THE UNIVERSITY OF MANITOBA

THE ROLE OF EDUCATION IN AREA ECONOMIC DEVELOPMENT

by

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ABSTRACT

The objective of this study is to determine the effects of educational expenditures on the Interlake Area and individuals residing in the Area. These expenditures will not only improve educational quality, but will have impacts on area sales, income and employment. To attain this objective, a framework is developed.

The framework consists of a regression equation which is used to determine the area of education where expenditures will have the greatest effect. The input-output table is used to determine the impact of educational expenditures on area sales, income and employment. The present value equation is used to determine the effects on continued education on high school students.

The conclusions of the study are:

1. That expenditures which increase average town income will have the greatest effect on reducing dropout rates. Subordinate effects will occur if the extra-curricular activities and/or courses available variable(s) are changed. Two other variables affect education but cannot be easily altered by policymakers in the short-run. They are the percentage of high school population of Indian or Metis descent and school size.

2. That educational expenditures have a significant effect on area sales, income and employment. An educational expenditure of $5,055,996 created an increment of $3,267,907 in area sales, $568,437 in area income and approximately 99 service sector jobs are induced.

3. That net benefits of increased amounts of education are greater for Selkirk than for the average town in the Interlake. Also, net benefits increase as education levels increase.

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CHAPTER I

INTRODUCTION

Politicians, communities, parents and students are questioning the amount of money which should be spent for educating today's youth. It is to this broad issue that this thesis is directed. This study does not try to answer the question of how much money should be spent; rather, it examines the areas of education in which money should be spent, and tries to ascertain the effects of this spending on the area under study.

Chapter I of the study gives the context of educational expenditures, defines the area under study, and states the objective and the three problems to be solved in order to achieve the objective. It also discusses in general terms the contributions which the study will make. In Chapter II, the literature related to the general concepts of the model being proposed in the study is reviewed. Chapter III examines the literature specifically related to the regression equation, and discusses briefly the input-output table and the present value equations. In Chapter IV, the source of the data and manipulations of all data used in the analysis are presented. Chapter V presents the results of the three methods of analysis and their implications. The limitations of the study and further research which can be carried out in related areas are discussed in Chapter VI. Chapter VII examines the applicability of this model to the northern area of Manitoba. Lastly,

both the specific and general conclusions of the study are presented in Chapter VIII.

THE CONTEXT

In his text, Principles of Economics, Alfred Marshall briefly mentions the effects that education has on people. He concludes that education ". . . will be profitable as a mere investment, to give the masses of the people much greater opportunities than they can generally avail themselves of."[1] He also states that education has two effects, a direct effect, ". . . immediate economic gain which the nation may derive from an improvement in the general and technical education of the mass of the people . . . ,"[2] and a less direct but equally important effect of ". . . medical discoveries, which increases our health and working power; and . . . scientific work such as that of mathematics or biology, even though generations may pass away before it bears fruit in general material well being."[3]

Examining the recent expenditures of Federal, Provincial and local governments, one might conclude that the three levels of government have indeed followed Marshall's philosophy. In Canada in 1967, education accounted for 20.9% of the total expenditures by all governments, and also accounted for 6.6% of G.N.P. This represents a substantial increase since 1965, when educational expenditures were 16.4%

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[1]Alfred Marshall, Principles of Economics (Toronto, Ontario: The MacMillan Company of Canada Ltd., 1964), p. 179.

[2]Ibid., p. 176.

[3]Ibid., pp. 179-180.

of total expenditures and 4.8% of G.N.P.[4]

Between 1965 and 1967, educational expenditures increased by about 27% of their relative share of total expenditure, and by about 37% of their relative share of G.N.P. During these years education became the department with the largest expenditures, exceeding social assistance (including veterans benefits), which had the largest expenditures in 1965. Of the total amount of goods produced in the Canadian economy, the amount consumed by the education sector has increased between 1965 and 1967.

The Economic Council of Canada has projected educational expenditures by all governments to 1975. They estimate an increase of $4.3 billion in educational expenditures from 1967 to 1975. This represents an annual percentage increase of 8.6%.[5]

In 1965, the province of Manitoba spent $81,114,000 on education; in 1967, the amount had increased to $107,000,000, an increase of 32% in two years. The projected figure for 1975 is $172,800,000, or an increase of 61.8% in eight years.[6] The amount spent for education in 1967 by the province of Manitoba represents 3.4% of G.P.I. and 28.5% of total Provincial Government Expenditures.[7]

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[4]Economic Council of Canada, Perspective 1975; Sixth Annual Review (Ottawa: Queen's Printer, 1969), p. 29.

[5]Ibid., p. 32.

[6]Manitoba Economic Consultative Board, Fifth Annual Review (Winnipeg: Queen's Printer, 1968).

[7]Gross Provincial Income for 1967 was $3,028 million and Provincial Government Expenditure for 1967 was $375,119,000. Both of these terms are analogous to the National Accounts definitions of G.N.I. and Federal Government expenditures. Statement by Pat Gannon, staff member of the Department of Finance, Manitoba Government, during a telephone interview on October 26, 1971.

Expenditures for education services represent a substantial portion of local government expenditures. In this regard, the Interlake municipalities are similar to other municipalities in Manitoba, as their expenditures for educational services in 1968 represented 40% of the local budget.[8]

THE AREA

The Interlake Area of Manitoba extends over an area of 10,000 square miles, and incorporated a population of 57,270 in 1966. The southern boundary of the area is the perimeter highway north of Winnipeg; the northern boundary is approximately $52^{o}10'$N latitude. Lake Manitoba forms the western boundary and Lake Winnipeg is the eastern boundary.

This area of Manitoba has a lower than average standard of living, as well as a higher than average unemployment or underemployment rate. Well over one-third of the labor force in the Interlake Area are working at extremely low levels of productivity.[9]

To alleviate this situation, the Provincial and Federal Governments signed an agreement in 1967 to make expenditures in this designated area in an attempt to raise the standards of living for people in the Interlake. The objectives of the agreement were to be achieved by expenditures for various programs, one of which is education.

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[8]Manitoba Development of Urban Development and Municipal Affairs, 1968 Statistical Information Respecting the Municipalities of the Province of Manitoba and the Metropolitan Corporation of Greater Winnipeg (Winnipeg, Manitoba: Queen's Printer, 1969).

[9]Canada Department of Forestry and Rural Development, Interlake Area of Manitoba, Federal-Provincial Rural Development Agreement (Agreement Concerning a Comprehensive Rural Development Plan for the Interlake Area of Manitoba) (Ottawa: Queen's Printer, 1967), p. 25.

PROBLEMATIC SITUATION AND OBJECTIVES

The effects of educational expenditures in the Interlake Area are to be analyzed. Figure 1 illustrates the relationships between educational expenditures and area economic development. There are three methods of analysis used to determine these relationships.[10] They are:

1. A regression equation to determine the relationship between dropout rates and three quality-of-education variables (teacher qualification, diversity of curriculum, and diversity of extra-curricular activities), average town income, percentage of the high school population which are of Indian or Metis descent, and school size. The quality variables are affected by the amount of money spent on education. This will not only influence the quality of the schools, but will also have an effect on sales and incomes in the area.

2. An input-output table which determines the effects of educational expenditures on sales and incomes in the Interlake Area.

3. Present value equations are used to determine the increased human capital value that will occur if the dropout rates are lowered.

The objective of this study is to develop a framework which will relate the role of education to area economic development, i.e., a framework which will measure the effects of educational expenditures on the Interlake Area.

The total effects of any expenditures would influence many

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[10] The interrelationships, along with the three methods of analysis, form the framework to determine the effects of educational expenditures on the Interlake Area.

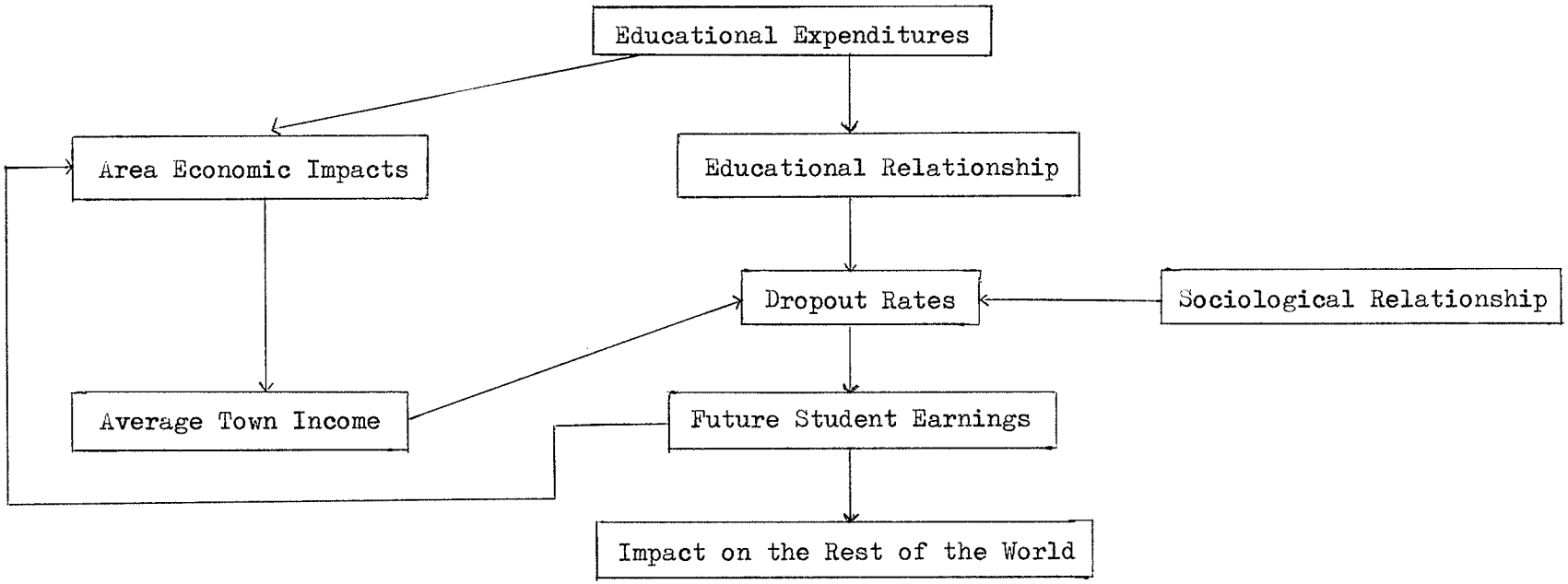

FIGURE 1

INTERLAKE AREA ECONOMIC IMPLICATIONS OF CHANGES IN EDUCATIONAL AND SOCIOLOGICAL RELATIONSHIPS

different disciplines, but in this analysis the economic results will be emphasized. Some sociological consequences and implications will also be discussed.

To achieve the main objective, three relationships must be analyzed, namely:

1. The estimation of the regression coefficients to determine significant variables which affect dropout rates.

2. The determination of the effects of educational expenditures on area sales and incomes by use of an input-output table.

3. The calculation of present value equations of benefits and costs to determine the economic returns associated with higher levels of education.

The objective of the study will be attained by combining the solutions of the three relationships defined above.

CONTRIBUTION OF THE STUDY

The contribution of the study will be to facilitate policy-makers with decisions concerning expenditures for education in the Interlake Area. The model is designed to examine two aspects of educational expenditures, namely, the effects on the student and the economic effects on the area. The model also shows the net benefits attributable to increased education. The quantification of the model will point out two things: the area of education where funds should be spent to encourage students to remain in school, and the result that the above expenditures will have on the area. Knowing this, the policy-makers can determine, a priori, the effects of educational expenditures and can compare these effects to other types of expenditures in the area.

CHAPTER II

REVIEW OF THE LITERATURE

THE INVESTMENT-CONSUMPTION DICHOTOMY

Before analyzing the educational expenditures of the Interlake Area, it must be decided whether these expenditures relate to consumption or investment. This decision will determine the methods of analysis used in the model. How can the investment and consumption portions of educational expenditures be separated?

The difference between physical capital and human capital is that physical capital is usually considered as an investment good, whereas human capital is both an investment and consumption good. As a consumption good, individuals obtain pleasure through increased knowledge; education can also yield a series of returns in the future, and is therefore an investment good.[1]

To classify the consumption and investment component of education, various methods have been described:

1. Income elasticity--all expenditures on education are assumed to be for consumption purposes and the amount of education demanded as

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[1]Bruce W. Wilkinson, Studies in the Economics of Education, Occasional Paper No. 4 (Ottawa: Economics and Research Branch, Department of Labour, 1965), p. 7.

income increases is calculated.[2]

2. Separating expenditures on high school and beyond from elementary school expenditures--it is assumed that elementary school expenditures are of a consumption nature, while expenditures beyond elementary school are investment expenditures.[3]

3. Count all outlays in education as investment--this method assumes that all education contributes to potential productivity, and every person is a potential member of the labor force and represents an investment in human capital. From this method a maximum capital value can be calculated.[4]

Of the three methods of separating the income and investment components of human capital expenditures, the third method is likely to be the most useful, although none of the three are without problems.[5]

Vaizey[6] concludes that education should be compulsory up to a certain age because education has a redistribution effect between income

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[2]Studies have been carried out to measure the income elasticity of education, i.e., the change in demand for education as income increases. See Conrad W. Sigurdson, "An Analysis of the Educational Effort of a Single Enterprise Community: Lynn Lake" (unpublished Master's dissertation, University of Manitoba, 1970); see also John Bock, "An Analysis of the Educational Effort of a Single Enterprise Community: Flin Flon" (unpublished Master's dissertation, University of Manitoba, 1970). A study by Brazes obtained an income elasticity of .73, while Schultz obtained an income elasticity of 3.5. See Wilkinson, op. cit., p. 8.

[3]No study using this method of separating consumption from investment has been found. Ibid., pp. 8-9.

[4]This method of analyzing educational expenditures is used by Wilkinson, ibid., Ch. II.

[5]Ibid., pp. 8-9.

[6]John Vaizey, "Criteria for Public Expenditures on Education," The Economics of Education, eds. E.A.G. Robinson and John Vaizey (New York: St. Martin's Press, 1966), p. 455.

groups. Burkehead[7] comes to the same conclusion as Vaizey, but mentions how redistribution occurs. Imposing a certain amount of education on lower-income people will redistribute income if they do not pay taxes to support education. The conclusion that lower-income people would likely obtain less education without compulsion is one inference which can be drawn from Siemens'[8] study of family factors. Generalizing from this conclusion, one might conclude that lower-income people may not take advantage of education beyond the prescribed minimum. This may tend to redistribute some of the benefits of education towards the middle-income people who have the greatest power in determining educational spending and standards.[9]

The conclusion which can be drawn from these statements is that if lower-income families take advantage of the educational facilities by going beyond the prescribed minimum, income redistribution towards lower-income people will likely occur. On the other hand, if only the prescribed minimum education is obtained, then the income will be redistributed towards the middle-income people.

Because of the difficulties of separating the consumption aspect of education from the investment aspect, this study will assume that education is an investment good. Considered in this way, education can

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[7]Jesse Burkehead, Public School Finance, Economics and Politics (Syracuse, New York: Syracuse University Press, 1964), p. 13.

[8]Leonard B. Siemens, The Influence of Selected Family Factors on the Educational and Occupational Aspiration Levels of High School Boys and Girls (Winnipeg, Manitoba: The Faculty of Agriculture and Home Economics, University of Manitoba, 1965), pp. 61-62.

[9]Vaizey, op. cit., p. 456.

be expected to contribute to growth. A measure of this contribution is needed.

MEASURING EDUCATIONAL PRODUCTIVITY

There are five indicators mentioned in the literature that are used as surrogates for the productivity of education. The five indicators are: years of schooling, cost of production or replacement, discounted value of future earnings, cost-benefit analysis and the residual approach. These five methods will be briefly described below.

1. Years of Schooling[10]--It is possible to obtain a total of all the years of education in the economy. However, a better method is to determine the average level of education of all occupations in the entire work force. Neither of these methods account for the monetary values of educational investment which is often more essential.

2. Cost of Production or Replacement[11]--The cost of production method of calculating human resources involves pricing the capital at the cost of the resources for one year; the cost of replacement is the cost of resources needed to replace the capital at present. Either method can be used depending upon the purpose of the study.

The main problem with this approach is in determining the method of measuring foregone earnings. Foregone earnings should be included as a cost, since a person continuing school is losing income that would be earned if he were employed.

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[10]Wilkinson, op. cit., pp. 9-10.

[11]Ibid., pp. 10-16.

However, there are problems involved, such as how to deal with unemployment, and how to account for the individual's capabilities in determining what his income would be if he were working. There is also the problem of determining society's benefit from increased levels of education. All of the other costs, such as teacher's salaries, operation costs and incidental expenses such as books or travel, are easily measured.

3. Discounted Value of Future Earnings[12]--This method consists of discounting to the present the value of a person's lifetime earnings. The problem associated with this analysis lies in predicting the future earnings of the individual. Many structural parameters of employment could greatly affect the outcomes. Another problem lies in determining what interest rate is to be used to discount future earnings. The higher the interest rate, the smaller the present value. As the interest rate plays such an important role, there is much discussion as to which interest rate should be used. There are also some non-monetary gains attributable to education, and when a present value of future earnings has been found, the analysis will not account for this and the benefit will be biased downward.

4. Cost-Benefit Analysis[13]--A cost-benefit analysis seems to be an appropriate tool to measure the worth of education programs. Although a very good measuring tool in theory, the application of benefit-cost

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[12]Ibid., pp. 16-25.

[13]Burkehead, op. cit.; see also Charles S. Benson, The Economics of Public Education (Cambridge, Massachusetts: Riverside Press, 1961).

analysis to educational expenditures has several serious difficulties, namely:

(a) Many of the benefits, especially those to society, and the consumption aspect of education to the individual are not quantifiable. Even if some of the benefits are quantifiable many are difficult to identify.

(b) The returns to educational investment occur over a long period of time and can only be estimated very crudely, and with such a long spread in returns that the questions of which interest rate is appropriate becomes dominant.

(c) Although estimates of manpower requirements have given indications as to the direction of educational spending, the relationship between skilled manpower and output is complex and subject to qualification.

This type of analysis is suggested by both Vaizey[14] and Burkehead.[15] Burkehead concludes that benefit-cost analysis would be good for comparing similar projects, but not as good for measuring multi-purpose projects. Vaizey points out the many difficulties of using benefit-cost analysis, and concludes that using such an analysis will not answer the question of how much ought to be spent on education.

The Economic Council[16] uses an internal rate of return[17] to

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[14]Vaizey, op. cit., p. 457.

[15]Burkehead, op. cit., pp. 8-10.

[16]Economic Council of Canada, Design for Decision Making (An Application to Human Resources Policies), Eighth Annual Review (Ottawa: Queen's Printer, 1971), pp. 205-213.

[17]The internal rate of return is the interest rate which equates benefits and costs.

measure the returns to society and individual by areas of Canada. It is mentioned that the purpose of education is not solely an investment objective, and that the rate of return must be interpreted cautiously as it measures only the investment aspect of education. However, there is also cultural development and equality of opportunity goals which must be achieved. It is not mentioned how these two goals can be measured. The difficulties with this type of analysis are the same as for calculating the benefit-cost ratio.

5. The Residual Approach[18]--This measurement technique is used to determine what part of increased output can be attributed to increased input, and that amount which cannot be attributed to increased input is called the residual. One important part of the residual is education, as it increases the quality of the work force.

The residual approach is most often used as a surrogate for educational productivity. Schultz[19] measures economic growth between 1929 and 1957 for the United States. He concludes that in the period 1929 to 1957, education contributed between 16.5% and 20% to economic growth. This supports Dennison's claim that education contributed about 21% of economic growth.[20]

This method of calculating educational productivity is criticized by Burkehead,[21] because it is impossible to separate educational returns

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[18]Wilkinson, op. cit., pp. 25-27.

[19]Theodore W. Schultz, The Economic Value of Education (New York: Columbia University Press, 1963), pp. 42-46.

[20]Ibid., p. 44.

[21]Burkehead, op. cit., p. 6.

from other personal characteristics such as, sex, ability, background, and other sociological, psychological or environmental aspects. Benson[22] agrees that education plays an important role in increasing the productivity of a nation, but concludes that education with respect to increasing productivity must rest its case not on carefully tested hypotheses, but on general assumptions that the quality of school programs helps the economy in its search for greater efficiency. Wilkinson[23] concludes that although these residuals are an imperfect measure, the analysis has major contributions and research should continue along these lines to refine this technique.

The conclusion that follows from the above discussion is that all the methods of calculating educational productivity have some problems of measurement, and the use of any one method, although it would give some indication of the productivity of education, would not be precise.

It would not be feasible to use the residual approach in this study, as the system of accounts needed for the Interlake Area is not available. To measure the effects of greater amounts of education, this study uses a combination of two methods--the present value method and a net benefit calculation. The present value of future earnings and the present value of future costs are calculated; from this a net benefit is derived.

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[22]Benson, op. cit., pp. 344-351.

[23]Wilkinson, op. cit., pp. 22-27.

EDUCATION IN AREA DEVELOPMENT

Educational expenditures have a twofold effect. The first is to create employment and income for the area, and the second effect is to increase a student's future earnings by increasing education levels, thereby aiding area development. The latter effect is discussed in this section.

The Economic Council of Canada[24] discusses regional differences in education. It is stated that the incomes of people tend to be closely correlated to the extent of schooling. It is also mentioned that the rates of return on educational investments compare favourably with other investments. Tweeten[25] concluded that, although short-run returns to education may be insignificant, long-run expenditures are a worthwhile investment for alleviating rural poverty.

In the Eighth Annual Review,[26] rates of return to education are quantified. These rates of return are calculated for society, for individuals, for high schools and for universities. The rate of return for individuals and society tends to be greater for high school students in the Atlantic provinces.[27] Society's and individual's returns from university education were similar for all regions of Canada, although

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[24]Economic Council of Canada, Perspective 1975, Sixth Annual Review (Ottawa: Queen's Printer, 1969), p. 123.

[25]Luther G. Tweeten, The Role of Education in Alleviating Rural Poverty, U. S. Department of Agriculture, Agriculture Economic Report No. 114 (Washington, D.C. Government Printing Office, 1967).

[26]Economic Council of Canada, Eighth Annual Review, pp. 205-213.

[27]Ibid., Chart 9-2, p. 209.

the Atlantic provinces now have the lowest returns.

In the Sixth Annual Review,[28] quality measures of education such as student-teacher ratios, teacher qualifications, student retention rates, expenditures per student, and also various types of institutions, systems, programs, and curriculums are discussed. In their analysis, the Economic Council evaluates the differences for 1966-67, and brings out the variance between provinces. No conclusions are drawn for policy recommendations from their evaluation, but they point out directions for further research. The Council also notes that variations within the province are not examined; but these differences could vary even more drastically than those among provinces.[29]

These variations within the province could be one reason why some areas are underdeveloped. Spitze[30] concludes that underdeveloped areas are usually rural areas; one reason for this is that rural area people are generally less knowledgable of the various opportunities available than are urban people. Rural people, therefore, are at a disadvantage because they have a lower level of living and are relatively isolated from the larger public service facilities. Also, due to their isolation, rural people have much less accessibility to the communications media, which in turn reduces the knowledge of occupational mobility. The lack of response to knowledge of occupational mobility may be caused

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[28]Economic Council of Canada, Sixth Annual Review, pp. 132-136.

[29]Ibid., p. 210.

[30]R.E.F. Spitze, "Problems of Adequacy in Rural Human Resource Development Concepts and Accomplishments," Benefits and Burdens of Rural Development, ed. Iowa State Center for Agriculture and Economic Development (Ames, Iowa: Iowa State University Press, 1970).

by the large amount of assets the farmer has, which limits his exit from this type of employment.

Not only are the rural people at a disadvantage in terms of knowledge of available opportunities, but they may have an inferior educational position because lower incomes permit fewer expenditures and savings. Lower labor returns are likely to be more common in rural areas.

As well as having lower incomes, rural areas must pay higher costs for educating their youth than do urban people. These increased costs, due to transportation, smaller unit sizes, and an increasing range of courses, are placing great burdens on the rural people.[31]

It follows from Spitze's conclusion that one method of alleviating rural poverty would be to provide better educational facilities at a cost which can be borne by the rural areas. This would mean some type of redistribution from urban areas to rural areas, thereby helping remove the isolation barrier of rural people.

The question that is often asked is whether low incomes cause poor education or whether it is because of poor education that incomes of these people are low. Some authors contend that it is the family background that has the greatest effect on educational achievement, and the method of breaking this vicious circle is to alleviate the economic and social difficulties of the families. For example, in a report to the President of the United States on minority groups, it was concluded

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[31] In Manitoba, the Foundation Program redistributes revenues to rural areas. The Foundation Program pays approximately 75 percent of total cost with the local school division paying the other 25 percent.

that the student's background was the important variable in educational achievement. It was stated thus:

> This is not to say, of course, that schools have no effect, but rather that what effects they do have are highly correlated with the individual student's background, and with the educational background of the student body in the school; that is, the effects appear to arise not principally from factors that the school system controls, but from factors outside the school proper. The stimulus arising from variables independent of the student background factors appears to be a weak one.[32]

Sexton's[33] study of an urban area concluded that much of the reason for poor academic achievement was due to the lack of proper facilities (not only educational facilities, but recreational and cultural ones as well) in the ghetto areas. It was thought that alleviating the social and economic problems of the area would likely help in lessening the discrepancy between the more and less affluent parts of the city. If you decrease the ghetto peoples' plight by increasing their incomes and improving social conditions of the area, this will raise these peoples' educational achievements, thereby helping the children escape the ghetto.

Many of the social problems of the ghettos in large cities cannot be generalized to the poor rural areas, but one important factor is common to both, and that is income. Raising people's income in both areas is one step towards breaking the vicious circle in which low-income

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[32]James S. Coleman et al., Equality of Educational Opportunity; Report of a Survey, submitted to the President and Congress under Sec. 402 of the Civil Rights Act of 1964, by the National Center for Educational Statistics (Washington, D.C.: Government Printing Office, 1966), p. 312.

[33]Patricia Cayo Sexton, Education and Income (New York: Viking Press, Inc., 1966).

people tend to have low educational achievement, and that low achievers become low-income people in the next generation.

From the literature reviewed, it was decided to consider educational expenditures as an investment. If educational expenditures are an investment, then a measure of its productivity must be obtained. Dropout rates were stated to be an objective of the education system, and the effects of lower dropout rates will be measured by using present value equations and a net benefit calculation.[34] Also, it was concluded from the literature reviewed in this chapter, that area development can be achieved by improving the social and economic conditions of the area.[35]

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[34]In this study education is used at three different levels. For the regression equation, high schools are used as the necessary observations. Expenditures for Grades I to XII are used for the input-output calculations. Benefits and costs are calculated from Grades 7-8 to university for the net benefit calculations.

[35]The input-output table, which is a method of measuring area development, is discussed in Chapter III.

CHAPTER III

MODEL FORMULATION

The regression equation results test the hypothesis that aspirations (measured in this study by a surrogate: income of the parents averaged over each town) and/or the quality of a school will encourage students to remain in school for a longer time. The dropout rate is the dependent variable in the study. Aspirations, three quality measures, and the fraction of the high school population which is of Indian or Metis descent are the independent variables. The quality variables are teacher's salaries (a surrogate for teacher qualifications) and a ranking of courses and extra-curricular activities available at each high school.

In this chapter three methods of analysis are considered. The regression equation is discussed with respect to the six independent variables. The input-output table and the present value equations are set forth and some of the problems associated with their formulation are discussed.

REGRESSION EQUATION

In this study, dropout rates are considered to be a link between the quality of education, social and economic variables, and the future earnings of students. Dropout rates are also a type of productivity measure, in that the objective of schools is to develop student abilities, thereby making the students better employees. If an increase in

the quality of education makes a student remain in school for a longer period of time, then he will likely be a more employable person. It is assumed that greater amounts of education equip students to do better work. Therefore, it can be said that the dropout rate is a measure of the education system's productivity.

One factor which affects dropout rates is the income of the parents. A study dealing with this factor was conducted in the United States; it showed that in large urban centers dropout rates and income class tend to be closely related.[1] Lower income people generally have poorer facilities, more poorly qualified teachers, over-crowded schools, fewer recreation areas. Lower income people have a worse educational and social environment, and this puts their children in an inferior position of learning from an early stage. Therefore, these students tend to fall further behind the students of higher income families. It would seem that these students tend to give up, that is, they lose their aspirations. The applicability of these results is not mentioned in this study, but it would seem that these differences may also occur between urban and rural populations.

The conclusions arrived at by Guest[2] lend support to a study by Siemens and Jackson,[3] which deals with the fulfillment of student

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[1]Patricia Cayo Sexton, Education and Income (New York: Viking Press, Inc., 1966).

[2]Harry H. Guest, A Study of Student Withdrawals From Schools in the Winnipeg School Division No. 1 ([Winnipeg, Manitoba]: n.n., 1968).

[3]Leonard B. Siemens and Winston J. E. Jackson, Educational Plans and Their Fulfillment: A Study of Selected High School Students in Manitoba (Winnipeg, Manitoba: The Faculty of Agriculture and Home Economics, University of Manitoba, 1965).

aspirations--the higher the student's aspirations, the greater the chance that the student will fulfill his aspirations. Guest's study found that of the 67% aspiring to go to university, only 39% withdrew. Comparing the four courses offered, we can see that withdrawals increase as aspirations decrease. Withdrawals from the university entrance course were 6.3%, general course dropouts totalled 15.9%, and industrial and commercial courses withdrawals were 24.4% and 26.6% respectively.

As mentioned earlier, the study by Siemens and Jackson supports the conclusions that the higher the aspirations the better the chance of fulfilling one's aspirations. Comparing percentages of fulfillment by various levels it was found that:

of those planning on university entrance	62% enrolled
of those planning on teacher training or nursing	58% enrolled
of those planning on business or technical training	35% enrolled

This study also found other variables related to fulfillment of aspirations. It was found that more Protestants tend to fulfill their aspirations compared to Catholics. The study showed that 53% of the Protestants and 29% of the Catholics fulfilled their plans. It was also found that ethnic origin was a significant factor.[4]

The author suggests four main reasons for non-fulfillment, namely:

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[4]It is interesting to note that socio-economic status was not related to past high school plan fulfillment, although it was significantly related to student aspirations.

1. The student's innate ability--I.Q.[5]

2. The financing of an extended period of training.

3. The motivation of the student.

4. The social acceptance of such training by the student's elders and peers.

One of the reasons for non-fulfillment is student motivation or aspiration. Two studies were completed on Manitoba high school students,[6] one dealing with school-related factors, while the second deals with family-related factors and their effects on, or relationship to, student aspirations.

For the relationship of school-related factors and aspirations, eight variables were tested and the conclusions were:

1. There is a variation between rural and urban youth aspirations, with urban youth having higher aspirations.

2. There is no consistent relationship between aspirations and the distance from the school or the number of schools attended.

3. Generally (except for low S.E.S.[7]), the higher the I.Q., the greater the aspirations.

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[5]For a discussion of I.Q. tests as a measure of innate ability, see a study by Patricia Cayo Sexton, Education and Income (New York: Viking Press Inc., 1966); see also Richard Hernstein, "I.Q.," The Atlantic Monthly, September, 1971, p. 55.

[6]Dennis P. Forcese and Leonard B. Siemens, School-Related Factors and the Aspiration Levels of Manitoba Senior High School Students (Winnipeg, Manitoba: The Faculty of Agriculture and Home Economics, University of Manitoba, 1965); see also Leonard B. Siemens, The Influence of Selected Family Factors on the Educational and Occupational Aspiration Levels of High School Boys and Girls (Winnipeg, Manitoba: The Faculty of Agriculture and Home Economics, University of Manitoba, 1965).

[7]S.E.S. is socio-economic status.

4. High school examination grades were most consistently related to aspiration levels--especially for Grade IX students.

5. For the low S.E.S. group, the more teacher encouragement, the higher the aspiration.

6. For middle and upper S.E.S. groups, the greater the extra-curricular activities, the higher the aspirations.

For the family-related factors, the conclusions were that educational and occupational aspirations for boys and girls are related to the following variables:

1. Socio-economic status of the parents.

2. The occupational status of the father.

3. The level of the father's (and mother's) educational achievement for boys and only the father's educational achievement for girls.

4. The strength of both the father's and mother's encouragement.

It was found that the religious background of the boys influenced aspiration levels, and also that boys in towns with a population less than 500 had higher aspiration levels than those in towns with a population from 500-2500. For girls, the larger the town, the greater the aspiration.

An attempt was made to directly incorporate aspirations as a variable in the analysis. Data were available showing the aspiration level of students in the Interlake Area in 1964 from a study conducted by Siemens.[8] There were two reasons for not completing this specification of the regression equation.

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[8]Siemens, op. cit.

1. The dropout rates for 1964 had to be computed using the Department of Education records. This was to be accomplished by determining whether a student was promoted from the grade he was registered for in the spring term to the next grade in the fall term. This was not an accurate method as it did not account for the students transferring in or out of schools during the summer months.

2. The aspiration of students in the Interlake Area did not include Selkirk in the 1964 study. Selkirk is a significant part of the Interlake Area as delineated for the purpose of the Interlake study, and therefore should be included.

Aspirations are a very important variable in the equation as they represent much of the home environment of the student. As this study uses secondary source data, it is impossible to use aspirations as a variable. For each town the average income of the parents is used as a surrogate.[9]

HYPOTHESES

Income is needed as a variable because it represents much of the attitudes towards school which are derived from the home environment. As was found in Siemen's study, the higher the S.E.S. level the higher the aspiration, so this would indicate that high schools in more affluent towns would tend to have lower dropout rates. Higher S.E.S. people tend to encourage their children to obtain more education and are also financially capable of helping their children to go through school.

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[9] A correlation between the S.E.S. scale and incomes is presented in Appendix A to indicate that income is a surrogate for aspirations.

Therefore, it is hypothesized that the higher the average town income the lower the dropout rates.[10]

It can be argued that the income variable must affect the dropout rates and not vice versa, as a student who drops out of school would not affect his parents' income.[11] If this statement is generalized to the town, the dropouts of a high school cannot increase the average income of the people in the town. Dropping out of school may affect the future income of that student, as well as his children's aspirations, but the relationship cannot be reversed. It is therefore justified to regress dropout rates upon the income variable.

There are three variables used to measure the quality of schools. In all three cases, some type of measure had to be found to represent quality in a numerical sense. For teacher qualifications, the salaries of the teachers were used.[12] Both of the other variables, namely, courses available at the school and extra-curricular activities, are measured using a scale to represent respective amounts of each variable available at high schools. It is hypothesized that the higher the wage, the better the teacher, the more interesting and appealing the subject matter will be, and the more the teacher will likely encourage the

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[10] A student aspiration variable was used in a study carried out by The Economic Council, Design for Decision Making, An Application to Human Resources Policies, Eighth Annual Review (Ottawa: Queen's Printer, 1971), p. 204.

[11] This is assuming that the student who drops out of school does not give his parents his income. Disposable income of parents may change, but not their net income.

[12] Salaries are not an ideal measure, but there is no other available standard. A primary source could be developed by having students and supervisors rate teachers' abilities, but only secondary source data are being used in this study.

student. This raises the aspirations of the student, as was shown in Siemen's study.[13] For the other two quality variables, it is hypothesized that the greater the range of courses offered, the more chance that the student will find a suitable course and will therefore tend to remain in school for a longer time. The same holds true for extra-curricular activities, which should hold the student's interest and make him feel a part of the school atmosphere, which in turn should encourage the student to stay in school.[14]

The fifth variable, the percentage of the high school student population which are of Indian or Metis descent, is used because it is felt that Indian and Metis people tend to have lower aspirations than other nationalities. This is due to the social environment in which they live.[15] It is hypothesized that the higher the percentage of high school students of Indian and Metis descent, the higher the dropout rate.

The size of school, a sixth variable used, is hypothesized to vary inversely with dropout, that is, that the larger the school, the lower the dropout rate. The reason for this is that larger schools have more facilities and it should be easier for a student to find the combination of courses which he prefers.[16]

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[13] Forcese and Siemens, op. cit., pp. 18-19

[14] Similar variables to these three are used in the study by the Economic Council, op. cit., p. 204.

[15] It is felt that this variable is particular to this area and should be included in the analysis.

[16] A study by Jesse Burkehead, Public School Finance, Economics and Politics (Syracuse, New York: Syracuse University Press, 1964), p. 62, uses size as an independent variable. The dependent variable was expenditure per pupil.

The above hypotheses can be summarized in the following table:

TABLE I

SUMMARY OF HYPOTHESES

Variable Number	Variable Name	Hypotheses
x_2	Average town income	The higher the average town income, the lower the dropout rate
x_3	Teacher's average salary by town	The higher the teacher's average salary, the lower the dropout rate
x_4	Courses available	The greater number of course options, the lower the dropout rate
x_5	Extra-curricular activities	The greater the number of extra-curricular activities, the lower the dropout rate
x_6	Percentage of high school students of Indian or Metis descent	The greater the percentage of Indian and Metis students in a high school, the greater the dropout rate
x_7	Size of school	The larger the school, the lower the dropout rate

The algebraic representation can be stated as follows:[17]

$$1)\quad X_1 = b_o - b_1 x_2 - b_2 x_3 - b_3 x_4 - b_4 x_5 + b_5 x_6 - b_6 x_7$$

where X_1 = dropout rates--measured by the number of dropouts divided by the size of the school;

x_2 = average income of each town--measured in dollars;

[17]The source of the data and the method used to compile the data are discussed in Chapter IV.

x_3 = average teacher's salaries--measured in dollars;

x_4 = courses available at each high school--measured using a scale from 0 - 4;

x_5 = extra-curricular activities available at each high school--measured by a scale where each extra-curricular activity is equal to .1;

x_6 = percentage of the high school population who are of Indian or Metis descent--measured in percentage; and

x_7 = size of the high school--measured by the number of students.

INPUT-OUTPUT TABLE[18]

Previous studies have used input-output tables as a tool to measure the effects of expenditures on a defined area.[19] In this study, the input-output table formulated for the Interlake Area[20] of Manitoba is used to determine the effects of educational expenditures on the area. As the formulation[21] of the input-output table is not included in this study, a brief discussion of its features and problems will be presented.

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[18] A discussion of the data may be found in Chapter IV.

[19] H. B. Chenery, "Development Policies for Southern Italy," Regional Analysis, ed. L. Needleman (Great Britain: The Chaucer Press, 1968); see also William H. Miernyk, Impact of the Space Program on a Local Economy (Parsons, West Virginia: McClain Printing Co., 1967).

[20] This table is taken from: James A. MacMillan and Change-Mei Lu, "Regional Development Planning and Evaluation: An Impact Analysis of Manitoba's Interlake Area Development Plan," Research Bulletin (Winnipeg, Manitoba: Department of Agricultural Economics, University of Manitoba, 1971), pp. 42-45.

[21] For the formation and appraisal of input-output models see Hugh O. Nourse, Regional Economics (Toronto: McGraw-Hill, 1968), Ch. 6; see also C. M. Tiebout, "Regional and Interregional Input-Output Models: An Appraisal," Regional Analysis, ed. L. Needleman (Great Britain: The Chaucer Press, 1968), p. 86.

An input-output table is used "to show how the output of each industry is distributed among other industries and sectors of the economy."[22] It also gives the relationship between inputs of various industries. The input-output relationships make up the processing sectors of the table. Along with this part of the table, there are the payment sectors which consist of gross inventory depletion, imports, payments to governments, depreciation allowances and households. There is also the final demand sector, which is autonomous from the rest of the table, and this is the sector in which changes occur which have effects throughout the rest of the table. Changes which occur will have an effect on gross output, which is a measure of the total value of each industry's output.[23]

There are many problems involved in formulating an input-output table. Some of these problems are: (1) the delineation of the industries--which ones should or should not aggregate, and (2) the units of measurement to be used are of three types--the direct and indirect method at producer's prices and the indirect method at purchaser's prices. Each method has its good and bad points.[24] There are also many problems associated with data collection and classification.[25]

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[22]William H. Miernyk, The Elements of Input-Output Analysis (Parsons, West Virginia: Random House Inc., 1965), p. 8.

[23]The reference for this section is Miernyk, ibid., pp. 11-14. Output in the Interlake table is measured in terms of sales.

[24]For further discussion of this point, see Richard Stone, Input-Output and National Accounts (Paris: Organization for Economic Co-operation and Development, 1961), pp. 48-51.

[25]For further discussion of these points see both the aforementioned books by Stone, pp. 33-46, and Miernyk, pp. 8-16.

PRESENT VALUE EQUATIONS[26]

It is hypothesized that if a student remains in school and successfully completes a higher education level, then net benefits measured in terms of future earnings will increase. If it is assumed that the difference in incomes of people at various education levels is extended over the remainder of their working lives, then these future benefits can be measured in terms of their present value.

It is necessary for the benefits to accrue for more than one year to determine their stability. Also, working life tables are not available for the Interlake Area; therefore, it must be assumed that working life tables for the prairie region developed from the 1961 Census are relevant. The present value of the benefits are then measured as follows:[27]

$$2) \qquad PVB_K = B_K \left[\frac{(1 + r)^{N_x} - 1}{r \quad (1 + r)}\right]$$

where PVB_K = the present value of benefits accruing to the k^{th} individual;

B_K = the benefit accruing to the k^{th} individual;

N_x = the mean expectation of the working life of the k^{th} individual of age x;[28] and

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[26] Data needed for the equations are discussed in Chapter IV.

[27] James A. MacMillan, Leo A. Bernat, and John J. Flagler, "Benefits and Costs of Manpower Services in the Interlake Rural Development Area," Research Bulletin (Winnipeg, Manitoba: Department of Agricultural Economics, University of Manitoba), p. 42.

[28] Working life tables are available for the prairie region based on the 1961 Census; see Frank T. Denton and Sylvia Ostry, Working Life Tables for Canadian Males (Ottawa: Queen's Printer, 1969).

r = a selected rate of interest.

To determine the present value of the costs of education, the following formula is used:[29]

$$3) \qquad PVC_K = \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_n}{(1+r)^n}$$

where PVC_K = present value of the costs of the k^{th} individual;

C_n = cost of the individual's education from year 1 to n; and

r = selected rate of interest.

This formula is used because C_K, the cost to the individual, changes over time due to changing opportunity costs as his education progresses. The costs in this model include the opportunity costs[30] of the student, which is measured by the average salary for each grade level[31] and the cost of the individual's education.

Particular assumptions needed for the application of the above model to the benefits and costs of education in the Interlake are:

1. Because social benefits and costs are extremely difficult (if not impossible) to measure, they are assumed to be equal.

2. The benefits and costs to the parents are assumed to be equal.

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[29]David G. Quirin, The Capital Expenditure Decision (Homewood, Illinois: Richard D. Irwin Inc., 1967), p. 6.

[30]This is assuming that a student dropping out of high school will definitely get a job.

[31]This figure is biased downward as the Interlake is a depressed area and wages could be higher if the average wage for Manitoba was used for each level of education attained.

3. It is assumed that the average amount of university training was two years. There are 759 people in the Interlake who have some university education and only 277 who have a degree.[32]

4. It is assumed that the cost of tuition and books is paid by each university student's summer earnings, that is, $500 of costs per year.[33]

5. For the lower income bracket (below $1500) and the upper income bracket (above $9000), average incomes for that bracket stated in The Interlake Fact, Income Data Supplement are assumed to be equal for each education level. For the intermediate brackets, the average of the income bracket is used.[34]

6. To calculate the present value of benefits for Selkirk, the St. Andrew's urban income distribution by education levels is used. The St. Andrew's urban classification includes Selkirk and Winnipeg Beach.[35]

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[32]C. F. Framingham, J. A. MacMillan, and D. J. Sandell, The Interlake Fact, Digest (Winnipeg: Hignell Printing Ltd., 1968), pp. 55-57.

[33]W. Lee Hansen and Burton A. Weisbrod, A New Approach to Higher Education Finance (Madison, Wisconsin: The University of Wisconsin, 1970), p. 14. The $500 figure was arbitrarily chosen.

[34]Taken from C. F. Framingham, J. A. MacMillan, and D. J. Sandell, The Interlake Fact, Income Data Supplement (Winnipeg: Hignell Printing Ltd., 1968), p. 2.

[35]Ibid., p. 32. The reason for using Selkirk is to compare the net benefits for the average of the Interlake Area and the higher income urban center in the Interlake Area.

CHAPTER IV

THE DATA

Chapter IV discusses the data collection and techniques for each of the three methods of analysis used in the model.

REGRESSION DATA[1]

The data described in this chapter consists of the data necessary for the derivation of the regression equation, the method of analyzing the area's education expenditures for use in the input-output table, and the data necessary to calculate the present-value of benefits and costs attributable to higher levels of education.

There are fourteen high schools located throughout the Interlake Area. Data for the Gypsumville High School were not available, therefore, there are thirteen observations for each variable in the regression equation. The regression equation consists of one dependent and six independent variables which have previously been identified. Each of the seven variables will be discussed with regards to its source and its method of computation.

Variable X_1 (dropout rate) was obtained from the Department of Education who had compiled tables which included dropouts from all

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[1]Table VII in Appendix B has all the regression data tabulated. Also, scatter diagrams for each variable are in Figure 2 to Figure 7.

schools in Manitoba.[2] The table classified dropouts[3] by school and grade and dropouts were extracted for Grades IX to XII inclusive. The total number of dropouts was divided by the school size to obtain the dropout rate.

The data source for variable x_2 (average town income) was The Interlake Fact, Digest.[4] For each town, the rural farm, rural non-farm and urban categories were used to obtain a weighted income figure which represents not only the urban community, but the rural area as well, because students come from both the urban and rural areas. In instances where towns have a high school, but where the town was not sufficiently large to be classified as an urban community, the weighted averages of the rural farm and rural non-farm categories were used.

Variable x_3 (teacher's average salary by town) was obtained from the Department of Education records of teacher's salaries for 1968-69. The teacher's salaries of each high school were extracted from the records, summed, and divided by the total number of teachers to obtain the teacher's average salary.

The fourth variable, x_4 (courses available at each high school), was obtained by telephoning each high school principal and inquiring about the curriculum offered at that high school. To measure the rela-

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[2]Tables compiled by the Department of Education, Table V, School Dropouts by School, and Grade, Manitoba. September 1, 1968-June 30, 1969.

[3]Ibid., Dropouts are defined as "...any individual who being reported in a prescribed program of studies in a Manitoba school in September, 1968, terminates his schooling without completing the required work. This definition excludes individuals who cannot continue because of physical injury, illness or death."

[4]C. F. Framingham, J. A. MacMillan, and D. J. Sandell, The Interlake Fact, Digest (Winnipeg: Hignell Printing Ltd., 1968).

tive differences between high schools, an arbitrary scale was used. The number zero was assigned to any high school that taught only the university entrance courses. If the high school taught one of the available course options it received the number one. If the high school taught two options, then it received the number two, etc. The five available alternatives were: the general course, the commercial course, the industrial course, the vocational course, and the university entrance course.

To get variable x_5 (extra-curricular activities available at each high school), each principal was asked for a list of the extra-curricular activities available at the high school. Each activity was arbitrarily assigned the number of .1. For example, a school with four extra-curricular activities would have a value of .4 assigned for that observation.

Variable x_6 (percentage of the high school population who are of Indian or Metis descent) was obtained by asking each principal the approximate number of students in that high school who are of Indian or Metis descent. This number was divided by the total size of the high school and multiplied by 100 to obtain the percent of Indian and Metis students in that high school.

The data source for variable x_7 (size of the high school) was the Department of Education records. A simple addition of the enrolments of Grade IX to Grade XII inclusive for each high school yielded the necessary figure.

INPUT-OUTPUT DATA

The government final demand sector contains expenditures made by the education sector. To determine the effects of educational expendi-

tures on the Interlake Area, the education expenditures must be separated from the rest of the government expenditures.

To obtain this data, each school division office was surveyed to obtain the expenditures for the calendar year 1968. The data available at the school division office includes expenditures made outside the Interlake Area. To separate these expenditures from those made in the Interlake Area, each secretary-treasurer was asked to give an estimate of the amount which was spent in the area. This same procedure was used for each school division in the Interlake.[5]

Each expenditure was classified into one of the seventeen industrial sectors or the household sector.[6] The expenditures for each sector were summed over all the school divisions to obtain the final demand vector of educational expenditures.[7]

PRESENT VALUE EQUATIONS

To calculate the present value of benefits attributable to education, several variables must be calculated to solve the present

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[5]One school division, White Horse Plains, was not totally inside the Interlake Area. To estimate the amount spent in the Interlake, the above method of obtaining expenditures was used, then a ratio of the number of students in the Interlake Area attending schools in the White Horse Plains School Division was divided by the total number of students in the White Horse Plains School Division. This ratio was applied to each industrial sector.

[6]It is assumed that the teachers live in the Interlake Area and spend their wages there.

[7]See Table VIII, Appendix B.

value equation. These variables are:

B_K = the benefit accruing to the k^{th} individual.

n_x = the mean expectation of the working life of the k^{th} individual of age x.

To calculate B_K, the mean salary was calculated for persons with the education levels Grades 7-8, 9-10, 11-12, technical vocation, and university. Two B_K's were calculated, one for the Interlake and one for Selkirk. The necessary data were extracted from The Interlake Fact, Income Data Supplement.[8]

To calculate the mean income the number of households in each "Household Income Distribution" section was multiplied by the median income of each section. These products were summed for each education level, then divided by the total number of households in each respective education level.

The other variable which needs to be calculated to solve the equation is n_x. To solve n_x, the approximate age of students at each education level was estimated, then working life tables were used to obtain the mean expected working life of the individual. Substituting these two variables into the equation along with a selected rate of interest determined the present value of benefits.

For determining the present value of costs, the same rate of interest as above was used and the only other variable required was the opportunity cost of the student, C_K. The opportunity cost used was the average income of the Interlake or Selkirk for the education level below

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[8] Framingham, MacMillan, and Sandell, op. cit., Table 21C, p. 2, for the B_K pertaining to the Interlake region, and Table 21C, p. 32, for the B_K pertaining to Selkirk.

the one being calculated. For example, the opportunity cost of a student at the education level 11-12 would be the benefits of the education level 9-10. Substituting the cost and the interest rate into the equation yields the present value of costs. To obtain net benefits, the present value of costs are subtracted from the present value of benefits.

The data which has been discussed will be used to quantify the three methods of analysis being used in the model.

CHAPTER V

EMPIRICAL RESULTS

In the previous chapters the model has been discussed, and the data needed to quantify it has been presented. In this chapter the empirical results are presented and discussed.

REGRESSION EQUATION

Regression results for the first equation showed that all regression coefficients were not statistically significant at the 5 per cent level, that is, the null hypothesis that the beta values are equal to zero could not be refuted. The reason for this occurence was that the Selkirk observation had a corresponding higher dropout rate than expected and, therefore, tended to result in large error terms which would give a poor fit to the regression line. Selkirk was therefore dropped from the sample. It is an urban centre of 10,000 people, which is much larger than the next largest town. It was thought that due to the size of its high school (1,256 students), students may tend to drop out in greater numbers because of the loss of identity associated with a larger school.

The St. Laurent observation has one variable which gives the equation much variance. The percentage of Indian and Metis students in the high school was 50 percent, while the next largest percentage was 10 percent. St. Laurent also had to be dropped.

A second regression equation was run with Selkirk and St. Laurent omitted, thereby reducing the number of observations to eleven. The result of this equation is:[1]

$$4) \quad X_1 = \underset{}{.326890} - \underset{(.165061)}{.000011x_2} - \underset{(.000016)}{.000015x_3} - \underset{(.000016)}{.031695x_4}^{*} - \underset{(.011481)}{.041893x_5} - \underset{(.023095)}{.798329x_6}^{*} + \underset{(.301398)}{.000228x_7}^{*} \qquad R^2 = .904$$
$$(.000110)$$

The hypotheses for variables x_2 (average town income) and x_3 (teacher's average salary by town) are not supported. For variables x_4 (courses available) and x_5 (extra-curricular activities), the hypotheses are supported at the 5 percent and 10 percent levels, respectively. For variables x_6 (percentage of high school population of Indian or Metis descent) and x_7 (size of school), the hypotheses are not supported, because both variables have the wrong sign. The constant in the equation, which represents the value of the dependent variable adjusted for all the independent variables was not significant.

As mentioned above, the size of school may affect the dropout rate in a positive way; therefore, the hypothesis could be that size of school and dropout rates are related in a positive way. Variable x_6 (percentage of high school population of Indian or Metis descent) also did not have the hypothesized sign. This was not too surprising as it is very difficult for a principal to determine which of his students are of Indian and Metis descent. It was pointed out by several principals

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[1] Level of significance (one-tailed t-test); *--5% and **--1%. The bracketed numbers below the regression coefficients are the standard errors of the regression coefficients.

that the Indian and Metis students in the high school do not usually drop out, as most of them who are going to drop out have done so by the time they reach high school. The hypothesis is likely incorrect; the greater the percentage of Indian and Metis students in the high school the lower the dropout rate.

The correlation coefficient between variables x_2 (average town income) and x_3 (teacher's average salary by town) has a value of .78. The level of correlation at which multicollinearity becomes a problem is not known, because the magnitude of biases created by multicollinearity is not known. Farrar and Blauber state that ". . . An admittedly arbitrary rule of thumb is established to constrain simple correlations between explanatory variables to be smaller than, say r = .8 or .9."[2] If this arbitrary rule of thumb is applied to the analysis in this study, then multicollinearity in this instance is not a problem.

Multicollinearity in regression equations varies with the sample size.[3] Examining the results of this study in the light of the above statement, it can be argued that the high multicollinearity between the variables may be due to the size of the sample.

Christ also states that multicollinearity is not a problem if the use of the regression equation is for forecasting purposes.[4] This

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[2]Donald E. Farrar and Robert R. Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," Reading in Econometric Theory, eds. J. M. Dowling and F. R. Glahe (Boulder, Colorado: Colorado Associated University Press, 1970), p. 208.

[3]Carl F. Christ, Econometric Models and Methods (New York: John Wiley and Sons Inc., 1967), p. 389.

[4]Ibid., p. 389.

is true if it is assumed that the relationship existing between the two variables stays the same for the forecasting period.[5]

It was stated in the opening paragraph of the thesis that the purpose of the study was to give policymakers some insight into the areas of education where expenditures would be the most productive. This implies that the model is explanatory, suggesting in turn that multicollinearity is not desirable. As there is no way of quantifying the effects of multicollinearity except by trial and error, an alternate form of the regression is used to determine the effects that multicollinearity has on equation 4. When x_2 (average town income) is deleted, the result of the equation is:

$$5) \quad X_1 = \underset{(.090136)}{.320520^*} - \underset{(.000010)}{.000024x_3^*} - \underset{(.010081)}{.028616x_4^*} - \underset{(.018304)}{.032909x_5} - \underset{(.212832)}{.655841x_6^*}$$

$$+ \underset{(.000087)}{.000185x_7^*} \qquad R^2 = .892$$

Variables x_3 (teacher's average salary by town), x_4 (courses available), x_6 (percentage of the high school population of Indian or Metis descent) and x_7 (size of school) were all significant at the 5 percent level. Variable x_5 (extra-curricular activities available) was significant at the 10 percent level. The constant was significant at the 5 percent level.

When x_3 (teacher's average salary by town) is deleted, the result of the equation is:

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[5]Table XII, Appendix E, contains correlation coefficients for the variables used in the regression equation.

$$6) \quad X_1 = \underset{(.072023)}{.296824^{**}} - \underset{(.000010)}{.000022x_2^{*}} - \underset{(.009312)}{.037427x_4^{**}} - \underset{(.018469)}{.053773x_5^{*}}$$

$$- \underset{(.250675)}{.940102x_6^{**}} + \underset{(.000099)}{.000268x_7^{*}} \qquad R^2 = .885$$

Variables x_2 (average town income), x_5 (extra-curricular activities) and x_7 (size of school) are significant at the 5 percent level. Variables x_4 (courses available) and x_6 (percentage of the high school population of Indian or Metis descent) were significant at the 1 percent level. The constant was also significant at the 1 percent level.

It can be argued that the correlation of .78 was sufficiently large in this instance to substantially bias the value of the t-values of variables x_2 (average town income) and x_3 (teacher's average salary). Equation 6, had higher t-values, therefore it would be the better explanatory equation.

The usefulness of the regression results is that it gives the direction that policymakers should pursue if their goal is to lower student dropout rates. The effects that this type of expenditure can have on an area is measured by means of an input-output table.

INPUT-OUTPUT TABLE

Input-output analysis is used to determine the effects on area sales, incomes and employment created by any given expenditure. The expenditures include only current expenditures. In this study, the educational expenditures of the Interlake are examined for the calendar year 1968. These expenditures in the Interlake Area total approximately

$5,056,000.[6] Salaries consist of $4,594,000[7] of this amount, which is approximately 90 percent of the total educational expenditures. Salaries thus form the most important aspect of educational expenditures. To determine the effects of these expenditures, the education vector is multiplied by the interdependence coefficient matrix. The result of this multiplication gives the effects in terms of sales on each of the seventeen industrial sectors, as well as the effects on incomes in the area.[8] The aggregate effect on sales and incomes has been to increase them to $8,892,340 from an original $5,056,000.

These increased sales and incomes have imposed a demand upon the system which will create jobs. To determine the number of jobs created by the educational expenditures, the education vector[9] is multiplied by interdependence coefficient matrix which has been multiplied by the direct employment coefficient vector.[10] The result of the multiplication will yield the number of jobs created in each industrial sector.[11] When summed the results will yield the total number of jobs created by the educational expenditures. The total number of additional jobs induced is 98.986, or approximately 99 jobs.

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[6] See Column 1, Table IX, Appendix C.

[7] This figure is the total of the salaries paid to 59 principals, 536 full-time teachers, 10 part-time teachers, 4 superintendents and several other full and part-time administrative and custodian staff, as well as school bus drivers.

[8] These results are seen in Column 19, Table IX, Appendix C.

[9] See Column 1, Table XI, Appendix C.

[10] See Columns 2 to 18 inclusive in Table XI, Appendix C. The direct employment coefficient vector is from Table X, Appendix C.

[11] See Column 19, Table XI, Appendix C.

The effects of educational expenditures on area sales, income and employment can be compared to other types of expenditures as listed in Table II.

The purpose of this table is to illustrate the important ramification attributable to changes in a given expenditure category. It can be used to compare the effects of equal amounts of expenditures by two categories. For example, education and sales to travellers both involve approximately the same amount of expenditure. The education expenditure has a larger multiplier effect (a ratio of 1:1.14). Both expenditure categories generate approximately the same amount of agriculture sales and income (a ratio of 1:1.06). However, in terms of total area income generated, sales to travellers substantially exceed that of education (a ratio of 1:2.35), whereas the opposite is the case for agriculture income (a ratio of 1:10.6). In terms of non-agricultural jobs created, sales to travellers more than doubles the education expenditure category (a ratio of 1:2.44). The conclusion which follows from the analysis of these figures is that sales to travellers create better opportunities for the non-agricultural sectors, while education has a proportionately larger effect on the agricultural sector.

The usefulness of this analysis is in terms of policy decisions. Governments can use this type of analysis to determine where expenditures should be made to stimulate various sectors. If we use the example from above, and if the policy was to stimulate non-agricultural sectors, then the choice between sales to travellers and sales to education would be the former. Other expenditure categories could be included in the comparison by increasing their expenditures to the same level as the other expenditure category being compared.

TABLE II

SUMMARY OF SALES, INCOME AND JOB IMPACTS IN THE INTERLAKE AREA ECONOMY BY EXPENDITURE CATEGORIES IN 1968

Expenditure Category	Expend. Level	Total Area Sales & Income Generated	Agr. Sales Income Generated	Total Area Income Generated	Agr. Income	No. of Non-Agr. Jobs Created
	. . . . .		millions of dollars		. . . . .	
FRED	2.4	2.9	0.160	1.586	.045	34
Sales to Travellers	5.2	7.8	0.157	1.336	.044	220
Exports by Agr. Livestock	1.0	1.9	1.073	0.353	0.795	11
Agr. Crops	1.0	1.9	1.042	0.381	0.313	12
Mining	1.0	1.6	0.010	0.323	0.003	48
Food and Bev. Manufacturing	1.0	2.5	0.724	0.384	0.200	33
Other Manufacturing	1.0	1.6	0.010	0.325	0.003	59
Air Base Closure	2.3	2.9	0.039	0.345	0.011	256
Education[a]	5.1	8.9	0.167	0.568	0.467	99

[a]This row of numbers is obtained by extracting and/or manipulating the area input-output coefficient table and the employment table (Table IX and Table X respectively). This row has been included in the table for purposes of comparison.

Source:

James A. MacMillan and Chang-mei Lu, "Regional Development Planning and Evaluation: An Impact Analysis of Manitoba's Interlake Area Development Plan," Research Bulletin (Winnipeg, Manitoba: Department of Agricultural Economics, University of Manitoba), p. 5.

In conclusion, input-output analysis of this type can be used by the policymaker to decide a priori the effects which will occur in various sectors if certain expenditure categories are stimulated.

PRESENT VALUE EQUATIONS

Based on the assumption in Chapter III, the effect on student's earnings attributable to higher levels of education can be determined by calculating the net benefits of increased amounts of education.[12] To do this, the present value of benefits and costs are calculated, then subtracted to determine net benefits. The net benefits for both Selkirk and the Interlake Area are calculated.

The present value of benefits for Selkirk and the Interlake are presented in Table III.

TABLE III

CHANGES IN INCOME, AND PRESENT VALUE OF THESE CHANGES FOR THE INTERLAKE AND SELKIRK

	Change in Income (Benefits)		Present Value of Benefits	
	Interlake	Selkirk	Interlake	Selkirk
Grades 7-8 to 9-10	$1,476/yr	$ 4,074/yr	$23,040	$ 63,595
Grades 7-8 to 11-12	$3,045/yr	$ 7,130/yr	$47,076	$110,230
Grades 7-8 to University	$5,524/yr	$12,206/yr	$83,965	$185,531

Source:

Charles F. Framingham, James A. MacMillan, and David J. Sandell, The Interlake Fact, Income Data Supplement (Winnipeg, Manitoba: Hignell Printing Ltd., 1970), pp. 2 and 32.

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[11] The benefits and cost of taking technical vocational training cannot be measured due to data problems.

The present value of the costs associated with increased amounts of education are:

TABLE IV

PRESENT VALUE OF COST OF INCREASED EDUCATION

	Present Value of Costs	
	Interlake	Selkirk
Grades 7-8 to 9-10	0*	0*
Grades 7-8 to 11-12	$14,099	$23,721
Grades 7-8 to University	$36,589	$62,683

*As the minimum age of a child leaving school is sixteen, most student's cost of achieving Grades 9 or 10 will be zero, as their opportunity cost in terms of employment is near zero.

Source:

Charles F. Framingham, James A. MacMillan, and David J. Sandell, The Interlake Fact, Income Data Supplement (Winnipeg, Manitoba: Hignell Printing Ltd., 1970), pp. 2-32.

The net benefits are shown in Table V.

Tentative conclusions can be drawn from this analysis, but the assumptions made in Chapter III must be kept in mind. Greater benefits are achieved if employment is in a larger center such as Selkirk. The net benefits of increased amounts of education rise as educational levels rise, with one exception. The net benefits attributable to obtaining technical vocational education decreased from the net benefits of obtaining Grade XII. This indicates that technical vocation is not a very desirable type of education in comparison to attaining a university degree or even completing Grade XII.

The results of the three methods of analysis indicate the type of variables that affect dropout rates, the effect of education on area sales, income and employment, and the net benefits of increased amounts of education.

TABLE V

NET BENEFITS OF INCREASED EDUCATION

	Present Value of Benefits		Present Value of Costs		Net Benefits	
	Interlake	Selkirk	Interlake	Selkirk	Interlake	Selkirk
Grades 7-8 to 9-10	$23,040	$ 63,595	0	0	$23,040	$ 63,595
Grades 708 to 11-12	$47,076	$110,230	$14,099	$23,721	$32,977	$ 86,509
Grades 7-8 to University	$83,965	$185,531	$36,589	$62,683	$47,376	$122,848

CHAPTER VI

LIMITATIONS AND FURTHER RESEARCH

The statistical analysis has two limitations:[1] the sample size, and the data availability.

The study deals with the Interlake Area of Manitoba, therefore only high schools located in the defined area were used as observations. This was a total of fourteen high schools, but data for the Gypsumville High School was not available, and the Selkirk observation was removed from the sample as was the St. Laurent observation. The reason for dropping these observations were stated in Chapter V. This left the analysis with only eleven observations. As there were six independent variables in the regression equation, this left only four degrees of freedom for testing the results. Generally, a large number of degrees of freedom is preferable, but this was not possible because of the area under study.

The second limitation of the statistical analysis is the data. All data used, except the data for the income variable, were from secondary sources. The income variable was obtained from The Interlake Fact, but all other variables were obtained either from the Department of Education or from the appropriate high school. All the variables could be more accurately measured using a survey technique, but this was impossible due to time and money constraints.

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[1]The analysis is conducted on the assumption that the institutional system is the best one.

The limitations of input-output analysis can be found in the books by Miernyk or Stone which are footnoted in Chapter III. The data used for the education vector in the input-output table was obtained by separating each Interlake school division's expenditures into expenditures made in the Interlake Area and those made outside the area. To obtain this breakdown, the secretary-treasurer of each school division in the Interlake Area was consulted. This breakdown of expenditures between the Interlake and other areas could also have been obtained by examining each expenditure made by the school division in 1968, but again, due to time and money constraints, this was impossible.

The analysis of net benefits should include the benefits and costs incurred by all levels of society. It was mentioned in Chapter III, that benefits and cost of education at the general society level and at the family level are very difficult to measure. For this analysis the net benefits were calculated from an individual's point of view. The analysis would be more complete if the net benefits were also calculated for the other levels.

There were also serious limitations in the data used to calculate the equations. To calculate benefits, the assumption pertaining to all income brackets would lead to bias the benefits upward for low income people, and downwards for high income people. This assumption reduced the range of the benefits calculated.

A second limitation in calculating benefits was that no differentiation was available from the data source between people having a university degree or just some university training. This would tend to bias university income downwards. Further research into the measurement

of social benefits and costs is needed before true net benefits can be calculated.

The field of educational economics is a relatively new area of study. With reference to the present study several areas could use further research. One area for research would include a proper method to measure quality variables. A second area would be to test the model to determine its generality. If the model is general, then it can be used to predict the effects of educational expenditures on dropout rates with increased educational expenditures. A third area would be to determine the limit to which the significant variables will affect dropout rates. For example, teacher's salaries could not be increased without limit to reduce dropout rates to nil. At some point, increasing teacher's salaries will not likely affect dropout rates. This type of limit should be known before large amounts of money are spent for any one variable which affects dropout rates.

In terms of the broader issue, further research is needed to define an appropriate measure of educational productivity. Such a measure is essential to determine the total amount of money which should be spent for the education of people. Another area for research would be to determine the optimal school size considering costs, as well as dropout rates. In this instance, dropout rates would be a measure of the benefits.

Interdisciplinary research would also be helpful. The book Disadvantaged Children[2] discusses the relationship between health,

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[2]Herbert E. Birch and Joan Dye Gussow, Disadvantaged Children, Health, Nutrition and School Failure (New York: Harcourt, Brace and World Inc., 1970).

nutrition and school failure. Research in the area of dropouts could try to weight the dropouts of various communities in such a way that the disadvantages of children in improvished areas are accounted for. If it is found that health and nutrition are significant factors in accounting for dropouts then this would have some policy implication.

This chapter has discussed some basic limitations of the study. It also mentions areas in which further research could be continued.

CHAPTER VII

APPLICABILITY TO NORTHERN COMMUNITIES

A more fundamental question than the applicability of the regression equation to northern communities is whether the conceptual aspect of the regression equation is generally applicable. To determine the generality of the equation, data must be collected for the fine independent variables in the equation. Substituting a new set of data into the equation will determine whether the original variables have the same explanatory power as they previously had. If the same variables are significant then it is concluded that the regression equation is general.

The implication of such a conclusion is that equation 6 can be used to explain dropout rates in any location which has similar educational characteristics, i.e., this particular equation may apply to Canada, but may not apply to a country such as the U.S.S.R. The reason is that the U.S.S.R. and Canada may have different social and cultural factors affecting school attendance. This equation can also be used for forecasting purposes.[1] The effects on dropout rates due to changes in any of the five independent variables can be determined. This type of analysis can be useful to policymakers if they desire to attain a given

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[1]The loss of forecasting ability between equation 4 and equation 6 is very small.

dropout rate. As mentioned in the previous chapter, the amount of sensitivity of each variable must be determined, because at some point increased educational expenditures may no longer affect the dropout rate.

CHAPTER VIII

CONCLUSIONS

The objective of this study was to analyze three relationships and thereby establish a viable framework for determining the role of education in area economic development. The limitations of the study are discussed in Chapter VI.

The first problem was to determine which independent variable(s) (which included average town income, teacher's average salary by town, courses available, extra-curricular activities, percentage of the high school population of Indian or Metis descent, and school size) best explain(s) dropout rates. This was accomplished by collecting the necessary data and using regression equation 6 to determine the results. Variables x_4 (courses available), x_6 (percentage of the high school population of Indian or Metis descent) and the constant were significant at the 1 percent level. Variables x_2 (average town income), x_5 (extra-curricular activities available) and x_7 (size of school) were significant at the 5 percent level.

Examining the results in terms of elasticities[1] it is determined that variable x_2 (average town income) has the highest elasticity, and therefore the greatest effect on dropout rates. An increase of 1 percent in average town income will decrease dropout rates by 1.9 percent. The

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[1]For a summary of the elasticities for equation 6, see Table XIII, Appendix E.

other variables which have negative elasticities are: x_5 (extra-curricular activities), x_6 (percentage of the high school population of Indian or Metis descent) and x_4 (courses available). Variable x_7 (school size) has the effect of increasing dropout rates as school size increases.

The implication of these conclusions is that policymakers should concentrate on increasing average town income to attain the greatest reduction on dropout rates. However, the policymaker must determine the effects of each variable in terms of the costs of implementation. It is possible that some effects on dropout rates may be attained by better use of present resources without increasing costs. The weighting of each variable for policy purposes must ultimately be made by the policymaker.

The second problem was to determine the effects on sales and incomes of expenditures in the education sector. This was achieved by determining the 1968 educational expenditures for the Interlake Area. These expenditures were multiplied by the inverse of the Interlake input-output table. The effect was to create $3,267,907 of area sales and $568,437 of area income. This represents a total of $3,836,344 of area sales and incomes generated from an educational expenditure of $5,055,996.

It was possible to determine the number of jobs created by expenditures in the education sector. The total jobs induced were approximately 99. If we assume that the coefficients remain constant over time, the impact of any future educational expenditures in the area can be determined by using the input-output table.

The third problem was to determine the net benefits of higher levels of education. This was accomplished by determining the present

value of costs and the present value of benefits associated with increased amounts of education. Due to the assumptions and the limitations of the data, conclusions from this particular analysis on a society level would be impossible. For an individual the net benefits of continued education were quite significant. For example, the net benefit for the average Interlake town for a Grade XII education was $32,977 while for a university education it was $47,376. There were greater net benefits received in Selkirk as opposed to the average Interlake town. For example, the net benefits available to a student having a university degree in Selkirk was $122,848 while the Interlake average was $47,376.

What general conclusion can be drawn with respect to the broad issue stated in the opening paragraph of the study? Although the study does not attempt to answer the question of how much money should be spent for education, it does point out the direction in which educational expenditures should be made. The conclusion is that certain quality variables are significant for decreasing the dropout rates of high school students, and this is one area of education where money could be spent. How much should be spent is another question which has yet to be answered.

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APPENDIX A

CORRELATION CALCULATION

Some logical basis must be determined to justify the use of average town income as a surrogate variable for student aspiration. Siemens,[1] in his study of family related factors, concluded that educational aspiration of students was correlated with the S.E.S. levels of the parents. If income and S.E.S. levels are correlated, then it follows that parental income can be used as a substitute for student aspiration.

A selective sampling technique, with every third average income taken from Podoluk's book,[2] is used to obtain the average income observations. The respective Blishen S.E.S. levels[3] are correlated with the average income figures.[4] These two sets of observations form the necessary data to determine a correlation coefficient.[5]

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[1]Leonard B. Siemens, The Influence of Selected Family Factors on the Educational and Occupational Aspiration Levels of High School Boys and Girls (Winnipeg, Manitoba: The Faculty of Agriculture and Home Economics, University of Manitoba, 1965).

[2]Jenny Podoluk, Incomes of Canadians, D.B.S. Cat. No. 99544 (Ottawa: Queen's Printer, 1968).

[3]Bernard R. Blishen, "The Construction and Use of an Occupational Class Scale," Canadian Society: Sociological Perspective, eds. Bernard R. Blishen et al (Glencoe, Illinois: The Free Press, 1961).

[4]It is assumed that the relative position of occupational classes has not changed significantly from 1951 to 1961, as Blishen's S.E.S. levels are for 1951 while Podoluk's average income figures are for 1961.

[5]John E. Freund, Modern Elementary Statistics (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1967), p. 355.

7) $$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2}\sqrt{n(\Sigma y^2) - (\Sigma y)^2}}$$

where n = number of observations;

x = the sample of income figures taken from the book Incomes of Canadians; and

y = Blishen's S.E.S. scale.

The numeral values of the above expressions are:

$n = 38.$

$x = 186,857.0$

$y = 2,035.4$

$xy = 11,361,895.0$

$x^2 = 1,201,790,433$

$y^2 = 115,983$

Solving the equation:

$$r = \frac{38\,(11,361,895) - (186,857 \times 2,035.4)}{\sqrt{38\,(1,201,790,433) - 34,915,538,449}\ \sqrt{38\,(115,983) - 4,141,225}}$$

$$r = \frac{431,752,010 - 380,328,737}{\sqrt{45,668,036,454 - 34,915,538,449}\ \sqrt{4,407,354 - 4,141,228}}$$

$$r = \frac{51,153,286}{\sqrt{10,752,498,005}\ \sqrt{265,069}}$$

$$r = \frac{51,153,286}{103,700 \times 515}$$

$$r = \frac{51,153,286}{53,405,500}$$

$$r = .958$$

This figure was tested and found to be significant at the 1 percent level.

TABLE VI

CORRELATION DATA

Occupation	Class.	Average Income[a]	Blishen S.E.S. Level[b]
Judges and Magistrates	1	11,555	90.0
Optometrists	1	9.150	81.2
Architects	1	8,880	73.2
Veterinarians	2	8,577	69.8
Osteopaths and Chiropractors	2	8,285	62.2
Sales Managers	2	7,890	63.5
Civil Engineers	1	7,634	75.0
Mechanical Engineers	2	7,517	72.6
Owners and Managers in Furniture and Fixture Industry	2	7,321	63.0
Pharmacists	2	7,127	64.0
Accountants and Auditors	2	6,961	61.8
Owners and Man. in Provincial Administration	2	6,567	60.6
Security Salesmen & Brokers	3	6,382	56.0
Owners & Man. in Federal Admin.	2	6,250	60.6
Owners and Man. in All Other Industries	2	6.181	57.7
Locomotive Engineers	3	6,088	54.0
Purchasing Agents and Buyers	3	5,863	54.8
Foremen, Paper & Allied Indus.	4	5,778	51.8
Credit Managers	2	5,716	57.7
Commercial Travellers	3	5,576	56.7
Painters, Paperhangers and Glaziers (Const. & Mtce.)	6	2,943	44.4

TABLE VI (continued)

Occupation	Class.	Average Income	Blishen S.E.S. Level
Hawkers and Pedlars	7	2,854	39.3
Nursing Ass't. and Aides	6	2,821	45.0
Fruit & Veg. Canners & Packers	6	2,813	43.4
Lawyers	7	2,779	41.2
Launderers & Dry Cleaners	6	2,745	42.4
Religious Workers	5	2,695	48.0
Bottlers, Wrappers, Labellers	6	2,666	45.0
Janitors	7	2,621	41.6
Shoemakers	7	2,540	40.2
Winders and Reelers	6	2,470	42.8
Forest Rangers	6	2,415	42.3
Laborers in Wood Industry	7	2,161	37.4
Teamsters	6	2,064	43.4
Messengers	7	1,822	40.2
Fish Canners	7	1,606	36.0
Attendants	7	1,141	37.8
Baby Sitters	7	453	38.8
Total		186,857	2035.4

[a]Jenny Podoluk, Incomes of Canadians, D.B.S., Cat. No. 99544 (Ottawa: Queen's Printer, 1968).

[b]Bernard R. Blishen, "The Construction and Use of an Occupational Class Scale," Canadian Society; Sociological Perspective, eds. Bernard R. Blishen et al (Glencoe, Illinois: The Free Press, 1961).

APPENDIX B

DATA FOR REGRESSION AND INPUT-OUTPUT ANALYSES

TABLE VII

REGRESSION DATA

	D.O.R. X_1[a]	Average Town Income x_2[a]	Teachers' Salaries x_3[a]	Courses Available x_4[a]	Extra Curricular Activities[b] x_5[a]	Percentage of High School Population of Indian or Metis Descent x_6[a]	Size of School x_7[a]
Selkirk	.0732	9352	8079	3	3.8	.1000	1256
St. Laurent	.0847	3979	7560	1	1.0	.5000	118
Stonewall	.0345	6698	8530	2	2.5	.0435	464
Teulon	.0383	6505	8395	2	1.5	.0500	313
Warren	.0136	6324	9225	2	1.9	.0000	220
Arborg	.0435	5435	7455	3	1.1	.0250	161
Gimli	.0417	5783	8310	3	1.5	.0777	503
Riverton	.0205	5527	7940	1	.9	.1000	146
Ashern	.1413	5156	5865	0	1.0	.0100	92
Eriksdale	.1028	5998	7590	0	.8	.0727	107
Fisher Branch	.0413	4662	6960	1	1.1	.1041	242
Lundar	.0680	3430	6580	0	1.8	.1000	103
Moosehorn	.1428	4018	6530	0	1.0	.0500	119
Averages (13 observations)	.068	5605	7617	1.38	1.50	.0948	295
Averages (11 observations excluding Selkirk and St. Laurent)	.063	5412	7580	1.27	1.40	.0575	225

[a]Definitions:

X_1 = dropout rate is calculated by dividing the school size by the number of dropouts per school.

x_2 = average town income is calculated by weighting the urban, rural non-farm and rural farm incomes by the number of households in each category.

x_3 = teacher's average salary by town is calculated by summing all teacher's salaries for the given town, then dividing by the number of teachers.

x_4 = courses available is obtained from information supplied by the principals of each high school.

x_5 = extra-curricular activities available is obtained from information supplied by the principal of each high school.

x_6 = percentage of the high school population of Indian or Metis descent is obtained from information supplied by the principal of each high school.

x_7 = school size is available from the Department of Education records.

[b]List of extra-curricular activities for each high school:

Selkirk	St. Laurent	Stonewall
Art Club	Basketball	Botany Club
Audio-Visual Club	Volleyball	Library Club
Badminton Club	Soccer	Art Club
Band	Track and Field	Chess Club
Basketball	Yearbook	Film Club
Botany Club	Football	Gymnastics
Bowling	Newspaper	Choir
Centennial Club	Dances	Dances
Dances and Games	Curling	Ping Pong
Chess Club	Science Club	Track and Field
Choir		Judo
Curling Club		Drama Club
Drama Club		Tennis
Echo-newspaper		French Club
Explorer's Club		Field Hockey
Field Hockey Girls		Badminton
Film Club		Science Club
French Club		Curling
Gymnastics Club		Hockey
Judo		Basketball
Library		Volleyball
Pep Club		Soccer
Ping Pong		Football
		Yearbook
		Newspaper

Selkirk
(continued)

Publicity
Public Speaking
Reach For The Top Team
Rythmics
Science Club
Soccer
Social Committee (Advisor)
Stage Crew
Stamp Club
Tennis
Track and Cross-Country
Volleyball
Weight Training Club
Wrestling
Yearbook

Tuelon

Science Club
Drama Club
Newspaper
Yearbook
Football
Basketball
Fastball
Curling
Hockey
Field Hockey
Badminton
Volleyball
Judo
Soccer
Track and Field

Warren

Art Club
Science Club
Chess Club
Film Club
Drama Club
French Club
Newspaper
Yearbook
Volleyball
Basketball
Fastball
Hockey
Field Hockey
Track and Field
Soccer
Badminton
Ping Pong
Gymnastics
Wrestling

Arborg

Basketball
Volleyball
Soccer
Badminton
Track and Field
Yearbook
Drama Club
Curling
Newspaper
Hockey
Football

Gimli

Newspaper
Yearbook
Volleyball
Basketball
Track and Field
Hockey
Curling
Science Club
Chess Club
Judo
Drama Club
Soccer
Football
Dances
Tennis

Riverton

Football
Volleyball
Basketball
Fastball
Curling
Hockey
Newspaper
Yearbook
Drama Club

Ashern

Volleyball
Basketball
Football
Soccer
Curling
Yearbook
Drama Club
Newspaper
Dances
Science Club

Eriksdale

Volleyball
Fastball
Hockey
Basketball
Track and Field
Newspaper
Yearbook
Dances

Fisher Branch

Yearbook
Newspaper
Dances
Drama Club
Football
Basketball
Track and Field
Volleyball
Curling
Soccer
Hockey

Lundar

Dances
Newspaper
Yearbook
Drama Club
Science Club
Art Club
Badminton
Football
Soccer
Curling
Hockey
Track and Field
Volleyball
Fastball
Chess Club
Ping Pong
Tennis
Library Club

Moosehorn

Curling
Soccer
Football
Track and Field
Basketball
Volleyball
Yearbook
Drama Club
Science Club
Dances

Source:

X_1 - dropout rate-Department of Education.

x_2 - average town income-The Interlake Fact, Digest.

x_3 - teacher's average salary by town-Department of Education.

x_4 - courses available-obtained by an interview with the high school principal in each town.

x_5 - extra-curricular activities available-obtained by an interview with the high school principal in each town.

x_6 - percentage of the high school population of Indian or Metis descent-obtained by an interview with the high school principal in each town.

x_7 - school size-Department of Education.

TABLE VIII

CLASSIFICATION OF INTERLAKE EDUCATIONAL EXPENDITURES FOR 1968 BY INDUSTRIAL SECTORS AND BY HOUSEHOLD SECTOR

Industrial Sectors	Educational Expenditure in Dollars
Agriculture Livestock	
Agriculture Crops and Others	
Mining	
Food and Beverage Manufacturing	
Other Manufacturing	3,634
Transportation	23,777
Construction	14,656
Petroleum Wholesale	201,475
Farm Equipment and Building Material	
Food Stores	
Other Retail	132,492
Auto Products Sales and Services	50,258
Apparel and Shoes	
Furniture	
Insurance	1,412
Personal Services	
Other Services	34,121
Total Sales	461,896
Households	4,594,067
Total Sales and Income	5,055,996
Expenditures Outside the Interlake Area	1,661,219
Capital Expenditures	686,316
Total Education Expenditure for the Interlake Area	7,403,531

Source:

Summation of "Expenditure Details as summarized in the Statement of Revenue and Expenditures for the year ended December 31, 1968," obtained from Manitoba Department of Education for the entire Interlake Area. The assistance of each school division's secretary=treasurer was needed to separate expenditures made in the Interlake Area and expenditures made outside the Interlake Area.

APPENDIX C

CALCULATION OF IMPACTS OF EDUCATION EXPENDITURES

S OF EXPENDITURE

Food & Bev. Mfg. 4	Other Mfg. 5	Trans-port. 6	Con-struction 7	leum sale	Farm Equip. 9	Food Stores 10	Other Retail 11	Auto Prod. S&S 12	Apparel 13	Furniture 14	Insurance 15	Personal Services 16	Other Services 17	Household 18	Output 19
0.0	0.031	0.128	0.128	484	0.0	0.0	0.920	0.196	0.0	0.0	0.027	0.0	0.402	133.420	135.922
0.0	0.007	0.073	0.038	112	0.0	0.0	0.156	0.054	0.0	0.0	0.006	0.0	0.093	30.847	31.387
0.0	0.020	0.000	0.001	001	0.0	0.0	0.001	0.001	0.0	0.0	0.000	0.0	0.002	0.052	0.077
0.0	0.006	0.066	0.019	100	0.0	0.0	0.722	0.041	0.0	0.0	0.006	0.0	0.098	27.707	28.766
0.0	3.606	0.055	0.095	110	0.0	0.0	0.200	0.115	0.0	0.0	0.012	0.0	0.286	9.141	13.619
0.0	0.033	23.921	0.171	157	0.0	0.0	2.125	0.223	0.0	0.0	0.109	0.0	0.753	33.912	61.403
0.0	0.052	0.296	15.201	326	0.0	0.0	0.925	0.215	0.0	0.0	0.025	0.0	0.952	120.574	139.567
0.0	0.092	2.985	0.297	206	0.0	0.0	1.905	0.608	0.0	0.0	0.085	0.0	1.100	333.638	543.916
0.0	0.015	0.111	0.848	218	0.0	0.0	0.237	0.072	0.0	0.0	0.009	0.0	0.171	47.105	48.786
0.0	0.086	0.875	0.247	343	0.0	0.0	1.481	0.546	0.0	0.0	0.074	0.0	1.087	372.576	378.316
0.0	0.163	1.828	0.508	554	0.0	0.0	135.487	1.110	0.0	0.0	0.151	0.0	3.445	683.321	828.567
0.0	0.208	4.710	0.725	374	0.0	0.0	3.855	51.774	0.0	0.0	0.188	0.0	2.819	885.657	954.311
0.0	0.018	0.181	0.051	278	0.0	0.0	0.306	0.113	0.0	0.0	0.015	0.0	0.225	77.054	78.241
0.0	0.007	0.070	0.020	.07	0.0	0.0	0.177	0.044	0.0	0.0	0.006	0.0	0.087	29.730	30.247
0.0	0.003	0.114	0.024	083	0.0	0.0	0.166	0.037	0.0	0.0	1.409	0.0	0.071	11.660	13.547
0.0	0.075	0.767	0.220	.80	0.0	0.0	1.383	0.480	0.0	0.0	0.065	0.0	1.196	326.630	331.997
0.0	0.018	0.205	0.158	87	0.0	0.0	0.526	0.221	0.0	0.0	0.043	0.0	34.695	74.688	111.142
															3729.803
0.0	1.172	11.940	3.365	30	0.0	0.0	20.210	7.455	0.0	0.0	1.014	0.0	14.836	5084.215	5162.537
0.0	5.612	48.512	22.116	31	0.0	0.0	170.783	63.305	0.0	0.0	3.245	0.0	62.317	8281.922	8892.340

TABLE IX

THE DIRECT AND INDIRECT AND INDUCED EFFECT ON SALES AND INCOMES OF EXPENDITURE BY EDUCATION IN THE INTERLAKE AREA[1]

	Education	Ag. Livestock 1	Ag. Crops 2	Mining 3	Food & Bev. Mfg. 4	Other Mfg. 5	Trans-port. 6	Con-struction 7
1. Agri. Livestock	0.0	0.0	0.0	0.0	0.0	0.031	0.128	0.128
2. Agri. Crop	0.0	0.0	0.0	0.0	0.0	0.007	0.073	0.038
3. Mining	0.0	0.0	0.0	0.0	0.0	0.020	0.000	0.001
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.006	0.066	0.019
5. Other Mfg.	3.600	0.0	0.0	0.0	0.0	3.606	0.055	0.095
6. Transportation	23.800	0.0	0.0	0.0	0.0	0.033	23.921	0.171
7. Construction	14.700	0.0	0.0	0.0	0.0	0.052	0.296	15.201
8. Petroleum Wholesale	201.500	0.0	0.0	0.0	0.0	0.092	2.985	0.297
9. Farm Equipment	0.0	0.0	0.0	0.0	0.0	0.015	0.111	0.848
10. Food Store	0.0	0.0	0.0	0.0	0.0	0.086	0.875	0.247
11. Other Retail	132.500	0.0	0.0	0.0	0.0	0.163	1.828	0.508
12. Auto Products Sales & Services	50.300	0.0	0.0	0.0	0.0	0.208	4.710	0.725
13. Apparel	0.0	0.0	0.0	0.0	0.0	0.018	0.181	0.051
14. Furniture	0.0	0.0	0.0	0.0	0.0	0.007	0.070	0.020
15. Insurance	1.400	0.0	0.0	0.0	0.0	0.003	0.114	0.024
16. Personal Services	0.0	0.0	0.0	0.0	0.0	0.075	0.767	0.220
17. Other Services	34.100	0.0	0.0	0.0	0.0	0.018	0.205	0.158
Subtotal Educational Expenditures	461.896							
Subtotal Sales								
18. Household	4594.100	0.0	0.0	0.0	0.0	1.172	11.940	3.365
Total Educational Expenditures & Wages	5055.996							
Total Sales and Income		0.0	0.0	0.0	0.0	5.612	48.512	22.116

leum sale	Farm Equip. 9	Food Stores 10	Other Retail 11	Au Prod. 12
484	0.0	0.0	0.920	0.1
112	0.0	0.0	0.156	0.0
001	0.0	0.0	0.001	0.0
100	0.0	0.0	0.722	0.0
110	0.0	0.0	0.200	0.1
157	0.0	0.0	2.125	0.2
326	0.0	0.0	0.925	0.2
206	0.0	0.0	1.905	0.6
218	0.0	0.0	0.237	0.0
343	0.0	0.0	1.481	0.5
554	0.0	0.0	135.487	1.1
374	0.0	0.0	3.855	51.7
278	0.0	0.0	0.306	0.1
.07	0.0	0.0	0.177	0.04
083	0.0	0.0	0.166	0.03
.80	0.0	0.0	1.383	0.48
187	0.0	0.0	0.526	0.22
330	0.0	0.0	20.210	7.45
131	0.0	0.0	170.783	63.30

$$ {}_{1}X^{Ed} = (I - T^{*})^{-1} \; Ed $$

Where: X^{Ed} = effect on area sales and incomes due to educational expenditures
I = identity matrix
T^{*} = input-output coefficient matrix with households included
Ed = vector of educational expenditures

Source:

James A. MacMillan and Chang-mei Lu, "Regional Development Planning and Evaluation: An Impact Analysis of Manitoba's Interlake Area Development Plan" (unpublished research bulletin), pp. 42-45.

TABLE X

EMPLOYMENT COEFFICIENTS BY INDUSTRIAL SECTORS

		Direct Employment Coefficients*
1.	Agriculture Livestock	0.0
2.	Agriculture Crop	0.0
3.	Mining	0.039
4.	Food and Beverage Manufacturing	0.022
5.	Other Manufacturing	0.052
6.	Transportation	0.134
7.	Construction	0.045
8.	Petroleum Wholesale	0.019
9.	Farm Equipment	0.013
10.	Food Store	0.015
11.	Other Retail	0.025
12.	Auto Products Sales and Services	0.013
13.	Apparel	0.025
14.	Furniture	0.034
15.	Insurance	0.130
16.	Personal Services	0.035
17.	Other Services	0.153
18.	Household	0.0
	Total	0.754

*Vector of direct employment coefficients (number of full time employee equivalents per $1,000 sales.

Source:

James A. MacMillan and Chang-mei Lu, "Area Manpower: Projection and Impact Model" (unpublished research bulletin), p. 75.

LOYMENT[1]

ing	Bev. Mfg. 4	Other Mfg. 5	Trans-port. 6	Con-struction 7	Petroleum Wholesale 8	Farm Equip. 9	Food Stores 10	Other Retail 11	Auto Prod. S&S 12	Apparel 13	Furniture 14	Insurance 15	Personal Services 16	Other Services 17	Household 18	Employment by Sector 19
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	0.0	0.001	0.000	0.000	0.000	0.0	0.0	0.000	0.000	0.0	0.0	0.000	0.0	0.000	0.002	0.003
0	0.0	0.000	0.001	0.000	0.002	0.0	0.0	0.016	0.001	0.0	0.0	0.000	0.0	0.002	0.610	0.633
0	0.0	0.188	0.003	0.005	0.006	0.0	0.0	0.010	0.006	0.0	0.0	0.001	0.0	0.015	0.475	0.708
0	0.0	0.004	3.205	0.023	0.021	0.0	0.0	0.285	0.030	0.0	0.0	0.015	0.0	0.101	4.544	8.228
0	0.0	0.002	0.013	0.684	0.060	0.0	0.0	0.042	0.010	0.0	0.0	0.001	0.0	0.043	5.426	6.281
	0.0	0.002	0.057	0.006	3.861	0.0	0.0	0.036	0.012	0.0	0.0	0.002	0.0	0.021	6.339	10.334
	0.0	0.000	0.001	0.011	0.003	0.0	0.0	0.003	0.001	0.0	0.0	0.000	0.0	0.002	0.612	0.634
	0.0	0.001	0.013	0.004	0.020	0.0	0.0	0.022	0.008	0.0	0.0	0.001	0.0	0.016	5.589	5.675
	0.0	0.004	0.046	0.013	0.064	0.0	0.0	3.387	0.028	0.0	0.0	0.004	0.0	0.086	17.083	20.714
	0.0	0.003	0.061	0.009	0.057	0.0	0.0	0.050	0.673	0.0	0.0	0.002	0.0	0.037	11.514	12.406
	0.0	0.000	0.005	0.001	0.007	0.0	0.0	0.008	0.003	0.0	0.0	0.000	0.0	0.006	1.926	1.956
	0.0	0.000	0.002	0.001	0.004	0.0	0.0	0.006	0.001	0.0	0.0	0.000	0.0	0.003	1.011	1.028
	0.0	0.000	0.015	0.003	0.008	0.0	0.0	0.022	0.005	0.0	0.0	0.183	0.0	0.009	1.516	1.761
	0.0	0.003	0.027	0.003	0.041	0.0	0.0	0.048	0.017	0.0	0.0	0.002	0.0	0.042	11.432	11.620
	0.0	0.003	0.031	0.024	0.090	0.0	0.0	0.081	0.034	0.0	0.0	0.007	0.0	5.308	11.427	17.005
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.212	3.481	0.792	4.243	0.0	0.0	4.016	0.828	0.0	0.0	0.218	0.0	5.691	79.506	98.986

IMPACTS OF EDUCATIONAL EXPENDITURES ON SECTOR EMPLOYMENT[1]

	Education	Livestock 1	Crops 2	Mining 3	Bev. Mfg. 4	Other Mfg. 5	Trans-port. 6	Con-struction 7
1. Agri. Livestock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Agri. Crop	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. Mining	0.0	0.0	0.0	0.0	0.0	0.001	0.000	0.000
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.000	0.001	0.000
5. Other Mfg.	3.600	0.0	0.0	0.0	0.0	0.188	0.003	0.005
6. Transportation	23.800	0.0	0.0	0.0	0.0	0.004	3.205	0.023
7. Construction	14.700	0.0	0.0	0.0	0.0	0.002	0.013	0.684
8. Petroleum Wholesale	201.500	0.0	0.0	0.0	0.0	0.002	0.057	0.006
9. Farm Equipment	0.0	0.0	0.0	0.0	0.0	0.000	0.001	0.011
10. Food Store	0.0	0.0	0.0	0.0	0.0	0.001	0.013	0.004
11. Other Retail	132.500	0.0	0.0	0.0	0.0	0.004	0.046	0.013
12. Auto Products Sales & Services	50.300	0.0	0.0	0.0	0.0	0.003	0.061	0.009
13. Apparel	0.0	0.0	0.0	0.0	0.0	0.000	0.005	0.001
14. Furniture	0.0	0.0	0.0	0.0	0.0	0.000	0.002	0.001
15. Insurance	1.400	0.0	0.0	0.0	0.0	0.000	0.015	0.003
16. Personal Services	0.0	0.0	0.0	0.0	0.0	0.003	0.027	0.003
17. Other Services	34.100	0.0	0.0	0.0	0.0	0.003	0.031	0.024
Subtotal Educational Expenditures	461.896							
18. Households	4594.100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Educational Expenditures & Wages	5055.996							
Total		0.0	0.0	0.0	0.0	0.212	3.481	0.792

Petroleum Wholesale 8	Farm Equip. 9	Food Stores 10	Other Retail 11	Pr
0.0	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	
0.000	0.0	0.0	0.000	
0.002	0.0	0.0	0.016	
0.006	0.0	0.0	0.010	
0.021	0.0	0.0	0.285	
0.060	0.0	0.0	0.042	
3.861	0.0	0.0	0.036	
0.003	0.0	0.0	0.003	
0.020	0.0	0.0	0.022	
0.064	0.0	0.0	3.387	
0.057	0.0	0.0	0.050	
0.007	0.0	0.0	0.008	
0.004	0.0	0.0	0.006	
0.008	0.0	0.0	0.022	
0.041	0.0	0.0	0.048	
0.090	0.0	0.0	0.081	
0.0	0.0	0.0	0.0	
4.243	0.0	0.0	4.016	

$$^{1}Y = [I - T^{*}]^{-1} \quad Ed \quad (Emp)$$

Where: Y = employment created by educational expenditure
I = Inverse Matrix
T^{*} = input-output coefficient matrix with households included
Ed = vector of educational expenditures
Emp = vector of direct employment (number of full time employee equivalents per $1,000 sales).

Source:

Multiplication of Tables IX and X.

APPENDIX D

POINT GRAPHS OF THE DEPENDENT VARIABLE AND EACH INDEPENDENT VARIABLE

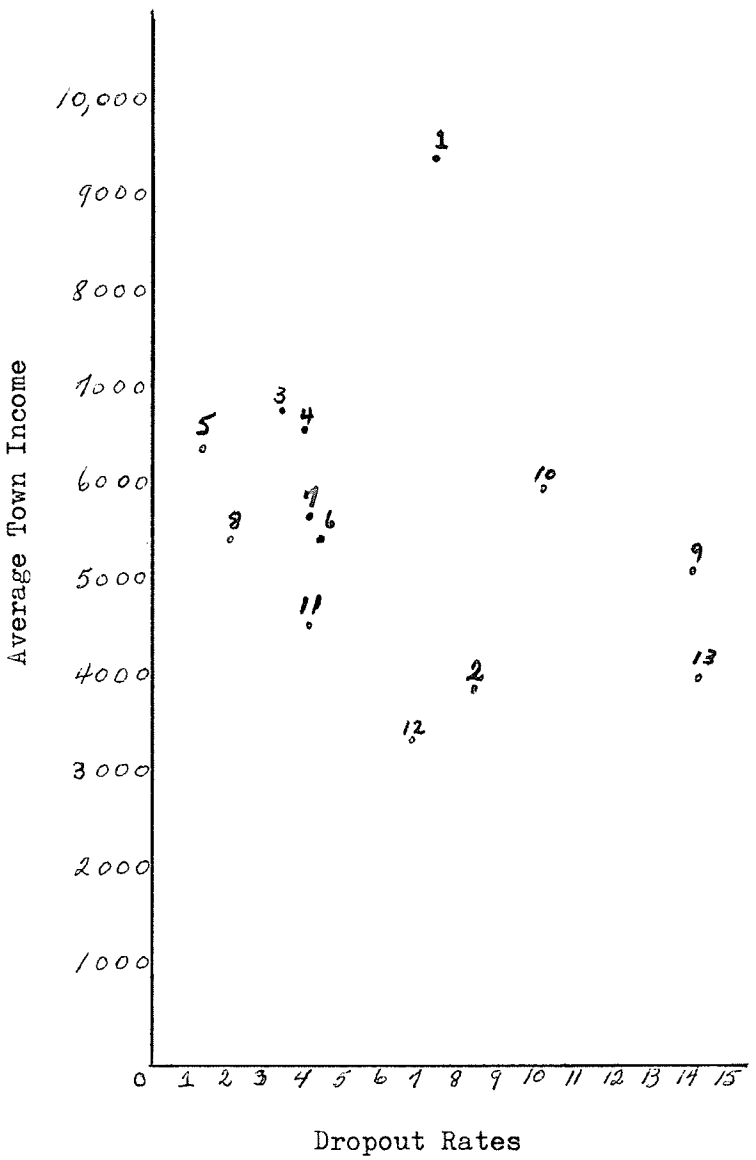

FIGURE 2

THE GRAPHICAL REPRESENTATION OF DROPOUT RATES AND AVERAGE TOWN INCOME[a]

[a]Definition:

1 - Selkirk

2 - St. Laurent

3 - Stonewall

4 - Teulon

5 - Warren

6 - Arborg

7 - Gimli

8 - Riverton

9 - Ashern

10 - Eriksdale

11 - Fisher Branch

12 - Lundar

13 - Moosehorn

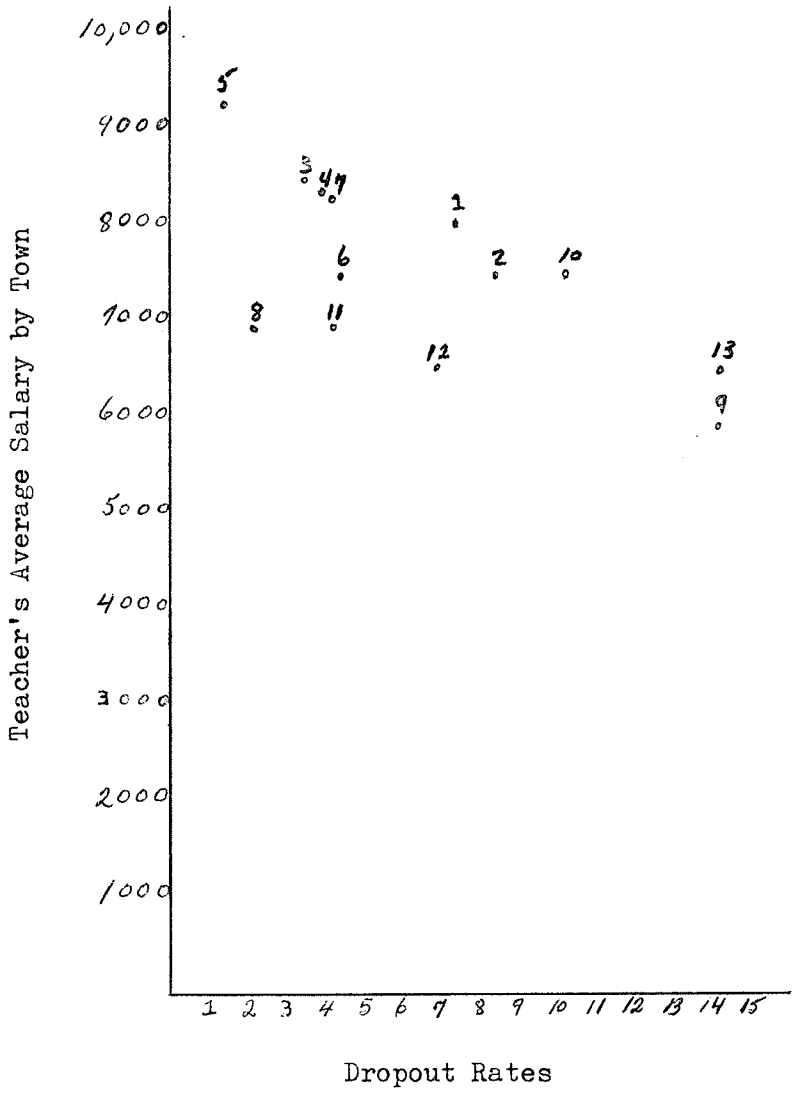

FIGURE 3

THE GRAPHICAL REPRESENTATION OF DROPOUT RATES AND TEACHER'S AVERAGE SALARIES BY TOWN[a] -

[a]Definition:

1 - Selkirk

2 - St. Laurent

3 - Stonewall

4 - Teulon

5 - Warren

6 - Arborg

7 - Gimli

8 - Riverton

9 - Ashern

10 - Eriksdale

11 - Fisher Branch

12 - Lundar

13 - Moosehorn

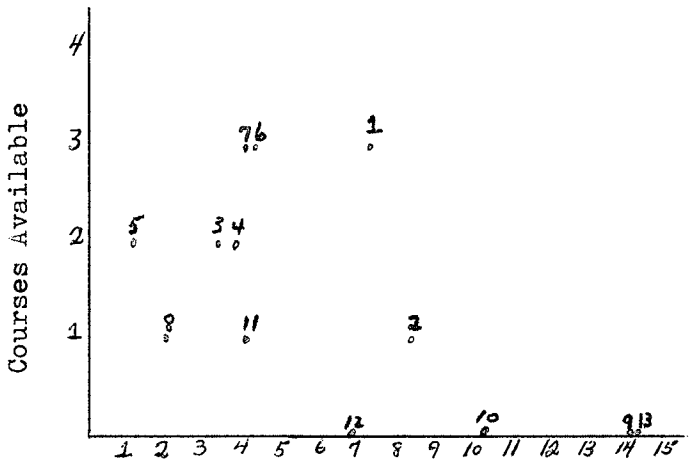

FIGURE 4

THE GRAPHICAL REPRESENTATION OF DROPOUT RATES AND COURSES AVAILABLE[a]

[a]Definition:

1 - Selkirk

2 - St. Laurent

3 - Stonewall

4 - Teulon

5 - Warren

6 - Arborg

7 - Gimli

8 - Riverton

9 - Ashern

10 - Eriksdale

11 - Fisher Branch

12 - Lundar

13 - Moosehorn

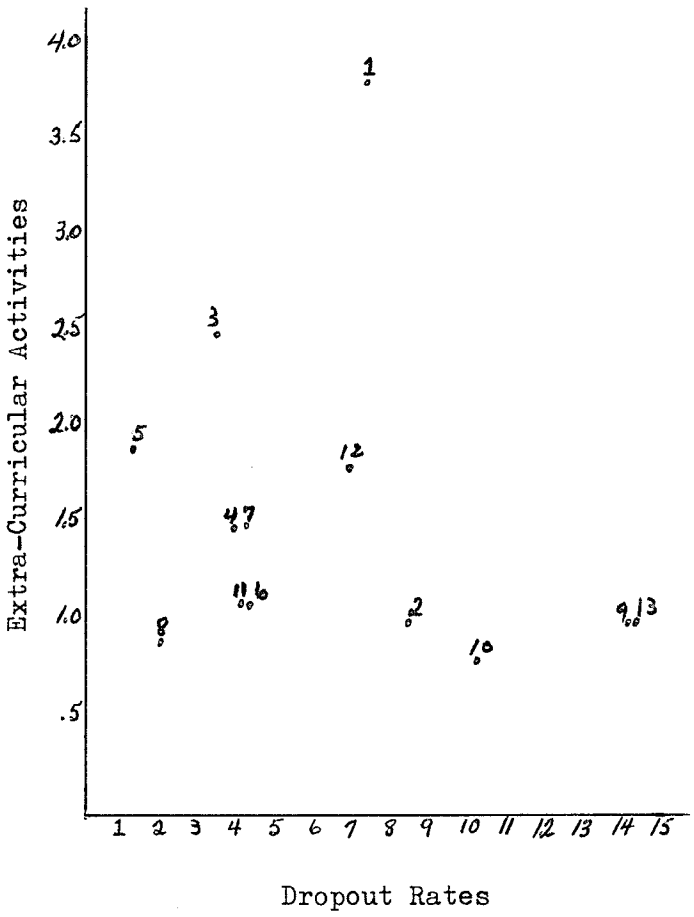

FIGURE 5

THE GRAPHICAL REPRESENTATION OF DROPOUT RATES AND EXTRA-CURRICULAR ACTIVITIES AVAILABLE[a] -

[a]Definition:

1 - Selkirk

2 - St. Laurent

3 - Stonewall

4 - Teulon

5 - Warren

6 - Arborg

7 - Gimli

8 - Riverton

9 - Ashern

10 - Eriksdale

11 - Fisher Branch

12 - Lundar

13 - Moosehorn

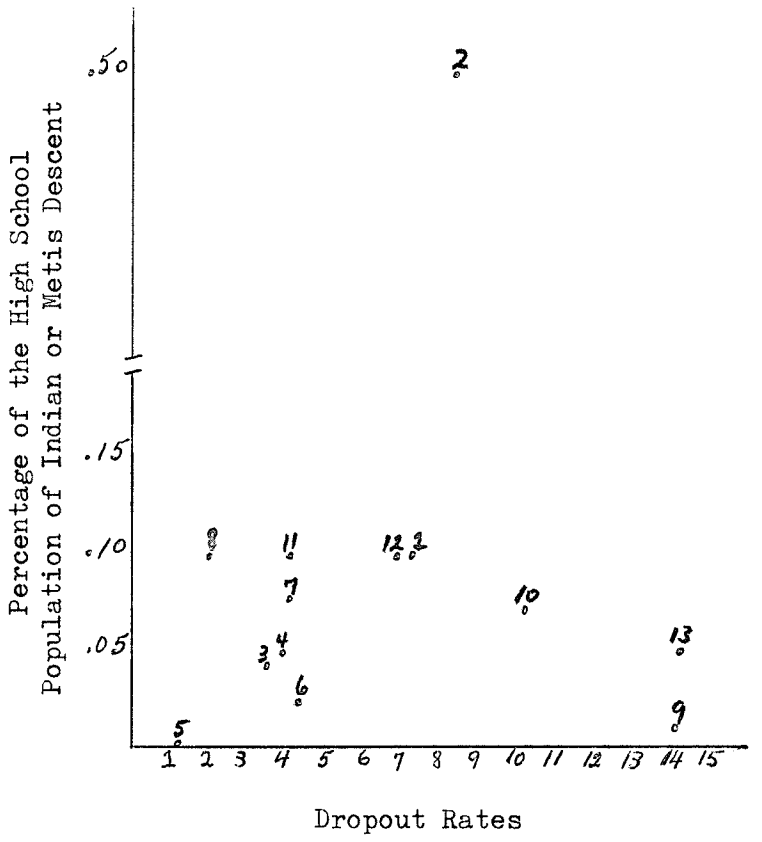

FIGURE 6

THE GRAPHICAL REPRESENTATION OF DROPOUT RATES AND THE PERCENTAGE OF THE HIGH SCHOOL POPULATION OF INDIAN AND METIS DESCENT[a]

[a]Definition:

1 - Selkirk

2 - St. Laurent

3 - Stonewall

4 - Teulon

5 - Warren

6 - Arborg

7 - Gimli

8 - Riverton

9 - Ashern

10 - Eriksdale

11 - Fisher Branch

12 - Lundar

13 - Moosehorn

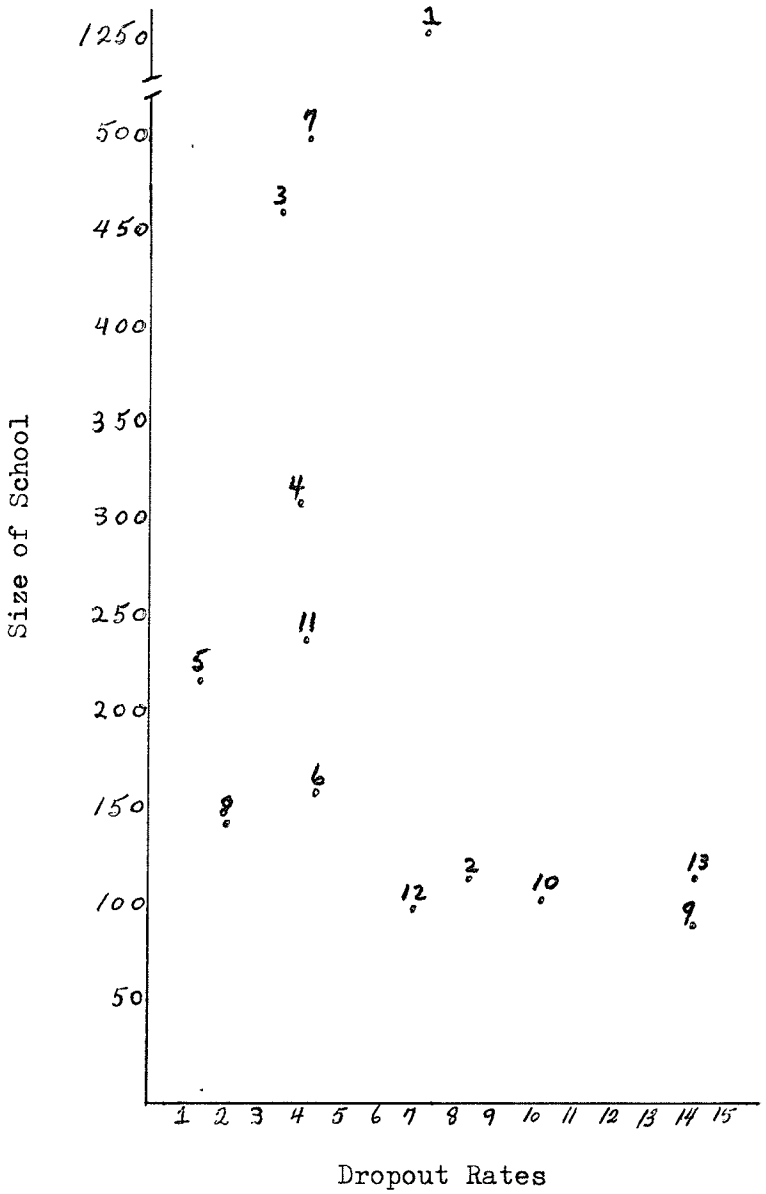

FIGURE 7

THE GRAPHICAL REPRESENTATION OF DROPOUT RATES AND SCHOOL SIZE[a]

[a]Definition:

1 - Selkirk

2 - St. Laurent

3 - Stonewall

4 - Teulon

5 - Warren

6 - Arborg

7 - Gimli

8 - Riverton

9 - Ashern

10 - Eriksdale

11 - Fisher Branch

12 - Lundar

13 - Moosehorn

APPENDIX E

SUMMARY OF CORRELATION COEFFICIENTS AND ELASTICITIES FOR EQUATION 6

TABLE XII

SUMMARY OF CORRELATION COEFFICIENTS

	X_1[a]	x_2[a]	x_3[a]	x_4[a]	x_5[a]	x_6[a]	x_7[a]
X_1	1.000000						
x_2	-0.782695	1.000000					
x_3	-0.471238	0.786415	1.000000				
x_4	-0.705642	0.690303	0.578999	1.000000			
x_5	-0.467071	0.518406	0.312995	0.381965	1.000000		
x_6	-0.160311	-0.166006	-0.409721	-0.244612	-0.201056	1.000000	
x_7	-0.519443	0.624213	0.555850	0.712049	0.616066	0.029159	1.000000

[a]Definitions:

X_1 = dropout rate.

x_2 = average town income.

x_3 = teacher's average salary .

x_4 = courses available.

x_5 = extra-curricular activities.

x_6 = percentage of high school students of Indian or Metis descent.

x_7 = size of school.

Source:

The correlation coefficients were obtained from the computer output for the solution of regression equations.

TABLE XIII

SUMMARY OF ELASTICITIES FOR EQUATION 6

Variable Number	Variable Name	Elasticities
x_2	average town income	-1.90
x_4	courses available	-0.76
x_5	extra-curricular activities available	-1.18
x_6	percentage of the high school population of Indian or Metis descent	-0.86
x_7	school size	+0.96

Source:

Elasticities are obtained from the computer output for the solution of regression equations.

Farm Equip. 9	Food Stores 10	Other Retail 11	Auto Prod. S&S 12	Apparel 13	Furniture 14	Insurance 15	Personal Services 16	Other Services 17	Household 18	Employment by Sector 19
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.000	0.000	0.0	0.0	0.000	0.0	0.000	0.002	0.003
0.0	0.0	0.016	0.001	0.0	0.0	0.000	0.0	0.002	0.610	0.633
0.0	0.0	0.010	0.006	0.0	0.0	0.001	0.0	0.015	0.475	0.708
0.0	0.0	0.285	0.030	0.0	0.0	0.015	0.0	0.101	4.544	8.228
0.0	0.0	0.042	0.010	0.0	0.0	0.001	0.0	0.043	5.426	6.281
0.0	0.0	0.036	0.012	0.0	0.0	0.002	0.0	0.021	6.339	10.334
0.0	0.0	0.003	0.001	0.0	0.0	0.000	0.0	0.002	0.612	0.634
0.0	0.0	0.022	0.008	0.0	0.0	0.001	0.0	0.016	5.589	5.675
0.0	0.0	3.387	0.028	0.0	0.0	0.004	0.0	0.086	17.083	20.714
0.0	0.0	0.050	0.673	0.0	0.0	0.002	0.0	0.037	11.514	12.406
0.0	0.0	0.008	0.003	0.0	0.0	0.000	0.0	0.006	1.926	1.956
0.0	0.0	0.006	0.001	0.0	0.0	0.000	0.0	0.003	1.011	1.028
0.0	0.0	0.022	0.005	0.0	0.0	0.183	0.0	0.009	1.516	1.761
0.0	0.0	0.048	0.017	0.0	0.0	0.002	0.0	0.042	11.432	11.620
0.0	0.0	0.081	0.034	0.0	0.0	0.007	0.0	5.308	11.427	17.005
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	4.016	0.828	0.0	0.0	0.218	0.0	5.691	79.506	98.986