for purposes of functional form. Comparison with the results of the Griliches (1964) study will be more relevant in the census division level regression results in the next section, because the aggregation level used is more comparable (census division and state averages).

5.2 Census Division Level

5.2.1. Earnings function

Analysis of the data utilizing the census division averages is undertaken for comparative purposes and to use a two-stage least squares procedure (not feasible at the micro level) in dealing with the endogeneity of the variable days worked. Table 4 shows the regression estimates of a modified earnings function using the days worked variable in specification (1) and the predicted days worked value in specification (2). The predicting equation for days worked is shown in the table (footnote b). All the determinants exhibited significant coefficients with the expected signs. The wage rate (WWAGE) variable is of the opposite sign as we would expect, but
insignificant. The two variables DUER (distance from city (D CITY x unemployment rate (UER))) and DURBY ((D CITY) x urban earnings (URBY)), as corrections for the degree of urbanization, behaved as predicted and supports the view that demand for labour off-farm is influenced not only by the unemployment rate and the urban earnings (in addition to all the other variables) but the location with respect to the city, of the farm operator.

Comparing results of specifications (1) and (2), we note an increase in the schooling coefficient (.056 to .080) as we go from a days worked to a predicted days worked (DAYSON*) variable specification (with a corresponding increase in the marginal product of schooling, $440 to $629). The experience variable is insignificant in both cases and the labour variable increased significantly (0.544 to 1.50). Use of the predicted labour input variable (DAYSON*) contributes to a better specified earnings function because it corrects for the endogeneity inherent in the variable. There were no significant differences, however, for the capital variable (.260 to .259) or the family labour variable (.102 to .112).

Comparing results of data set (1) in Table 4 with the corresponding earnings function results of data set (A), all farms (Table 1), we note that all variables exhibited relatively higher coefficients at the census division level. The experience term also becomes positive and insignificant. The schooling coefficient in particular, increased 180% (from .020 to .056) or a corresponding $308 difference ($132 to $440) in
Table 4. Regression estimates\textsuperscript{a} of the modified earnings function for farm operators with Sales of at least $2500, using reported days worked on farm (DAYSON) and predicted DAYSON\textsuperscript{*}, and using census division averages (n=242). Canada. 1971.

<table>
<thead>
<tr>
<th>Specification</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schooling(S)</td>
<td>0.056</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>(2.14)</td>
<td>(2.56)</td>
</tr>
<tr>
<td>Experience(T)</td>
<td>0.003</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.25)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>ln DAYSON</td>
<td>0.544</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.69)</td>
<td></td>
</tr>
<tr>
<td>ln DAYSON\textsuperscript{*}</td>
<td></td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.06)</td>
</tr>
<tr>
<td>ln FC</td>
<td>0.260</td>
<td>0.259</td>
</tr>
<tr>
<td></td>
<td>(10.62)</td>
<td>(10.61)</td>
</tr>
<tr>
<td>ln NUMCH</td>
<td>0.102</td>
<td>0.112</td>
</tr>
<tr>
<td></td>
<td>(0.90)</td>
<td>(0.98)</td>
</tr>
<tr>
<td>R\textsuperscript{2}</td>
<td>0.53</td>
<td>0.53</td>
</tr>
<tr>
<td>Reg. F</td>
<td>52.53</td>
<td>53.11</td>
</tr>
<tr>
<td>MP\textsubscript{S}</td>
<td>$440</td>
<td>$627</td>
</tr>
</tbody>
</table>


\textsuperscript{a}Regression coefficient (t-statistic)

\textsuperscript{b}ln DAYSON\textsuperscript{*} = \log (300 - DAYSOFF\textsuperscript{*})

where:

\[
\text{DAYSOFF}^* = 6.08 S - 0.005 FC + 0.087 WWAGE - 1.96 UER \\
\text{(5.40) (2.31) (1.49) (2.40)}
\]

\[
+ 0.008 \text{URBY} + 0.014 \text{DUER} - 0.000007 \text{DURBY} \\
\text{(5.74) (3.29) (2.49)}
\]

\[
+ 3.73 \text{NUMCH} \\
\text{(2.24)}
\]

\[R^2 = 0.37\]

where DAYSOFF\textsuperscript{*} is the predicted value of DAYSOFF when regressed on schooling (S); farm capital (FC); hired wage rate (WWAGE); unemployment of males (24-44 years old) whose schooling level is not greater than high school graduation but greater than or equal to grade 8 (UER); urban earnings of males (24-44 years old) whose schooling level is not greater than high school graduation but greater than or equal to grade 8 (URBY); DUER = (UER x DCITY), where DCITY is distance from nearest city; and DURBY = (URBY x DCITY).

\[\text{MP}_{S} = \text{marginal product of schooling.}\]
the marginal product value. These results were expected since the aggregated level (census division) allows more room for allocative ability (via commodities produced) and the schooling coefficient captured this.

5.2.2. Value added function

Utilizing the value added function, we correct for the endogeneity of days worked in a similar two stage least squares procedure as discussed above for the modified earnings function. Table 5 shows the regression estimates of a value added function using the days worked variable in specification (1) and the predicted days worked value (DAYSON*) in specification (2). The predicting equation for days worked is shown in the table (footnote b) and is the same equation used in the preceding table, for correcting the endogeneity of days worked in the earnings function formulation.

Comparing results of the two specifications we note a substantially higher estimate of the return to schooling for the predicted days worked specification (with a corresponding increase in the marginal product of schooling, from $438 to $639). This formulation is clearly a better specified equation because the use of the predicted labour input variable (DAYSON*) corrects for the simultaneous equation bias arising from the reported days worked variable (DAYSON).

The same table shows the regression estimates of a value added function using disaggregated capital variables (specification 3). As in a similar test of functional form (Table 3
for the micro data) performed earlier, Table 5 reveals that the formulation with the aggregated capital specification (1), allows the schooling coefficient to pick up the gains from re-allocating among the different capital components. Again, the estimated coefficients and marginal products of value added functions at the census division level are higher compared to the corresponding estimates of functions computed at the micro level (refer to Table 3).

Table 5 also illustrates the census division level treatment of the value added specification using the transformed labour variable (SDAYS, weighted by schooling, as the labour quality index). In specification (1), we note that the output elasticity with respect to labour or DAYSON (0.527) are not significantly different from each other. That the output elasticities for both labour quantity (DAYSON) and the labour quality (schooling) are not significantly different implies that we can combine the two variables into one measure of labour, as in specification (4) of Table 5. The product (SDAYS) of the labour and schooling variables, exhibited a more significant coefficient (.447 with t-value of 2.26) than the two variables (DAYSON and schooling) exhibited when they entered the equation separately in specification (1) of the same table. More important is the finding that these results

---

1 The computed t-statistic for the test of equality of the two coefficients is 0.34; the "critical" value of t with 241 degrees of freedom is at least 1.96.
Table 5  Regression estimates\(^a\) of the value added function for farm operators with Sales of at least $2500, using different specifications and using census division averages (n=242). Canada, 1971

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln S</td>
<td>.428</td>
<td>.624</td>
<td>.239</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.07)</td>
<td>(2.50)</td>
<td>(1.26)</td>
<td></td>
</tr>
<tr>
<td>ln DAYSON</td>
<td>.527</td>
<td></td>
<td>.740</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.65)</td>
<td></td>
<td>(2.48)</td>
<td></td>
</tr>
<tr>
<td>ln DAYSON* (^b)</td>
<td>1.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.99)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln FC</td>
<td>.259</td>
<td>.262</td>
<td>.260</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(11.41)</td>
<td>(11.57)</td>
<td>(11.65)</td>
<td></td>
</tr>
<tr>
<td>ln NUMCH</td>
<td>.086</td>
<td>.118</td>
<td>.195</td>
<td>.093</td>
</tr>
<tr>
<td></td>
<td>(0.87)</td>
<td>(1.17)</td>
<td>(2.16)</td>
<td>(0.99)</td>
</tr>
<tr>
<td>ln FLB</td>
<td>.560</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(11.29)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln FL</td>
<td>.089</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.43)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln FVME</td>
<td>-.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.51)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln SDAYS (^c)</td>
<td></td>
<td></td>
<td></td>
<td>.447</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.26)</td>
</tr>
<tr>
<td>R(^2)</td>
<td>.61</td>
<td>.53</td>
<td>.61</td>
<td>.53</td>
</tr>
<tr>
<td>Reg. F</td>
<td>62.46</td>
<td>66.44</td>
<td>62.46</td>
<td>87.99</td>
</tr>
<tr>
<td>MP (_{s})</td>
<td>$438</td>
<td>$639</td>
<td>$244</td>
<td></td>
</tr>
</tbody>
</table>


\(^a\)regression coefficient (t-statistic)
\(^b\)ln DAYSON* = log (300 - DAYSOFF*)
where:

\[
\text{DAYSOFF}^* = 6.08 S + 0.005 FC + 0.087 WWAGE - 1.96 UER + 0.008 URBY + 0.014 DUER - 0.000007 DURBY + 3.73 NUMCH
\]

\[
R^2 = 0.37
\]

where DAYSOFF* is the predicted value of DAYSOFF when regressed on schooling (S); farm capital (FC); hired wage rate (WWAGE); unemployment of males (24-44 years old) whose schooling level is not greater than high school, but greater than grade 8 (UER); urban earnings of males (24-44 years old) whose schooling level is not greater than high school but greater than grade 8 (URBY); DUER = (UER x DCITY), where DCITY is distance from nearest city; and DURBY = (URBY x DCITY).

\(^c\)SDAYS = log (schooling x DAYSON)
\(^d\)MP \(_{s}\) = marginal product of schooling.
are almost identical to the coefficients found by Griliches (1964, page 966) when he ran an aggregate production function utilizing pooled 1954-59 data for the U.S. The coefficients he found were as follows: 0.511 for labour; 0.405 for education; and 0.448 for (labour x education). Although our data is for 1971, the twelve-year difference could approximately compensate for the lag that Canadian agriculture has, behind the level of American agricultural technology and extension services. This provides us with a comparable basis for the behaviour of the agricultural sectors of both countries. It also proves that in both countries education is a significant determinant of output (earnings), as a labour quality index or as an independent input of production itself.

5.3 Summary of Results

In summary, this study has estimated reasonable measures of the return to schooling whether using modified earnings function approach or a value added function approach. We note however that higher estimates of the contribution to schooling to farm income are arrived at, utilizing the value added approach. As both functions utilized the same variables (with the exclusion of the experience term in the value added function), we are inclined to conclude that the value added formulation, with respect to estimating returns to farm employment income (or synonymously, value added) is a better specified function.

The estimated marginal return (annual) to schooling,
using the value added specification at the micro level (specification (A) in Table 3) is $260 per year of schooling. This value is based on the assumption of a 300-day work year. Our sample reports an average of 230 days that the farm operator works on the farm. By extrapolating this return to a full (300 day) year of farm work, the return to schooling increases to $375 per year of schooling. This is comparable to Fane's estimate of $321 (Fane, 1972) using 1961 data from U.S. Corn Belt States.

The equations using census division averages, when compared to the results of equations using micro data, all gave higher estimates due largely to the aggregation difference. Our models however are based on micro data and the census division approach was undertaken primarily to correct for the endogeneity of one of the independent variables.

At the census division level the estimated return to schooling was $639, after a two stage least squares procedure was utilized, with days worked as the instrument. This is clearly the best specified value added function specification in this study because the simultaneous equation bias arising from the endogenous variable (days worked) has been corrected for.

Using a transformed labour variable in the value added function at the census division level led to an important finding that a similar output-input relationship exists in the agricultural sectors of the U.S. and Canada. In particular, the relationship was identical for the elasticities of output
with respect to the weighted labour variable (or product of these two factors) values of selected years.

It is recognized that the estimates for the earnings function can be improved with additional information (like actual years of experience) and other measures to enable us to treat the endogeneity of schooling and its rate of return, which we assumed in this study both to be exogenous. For the value added function, the specification of the model could be improved with measures for prices of inputs.
VI SUMMARY AND CONCLUSIONS

Application of the earnings function to the agricultural sector has been done by incorporating the unique characteristics of the sector into the human capital model with net farm employment income as the dependent variable. With the main objective of estimating the returns to schooling, an earnings function for Canadian farm operators was formulated, taking into account all the various data transformations needed by the model to be applicable to the available data. With this completed, a digression on the value added function followed because of the similarity in functional form of the two models. As a test of functional form, the value added approach was pursued, with the similar objective of estimating the contribution of schooling to farm income.

Using micro data, rates of return to schooling were computed and in all cases the corresponding marginal products of schooling using both the modified earnings function and value added approach, were substantial. The estimates using the modified earnings function approach, were however lower than the corresponding measures when value added was used, raising the question of the correct functional form to use.

In the modified earnings function approach, use of two criteria (occupation stated and days worked) to separate the commercial farmers (for whom the model was specified) proved to be useful in arriving at reasonable estimates of the contribution of schooling to farm operator income. In both
cases, the fit was better and the return to schooling higher, when the group is more specialized in farming.

The value added function approach likewise gave estimates of the return to schooling which differed as different input specifications were used. The aggregated capital variable formulation yielded a higher return to schooling than the disaggregated capital specification. Schooling was found to be an important determinant of value added and its role increases as we decrease the number of decision variables in the estimating equation. Estimates of the annual contribution of schooling found in this study are $172 per year of schooling (using a modified earnings function) and $375 per schooling year; (using a value added function) both of these values were adjusted for a full 300-day work year. The latter estimate is comparable to the estimate found in the U.S. Corn Belt States, a return of $321 (Fane, 1972).

For the earnings function, the problem of simultaneous equation bias arising from the endogeneity of days worked was remedied at the census division level with the use of a two-stage least squares procedure (which was not feasible at the micro level). It is recognized, however, that even with this correction, estimates of the return to schooling are not without biases. The bias arises from the schooling variable, which we assumed to be exogenous in this study. Added to this is the measure of farm earnings which includes return to operator's labour and other owned inputs. Although corrections for these factors were made to enable us to build a modified
earnings function for entrepreneurs, particularly farm operators, the procedure was not particularly conventional and the theoretical justification for doing so is not too strong. This however does not weaken the results of this study. As we discussed in the previous chapter, the results indicate that the value added function is a better specified formulation with respect to estimating the contribution of schooling to farm income.

The estimates of the return to schooling using the value added approach also has its shortcomings. The omission of the prices of the inputs purchased and the hired labour wage rate has biased the schooling coefficient. A priori expectations lead us to assume a negative correlation between prices of inputs purchased and schooling, so omission of the price of inputs biases the schooling coefficient upwards. On the other hand, if we assume a positive correlation between schooling and the hired labour wage rate, the schooling coefficient will be biased downwards when the hired wage rate is excluded from the equation. The net effect on schooling will depend on which bias will dominate.

Another bias arising from our estimate of the return to schooling in farm production, is that it is an incomplete measure of its productivity. The level of aggregate capital services and days worked on the farm are held constant. Any gains from optimizing the level of total capital and family labour are not captured by our schooling coefficient and as a result our measure of the productivity of schooling is a
lower bound estimate. However the schooling productivity measures behave as predicted and we have shown this through the different specifications we have tested. Using the value added approach on the census division level, and correcting for the endogeneity of days worked yielded a marginal product of schooling of $639 per year of schooling. Adjusting for a full (300-day) work year, this increases to an annual increment in value added of $831 per year of schooling. Clearly these results, being in the lower bound of the complete measure of the productivity of schooling, strongly indicate that schooling as an investment is an important determinant of farm incomes.

In another test of functional form the labour variable was weighted by the labour quality index, education (schooling in this case). At the census division level this led to an important finding about the similarity of the results with those of a U.S. study by Griliches (1964). Specifically, the relationship was identical for the estimated output elasticities with respect to labour, with respect to education (schooling) and with respect to the (labour x education) variable.

In summary, this study has succeeded in building a modified earnings function for the Canadian farm operators, and in estimating the contribution of schooling to farm income, using this model. As a digression and test of functional form, a value added function approach was utilized to augment the analysis. Although both methods yielded reasonable estimates
of the marginal product of schooling, the value added approach was found to be a better specified equation, for purposes of estimating the productivity of schooling. The results of this study also disprove an earlier contention about the ambiguous effect that schooling has on farm income, which another study (Shaw, 1977) suggests. This study provides strong evidence that schooling is an important determinant of farm incomes. Policy makers could also utilize the findings of this study as guidelines in policies to improve the well-being of farmers (like increasing farm incomes). This could be done by upgrading the farm labour quality through policies which will lead to increased investment in farmers' educational attainment. Improvements in these estimates are however, still possible with the availability of new data and the use of an improved analytical procedure (system of simultaneous equations procedure, at the micro level).
BIBLIOGRAPHY
BIBLIOGRAPHY


Federal Task Force on Agriculture, Canadian Agriculture in the Seventies. FTFA. Ottawa, Queens Printer. 1969.


APPENDIX A

Tables on the Comparison of Urban-Rural Educational Attainment and Family Income Levels
Table A.1  Percentage Distribution of the Urban and Rural Population 15 Years and over Showing Educational Achievement at the Academic Levels, Canada. 1961 and 1971.

<table>
<thead>
<tr>
<th>Area</th>
<th>1961</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elementary</td>
<td>Secondary</td>
<td>Some Univ.</td>
<td>Univ. Degree</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>46.8</td>
<td>47.1</td>
<td>3.1</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>41.3</td>
<td>51.4</td>
<td>3.6</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>60.6</td>
<td>36.4</td>
<td>2.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Non-farm</td>
<td>58.3</td>
<td>38.2</td>
<td>2.2</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Farm</td>
<td>64.5</td>
<td>33.5</td>
<td>1.5</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area</th>
<th>1971</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elementary</td>
<td>Secondary</td>
<td>Some Univ.</td>
<td>Univ. Degree</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>37.2</td>
<td>53.0</td>
<td>5.2</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>33.7</td>
<td>55.1</td>
<td>5.7</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>49.3</td>
<td>45.6</td>
<td>3.3</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Non-farm</td>
<td>48.9</td>
<td>45.6</td>
<td>3.4</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Farm</td>
<td>50.3</td>
<td>45.5</td>
<td>3.2</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

Table A.2 Ratios of Census Farm Family Income to Urban Family Income, Canada, Selected Years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
<th>Ratio Cash Income</th>
<th>Ratio Cash Income adjusted for income in kind</th>
<th>Non-farm family unit used as denominator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1941</td>
<td>Census of Agriculture</td>
<td>0.40</td>
<td>0.57</td>
<td>Urban families headed by wage earners</td>
</tr>
<tr>
<td>1958</td>
<td>Sample Farm Survey</td>
<td>0.54</td>
<td>0.62</td>
<td>Urban families</td>
</tr>
<tr>
<td>1970</td>
<td>Agriculture-population linkage data</td>
<td>0.67 (.72)</td>
<td>0.80 (.85)</td>
<td>Urban families (all families)</td>
</tr>
</tbody>
</table>

Source: Adapted from P. Shaw Farm Incomes: A Look at Levels, Origins, Distribution and Farm: Non-Farm Comparisons. 1977. (p. 27). The relevant sources are: a) DBS, Economic Differentials in Family Size, Canada, 1941, Bull. no. F-S, (which supplied average family income of families headed by wage earners) and 1941 Census of Agriculture (which supplied average total farm family income); b) J.M. Fitzpatrick, "Distribution of Income in Canadian Agriculture." Paper presented to the 35th Annual Meeting, Canadian Agricultural Economics Society, 1965 (which supplied average total farm family income according to the 1958 Sample Farm Survey), and DBS (which supplied estimates of 1958 urban total family income; and c) 1971 Agriculture-Population Linkage and 1971 Census of Canada.
APPENDIX B

Glossary of Terms
GLOSSARY OF TERMS

1. **Census-farm**: This term is defined in the 1971 Census as a farm, ranch or other agricultural holding of one acre or more with sales of agricultural products, during the 12-month period prior to the census, of $50 or more.

2. **Operator**: This term is used in the Census of Agriculture to designate the person who is directly responsible for the agricultural operation of the holding, whether as owner, tenant or hired manager. As only one operator is listed for each census-farm, the number of census farms is the same as the number of operators. If, for example, the holding was operated as a partnership, only one partner was considered to be the operator.

3. **Farm Income** (net self-employment or income from farming) - Refers to total receipts from farm sales less depreciation and operating expenses during 1970, regardless of whether the farm was operated by the respondent alone or in partnership, or for the respondent by a paid manager. In the case of a partnership, only the share of income actually received was reported. Cash advances and supplementary and assistance payments from governments as well as acreage reduction payments were considered as farm income. Provision was made for reporting a loss or no income.
4. **Capital values**: This is the value of census-farm capital: land and buildings, machinery and equipment (including automobiles), livestock and poultry. Census-farm operators were asked to give a value for land and buildings, farm machinery and equipment on their holding regardless of tenure. The value reported was to be an estimate of the market value, not the original, replacement or assessed value.

The value of land and buildings was to be the value of the property when used for agricultural purposes. For areas surrounding cities or towns, the real estate value for non-agricultural purposes of the census-farm property was not to be reported.

The value to be reported for farm machinery was the present market value - that is, the amount for which the machinery and equipment would sell if there was a willing buyer and a willing seller, and not a forced sale. The number and value was to be reported for agricultural machines on the holding at the census date, regardless of whether the machines were owned by the operator or someone else. Old machines no longer being used were not to be reported. Equipment owned in partnership was to be reported on the census-farm where it was located.

Values for the livestock and poultry reported in the census were compiled from data on average farm values for various types of livestock and poultry obtained by the Agricultural Division of Statistics Canada.
5. **Hired agricultural labour:** Total weeks of paid agricultural labour (15 years and over) hired during 1970 were recorded. The number of paid agricultural workers employed on a year-round basis as of June 1, 1971 was also to be enumerated. (Housework was not included as agricultural labour). Any person doing agricultural work on the census-farm for wages, salary, commission or on a piece-rate labour contract basis was reported as paid labour. This included paid managers and members of the operator's family receiving regular or specified cash wages. Total weeks of agricultural work done by members of a Hutterite Colony were included as agricultural labour and full-time labour of the colony was included as paid year round agricultural workers.

6. **Selected expenditures:** These expenditures, whether paid in cash or obtained on credit, were reported for each census-farm for the year 1970. Cash wages paid to hired agricultural labour did not include amount paid for housework, custom work and construction labour. Custom work was to be included in the item "machine rental, custom work, or contract work". Taxes were the amount levied on all agricultural property owned and operated by the respondent on June 1, 1971 whether paid or not. Rent was on all rented or leased agricultural property operated by the respondent on that same date. Fuel and oil used did not include that used in automobiles. Finally, lime was not included in commercial fertilizers purchased.
7. **Value of agricultural products sold (sales):** Respondents were asked to report the value of all agricultural products sold during 1970 (whether received by the operator or some other person). They were to include cash advances for stored grain, deficiency payments and patronage dividends for the particular products involved. For tenant-operated farms, the landlord's share of products sold was to be included. Products of an institutional farm or Hutterite Colony used by the same were considered sold and an estimate of their value in the appropriate question.

8. **Census division:** Includes a variety of titles such as the administrative units of the provinces of Prince Edward Island, Nova Scotia, New Brunswick, Quebec, and Ontario called "counties"; British Columbia's regional districts; Ontario's regional municipalities, territorial districts, district municipality and metropolitan municipality; and finally the use of the title "census division" itself, created by Statistics Canada in collaboration with the provincial governments of Newfoundland, Manitoba, Saskatchewan and Alberta, since these provinces do not possess administrative units comparable to the counties of the other provinces.

9. **Off-farm work during 1970:** Two questions relating to all off-farm work performed during 1970 by the census-farm operator were asked. First, "How many days did you (the operator) work off this holding at paid agricultural and
non-agricultural work during 1970?" Exchange work was not to be included. The second asked for the "kind of paid off-farm work done during 1970 and number of days worked at each." For agricultural work off the holding, custom work was not to be included.

10. **Occupation:** Refers to the specific type of work the person did on the job, as determined by the reporting of the kind of work, the description of the most important duties and the job title. Data relate to the respondent's job in the week prior to enumeration if he or she had a job during that week or to the job of longest duration since January 1, 1970 if not employed in that week. Persons with two or more jobs during the reference week were asked to give the information for the one at which they worked the most hours.
APPENDIX C

Tables on Receipts from Wheat Sales (1961-71) and Comparison of Declared Farm Income Values with Computed Farm Income Values (1971).
### APPENDIX C

**Table C.1** Total Cash Receipts from Sale of Wheat\(^a\), Canada and the Prairie Provinces, 1961-71.

<table>
<thead>
<tr>
<th>Year</th>
<th>Canada (million dollars)</th>
<th>Manitoba</th>
<th>Saskatchewan</th>
<th>Alberta</th>
<th>Prairie Provinces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>572</td>
<td>74</td>
<td>343</td>
<td>136</td>
<td>553</td>
</tr>
<tr>
<td>1966</td>
<td>999</td>
<td>114</td>
<td>627</td>
<td>234</td>
<td>975</td>
</tr>
<tr>
<td>1967</td>
<td>1043</td>
<td>123</td>
<td>645</td>
<td>246</td>
<td>1014</td>
</tr>
<tr>
<td>1968</td>
<td>973</td>
<td>123</td>
<td>579</td>
<td>244</td>
<td>946</td>
</tr>
<tr>
<td>1969</td>
<td>895</td>
<td>92</td>
<td>410</td>
<td>168</td>
<td>670</td>
</tr>
<tr>
<td>1970</td>
<td>471</td>
<td>52</td>
<td>298</td>
<td>93</td>
<td>443</td>
</tr>
<tr>
<td>1971</td>
<td>673</td>
<td>68</td>
<td>413</td>
<td>129</td>
<td>610</td>
</tr>
</tbody>
</table>

\(^{\text{a}}\)Includes Canadian Wheat Board payments and net cash advance made under the provisions of the Prairie Grain Advance Payments Act in 1957.

% change of 1970 receipts compared with 1961-71 ave.

-38%  -43%  -37%  -47%  -40%

Table C.2 Comparison of Declared Net Farm Income with Computed Values, Selected Provinces and Census Divisions, Canada, 1971.

<table>
<thead>
<tr>
<th>Province/Census Division</th>
<th>Net Farm Income A</th>
<th>Net Farm Income B</th>
<th>% Difference 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nova Scotia</td>
<td>3328</td>
<td>935</td>
<td>-256</td>
</tr>
<tr>
<td>Quebec</td>
<td>3577</td>
<td>1922</td>
<td>-86</td>
</tr>
<tr>
<td>Ontario</td>
<td>7201</td>
<td>1708</td>
<td>-322</td>
</tr>
<tr>
<td>Manitoba</td>
<td>4399</td>
<td>1440</td>
<td>-205</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>4550</td>
<td>1831</td>
<td>-148</td>
</tr>
<tr>
<td>British Columbia</td>
<td>4604</td>
<td>1026</td>
<td>-349</td>
</tr>
<tr>
<td>Arthabaska, Quebec</td>
<td>4964</td>
<td>2489</td>
<td>-99</td>
</tr>
<tr>
<td>Div.15, Manitoba</td>
<td>3144</td>
<td>1298</td>
<td>-142</td>
</tr>
</tbody>
</table>

1 Computed as (gross farm sales - selected expenditures - depreciation cost). Depreciation cost was assumed to be 15% of the value of machinery and equipment. Value of sales and expenditures and value of machinery & equipment were taken from Statistics Canada. 1971 Advance Bulletin. Census of Canada. Cat. no. 96-729; 96-730; 96-731 and 96-732.

2 Computed as ((B-A)/B) 100.
APPENDIX D

Income Question From The Long Form 1971
Census Population Questionnaire
### INCOME QUESTION FROM THE LONG FORM 1971 CENSUS

#### POPULATION QUESTIONNAIRE

**POPULATION QUESTIONNAIRE**

#### QUESTION SUR LE REVENU TIREE DU QUESTIONNAIRE COMPLET DU RECENSEMENT DE LA POPULATION DE 1971

**INCOME QUESTION FROM THE LONG FORM 1971 CENSUS**

**QUESTION SUR LE REVENU TIREE DU QUESTIONNAIRE COMPLET DU RECENSEMENT DE LA POPULATION DE 1971**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>During 1970 what were your total wages and salaries, commissions, bonuses, tips, etc.? (before any deductions)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 what was your net income from self-employment or operating your own non-farm business or professional practice? State total business income less expenses of operation. If lost money, give amount and write &quot;Loss&quot;.</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 what was your net income from operating a farm on your own account or in partnership? State total farm income less expenses of operation. If lost money, give amount and write &quot;Loss&quot;.</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 how much income did you receive from: 1. Family and youth allowances?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>2. Government old age pensions, Canada pensions, and Quebec pensions?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>3. Other government income? (e.g., unemployment insurance, sickness, pension; and allowances, welfare)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>4. Retirement pensions from previous employment?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>5. Bond and deposit interest and dividends?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>6. Other investment income? (e.g., net rents)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>7. Other income? (e.g., alimony)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 what was your total income? (a + b + c + d)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 what was your total wages and salaries, commissions, bonuses, tips, etc.? (before any deductions)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 what was your net income from self-employment or operating your own non-farm business or professional practice? State total business income less expenses of operation. If lost money, give amount and write &quot;Loss&quot;.</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 what was your net income from operating a farm on your own account or in partnership? State total farm income less expenses of operation. If lost money, give amount and write &quot;Loss&quot;.</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 how much income did you receive from: 1. Family and youth allowances?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>2. Government old age pensions, Canada pensions, and Quebec pensions?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>3. Other government income? (e.g., unemployment insurance, sickness, pension; and allowances, welfare)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>4. Retirement pensions from previous employment?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>5. Bond and deposit interest and dividends?</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>6. Other investment income? (e.g., net rents)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>7. Other income? (e.g., alimony)</td>
<td>Amount $ $0.00</td>
</tr>
<tr>
<td>During 1970 what was your total income? (a + b + c + d)</td>
<td>Amount $ $0.00</td>
</tr>
</tbody>
</table>

**REVENUE DE 1970**

(Montant en dollars seulement)

<table>
<thead>
<tr>
<th>Question</th>
<th>Amount $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quel a été, en 1970, le montant total de votre salaire ou traitement, de vos commissions, gratifications, pourboires, etc. (avant les déductions)?</td>
<td>$0.00</td>
</tr>
<tr>
<td>Quel a été, en 1970, votre revenu net provenant d'un travail à votre compte, de l'exploitation d'une entreprise non-agricole ou de l'exercice d'une profession? Indiquez le revenu total moins les frais d'exploitation. En cas de perte, donnez le montant et écrivez &quot;Perte&quot;.</td>
<td>$0.00</td>
</tr>
<tr>
<td>Quel a été, en 1970, votre revenu net provenant d'une exploitation agricole à votre compte ou en association? Indiquez le revenu total moins les frais d'exploitation. En cas de perte, donnez le montant et écrivez &quot;Perte&quot;.</td>
<td>$0.00</td>
</tr>
<tr>
<td>Quel a été, en 1970, votre revenu provenant des sources suivantes: 1. Allocations familiales et allocations scolaires?</td>
<td>$0.00</td>
</tr>
<tr>
<td>2. Pensions de vieillesse de l'État, du Régime de pensions du Canada et du Régime des rentes du Québec?</td>
<td>$0.00</td>
</tr>
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<td>3. Autres sources publiques (par ex., prestations d'assurance-chômage, pensions aux anciens combattants, bien-être social)?</td>
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<td>4. Pensions de retraite relatives à un emploi antérieur?</td>
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<td>Quel a été votre revenu total en 1970? (a + b + c + d)</td>
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</tr>
<tr>
<td>Quel a été, en 1970, le montant total de votre salaire ou traitement, de vos commissions, gratifications, pourboires, etc. (avant les déductions)?</td>
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</tr>
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<td>Quel a été, en 1970, votre revenu net provenant d'un travail à votre compte, de l'exploitation d'une entreprise non-agricole ou de l'exercice d'une profession? Indiquez le revenu total moins les frais d'exploitation. En cas de perte, donnez le montant et écrivez &quot;Perte&quot;.</td>
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