THE UNIVERSITY OF MANITOBA

A DYNAMIC MODEL FOR SIMULATING RESOURCE DEVELOPMENT PROGRAM IMPACTS IN THE INTERLAKE AREA OF MANITOBA

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

by

Fu-Lai Tung

DEPARTMENT OF AGRICULTURAL ECONOMICS AND FARM MANAGEMENT

February, 1975

A DYNAMIC MODEL FOR SIMULATING RESOURCE DEVELOPMENT PROGRAM IMPACTS IN THE INTERLAKE AREA OF MANITOBA

by

FU-LAI TUNG

A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

DOCTOR OF PHILOSOPHY

© 1975

Permission has been granted to the LIBRARY OF THE UNIVERSITY OF MANITOBA to lend or sell copies of this dissertation, to the NATIONAL LIBRARY OF CANADA to microfilm this dissertation and to lend or sell copies of the film, and UNIVERSITY MICROFILMS to publish an abstract of this dissertation.

The author reserves other publication rights, and neither the dissertation nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

ABSTRACT

A DYNAMIC MODEL FOR SIMULATING RESOURCE DEVELOPMENT PROGRAM IMPACTS IN THE INTERLAKE AREA OF MANITOBA

by

Fu-Lai Tung

Federal and Provincial Governments have been involved in attempts to improve the low income and unemployment situations in the Interlake Area of Manitoba by means of public investment of $85 million in natural, social and human capital during the period of 1968-77. Of the $85 million Fund for Rural Economic Development (FRED), $20 million is designated for resource development programs including drainage, land clearing and farm management training programs. There is an urgent need to provide quantitative information relevant to the effectiveness of these programs for improving the economic conditions in the Interlake Area. This information is required so that informed decisions in regional and resource planning can be made more effectively. A significant gap exists in the capability of current economic models to provide answers to current issues related to the potential impacts of resource development programs on regional economies.

The basic purpose of this study, therefore, is to develop a model for analyzing the accumulative long-run economic impacts of resource development programs on structural change in the agricultural sectors and their contributions to related sectors of the economy in the study area. More specific objectives of this study are: (1) to explore a method to incorporate changes in trade and primary resource

input coefficients in an input-output model with particular reference to agricultural sectors; (2) to establish a set of economic development indicators to assess program impacts for public concerns; (3) to project economic development indicators specified in five target years, 1971, 1976, 1977, 1981 and 1986; and (4) to simulate impacts of resource development programs, drainage, land clearing and farm management training programs, on selected economic development indicators to assess the program effectiveness.

To meet the objectives, a 24 sector input-output model constructed for the Interlake Area is used as a framework. The 24 sector input-output model is modified in constructing three alternative simulation models referred to as static, comparative static and dynamic simulation models. Each simulation model includes the resource constraints, labor and land, so that the realized gross output is determined not only by the demand factors but also by supply constraints. The static simulation model is the conventional input-output model neglecting changes in trade or technical coefficients as well as primary input requirement coefficients over time. The comparative static simulation considers the changes in trade coefficients as well as primary input requirement coefficients over time but investment is assumed to be exogenously determined. The dynamic simulation model permits the trade and primary input requirement coefficients to change over time. In addition, investment is determined endogenously by the dynamic simulation system.

Productive capacity limitations by farm size class are used to derive the changes over time for trade coefficient and primary input requirement coefficients employed in the comparative and dynamic simulation models. Each farm size has its productive capacity limits resulting from the fixed technical as well as primary input requirement coefficients associated with the size of farms. The technical coefficient as well as primary input requirement coefficient changes are caused by the structural changes represented by increases in the number of large size farms and decreases in the numbers of small size farms. A modified Markov process emphasizing migration relationships is used to project changes in farm numbers by size class and projection results are employed to adjust the trade as well as primary input requirement coefficients over time for the comparative and dynamic simulation models.

The impacts of the three resource development programs on the selected economic development indicators are determined by the difference between projections and impact simulation results. The projection results represent the performance of the Interlake economy without the three resource development programs. The impact simulation results include changes in the economy due to the cumulative effect of three resource development programs as well as changes projected to occur as a result of economic growth without programs.

The three alternative simulation models mentioned above are used to project the performance of the Interlake economy represented by gross output, employment, area income by sources and primary resource utilization rates. These results are compared with historical observations in assessing the results of the three alternative simulation models. The results indicate that the dynamic simulation model performs best among the three alternative simulation models: (1) the dynamic simulation model yields consistent estimates of investment; (2) the projected trade and primary resource input coefficients are very close to the actual observations indicating that these coefficients in fact do change over time as a result of structural changes in agricultural sectors; and (3) the simulated economic development indicators for 1971 are all within 12 percent deviation of the historical series for 1971.

Given that the dynamic simulation provides the best estimates of economic performance in the Interlake area, the impacts of the three resource development programs on the selected economic development indicators are derived from the dynamic simulation model. The results indicate that all of the simulated resource development programs yield positive impacts on each selected economic development indicators. The three resource development programs generate increasing employment opportunities for Interlake people. An additional 1,300 jobs are attributable to the three resource development programs in 1976. The area income is estimated to be $88 million if weather conditions were normal in 1971 as compared to actual figure of about $85 million. The three resource development programs contribute about 8 percent of total area income to the Interlake economy in 1971 and this contribution is estimated to be 10 percent of income by 1976. In addition, about 80 percent of income generated from the three resource development programs is farm income. As a result, each farm, on average, has gained an additional thousand dollars of farm income due to the three resource development programs.

The magnitude of impacts per million dollar program expenditure is different for each program and for every selected economic indicator.

In general, there is no consistently "best" resource development program relative to the FRED objectives of increasing employment opportunities and income and improving the standard of living for the Interlake people specified in the FRED plan. The farm management training program in general, is more favourable than the other two programs in terms of their impacts on FRED plan objectives.

A number of policy implications of the results are noted. The most significant implication of the results is that the three resource development programs will not be able to prevent the out-migration of agricultural labor force. Some complementary manpower training and education programs for agricultural labor force are required for monitoring the potential manpower problems in agricultural sectors. Another implication which is useful for regional development planning and program evaluations is indicated by the results that the impacts of each resource development program on the selected economic development indicators are different from one time period to another. The magnitude of the impacts on the selected economic development indicators is not equal for each resource development program. The implication of these results is that governments could be more effective in their pursuit of development targets by making objectives more specific in terms of the selected economic development indicators and analyzing the economic structural changes for both short and long-run caused by particular programs.

Additional findings and some of the limitations underlying these findings are discussed and suggestions are made for further research. The modified dynamic model has the potential for overcoming many problems in estimating the impacts of government development programs on the structure of a regional economy which is a requirement for effective regional development planning.

ACKNOWLEDGEMENTS

I am grateful to many organizations and individuals who have supported my graduate study and contributed significantly to the completion of this dissertation. In particular, I would like to express my appreciation to the following:

I am deeply grateful to my advisor, Dr. James A. MacMillan, for his help throughout this study. Professor MacMillan generously shared his ideas and his personal contributions are many more than I am able to acknowledge in this page. Without his guidance and constant encouragement throughout the entire period of my study, helping me with patience and care in other matters than study, this research would not have been possible. Participation in several research projects with Professor MacMillan provided excellent opportunities in gaining research experience.

I am also grateful to Dr. Charles F. Framingham for his continuous guidance in the organization and the writing of this dissertation through from one draft to another. I also benefitted from his constant encouragement and moral support especially when he served as acting advisor during my graduate study while Professor MacMillan was on leave.

Special thanks are due to my dissertation committee members, Dr. James Seldon and Dr. R.M.A. Loyns, for their thoroughly and patiently going through from one draft to another and making important suggestions towards improvement. I am deeply indebted to them. Thanks are also due to Dr. Wilber R. Maki, Professor of Agricultural and Applied Economics, University of Minnesota, for his careful reading of the dissertation and valuable suggestions.

I also wish to thank Mr. R. Ali who had made helpful suggestions and comments during the initial stages of writing. My thanks are also extended to Mr. Ed. Somers, FRED Co-ordinator, the Manitoba Department of Agriculture, who provided data and background information for this study.

I am grateful to the Canada Council and the Department of Agricultural Economics, University of Manitoba for their financial support for my graduate study.

I would also like to thank Mrs. Edna R. Smiley, typist at the Department of Agricultural Economics, University of Manitoba and Mrs. Rita L. Emerson for their excellent typing and careful reading of the thesis.

Finally, I would like to extend my most sincere appreciation to my wife, Yung-Tei, and my son, David, for their patience and understanding throughout the entire period of my graduate study and to my parents who sacrificed much to finance my earlier education in Taiwan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

A number of agricultural development programs have been designed in Canada to increase agricultural productivity and improve incomes of low income farmers in marginal agricultural areas. These include programs under the Agricultural and Rural Development Act, 1961 (ARDA), the Fund for Rural Economic Development, 1966 (FRED), and the Small Farm Development Program, 1972 (SFDP). The various programs have unique elements and represent alternative approaches to resolving rural development problems.

However, models of the agricultural development process which permit an analysis of the potential impacts of such programs on jobs, income, the changing structure of agriculture, and the relationship between agricultural and non-agricultural sectors are not available.[1] Such dynamic regional models of agriculture which would provide an explicit linkage between the agricultural development programs and the regional economy (including rural and urban dimensions) are critical for development of a full understanding of regional development and the formulation of future policy.

A. Problematic Situation

The Government of Canada and the Province of Manitoba signed an

---

[1]W.J. Craddock, "Interrelation and Use of the Results Obtained with National and Regional Economic Models," National and Regional Economic Models of Agriculture, ed. Roger K. Eyvindson, Economics Branch Publication No. 72/9 (Ottawa: Canada Department of Agriculture, 1972).

agreement in May 1967 for developing the Interlake Area of Manitoba. The Interlake Area was the third area designated under FRED, which was administered by the Department of Forestry and Rural Development and is now under the Department of Regional Economic Expansion (DREE).[2] The basic objective of this plan is to increase the level of income, employment opportunities and the standard of living of the people residing in the area. This basic objective is to be achieved by programs including public investment of $85 million[3] to be spent on education, training, and mobility, and investment to be made to rationalize and develop the full economic potential of agriculture, fisheries, recreation, and industry in the area during the next decade. Of the $85 million FRED plan expenditure (from 1967-1977), $20 million is designated for agricultural resource development programs including drainage, land clearing, and farm management training programs.

The designed agricultural resource development programs are not only directed toward the agricultural sector, but also ultimately stimulate development throughout the whole regional economy. These programs alter the resource base available to agriculture, and consequently, change the agriculture outputs. Changes in agricultural production, in turn, have impacts on the level of economic activity in the regional economy as well as other relevant regional economies. A change in agricultural production will create a direct change in economic activity

---

[2]Department of Forestry and Rural Development, Interlake Area of Manitoba: Federal-Provincial Rural Development Agreement (Ottawa: Queen's Printer and Controller of Stationery, 1967).

[3]*Ibid.*, pp. 25-28.

in: (1) industries supplying inputs to agriculture, (2) industries processing and distributing agricultural production, and (3) industries supplying consumer goods to those consumers who are the direct recipients of the programs.[4] Information is needed on the economic interrelations among various sectors of agriculture and related sectors of the economy in order to identify the impacts of agricultural resource development programs on the related sectors of the economy.

In addition, economic growth has been accelerated further by various structural changes in production due to improved technology. Labor-saving technology has been introduced in the production process in past decades. As in the past, economic growth in the future will depend upon, among others, adequate supplies of capital, labor, and natural resources such as land. Demand and supply of these resources must be known to both public and private concerns to facilite development planning and implementation. However, information on the level of future demand for resource inputs, in turn, requires knowledge of the future production levels.

Consequently, two relevant questions are: (1) How much can the region produce in order to meet the final demand? and (2) What will be the levels and distribution of the resource base associated with alternative future levels of production? Answers to these and similar questions provide the basis for planning and for *ex ante* evaluation of agricultural

---

[4] F.T. Moore, "Regional Economic Reaction Paths," American Economic Review, 45 (December 1955), 133-148. Also see: Office of the Appalachian Studies, Development of Water Resources in Appalachia, Main Report Part IV: Planning, Concepts, and Methods (Cincinnati: Office of Appalachian Studies, Corps of Engineers, 1969).

resource development programs. In the evaluation of resource development programs, for example, one of the required procedures is the assessment of future growth in the regional economy without such development programs. This procedure together with the impact of an agricultural resource development program on regional economic development, provides the basis for program evaluation.

Unlike the economic efficiency studies, the incidence of program impacts can best be determined using input-output or interindustry analysis since a central feature of input-output analysis is its emphasis on the interdependence of the various sectors or industries of an economy.[5] Accordingly, a number of impact studies concerning the Interlake economy, using an input-output framework, have been made.[6] Past studies, however, were based on 1968 technical coefficients and changes in the resource base were not considered, an obvious limitation of the prior studies.

An important question is the stability of technical coefficients over time, and stability has been questioned on both theoretical and

---

[5]Walter Isard, Methods of Regional Analysis (Cambridge, Mass: M.I.T. Press, 1963), p. 362.

[6]The relevant studies are: (1) J.A. MacMillan and Chang-mei Lu, Urban Impacts of Rural resource Development Expenditures in the Interlake Area of Manitoba, Research Report No. 7 (Winnipeg: Agassiz Center for Water Studies, University of Manitoba, 1973) (2) J.A. MacMillan and Chang-mei Lu, Projection and Impact Models: Area Manpower Planning in the Interlake Region, Manitoba, Research Bulletin No. 72-5 (Winnipeg: Department of Ag. Econ., U. of Manitoba, 1972); (3) Philip G. Douglas and J.A. MacMillan, Simulation of Economic Impacts of Highway Expenditures, Research Report No. 9 (Winnipeg: Center for Transportation Studies, U. of Manitoba, 1972); (4) Paul Molgat and James A. MacMillan, Education in Area Economic Development, Research Report No. 10 (Winnipeg; Center for Settlement Studies, the University of Manitoba, 1972); (5) James A. MacMillan, C.M. Lu and C.F. Framingham, Regional Development Planning and Evaluation: An Impact Analysis of Manitoba's Interlake Area Fred Plan (Iowa: Iowa State University Press) (Forthcoming).

empirical grounds by many researchers, including Leontief.[7] The stability of technical coefficients depends upon the stability of production structure over the period studied. In fact, resource development programs are related to changing production structure; hence, any impact study concerning resource development programs using input-output analysis needs to consider the problem of technical coefficient changes over time with particular reference to agriculture, and to consider structure of agricultural production (types of products, distribution of farm size, number of farms, and agricultural labor force).

Impacts may be measured in terms of the objectives specified in the Interlake FRED agreement where the objectives include increasing per capita income, expanding employment opportunities, and increasing the standard of living for people residing in the area. These objectives will not always be complementary. Trade-off decisions will have to be made whenever they conflict. The impacts of agricultural resource development programs on broadly defined objectives will help policy-makers and resource planners to resolve the details of trade-off problems. To facilitate detailed assessment of agricultural resource development programs, a set of goal variables or economic indicators including net farm income by farm size and by product type is required.

---

[7] See for example, (a) H. Theil and C.B. Tilanus, "The Demand for Production Factors and the Price Sensitivity of Input-Output Predictions," International Economic Review, 5 (Sept. 1964); (b) I. Ozaki, "Economies of Scale and Input-Output Coefficients," in A.P.C. Carter and A. Brody (eds.), Application of Input-Output Analysis (Amsterdam: North-Holland Publishing Co., 1970), 280-302; (c) M. Sevaldson, "Change in Input-Output Coefficients," in T. Barna (ed.), Structural Interdependence and Economic Development: Proceedings of an International Conference on Input-Output Techniques, (London: St. Martin's Press, 1963); and (d) W. Leontief, Input-Output Economics (New York: Oxford U. Press, 1966).

B. Study Objectives

A basic premise of this study is that a significant gap exists in the capability of current economic models to provide answers to current issues related to the potential impacts of agricultural resource development programs on economic indicators (i.e., goal variables in the sense of planning) such as income, jobs, structural changes, etc. Thus, the basic objective of this study is to develop a model for analyzing the cumulative long-run economic impacts of agricultural resource development programs on structural change in the agricultural sectors and their contributions to related sectors of the economy in the study area.

The specific objectives of this study are:

(1) to explore methods to incorporate changes in technical and primary resource input coefficients into an input-output model with particular reference to agricultural sectors;

(2) to establish a set of goal variables to assess program impacts for public concerns;

(3) to project gross regional outputs for each sector in target years 1971, 1976, 1977, 1981 and 1986, consistent with a set of final demands projected exogenously for these target years;

(4) to derive agricultural resource requirements for agricultural sectors and a social accounting system for non-agricultural sectors consistent with projected gross regional outputs in each of the target years; and

(5) to simulate impacts of agricultural resource development programs on goal variables.

C. Policy Implications

A number of policy implications can be drawn from the results of this study. One example is the projection of resource utilization levels associated with the production and distribution of the economic wealth in the regional economy without resource development programs. These projections will provide information on the constraining production factors in target years. The comparisons of the resource utilization levels between the results with and without the programs will provide insights into: (1) the desirability of the policy for agricultural resource development in terms of the impacts of the programs on related sectors of the economy, and (2) the capability of the farming industry to adjust to changing resource utilization conditions induced by the programs.

A second implication is that the established economic indicators or goal variables form a useful background for developing and implementing rural development policies. The indicators can be used to empirically evaluate nation-wide rural development targets and to suggest required elements of a program which need to be coordinated in reaching targets. In other words, the established economic indicators can assist in modifying national policies to the needs of regions with different regional economic and social structures, such as those that are more rural-oriented regions.

Another implication is the importance of using multisectoral models for formulating, analyzing, and implementing rural development programs. Empirical estimates of labor transaction tables and employment multipliers, for example, can provide a great deal of information useful in formulating manpower policy.

D. Organization of the Study

The need for impact information and resource development program evaluation, the objectives of the study and policy implication have been presented in this Chapter. Chapter II reviews the relevant theories and empirical studies of regional growth. The partial regional economic growth models and their limitations are briefly examined in the first two sections. Then the basic input-out model is briefly described and the limitations of the basic model for simulation purposes are noted. Methods for adjusting technical coefficients are also reviewed for the reference to model specification. In Chapter III, a modified input-output model, emphasizing methods to incorporate changes in trade coefficients and resource constraints, is constructed for empirical analysis. The simulation procedures using the modified input-output model are briefly discussed.

Empirical procedures for model construction are discussed in Chapter IV. The first section of the Chapter presents the Interlake areas's 1968 social accounting system that represents the essential features of the Interlake region's development process. The second section presents the estimated trade coefficients matrix which is associated with changes in trade and primary resource inputs coefficients for each target year. The estimated resource base for each target year is also presented in this Chapter. Finally, detailed projections of final demand, including household demand, government demand, exports, capital formation, and price levels for the target years, 1976, 1977, 1981, 1986 are derived.

The results of simulations from the model are presented and discussed in Chapter V. Results of the simulation without resource development programs and assessment of alternative model results are presented in the first two sections. The simulations with resource development programs are carried out for each program and relative effects of each program compared.

The "Summary and Conclusions Chapter" contains a brief summary of findings and their policy implications. Limitations of this study and suggested further study are also presented in this Chapter. To facilitate reading, information or data which are not immediately referred to in the contents are included in appendices.

CHAPTER 2

REVIEW OF REGIONAL GROWTH THEORIES AND EMPIRICAL MODELS

One of the more disturbing aspects of formulating and evaluating regional development programs is the wide difference of opinion regarding the long-term regional growth process. Theoretical models which have been constructed show that changes in final demand or demand parameters may or may not be the only means of stimulating regional growth. The purpose of this chapter therefore is to review the theoretical basis for patterns of regional growth. A comprehensive survey of regional economic growth models can be found elsewhere,[1] and therefore will not be repeated in this study. Consequently, this review of relevant literature is not in any way intended to be comprehensive, but will rather illustrate the different theoretical frameworks used to deal with the problem for the reference of model construction to be dealt with in the next chapter.

Since the issue has been raised as to whether or not an increase in any final demand or demand parameters causes a permanent effect on long-term growth of a region, a model will be said to be one of "demand-determined" growth if in the model it is assumed that a change in final

---

[1]Useful literature concerning a comprehensive survey of regional development models are as follows: (1) J.R. Meyer, "Regional Economics: A Survey", in L. Needlemen (ed.), Regional Analysis (Middlesex, England: Penquin Books Ltd., 1968), 19-60; (2) Harry W. Richardson, Elements of Regional Economics (Middlesex, England: Penquin Books Ltd., 1969).; and (3) J. Thomas Romans, Capital Exports and Growth Among U.S. Regions (Middletown, Connecticut: Wesleyan University Press, 1965).

demand (or spending parameters) is the only theme in stimulating the long-run growth of a region. On the other hand, if in the model it is assumed that change in supply parameters is the only theme in stimulating regional growth, then the model is said to be a "supply-determined" growth model. The classification "demand-determined" or "supply-determined" growth model is based on the debate between North[2] and Tiebout.[3]

A. "Demand-determined" Regional Growth

Types of Demand-determined Regional Growth Models

In general, any regional growth model that utilizes the Keynesian income multiplier concept to analyze an open economy can be said to be one of demand-determined growth. Export base, economic base and conventional input-output or interregional input-output models are of this type.

Export Base Model This model postulates that the growth of a region depends upon the growth of its export industries, and that expansion of demand external to the region is the main determinant of regional growth.[4] The central assumption of the theory is that exports are the sole autonomous item of expenditures. All other components of expenditures

---

[2] D.C. North, "Location Theory and Regional Growth", Journal of Political Economy, 63 (1955), 243-58.

[3] Charles M. Tiebout, "Exports and Regional Economic Growth", Journal of Political Economy, 64 (1956), 1960-64, and the reply by North and rejoinder by Tiebout in the same issue, 169.

[4] North claimed that even in an agricultural region exports determine regional growth. D.C. North, "Agriculture in Regional Economic Growth", Journal of Farm Economics, (1959), 943-51.

are treated as a function of income. Thus, export base theory states that regional growth is determined by the following system:

$$Y = (C - M) + E \tag{2.1}$$

$$C = \alpha Y \tag{2.2}$$

$$M = \beta Y \tag{2.3}$$

$$E = \overline{E}$$

where Y is regional income (or output); C is domestic total consumption in this case, including household, investment and government consumption; M is imports of total consumption; E is autonomous, exports and α and β are the marginal propensity to consume with respect to total consumption and imports of total consumption to be estimated.

Substitution of (2.2), (2.3) and (2.4) into (2.1) and rearrangement yields the multiplier

$$\frac{Y}{E} = \frac{1}{1 - \alpha + \beta} \tag{2.5}$$

Regional growth is, therefore, determined by exports, given the condition that the domestic marginal propensity to spend internally $(\alpha - \beta)$ is less than unity. The theoretical explanation of the export base model is that expansion of export industries adds to aggregate spending in a region, thus raising income, inducing new investment, and promoting regional growth. If this theoretical underpinning is to be true, two conditions must be fulfilled. The first condition which is implicitly assumed by export base models as well as other demand-determined regional growth models is that there is always unemployment or excess capacity in the regional economy. The second condition for an increase in exports to induce growth, according to (2.5) is that α must be greater than β. If α is less than β, rising exports can have a dampening effect on the rate of growth and eventually an increase in exports may have a negative effect on long-run rate of regional growth.[5]

Export-base models consider that exports are the sole autonomous sector in the regional economy. Because of this, Tiebout has pointed out that this approach may overemphasize the role of exports relative to other demand sectors even if both the first and the second conditions are fulfilled.[6]

Economic Base Model The economic base model focuses on exogenous forces of the export sector, as does the export base model, the growth in demand for the region's exports being the primary basis for long-run regional growth and short-run regional fluctuations.[7]

An elaboration of the economic base model is mainly concerned with the division of regional economic activities into two sectors: basic and non-basic sectors. Empirically, several methods have been adopted to classify regional activities (or industries) into basic and non-basic sectors, either based on income statistics or on employment statistics.[8] However, the fundamental principle is the same: industries producing goods and services for export are classified as the basic

---

[5] J. Thomas Romans, Op. Cit., pp. 80-81.

[6] C.M. Tiebout, "Exports and Regional Growth" Op. Cit., pp. 160-61.

[7] C.M. Tiebout, "The Urban Economic Base Reconsidered", Land Economics, 32 (1965), 95-99. A Historical Survey of application and concepts of economic base can be found in Meyer, Op. Cit., pp. 32-35.

[8] Different methods which have been empirically employed to classify regional industries into basic and non-basic sectors in economic base studies are summarized in Richardson, Op. Cit., Part 1.

sector and the remaining industries are classified as the non-basic sector. The ratio between the basic and total employment is the multiplier. A ratio of 1:1.30 of employment, for example, implies that for every individual employed in the basic sector, there are .30 persons employed in the non-basic sector. Thus, the multiplier is 1.30.

One virtue of base models, either export base or economic base, is that these models allow the empirical simplicity of partial analysis to influence the interrelationship between activities of certain sectors and overall regional economic activity.[9] However, the matter is expressed very clearly by Meyer in the following sentences:[10]

> "It suffers from the usual disabilities of partial analyses in that the needed preliminary simplications may not be obvious or easily ascertainable in complex interdependent situations. Particularly likely to be ignored are such considerations as economies of scale, factor price changes induced by inelastic supply functions, and external economies attributable to urbanization or similar influences."

The Conventional Input-Output Model Disregarding the problems of aggregation, one may say that the economic base and export base models described above treat the role of demand in regional economic growth in a rather unsatisfactory way. In order to gain information in disaggregated form concerning the role of demand in the regional economy, the conventional input-output model has been widely applied to regional growth studies. With the multiplier, the change in final demand (or exogenous variables) is a given or estimated direct quantity change which is then

---

[9]Robert J. Anderson, "A Note on Economic Base Studies and Regional Econometric Forecasting Models", Journal of Regional Science, 10 (1970), pp. 325-333.

[10]Meyer, Op. Cit., p. 34.

used to compute the presumed direct, indirect and induced effects (some studies do not consider induced effects) on sector output, income, or employment. Mathematically, the conceptual framework of an open static input-output model is given by Leontief in matrix notation as:[11]

$$X = A\,X + F \tag{2.6}$$

where X is a matrix of sector output; A is the technical coefficient matrix; and F is the final demand vector. Thus, the level of output change resulting from a final demand change can be computed by inversion of the technical coefficient matrix.

From the theoretical point of view, empirical analyses applying regional or interregional input-output models during the past decade differ mainly with regard to the question of which variables are to be estimated exogenously and which are to be taken as endogenous in the models. Possibly the most typical studies in this respect are the regional analyses presented by Miernyk,[12] MacMillan, Lu and Framgingham,[13] in interregional input-output models by Chenery, Clark and Pinna,[14] Moses,[15]

---

[11] W. Leontief, et al., Studies in the Structure of the American Economy (New York: Oxford University Press, 1953).

[12] W.H. Miernyk, Impact of the Space Program on a Local Economy, (Parsons, West Virginia: West Virginia University Foundation, 1967).

[13] James A. MacMillan, C.M. Lu, and C.F. Framingham, Regional Development Planning and Evaluation: An Impact Analysis of Manitoba's Interlake Area, FRED Plan (Ames, Iowa: Iowa State University Press, 1974) (forthcoming).

[14] H.B. Chenery, P.G. Clark, and Ver Cao Pinna, The Structure and Growth of the Italian Economy, (Rome: United States Mutual Security Agency, 1953).

[15] L.N. Moses, "The Stability of Interregional Trading Patterns and Input-Output Analysis", American Economic Review, 40 (1955), 803-832.

and Leontief and Strout[16] and the national model by Statistics Canada.[17] Thus, the input-output models, either regional or interregional, are also constructed along the theme of demand-determined growth: the regional growth is determined by the matrix multiplier and the associated input-output or technical coefficients.

Tiebout has pointed out the limitations of regional and interregional input-output models based on the standard assumptions of all input-output models: no multi-product industries; linear input functions; no external economies; neglect of capital formation; and existing excess capacity. Additional assumptions required by interregional input-output models are: stable trade coefficients and fixed supply areas, which in turn imply other things such as stable relative prices between regions and an absence of interregional competition.[18] Major regional problems require dynamic analysis. Unless static underlying assumptions can be removed, any static input-output model is inappropriate for such dynamic investigations. Research has been undertaken to trace some of the main themes in the evolution of input-output models in recent years.[19] The

---

[16] W.D. Leontief and A. Strout, "Multiregional Input-Output Analysis", in T. Barna (ed.), Structural Interdependence and Economic Development Op. Cit., 119-150. Reprinted in W. Leontief, Input-Output Economics (New York: Oxford University Press, 1966).

[17] Statistics Canada, the 1961 Input-Output Table (Ottawa: Queen's Printer, 1963).

[18] C.M. Tiebout, "Regional and Interregional Input-Output Models: An Appraisal", Southern Economic Journal, 24 (1957), 140-147. Also reprinted in L. Needleman (ed.), Op. Cit., pp. 86-96.

[19] A brief introduction by H.B. Chenery at the Fourth International Conference on Input-Output Techniques in Geneva in January 1968 provided information concerning the evolution of input-output model in recent years. See: H.B. Chenery, "Introduction", in A.P. Carter and A. Brady (eds.), Application of Input-Output Analysis, (Amsterdam: North-Holland Publishing Company, 1970), 1-6.

themes which have been investigated will be discussed in subsequent sections.

Aggregate Dynamic Regional Growth Models A prominent aggregate dynamic regional growth model is the one suggested by Hartman and Seckler.[20] The model suggested by Hartman and Seckler is

$$Y_t = C_t + I_t + E_t - M_{ct} - M_{kt} \tag{2.7}$$

where Y_t = income, C_t = consumption, I_t = investment, M_{ct} = import of consumer goods, E_t = exports net of imports of goods used in export production and M_{kt} = imports of capital goods used in the production. Then the following functional relations are hypothesized.

$$C_t = b\, Y_{t-1} \tag{2.8}$$

$$M_{ct} = c\, C_t \tag{2.9}$$

$$E_t = \text{autonomous} \tag{2.10}$$

$$I_t = K[C_{t-1} - M_{ct} + M_{ct-1}] + (E_t - E_{t-1}) \tag{2.11}$$

$$M_{kt} = m\, I_t \tag{2.12}$$

Substitutions of all equations from (2.8) to (2.12) into (2.7) yields regional dynamic growth model

$$Y_t = \frac{E_t}{1 - b(1 - c)} + \frac{K(1 - m)}{1 - b(1 - c)} (E_t - E_{t-1}) + a_1(x_1)^t + a_2(x_2)^t \tag{2.13}$$

Thus, the growth path of regional income is composed of two factors: first, the autonomous growth path described by the first two elements of equation

---

[20] L.M. Hartman and D. Seckler, "Toward the Application of Dynamic Growth Theory to Regions", Journal of Regional Science, (1967), 167-173.

(2.13) and secondly, the endogenous "self-sustaining path described by the last two elements of equation (2.13).

This model modifies the multiplier-accelerator principle to incorporate interregional trade in both consumption and investment.[21] Thus, the regional growth pattern depends on (a) the relative size of c_t and b_t, (b) the values of interregional trade coefficients, and (c) stochastic disturbances. The model may explain the process of long-run regional economic growth and short-run fluctuation. However, the absence of resource constraints in the model makes it impossible to estimate structural changes over time. In any event, although the Hartman and Seckler treatment enables something to be said about the process of regional growth, it falls far short of a comprehensive analysis of regional long-run growth patterns and short-run fluctuations.

Limitations of Demand-determined Regional Growth Models

No demand-determined regional growth models explicitly consider the supply side of the economy, so that if demand factors alone are capable of sustaining regional growth in the long-run, regional growth is simply a function of demand parameters. A change in any one of the demand parameters alters the long-run growth rate of regional output since demand creates its own supply through induced or multiplier effects. It is plausible that an increase in final demand could set off an induced growth if the region is subject to excess capacity or underemployment. However, the demand-determined regional growth models neglect the role of scarce resources in regional

---

[21] This concept has been used to construct an aggregate dynamic regionalgrowth model similar to the Hartman and Seckler model. See: J. Airov, "Fiscal-Policy Theory in an Inter-regional Economy: General Interregional Multipliers and their Application", Papers and Proceedings of the Regional Science Association, 19 (1967), 83-108.

growth. However, empirical evidence indicates that resource endowments do play an important role in regional growth, particularly for rural-oriented regions.[22] In addition, no model of regional growth will be adequately explanatory without a theory of structural change as implied in changing input-out-put coefficients or production function and the structure of resource utilization.[23] To consider these factors in regional growth, another extreme type of regional growth model, the "supply-determined" growth model, has been increasingly emphasized.

B. "Supply-determined" Regional Growth

Types of Supply-determined Regional Growth Models

The demand-determined regional growth models described above neglect the role of production in regional growth. In response to this and other problems, economists recently have turned to supply-determined regional growth models, borrowing from the national economic growth models of Harrod-Domar and neoclassical growth models such as the regional growth models contributed by Romans[24] and Borts[25] and Borts and Stein.[26]

---

[22]For example, H.S. Perloff et al., Regions, Resources and Economic Growth (Lincoln: University of Nebraska Press, 1960), and H. Perloff and L. Wingo, "National Resource Endowment and Regional Economic Growth", in J. Friedman and W. Alonso (eds.), Regional Development and Planning (Cambridge: The M.I.T. Press, 1964), 215-239.

[23]L.M. Hartman, "The Input-Output Model and Regional Water Management", Journal of Farm Economics, 47 (Dec., 1965), 183-191.

[24]Romans, Op. Cit., pp. 76-78.

[25]G.H. Borts, "Return Equilization and Regional Growth", American Economic Review, 50 (196), 319-347. Also, see, G.H. Borts, "A Theory of Long-Run International Capital Movements", Journal of Political Economy, 72 (1964), 341-359.

[26]G.H. Borts and J.L. Stein, "Regional Growth and Maturity in the United States: A Study of Regional Structural Change", Schweizerische Zeitschrift für Volkswirtchaft and Statistik, 98 (1962), 290-321. Reprinted in L. Needleman (ed.), Op. Cit., pp. 159-197.

Harrod-Domar Type Regional Growth Model By allowing for inter-regional movements of capital and labour, Romans adapts the Harrod-Domar type of growth model in his first empirical test of regional growth. He begins by assuming that (a) investment is a function of income over time, $I = b \frac{dY}{dt}$: (b) saving is equal to a constant times the level of income, $S = sY$; (c) imports are also equal to a constant times the level of income, $M = mY$; (d) capital-output ratios are fixed in proportion over time, $V = \frac{K}{Y}$: and (e) the labour force growth rate is constant, n. Then the equilibrium condition for an open economy is

$$S + M = I + E \qquad (2.14)$$

where E represents exports and I is investment. By assuming the rate of growth in exports constant, $E = \bar{E}$, substituting assumptions (a), (b) and (c) into (2.14) and rearranging it, the regional growth rate (g) at full capacity which is represented by $g = \frac{1}{Y}\frac{dY}{dt}$, is determined by equation (2.15).[27]

$$g = \frac{s + m - \bar{E}/Y}{V} \qquad (2.15)$$

The theoretical explanation of this type of regional growth is that regions are open economies. Imports are leakages as well as savings and exports as well as investment, can fill the gap between domestic consumption and full capacity output. Excess savings can be diverted to other regions by raising an export surplus. Thus, if a region's population is increasing too fast to be absorbed into employment at the current growth rate, net migration may help to balance labor force growth

---

[27] Romans, Op. Cit., 76-79.

rate (n) and the regional growth rate (g). Similarly, capital movement will autonomously adjust the regional capital deficits.

This type of growth model, however, overemphasizes the role of saving and capital and labour mobility in the regional growth process. Unless, a region is always growing at its full capacity level, savings for investment perhaps plays a small role in regional growth.

Neoclassical Type Regional Growth Models The rigidity of capital-output ratios in the Harrod-Domar type of regional growth model implies that substitution between capital and labour is not allowed. Because of this unrealistic assumption, the neoclassical, or production function, type of growth model is applied in regional analysis. The neoclassical growth model implies a theory of factor mobility in addition to a theory of growth. The argument that factor substitution exists is based on the facts that (1) there are alternative techniques available in production using different combinations of labour and capital; (2) there are inter-commodity substitutions in demand in the economy which induce changes of different degrees in production techniques to adjust to demand changes; and (3) there are existing interregional product and resource mobilities, and through these movements the production techniques are altered.[28]

By considering the possibility of factor substitution between capital and labour and factor mobility between regions, the neoclassical type of regional growth model constructed by Borts and Stien emphasizes:

---

[28] Borts and Stien, Op. Cit., p. 177. Also see: Romans, Op. Cit., pp. 82-83; R.N. Batra and F.R. Casas, "A Model of Regional Income Differences and Economic Growth", Regional Science Perspectives, 2 (1972), 19-40.; N.H. Lithwick, Economic Growth in Canada: A Quantitive Analysis (Toronto: University of Toronto Press, 1967).

capital accumulation, an increase in labour supply and technological change. Assuming that the rate of technological change is a function of time (T) and the production function is linear and homogenous with respect to capital (K) and labour (L), the regional production or income (Y) is

$$Y = f(K, L, T) \tag{2.16}$$

Let $a = \frac{\partial Y}{\partial L}\frac{L}{Y}$, the labour income share so that $(1 - a) = \frac{\partial Y}{\partial K}\frac{L}{Y}$, the capital income share and $t = \frac{1}{Y}\frac{\partial Y}{\partial T}$, the rate of shift of output resulting from technological change, regional growth (ΔY) is represented by

$$\Delta Y = (1 - a)\ \Delta K + a\Delta L + t \tag{2.17}$$

As in the Harrod-Domar type of regional growth model, the neo-classical growth model also requires full capacity growth, and this in turn requires a mechanism to equate investment with full employment savings which is represented by the national rate of interest (i), for equilibrium growth. That is

$$1 - a = \frac{\partial Y}{\partial K} = MPK = i\ \frac{K}{Y} \tag{2.18}$$

If i is given, for steady growth Y must equal K. Substitution of this into equation (2.17) yields

$$\Delta Y = \frac{\Delta L + t}{a} \tag{2.19}$$

This is the long-run growth for all regions in the nation. However, interregional differences in the rates of technical progress and population growth cause the different growth rates among regions as noted above. An equilibrium condition for the whole system is that aggregate investment is equal to aggregate full employment saving in the system. But internally generated savings in the individual regions do not necessarily equal the region's investment. Resource mobility is assumed to adjust the imbalance of individual region's savings and investment.

It is easily seen that the neoclassical growth model as applied to explain regional growth is constructed on the basis of resource mobility and factor substitutability in response to their returns. However, there is no assurance that factors will move in response to these returns. Estimated regional growth patterns often show high wage regions growing faster than low wage regions.[29] This fact is not consistent with neoclassical type of regional growth model because the assumptions of homogenous production for all regions and factor mobility do not hold in general.

Limitations of Supply-determined Regional Growth Models

The role of demand is purely passive in supply-determined regional growth models. Demand always adjusts to supply so that regional growth is a function of supply parameters and the market forces could automatically alter the regional growth rates to lead to convergence for all regions through resource mobility and factor substitution mechanisms as stated in the neoclassical type model of regional growth. However, Canada's experience suggests that these mechanisms have not been so effective as to produce a significant convergence and hence interregional income disparity is apparent.[30]

---

[29] Richardson, Op. Cit., pp. 62-65.

[30] S.E. Chernick, Interregional Disparities in Income, Staff Study No. 14 (Ottawa: Economic Council of Canada, 1966).

To sum up, neither purely demand-determined nor purely supply-determined regional growth models completely explain the complicated regional growth patterns. Both types of models are too simple and have serious shortcomings. Cornwall has clearly pointed out these shortcomings:[31]

> "It is difficult to believe that there are no supply constraints, that demand always creates its own supply without limits. On the other hand, the neoclassical world is one of pure competition, perfect foresight, price flexibilities, and instantaneous adjustments at the margin. And here too it is difficult to accept the one-way direction of causation, this time from supply or maximum output to demand.
>
> Whatever the adjustment mechanism adopted, the assumption that there is never any excess demand or supply in either the goods or factor markets must be dropped...If one held the view that demand always creates its own supply or the reverse, no further model building would be necessary."

This suggests that both demand and supply stimulate regional or national economic growth. Therefore a model which can appropriately explain regional economic growth should consider both dimensions. This is the concern of the next section.

C. The Patterns of Regional Growth in the Long-run

How do supply and demand interactions affect long-run patterns of regional growth? It is through the complex process of income generation and change of industrial structure in the regional economy.[32] The rate

---

[31] J. Cornwall, "The Role of Demand and Investment in Long-Term Growth", Quarterly Journal of Economics, 84 (1970), 48-69. Also see: S. Minabe, "Some Comments on the Role of Demand and Investment in Long-Term Growth", Quarterly Journal of Economics, 85 (1971), 337-343 and A Reply by Cornwall in the same issue, 344-348, and C.L. Leven, "The Economic Base and Regional Growth", in W.R. Maki, J. Brian and L. Berry (eds.), Research and Education for Regional Growth (Iowa: Iowa State University Press, 1966), 79-109.

[32] J.H. Cumberland, "A Regional Interindustry Model for Analysis of Development Objectives", The Papers of the Regional Science Association, 17 (1966), 85-103.

of growth of demand influences the rate of growth of supply through three main reactions.[33] First, the behaviour of productivity in each sector depends on the rate of growth of demand rather than on the neo-classically stressed technological change and factor supply. Assume that any firm or sector trying to work out its production plan is faced with the problem of having only a limited number of ways of combining capital and labour. Assuming further that the possibilities of achieving economies of scale and rapid growth in productivity through mass production are positively related to the capital intensity of the technique chosen, the economies of scale position determines the growth of productivity. Some firms or industries are less responsive to rapid growth in demand. When the market for goods becomes relatively saturated, demand shifts to other industries or sectors, thus slowing down the rate of growth of productivity.

Second, demand also affects the rate of transfer of resources. The mobility of the labour force from one sector to another, or from one region to another, for example, depends upon the vacancy rate and opportunities for advancement in the expanding sectors or expanding regions.

Finally, demand influences the growth of the labour force. This effect can be divided into two parts; the effect of a high rate of growth of demand on participation rates of the existing labour force, and the effect on migration into the region. The former possibility can be thought of as an influence adjusting the level of supply to that of demand.

---

[33] Cornwall, Op. Cit., pp. 60-65.

The effect of induced migration on the rate of growth of aggregate income and output is straightforward.

The induced effects of demand forces would result in increased regional income. Increases in regional income through saving and capital accumulation mechanisms allow the supply side of the regional economy to stimulate growth since supply is constrained by the rate of growth of productive resources: capital; land; etc. Growing supplies of productive resources further influence an economy's output mix and patterns of trade. The shift of a regional economy's output mix and increased income level influence the demand forces further.

These two major forces influence regional growth in a dynamic process through their interaction as stated above. Because of this dynamic growth process in an open economy, regional economic growth models have tended to include such concepts. Several regional growth models have been developed by considering joint interactions between demand and supply within an economy.[34] However, the models employed in these studies are based on extensions of the conventional input-output model described above. Some studies attempt to make the model dynamic

---

[34]For example, (1) W.R. Maki et al., Simulation of Regional Product and Income with Emphasis on Iowa 1954-1974, Agricultural and Home Experiment Station Research Bulletin 548 (Ames, Iowa: Department of Economics, Iowa State University, 1966); (2) G.A. Doeksen and D.F. Schreiner, "Simulating Short, Intermediate, and Long Run Effects of Private Investment on Employment by Industrial Groupings", Journal of Regional Science, 12 (Aug., 1972), 219-232; (3) P. Zusman, California Growth and Trade, 1954-63: An Inter-industry Analysis Emphasizing Agriculture and Water Resource Development, Giannini Foundation Monograph No. 27 (Berkeley: California Agricultural Experiment Station, University of California, 1971); and (4) W.A. Miernyk et al., Simulation Regional Economic Development: An Inter-industry Analysis of the West Virginia Economy (Lexington: Heath Lexington Books, 1970).

by incorporating investment as a time variable in the model. Other extensions examine feasible methods of reducing the limitations of input-output models for empirical analysis. The model for this study also will be constructed on the basis of an input-output framework. The advantages and disadvantages of several studies mentioned will be discussed together with the theoretical framework in the next chapter.

D. The Basic Input-Output Model and Its Limitations

As stated earlier, the economy is not composed of several separate industries or sectors that operate independently. Production and consumption are interdependent in determining regional economic growth. Consequently, the interactions between production and consumption caused by development programs are important in impact studies. The analytical framework of general equilibrium theory, or the Walrasian system, is appropriate because it emphasizes the interactions and feedback occurring within an economy. However, the general equilibrium system is empirically non-operational since data to implement the system are not available and even if they were, the numbers of equations and variables are too large for the system to be operationally useful. The operational model which also focuses on interactions and feedback within an economy and is easier to implement, is the basic input-output model. Therefore, the theoretical framework for this study is based on a modified input-output model which is similar to the Walrasian general equilibrium. However, the basic input-output model has been modified in some respects as mentioned in the preceding chapter. This section is devoted to reviewing the basic input-output model and the modifications which have been developed for the empirical analysis of this study.

Basic Input-Output Model As A Simulation Technique

The basic input-output model is essentially constructed on the basis of a set of "accounting equations" each of which depicts how the total gross product of an industry or a sector are distributed and how the total primary resource base in the economy is used up in a given period. Table 2.1 illustrates the accounting system of the input-output model in which the economic activities in the area are divided into n endogenous sectors and m exogenous sectors. Producing industries which are functionally related to the output of other sectors are endogenous. Sectors such as household, government, inventories and exports which are not commonly regarded as a function of other sectors, are classified as exogenous sectors. The exogenous sectors supply primary resource inputs and consume outputs as final demand.

The upper left (n x n) submatrix of Table (2.1) represents the intersectoral output relationships for each sector. The upper right (n x m) submatrix of the table represents the flow relations between producing sectors and the final demand sectors. Thus, a set of accounting equations representing the distribution of gross output in the economy may be written:

$$X_i = \sum_{j=1}^{n} X_{ij} + F_i \quad i, j=1, \ldots, n \qquad (2.20)$$

where X_i = total output of sector i within a given period of time;

X_{ij} = the portion of total output produced by sector i and entered as an intermediate input in the production of sector j; and

F_i = the portion of total output produced by sector i delivered to final consumers.

TABLE 2.1

Input-Output Model Components

	Endogenous Sector							Exodenous Sector					Row Sum
	1	2	...	j	...	n	$\sum_{j=1}^{n}$	1	2	...	m	$\sum_{j=1}^{n}$	
1	X_{11}	X_{12}	...	X_{1j}	...	X_{1n}	$X_{1.}$	F_{11}	F_{12}	...	F_{1m}	$F_{1.}$	X_1
2	X_{21}	X_{22}	...	X_{2j}	...	X_{2n}	$X_{2.}$	F_{21}	F_{22}	...	F_{2m}	$F_{2.}$	X_2
. . .													
i	X_{i1}	X_{i2}	...	X_{ij}	...	X_{in}	$X_{i.}$	F_{i1}	F_{i2}	...	F_{im}	$F_{i.}$	X_i
n	X_{n1}	X_{n2}	...	X_{nj}	...	X_{nn}	$X_{n.}$	F_{n1}	F_{n2}	...	F_{nm}	$F_{n.}$	X_n
$\sum_{j=1}^{n}$	$\Sigma X_{.1}$	$\Sigma X_{.2}$	...	$\Sigma X_{.j}$	...	$\Sigma X_{.n}$	ΣX_{nn}	$\Sigma F_{.1}$	$\Sigma F_{.2}$	...	$\Sigma F_{.m}$	ΣF_{ne}	$\sum_{ij}\Sigma X_{ij}$
	Z_{11}	Z_{12}	...	Z_{1j}	...	Z_{1n}	$\Sigma Z_{1.}$	FZ_{11}	FZ_{12}	...	FZ_{1m}	$FZ_{1.}$	$\bar{Z}_1$
	Z_{21}	Z_{22}	...	Z_{2j}	...	Z_{2n}	$\Sigma Z_{2.}$	FZ_{21}	FZ_{22}	...	FZ_{2m}	$FZ_{2.}$	$\bar{Z}_2$
	. . .												
	Z_{e1}	Z_{e2}	...	Z_{ej}	...	Z_{en}	$\Sigma Z1_{.}$	FZ_{e1}	FZ_{e2}	...	FZ_{em}	$FZ_{e.}$	$\bar{Z}_e$
Column Sum	X_1	X_2		X_j		X_n	X	F_1	F_2		F_m	F	X°

The lower left (l x n) submatrix contains primary resource factors such as labor, capital and land, supplied by the exogenous sectors and entered as primary inputs to the endogenous sectors. The lower right (e x m) submatrix represents purchases of primary resource factors by exogenous column sectors from exogenous row sectors. The accounting equation for primary resource factor i is represented by

$$Z_i = \sum_{j=1}^{n} Z_{ij} + FZ_i \quad i=1, \ldots, e \qquad (2.21)$$

where Z_i = the total amount of primary resource factors required by all sectors (endogenous and exogenous sectors);

Z_{ij} = the amount of primary resource factor i employed by endogenous sector j; and

FZ_i = the amount of primary resource factor i purchased by column exogenous sectors.

Conceptually, the intersectoral transaction table (account) should be constructed on the basis of production theory. However, in a small area such as the Interlake, exports and imports make up a large proportion of total area sales, and it is useful to separate imports for regional production (intermediate goods import) from those for final demand (final goods import). The most useful way of constructing an intersectoral transaction table for a small region is based on trade concepts (based on purchases of goods and sales of goods among sectors and between regions in which purchases of either intermediate goods or final goods are lumped together as imports of goods and raw materials). Therefore, the nature of input-output relations among sectors in the region are based on trade relationships rather than production.[35]

---

[35] MacMillan, Lu and Framingham, Op. Cit.,

The Input-Output Model For Projection or Simulation

Assume that the input of any factor is directly proportional to the production; that is:

$$X_{ij} = a_{ij} X_j \quad \text{for intermediate inputs} \tag{2.22}$$

$$Z_{ij} = b_{ij} X_j \quad \text{for primary resource factors} \tag{2.23}$$

The symbols X_{ij}, X_j and Z_{ij} are as defined above and the coefficients a_{ij} and b_{ij} denote the amount of output of sector i and primary resource factor i respectively required to produce one unit of output by sector j and are called "technical" or "input-output" coefficients and "Resource input coefficients" respectively.

It should be noted that two different types of input-output coefficients are distinguished in this study. One refers to trading coefficients whenever the coefficients are derived from an input-output table constructed on the basis of trade relationships and total sales as a measure of output. The other refers to technical coefficients whenever the coefficients are derived from an input-output table constructed on the basis of production function relationships and value of shipments and margins as a measure of output.

Furthermore, if we assume that: (a) each sector produces a homogenous product[36] and (b) no substitution exists between different products,[37] then by substituting, the balance equation (2.20) for n-sectors

---

[36]This assumption does not imply that the number of commodities is equal to the number of sectors. If a sector produces two or more products in constant proportion, one can define a single new output to include all products without harm to the assumption.

[37]This assumption implies that there is only one production process used to produce a homogenous product in each producing sector.

can be written as:

$$X_i - \sum_{j=1}^{n} a_{ij} X_j = F_i \quad i, j=1, \ldots, n \tag{2.24}$$

or in matrix notation as:

$$(I - A) X = F \tag{2.25}$$

where I = n x n identity matrix. The system of equations (2.25) states outputs, X, is a function of the specified and fixed structural interrelationships, a_{ij}'s, and the vector of final demand, F. Thus, the system of (2.25) can be solved for X in terms of F:

$$X = (I - A)^{-1} F \tag{2.26}$$

The matrix $(I - A)^{-1}$ is called the interdependence coefficient matrix whose elements, defined as μ_{ij}, show the output of sector i required directly and indirectly to satisfy one unit of final demand for output of sector j.

The amount of primary resource factors required in production should be added to the set of equation (2.25) in order to have a complete input-output model. Substituting (2.23) into (2.21), the demand for primary resource factors in production can be estimated by,

$$Z' = BX \tag{2.27}$$

where B is a matrix (ℓ x n) of primary resource factor coefficients and Z' is a column vector whose element depicts total factor requirements by sector j. Substituting for X, the system (2.27) can be written as:

$$Z' = B(I - A)^{-1} F \tag{2.28}$$

subject to

$$Z' \leq \bar{Z} - FZ \tag{2.29}$$

where $\bar{Z}$ denotes a vector of total primary resource factors available in a certain time period and FZ is a vector of primary resource factors required by column exogenous sectors (public use of land and capital are typical examples). The term $B(I - A)^{-1}$ is called the resource interdependence coefficient matrix.

Consequently, given the state of technology (the matrices A and B) and final demand (the vector F) the system (2.26) gives a unique solution for output (the vector X) and the system (2.27) gives the sectoral requirements of primary resource factors Z_ℓ, consistent with output level X. Thereby, the system of equations (2.26) and (2.28) are commonly used for developing projections of sectoral outputs and primary resource factor requirements.

However, the problem defined in this study is somewhat different from the projection systems because the exogenous change is in the primary resource factor supply rather than in final demand. Initially, changes occur in the agricultural land resource supply due to land clearing programs or changes in the state of technology (the matrices A and B) due to drainage and farm management training programs. The first effect to be estimated from agricultural resource development programs is the increase in agricultural outputs. These production changes can then be fed into the system of (2.26) to determine the impacts on the interdependent sectors. Knowledge of the change in agricultural output, together with sectoral multipliers allows for the calculation of the total value of production created in the economy resulting from the agricultural resource development programs.[38]

---

[38] L.M. Hartman, "The Input-Output Model and Regional Water Management", Op. Cit., and Discussion by J.D. Jansma in the same issue, p. 1591-1593.

Accordingly, by incorporating a subsystem that is used for estimating changes of agricultural outputs induced by agricultural resource development programs, into the basic input-output model enables one to simulate the impacts of these programs on related sectors of the economy. The simulation procedure is the reverse of the projection procedure. Assuming that the primary resource factor increase is ΔZ, which is limited for agricultural production, and generated from the agricultural resource development programs, and that the technical coefficients (the matrices A and B) do not change over time, the changes in agricultural output, ΔX_a, can be estimated by

$$\Delta X_a = B_\ell^{-1} \Delta Z_\ell \qquad (2.30)$$

where B_ℓ is a element of the primary resource factor coefficients, B. Subsequent to determining the changes in value of agricultural outputs, the impacts on related sectors can be estimated by

$$\Delta X = (I - A)^{-1} \Delta X_a \qquad (2.31)$$

Thus, the basic input-output model provides the theoretical framework for evaluating the impact of agricultural resource development programs on structural changes in production and distribution in agricultural sectors and on related sectors of the economy. A change in the resource base available for particular sectors not only creates a direct impact on changes in the levels of output for those sectors, but also induces indirect change in the level of output of related sectors. The matrix B provides the linkage between the resource development programs and the resulting change in output. The inverse matrix $(I - A)^{-1}$ further provides the information necessary for estimating the consequence of the changes in production of the related sectors of the economy.

Limitations of the Basic Input-Output Model

The stability of technical coefficients in the basic input-output model is restrictive when used for simulation and/or projection purposes. This aspect has received much criticism on both theoretical and empirical grounds in the literature. Though a definite conclusion concerning the stability of technical coefficients is still to be drawn, empirical evidence shows that technical coefficients do, in fact, change over time.[39] Therefore, applications of the basic input-output model should be modified to take account of changes in technical coefficients in order to minimize the error of longer term projections of sectoral output levels and/or resource utilizations.

It has been argued that changes in technical coefficients are not the same in all circumstances. Factors alleged to influence the change of technical coefficients are as follows.

(1) Substitution between inputs caused by changes in the relative prices of inputs over time. Stone, Bates and Barcharach have postulated that changes in the relative prices of inputs over time cause technical coefficient changes through two types of effects.[40] The first is the "substitution effect" through which commodity j has been substituted for other commodities as an intermediate input over the period considered. The

---

[39] A brief review of empirical tests of the constancy of technical coefficients can be found in: M. Bacharach, Biproportional Matrices and Input-Output Change (London: Cambridge University Press, 1970) Chapter 2.

[40] R.J. Stone, J. Bates and M. Bacharach, A Programme for Growth, (Part 3) "Input-Output Relationships 1954-66" (Cambridge, Mass: The MIT Press, 1963).

second is the "fabrication effect", through which commodity j has absorbed a larger or smaller proportion of intermediate to primary inputs.

(2) Changes in the composition of aggregate sectors. A technical coefficient for a composite sector is a weighted average of the component products included in the composite sector where the weights are the relative output shares of each component product. Since the weights are not always expected to grow by the same proportions as the level of output of the composite sector increases, the aggregate coefficient will vary correspondingly.

(3) Technological change. Technological change causes technical coefficient changes. The introduction of the electronic computer causing structural changes in production is a typical example. Technological change in the structure of agriculture may come from the use of new crop varieties, improved breeds in the livestock industry, and new machinery and equipment.

E. Review of Methods for Adjusting Technical Coefficients

Several methods have been used to adjust input-output relations based on the factors causing such changes over time.[41] The methods ranging from simple extrapolations to complex simultaneous equation systems. These methods are reviewed and their advantages and disadvantages are discussed below.

The Theil and Tilanus Method

Theil and Tilanus attempt to incorporate the substitution effect

---

[41]This section relies heavily on N. Demir, "Input-Output Projections of California Resource Requirements", Unpublished Ph.D. Dissertation (California: Department of Ag. Economics, University of California, Davis, 1970).

into the input-output model by using the general theory of derived demand for inputs.[42] The demand function for inputs is of the tollowing type:

$$\Delta X_{ij} = a_{ij} \Delta X_j + \sum_i b_{ij} \Delta P_{ij} \qquad i, j=1, . . ., n \tag{2.32}$$

where ΔX_{ij} = changes in the volume of commodities bought by sector j from sector i;

ΔX_j = changes in the volume of total output produced by sector j;

ΔP_{ij} = changes in the price of the commodities supplied by sector i to sector j;

a_{ij} = technical coefficients in physical terms; and

b_{ij} = demand elasticities which are zero in the usual input-output model.

By mathematical estimation of the following system (2.33), in matrix form, it is possible to account for technical coefficients changes caused by the substitution effect.

$$\Delta(X - F) = (I - A)^{-1} (A\Delta F + B\Delta P) \tag{2.33}$$

Each element of matrix B specifies the change in the demand for the output of some particular sector by all other sectors as induced by a change in price. The result (2.33) can be used to formulate conditioned forecasts of the change in the volume of intermediate demand to re-estimate the new technical co-efficients, given specified changes in price and final demand.

The necessary information for this method is the initial technical coefficient matrix A, relative price changes over time, and changes in estimated final demand. While the information needed is relatively less

---

[42] H. Theil and C.B. Tilanus, Op. Cit.

than for other techniques, the disadvantage of this method is its neglect of the "fabrication effect" mentioned above.

The RAS or Bioproportional Method

Stone and Brown have developed the "RAS" or "bioproportional method" to adjust for changes in technical coefficients over time caused by the substitution and fabrication effects.[43] This technique starts with correcting the updated technical coefficient matrix (A) for price changes between period 0 and period 1. More specifically,

$$\bar{A}_{O} = \hat{P} \, A \, \hat{P}^{-1} \tag{2.34}$$

where $\bar{A}_{O}$ = the technical coefficients matrix of period 0 expressed in terms of the prices of period 1; and

$\hat{P}$ = the relative price matrix whose elements are the prices in period 1 relative to those of period 0.

A major assumption of this method is that the substitution and fabrication effects are working uniformly over time. That is, if input i is a substitute for input j caused by relative price changes, the amount of substitution is in the same proportion to all coefficients located in row i. If there is a tendency for electricity to be used increasingly as a fuel input, the row of coefficients $a_{i1}, a_{i2}, \ldots, a_{in}$ relating to the electricity producing sector is multiplied by the rate of increase in electricity used. To adjust for substitution effects, the row of coefficients $a_{i1}, a_{i2}, \ldots a_{in}$ relating to the i^{th} producing sector

---

[43]See: (a) R. Stone and A. Brown, A Programme for Growth, (Part 1), "Computable Model of Economic Growth" (London: Chapman and Hall Limited, 1962); (b) R. Stone, J. Bates and M. Bacharach, A Programme for Growth, (Part 3), "Input-Output Relationships, 1954-66", (London: Chapman and Hall Ltd., 1963); and (c) M. Bacharach, Op. Cit., Chapter 3.

is multiplied by a scalar, r_i which is the i^{th} element of a vector R. The r_i will be greater than unity for expanding sectors and less than unity for declining sectors.

The same type of assumption and procedure are used to adjust for the fabrication effect. In this case, the adjustment is focused on a column sector rather than a row sector. The column of coefficients $a_{1j}, a_{2j}, \ldots a_{nj}$ relating to the j^{th} purchasing sector is multiplied by a scalar s_j which is the j^{th} element of a vector S. The s_j will be greater than unity if the degree of fabrication has decreased and less than unity if it has increased. Thus, if R and S are known the technical coefficients matrix of period 1 (i.e. A_1) can be estimated by

$$\begin{aligned} A_1 &= R\,\bar{A}_o\,S \\ &= R\,\hat{P}\,A\,\hat{P}^{-1}\,S \end{aligned} \tag{2.35}$$

The R and S are estimated from knowledge of the changes in relative prices and estimates of the total intermediate sales and purchases of commodities, between period 0 and period 1.

The bioproportional method is superior to the Theil and Tilanus method provided the following two problems can be resolved. First, there is the problem of identifying important coefficients concerning the movement of R and S. The assumptions that "substitution" and "fabrication" effects work uniformly along the rows and columns are not realistic. Not all of the purchasing sectors can be expected to substitute inputs in the same proportions. The substitutability depends upon the nature of the production. Grain, for example, is an input to both livestock and grain processing sectors. Forage on the other hand is an input to the livestock sector, but not to the grain processing sector. A sharp increase in the price of grain relative to forage may induce the livestock sector to substitute forage for grain without substitution taking place in the grain processing sector. Consequently, the uniform substitution assumption does not hold. The problem could be solved if one is able to construct R and S operators for each sector. Secondly, considerable data are required in order to identify the movements caused by the substitution and fabrication effects. The absence of time-series input-output tables prevents the practical application of the bioproportional method to the regional level.

The Incremental Technical Coefficient Method

The two methods described above are specifically concerned with the adjustment of technical coefficients caused by "changes in the relative prices of inputs" over time. The incremental technical co-efficients approach and other methods to be explained later are specifically concerned with the adjustment of technical coefficients caused by "technological change" over time.

The theoretical formulation of the incremental technical coefficient method as proposed by Carter[44] is based on the notion that the set of average input-output coefficients for the industry is the sum of the set of input-output coefficients for each technique in use weighted by its contribution to gross output. An important component of the variation in average coefficients over time is the introduction of new technique

---

[44] A.P. Carter, "Incremental Flow Coefficients for a Dynamic Input-Output Model With Changing Technology", in T. Barna (ed.) Structural Interdependence and Economic Development (London: MacMillan and Company Ltd., 1963), 277-302.

and scrapping of an old one. Carter assumed that all changes in input structure are embodied in new capital goods. This means that additional investment will reflect the most advantageous techniques available. Thus, changes in new capital investment are used as explanatory variables for changes in technique coefficients over time.

Consequently, the technical coefficient can be expressed as a capacity-weighted average of the initial value of the technical coefficient and the incremental technical coefficient, in matrix form as:

$$A_t = \bar{A}_t Z_{1t} + A_{t-1} (I - Z_{1t}) \tag{2.36}$$

where A_t = the technical coefficient matrix at time t;

A_{t-1} = the technical coefficient matrix in the previous year or the initial technical coefficient matrix;

$\bar{A}_t$ = the "incremental" or the "best practice" technical coefficient matrix; and

Z_{1t} = the proportion of the total capacity existing at time t, that was installed between t-1 and t.

Therefore Z_{1t} constitutes the link between changes in technical coefficients and growth in the capacity of the system.

If the hypothesis is correct, the system of (2.36) becomes an extremely practical method for predicting changes in technical coefficients over time as only a limited amount of information is required. The basic problems are to estimate Z_{1t} and $\bar{A}_t$. Referring to the former, the accelerator theory as proposed by Carter is,

$$Z_{1jt} = \frac{X_{jt} - X_{jt-1}}{X_{jt}} \tag{2.37}$$

where X_j represents the output level of sector j and the subscript t associated with X_j is the time span. Referring to the latter, two different approaches are used by the author. The first approach is to use the new established plants input-output coefficients as the incremental technical coefficients and the second method is called the indirect approach in which statistical procedures are used to infer what the incremental coefficients must have been in a given period from observed changes in average coefficients with a given volume of new capacity. However, Carter concludes, based on empirical application to the Tin Can, and Ball and Roller Bearings Industries, that predictions of changes in technical coefficients using the new plant coefficients method is better than the indirect approach. The results using the former approach however still overestimate the actual change. Therefore, further specification is required to estimate the incremental technical coefficients in order for this method to be practical.[45] In addition, the incremental technical coefficient method relies on the assumption that only new capacity installed is taken as the explanatory variable for changes in technical coefficient. However, other factors, as mentioned above, may induce change in technical coefficients. Nevertheless, this method can be applied at the regional level if specifications measuring the incremental technical coefficients and the level of investments on new plants are available.

Linear Programming Method

Matuszewski, Pitts and Sawyer suggest that linear programming is

---

[45] Wigley attempts to improve the method of estimating the incremental technical coefficients by assuming that the input-output coefficients for scrapped and new plants are proportionally related to the corresponding average values for the industry. See: K.J. Wigley, "Production Models and Time Trends of Input-Output Coefficients", in W.F. Gossling (ed.), Input-Output in the United Kingdom (London: Frank Cass and Company Ltd., 1970).

a useful technique for adjusting technical coefficients if the following data are available: (a) a base-year coefficient matrix, and (b) information on the true values of final demand, total output, and primary input of each industry or sector in the updating year.[46] Total intermediate outputs and inputs of each industry, i.e., the row and the column of total intermediate sectors, for year t then can be derived from the above mentioned information.

Given this information, two steps are employed by the authors to adjust the updated technical coefficients, using standard LP technique. The first step is to establish a general objective function and constraints. This means finding a set of technical coefficients for the year considered (year t) such that (a) the set of technical coefficients compatible with the row and column totals actually observed in year t and (b) the difference between the set of technical coefficients and the corresponding coefficients for the base year is a minimum. The mathematical formulation is as follows:

Find a set of coefficients a_{ijt} (i, j=1, . . ., n) such that

$$A_t = \sum_i \sum_j \left| \frac{a_{ijt}}{a_{ijo}} - 1 \right| = \text{Min}, \tag{2.38}$$

Subject to:

$$\Sigma a_{ijt} X_{jt} = X_{.jt} \tag{2.39}$$

$$\Sigma a_{ijt} X_{jt} = X_{i.t} \tag{2.40}$$

---

[46] T.I. Matuszewski, P.R. Pitts and J.A. Sawyer, "Linear Programming Estimates of Changes in Input Coefficients", Canadian Journal of Economics and Political Science, 30 (1964), 203-210.

$$\frac{1}{2} \leq \frac{a_{ijt}}{a_{ijo}} \leq 2 \quad (2.41)$$

where A_t = the objective function;

a_{ijt} = a set of technical coefficient being solved from LP model to represent the updated technical coefficient for sectors i and j;

a_{ijo} = the base year technical coefficient for sectors i and j that is known;

X_{jt} = the total output of sector j in year t (known);

$X_{.jt}$ = the total intermediate input of sector j in year t (known);

$X_{i.t}$ = the total intermediate output of sector i in year t (known).

Let $X_{ij} = a_{ijo} X_{jt}$ be called the "implicit flows" as implied by the base year coefficient, and $X_{ijt} = a_{ijt} X_{jt}$ be called an "adjust flow". For convenience of programming the objective function of (2.38) can be expressed by

$$A_t = \sum_i \sum_j \left| a_{ijt} X_{jt} - a_{ijo} X_{jt} \right| \frac{1}{a_{ijo} X_{jt}}$$

$$= \sum_i \sum_j \left| X_{ijt} - X_{ij} \right| \frac{1}{X_{ij}} \quad (2.42)$$

Thus, the set of equations (from (2.31) to (2.34) become:

$$A_t = \sum_i \sum_j \left| X_{ijt} - X_{ij} \right| C_{ij} = \text{Min}, \ (\text{where } C_{ij} = \frac{1}{X_{ij}}) \quad (2.43)$$

Subject to:

$$\Sigma X_{ijt} = X_{.jt} \quad (2.44)$$

$$\Sigma X_{ijt} = X_{i.t} \quad (2.45)$$

$$\frac{1}{2} \leq \frac{X_{ijt}}{X_{ij}} \leq 2 \quad (2.46)$$

The X_{ij} are constants which can be calculated from the known variables a_{ijo} and X_{it}.

However, the objective function defined in (2.43) is non-linear. Thus, the second step is to convert the non-linear objective function into a linear form in order to solve the problem with standard LP technique. This is done by introducing two new variables X^+_{ij} and X^-_{ij} such that

$$X_{ijt} = X_{ij} + X^+_{ij} - X^-_{ji} \tag{2.47}$$

subject to $X^+_{ij} \geq 0$ and $X^-_{ij} \geq 0$ (i, j=1, . . ., n).

Substituting (2.47) into the set of equations (2.43) to (2.46) and rearranging terms, the final formulation of the problem which is now computable in terms of standard LP technique is as follows:

Find a set of values X^+_{ij} and X^-_{ij} (i, j=1, . . ., n) such that:

$$\sum_i \sum_j (X^+_{ij} + X^-_{ij}) C_{ij} = \text{Min.} \tag{2.48}$$

Subject to:

$$\sum_i (X^+_{ij} - X^-_{ij}) = X_{.jt} - \sum_i X_{ij} \tag{2.49}$$

$$\sum_j (X^+_{ij} - X^-_{ij}) = X_{i.t} - \sum_j X_{ij} \tag{2.50}$$

$$X^+_{ij} \leq X_{ij} \tag{2.51}$$

$$X^-_{ij} \leq X_{ij}/2 \tag{2.52}$$

$$X^+_{ij} \geq 0 \text{ and } X^-_{ij} \geq 0 \tag{2.53}$$

This method is useful for adjusting updated technical coefficients as only a small amount of information is required. However, the following serious problems still remain. First, there are no functional relations in the model derived from the initial estimate of the technical coefficients. Therefore, the result can not be extrapolated to the future. The "fixed updating technical coefficients" assumption is still required for projection. Secondly, the constrained upper and lower boundaries of technical coefficients are arbitrary, without any empirical or theoretical consideration.

Regression Method

If a sequence of time series input-output tables are available, regression analysis can be applied to estimate changes in technical coefficients over time. Arrow and Hoffenberg[47] were the first to attempt using regression analysis for this purpose. They hypothesize that the input-output relationship is associated with a random variable with mean value 0. That is

$$X_{ij} = a_{ij} X_j + U_{ij} \tag{2.54}$$

where U_{ij} is a random variable with mean value 0. The other variables are as defined previously. Substituting (2.54) into the basic Leontief balance (equation 2.21), equation (2.54) becomes:

$$X_i = \sum_{i=1}^{n} a_{ij} X_j + F_i + U_i \tag{2.55}$$

where $U_i = \sum_{j=1}^{n} U_{ij}$. Thus, regression analysis can be used to estimate the coefficients (2.55), which are the technical coefficients a_{ij}, from time series data on X_i and F_i. No direct observations on the inter-industry flow are required. However, data limitation do not allow this

---

[47] K.J. Arrow and M. Hoffenberg, with the assistance of H. Markowitz and R. Shephard, A Time Series Analysis of Inter-Industry Demands (Amsterdam: North-Holland Publishing Company, 1959).

model to be operational. The number of parameters to be estimated a_{ij} in (2.55) is n (the number of industries) and we need at least as many observations on the variables X_i and F_i as the number of parameters to be estimated.

Consequently, the authors search for factors governing individual parts of the production system with each relation being as independent as possible of the other production relations and of demand conditions. The regression model hypothesized by the authors is

$$a_{ijt} = b_{ij} + C_{ij}\, t + d_{ij}\, W_t + e_{ij}\, y_t + F_{ij}\, [V_{jt}/X_{jt}] \qquad (2.56)$$

where t = time;

a_{ijt} = input coefficient from industry i to industry j in year t;

W_t = ratio of defense expenditures on goods to private gross national product in year t;

y_t = real per capita disposable income in year t;

V_{jt}/X_{jt} = the ratio of excess output over the highest previous peak to output when the excess is positive. It is zero otherwise.

The theoretical explanation of equation (2.56) is as follows. Higher disposable incomes may lead to a shift in j's product-mix towards better quality products which are more fabricated and so the intermediate input coefficients tend to be smaller. The ratio of defense expenditures on goods serves to account for product-mix changes. The time variable captures the effects of changes in technology and other excluded variables such as changes in consumer tastes on product-mixes. The last variable accounts for the adjustments to economies of scale in production.[48]

---

[48]Ibid., pp. 40-42.

The important relative price change variable is not included in this model. The omission is defended on the ground that the production techniques are insensitive to price change in the short-run and the relative price change affecting input coefficient changes are partially absorbed by other variables that are included in the model.

However, data do not allow equation (2.56) to be estimated because a long series of time series data on a_{ij} is not available. To overcome this statistical problem, an alternative form of equation is employed for empirical estimation. Substituting equation (2.56) into equation (2.55), the following equation is obtained:

$$X_{it} = \sum_{j=1}^{n} b_{ij} X_{jt} + \sum_{j=1}^{n} C_{ij} X_{jt} t + \sum_{j=1}^{n} d_{ij} X_{jt} W_t + \sum_{j-1}^{n} e_{ij} X_{jt} y_t + \sum_{j=1}^{n} f_{ij} (V_{jt}/X_{jt}) + F_{it} + U_{it} \quad (2.57)$$

Substituting the estimates of b_{ij}, C_{ij}, d_{ij}, e_{ij} and f_{ij} into equation (2.56), the technical coefficients a_{ij} for year t are then estimated.

A sequence of thirteen comparable input-output tables for the Netherlands providés opportunity for Tilanus to estimate technical coefficients, using a regression equation similar to (2.58).[49] For the sake of the resulting gain in degrees of freedom, a simple regression model in which each input coefficient is a linear function of time, t is hypothesized by Tilanus. That is

$$a_{ijt} = \alpha_{ij} + \beta_{ij} t + u_{ijt} \quad (2.58)$$

---

[49] C.B. Tilanus, Input-Output Experiments, The Netherlands 1948-1961 (Rotterdam: Rotterdam University Press, 1966).

The ordinary least square method is employed to estimate (2.58), using the thirteen time series observation of a_{ijt}.

Clearly the Tilanus model is oversimplified. For analytical purposes the model should be able to analyze the factors governing the individual parts of the production system. At present, however, it is not possible to establish such a model for empirical analysis because of the data problems. At least more than five year time series data on a_{ij} are required to apply the Tilanus method.

Aside from data problems there is a statistical problem. The least-squares estimate possesses neither the property of non-negativity nor that of the preservation of zero elements. Because of this, a number of the estimated input coefficients in Arrow and Hoffenbergs' study are negative at one or more points of time. However, Nerlove suggests that it may be possible to compute successful estimates of structural equations using Theil's two-stage least-squares method with restrictions on the estimated input-output coefficients. However, data problems still prevents its applications.[50]

---

[50]See the statement by Bacharach in Bioproportional Matrices and Input-Output Changes, Op. Cit., p. 16.

CHAPTER 3

MODEL SPECIFICATION AND SIMULATION PROCEDURES

A. Introduction

The general nature of the input-output model and its limitations have been indicated in the preceding chapter. This chapter presents the detailed verbal and mathematical description of the specific model to be used in the study. In addition, the simulation procedures of the model are also discussed.

The model used in the present study is an extension of that used by MacMillan, Lu and Framingham.[1] The similarities between the model used for the present study and the MacMillan-Lu-Framingham model are that: (1) both use the same 17 producing sectors, (2) both use basically the same final demand sectors; (3) in both studies the input-output table is constructed on the basis of the trade concept rather than the production function concept; and (4) both emphasize impacts on the Interlake Area regional economy. In the present model flow relations are revised to account for technological changes over time. Primary resource factor expansions in relating to regional economic growth over time are then incorporated in the model to capture the supply forces operating in the regional economic growth process. The model is not closed in the sense that it does not provide a complete explanation of economic behavior. Levels of trade and government activities on goods and

---

[1]MacMillan, Lu and Framingham, Op. Cit.,

services constitute a set of open end variables specified exogenously. However, the model can be closed in a variety of ways to be discussed subsequently.

B. General Assumptions Concerning Determinants of Regional Growth

To facilitate the analysis, the following assumptions are maintained throughout the model unless otherwise specified.

(1) The production in the region can be classified into two major parts. One part represents agricultural production in which two sectors are covered i.e., livestock and crop sectors. The other part includes all nonagricultural sectors including manufacturing, wholesales, retail sales and services of fifteen sectors.[2] It is assumed that the proportion of commodity production by different sectors is constant during the period being studied (1968 to 1986).[3]

(2) There is perfect competition prevailing in the markets for outputs and inputs including noncompetitive imported raw materials. Thus, the prices of output and raw material inputs are exogenously predetermined.[4]

(3) Each producing sector requires raw materials, labour, and capital for production. In addition, agricultural production requires an additional factor, land. The structure of the resource base

---

[2] The classification of sectors will be discussed in Chapter 4.

[3] This assumption does not imply that the number of commodities is equal to the number of sectors, but it does imply that the product components in a sector are constant.

[4] The perfect competition assumption may not be appropriate for a large region but it is reasonable for the region being studied.

including labour and land is partially determined by the state of the economy and government policies.

(4) Consumer demands for goods and services are explained by prices and consumer disposable income only.[5]

With the general assumptions described above, the actual growth of an agriculture-oriented regional economy is generated by the following factors:

(1) the structure of the primary resource base in the region including labour and land;

(2) growth in productivity i.e., technological change; and

(3) changes in final demand.

Of these factors, (1) and (2) are the basis for analyzing "supply determined" regional growth and (3) the basis for analyzing "demand determined" regional growth. The interactions among these three broad categories of factors determine the actual rate of growth of the region without government policy interference. Resource development programs enhance these three factors in the stimulation of regional economic growth further.

C. Model Framework

The basic framework of the model set up for the study is an

---

[5] Other factors such as annuitized assets, family size, change in net worth may be important factors determining household consumption but they are neglected in the present study due to lack of time-series data at the regional level. These factors are important see: James A. MacMillan, F.L. Tung and R.M.A. Loyns, "Differences in Regional Household Consumption Patterns By Urbanization: A Cross-Section Analysis", Journal of Regional Science, 12 (Dec. 1972), 417-24.

input-output model of the Interlake area. This basic model ensures the interactions between production and consumption in determining regional economic growth. As stated earlier, the regional growth path is determined by both supply and demand factors. The production or supply conditions are reflected by input-output coefficients and primary resource constraints. Demand factors are the feedback in determining the level of output under the constraints of production. Moreover, the equations reveal the consistency of the interlocking economic system where events in one sector influence activities to other sectors. These features of the model are necessary for impact analysis associated with development programs.

In this section a general description of the components of the model and interrelation of each component in the model is first presented. Following this general description, the procedure used to modify each component of the model is described. The simulation procedures and the nature of the solution are presented in the subsequent sections.

Components of the Model

The model consists of five components: (1) final demand; (2) input-output coefficients; (3) primary resources, labor and land, requirements coefficients; (4) capital requirements coefficients; and (5) resource constraints; (Figure 3.1). Each component serves its particular function in the model and thereby forms a submodel. Thus, the model basically consists of a set of production and trade activities and a set of constraints which limit the production of each producing sector thereby insuring that the maximum output attainable for each producing sector is

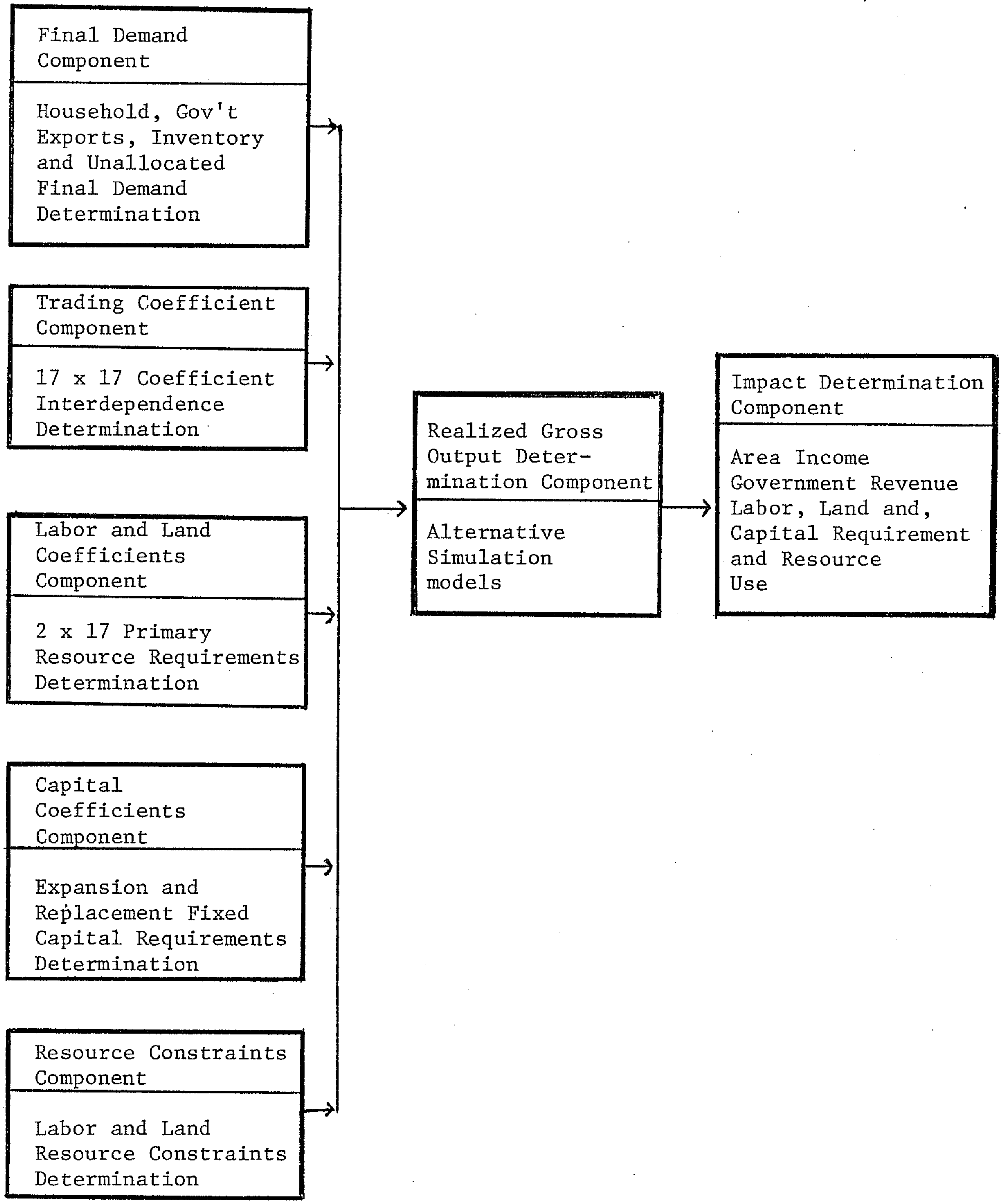


Figure 3.1

The Components of the Model

satisfied. Any combination and trade activities which satisfies the constraints is a feasible solution to the model. The determination of the solution then is controlled by the final demand forces and the constraints associated with production technology.

The behavioural equations in the final demand component are specified to capture the role of demand in determining the nature of the industrial development process. The behavioural relationships for household expenditure are typical. The estimates of income and direct and cross elasticities of demand provide insight into the structural changes in production caused by household demand forces. High income elasticities of demand for particular products are expected to induce these sectors to increase production, given the technology of production. Demand equations are specified for each final demand sector in terms of data availability and the explanatory variables that are able to reflect the behavioural relationships for that final demand sector. There is sufficient information on the demand side of the model to forecast regional changes induced by demand forces.

The trading coefficients component of the model represents the sectoral transaction relations which determine the transformation of material inputs to outputs. This component forms the core of economic relations in the regional economy and is basically an integration of input-output and income and products accounts in tracing the development process through the interrelationships among sectors.

Similar to the trading coefficients component, the inclusion of labor, land and capital requirements coefficients component in the model allows the transformation of primary resource inputs into output through the primary resource requirement coefficients matrix. Furthermore, the capital requirements coefficients are extended to include two basic motivations for investment: (1) investment for expansion of capacity to increase output levels to meet expected increases in demand; and (2) investment for replacement to maintain the same level of capacity to meet unexpected increases in demand. This device can be used to build a dynamic input-output model with incorporation of the accelerator principle. A theoretical explanation is that increase in aggregate demand for an industry's final products will accelerate the diffusion of new techniques by raising the investment potential in new methods to create new capacity toward expected or desired capacity level.

Production is constrained by some primary input factors. These constraints place an upper bound on the supply side in a given period of time in the regional economy. The resource constraints component of the model provides detailed information useful in checking the projected output levels consistent with final demand determined by its behavioural equations specified in the final demand component. Like the national economy, the regional economy is constrained by the condition that the output levels are to be produced at the limits imposed by technology and various behavioural constraints on the supplies of inputs. The inclusion of the primary resource input constraints in the model is the essential feature in determining the impact of resource development programs on the regional economic growth.

Regional economic development resulting from the forces included in the model is summarized by a set of economic indicators. These indicators are presented in the impact determination component of the model.

The first set of economic indicators to be measured is realized gross output. This indicator shows the general business activity resulting with and without resource development programs and is considered as an intermediate goal showing the need for resource development programs. The second set of economic indicators to be measured are directly related to the objectives of regional development programs such as area income, government revenue, and resource utilization rates. Thus, the quantitive impacts on these indicators derived from the model can be employed to assess regional development programs in achieving specified targets in specified time periods.

Final Demand Submodel

One of the basic steps in simulating the impact of the resource development programs using the input-output model is the estimation of final demand without and with resource development programs for the target years. In the present section the independent projections of final demand vectors are presented.

The components of the final demand vector depends upon the assumed regional development process. The regional development process is assumed to follow a static process in one case and to follow a dynamic process in another, to be discussed later. The government, net inventory change, exports and unallocated sectors are considered to be the final demand vectors in all cases and the household and capital formation sectors are considered to be the additional final demand components in the static case. The procedures for estimating each component of the final demand vectors are discussed in this section.

Household Consumption Expenditure The estimation of household demand is of crucial importance in impact studies since Interlake households represent the largest component of final demand. Decisions by Interlake consumers to spend an extra dollar for the product of a particular sector stimulates an economic chain reaction because of the linkage between consumers and the producing sectors on the one hand, and the inter-dependency among producing sectors on the other. The task is to determine the levels of household demand for Interlake products for each of the target years.

The general theory of demand suggests that the level of consumption is determined by the behaviour of consumers, maximizing their utility, subject to budget constraints. It follows that the per capita consumption of commodity i is a function of price and income levels faced by consumers. For the present study, the first step, therefore, is to determine a set of demand and income elasticities indicating the relationships between demand for various commodities or commodity groups and prices, and the relationships between consumption and income in the Interlake. Since time series data in the region are not available, an alternative method of deriving consumer demand function under insufficient time series data is employed in the study. The method of deriving a system of demand equations is based on Frisch's postulation.[6] Given the additive utility assumption, common to demand theory, and applying Frisch's indirect method, one only needs to estimate k income elasticities of demand from

---

[6]R. Frisch, "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model With Many Sectors", Econometrica, 27 (April, 1957), 177-196.

cross-section information and one parameter that Frisch called the money flexibility of marginal utility of income (simply called money flexibility).[7] All price elasticities can be derived from these k+1 parameters. The detailed specification of the method will be discussed in Chapter 4. The second step is to develop per capita income and price change projections for each target year to project per capita consumption. Third, the product of per capita consumption with the independent projections of Interlake population yields projections of total household expenditures. Finally, consumer's purchases are not all from the regional producing sectors. In the Interlake, 20% of total household consumption was purchased outside the region in 1968.[8] Thus, the portion of consumer's purchases from outside of the region are substracted from the estimates of total household expenditure and the results are allocated to the 17 producing sectors based on a matrix showing the patterns of household consumption expenditures of different commodities purchased from different sectors in the base year (1968) obtained from the household survey.

Government Expenditure The absence of adequate underlying theory and lack of understanding of the complete process of government expenditure decision-making presents difficulties in projecting future government expenditure patterns. For this reason, most studies involving projections

---

[7]K refers to the number of commodities or commodity groups being considered in the study.

[8]See: C.F. Framingham, J.A. MacMillan and D.F. Sandell, The Interlake Fact (Winnipeg: The Continuing Program Secretariat, Planning and Priorities Committee of Cabinet, 1973), Table 23.

of government expenditures use simple extrapolation procedures.[9] In this study, an attempt is made to use a theoretical model for projecting local government expenditure for two reasons: (1) detailed time-series data on local government expenditure are available and (2) goods and services produced in the area are mainly sold to local government, and the other two governments, federal and provincial, are less important in constituting final demand. Thus, the model employed to project future government expenditure on goods and service is divided into two parts: one part of the model is constructed to estimate Federal and Provincial governments expenditure in relation to its portion of purchasing goods and services from the area and the other part is elaborated for estimating local government expenditure.

Estimation of Federal and Provincial government expenditures are based on the method employed by MacMillan and Lu.[10] A simple regression on time (t) is employed to estimate the Federal and Provincial government expenditure function using time-series data. The estimated equation then is used to project Federal and Provincial government expenditures for each target year. These estimates are allocated to 17 producing sectors based on the vector of Federal and Provincial governments demand

---

[9] Oklahoma and California's Studies are typical examples. See: (1) Doeksen, G.A. and D.F. Schreiner, A Simulation Model for Oklahoma With Economic Projections From 1968 to 1980; bulletin B-693 (Oklahoma: Agricultural Experiment Station, Oklahoma State University, 1971), and (2) Lee, I.M., Conditional Projections of California Economic Growth, Giannini Foundation Monograph No. 19 (California: Giannini Foundation of Agricultural Economics, University of California, 1967).

[10] MacMillan, J.A. and C.M. Lu, Projection and Impact Models: Area Manpower Planning in the Interlake Region, Manitoba, Research Bulletin No. 72-5 (Winnipeg: Department of Agricultural Economics, University of Manitoba, 1972).

for regional goods and services generated from 1968 government expenditure survey data.

The estimation of local government expenditure is derived from a hypothesized local government expenditure function. It is hypothesized that the local government expenditure for the i^{th} category in year t is determined by the community's population size in that year and previous local government expenditure on the i^{th} category (the derivation of this hypothesized local government expenditure function will be given in the next chapter). This hypothesized local government expenditure functions by category are estimated and the results are employed to project the target year's local government expenditures. The vector of local government expenditure survey in 1968 for each category is used to allocate the projected local government expenditures into 17 producing sectors.

Investment Almon's stock adjustment model is employed to project the regional capital formation for each target year.[11] Almon assumes that gross investment, KI_{jt} is proportional to the gap between the desired stock in year t for the j^{th} sector, $\overset{*}{K}_{jt}$, and the capital stock, K_{jt-1} that would be available at the end of the year if no investment was made during the past year. Mathematically, that is:

$$KI_{jt} = \Psi_j \, [\overset{*}{K}_{jt} - (1 - d_{oj}) \, K_{jt-1}]; \quad j=1, \ldots, 17 \qquad (3.1)$$

where d_{oj} represents the depreciation rate for the j^{th} sector and hence $(1 - d_{oj}) \, K_{jt-1}$ is the available stock at the end of the year for the j^{th} sector.

[11] Almon, C.,"Investment in Input-Output Models and the Treatment of Secondary Products", in Carter, A .C. and A. Brody (eds.) Op. Cit., pp. 103-116. Unpublished capital and investment data are avaiable from the 1968 Interlake Area business survey.

The desired capital stock depends on lagged realized gross output, RX_{jt-1}.

$$\overset{*}{K}_{jt} = b_{oj} + b_{ij}\ RX_{jt-1};\quad j=1,\ldots,17 \tag{3.2}$$

Substitution of equation (3.2) into (3.1) yields

$$KI_{jt} = \Psi_j\ b_{oj} + \Psi_j\ b_{ij}\ X_{jt-1} + \Psi_j\ (1 - d_{oj})\ K_{jt-1};\quad j=1,\ldots,17 \tag{3.3}$$

Since no time-series data are available for regional capital stock in Canada, it is convenient to eliminate the capital stock variable in equation (3.3). In eliminating the capital stock and adding a stochastic term, the gross investment functions become:[12]

$$KI_{jt} = \gamma_j + \sim_j\ [RX_{jt-1} - RX_{jt-2}] + \Psi_j\ KI_{jt-1};\quad j=1,\ldots,17 \tag{2.34}$$

where $\gamma_j\ [= \Psi_j\ b_{oj}]$, $\sim_j\ [= \Psi_j\ b_{ij}]$ and Ψ_j are parameters to be estimated by ordinary least squares.

The estimates obtained from equations (3.4) for each target year are then allocated to the 17 producing sectors by the following formula:

$$ID_{it} = \sum_{j=1}^{17} \bar{K}_{ijo}\ KI_{jt} \tag{3.5}$$

where $\sum_{j=1}^{17} \bar{K}_{ijo}\ KI_{jt}$ is the summation of the product of $\bar{K}_{ijo}$ and KI_{jt}.

The KI_{jt} is estimated from equation (3.4), given the levels of $(RX_{jt-1} - RX_{jt-2})$ and KI_{jt-1} and $\bar{K}_{ijo}$ is the proportion of purchase of

---

[12] Lag equation (3.2) one period, multiply this lagged equation by Ψ_j, substract the result from equation (3.2), and arrange terms using the relation $KI_{jt} = [K_{jt} - (1 - d_{oj})\ K_{jt-1}]$.

capital goods from sector i by sector j in the base year (1968).

Exports, Net Inventory Change and Unallocated Final Demand Estimation of the future level of regional exports requires knowledge about the comparative costs of goods and services for exports and the demand for export goods and services in the relevant markets. The knowledge of comparative costs of goods and services production for exports specifies the area's exports induced by changes in comparative advantages of export goods and services production given the level of demand for export in the relevant export markets. Changes in demand for export goods and services in the relevant export markets also stimulate changes in area's exports, given the state of comparative advantage for export goods and services production.

The relevant export markets in this study include the rest of Manitoba and of Canada. In 1968, the area exports primarily agricultural products to the rest of Manitoba. However, a large portion of such exports are re-exported to world markets due to the specific marketing system. In addition, there are no time-series data available for estimating the demand for these outputs in the relevant export markets.

To the extent that regional exports are within the scope of national planning, the Federal Government can implement policies to change the composition of exports among regions, given the national level of export to the world market. Given 10 million bushels of Canadian wheat exports to world markets, for example, the Canadian Government can increase the Interlake Area's export share faster than other areas by implementing development programs. Information is not available on trends in Interlake exports. The Manitoba growth rate of output (mainly in primary sectors) is used to project the export sales by the Interlake firms consistent with the procedure used by MacMillan and Lu.[13] That is

$$ED_{it} = ED_{io}\,[1 + r_i]^T;\ T = t - 1968 \text{ for all } i=1,\ldots,17 \quad (3.5)$$

where ED_i is the export demand for the i^{th} sector and r_i is the average annual growth rate of output for the i^{th} sector in Manitoba for the period 1960-1971.

The remaining components of final demand include net inventory change and unallocated sectors. Due to insufficient information on these components, the projection of these components of final demand is also based on the Manitoba's average annual output growth rate as for the projection of export demand. That is.

$$INV_{it} = INV_{io}\,[1 + r_i]^T;\ T = t - 1968 \text{ for all } i=1,\ldots,17 \quad (3.6)$$

$$UD_{it} = UD_{io}\,[1 + r_i]^T;\ T = t - 1968 \text{ for all } i=1,\ldots,17 \quad (3.7)$$

where INV_{it} and UD_{it} are respectively the net inventory changes and the unallocated final demands for the i^{th} sector in year t and other variables are as defined above.

<u>Trading Coefficients Submodel</u>

The major limitation associated with the application of the input-output model for impact analysis is the assumption of fixed input-output coefficients over time. The methods of reducing such limitations have been discussed in the preceding chapter. However, none of the methods can be employed for the Interlake due to insufficient data. Therefore, an alternative method is employed for this study and discussed below. The adjustments concentrate on construction of dynamic trading coefficients

---

[13] MacMillan and Lu, Projection and Impact Models, Op. Cit., Appendix A.

for the agricultural and related sectors based on farm business surveys assuming the remaining cells constant.

As stated in the beginning of the chapter, the input-output table for the Interlake area was constructed on the basis of trade relationships. The coefficients derived from such type of input-output table are trading coefficients rather than technical coefficients. However, the difference between technical and trading coefficients is that the former separates the imports in production and final demand and the latter does not.[14] Nevertheless, the conceptual framework employed to adjust technical coefficients can also be used to adjust trading coefficients assuming that there is a constant relationship between imports for intermediate use and for final demand.

Concept and Adjustment Procedure Generally, two types of production technology must be distinguished: One is the technology peculiar to the production process for a single commodity, and another is for product mix type of technology. In this study, the problem deals with the former since it was assumed that the proportion of each commodity produced by different sector is constant during the period studied. The instability of technical coefficients (trading coefficients) is mainly due to the fact that the production function is not a constant return to scale. The nature of economies of scale for agricultural commodities in Canada can be found in the studies by Auer[15] and by

---

[14]The distinction of "technical" and "trading" coefficients lies in the treatment of the import element used to construct input-output table as stated in the preceding chapter.

[15]Auer, L., Canadian Agricultural Productivity, Staff Study No. 24 (Ottawa: Economic Council of Canada, 1969).

Yorgason and Spears.[16] Thus, a more generalized production function that will permit variable returns to scale and will not lose its generality, is more appropriate for the production of agricultural commodities. Klein has shown that the generalized Cobb-Douglas type of production function is an appropriate one.[17] It implies that technical coefficients (also trading coefficients) in the input-output table change over time as a result of the number of components stated earlier, the principal one being the effect of changes in the size of the farm (or firm).[18]

The generalized Cobb-Douglas type production function has the following economic implications.[19] First, each farm size class in terms of acreage forms a production unit in each agricultural sector.[20] Let C_n be the productive capacity of the n^{th} farm size class, a vector of inputs associated with its productivity capacity, C_n describes the technical characteristics of the n^{th} farm size class. Various kinds of vectors represent the various techniques in producing the same kind of product.

---

[16] Yorgason, V.W. and D.E. Spears, "The Canadian Agricultural Production Function", Canadian Journal of Agricultural Economics, Vol. 19 (1971), pp. 66-76.

[17] Klein, L.R., "On the Interpretation of Professor Leontief's System", Review of Economic Studies, 20 (1952-53), pp. 131-136.

[18] Smith, A., "Surveys in Applied Economics: Technical Progress", The Economic Journal, 82 (March, 1972), pp. 11-72.

[19] Iwao, Ozaki, "Economics of Scale and Input-Output Coefficients", in A.P.C. Carter and A. Brody (eds.), Application of Input-Output Analysis, Op. Cit., 280-302.

[20] The size class is divided into three categories: small (ranging from 20 acres to 240 acres), medium (ranging from 240 acres to 760 acres), and large (over 760 acres).

Secondly, each farm size class with its specific technique has a definite productive capacity due to the technical indivisibility associated with each farm size class and the technical substitutability of factors for a given farm size class is not possible. Factor substitution occurs only through changes in farm size.

Now let us turn to an interpretation of changes in the trading (or technical) coefficients in the Leontief input-output system. Let FN_{jnt} be the farm numbers by size class in terms of acreage within the j^{th} sector in a given period. Given the assumption that the relation between imports for intermediate input and for final demand is constant associated with each farm size class, the ordinary trading coefficient for each sector in a given period is represented by

$$a_{ijt} = \frac{\sum_{n=1}^{3} (\bar{X}_{jni} \cdot FN_{jnt})}{\sum_{i=1}^{26} \sum_{n=1}^{3} (\bar{X}_{jni} \cdot FN_{jnt})} = \frac{\dot{X}_{ijt}}{\dot{X}_{\cdot jt}}\text{; for } j=1,\ 2\text{: } i=1,\ \ldots\ 26 \quad (3.8)$$

where $\dot{X}_{ijt}$ = inputs purchased from sector i by sector j in year t which is the sum of total input i for each size class;

$\dot{X}_{\cdot jt}$ = total inputs purchased by sector j in year t which is the sum of total inputs of each size class and is equal to total output from all production units; and

$\bar{X}_{jni}$ = average per farm purchasing pattern for the n^{th} size class in the j^{th} agricultural sector.

If $\bar{X}_{jni}$ is the same for all n (that is, if the average per farm purchasing pattern is the same for each farm size class) irrespective of the distribution of the farm numbers, the constancy of the trading co-efficients (so to technical coefficients) is guaranteed. However, if $\bar{X}_{jni}$ is represented by a more general form rather than the special one, the trading coefficients will change with shifts in the distribution of farm numbers by size class. Thus, if changes in the distribution of farm numbers by size class and a more general form of input purchasing patterns for each size class are known, changes in trading coefficients over time can be estimated by equation (3.8) for agricultural sectors.

Moreover, it is plausible that the distribution or treatment of output also will be different by farm size class because of differences in production techniques associated with trade patterns. If the product produced by small size farms, for example, is mainly distributed or sold to other intermediate sectors and if a large portion of the same product produced by large size farm is exported, transactions between the agricultural sector and other sectors will change with shifts in the distribution of farm numbers by size class. Consequently, it alters the trading coefficients for nonagricultural sectors through factor substitution. Thus, the trading coefficients for nonagricultural sectors in year t can be estimated if changes of the distribution of farm numbers and sales patterns by farm size class are known. The adjustment procedures involve revising the first two rows of each element in the input-output table and then recalculating the coefficients. These procedures are similar to that of estimating trading coefficients for agricultural sectors from the sales point of view. Mathematically, the procedures are presented by the following equations:

$$\dot{X}_{ijt} = \sum_{k=1}^{3} \bar{X}_{jni} \cdot FN_{jnt}; \text{for } i=1,\ 2;\ j=3,\ .\ .\ .,\ 24 \qquad (3.9)$$

$$\text{then } a_{ijt} = \frac{\dot{X}_{ijt}}{\sum_{i=1}^{2} \dot{X}_{ijt} + \sum_{i=3}^{26} X_{ij}} = \frac{\dot{X}_{ijt}}{\dot{X}_{\cdot jt}}; \text{for } i=1,\ 2;\ j=3,\ .\ .\ .,\ 17 \qquad (3.10)$$

$$\text{and} \quad a_{ijt} = \frac{\dot{X}_{ij}}{X_{\cdot jt}} \text{ for } i, j=3, \ldots, 17 \tag{3.11}$$

where $\dot{X}_{ijt}$ = the estimated sales from the agricultural sector (i=1, 2) to the j^{th} sector in year t; and other variables are previously defined.

Farm Plant-Scale Distribution Projection The adjustment procedure requires the knowledge of farm plant-scale distribution for each target year. The model specified to project farm numbers by size class (plant-scale distribution) is based on a Markov Process Model[21] using two time periods of agriculture census data.[22] This traditional Markov Process Model has been employed to project for the 1971 Prairie region using data from the 1961 and 1966 agriculture census based on a gross receipts classification, by MacMillan, Tung and Tulloch.[23] However, traditional Markov process models over-estimate the larger classes and underestimate the small classes because the Markov process model does not reveal the transition probability of farm-nonfarm migration and it does not take price changes into consideration. Therefore migration analysis and price changes are used to adjust the transition probability

---

[21] A large number of studies have applied the Markov chain process. See Dent, W. and R. Ballintine, "A Review of the Transition Probabilities in Markov Chain", The Australian Journal of Agricultural Economics, 15 (Aug., 1971), pp. 69-81; and for an analysis of migration probabilities in the Interlake area, see Tulloch, J.R. and J.A. MacMillan, "A Micro-Analytic Model of Migration", Regional Science Perspectives 3 (1973).

[22] Dominion Bureau of Statistics, 1961, 1966 and 1971 Census of Canada, Agriculture (Ottawa: Queen's Printer).

[23] MacMillan, J.A., F.L. Tung and J.R. Tulloch, "Migration Analysis and Farm Number Projection Models: A Synthesis", American Journal of Agricultural Economics, 56 (May, 1974), 292-299.

matrix. This way of adjusting the Markov process model to estimate farm numbers by size class has been tested by the authors for Manitoba. It is concluded that such a method could substantially improve projection results. Consequently, the same approach is applied in this study to project the farm plant-scale distribution for the study area. The procedures for projection of farm numbers by gross receipt class employed by MacMillan, Tung and Tulloch are illustrated below.

First, the transition probabilities matrix between 1961 and 1966 for Manitoba is constructed according to the assumptions: (1) increases in the number of farms in any income state, U_f come only from the next smallest state, U_{f-1}, in the five-year period; (2) any decrease in any income state means that those farms go out of farming.

Second, a set of determinants (changes in off-farm work, change in number of operators less than 25 years, change in number of operators less than 25 years, change in number of operators greater than 60 years and change in capital stock) is used to determine the farm-nonfarm migration function. Then the transition probabilities are adjusted by means of the estimated migration relationships. This is done by replacing the estimates derived from the migration function with 1966 actual farm numbers.

Third, an adjustment is made for the effect of the 10.9 percent increase in the index of prices received for farm commodities for 1961-66 in Manitoba.[24] It is assumed that farm operator numbers are uniformly

---

[24]Farm commodity price indices for Manitoba were 100.0, 110.9 and 100.5 for 1961, 1966 and 1971 respectively, obtained from Agricultural Yearbook of Manitoba.

distributed in each class. Thus, 10.9 percent of farm operators who moved from lower to higher classes are estimated to have moved due to price increases.

Fourth, projections of the farm operators distributed by size class for each target year, FR_{ft}, are derived by multiplying the transposed transition probability matrix, U' calculated from the above three steps and presented below by the vector of actual farm operators by class in each previous target year, FR_{ft-1}. Mathematically, it is represented by

$$FR_{ft} = U'_{fm} \; FR_{ft-1}; \; f=1, \ldots, 7 \qquad (3.12)$$

The projections are based on the assumption that the estimated Manitoba transition probabilities matrix for 1961-66 is constant over the period to 1986 and applied to the Interlake.

However, the distribution of the farm plant-scale in this study is based on "acreage" rather than on "gross receipts"; a conversion from a "gross receipts" to "acreage" base is required. It is found that the correlation between gross receipts and farm size (acreage) is very high.[25] Thus, the conversion is based on the distribution of farm numbers by gross receipts and by size class for 1968 in the Interlake assuming that distribution is constant over time. Mathematically, the conversion of the distribution of farm plant-scale from a gross receipts to acreage base is made by

$$FN_{int} = V_{ifn} \; FR_{ft}; \; i=1, 2; \; n=1, \ldots, 3; \; f=1, \ldots, 7 \qquad (3.13)$$

---

[25] The estimated correlations between farm size class (acreage) and gross receipts for Alberta and Manitoba are 0.80 and 0.76 respectively for 1966 based on data obtained from DBS Agriculture Census. It is assumed that the base period coefficients converting farm numbers by receipts class to farm numbers by acreage class holds throughout the projection period.

where V_{ifn}, represents the coefficients of the number of farm for the f^{th} gross receipt class of the n^{th} size class in sector i, that is estimated by dividing the number of farms for the f^{th} gross receipt class of the n^{th} size class in the sector i by total farm numbers for n^{th} size class in sector i.

Given the estimate of farm numbers by size class FN_{int}, the trading coefficients are adjusted to the target years based on the following two steps. First, the trading coefficients for agricultural sectors are adjusted in terms of equation (3.8). Second, the first two rows of each element in the input-output table are revised in terms of the estimated sales derived from equation (3.9) and then the trading coefficients for nonagricultural sectors are recalculated using equations (3.10) and (3.11). The second step is similar to the first but from the sales point of view.

Primary Resource Requirement Coefficients Submodel

A primary resources (labour and land) requirement coefficient matrix is defined as the amount of primary resources required by a sector to produce one unit of output per year.[26] Mathematically, that is

$$Z_t = \frac{\dot{ZR}_t}{RX_t} \text{ or } z_{jrt} = \frac{\dot{ZR}_{jrt}}{RX_{jt}}; \; r=1,\ 2;\ j=1,\ .\ .\ .,\ 17 \tag{3.14}$$

where Z_t = the primary resource requirements coefficient matrix; its element z_{jrt} represents the amount of the r^{th} primary resources required by the j^{th} sector to produce one unit of output in year t; and

[26]The reciprocal of the coefficient represents its average productivity of that primary resource at certain time period, given the level of other inputs and technology.

$\dot{ZR}_t$ = the amount of primary resource utilized; the element $\dot{ZR}_{jrt}$ indicates the amount of the r^{th} primary resources used by the j^{th} sector in producing total realized output of RX_{jt}.

The primary resource requirement coefficients change over time because of the continuous changes in factor productivity. Factor productivity tends to change over time mainly due to: (1) continuous shifts in the economies of scale and (2) continuous changes in the combination of factor inputs in production.[27] In order to estimate the primary resource requirement coefficients change over time following the course of such changes, two steps are employed.

Primary resource Coefficient Changes Caused by Continuous Shift of Farm Plant-Scale The first step is to measure the primary resource input coefficient changes caused by continuous shift of plant-scale with particular reference to agricultural sectors. To measure this effect, let us rewrite primary resource input requirement coefficients by their components:

$$z_{jrt} = \sum_{n=1}^{3} (\bar{z}_{jnr} \cdot FN_{jnt}) \text{ for } j=1, 2; n=1, \ldots, 3; r=1, 2 \quad (3.15)$$

Where $\bar{z}_{jnr}$ is the r^{th} primary input coefficient of the n^{th} farm size class (plant-scale) for sector j; and other variables are as defined before. As shown in the trading coefficient submodel, the distribution of farm plant-scale by size class is changing over time and $\bar{z}_{jnr}$ is constant. Thus, the primary resource input requirement coefficients, z_{jrt},

[27]The distinction of the scale effect and changes in input combination effect are based on the technical characteristics of production function described in: Auer, Canadian Agricultural Productivity, Op. Cit., App. C.

are expected to change with changes in FN_{jnt} over time. Consequently, equation (3.15) is used to adjust the primary resource input coefficient changes caused by the shifts of farm plant-scale for agricultural sectors.

Primary Resource Coefficient Changes Caused by Continuous Changes in the Combination of Factor Inputs This step is to measure factor input requirement coefficients changes caused by continuous changes in the combination of inputs in production. The combination of factor inputs tends to change due to technological change and thus, factor input requirement coefficients tend to change. Thus, the primary input requirement coefficients, z_{jrt}, are adjusted further by

$$z_{jrt} = z_{jrt} / (1 + \Delta AP_{jr})^{t} \text{ for } r=1, 2; j=1, . . ., 17 \qquad (3.16)$$

Where ΔAP_{jrt} represents the growth rate of the r^{th} primary input's average productivity for the j^{th} sector in year t and the right-hand side of z_{jrt} represents the primary input requirement coefficients after adjusting that coefficients change caused by shift of farm plant-scale effect for agricultural sector and the base year's primary input requirement coefficients for non-agricultural sectors.

Capital Requirement Coefficients Submodel

As stated earlier, the model in this study is modified to permit dynamic analysis. The basic difference between the static and dynamic input-output model is that the latter generates the means of creating capacity endogenously.[28] In this way, increases in final demand are consistently met by intermediate and capital goods producing sectors.

---

[28]Further distinction between the static and the dynamic input-output system employed in this study will be discussed in detail in the subsequent section of the chapter.

A set of capital coefficient matrices to be considered consists of (a) an expansion capital coefficient matrix (capital goods required to generate capacity to increase output), (b) replacement capital coefficient matrix (capital goods required to replace obsolete plants in order to maintain constant capacity) and (c) an overall capital coefficient matrix formed by the addition of expansion capital and replacement capital coefficient matrices.

The capital coefficient matrices may be useful in a variety of applications. A particular application is the analysis of regional growth in the dynamic context, explaining (or predicting) the generation and utilization of sectoral and aggregate capacity. In a growing economy, the induced investment is known to have a significant effect (via the multiplier and accelerator) on changes in output and income.

Capital Coefficient Matrices and the Dynamic Input-Output System

The dynamic input-output system accounts for the capacity creation process primarily through the capital coefficient matrices. However, in most of dynamic input-output systems developed thus far, only expansion of capacity have been explicitly accounted for, whereas replacement and maintenance expenditures are considered as final demand. The dynamic input-output system can be extended to incorporate a replacement capital coefficient matrix as was done by Miernyk et. al.[29] To obtain the dynamic system, the final demand FD_t is reduced by the amount of capital investment needed to generate enough capacity to meet RX_t. This dynamic input-output system is actually based on the accelerator principle by

[29] W.H. Miernyk et. al., Simulating Regional Economic Development (Lexington, Massachusetts: D.C. Heath and Company, 1970), 52-74.

introducing a behavioural aspect to investment decisions in relation to output levels.[30]

A question arises in the dynamic system concerning the stability of capital coefficient matrices. Morishima has shown that the rate of interest, the rate of real wage and the profit margin cause capital coefficient matrix changes.[31] Moreover, Anne Carter has stated that the change of capital coefficients are basically due to (1) technological change, (2) the incremental nature of the coefficients and (3) the problem of balance versus unbalanced expansion of capital stock.[32] However, each of these factors are interrelated. A change in technology, for example, can lead to expansion of capacity which may be of a balanced or unbalanced nature. The incremental nature of the coefficients is uniquely related to unbalanced expansions since a new machine is simply added to the existing stock of capital rather than to add a whole new process. Intra-industry shifts also change aggregated capital coefficients. In examining 15 industry groups in Canada over the period 1926-67, LaTourette concluded that agriculture tended to have a large positive intra-industry effect on capital coefficient changes.[33] The

---

[30] W.W. Leontief, "The dynamic Inverse", in A.P. Carter and A. Broady (eds.) Op. Cit.,

[31] Michio Morishima, "Prices, Interest, and Profits in a Dynamic Leontief System", Econometrica, Vol. 26, 1958, pp. 358-80.

[32] Anne P. Carter, "Capital Coefficients as Economic Parameters: The Problem of Instability", in National Bureau of Economic Research, Problems of Capital Formation (Princeton: Princeton University Press, 1957), 287-310.

[33] John E. LaTourette, "Private and Public Capital and the Capital Coefficient in Canada", The Quarterly Review of Economics and Business, Vol. 12, No. 2, 1972, pp. 53-75.

intra-industry shift was explained by five explanatory variables, namely technological change and economies of scale, relative price of capital, rate of return, average age of capital and rates of construction of machinery and equipment. Among these variables, the technological change and the economies of scale factor were the most important factors in explaining the intra-industry shift effect on the change of capital coefficient. This implies that the same procedure applied to adjust input-output coefficients can be used to estimate capital coefficient changes for agricultural sectors over the study period.

Estimation of Capital Coefficient Matrices As stated, the explicit consideration of the capacity generating process is introduced into the input-output system by means of the B matrix for expansion of fixed capital coefficients and by the D matrix of replacement fixed capital coefficients. An element of the B, b_{ij}, is defined as the purchase of expansionary capital (NI_{ij}) goods from sector i by sector j, per unit increase in capacity (ΔCK) in sector j. That is:

$$b_{ij} = NI_{ij} / \Delta CK_j \qquad (3.17)$$

Thus, the B matrix, its element is b_{ij}, only measures net changes in capital and capacity.

In order to complete the dynamic input-output system, however, the D matrix also needs to be brought into the system because replacement investment is for maintenance of capacity. The elements of the D matrix are d_{ij}, and a d_{ij} may be defined similar to b_{ij} as the purchase of replacement capital (RI_{ij}) goods from sector i by sector j in order to maintain a constant level of capacity (CK_{jo}) in sector j. Thus, the d_{ij} is

$$d_{ij} = RI_{ij} / CK_{jo} \tag{3.18}$$

Determination of Capacity A relevant question for present analysis is how to measure the b_{ij} and d_{ij} that are related to the measurement of capacity. In other words, the ΔCK_j and CK_j must be determined a priori to estimate b_{ij} and d_{ij}. But capacity is difficult to measure since it is a vague concept. Meirnyk et. al. have illustrated this point.[34] From an engineering point of view, the capacity of a plant is represented by the maximum output that is feasible under the existing technical conditions. This suggests that the basic tool for measuring changes in capacity is the production function since it reveals the maximum output attainable from a quantity of inputs given constant technology. By making a "full utilization" of available inputs assumption, one can estimate the capacity (maximum output) using the estimated production function. In practice, however, the empirically estimated parameters of the production function do not sufficiently account for bottlenecks encountered in the production process from a lower level to high level of input utilization. For example, when we go from 92 percent to 98 percent of the labor force being utilized or from 70 percent to 95 percent of capital stock, certain bottlenecks and inefficiencies result which are not accounted for by the production function empirically estimated.

The economic concept of capacity is difficult to measure because it is a function of price (demand), costs (supply), the objectives of the firm, and the time element (short run or long run). Each of these

---

[34]Meirnyk et. al., Op. Cit., pp. 54-59.

factors affects the level of capacity to be measured. In the short-run, the cost function can be used to measure the economic concept of capacity if we know the objectives of the firm or industry and price level. Assuming that the price is constant for the firm or industry's output (via constant demand), the economic capacity is determined by the output level where marginal cost equals marginal revenue for the profit maximizing firm or industry. If the objective of the firm is not to maximize profit, but to maximize sales subject to some minimum profit constraint, the level of capacity would be less or greater than that of the profit maximizing firm. Moreover, under monopolistic competitive conditions price is greater and output smaller compared to price and output under purely competitive conditions. Thus, if we define economic capacity as the equilibrium point under pure competition, the difference in output level between pure competition and monopolistic may be said to be "excess capacity".[35]

In the long-run all factor inputs become variable, whereas in the short-run plant and equipment are assumed to be fixed. The capacity is subject to change in the long-run. But change of capacity comes after a certain level of capacity utilization is reached. If all possible substitutions among existing fixed and variable factors have taken place before plant and equipment are increased, the capacity utilization is said to be 100%. Thus, strictly speaking, the excess capacity refers only to the long-run since the ideal output is determined by equating marginal revenue and marginal cost under pure competition,

---

[35] L.R. Klein, "Some Theoretical Issues in the Measurement of Capacity", Econometrica, Vol. 28, 2 (April, 1960) p. 273.

and the output actually attained in long-run equilibrium.[36] This suggests that capacity is determined by the minimum cost point of production under pure competition in the long-run since at that point of output the capacity utilization rate reaches to 100%. In practice, however, a firm may not operate at 100% capacity for long before deciding to change capacity. Thus, theoretical cost curves offer few insights in estimating capacity empirically.

However, Alchian argues that the classical statements of the short and long-run cost concept are misleading because the producer will choose which input to vary according to economic costs and not because of technical or legal fixities that prevent the changes of some inputs.[37] Thus, the fixed factor is simply the one which is too expensive to be worth changing. Consequently, according to Alchian, there is no short and long-run cost functions but there is only one cost function in the operation. Nevertheless, the capacity is subject to change over time and such change complicates the empirical measurement of capacity determined by equating marginal revenue and marginal cost under pure competition.

In short, the production function allows the estimation of capacity when all factors are variable and technical change is constant. It is difficult to include the necessary engineering information in the model. On the other hand, theoretical cost curves offer few insights

---

[36] C.E. Ferguson, Microeconomic Theory, revised edition (Homewood, Illinois: Richard D. Irwin Inc., 1969) p. 295.

[37] A.A. Alchian, "Costs and Outputs", in W. Breit and H.M. Hochman (eds.), Readings in Microeconomics, Second Edition (New York: Holt, Rinehart and Winston, Inc., 1971), 159-171.

into estimating capacity empirically. Depending on the objectives of the firm or industry, the market structure and the time dimension (short-run or long-run), one can derive a number of output levels that may be called capacity. Therefore, the differentiation of capacity into engineering and economic concepts does not reduce the problems encountered in empirical estimation.

Turning to empirical estimation of capacity, there are several methods which cannot be classified as either engineering or economic. These are (1) the capital stock approach, (2) the potential employment approach, (3) the peak output approach, and (4) the potential output approach.[38] The capital stock approach to capacity measurement is based on the hypothesis that the capital stock of an industry is the most significant determinant or constraint on capacity. Then the capacity can be derived by: (1) determining capital-output ratio for a benchmark period where a benchmark period is defined as a time period when outside evidence suggests that capacity was being fully utilized; and (2) then dividing the estimated capital-output ratio into estimates of capital for those periods surrounding the benchmark.

The potential employment approach to capacity estimation is based on two general assumptions. First, employment is assumed to be the key factor in determining capacity. Second, all other factors

---

[38]These methods have been employed to estimate capacity for West Virginia by Brown. But no conclusion can be drawn in determining which method is more appropriate for estimating capacity. See: D.M. Brown, "Productive Capacity and Economic Growth in West Virginia", Unpublished Ph.D. Dissertation (West Virginia: Department of Economics, West Virginia University, 1969).

associated with production as well as output are raised proportionately when the actual employment is increased. Under these assumptions, the capacity can be estimated by simply multiplying average output per employee by total potential labour force. This method of estimating capacity is empirically applicable if a high capital output ratio exists in a sector along with a sizeable amount of unutilized capital, then increases of employment would be the key factor in increasing capacity.

The peak output approach involves nothing more than connecting a trend line to output peaks and calling the trend lines capacity. Excess capacity is estimated by taking differences between the line segments. The capacity measured by this method is based on economic concepts. The economic concept of capacity is determined by the cost curve. Output peaks and minimum average cost should be reached at the same time. The peak output method is easy to apply. But it can not be used in this study because of the lack of time-series data on output by sector in the Interlake area.

The potential output approach to capacity estimation is based on data collected from establishments in the form of potential output estimated by businessmen. This method was employed in West Virginia input-output study by Meirnyk et. al.[39] Potential output refers to the maximum level of output attainable under normal working conditions. Normal working conditions refers to (1) the usual number of shifts worked per day, (2) normal usage of obsolete equipment, (3) seasonal effects of demand, and (4) the usual downtime for repairs and other

---

[39] Meirnyk et. al., Op. Cit., pp. 54–57.

interruptions. Then the capacity by sector, CK_j is determined by the following proportion:[40]

$$CK_j = PO_s \cdot \frac{X_j}{X_s} \qquad (3.19)$$

Where X_j/X_s refers to the ratio of sector output and sample output and PO_s represents the potential output estimated from sample .CK_j is the j^{th} sector's capacity.

As Meirnyk et. al. recognized, one of the drawbacks of the approach is that the respondent must make his own interpretation of potential output. Respondents in the trade and service sectors find that it is very difficult to estimate potential output under the normal condition specified above because there are rush hour and slack period. If customers are willing to change their shopping habits to smooth out the rush and slack times, total output could be increased substantially without additional plant and equipment. Therefore, the estimation bias is expected to be very large. Moreover, there is no theory to support this approach as the capital stock or peak output approaches described above.

From the above discussions, it is clear that each method of estimating capacity is derived from a functional relationship between capacity and its main determinants. The capital stock approach is based on the assumption that capital stock is the main factor in determining capacity. On the other hand, the potential employment approach assumes that the labour force is the critical factor in determining

---

[40] D.M. Brown, Op. Cit., p. 97.

capacity level. Thus, it implies that other inputs are readily available for use in increasing output when the demand is increased.

Theoretically, the industry's input utilization rates can be employed to determine the key factor of capacity constraints (at least in the short-run) since the rates represent the amount of input available and used up by the corresponding industry. This argument will be true if the production function of the industry is a Leontief type in which all inputs are raised proportionately when output is proportionately increased. In other words, if an industry's production function does not have any substitution between inputs, the input utilization rates can be used to determine the key factor in determining capacity. It will not be as appropriate to use the input utilization rate in determining the key factor of constraint on capacity if an industry's production function possesses a high level of substitutability between factors because the capacity can be changed through factor substitutions. Nevertheless, it is believed that using the input utilization rate to determine the key factor of constraint on capacity is a useful guide to capacity measurement at the present time mainly since the actual production function for industrial level still requires further investigation.

The measurement of capacity for each sector in the present study, therefore, is based on the above arguement. First, input utilization rates, the ratio of actual to potential input use, are estimated and compared. Then the factor that has the highest utilization rate is selected as the key factor in determining capacity for empirical estimation. While the factor that has the highest utilization rate is determined, the capacity for the j^{th} sector, CK_{jt}, is obtained by

$$CK_{jt} = RX_{jt} \div (EA_{jt} \;/\; EP_{jt}) \text{ for } j=1, \ldots, 17 \tag{3.20}$$

where RX_{jt} = the actual realized output of the j^{th} sector in year t; and

EA_{jt}/EP_{jt} = the ratio of actual to potential input use for the j^{th} sector in year t.

The increase in capacity (ΔCK_j) for sector j then is estimated by

$$\Delta CK_{jt} = CK_{jt} - CK_{jt-1} \text{ for } j=1, \ldots, 17 \tag{3.21}$$

Given the estimates of CK_{jt} and ΔCK_{jt}, equations (3.17) and (3.18) can be used to determine the B and D matrices for dynamic input-output simulation.

Primary Resource Constraints Submodel

To an extent, the input-output model for the present study is modified further to incorporate primary resource constraints. Resource development alters agricultural output within the study area. The changes in production have implications for the agricultural related sectors. These changes occur because the resource base available for agricultural production will increase and for others it will decrease. In some cases, the agricultural product mix may change with the production of some crops increasing and other decreasing.

As stated earlier, traditional impact analysis using input-output models does not take resource constraints into consideration. However, resource constraints do play an important role in regional growth particularly for rural-oriented region because resource endowments determine the regional maximum output level. If total demand including intermediate and final demand for goods and services are greater than the regional maximum output level, one would expect imports to increase in order to meet total demand in the regional economy. Under this condition, the resource development program will have a significant effect on changes in output and income. Thus, this modified submodel is designed to measure sectoral maximum output and to estimate resource requirements for planning purposes as well.

The resource constraints to be considered in the conceptual analysis should include labour, land and capital for all sectors. However, land is not as important a factor in the non-agricultural sectors so that the land constraint is applied only to agricultural sectors. In addition, capital is not considered as a constraint factor in this study because of the complexity of capital flows among regions.

Agricultural Land Constraint Land is often considered a major constraint in agricultural production. Therefore, land available for agricultural production for each target year with and without programs is important in the analysis of agricultural resource development programs. However, the heterogeniety of land and its suitability for special crop production complicates the analysis of land use.

For simplicity, it is assumed that the area is a homogenous agricultural production area and the diversification of land use from one crop to another is governed by the marginal value of productivity of land with respect to the corresponding crops. Based on this assumption, the agricultural land includes all improved land in the area either the land is under crops, summer fallow, improved pasture or unimproved land.[41]

---

[41] For detailed discussion in relation to land utilization see: C.R. Shumway et. al., Regional Resource Use for Agricultural Production in California, 1961-65 and 1980, Giannini Foundation Monograph No. 25 (California: Giannini Foundation of Agricultural Economics, University of California Division of Agricultural Science, 1970).

Not all of the area's land is available for agriculture. Land may be allocated for urban and public use, for agricultural use, or for other use. Hence, future land available for agricultural production depends upon: (1) the rate of agricultural land transferred to urban and public use,[42] and (2) the rate of other land transferred to agricultural land. Accordingly, the following procedures are employed to estimate future land available for agricultural production, without land clearing programs for each target year.

$$LA_t = LA_{t-1} - \Delta SL_t + \Delta UL_t \tag{3.22}$$

$$\Delta SL_t = o.1\ SL_{t-1} \tag{3.23}$$

$$\Delta UL_t = \delta + \pi t \tag{3.24}$$

Where LA_t = total land available for agricultural use without resource development program for year t;

ΔSL_t = the amount of agricultural land shift to urban and public use in year t; and

ΔUL = cleared land without resource development programs, representing the amount of semi-agricultural land shift to agricultural land without resource development program.

Resource development programs under FRED plan are expected to stimulate the transformation of semi-agricultural land to agricultural land further during the period of implementation. Let ΔUL^*_t be the cleared land under the resource development programs in the t^{th} target year, the total land available for agriculture with resource development programs, LA^*_t, becomes

$$LA^*_t = LA^*_{t-1} - \Delta SL_t + \Delta UL_t + \Delta UL^*_t \tag{3.25}$$

<u>Labor Constraint</u> Among available operational methods for analyzing

---

[42]It is assumed that it is impossible to transfer agricultural land back to semi-agricultural land use.

and forecasting population, potential labor force and labor force growth and changes, one may distinguish these methods into two broad models: demographic and economic system models.

The demographic model is concerned with total births, deaths and migration focusing on the behaviour of cohorts disaggregated by age and sex. The model begins by analyzing the behaviour of each element of major components of population change (i.e., births, deaths and migration) and combines this information with population data for a based period to establish an estimate of a future population. The labor force is then derived from the ratio of projected population to labor force relation. This method has been employed by Maki, Framingham and Sandell, to project Manitoba and Manitoba subregions' population, labor force and household numbers.[43] Another method involves deriving population from the economic system, using shift-share analysis or the economic base technique, as employed by Maki and MacMillan[44] for projection of Manitoba and Manitoba subregions' population and labor force.

Both methods are subject to restrictive assumptions; the former approach is subject to the assumption of the stability condition of important elements contributing to population change and the latter model is subject to its assumptions of constraint employment-labor force and labor force-population ratios. In addition, the economic system model

---

[43]W.R. Maki, C.F. Framingham and D.J. Sandell, Population Growth in Manitoba - Some Alternatives, 1971-1990, Research Bulletin No. 73-2 (Winnipeg: Department of Agricultural Economics, University of Manitoba, 1973).

[44]W.R. Maki and J.A. MacMillan, Regional Systems For Development Planning in Manitoba, Research Bulletin No. 70-1 (Winnipeg: Department of Agricultural Economics, University of Manitoba, 1970).

requires perfect knowledge of commodity production in basic sectors and correlation of the specific service sectors with the total basic labor force. The projected labor force using the demographic model is employed in this study as the area's total labor force for each target year.

The procedures for estimating the labor constraint for each target year using the demographic model employed by Maki, Framingham and Sandell involve two steps. First, the area's population size is derived from the following three equations:[45]

$$PO_{qot} = \sum_{a=15}^{49} [(PO_{1at-1}) + (PO_{1at-1}) \cdot (M_{1at-1}) - (PO_{1at-1}) (1 - S_{1at}) \cdot \tfrac{1}{2}] f_{at} (h_{qt}) \tag{3.26}$$

q = 1 for female
q = 2 for male
a = 15, . . ., 49 for age

$$PO_{qat} = (PO_{qa-1\ t-1}) (S_{qa-1t}) + (PO_{qa-1\ t-1}) (M_{qat-1}) \tag{3.27}$$

q = 1 for female
q = 2 for male
a = 1, . . ., 80^{+} for age

$$M_{qat} = [\overline{PO}_{qbt} / \overline{CPO}_{qbt-1} \cdot S_{qbt})] \tfrac{1}{5} - 1 \tag{3.28}$$

m = 1 for female
m = 2 for male
b = 1, . . ., 17 for age cohort

Where PO_{qot} = population of sex q and age o at time t (births);

PO_{qat} = population of sex q and age a at time t;

M_{qat} = the net migration rate of sex q and age a at time t;

---

[45] Maki, Framingham and Sandell, Op. Cit., pp. 39-44.

S_{qat} = the survival rate of sex q and age a at time t;

F_{at} = the fertility rate of females at age a at time t where a = 15, . . , 49;

h_q = proportion of births of sex q;

$\overline{PO}_{qbt}$ = population of sex q and age cohort b at time t; and

S_{qbt} = survival rates of sex q and age cohort b at time t.

The labor force is derived through the application of labor force participation rates for each target year. That is

$$L_t = \sum_{b=1}^{17} (\overline{PO}_{qbt} \cdot P_{qbt}) \tag{3.29}$$

q = 1 for female
q = 2 for male
b = 1, . . ., 17 for age group in 5 year intervals from age 15 up and 65 over in one group.

Where L_t = total labor force in target year t;

P_{qbt} = the projected participation rates of sex q and age group b at time t; and

$\overline{PO}_{qbt}$ = projected population of sex q and age group b at time t.

The estimated primary resource constraints for each target year, agricultural land and labor constitute the primary resource availability vector, ZR_t. That is

$$ZR_t = (LA_t, L_t) \tag{3.30}$$

Realized Gross output Determination Submodel

A central focus of the study is the use of the modified input-output model to simulate certain aspects of regional development without and with agricultural development programs. The term simulation is used here in a general sense. The word "simulation" is used to describe both a "type" of model and a "technique" of experimentation with models.[46] The present model developed is essentially a simulation type of model in which an attempt is made to strengthen the validity of the structure by estimating some of the behavioural parameters empirically, either from time-series data or point estimates. Each experiment in the simulation produces specific results depending on the initial conditions and the values assigned to parameters. The results of each experiment must be specifically examined with respect to assumptions underlying the structure of the model before drawing any general meaningful conclusion. For this reason, this section discusses the assumptions underlying the model in the first portion of the section and the second portion of the section presents the procedures for simulating regional development using the constructed input-output model.

Types of Regional Development Simulations In order to examine the impact of agricultural resource development programs on regional development indicators using the model, there is a need to specify assumptions concerning the regional development process over time. The model can be viewed in different ways depending upon the underlying assumptions associated with the process of regional development. It is assumed that regional development follows a static process in one case and follows a dynamic process in another. The simulation based on static assumption is called "static simulation". Moreover, for the dynamic process of regional development, one assumes that causal relationships of the model are known and for another the causal relationships are not known

---

[46] G.H. Orcutt, "Simulation of Economic System", American Economic Review, L(Dec., 1960), 893-907.

but the effect. The former is defined as a dynamic simulation model and the latter is a comparative static simulation model. Therefore, regional development simulations include three: static, comparative static and dynamic simulations.

The conditions specified in different simulation models are summarized in Table 3.1. As shown in the table, the static simulation model does not permit any changes. The trading coefficients and the primary resource and capital requirements coefficients are all constant from the base to the end of target year. Furthermore, there are no induced consumption and capital formation effects being considered in the model. According to Hicks, this is a static simulation involving time.[47]

For comparative statics, the simulation allows trading coefficients and the primary resources and capital requirements coefficients to change over time. However, the analysis of the process of change is neglected. In other words, the comparative static simulation permits the system to change over time as a result of some stochastic or non-stochastic causal factors, but the causal system or the sequence of the changes is neglected. This type of simulation model is similar to comparison of one equilibrim level to another without specifying the path of change from one level to another. Hence, it is called comparative

[47]Hicks states that analysis of stationary situations, situations where nothing changes and where no attentions need to be paid to the future because the fact that the present analysis will apply well at any other time in the future, is static. Once the system begins to change, then the analysis becomes dynamics. See: W.J. Baumol, Economic Dynamics, third edition (New York: The MacMillan Company, 1971), p. 9.

TABLE 3.1

SUMMARY OF THE CHARACTERISTICS OF ALTERNATIVE SIMULATIONS

Characteristics	Alternative Simulations		
	Static (SIM I)	Comparative Static (SIM II)	Dynamic (SIM III)
I. Final Demand Components	1. Household 2. Government 3. Investment 4. Net Inventory Changes 5. Exports 6. Unallocated	Same as SIM I	1. Government 2. Net Inventory Changes 3. Exports 4. Unallocated
II. Interdependence in the Economy	Fixed trading coefficients and fixed resource and gross fixed capital requirement coefficients (based on 1968) over the simulation period	Changes in trading coefficients, primary resource and gross fixed capital requirement coefficients derived from 1968 over the simulation period	1. Changes in trading coefficient with household endogenous. 2. Capital requirements for expansion and replacement coefficients are added to the SIM II to turn the latter into a dynamic system over the simulation period
III. The Economic Effects From Agricultural Resource Develop. Programs	1. Direct effect 2. Indirect effect 3. Capital formation effect	Same as SIM I	1. Direct effect 2. Indirect effect 3. Capital formation effect 4. Induced consumption effect 5. Induced capacity effect

static simulation.

A comparative static simulation tells nothing about the process by which the economy moves from one level of output to another. Information on how the economic system changes from one level of output to another is of crucial importance in the analysis of the impact of agricultural resource development programs. Unless the process of economic development is realized, the impact of any development program can not be measured. Therefore, the comparative static simulation model is further modified to include some causal relationships of the development process. The process of development is based on multiplier-accelerator relationships.

It should be noted that the definition of dynamic simulation employed in the present study is not consistent with Samuelson's classification and definition of dynamics but follows Baumol's classification.[48] It also needs to be noted that the interest in distinguishing static, comparative static and dynamic simulations is not the definition and classifications. Rather, the interest is in the method of analysis to clarify the nature and potential magnitude of the impact and repercussions of agricultural resource development programs.

Turning to the economic effects associated with different simulations, three economic effects are associated with static and

---

[48] According to Samuelson, the dynamic system should be distinguished into a sixfold classification. See: P.A. Samuelson, Foundations of Economic Analysis (New York: Harvard University Press, 1965), pp. 311-320. However, Baumol classified systems into three categories in which the third category is concerned with process analysis (Baumol, Ibid., p. 8) that is the definition of dynamics in the present study.

comparative static simulations and four with dynamic simulation (Table 3.1). The direct effect measures economic activity generated in a sector due to increased production.[49] The indirect effects arise as the sector which increases production demands additional goods and services from all other sectors. These sectors, in turn, will increase their demands for goods from other sectors. All repercussions of the increased production due to increased production in a sector are included in the indirect effects. The capital formation effect measures economic activity generated by program expenditure associated with particular sectors engaged in program implementation. For example, the land clearing program requires machinery from the construction sector to knock down bush and trees. Thus, the construction sector tends to increase its capital and that in turn will have repercussions in increase output mainly capital goods. These effects are classified as capital formation effects and are predominantly associated with the construction and durable goods sectors.

In reality, however, a dynamic system is much closer to the economic development process. Under a dynamic system, two additional effects arise and are referred to as induced consumption and induced capacity effects. The induced consumption effect arises as the increased production yields a greater amount of regional personal income that leads to increase consumption of goods and services. In turn, it induces further increases in production. In order to produce additional goods generated from indirect and induced consumption effects, the producing sectors need

---

[49]Doeksen and Schreiner, Op. Cit., pp. 228-29.

to increase their capacity. This effect is called the induced capacity effect.[50]

Realized Gross Output Determination Procedures The general procedures of the regional development process have been discussed above. The equations used to determine the realized gross output for each simulation model are presented in this section.

(i) The static simulation The static simulation employs the Leontief' static input-output type model. The gross output, FX_t by sector is obtained by solving the following system

$$FX_t^1 = (I - A)^{-1} FD_t \tag{3.31}$$

Where $(I - A)^{-1}$ is the Leontief inverse matrix with fixed trading coefficients in the base year (1968). The estimate is the gross output consistent with final demand by sector.

However, the level of gross output consistent with final demand can be produced or not depending on the availability of primary resources under the static model. The next step is determining maximum output level by sector. Two steps are involved in estimating the level of maximum output by sector. The first step is to estimate the maximum output of each constrained input, via labor or land. The following equations are employed for such estimation:

---

[50] Ibid., p. 229. Doeksen and Schreiner state that the induced capacity effect arises during the first and second years following the initial change in production and eventually tapers off to zero over a period of years. The result seems unlikely unless the induced consumption effect tapers off to zero at the same time but, they specify the induced consumption effects remain in the long run.

$$MX^1_{irt} = ZR_{rt} \cdot \frac{1}{z_{iro}} \cdot \frac{FX^1_{it}}{\sum_{j=1}^{17} FX^1_{it}} \qquad (3.32)$$

r = 1 for agricultural land
r = 2 for labor
i = 1, . . ., 17 for 17 producing sectors

Where MX_{irt} denotes the maximum output due to the r^{th} primary resource constraint for the i^{th} sector and other variables are as defined before.

Equation (3.32) specifies that maximum output due to agricultural land in livestock sectors is calculated by multiplying the fixed (1968) average productivity (per acre) which is the reciprocal of agricultural land requirements coefficients, by the amount of available agricultural land for that sector. However, the problem is we do not know available agricultural land by sector since it can be employed to produce either livestock or crop products. In order to overcome this problem, it is assumed that available agricultural land by sector is determined by the demand for different products. The demand is a proxy variable in determining the rate of transfer of resources.[51] More specifically, the diversification of primary resource input use from one sector to another is governed by the marginal value of productivity of that input with respect to the corresponding sector. Thus, when the demand for products of one sector increase, ceteris paribus, the available primary resource input will shift to the sector because the marginal productivity of that primary resource input with respect to the corresponding sector is now relatively higher due to increase in the price of output.

---

[51] Cornwall, Op. Cit., p. 62.

This implies that the relative share of estimated gross output consistent with final demand for those sectors that employ the same kind of primary resource input in production determines the available amount of that primary resource input for that sector. Accordingly, the available amount of agricultural land for the livestock sector, for example, is determined by multiplying total available agricultural land, ZR_{1t} by the ratio of gross output of livestock sector to total gross output of livestock and crop sectors, $\sum_{i=1}^{2} FX_i^1$. The same argument is employed to estimate available labor for all sectors. In this case, the allocation of estimated total labor force is based on $FX_{it} / \sum_{i=1}^{17} FX_{it}^1$.

After the maximum output due to each primary resource input is determined, the maximum output of the sector is determined by

$$MX_{it}^{*1} = \min\ [MX_{i1t}^1, MX_{i2t}^1] \text{ for } i=1,\ 2 \tag{3.33}$$

and $$MX_{it}^{*1} = MX_{i2t}^1 \text{ for } i=3, \ldots, 17 \tag{3.34}$$

That is, the maximum output of the sector, MX_{it}^{*1} is determined by the minimum of the maximum output due to each primary resource input (via, minimum-maximum). In other words, if the MX_{i1t}^1 is less than MX_{i2t}^1 for the i^{th} sector, the maximum output of the i^{th} sector is MX_{i1t}^1, otherwise the reverse.

The last step in solving the system is the determination of realized gross output for each sector. It is determined by comparing the estimates of gross output consistent with final demand and maximum output of the sector. If the gross output consistent with final demand (FX_{it}^1) is less than maximum output of the sector (MX_{it}^{*1}), the realized gross output is equal to the former. If gross output consistent with final demand is greater than the maximum output of the sector, the difference between FX^1_{it} and $\overset{*}{MX}{}^1_{it}$ is compensated by increasing imports. Mathematically, the realized gross output by sector is determined by

$$RX^1_{it} = \overset{*}{MX}_{it} \quad \text{if } FX_{it} > \overset{*}{MX}_{it} \quad \text{or} \tag{3.35,a}$$

$$RX^1_{it} = FX_{it} \quad \text{if } FX_{it} < \overset{*}{MX}_{it} \tag{3.35,b}$$

The level of realized gross output by sector represents the degree of regional development in terms of intersectoral relationships This is the nature of the system employed in the present study in which the system permits us to investigate theoretically and empirically the phenomena of the regional development process. If the realized gross output is determined by maximum output of the sector, it is said to be more likely the type of supply-determined growth for that sector. On the other hand, if the realized output of a sector is determined by the estimates of gross output consistent with final demand then that sector is likely of the demand-determined growth type.[52] In this context, policy implications are apparent. Suppose that the sector illustrates a supply-determined growth pattern, one would expect to establish a program to expand the scarcity of primary resource inputs because they are a constraint on growth. The reverse type of growth pattern leads to formulation of programs to stimulate demand forces including an increased

[52]The realized gross output is ultimately determined by profitability of inputs and enterprises. This is a disequilibrium situation. The argument concerning supply or demand-determined growth model has been analyzed in Chapter 2.

share of national exports.

(ii) The Comparative Static Simulation The static simulation model does not take into account the effects of technological change and changing trade patterns over time. As stated earlier, trading coefficients are not constant over time due to technological change expressed by economies of scale and difference in trade patterns. Therefore, the static simulation model is modified to permit trading coefficient changes over time in this comparative simulation model.

The gross output consistent with final demand by sector is obtained by solving the following system

$$FX_t^2 = [I - A_t]^{-1} FD_t \qquad (3.36)$$

Where $[I - A_t]^{-1}$ is the Leontief inverse matrix with trading coefficients projected to each target year t using the approach specified in the trading coefficients submodel.

In permitting trading coefficient changes over time, the average productivities of associated primary resource inputs are also expected to change. Therefore, the system used to estimate maximum output of each sector is also modified to permit such changes. In this case, the $1 / z_{irt}$ is the target year's average productivity of agricultural land for the i^{th} sector whereas the base year's average productivity is used in the static simulation. The same procedure as used in static simulation is used to determine the realized gross output.

The estimated realized gross output level in terms of the comparative static simulation model may not be higher than the static one, the area's income may be expected to be higher for the latter case if technological change is expected to cause a reduction in production cost.

(iii) Dynamic Simulation As explained earlier, the comparative static simulation tells nothing about the process of regional development on the sequence of changes in the economic system; information on how the regional economic system changes from one level of output to another through the capacity increases is neglected in the comparative static simulation.

Consequently, the final simulation model permits the simultaneous determination of capital requirements for replacement and expansion which convert it to a dynamic system. In a dynamic system, investment is no longer exogenous being estimated independently as one of the final demand sectors. The dynamic simulation model presented in this study is closely related to the work of Meirnyk et. al.[53] but not Leontief.[54] As will be shown, the difference between Meirnyk et. al. and Leontief lies in the solution to solving the dynamic system.

The basic balance equation of dynamic input-output system is

$$FX_i - \sum_{j=1}^{17} FX_{ij} - \sum_{j=1}^{17} NI_{ij} - \sum_{j=1}^{17} RI_{ij} = FD_i - ID_i \text{[55]} \qquad (3.37)$$

Where FX_i is the total output of sector i; FX_{ij} is the total current input requirement by sector j purchased from sector i; RI_{ij} is the fixed capital required by sector j purchased from sector i for replacement

[53]Meirnyk et. al., Op. Cit., Chapter 3.

[54]Leontief, "The Dynamic Inverse", Op. Cit., p. 18.

[55]For notational convenience, the time subscript is omitted in the equation. But there is time-dimension involved. The balance equation represents its balanced relation at a certain point of time.

purposes to maintain the same level of capacity; NI_{ij} is the fixed capital required by sector j purchased from sector i for expansion of capacity; and $FD_i - ID_i$ is the final demand in which investment is no longer a final demand sector.

To transform the balance equation into the conventional form, the technical coefficients, defined as before are expressed as

$$a_{ijt} = \frac{FX_{ijt}}{FX_{jt}} \tag{3.38}$$

Since capital is required for replacement to maintain the same level of capacity for current production, it is assumed that capacity holds a constant relationship to output at all times. The sales of replacement capital by sector i to sector j can be transformed into the form expressed in terms of the replacement fixed capital requirement coefficients defined in the preceding section as

$$RI_{ijt} = d_{ij}\ CK_{jt} \tag{3.39}$$

Similarly, the sales of expansion fixed capital by sector i to sector j can be converted in terms of expansion fixed capital requirement coefficients as

$$NI_{ijt} = b_{ij}\ \Delta CK_{jt} \tag{3.40}$$

Substituting the relationships of (3.38), (3.39) and (3.40) into (3.37), we obtain the dynamic input-output system as

$$FX_{it} - a_{ijt}\ FX_{it} - b_{ij}\ \Delta CK_{jt} - d_{ij}\ CK_{jt} = FD_{it} - ID_{it} \tag{3.41}$$

In matrix form as

$$FX_t - A_t FX_t - B\Delta CK_t - DCK_t = FD_t - ID_t \tag{3.42}$$

The dynamic input-output system of (3.42) is not operational because ΔCK_t and CK_t are not known. There are several ways to approximate ΔCK_t and CK_t.[56] The one used in this study is to assume that there is a constant relation between the capacity and gross output for each sector during the study period.

Let $\bar{D}$ (= $\bar{d}_{ij}$) be the ratio of capacity to gross output FX_t and $\bar{B}$ (= $\bar{b}_{ij}$) be the ratio of changes in capacity to gross output, the constant relation between CK_t and FX_t and ΔCK_t and FX_t are respectively as

$$CK_t = \bar{D}FX_t \tag{3.43}$$

and

$$\Delta CK_t = \bar{B}FX_t \tag{3.44}$$

The operational dynamic input-output system, derived from substituting equations (3.43) and (3.44) into equation (3.42) is

$$FX_t - A_tFX_t - B\,\bar{B}FX_t - D\,\bar{D}FX_t = FD_t - ID_t \tag{3.45}$$

where $\bar{B}$ and $\bar{D}$ are diagonal matrices.

Thus far, the concern is on investment in relation to the dynamic system. As explained earlier, however, when the regional economy moves from one level of output to another through the dynamic process, one would expect to increase the regional income level. This will have induced

---

[56] In order to obtain an operational dynamic input-output system, Leontief assumes that $\Delta CK_{it} = FX_{it+1} - FX_{it}$ and Miernyk et. al. assumes that $\Delta CK_{it} = FX_{it} - FX_{it-1}$. See: (1) W.W. Leontief, "Thy Dynamic Inverse", Op. Cit., p. 18 and (2) Meirnyk et. al., Simulating Regional Economic Development, Op. Cit., pp. 59-64. According to the same argument, Leontief's dynamic system can be solved by "backward process". The process of solving Leontief's dynamic system is backward because of the need to specify the terminal year's expected output moving back to current time. This backward process of solving the dynamic system, however, does not provide a behavioural aspect to investment since capital stock is in place in time t to meet output levels in time t + 1.

consumption effects through consumption-income relations and stimulate the regional economy. This result, in turn, will have further impacts and increase investment by means of the "induced-accerelator" relation.

To transform this induced-accerelator scheme into the dynamic input-output system, the household sector is closed to the system. Hence, the complete dynamic system for present study becomes:

$$FX_t - \overset{*}{A}_t X_t - B\bar{B}\ FX_t - D\bar{D}\ FX_t = \overset{*}{FD}_t \qquad (3.46)$$

where $\overset{*}{A}_t$ = a matrix of trading coefficients and average propensity to consume by sector;

$\overset{*}{FD}_t$ = final demand vector excluding household and investment sectors; and other variables are as defined before.

Given the specified dynamic input-output system (3.46), the gross output by sector consistent with final demand is determined by solving the system as

$$FX_t = (I - \overset{*}{A}_t - B\bar{B} - D\bar{D})^{-1}\ \overset{*}{FD}_t \qquad (3.47)$$

In addition, as a comparative static simulation, the current average productivities of primary resource inputs are employed to estimate maximum output of each sector associated with the capacity creation nature of the dynamic system. The realized gross output again is determined by comparing the estimated gross output consistent with final demand and the minimum-maximum of gross output by sector.

<u>Impact Determination Submodel</u>

Resource development programs are designed to use and to improve the resource base in order to provide individuals favorable level of resource performance. The improved resource performance through resource development programs may be reflected in some economic development indicators such as the availability of jobs, the level of area incomes, government revenues, the use of the resource base, etc.[57] Thus, the best way of measuring the impact of resource development programs is based on a set of economic development indicators as mentioned above.

Moreover, the resource development program will have short and long-run impacts on the economic development indicators. The economic effects from one million dollars of investment on land clearing program, for example, would expect to have immediate (short-run) impact on changes in area incomes without any additional production increase from the cleared land. Once the land is cleared and put in production (long-run), the structure of the regional economy tends to change further and the level of production and area income are stimulated to a high level. An acre of bush land will take at least a year to clear with no production. That period of time may be considered as short-run. After completion of land clearing, agricultural output tends to increase from the cleared land, although it may take several years to bring newly cleared land into full production. This may be considered as the long-run impact. Within a certain time period, however, both short and long-run impacts are mixed together since the resource development programs are ongoing in nature. These short and long-run impacts are accumulated over time through the program implementation periods. For a given year, the short and long-run impacts are difficult to separate. Consequently, this study does not intend to measure the impacts in terms of short-run

---

[57] C.F. Framingham, J.A. MacMillan and P.E. Nickel, Guidelines for Community Planning, Extension Bulletin No. 73-1 (Winnipeg: Department of Agricultural Economics, University of Manitoba, 1973) pp. 24-28.

and long-run. Rather, both short and long-run impacts are measured at once.

Measurement of Impact The impact of resource development programs is dependent on the regional development process. If a regional economy is identified to follow a dynamic development process, the area income coefficients tend to change over time. Therefore, the impact of resource development programs are measured on the basis of the following two steps. First, the regional development process is identified and changes in the coefficients of area income, primary resources input requirements, government revenues resulting from resource development programs are estimated for each target year. Secondly, the adjusted area income coefficients, government revenue coefficients etc. are employed to estimate the level of area income, government revenue, labor, land and capital requirements. The difference between the level of area income with and without resource development programs represents the impact of resource development programs on area income.

Specifically, the area income is determined

$$AY^{e}_{jt} = \sum_{g=1}^{2} y_{jgt} \cdot RX^{e}_{jt} \tag{3.48}$$

g = 1 for average household income coefficient in year t;

g = 2 for average depreciation and retained earning coefficient in year t;

e = 1 for static simulation

e = 2 for comparative static simulation

e = 3 for dynamic simulation

j = 1, . . ., 17 for producing sectors defined.

where AY^e_{jt} = the area income for j^{th} sector simulated from the e^{th} simulation model for year t;

y_{jgt} = the g^{th} average area income coefficient for the j^{th} sector in year t; and

RX^e_{jt} = the realized gross output for the j^{th} sector simulated from the e^{th} simulation model for year t.

The government revenue is determined by equation (3.49). It is assumed that the tax rates for each income bracket do not change during the study period.

$$GR^e_{jt} = g_{jt} \cdot RX^e_{jt} \ ; \ j=1, \ldots, 17; \ e=1, \ldots, 3 \qquad (3.49)$$

where GR^e_{jt} = estimated government revenue for the j^{th} sector in year t resulting from the e^{th} simulation model;

g_{jt} = average government revenue coefficient, which is defined as average government revenue associated with per dollar of realized gross output, by sector.

Primary resource, labor and land, and gross fixed capital requirements are measured by multiplying primary resource and gross fixed capital requirement coefficients by the estimated realized gross output. That is,

$$RR^e_{jrt} = z_{jrt} \cdot RX^e_{jt} \qquad (3.50)$$

r = 1 for labor requirements;

r = 2 for land requirements;

r = 3 for gross fixed capital requirement; and

j = 1, . . ., 17 and e = 1, 2, 3 are as defined before.

Then the primary resource utilization rates (UR_{rt}) can be determined by comparing the primary resource requirements obtained from (3.50) and the availability of primary resource estimated from primary resource constraints submodel i.e.,

$$UR^{e}_{1t} = \sum_{j=1}^{2} RR^{e}_{j1t} \;/\; LA_t \;\; (\text{or } LA^{*}_t) \;;\; e=1, \ldots, 3 \tag{3.51a}$$

$$UR^{e}_{2t} = \sum_{j=1}^{17} RR^{e}_{j2t} \;/\; L_t \;;\; e=1, \ldots, 3 \tag{3.51b}$$

where RR^{e}_{jrt} = the r^{th} primary resource or gross fixed capital requirements for the j^{th} sector for the e^{th} simulation in year t;

UR^{e}_{rt} = the r^{th} primary resource utilization rate for the e^{th} simulation in year t in which UR^{e}_{1t} denotes the utilization rate of labor in year t resulting from simulation e and UR^{e}_{2t} denotes the utilization rate of agricultural land in year t resulting from simulation e.

D. Mathematical Description of the Model

To complete the model description for understanding the whole system in relation to simulation procedures, the mathematical model is now presented. Note that the specified model is very detailed so that only the major components of the model specified above are presented here.

Notation

Although the actual mathematical relationships of the model are not extremely complicated, the notation is unfortunately, but necessarily, rather cumbersome. To somewhat simplify the notation, the subscripts or superscripts are numbered consecutively beginning with the first portion of notation. The variables listed in the second portion are expressed by a combination of at least two capital letters. The coefficients are presented in the last portion with only a single letter in which the capital letter represents a matrix or a vector form and the corresponding small letter represents the elements of the matrix or vector. In addition, some Greek small letters are employed to denote coefficients. For convenience, the left-hand side of the symbols represent matrix form for all variables and coefficients and their elements are listed in the right-hand side if the variables or coefficients are not a scalar (Table 3.2).

TABLE 3.2

VARIABLES AND COEFFICIENTS USED IN THE MODEL

I. Subscripts or Superscripts

Let: i, j be subscripts denoting the producing sector in which i denoting the row sector and j denoting the column sector:

i, j = 1 for agriculture livestock

i, j = 2 for agriculture crops and other

i, j = 3 for mining

i, j = 4 for food and beverage manufacturing

i, j = 5 for other manufacturing

i, j = 6 for transportation

i, j = 7 for construction

i, j = 8 for petroleum wholesale

i, j = 9 for farm equipment, building material

i, j = 10 for food store

i, j = 11 for other retail

i, j = 12 for auto product sales and service

i, j = 13 for apparel and shoes

i, j = 14 for furniture and applicance

i, j = 15 for insurance

i, j = 16 for personal service

i, j = 17 for other service

k, h be subscripts denoting the commodity or commodity group of consumer goods and services and consumer price index of the corresponding commodity group,

k, h = 1 for meat

k, h = 2 for dairy products

k, h = 3 for fruit and vegetables

k, h = 4 for other food

k, h = 5 for housing

k, h = 6 for clothing

k, h = 7 for transportation

k, h = 8 for health and personal care

k, h = 9 for recreation and reading

k, h = 10 for tobacco and alcohol

k, h = 11 for other including saving

ℓ be a subscript denoting the local government expenditure by category or function,

ℓ = 1 for administration

ℓ = 2 for public work

ℓ = 3 for protection

ℓ = 4 for health and welfare

ℓ = 5 for recreation and culture

ℓ = 6 for environmental health

ℓ = 7 for other expenditure including capital expenditure

f, m be subscripts denoting farm size class by gross receipts in which f and m are the row and column respectively,

f, m = 1 for exist from farming

f, m = 2 for gross receipts less than $2,500 f, m = 3 for gross receipts $2,500-$4,999

f, m = 4 for gross receipts $5,000-$9,999

f, m = 5 for gross receipts $10,000-$14,999

f, m = 6 for gross receipts $15,000-$24,999

f, m = 7 for gross receipts $25,000 and over

n be a subscript denoting farm size class by acreage,

n = 1 for small farm size ranging from 20-239 acres

n = 2 for medium farm size ranging from 240-759 acres

n = 3 for large farm size ranging from 760 acres and over

r be a subscript denoting the type of primary resource inputs,

r = 1 for labor input

r = 2 for agricultural land input

r = 3 for gross fixed capital input

q be a subscript denoting the sex of population,

q = 1 for female

q = 2 for male

a be a subscript denoting the age,

b be a subscript denoting the age cohort

b = 1 for age group 0-4

b = 2 for age group 5-9

b = 3 for age group 10-14

b = 4 for age group 15-19

b = 5 for age group 20-24

b = 6 for age group 25-29

b = 7 for age group 30-34

b = 8 for age group 35–39

b = 9 for age group 40–44

b = 10 for age group 45–49

b = 11 for age group 50–54

b = 12 for age group 55–59

b = 13 for age group 60–64

b = 14 for age group 65–69

b = 15 for age group 70–74

b = 16 for age group 75–79

b = 17 for age group 80 and over

e be superscript denoting the type of simulation model,

e = 1 for static simulation model

e = 2 for comparative static simulation model

e = 3 for dynamic simulation model

p be a subscript denoting the consumer price index of the commodity groups,

p = 1 for consumer price index of meat products

p = 2 for consumer price index of dairy products

p = 3 for consumer price index of fruit and vegetable products

p = 4 for consumer price index of other food product

p = 5 for consumer price index of housing

p = 6 for consumer price index of clothing

p = 7 for consumer price index of transportation

p = 8 for consumer price index of health and personal care

p = 9 for consumer price index of recreation and reading

$p = 10$ for consumer price index of tobacco and alcohol

$p = 11$ for consumer price index of other products

t be a subscript denoting the time span

$t = 0$ for the base year (1968)

$t = 1$ for 1971

$t = 2$ for 1976

$t = 3$ for 1977

$t = 4$ for 1981

$t = 5$ for 1986

g be a subscript denoting the area income coefficients,

$g = 1$ for average household income coefficient by sector

$g = 2$ for depreciation and retained earning income coefficient by sector

II. <u>Variables</u>

$FX^e_t = [FX^e_{it}]$ the gross output consistent with final demand for sector i in year t (i=1, . . ., 17; e=1, . . ., 3; t=0, . . ., 5), hence FX^e_t is a vector for each e and each t;

$FD_t = [FD_{it}]$ the final demand including household, government, exports, net inventory changes, unallocated and investment sectors for sector i in year t (i=1, . . ., 17; t=0, . . ., 5), hence FD_t is a vector for each t;

$HD_t = [HD_{it}]$ the household consumption for sector i in year t (i=1, . . ., 17; t=0, . . ., 5), hence HD_t is a vector for each t;

$GD_t = [GD_{it}]$ the government expenditure for sector i in year t (i=1, . . ., 17; t=0, . . ., 5), hence GD_t is a vector for each t;

$ED_t = [ED_{it}]$ the export demand for sector i in year t (i=1, . . ., 17; t=0, . . ., 5), hence ED_t is a vector for each t;

$UD_t = [UD_{it}]$ — the unallocated final demand for sector i in year t (i=1, . . ., 17; t=0, . . ., t), hence UD_t is a vector for each t;

$ID_t = [ID_{it}]$ — the investment demand for sector i in year t (i=1, . . ., 17; t=0, . . ., 5), hence ID_t is a vector for each t;

$CH_t = [CH_{kt}]$ — per capita consumption of the k^{th} commodity or commodity group in year t (k=1, . . ., 11; t=0, . . ., 5), hence CH_t is a vector;

$INV_t = [INV_{it}]$ — the net inventory changes for the i^{th} sector in year t (i=1, . . ., 17; t=0, . . ., 5), hence INV_t is a vector;

YD_t — per capita personal disposal income in year t (t=0, . . ., 5), a scalar for each t;

$PC_t = [PC_{kt}]$ — consumer price index for the k^{th} commodity or commodity group in year t (k=1, . . ., 11; t=0, . . ., 5), hence PC_t is a vector for each t;

PH_t — the consumer price index for all commodity groups in year t (t=0, . . ., 5), a scalar for each t;

TP_t — the total population size in year t, a scalar for each t;

$TLG_t = [TLG_{\ell t}]$ — local government expenditure for the ℓ^{th} function in year t (ℓ=1, . . ., 7; t=0, . . ., 5), hence TLG_t is a vector for each t;

$LG_t = [LG_{it}]$ — local government expenditure for the i^{th} sector in year t (i=1, . . ., 17; t=0, . . ., 5), hence LG_t is a vector for each t;

TFG_t — total federal and provincial government expenditure in the Interlake in year t (t=0, . . ., 5), a scalar for each t;

$FG_t = [FG_{it}]$ — total federal and provincial government expenditure for the i^{th} sector in year t (i=1, . . ., 17; t=0, . . ., 5), hence FG_t is a vector for each t;

$GD_t = [GD_{it}]$ — total government expenditure for the i^{th} sector in year t which is the sum of FG_{it} and LG_{it} (i=1, . . ., 17; t=0, . . ., 5), hence GD_t is a vector for each t;

$KI_t = [KI_{jt}]$ — investment for the j^{th} sector in year t (j=1, . . ., 17; t=0, . . ., 5), hence KI_t is a vector for each t;

$FR_t = [FR_t]$ — farm numbers for the f^{th} farm size class by gross receipts in year t (f=1, . . ., 7; t=0, . . ., 5), hence FR_t is a vector for each t;

$FN_t = [FN_{jnt}]$ — farm numbers for the n^{th} farm size class by acres for sector j in year t (j=1, 2; n=1, . . ., 3; t=0, . . ., 5), hence FN_t is a matrix for each t;

$\Delta AP = [\Delta AP_{jr}]$ — the growth rate of the r^{th} primary inputs average productivity for the j^{th} sector (r=1, 2; j=1, . . ., 17), hence ΔAP is a matrix;

$CK_t = [CK_{jt}]$ — the capacity for the j^{th} sector in year t (j=1, . . ., 17; t=0, . . ., 5), hence CK_t is a vector for each t;

$EC_t = [EA_{jt}/EP_{jt}]$ — the ratio of actual to potential input use for the j^{th} sector in year t (j=1, . . ., 17; t=0, . . ., 5), hence, EC_t is a vector for each t;

$\Delta CK_t = [\Delta CK_{jt}]$ — the change in capacity for the j^{th} sector in year t (j=1, . . ., 17; t=0, . . ., 5), hence ΔCK_t is a vector for each t;

$NI_o = [NI_{ijo}]$ — the purchase of expansionary capital goods from sector i by sector j in the base year (1968) (i, j=1, . . ., 17), hence NI_o is a matrix;

$RI_o = [RI_{ijo}]$ — the purchase of replacement capital goods from sector i by sector j in the base year (1968) (i, j=1, . . ., 17), hence RI_o is a matrix;

LA_t — total land available for agricultural use without resource development programs for year t (t=0, . . ., 5), a scalar for each t;

$\overset{*}{LA}_t$ — total land available for agricultural use with resource development programs for year t (t=0, . . ., 5), a scalar for each t;

ΔSL_t — the amount of agricultural land shifted to urban and public use in year t (t=0, . . ., 5), a scalar for each t;

ΔUL_t — cleared land without resource development programs in year t (t=0, . . ., 5), a scalar for each t;

$\Delta \overset{*}{UL}_t$ — cleared land under resource development programs in year t (t=0, . . ., 5), a scalar for each t;

$PO_t = [PO_{qat}]$ — population of sex q and age a at time t in which a=0 denote birth (q=1, 2; a=0, . . ., 80^+ for age; t=0, . . ., 5), hence PO_t is a matrix for each t;

$\overline{PO} = [\overline{PO}_{qbt}]$ — population of sex q and age cohort b at time t (q=1, 2; b=1, . . ., 17; t=0, . . ., 15), hence PO_t is a matrix for each t;

$\overset{*}{FD}_t = [\overset{*}{FD}_{it}]$ — the final demand including government, exports, net inventory change and unallocated sectors, for sector i in year t (i=1, . . ., 17; t=0, . . ., 5), hence $\overset{*}{FD}_t$ is a vector for each t;

$MX^e_t = [MX^e_{irt}]$ — the estimated maximum output due to the r^{th} primary resource constraints for the i^{th} sector in year t resulting from simulation e (r=1, 2; i=1, . . ., 17; t=0, . . ., 5; e=1, . . ., 3), hence MX^e_t is a matrix for each e for each t;

$ZR_t = [ZR_{rt}]$ — the availability of primary resource r in year t (r=1, 2; t=0, . . ., 5), hence ZR_t is a vector for each t;

$\overset{*}{MX}{}^e_t = [\overset{*}{MX}{}^e_{it}]$ — maximum output of sector i in year t resulting from simulation e which is determined by minimum-maximum output of the primary resource constraints, $\overset{*}{MX}{}^e_{irt}$ (i=1, . . ., 17; t=0, . . ., 5; e=1, . . ., 3), hence $\overset{*}{MX}{}^e_t$ is a vector for each e for each t;

$RX_t^e = [RX_{it}^e]$ — the realized gross output for sector i in year t (i=1, . . ., 17; t=0, . . ., 5; e=1, . . ., 3), hence RX_t^e is a vector for each e and for each t;

$AY_t^e = [AY_{jt}^e]$ — the area income for the j^{th} sector simulated from the e^{th} simulation for year t (j=1, . . ., 17; t=0, . . ., 5; e=1, . . ., 3), hence AY_t^e is a vector for each e and for each t;

$GR_t^e = [GR_{jt}^e]$ — government revenue for the j^{th} sector in year t resulting from the e^{th} simulation (j=1, . . ., 17; t=0, . . ., 5; e=1, . . ., 3), hence GR_t is a vector for each e and for each t;

$RR_t^e = [RR_{jrt}^e]$ — the amount of the r^{th} primary resource (or gross fixed capital) requirements for sector j in year t resulting from the e^{th} simulation (r=1, . . ., 3; j=1, . . ., 17; t=0, . . . , 5; e=1, . . ., 3), hence RR_t^e is a matrix for each e and for each t;

$UR_t^e = [UR_{rt}^e]$ — the r^{th} primary resource utilization rate in year t resulting from the e^{th} simulation (r=1, 2; t=0, . . ., 5; e=1, . . ., 3), hence UR_t^e is a vector for each e and for each t in which UR_{it}^e demotes the utilization rate of labor in year t resulting from simulation e (t=0, . . ., 5; e=1, . . ., 3), hence UR_{it} is a scaler for each t and each e, and UR_{2t}^e denotes the utilization rate of agricultural land in year t resulting from simulation e (t=0, . . ., 5, e=1, . . ., 3), hence UR_{2t}^e is a scaler for each t and each e;

$\overline{X} = [\overline{X}_{jni}]$ — average per farm purchasing patterns for the n^{th} size class in the j^{th} agricultural sector;

III. Coefficients

$A_o = [a_{ij}]$ — the base year (1968) trading coefficients showing the proportion of direct purchases made from the i^{th} sector for producing a dollar of output of the j^{th} sector in the base year (i, j=1, . . ., 17), hence A_o is a matrix;

$A_t = [a_{ijt}]$ — the target year's trading coefficients indicating the proportion of direct purchases made from the i^{th} sector for producing a dollar of output of the j^{th} sector in the t^{th} year (i, j=1, . . ., 17; t=1, . . ., 5), hence A_t is a matrix for each t;

$\overset{*}{A}_t = [\overset{*}{a}_{ijt}]$ — the target year's trading coefficients with household sector endogenous (i j=1, . . ., 18; t=0, . . ., 5), hence A_t is a matrix of trading coefficients and average propensity to consume by sector for each t;

$B = [b_{ij}]$ — the purchase of expansionary capital (NI_{ij}) goods from sector i by sector j, associated with per unit increase in capacity in sector j (i, j=1, . . ., 17), hence B is a matrix indicating the expansion capital requirement coefficient matrix ;

$D = [d_{ij}]$ — the purchase of replacement capital goods (RI_{ij}) from sector i by sector j in order to maintain a constant level of capacity in sector j (i, j=1, . . ., 17), hence D is a matrix indicating the replacement capital requirement coefficient matrix;

$E_t = [e_{kht}]$ — price elasticities in which k=h is own price elasticity and $k \neq h$ is cross-price elasticity for each year t (k, h=1, . . ., 11; t=0, . . ., 5), hence E_t is a matrix for each t;

$\alpha = [\alpha_k]$ — the constant term of the k^{th} Engel function (k=1, . . ., 11), hence α is a vector;

β — the constant term of total Federal and Provincial government expenditure, hence β is a scalar;

$\gamma = [\gamma_j]$ — the constant term of the j^{th} sector's investment (j=1, . . ., 17), hence γ is a vector;

δ — the constant term of land clearing without government land clearing program function, hence δ is a scalar;

$\epsilon = [\epsilon_\ell]$ — the constant term of the ℓ^{th} category of local government expenditure function ℓ=1, . . ., 17), hence ϵ is a vector;

η — the rate of change in total Federal and Provincial government expenditure over time, hence η is a scalar;

π — the rate of change in cleared land over time without land clearing program, hence π is a scalar;

$\phi = [\phi_\ell]$ — the marginal propensity to local government spend by category ℓ with respected to lagged local government expenditure of ℓ (ℓ=1, . . ., 7), hence ϕ is a vector;

$\psi = [\psi_j]$ — the j^{th} sectors' capital stock adjustment coefficient with respect to lagged investment (j=1, . . ., 17), hence ψ is a vector;

$\iota = [\iota_j]$ — the marginal propensity to invest with respect to changes in realized gross output for sector j (j=1, . . ., 17), hence ι is a vector;

$\mu = [\mu_k]$ — the income elasticity of the k^{th} commodity group (k=1, . . ., 11), hence μ is a vector;

$\rho = [\rho_\ell]$ — the marginal propensity to local government spend by category ℓ with respected to population size (ℓ=1, . . ., 7), hence ρ is a vector;

$\theta = [\theta_k]$ — the proportion of consumer's expenditure on the k^{th} commodity or commodity group to total expenditure (i.e., budget shares) in the base year (k=1, . . ., 11), hence θ is a vector;

ω_t — the estimated Frich's money flexibility that is $\frac{\partial u}{\partial Yd}\frac{Yd}{\partial}$ where u is marginal utility of income, hence ω_t is a scalar for each t;

$C_o = [C_k]$ — the portion of the k^{th} consumer commodity or commodity group purchased from outside of the region in the base year, 1968; hence C_o is a vector;

$o = [o_i]$ — the proportion of total Federal and Provincial government expenditure purchased goods and services from the i^{th} sector in the base year ($i=1, \ldots, 17$), hence o is a vector;

$\lambda = [\lambda_{ki}]$ — the proportion of the k^{th} commodity or commodity group purchased from the i^{th} sector in the base year ($k=1, \ldots, 11$; $i=1, \ldots, 17$), hence λ is a matrix;

$\sigma = [\sigma_{\ell i}]$ — the proportion of the ℓ^{th} local government expenditure purchased goods and services from the i^{th} sector in the base year $\ell=1, \ldots, 7$; $i=1, \ldots, 17$), hence σ is a matrix;

$\tau = [\tau_{ji}]$ — the proportion of the j^{th} sector's capital goods purchased from the i^{th} sector in the base year ($i, j=1, \ldots, 17$), hence τ is a matrix;

$F_t = [f_a]$ — the fertility rate of female at age a at time t ($a=15, \ldots, 49$; $t=0, \ldots, 5$), hence F_t is a vector;

$G_t = [g_{jt}]$ — the average government revenue coefficient which is average government revenue from the j^{th} sector, per dollar of realized gross output of sector j ($j=1, \ldots, 17$; $t=0, \ldots, 5$), hence G_t is a vector for each t;

$H_t = [h_q]$ — the proportion of births of sex q in year t ($q=1, 2$; $t=0, \ldots, 5$), hence H_t is a vector for each t;

$S_t = [S_{qat}]$ — the survival rates of sex q and age group b at time t ($q=1, 2$; $b=1, \ldots, 17$; $t=0, \ldots, 5$), hence S_t is a matrix for each t;

$M_t = [m_{qat}]$ — the net migration rate of sex q and age a at time t ($q=1, 2$; $a=1, \ldots, 80^+$; $t=0, \ldots, 5$), hence M_t is a matrix;

$P_t = [P_{qbt}]$ — the participation rates of sex q and age cohort b at time t ($q=1, 2$; $b=4, \ldots, 17$; $t=0, \ldots, 5$), hence P_t is a matrix for each t;

$R = [r_i]$ — the i^{th} sector's average annual growth rate of gross output in Manitoba (i=1, . . ., 17), hence R is a vector;

$U' = [u_{fm}]'$ — the transition probability from the f^{th} class to the m^{th} class (f, m=1, . . ., 7), hence U is a transition probability matric and " ' " indicated the transpose of the matrix;

$V = [v_{ifn}]$ — the proportion of the number of farms for the f^{th} gross receipts class of the n^{th} size class for sector i (i=1, 2; f=1, . . ., 7; n=1, . . ., 3), hence V is a matrix;

$\overline{Z} = [\overline{z}_{inr}]$ — the amount of the r^{th} primary resource imput required by the n^{th} farm size class in the i^{th} sector to produce one unit (thousand dollars) of output in the base (1968) year i=1, 2; n=1, . . ., 3; r=1, 2), hence $\overline{z}$ is a matrix;

$Z_t = [Z_{irt}]$ — the amount of the r^{th} primary resource input required by the i^{th} sector to produce one unit of output (thousand dollars) at year t (i=1, . . ., 17; r=1, 2; t=0, . . ., 5), hence Z_t is a matric for each t;

$\overline{B} = [\overline{b}_{ij}]$ — the ratio of the capacity to realized gross output for the i^{th} sector (i.e., constant relation between K_t and X_t) (i, j=1, . . ., 17 only for i=j), hence B is a diagonal matrix;

$\overline{D} = [\overline{d}_{ij}]$ — the ratio of change in capacity to gross output for the j^{th} sector i.e., constant relation between ΔK_t and X_t (i, j=1, . . ., 17 only for k-j,) hence D is a diagonal matrix;

$Y_t = [Y_{jgt}]$ — the g^{th} average area income coefficient for the j^{th} sector in year t (g=1, 2; j=1, . . ., 17; t=0, . . ., 5) which is the g^{th} average area income associated with per dollar of realized gross output of sector j, hence Y_t is a matric for each t;

$\overline{K}_o = [k_{ijo}]$ — the proportion of purchase of capital goods from sector i by sector j in the base year, 1968 (i, j=1, . . ., 17), hence K_o is a matrix;

The Model Expressed Mathematically

Given the notation defined in Table 3.2, the structural relationships in the model are mathematically expressed in Table 3.3.

TABLE 3.3

SUMMARY OF THE MODEL EXPRESSED MATHEMATICALLY

I. An Overview of the Basic Model (in Matrix Form)

(1) $FX_t = A_o$ (or A_t or $\overset{*}{A}_t$) $FX_t + FD_t$ (or $\overset{*}{FD}_t$)

(Varies according to different simulations)

Subject to

(2) $\Sigma Z_t \; FX_t \leq ZR_t$

II. The Components of the Model

A. Final Demand Submodel

1. Total Final Demand (varies according to different simualtions)

(3) FD_{it} (or $\overset{*}{FD}_{it}$) $= HD_{it} + GD_{it} + ED_{it} + UD_{it} + ID_{it} + INV_{it}$

(i=1, . . ., 17; t=0, . . ., 5)

2. Household Consumption Expenditure

(a) for determination of μ_k:

(4) $\ell_n \; CH_{kt} = \alpha_{kt} + \mu_{kt} \; \ell_n \; YD_t$ (k=1, . . ., 11)

(b) for determination of E_t matrix:

(5) $e_{kht} = \mu_k \; [\theta_k - (1-\theta_k\mu_k) \;/\; w_t]$; for k=h

(6) $e_{kht} = -\mu_k \; \theta_h \; [1 + \mu_k \;/\; w_t]$; for k≠h

(k=1, . . ., 11; t=0, . . ., 5)

(c) projection of household consumption expenditure by sector:

(7) $\ell_n \; CH_{kt} = \alpha_{kt} + e_{kht} \; \ell_n \; (PC_{kt} \;/\; PH_t) + \mu_k \; \ell_n \; YD_t$

(8) $HD_{it} = \lambda_{ik} [C_k \text{ Anti } \ell_n \, CH_{it}] \cdot TP_t$

3. Government Expenditure

(a) for local government expenditure

(9) $TLG_{\ell t} = \varepsilon_{\ell t} + \phi_{\ell t} TLG_{\ell t-1} + \rho_{\ell} TP_t$

(10) $LG_{it} = \sigma_{\ell io} \cdot TLG_{\ell t}$

(i=1, . . ., 17; ℓ=1, 1. . ., 7; t=0, . . ., 5)

(b) for federal and provincial government expenditure

(11) $TFG_t = \beta_t + \eta t$

(12) $FG_{it} = o_{io} \cdot TFG_t$

(i=1, . . ., .7; t=0, . . ., 5)

(c) for total government expenditure by sector

(13) $GD_{it} = LG_{it} + FG_{it}$

(i=1, . . ., 17; t=0, . . ., 5)

4. Investment Demand

(14) $KI_{jt} = \gamma_{jt} + \psi_{jt} [RX_{jt-1} - RX_{jt-2}] + \iota_j KI_{jt-1}$

(15) $ID_{it} = \tau_{ji} \sum_{j=1}^{17} KI_{jt}$

5. Exports, Net Inventory Changes and Unallocated Final Demand

(16) $ED_{it} = ED_{io} [1 + r_i]^T$; T=t - 1968

(17) $INV_{it} = INV_{io} [1 + r_i]^T$; T=t - 1968

(18) $UD_{it} = UD_{io} [1 + r_i]^T$; T=t - 1968

(i=1, . . ., 17; t=0, . . ., 5)

B. Trading Coefficients Submodel

1. Projection of Farm Plant-Scale Distribution

$$(19)\quad FR_{ft} = U'_{fm}\ FR_{ft-1}$$

$$(20)\quad FN_{jnt} = V_{ifn}\ FR_{ft}$$

(j=1, 2; f=1, . . ., 7; n=1, . . ., 3;

t=0, . . ., 5)

2. Trading Coefficient Adjustments

$$(21)\quad a_{ijt} = \frac{\sum_{n=1}^{3} (\bar{X}_{jni}\ FN_{jnt})}{\sum_{i=1}^{26} \sum_{n=1}^{3} (\bar{X}_{jni}\ FN_{jnt})} \quad \text{for } j=1, 2;\ i=1, \ldots, 26$$

$$(22a)\quad a_{ijt} = \frac{\sum_{n=1}^{3} (\bar{X}_{jni}\ FN_{jnt})}{\sum_{i=1}^{2} \sum_{n=1}^{3} (\bar{X}_{jni}\ FN_{jnt}) + \sum_{i=3}^{26} FX_{ij}};$$

(for i=1, 2; j=3, . . ., 17)

$$(22b)\quad a_{ijt} = \frac{FX_{ij}}{\sum_{i=1}^{2} \sum_{n=1}^{3} (\bar{X}_{jni}\ FN_{jnt}) + \sum_{i=3}^{26} FX_{ij}};$$

for i, j=3, . . ., 17

C. Primary Input Requirement Coefficients Submodel

1. Adjusting Primary Input Requirement Coefficient Changes Caused by Canges in Farm Plant-Scale

$$(23)\quad z_{jrt} = \sum_{r=1}^{3} (\bar{z}_{jnr} \cdot FN_{jnt}) \quad (j=1, 2;\ r=1, \ldots, 3$$

n=1, . . ., 3)

2. Adjusting Primary Input Requirement Coefficient Changes Caused by Changes in the Combination of Factor Input

$$(24)\quad z_{jrt} = z_{jrt} \,/\, (1 + \Delta AP_{jr})^{t} \quad (r=1, \ldots, 3;\ j=1,$$

. . ., 17)

D. Capital Coefficients Submodel

1. Determination of Capacity and Changes in Capacity

$$(25)\ CK_{jt} = \frac{RX_{jt}}{EA_{jt}/EP_{jt}} \quad (j=1, \ldots, 17;\ t=0, \ldots, 5)$$

$$(26)\ \Delta CK_{jt} = CK_{jt} - CK_{jt-1} \quad (j=1, \ldots, 17;\ t=0, \ldots, 5)$$

2. Estimation of Capital Coefficients

$$(27)\ b_{ij} = \frac{NI_{ij}}{\Delta CK_j} \quad (i,\ j=1, \ldots, 17)$$

$$(28)\ d_{ij} = \frac{RI_{ij}}{CK_j} \quad (k,\ j=1, \ldots, 17)$$

E. Primary Resource Constraint Submodel

1. Agricultural Land Constraint

$$(29)\ LA_t = LA_{t-1} - SL_t + \Delta UL_t$$

$$(30)\ \Delta SL_t = .1\ SL_{t-1}$$

$$(31)\ \Delta UL_t = \delta + \pi t$$

$$(32)\ \overset{*}{LA}_t = \overset{*}{LA}_{t-1} - \Delta SL_t + \Delta UL_t + \Delta \overset{*}{UL}_t$$

(for t=0, . . ., 5)

2. Labor Constraint

$$(33)\ PO_{qot} = \sum_{a=15}^{49} \left[(PO_{1at-1}) + (PO_{1at-1} \cdot m_{1at-1}) - (PO_{1at-1})(1 - s_{1at}) \frac{1}{2} \right] f_{at}\ (h_{qt})$$

$$(34)\ PO_{qat} = (PO_{qa-1t-1})(s_{qa-1t}) + (PO_{qa-1t-1})(m_{qat-1})$$

(35) $m_{qat} = [\overline{PO}_{qbt} / (\overline{PO}_{qbt-1} \cdot s_{qbt})]^{\frac{1}{5}} - 1$

(q=1, 2; a=1, . . ., 80+; b=1, . . ., 17;

t=0, . . ., 5)

(36) $L_t = \sum_{b=1}^{17} (\overline{PO}_{qbt} \cdot p_{qbt})$ (q=1, 2; b=1, . . ., 17;

t=0, . . . 5)

F. Realized Gross Output Determination Submodel

1. Determination of Gross Output Consistent With Final Demand

(a) for static simulation:

(37) $FX^1_{it} = a_{ijo} FX_{ijo} + FD_{it}$ (i, j=1, . . ., 17;

t=0, . . ., 5)

(b) for comparative static simulation:

(38) $FX^2_{it} = a_{ijt} FX_{ijt} + FD_{it}$ (i, j=1, . . ., 17;

t=0, . . ., 5)

(c) for dynamic simulation:

(39) $FX_{it} = a_{ijt} FX_{it} + b_{ij} \bar{b}_{ij} FX_{it} + d_{ij} \bar{d}_{ij} FX_{it}$

$+ \overset{*}{FD}_{it}$ (i, j=1, . . ., 17; t=0, . . ., 5)

2. Determination of Minimum-Maximum Output

(40a) $$MX^1_{irt} = ZR_{rt} \cdot \frac{1}{z_{iro}} \cdot \frac{FX^1_{it}}{\sum_{i=1}^{17} FX^1_{it}}$$; for static simulation

(40b) $$MX^2_{irt} = ZR_{rt} \cdot \frac{1}{z_{irt}} \cdot \frac{FX^2_{it}}{\sum_{i=1}^{17} FX^2_{it}}$$; for comparative static simulation

(40c) $MX^3_{irt} = ZR_{rt} \cdot \frac{1}{z_{irt}} \cdot \frac{FX^3_{it}}{\sum_{i=1}^{17} FX_{it}}$; for dynamic simulation

(41a) $\overset{*}{MX}{}^e_{it} = \min\ [MX^e_{1it},\ MX^e_{2it}\ ]$; for j=1, 2

(41b) $\overset{*}{MX}{}^e_{it} = MX^e_{2it}$; for i=3, . . ., 17

(e=1, . . ., 3; i=1, . . ., 17; t=0, . . ., 5)

3. Determination of Realized Gross Output

(42a) $RX^e_{it} = \overset{*}{MX}_{it}$ if $FX^e_{it} > \overset{*}{MX}{}^e_{it}$

(42b) $RX^e_{it} = FX^e_{it}$ if $FX^e_{it} < \overset{*}{MX}{}^e_{it}$

G. Impact Determination Submodel

1. Area Income

(43) $AY^e_{jt} = \sum_{g=1}^{2} y_{jgt} \cdot RX^e_{jt}$

(j=1, . . ., 17; g=1, 2; e=1, . . ., 3;
t=0, . . ., 5)

2. Government Revenue

(44) $GR^e_{jt} = g_{jt} \cdot RX^e_{jt}$ (j=1, . . ., 17; e=1, . . ., 3;
t=0, . . ., 5)

3. Labor, Land and Gross Fixed Capital Requirements

(45) $RR^e_{jrt} = z_{jrt} \cdot RX^e_{jt}$ (j=1, . . ., 17; r=1, . . ., 3
e=1, . . ., 3; t=0, . . ., 5)

4. Primary Resource Utilization Rates

(46) $UR^e_{1t} = \sum_{j=1}^{2} RR^e_{j1t} \ /\ LA_t$ (or $\overset{*}{LA}_t$) (e=1, . . ., 3)

$$(47)\ UR^{e}_{2t} = \sum_{j=1}^{17} RR^{e}_{j2t} / L_t \quad (e=1, \ldots, 3)$$

E. Description of Simulation Procedures

Simulations of the impact of agricultural resource development programs are developed on the basis of an assumed regional development process, static, comparative static, and dynamic processes. But each simulation follows the procedures described below.

Given the components of the model specified above and an assumed development process, the simulation procedures are performed repeatedly in order to estimate the impacts of agricultural resource development programs on a set of economic development indicators for the regional economy. The simulation procedures include two steps. The first step determines the values of economic development indicators without agricultural resource development programs. Thus, this run is actually trend projections derived from available historical data series without development programs interference. The second step incorporates agricultural resource development programs into the system in determining the values of economic development indicators. The difference between the two steps represents the impacts of agricultural resource development programs on goal variables.

The schematic presentation of the simulation procedures for both steps are shown in Figure (3.2). The simulation procedures for each step are developed in a series of interrelated stages which can be simply summarized as follows: Given autonomous changes in certain variables, the expected changes in other related variables can be determined. The changes in turn will have repercussions on additional variables. This cause and effect process characterizes the present simulation model and reflects the essential regional economic development process.

The Procedures of the First Step (Projections)

In the first step, the procedure starts with certain variables in the regional economy which are assumed to change autonomously such as output price growth rates, population, income, lagged output, etc. Stage 1 of Figure (3.2) lists these autonomous or exogenous variables both for the Interlake and Manitoba. The consumer price growth rate variable is introduced to reflect price effects on consumer expenditure patterns. The exogenous Manitoba output growth rate is used to predict the shipment of commodities in which the Interlake has trade relationship with the rest of Manitoba. The autonomous variables presented in the left of stage 1 in the Figure are datum for the model.

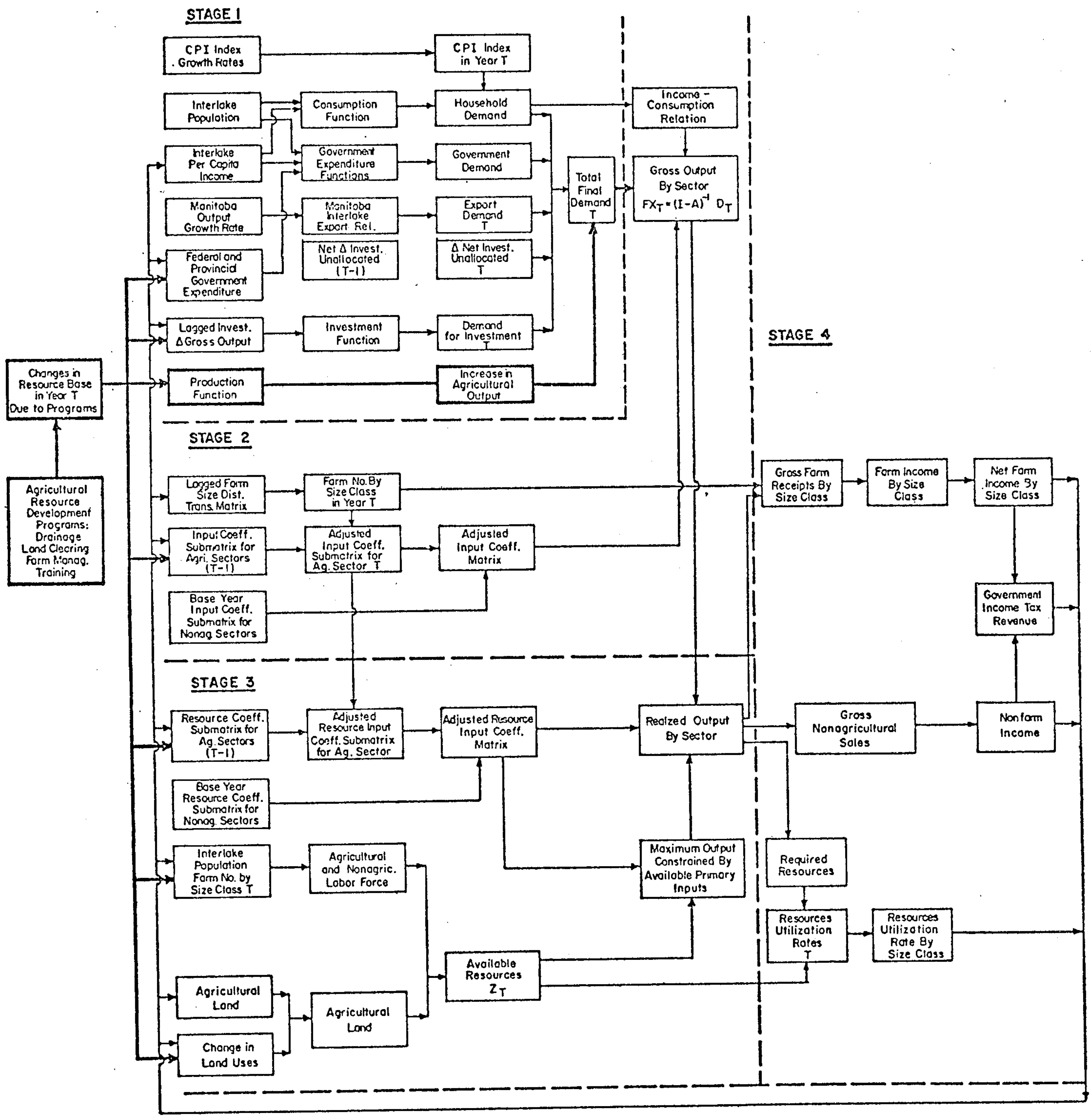
As regional personal income grows, demand for goods and services increases. Moreover, as income increases, household preferences may shift from one product to another. For example, as personal income increases, more luxury and less food items may be consumed. Change in the regional population affects not only household demand but also government expenditures on goods and services in the region.

Accordingly, the exogenous variables listed in the stage 1 determine the activity level of the major components of the final demand. The sum of the final demand components for each sector yields the vector of total final demand for target year t. The procedures for estimating overall final demand are based on the final demand submodel.

Given the final demand for goods and services, production in the region can be determined. The A matrix, which indicates the amounts of

FIGURE 3.2

A Diagrammatic Presentation of the Modified Simulation Model.*



*The heavy solid line indicates the second step of the simulation procedures in which the effects of agricultural resource development programs are indicated in the related stages of the simulation procedure. The light solid line presents the first step of the simulation procedures.

inputs needed from all sectors to produce a dollar of any given commodity summarizes a set of production relations. Since such production relations change over time except for the static simulation, stage 2 indicates the procedures necessary to estimate the A matrix for each target year for the comparative static and dynamic simulations. First, the farm size distribution for target year t is independently estimated from the modified Markov chain process. The estimates are then incorporated into adjustment of the trading coefficients submodel to determine a new trading coefficient matrix.

The gross output consistent with final demand by sector for target year t can be determined by the equation (1) in Table 3.3. Estimated gross output by this system is consistent with a set of final demands projected exogenously from stage 1. However, such output can not be produced if labor and land resources are not available. Thus, the third stage estimates realized gross output, given the state of production techniques associated with different simulation models. Three steps are employed to estimate the realized gross output by sector. First, efforts are made to adjust resource requirement coefficients for agricultural sectors for comparative static and dynamic simulations. Given the estimates of size distribution resulting from stage 2, the resource requirement coefficients are adjusted using the same procedure for changes in the A matrix in stage 2. Secondly, the amounts of resources available, namely labor and land, are estimated exogenously in terms of the specified primary resource constraints submodel. Having estimated the resource requirement coefficient matrix, R_t and the elements of resource constraint vector, ZR_t, the maximum gross output due to resource constraints for target year t can be estimated using equations from (40.a) to (41.b) in Table 3.3. Finally, the realized output by sector is determined by

$$RX_{it} = \min.\ (MX^1_{it},\ MX^2_{it}) \tag{3.52}$$

That is, the realized gross output (RX_i) in each sector can not be greater than the minimum due to labor force constraint (MX^1_{it}) or land constraint (MX^2_{it}). If the gross output by sector estimated from stage 2 is less than the minimum of maximum output of equation (3.52), the realized gross output is consistent with the final demand projection. Otherwise the realized output is less than estimated gross output and the difference is assumed to be compensated for by increasing imports to meet demand.

Once realized gross output is determined, the simulation model continues to project the values of economic development indicators to complete the first step. This is shown in stage 4 of Figure (3.2). The economic development indicators include: area income from farm operation and non-farm business, taxes, resource utilization rates for labor and land, primary resource and capital requirements by sector. The system employed to estimate the values of economic development indicators are presented in the impact determination submodel, (Table 3.3).

The Procedures of the Second Step (Impact Simulation)

Unlike the first step, the second step considers the economic effects of agricultural resource development programs on regional development. An additional stage is required to estimate the direct economic effect associated with development programs in order to simulate the impacts of that program on economic development indicators.

The linkage of this additional stage to the procedures of simulations is shown in Figure (3.2) as indicated by the heavy solid line connected to the production function matrix. The detailed explanation of procedures estimating the direct economic effect associated with each agricultural resource development program is presented in Appendix IV. The increased agricultural output resulting from the direct effect of agricultural resource development programs is an additional component of final demand.

Changes in the resource base due to the programs may or may not result in changes in trading coefficients in agricultural sectors. The land clearing program, for example, enhances farm size without reducing farm numbers. The initial impact of the land clearing program is to increase the number of large farms and trading coefficients are expected to change according to the specified trading coefficient adjustment submodel. Therefore, further changes in trading coefficients in agricultural sectors due to particular development programs are adjusted in stage 2. The re-estimated trading coefficients form the trading coefficient matrix for comparative static and dynamic simulations with resource development programs. Given this re-estimated trading coefficient matrix and estimated final demand vector the gross output can be re-estimated. Eventually, a revised set of economic development indicators can be determined following the same procedures as the first step.

The differences in the values of goal variables between the first step and the second step represent the impacts of agricultural resource development programs under alternative assumptions. Consequently, the specified development programs can be analyzed in *ex ante* for evaluation purposes.

F. The Nature of the Model

This section discusses the nature of the model for simulating regional development without and with agricultural resource development programs using the constructed input-output model. Since regional development can be assumed to follow static, comparative static and dynamic processes, three different types of simulation model are formulated in terms of different assumptions of the development process. The assumptions associated with each simulation model, are formulated and summarized below. In the static simulation model, fixed trading coefficients over time are assumed and household and investment sectors are independently determined outside of the system. This simulation model is typically the Leontief static input-output type.

On the first applications of input-output analysis there was frequent criticism of the assumption of fixed technical coefficients in the static input-output model. Many empirical studies including the present study provides for the possibility that technical coefficients or trading coefficient change over time.[58] Thus, the comparative static simulation considers such changes over time. In addition, the average productivities of primary resource inputs are also considered to change over time due to the technological change affecting the technical or trading coefficients. The other conditions concerning the treatment of final demand are based on the static simulation model.

However, the comparative static simulation model does not provide

---

[58]Empirical studies to test the changes of technical coefficients over time have been discussed in Chapter 2.

any insights concerning the development mechanism. In order to understand the development process over time, the comparative static simulation model is further modified to permit some causal relationships of the development process in action and is called a dynamic simulation model. The analysis of the process of regional economic development in this dynamic simulation is based on the concepts underlying the multiplier-accelerator mechanism.

Another reason to simulate regional development in terms of static, comparative static and dynamic processes is that the economic effects of agricultural resource development programs will be different according to types of development process. Supposing that regional development is observed to follow the static development process, the agricultural resource development programs will have direct, indirect and capital formation effects only. If the development process is observed to be dynamic, as is more likely, then the programs can expect to have two additional economic effects: induced consumption and capacity effects. Therefore, for *ex ante* evaluation of a program, an elaboration of the development process is the key factor. Consequently, three types of development process are assumed in the present study for simulating the impacts of agricultural resource development programs.

Once the simulation models have been formulated, the technical question becomes that of how to simulate the impact of resource development programs through the system. Unlike other studies, the present study considers the interaction of demand and supply forces. The impacts of agricultural resource development programs are indicated by the realized gross output by sector in the first approximation and then they are indicated by a set of economic indicators such as income, employment etc. In order to measure the realized gross output by sector according to different simulation models, two different types of gross output are distinguished; one is defined as gross output consistent with final demand and another is defined as maximum output of the corresponding sector. The former gross output is obtained by solving the simulation system and the latter is obtained consistent with the maximum gross output due to different primary resource constraints. Then, the realized gross output is determined by comparing the estimates of gross output consistent with final demand and maximum output of the sector. If the former is less than the latter output, the realized gross output is said to equal the gross output consistent with final demand. Otherwise the realized gross output is equal to the maximum gross output of the sector and the difference is compensated for by increasing imports.

In summary, the model depicts the process of regional economic development over time. Regional economic development depends on the production techniques, on capitalized values of investment goods, on final demand forces, and on the maximum potential growth constraints. The interactions among those forces, one on the demand side and other on the supply side, determine actual regional development summarized by selected economic indicators. During the period one set of these forces may be critical in limiting the development; during another period quite a different set of forces may be critical. The specified model can be used to determine their order as a resultant of all the forces explaining the time path of the regional economic growth through simulation.

Theoretical limitations of the model encountered in the dynamic input-output system are its inability to handle (1) long periods of excess capacity, and (2) declines or constant demand.[59] The former limitation is solved by allowing investment to occur after a desired capacity utilization rate has been achieved. That is solved by the system where changes in capacity were assumed to be constant associated with realized gross output (the $\bar{B}$ and $\bar{D}$ matrices specified in equations 3.43 and 3.44). But this way of handling the former problems goes against the latter problem. If no change in demand occurs, then no investment will be made i.e., $\Delta CK = 0$. By definition, b_{ij} becomes infinity and the dynamic input-output system breaks down. Similarily, if $RX_{t-1} > RX_t$, we would have $\Delta CK < 0$ and the b_{ij} becomes negative. A negative b_{ij} is not consistent with a solution to the dynamic input-output system.

The dynamic input-output system as formulated above depicts a growing economy. The dynamic input-output system can be used for the same purposes as a static input-output model in a growing economy, but of course the dynamic input-output model yields more information and produces consistent projections of investment expenditures required to meet forecasted level of realized gross output.

[59] W. Leontief, Input-Output Economics, Op. Cit., p. 150.

CHAPTER 4

EMPIRICAL PROCEDURES FOR MODEL CONSTRUCTION

The procedures used in collecting the data required for the study and empirical procedures for constructing the model are presented in this chapter. The data collection process and empirical model construction were complicated not only by the volume of the data requirements but also by the fact that many of the data required were not readily available. When the required data could not be obtained from the available sources, procedures had to be developed to estimate the necessary data from related data that were available. The introduction to each section includes a general outline of the procedures described in that section.

The components of the model specified in the preceding chapter are derived from the Interlake 1968 social accounting system. Thus, the first section of this chapter presents the social accounting matrix (SAM) for the base year (1968). Given the constructed 1968 Interlake social accounting matrix, the procedures for deriving the dynamic trading and primary input requirement coefficients are presented in the next section. The procedures employed to project primary resource constraints are discussed in the third section. The procedures for final demand projections are presented in the final section.

A. Construction of 1968 Social Accounting System for the Interlake Economy

Scope and Estimation Procedures

By considering the model hypothesized and the difficulty of obtaining reliable statistical information in constructing a social accounting matrix (SAM) for the Interlake Area, the SAM is divided into two major accounts: (1) an intersectoral transaction account and (2) primary resources accounts including capital, labor force and land accounts. The intersectoral transaction account forms the core of economic relations in the economy and is basically an integration of Input-Output table and income and product account. Thus, this account enables one to trace the development process through the interrelations among sectors and the relations between this account and other accounts.

Classification of Sectors It is realized that additional sectors would yield greater detail regarding the impact of a particular development program on the economy. However, two factors limit disaggregation. First, it seems wise to keep a fairly manageable size since the number of cells of the matrix increases exponentially as sectors are added. Second, additional information is limited for the detailed sectors due to data not being available at the regional level. Accordingly, the Interlake regional economy is divided into seventeen endogenous sectors. The endogenous sectors include the major divisions agriculture, mining, manufacturing and services. Agricultural activities are further divided into two sectors: livestock, and crop and other. This division allows the two main agricultural enterprises to be studied separately. Manufacturing activities are aggregated into food and beverage manufacturing and other manufacturing because many other types of manufacturing cover a very small portion of economic activities in the region. Service activities are classified into twelve sectors including transportation and communication, wholesales, retail sales and other types of services since service activities dominate the major economic activity as agricultural sectors. Seven exogenous sectors are included in the system as listed below together with endogenous sectors.[1]

Endogenous Sectors

1. Agriculture-Livestock
2. Agriculture-Crop & Other
3. Mining
4. Food & Beverage Manufacturing
5. Other Manufacturing
6. Transportation
7. Construction
8. Petroleum Wholesale
9. Farm Equipment, Building Material
10. Food Store
11. Other Retail
12. Auto Product Sales & Services
13. Apparel & Shoes
14. Furniture & Appliances
15. Insurance
16. Personal Service
17. Other Services

Exogenous Sectors

18. Household

---

[1]The detailed description of sector classification see: MacMillan, Lu, and Framingham, Op. Cit., Appendix A.

19. Government

20. Inventory

21. Investment

22. Unallocated

23. Export to Manitoba

24. Export to Canada

Estimation Procedure Two steps are employed to estimate the SAM. First, the intersectoral transaction account was estimated by MacMillan, Lu, Framingham, based on 1968 household and business survey data.[2] The estimation procedures were given in detail in the appendices of their study and will not be repeated here. The estimated intersectoral transaction table explicitly contains the capital formation and implicitly contains the employment figures.

The second step is to construct primary resources and capital accounts which are also mainly based on 1968 household and business survey data. Secondary data are also used to estimate and/or to adjust some accounts. The estimated results are compared with the estimates obtained from the first step. The estimation procedures for constructing primary resources accounts are explained in detail in Appendix I.

The Components of the 1968's Interlake Social Accounting System

Intersectoral Transaction Account According to trade concepts, the intersectoral transaction table is constructed from a sales and purchases points of view. From the sales point of view, area sales are equal to:

---

[2] Ibid.

$$FX_i = \sum_{j=1}^{n} FX_{ij} + HD_i + GD_i + ED_{i1} + ED_{i2} + UD_i + ID_i + INV_i \quad (4.1)$$

where FX_i = total sales of sector i;

FX_{ij} = sales from the i^{th} sector to the j^{th} sector;

HD_i = local household consumption purchased from the i^{th} sector;

ED_{i1} = exports to the rest-of-Manitoba by the i^{th} sector;

ED_{i2} = exports to the rest-of-Canada by the i^{th} sector;

UD_i = sales from the i^{th} sector to the unallocated sector;

GD_i = government local expenditure of goods and services purchased from sector i;

INV_i = inventory addition of the i^{th} sector; and

ID_i = investment demand for the i^{th} sector.

From a purchase point of view, area intermediate sector purchases are equal to:

$$FX_{\cdot j} = \sum_{i=1}^{n} FX_{ij} + \sum_{i=j}^{m} P_{ij} + \sum_{i=1}^{e} M_{ij} \quad (4.2)$$

where P_{ij} = inputs purchased from payment sector i by sector j;

M_{ij} = imports of intermediate goods and final goods from sector i by sector j;

$FX_{\cdot j}$ = total purchases of inputs; and

other variables are as defined above. Area final demand sector purchases are also similar to (4.2). The sum of area intermediate sector and final demand sector purchases are the area's total purchases which are equal to area's total sales.

In addition, there exists considerable controversy concerning the method of constructing the intersectoral transaction table according to the input-output framework. In general, the intersectoral transaction table can be constructed by means of the direct or indirect method in terms of producer's prices or purchaser's prices. The choice among the alternative bases for measuring intersectoral transactions depends upon the structure of the area economy under consideration and the objective of the study. The 1968 intersectoral transaction table for Interlake constructed by MacMillan, Lu and Framingham was based on the direct routing with producer's prices of transaction flows which emphasize the direct trade relationships among sectors, and between the producing and final demand.[3] The table constructed is reproduced and shown as Table 4.1. The table summarizes all sales and purchases occurring in the Interlake area in 1968. To read across the table, sales of each sector to other sectors are determined and to read down the table (column), purchases of one particular sector from other sectors are realized. Thus, the table provides information on sales by sector, intersectoral transactions, consumer and government transactions, and transactions between intermediate sectors and the rest of the world.

The intersectoral transaction table indicates that there is a considerable amount of imports and exports with about 50% of total purchases in the area from import sectors and about 44% of total sales as exports. Also the table indicates that the area's economy is very dependent upon the agricultural sectors. Total sales of agricultural products are $47 million and accounts for about 30% of the area's total sales, while $16.5 million of agricultural purchases are made locally

[3] Ibid., Chapter 4.

TABLE 4.1

INTERLAKE AREA TRANSACTIONS, 1968
Unit: $1,000

Purchasing Sector / Producing Sector	Agr. Lvstk. (1)	Ag. Crops & Other (2)	Min-ing (3)	Food & Bev. Mfg. (4)	Other Mfg. (5)	Transp. (6)
Intermediate Sector			(thousand dollars)			
(1) Agr. Livestock	1,103.5	116.4	0.0	2,764.0	0.0	0.0
(2) Agr.Crops&Other	689.0	206.9	0.0	176.4	0.0	0.0
(3) Mining	0.0	0.0	0.0	0.0	123.9	0.0
(4) Food & Bev. Mfg.	78.8	6.0	0.0	139.8	0.0	0.0
(5) Other Mfg.	0.0	0.8	0.1	0.3	21.3	2.0
(6) Transportation	170.5	162.5	9.0	28.7	148.3	1.7
(7) Construction	0.0	3.4	60.0	0.0	136.0	0.0
(8) Petroleum Wholesale	3,064.0	857.1	15.5	44.7	75.5	167.4
(9) Farm Equipment, Bldg. Material	1,998.3	86.1	0.0	3.5	16.1	0.0
(10) Food Store	18.7	1.3	0.0	0.0	0.0	0.0
(11) Other Retail	134.3	8.8	0.0	4.3	31.5	16.4
(12) Auto Product Sales&Service	1,613.6	1,317.8	0.0	3.3	5.7	199.5
(13) Apparel & Shoes	0.0	0.0	0.0	0.0	0.8	0.0
(14) Furniture and Appl.	0.0	0.0	0.0	0.0	0.0	0.0
(15) Insurance	34.3	25.0	0.0	0.8	0.9	0.5
(16) Personal Service	0.0	0.0	0.0	0.0	0.0	0.0
(17) Other Service	39.9	31.2	0.0	1.4	5.7	1.4
Sub-Total	8,944.9	3,598.3	84.6	3,167.2	565.7	394.9
Payment Sector						
(18) Households	9,169.0	4,068.6	299.2	560.4	6,303.6	777.5
(19) Government	767.9	529.9	65.0	10.7	3,814.6	80.1
(20) Inventory Depl.	2,583.6	979.5	0.0	6.4	0.0	0.0
(21) Deprec.&Retained Earning	3,324.0	2,047.0	363.2	400.5	2,548.5	242.3
(22) Rent	434.2	91.3	0.2	0.0	37.6	2.3
(23) Interest	215.5	136.7	0.0	1.8	22.9	26.7
(24) Unallocated	175.9	129.5	15.3	10.5	14.2	49.2
(25) Imports (R.O.M.)	7,861.8	1,873.9	259.1	364.2	7,268.5	245.2
(26) Imports (R.O.C.)	0.0	60.4	0.0	2.8	1,396.1	4.8
Total Payments	24,531.9	9,916.8	1,002.0	1,357.3	21,396.0	1,428.1
Total Purchases	33,476.8	13,515.1	1,086.6	4,524.5	21,961.7	1,823.0
Gross Output	30,893	12,535.6	1,086.6	4,518.1	21,961.7	1,823.0

TABLE 4.1
Continued

Sector No.	Const. (7)	Pet. Whole-sale (8)	Farm Equip., Bldg. Mat. (9)	Food Stores (10)	Other Retail (11)	Auto Prod. Sales & Service (12)	App'l & Shoes (13)	Furn. & Appl. (14)
	(thousand dollars)							
(1)	0.0	0.0	269.9	23.6	0.0	0.0	0.0	0.0
(2)	0.0	0.0	116.9	28.6	0.0	3.7	0.0	0.0
(3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(4)	0.0	0.0	0.0	183.3	51.4	0.0	0.0	0.0
(5)	45.0	3.1	10.2	1.3	13.5	43.7	9.4	0.4
(6)	66.8	0.6	116.2	8.5	171.2	72.8	9.0	2.6
(7)	219.5	39.8	4.2	12.8	37.1	14.9	0.6	2.6
(8)	28.1	22.8	22.1	16.2	30.2	44.2	3.7	3.3
(9)	427.8	0.0	0.0	0.0	0.0	0.0	2.6	0.0
(10)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(11)	25.3	3.3	8.1	3.0	20.7	44.1	1.3	0.2
(12)	59.8	53.9	29.8	8.0	7.4	67.4	2.2	3.9
(13)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(14)	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0
(15)	8.0	0.9	2.9	4.8	9.6	8.4	0.8	0.6
(16)	1.7	0.0	0.0	0.0	7.2	0.0	0.0	0.0
(17)	55.6	14.1	2.0	6.0	18.9	47.9	2.0	5.5
	937.6	138.5	582.3	296.1	372.3	347.1	31.6	19.1
(18)	1,455.9	743.3	605.6	609.5	1,466.8	2,863.4	163.1	101.4
(19)	71.2	47.9	123.7	73.7	240.1	454.1	42.8	17.1
(20)	9.5	0.0	0.0	1.8	48.9	54.1	20.0	2.7
(21)	456.2	105.3	170.8	166.2	455.7	427.5	51.7	7.7
(22)	14.2	0.0	0.0	0.0	40.8	48.4	17.2	12.3
(23)	56.3	104.5	28.1	16.1	77.9	91.0	6.2	2.9
(24)	86.5	22.1	24.3	30.9	79.8	79.6	6.7	6.2
(25)	3,758.9	6,364.5	4,226.2	5,468.7	8,804.6	17,705.1	921.4	337.9
(26)	1,108.8	1,821.9	0.0	1.8	0.7	6.1	0.0	0.0
	7,017.5	9,209.5	5,178.7	6,368.7	11,215.3	21.729.3	1,229.1	488.2
	7,955.1	9,348.0	5,761.0	6,664.8	11,587.6	22,076.4	1,260.7	507.3
	7,945.6	9,348.0	5,761.0	6,663.0	11,538.0	22,022.3	1,240.7	504.6

TABLE 4.1
Continued

Sector No.	Ins. (15)	Pers. Serv. (16)	Other Serv. (17)	Total Inter-mediate (17-S)	House-hold (18)	Govern-ment (19)
(1)	0.0	19.7	0.0	4,297.1	1,600.1	73.8[a]
(2)	0.0	36.7	0.0	1,258.2	332.9	28.0[a]
(3)	0.0	0.0	0.0	123.9	0.0	117.7
(4)	0.0	329.0	0.0	788.3	0.0	0.0
(5)	2.1	14.2	11.8	179.2	56.5	11.2
(6)	21.7	35.3	29.0	1,054.4	190.7	71.0
(7)	0.0	60.1	26.9	617.9	1,612.9	166.9
(8)	2.0	33.6	2.6	4,433.0	4,587.0	179.3
(9)	0.0	0.0	0.0	3,309.4	454.0	361.5
(10)	0.0	0.6	0.0	20.6	5,543.6	111.6
(11)	2.6	39.3	67.3	410.5	10,028.4	465.5
(12)	0.0	24.6	7.2	3,404.1	12,861.1	796.4
(13)	0.0	0.0	0.0	0.8	1,146.8	34.9
(14)	0.0	0.0	0.0	5.1	438.0	0.0
(15)	1.3	8.3	1.5	114.6	140.7	2.3
(16)	0.0	7.7	11.3	27.9	4,842.2	192.8
(17)	6.0	31.8	17.2	286.6	996.2	5.1
	35.7	640.9	174.8	20,331.6	44,831.1	2,618.0
(18)	183.6	2,096.9	590.8	32,058.6	0.0	23,088.0[e]
(19)	5.1	215.3	28.7	6,587.9	11,482.3[b]	
(20)	0.0	0.0	0.0	3,706.5	0.0	
(21)	7.0	262.8	38.1	11,074.5	4,441.1[c]	
(22)	8.1	43.7	58.4	798.7	967.5[d]	
(23)	2.9	59.0	18.0	866.5	0.0	
(24)	14.0	90.2	84.3	919.2	3,997.9[f]	
(25)	45.1	4,671.9	597.4	70,774.4	9,949.4	
(26)	0.6	32.5	23.1	4,459.6	0.0	
	266.4	7,472.3	1,438.8	131,245.9	30,838.2	
	302.1	8,113.2	1,613.6	151,577.5	75,669.3	
	302.1	8,113.2	1,613.6			

TABLE 4.1
Continued

Sector No.	Inven-Tory Addition (20)	Sales to Invest-ment (21)	Unalloc. (22)	Exports to Manitoba (23)	Exports to Canada (24)	Total Final Demand (25)	Total Output (26)
			(thousand dollars)				
(1)	3,655.6	0.0	8.4	23,841.8	0.0	29,179.7	33,476.8
(2)	2,656.3	0.0	2.8	9,236.9	0.0	12,256.9	13,515.1
(3)	0.0	0.0	0.0	260.3	584.7	962.7	1,086.6
(4)	5.5	0.0	662.4	3,068.3	0.0	3,736.2	4,524.5
(5)	85.5	0.0	1,051.9	138.5	20,438.9	21,782.5	21,961.7
(6)	21.4	0.0	364.6	120.9	0.0	768.6	1,823.0
(7)	10.8	4,523.4	0.0	579.9	443.3	7,337.2	7,955.1
(8)	0.0	0.0	0.0	148.7	0.0	4,915.0	9,348.0
(9)	5.5	1,410.3	29.9	190.4	0.0	2,451.6	5,761.0
(10)	98.0	0.0	0.0	889.2	0.0	6,644.2	6,664.8
(11)	173.3	5.1	0.0	460.5	55.3	11,177.1	11,587.6
(12)	336.8	2,291.3	475.9	1,910.8	0.0	18,672.3	22,076.4
(13)	13.0	0.0	0.0	65.2	0.0	1,259.9	1,260.7
(14)	0.0	9.1	31.0	4.1	0.0	502.2	507.3
(15)	0.0	0.0	0.0	44.5	0.0	187.5	302.1
(16)	0.0	0.0	0.0	2,980.5	69.8	8,085.3	8,113.2
(17)	0.0	0.0	0.0	325.7	0.0	1,327.0	1,613.6
	6,063.5	8,239.2	2,626.9	44,286.2	21,581.0	131,245.9	151,577.5
(18)	0.0	0.0	10,595.8[g]	9,926.9[h]	0.0	43,610.7	75,669.3

[a]Subsidies paid by government for land clearing. Allocation between livestock farms and crop farms is based on the estimate from farm sample.

[b]Government income tax, property tax, licenses, medical and tuition payments to government.

[c]Savings plus house depreciation.

[d]Housing rent paid.

[e]Wages paid by government plus transfer payments.

[f]Room and board expenses and perquisites produced by nonfarm households.

[g]Rental incomes, interest and dividends, plus wage earnings in finance institutions.

[h]Non-local earnings received by Interlake Households.

Source: MacMillan, Lu and Framingham, Op. Cit., Table 12.

(sum of subtotal row under columns 1 and 2).

Column 21 of Table (4.1) is a vector of local investment goods sold by the local producing sector and purchased by other producing sectors. They represent gross fixed capital formation which occurred locally in 1968. Only $8 million (the entry of the sub-total row under sales to investment column) of gross fixed capital formation are from the local economy. The distribution of $8 million of gross fixed capital formation to each producing sector is shown in the capital account. The gross fixed capital formation sector in the intersectoral transaction table corresponds to the depreciation and retained earning row in the payment sectors. Thus, the net fixed capital formation can be derived from the gross fixed capital account and the depreciation and retained earning row simply by substracting depreciation from gross fixed capital formation.

The household row (row 18) shows the income received from business firms, government and from outside of the area. For example, $23,088.0 thousand in the entry of row 18 under the government column indicates that the household receives that amount of cash including wages and salaries, transfer payments, training grants etc. from governments. The value of $9,169.0 thousand in the entry of row 18 under the agricultural livestock sector represents household income including hired labor payments for permanent and temporary labor, as well as wages in kind, and the return to farm operators. Therefore, this row implicitly contains the employment figures in the intermediate sectors.

<u>Primary Resource Accounts</u> Primary resource accounts furnish information on resource utilization associated with the area's economic

activities in relation to regional growth. For example, how much capital, land and labor are required to produce $1 million of output? The primary resource account associated with the estimated intersectoral transaction account could provide information to answering this and similar types of question. The primary resource accounts considered in this study include labor force and land accounts. The estimated results of each account are explained and presented below.

(i) Labor Force and Employment Account The labor force is defined as persons over 15 years of age and over who, during the reference week, were employed or unemployed.[4] Employment figures in man-year were derived from employment position data . Based on these definitions, the estimated total labor force in the area in 1968 is 16,619 (Table 4.2) with 7,135 is classified as agricultural labor force and 9,484 classified as non-agricultural labor force. Of this available labor force in the area, 735 persons are unemployed (an unemployment rate of 4.42%).

The composition of employment by type is of particular interest. If the agricultural labor force is assumed to be engaged in agricultural production according to skill categories, the unemployment rate for the agricultural labor force is very high (8.58%).[5] On the other hand, the umemployment rate for the non-agricultural labor force is only 1.30% which is below full employment position given the normal full employment definition of a 4% unemployment rate.

---

[4]Dominion Bureau of Statistics, The Labor Force, Cat. No. 71-001 (Ottawa, Ontario: Queen's Printer, Monthly), p. 3.

[5]Estimated by dividing labor force employed in the agricultural sectors by the estimated agricultural labor force.

TABLE 4.2

ESTIMATED TOTAL LABOR FORCE AND EMPLOYMENT BY SECTOR IN THE INTERLAKE AREA, 1968[a]

(Unit: Man-Year)

Labor Force	No.	Employment By Sector	No.
I. Agricultural Labor Force	7,125.0	I. Producing Sector	
		1. Ag.-Livestock	4,258.0[b]
		2. Ag.-Crop & Other	2,265.0
II. Non-agricultural Labor Force	9,484.0	3. Mining	42.4
		4. Food & Bev. Mfg.	130.4
		5. Other Mfg.	1,169.2
		6. Transportation	228.1
		7. Construction	404.5
		8. Petroleum Wholesale	152.7
		9. Farm Equip. & Service	132.8
		10. Food Stores	172.6
		11. Other Retail	393.2
		12. Auto Product & Service	532.4
		13. Apparel & Shoes	51.5
		14. Furniture & Appliance	20.2
		15. Insurance	35.4
		16. Personal Services	658.5
		17. Other Services	187.8
		Intermediate Sector Subtotal	10,834.7
		II. Final Demand Sector	
		18. Government	3,957.0
		Local Government	191.0
		Provincial Government	2,191.0
		Federal Government	1,575.0
		23. Commuting	1,092.3[c]
		Final Demand Subtotal	5,049.3
		III. Total Employment	15,884.0
		IV. Unemployment	735.0
Total Labor Force	16,619.0	Total Labor Force	16,619.0

[a]The estimation procedures are explained in Appendix I.

[b]This employment figure includes 36 fur farms and 12 employees working in service to agriculture.

[c]This figure includes number in the labor force employed outside of the area but they are resident in the area (commuting).

Sources: (1) MacMillan and Lu, Projection and Impact Models, Op. Cit., Appendix C. Table 23; (2) Framingham, MacMillan and Sandell, Op. Cit., Table 6.

The distribution of labor force by sector indicates that agriculture constitutes the largest proportion of total employment while the government sector is the second. The labor force in agriculture accounts for 41% of total employment and 25% of total employment is in the government sector. There is 68% of total employment in the producing sectors.

It should be noted that there is a large number in the labor force (1,092.3 man-year) who are employed outside of the area but residing in the area (i.e., commuters). Thus, the employment situation is also partially dependent on the economic activities outside of the area mainly in Winnipeg.

(ii) Land Account Not all land is suitable for agricultural production. In order to measure available land for agricultural production over time, the total land in the area (defined as total land area) is classified into three categories according to the characteristics of the land. They are classified as: (1) town and public land; (2) agricultural land which is further classified into good and poor agricultural land; and (3) crown, lake and other land. Total available land for farming is confined to the second category - agricultural land. This way of classifying available land for agricultural production is arbitrary since additional crown land could be used for farming. However, there is no information available concerning acreages of crown land that are also suitable for farming but not yet leased to farmers. In general, the crown owns most of the poorer land. A large part of the crown land is too wet or too stony and hence not suitable for farming.[6] In addition, the crown land, usually pasture land, which is operated under a lease arrangement with Federal, Provincial or Municipal governments are reported as part of agricultural land either in good or in poor agricultural land classes.[7]

Definitions, sources and estimation procedures for each type of land are explained in Appendix I. The results are summarized in Table (4.3). It is clear that most of the land acreage in the area is crown, lake and other land (almost 75% of the total). The agricultural land accounts for 22% in 1961 but increased each year through new breaking (27%, 28% and 30% in 1966, 1968 and 1971 respectively).

The impact of town and public land expansion on the agricultural land is not significant. It is estimated that town and public land increased an average of one percent since 1961, and it is likely to continue the similar pattern of expansion in the near future (see section c of Appendix I). However, there is little information concerning where the expanded town and public use of land occurs. It is assumed that all such lands are transferred from agricultural land. Given this assumption, the available agricultural land for farming over time can be projected by substracting agricultural land transferred to town and public use and adding new breaking. The detailed procedures for projecting available agricultural land will be given in the forthcoming section.

---

[6]Mimeographed Report of the Interlake FRED planners, Guidelines for Development, the Interlake Region of Manitoba, Winnipeg, 1970 (Draft Copy).

[7]Dominion Bureau of Statistics, 1961 Census of Canada, Agriculture Manitoba, Cat. No. 96-537 (Ottawa: Queen's Printer, 1963) p. ix.

TABLE 4.3

TYPES AND USES OF LAND IN THE INTERLAKE AREA
IN 1961, 1966, 1968 AND 1971

(Unit: '000 Acres)

Types and Uses of Land	1961	1966	1968	1971
1. Total Land Area	5,945.3	5,945.3	5,945.3	5,945.3
2. Types and Uses of Land:				
(1) Town and Public Land	178.4	187.4	196.4	205.4
(2) Agricultural Land	1,308.8	1,611.1	1,687.6	1,756.9
(i) Good Agricultural Land	908.1	986.0	1,038.2	1,095.4
(a) Under Crops	629.3	709.5	760.7	795.8
(b) Improved Pasture	99.5	115.1	113.0	133.9
(c) Summer Fallow	179.3	161.4	164.5	165.7
(ii) Poor Agricultural Land - Unimproved Pasture	400.7	625.1	649.4	661.5
(3) Crown, Lake and Other Land	4,458.1	4,146.8	4,061.3	3,983.0

Source: For calculation and sources, see section c of Appendix I, Estimation of Land Account

TABLE 4.4

DISTRIBUTION OF AGRICULTURAL LAND
BETWEEN AGRICULTURAL SECTORS
IN THE INTERLAKE AREA, 1968

(Unit: '000 Acres)

Sector	Total Ag. Land	Summer Fallow	Ag. Land Under Crops: Total	Ag. Land Under Crops: Poor Ag. Land Under Crops	Ag. Land Under Crops: Good Ag. Land Under Crops
1. Ag.-Livestock	714.6	37.4	677.2	454.6	222.6
2. Ag.-Crop	973.0	127.1	845.9	194.8	651.1
Total	1,687.6	164.5	1,523.1	649.4	873.7

Source: For Calculation and Sources, see section c of Appendix I, Estimation of Land Account.

Distribution of agricultural lands between agricultural sectors is shown in Table (4.4). The first column of the Table shows the distribution of total agricultural land (the sum of good and poor agricultural land) between livestock, and crop and other sectors (for estimation procedures, see section c of Appendix I), of which the agricultural livestock sector holds 42% and agricultural crop and other sector occupies 58%. In addition, agricultural livestock occupies most of the poor agricultural land and agriculture crop and other sectors occupy most of the good agricultural land (comparing columns 2 and 3 of the Table).

Capital Account Conceptually, overall capital requirements of any industry or sector consist of capital required for (1) the expansion of "productive capacity," (2) replacement to maintain the capacity and inventories. The term productive capacity refers to the physical plant of a given sector. It may be measured by the value of the capital which makes up the productive capacity.[8] Capital required for both expansion and replacement purposes is called fixed capital and inventories are classified as current capital.[9] For convenience, fixed capital required for expansion purposes is called "expansion fixed capital" and for replacement purpose, is called "replacement fixed capital." The sum of expansion and replacement fixed capital is defined

[8]The productive capacity may be measured by the maximum output of that sector. See: William H. Miernyk, et. al., Simulating Regional Economic Development Op. Cit., pp. 54-57.

[9]Fixed capital goods include buildings, machinery, equipment and furniture constituting a plant and inventories would include inventories of raw materials, goods in process and finished goods.

as "Gross fixed capital."[10]

The distinction between fixed capital and inventories is not always clear-cut, and some arbitrariness in definition is unavoidable. Many other conceptual problems concerning the definition, estimation and use of capital account are discussed in some detail by Level, Legler and Shapiro.[11] The distinction is irrelevant to constructing a capital account. However, the distinction could be relevant in projection or planning applications since fixed capital is subject to depreciation, whereas inventory is not, Hence inventory is excluded from the capital account. In addition, expansion of fixed capital creates additional productive capacity for the regional economy but the replacement of fixed capital normally does not. Thus, it becomes apparent that a complementary transaction table for replacement of fixed capital can be constructed with little additional effort.

The relationship between gross fixed capital and expansion and replacement fixed capital can be written, in matrix form, as:

$$\begin{bmatrix} K^g_{11} & \cdots & K^g_{1n} \\ \vdots & K^g_{ij} & \vdots \\ K^g_{n1} & \cdots & K^g_{nn} \end{bmatrix} = \begin{bmatrix} K^e_{11} & \cdots & K^e_{1n} \\ \vdots & K^e_{ij} & \vdots \\ K^e_{n1} & \cdots & K^e_{nn} \end{bmatrix} + \begin{bmatrix} K^z_{11} & \cdots & K^z_{1n} \\ \vdots & K^z_{ij} & \vdots \\ K^z_{n1} & \cdots & K^z_{nn} \end{bmatrix}$$

---

[10] Capital stock or stock of capital refers to the sum of capital stock at the beginning of the year plus capital formation including inventory additions minus depreciation and inventory depletion. Hence, the capital account presented here is limited to capital formation transactions during the period rather than the capital stock account. The definition of capital stock and estimation procedures from capital formation can be found in: Business Finance Division, Dominion Bureau of Statistics, Fixed Capital Flows and Stocks Manufacturing Canada 1926-1960, Methodology (Ottawa: Queen's Printer, 1967), Cat. No. 13-522.

[11] Charles L. Leven, John B. Legler and P. Shapiro, An Analytical Framework for Regional Development Policy (Cambridge, Massachusetts: The MIT Press, 1971), pp. 24-65.

where K^g_{ij} is gross fixed capital flows indicating gross fixed capital transaction among sectors. Summation of column $\sum_{i=1}^{n} K^g_{ij}$ represents total gross fixed capital purchased by sector j and summation of row $(\sum_{j=1}^{n} K^g_{ij})$ is total gross fixed capital sales by sector i. In similar fashion, K^e_{ij} and K^z_{ij} are expansion and replacement fixed capital flows respectively. Hence, the capital transaction table similar to the intersectoral transaction table can be constructed according to equation (4.3).

The estimated gross fixed capital transaction is shown in Table (4.5). The estimation procedures are explained in Appendix I. As on the intersectoral transaction table, each column of the table shows the composition of the purchases of gross fixed capital from the row sectors. The total of the column shows the amount of gross fixed capital formation which has occurred within the sector over the year to which the table refers. Each row shows the sales of fixed capital goods from that sector to other sectors. According to the data in Table (4.5), agricultural livestock made the largest purchases of fixed capital goods ($9,180.1 thousand). The agricultural crop sector was next, purchasing fixed capital goods of an estimated $4,496.7 thousand.

A large portion of gross fixed capital is imported from the rest of Manitoba. The other manufacturing sector is the largest importing $1,887.5 thousand out of $1,974.6 thousand gross fixed capital formation. Only the agricultural livestock sector has purchases of gross fixed capital from the rest of Manitoba smaller than that of purchases made in the area. Imports of fixed capital goods make up a large proportion of total gross fixed capital formation in most sectors.

As explained earlier, not all gross fixed capital formation

TABLE 4.5

INTERSECTORAL GROSS FIXED CAPTIAL
TRANSACTION, INTERLAKE 1968

Unit: $1,000

Producing Sector \ Purchasing Sector[a]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	Total Capital
1. Ag.-Livestock																		
2. Ag.-Crop																		
3. Mining																		
4. Food & Bev. Mfg.																		
5. Other Mfg.																		
6. Trandportation																		
7. Construction	2,680.1	1,219.1	23.5	6.8	33.9	48.4	238.4	15.8	24.9	17.2	48.9	45.2	6.3	0.9	37.1	53.4	23.5	4,523.4
8. Petroleum Wholesale																		
9. Farm Equipment	1,246.0	160.8			0.2		3.3											1,410.3
10. Food Store																		
11. Other Retail	2.0	0.9			0.1	0.1	1.1	0.1	0.1	0.1	0.1	0.2			0.1	0.1	0.1	5.1
12. Auto Prod. & Service	905.0	411.7	18.6	20.2	52.7	63.2	473.8	20.9	32.5	22.5	59.6	58.2	7.6	0.8	48.3	65.5	30.2	2,291.3
13. Apparel & Shoes																		
14. Furniture & Appl.	3.6	1.6	0.1	0.1	0.2	0.3	1.9	0.1	0.1	0.1	0.2	0.2			0.2	0.3	0.1	9.1
15. Insurance																		
16. Personal Service																		
17. Other Service																		
Intermediate Subtotal	4,836.7	1,794.1	42.2	27.1	87.1	112.0	718.5	36.9	57.6	39.9	108.8	103.8	13.9	1.7	85.7	119.3	53.9	8,239.2
(25) Import (R.O.M.)	4,343.4	2,702.6	297.1	306.6	1,887.5	269.0	904.5	106.5	171.6	153.3	418.1	393.3	48.3	6.7	79.2	291.2	74.4	12,453.3
Total Capital Stock	9,180.1	4,496.7	339.3	333.7	1,974.6	381.0	1,623.0	143.4	229.2	193.2	526.9	497.1	62.2	8.4	164.9	410.5	128.3	20,692.5

[a] The sector number at the top is same as the sector number listed at the left of the table.

Source: For calculation and sources, see Appendix I.

expands production capacity. Therefore, the gross fixed capital transaction table is further disaggregated into expansion and replacement fixed capital. The expansion fixed capital formation represents net fixed capital formation which increases the productive capacity. As shown in Tables (4.6) and (4.7), the estimated total expansion fixed capital formation and replacement fixed capital formation are $13,475.7 thousand and $7,263.8 thousand respectively. The results indicate that expansion fixed capital formation constitutes the largest proportion of gross fixed capital formation and is a high portion of net capital formation imported from the rest of Manitoba.

Table (4.8) summarizes the capital structure of Interlake industries. From the results in Table (4.8), net fixed capital formation of various sectors can be compared. The high rate of growth of domestic production requires a high rate of expansion in domestic productive capacities. The second column of the table shows the expansion of fixed capital formation as a percentage of gross fixed capital formation. The insurance sector has the highest portion of total purchases of gross fixed capital goods for expansion of productive capacity due to law depreciation rates. Petroleum wholesale, construction, agriculture livestock, agriculture crop and other, and other service sectors are second. Each of these sectors made more than 70% of purchased gross capital for expansion of the productive capacity. For producing sectors as a whole, however, the expansion of productive capacity is relatively low (only 65% of gross fixed capital formation is for such purposes).

Given the structure of net fixed capital formation shown in Column 2 of Table (4.8), the degree of interdependence on capital input

TABLE 4.6

INTERSECTORAL EXPANSION FIXED CAPITAL
TRANSACTIONS, INTERLAKE AREA, 1968

Unit: $1,000

Producing Sector \ Purchasing Sector[a]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	Total Capital
1. Ag.-Livestock																		
2. Ag.-Crop																		
3. Mining																		
4. Food & Bev. Mfg.																		
5. Other Mfg.																		
6. Transportation																		
7. Construction	2,103.3	888.4	5.6	1.0	4.3	26.4	190.7	7.5	11.6	6.6	18.7	17.5	2.5	0.2	35.8	29.0	18.3	3,367.4
8. Petroleum Wholesale																		
9. Farm Equipment	977.9	117.2			0.1		2.6											1,097.8
10. Food Store																		
11. Other Retail	1.5	0.6				0.1	0.9					0.1			0.1	0.1		3.5
12. Auto Prod. & Service	210.2	300.0	4.5	2.9	2.7	34.6	379.0	10.0	15.3	8.6	22.8	22.4	3.0	0.2	46.5	35.4	23.6	1,623.3
13. Apparel & Shoes																		
14. Furniture & Appl.	2.9	1.2				0.2	1.5	0.1		0.1	0.1	0.1			0.2	0.2	0.1	6.9
15. Insurance																		
16. Personal Service																		
17. Other Service																		
Intermediate Subtotal	3,795.8	1,307.4	10.1	3.9	7.1	61.3	584.7	17.6	26.9	15.3	41.6	40.1	5.5	0.4	82.6	64.7	42.0	6,097.0
(24) Import (R.O.M.)	3,408.7	1,969.4	70.9	44.6	153.1	147.2	723.5	97.9	80.2	58.6	160.0	151.7	19.0	1.7	76.4	157.8	58.0	7,378.7
Total	7,204.5	3,276.8	81.0	48.5	160.2	208.5	1,298.2	115.5	107.1	73.9	201.6	191.8	24.5	2.1	159.0	222.5	100.0	13,475.7

[a] The sector number at the top is same as the sector number listed at the left of the table.

Source: For calculation and sources, see Appendix I.

TABLE 4.7

INTERSECTORAL REPLACEMENT FIXED CAPITAL TRANSACTIONS, INTERLAKE AREA, 1968

Producing Sector \ Purchasing Sector[a]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	Total Capital
1. Ag.-Livestock																		
2. Ag.-Crop																		
3. Mining																		
4. Food & Bev. Mfg.																		
5. Other Mfg.																		
6. Transportation																		
7. Construction	576.8	330.7	17.9	5.8	29.6	22.0	47.7	8.3	13.3	10.6	30.2	27.7	3.8	0.7	1.3	24.4	5.2	1,156.0
8. Petroleum Wholesale																		
9. Farm Equipment	268.1	43.6			0.1		0.7											312.5
10. Food Store																		
11. Other Retail	0.5	0.3			0.1		0.2	0.1	0.1	0.1	0.1	0.1					0.1	1.6
12. Auto Prod. & Service	194.8	111.7	14.1	17.3	50.0	28.6	94.8	10.9	17.2	13.9	36.8	35.8	4.6	0.6	1.8	30.1	6.6	668.0
13. Apparel & Shoes																		
14. Furniture & Appl.	0.7	0.4	0.1	0.1	0.2	0.1	0.4		0.1		0.1	0.1				0.1		2.2
15. Insurance																		
16. Personal Service																		
17. Other Service																		
Intermediate Subtotal	1,040.9	486.7	32.1	23.2	80.0	50.7	143.8	19.3	30.7	24.6	67.2	63.7	8.4	1.3	3.1	54.6	11.9	2,142.2
(25) Import (R.O.M)	934.7	733.2	226.2	262.0	1,734.4	121.8	181.0	55.6	91.4	94.7	258.1	241.6	29.3	5.0	2.8	133.4	16.4	5,121.6
Total Capital for Repl.	1,975.6	1,219.9	258.3	285.2	1,814.4	172.5	324.8	74.9	122.1	119.3	325.3	305.3	37.7	6.3	5.9	188.0	28.3	7,263.8

[a] The sector number at the top is same as the sector number listed at the left of the table.

Source: For calculation and sources, see Appendix I.

TABLE 4.8

SUMMARY STATISTICS OF EXPANSION FIXED CAPITAL FORMATION BY SECTOR, INTERLAKE AREA, 1968[a]

Sector	Expansion Fixed Capital Formation ($',000) (1)	EFCF as % of GFCF (%) (2)	Local Purchase as % of EFCF (%) (3)	Bldgs. Capital as % of Local Purchase of EFCF (%) (4)	Dist. of EFCF (%) (5)	Gross Fixed Capital Formation ($',000) (6)
1. Ag.-Livestock	7,204.5	78.5	52.7	55.4	53.3	9,180.1
2. Ag.-Crop & Other	3,276.8	72.9	39.9	68.0	24.2	4,496.7
3. Mining	81.0	23.9	12.5	55.4	0.6	339.3
4. Food & Bev. Mfg.	48.5	14.5	8.0	25.6	0.4	333.7
5. Other Mfg.	160.2	8.1	4.4	60.6	1.2	1,974.6
6. Transportation	208.5	54.7	29.4	43.1	1.5	381.0
7. Construction	1,298.2	80.0	44.3	33.2	9.6	1,623.0
8. Petroleum Wholesale	115.5	80.5	15.2	42.6	0.9	143.4
9. Farm Equip. Bldg. Materials	107.1	46.7	25.1	43.1	0.8	229.2
10. Food Stores	73.9	38.3	20.7	43.2	0.5	193.2
11. Other Retail	201.6	38.2	20.6	45.0	1.5	526.9
12. Auto Product Sales & Service	191.8	38.6	29.9	43.6	1.4	497.1
13. Apparel & Shoes	24.5	39.4	22.4	45.5	0.2	62.2
14. Furniture & Appl.	2.1	25.0	19.0	50.0	0.0	8.4
15. Insurance	159.0	96.4	51.9	43.3	1.2	164.9
16. Personal Service	222.5	54.2	29.1	44.8	1.6	410.5
17. Other Service	100.0	77.9	42.0	43.6	0.7	128.3
Total	13,475.7	65.1	45.2	55.2	100.0	20,692.5

[a]Column (2) shows the expansion fixed capital formation (EFCF) as a percentage of gross fixed capital formation (GFCF). Column (3) indicates the locally purchased expansion fixed capital formation as a percentage of total expansion fixed capital formation. Column (4) represents the building capital as a percentage of total expansion fixed capital formation (EFCF). Column (5) indicates the distribution of total expansion fixed capital formation by sector.

Source: Calculated from Tables (4.5), (4.6) and (4.7).

can roughly be seen from Column 3 of the table. The sector exhibiting the highest degree of interdependence on the capital input side is the agricultural livestock sector, which obtains 52.7 percent of total purchases of expansion fixed capital goods from other producing sectors. The insurance sector and construction sectors are expanding productive capacity faster but a relatively small proportion of total capital input are purchased from the Interlake including agricultural crop and other, and petroleum wholesale.

Table (4.9) summarizes estimates of the sources of capital formation in the Interlake economy in 1968. It is obvious from Table (4.9) that the observed total private investment could not be fully supported by domestically generated savings, which provide only about two-thirds of the required capital funds. Yet, total domestically generated savings are almost enough (about 80%) to support capital funds for expansion of productive capacity. In addition, household saving provides a very small portion of total capital funds. Most capital funds are from depreciation and retained earnings.

B. Construction of Dynamic Trading and Factor Input Requirement Coefficients

Trading Coefficient Differential by Size Class in Agricultural Sectors

As stated earlier, the trading coefficients tend to change over time mainly due to the fact that the composition of farm numbers by size within a sector is not always changing by the same proportion when the level of output increases or decreases. In addition, the trading coefficients are different for each farm size due to the technical indivisibility associated with a definite productive capacity for a certain

TABLE 4.9

SUMMARY OF SOURCES AND USES OF CAPITAL FORMATION, INTERLAKE AREA, 1968[a]

(Unit: $',000)

Sources		Uses[b]	
Type of Sources	Values	Type of Uses	Values
Household Saving	317.0	Net Investment	13,475.7
Depreciation & Retained Earning	11,074.5	Replacement Investment	7,263.8
Net Foreign Investment	9,301.0		
All Sources	20,692.5	Total Private Investment	20,692.5

[a]For estimation procedures and sources, see Appendix I, Primary Resource Accounts and Estimation Procedures.

[b]The values by type of use are obtained from Tables 4.6 and 4.7.

size of farm in operation (See: Tables 4.11 to 4.14).[12] Tables (4.11) throughout (4.14) show the difference in purchases, while the latter two tables indicate the difference in sales by size class for agricultural sectors. In the agricultural livestock sector, for example, each small farm, on average, imports 25% of total inputs in 1968, but medium size farms import only 10% (Table 4.15, Import Row). Furthermore, the medium farm size farm, on average, has higher returns from farm operation than the other two size of farms as shown in the household and retained earnings row of Table (4.15). The small size farms in agricultural crop sector imports 25% of total inputs but medium and large scale of farms only import 10% and 16% respectively. The medium size farm purchases a higher portion of inputs from local producing sectors (intermediate sectors) than the other two types of farms for both sectors (Intermediate sector rows of Tables 4.15 and 4.16).

On the other hand, the difference in sales pattern by size class also can be observed from Tables (4.15) and (4.16). Table (4.15) and (4.16) show that for the agricultural livestock sector, the larger the scale of the farm, the larger portion of output is exported and the smaller portion of output is sold to intermediate sectors. However, a consistent sales patterns as in the livestock sector is not observed in the crop and other secotr. Nevertheless, the difference in sales pattern by size class is still apparent in the crop and other sector.

The methodology proposed in the previous chapter is used to

---

[12]Strictly speaking, the difference in input-output relations by size class needs to be tested using F or t test, when time series data are available.

TABLE 4.11

AVERAGE PER FARM PURCHASING PATTERN BY FARM SIZE FOR THE AGRICULTURAAL-LIVESTOCK SECTOR, INTERLAKE AREA, 1968

(Unit: 1968 Dollars)

Purchases From	Purchasing Pattern By Farm Size Class			
	Small Farm	Medium Farm	Large Farm	Over All Average
1. Ag.-Livestock	185.3	176.0	742.0	286.3
2. Ag.-Crop & Other	53.6	278.9	297.2	178.8
3. Mining	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	11.8	24.3	34.4	20.4
5. Other Mfg.	0.0	0.0	0.0	0.0
6. Transportation	14.3	36.3	132.6	44.2
7. Construction	0.0	0.0	0.0	0.0
8. Petroleum Wholesale	513.8	735.7	1,596.6	795.0
9. Farm Equip. Bldg. & Mat.	369.6	530.0	861.9	518.5
10. Food Store	3.3	5.0	8.5	4.9
11. Other Retail	23.4	36.0	60.9	34.8
12. Auto Product & Services	360.4	430.3	539.8	418.7
13. Apparel & Shoes	0.0	0.0	0.0	0.0
14. Furniture & Appliance	0.0	0.0	0.0	0.0
15. Insurance	7.9	8.7	11.7	8.9
16. Personal Services	0.0	0.0	0.0	0.0
17. Other Services	8.9	7.3	19.7	10.4
Intermediate Subtotal	1,552.2	2,268.7	4,305.1	2,320.9
18. Household	1,834.0	2,337.1	3,795.2	2,379.1
19. Government	154.2	199.2	309.8	199.2
20. Inventory Dept.	365.5	673.2	1,413.0	670.4
21. Depreciation, Retained Earn.	661.5	902.1	1,280.6	862.5
22. Rent	37.3	139.4	247.2	112.7
23. Interest	9.6	82.9	118.6	55.9
24. Unallocated	25.1	31.4	122.8	45.6
25. Import (R.O.M.)	2,324.2	1,035.1	3,236.7	2,039.9
26. Import (R.O.C.)	0.0	0.0	0.0	0.0
Payment Sector Subtotal	5,411.6	5,400.3	10,523.8	6,365.3
Total Purchase	6,963.8	7,669.0	14,829.0	8,686.2

Source: Calculated from household expenditure and receipts for the 1968 calender year conducted by the Department of Agricultural Economics, University of Manitoba under the supervision of Dr. James A. MacMillan.

TABLE 4.12

AVERAGE PER FARM PURCHASING PATTERNS BY FARM SIZE FOR AGRICULTURAL CROP AND OTHER SECTOR, INTERLAKE AREA, 1968

(Unit: 1968 Dollars)

Purchases From	Purchasing Pattern By Farm Size Class			
	Small Farm	Medium Farm	Large Farm	Over All Average
1. Ag.-Livestock	66.4	44.2	68.0	57.0
2. Ag.-Crop & Other	7.0	162.5	271.0	101.3
3. Mining	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	1.4	2.6	11.2	2.9
5. Other Mfg.	0.0	0.6	1.2	0.4
6. Transportation	10.9	129.2	182.0	79.6
7. Construction	0.5	2.8	2.4	1.7
8. Petroleum Wholesale	149.9	584.0	950.4	419.7
9. Farm Equip. & Bldg. Mat.	156.1	604.8	854.2	421.7
10. Food Store	0.3	0.9	1.3	0.6
11. Other Retail	2.0	5.8	8.5	4.3
12. Auto Product & Services	236.2	858.0	1,602.8	645.3
13. Apparel & Shoes	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0	0.0	0.0	0.0
15. Insurance	6.3	12.5	38.2	12.2
16. Personal Service	0.0	0.0	0.0	0.0
17. Other Services	5.2	11.9	74.9	15.3
Intermediate Subtotal	642.3	2,419.8	4,066.1	1,762.1
18. Household	633.7	2,990.1	3,949.3	1,992.5
19. Government	133.9	332.5	520.9	259.5
20. Inventory Dept.	33.5	508.7	2,376.2	479.7
21. Depreciation & Retained Earn.	443.6	1,186.6	2,757.3	1,002.4
22. Rent	7.1	34.9	256.1	44.7
23. Interest	3.5	92.3	247.5	66.9
24. Unallocated	45.5	37.8	252.0	63.4
25. Import (R.O.M.)	648.5	814.0	2,570.9	917.7
26. Import (R.O.C.)	2.3	45.1	87.8	29.6
Payment Sector Subtotal	1,951.6	6,041.9	13,018.0	4,856.4
Total Purchase	2,593.9	8,461.7	17,084.1	6,618.6

Source: See Table 4.11.

TABLE 4.13

AVERAGE PER FARM SALES PATTERN BY FARM SIZE FOR THE AGRICULTURAL LIFESTOCK SECTOR, INTERLAKE AREA, 1968

(Unit: 1968 Dollars)

Sales To	Sales Pattern By Farm Size			
	Small Farm	Medium Farm	Large Farm	Over All Average
1. Ag.-Livestock	319.9	181.8	401.0	286.3
2. Ag.-Crop & Other	48.5	17.1	9.9	30.2
3. Mining	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	677.1	854.2	557.2	717.2
5. Other Mfg.	0.0	0.0	0.0	0.0
6. Transportation	0.0	0.0	0.0	0.0
7. Construction	0.0	0.0	0.0	0.0
8. Petroleum Wholesale	0.0	0.0	0.0	0.0
9. Farm Equip. & Bldg. Mat.	0.0	88.7	206.6	70.0
10. Food Store	4.7	5.5	10.9	6.1
11. Other Retail	0.0	0.0	0.0	0.0
12. Auto Product & Services	0.0	0.0	0.0	0.0
13. Apparel & Shoes	0.0	0.0	0.0	0.0
14. Furniture & Appliance	0.0	0.0	0.0	0.0
15. Insurance	0.0	0.0	0.0	0.0
16. Personal Service	3.9	4.6	9.1	5.1
17. Other Services	0.0	0.0	0.0	0.0
Intermediate Subtotal	1,054.1	1,151.9	1,194.8	1,115.0
18. Household	628.0	227.2	247.8	415.2
19. Government	94.7	839.8	3,247.7	948.5
20. Inventory Addition	14.3	20.9	27.6	19.1
21. Sales to Investment	0.0	0.0	0.0	0.0
22. Unallocated	1.7	1.9	3.9	2.2
23. Exports to Manitoba	3,850.0	5,378.8	13,439.0	6,186.2
24. Exports to Canada	0.0	0.0	0.0	0.0
Final Demand Subtotal	4,588.7	6,468.7	16,965.5	7,571.3
Total Sales	5,642.8	7,620.6	18,160.3	8,686.2

Source: See Table 4.11.

TABLE 4.14

AVERAGE PER FARM SALES PATTERN BY FARM SIZE FOR AGRICULTURAL CROP AND OTHER SECTOR, INTERLAKE AREA, 1968

(Unit: 1968 Dollars)

Sales To	Sales Pattern By Farm Size			
	Small Farm	Medium Farm	Large Farm	Over All Average
1. Ag.-Livestock	92.2	409.6	1,143.8	337.4
2. Ag.-Crop and Other	19.5	109.9	435.3	101.3
3. Mining	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.4	174.5	105.2	86.4
5. Other Mfg.	0.0	0.0	0.0	0.0
6. Transportation	0.0	0.0	0.0	0.0
7. Construction	0.0	0.0	0.0	0.0
8. Petroleum Wholesale	0.0	0.0	0.0	0.0
9. Farm Equip. & Bldg. Mat.	0.0	132.5	0.0	57.2
10. Food Store	5.6	17.9	35.7	14.0
11. Other Retail	0.0	0.0	0.0	0.0
12. Auto Product & Services	0.7	2.3	4.6	1.8
13. Apparel & Shoes	0.0	0.0	0.0	0.0
14. Furniture & Appliance	0.0	0.0	0.0	0.0
15. Insurance	0.0	0.0	0.0	0.0
16. Personal Service	7.2	22.9	45.8	18.0
17. Other Serivces	0.0	0.0	0.0	0.0
Intermediate Subtotal	125.7	869.7	1,770.2	616.2
18. Household	99.9	219.3	212.1	163.0
19. Government	0.0	933.6	8,728.0	1,300.8
20. Inventory Addition	5.5	17.6	34.6	13.7
21. Sales to Investment	0.0	0.0	0.0	0.0
22. Unallocated	0.5	1.8	3.5	1.4
23. Exports to Manitoba	1,862.4	5,625.0	11,935.2	4,523.5
24. Exports to Canada	0.0	0.0	0.0	0.0
Final Demand Subtotal	1,968.3	6,797.3	20,913.3	6,002.4
Total Sales	2,094.0	7,667.0	22,683.6	6,618.6

Source: See Table 4.11.

TABLE 4.15

PERCENTAGES OF PER FARM PURCHASES FROM AND SALES TO AGGREGATED SECTORS FOR AGRICULTURAL LIVESTOCK SECTOR, INTERLAKE AREA, 1968

	Percentages of Purchases or of Sales			
	Small Farm	Medium Farm	Large Farm	Over All Average
I. Purchases From				
1. Intermediate Sectors	24.76	28.60	23.80	26.62
2. Household & Retained Earning	35.04	42.24	34.23	37.32
3. Government	5.16	3.93	3.05	3.92
4. Imports	25.09	10.15	15.56	14.31
5. Other	9.15	15.08	23.36	17.83
Total Purchases	100.00	100.00	100.00	100.00
II. Sales To				
1. Intermediate Sectors	18.68	15.12	6.58	12.84
2. Household and Investment	11.13	2.98	1.36	4.78
3. Government	1.68	11.02	17.88	10.92
4. Exports	68.23	70.58	74.00	71.22
5. Other	0.28	0.30	0.18	0.24
Total Sales	100.0	100.0	100.0	100.0

Source: See Table 4.11.

TABLE 4.16

PERCENTAGES OF PER FARM PURCHASES FROM AND SALES TO AGGREGATED SECTORS FOR AGRICULTURAL CROP AND OTHER SECTOR, INTERLAKE AREA, 1968

	Percentages of Purchases or of Sales			
	Small Farm	Medium Farm	Large Farm	Over All Average
I. Purchases From				
1. Intermediate Sectors	24.76	28.60	23.80	26.62
2. Household & Retained Earning	41.53	49.36	39.26	45.25
3. Government	5.16	3.93	3.05	3.92
4. Imports	25.09	10.15	15.56	14.31
5. Other Sectors	3.46	7.96	18.33	9.90
Total Purchases	100.00	100.00	100.00	100.00
II. Sales To				
1. Intermediate Sectors	6.00	11.34	7.80	9.31
2. Household and Investment	4.77	2.86	0.94	2.46
3. Government	0.00	12.18	28.48	19.65
4. Exports	88.94	73.37	52.62	68.34
5. Other Sectors	0.29	0.25	0.16	0.24
Total Sales	100.00	100.00	100.00	100.00

Source: See Table 4.11.

adjust the trading coefficient change over time. First, the changes in farm numbers by size class are discussed in the next section followed by the procedures for adjustment.

Projection of Farm Size Distribution

In projecting the farm size (plant-scale) distribution, a transition probabilities matrix is estimated based on the following steps. First, the transition probabilities matrix between 1961 and 1966 for Manitoba is constructed using the data obtained from Agricultural Census, according to the assumptions specified: (1) increase in the number of farm in any gross receipt class come only from the next smallest class; and (2) any decrease in any gross receipt class means that those farms go out of farming.[13] Next, the estimated migration regression obtained from the MacMillan, Tung and Tulloch study is used to adjust the changes of transition probabilities caused by the farm-non-farm migration relation, given the predetermined levels of exogenous variables (levels of off-farm work, percent of operators less than 35 years of age, percent of operators greater than 60 years and capital stock).[14] This is done by replacing the estimates derived from the migration function with 1966 actual farm numbers. Finally, additional adjustment is made for the effect of the 10.9 percent increase in the index of price received for farm products for 1961-66 in Manitoba.[15] It

[13] Dominion Bureau of Statistics, Agricultural Census, 1961 and 1966, Op. Cit.,

[14] MacMillan, Tung and Tulloch, Migration Analysis and Farm Number Projection Models: A Synthesis, Op. Cit., Table 3.

[15] Farm product price index for Manitoba were 100.0, 110.9 and 100.5 for 1961, 1966 and 1971 respectively according to the statistics obtained from: Manitoba Department of Agriculture, Manitoba Agricultural Year Book (Winnipeg: Manitoba Department of Agriculture, 1971) p. 81.

is assumed that farm operator numbers are uniformly distributed in each class. Thus, 10.9 percent of farm operators who moved from lower to higher classes were estimated to have moved due to price increases. After the adjustment procedures have been completed, the transition probabilities matrix is calculated by dividing each element by the row total for each row. The result is presented in Table (4.17).

TABLE 4.17

ESTIMATED MANITOBA TRANSITION PROBABILITIES MATRIX

		S_1	S_2	S_3	S_4	S_5	S_6	S_7
	S_1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	S_2	0.2729	0.6648	0.0623	0.0000	0.0000	0.0000	0.0000
	S_3	0.0000	0.0000	0.6289	0.3711	0.0000	0.0000	0.0000
U =	S_4	0.0000	0.0000	0.0000	0.4518	0.4539	0.0943	0.0000
	S_5	0.0000	0.0000	0.0000	0.0000	0.1081	0.8858	0.0061
	S_6	0.0000	0.0000	0.0000	0.0000	0.0000	0.1094	0.8906
	S_7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000

The projection of the distribution of farm numbers by gross receipt for each target year, FR_{ft}, is derived by multiplying the transposed Manitoba transition probabilities matrix, U', shown in Table (4.17), by the vector of actual farm numbers by receipt class in the Interlake in each previous target year, FR_{ft-1}. The projection is based on the assumption that the estimated Manitoba transition probabilities matrix is constant over the period to 1986 and applied to Interlake. The projected results are summarized in Table (4.18).

TABLE 4.18

PROJECTED FARM NUMBERS BY GROSS RECEIPTS
FOR THE TARGET YEARS, INTERLAKE AREA,

Gross Receipts	Base Year 1968	Projections 1971	1976	1977	1981	1986
1. Greater than $25,000	246	399	783	882	1,279	1,796
2. $15,000 - $24,999	340	428	554	559	577	520
3. $10,000 - $14,999	433	469	491	481	442	366
4. $ 5,000 - $ 9,999	1,007	970	857	826	701	547
5. $ 2,500 - $4,999	1,286	1,129	845	800	621	451
6. Less than $2,499	2,605	2,169	1,442	1,345	959	638
Total Farm Numbers	5,917	5,564	4,972	4,893	4,579	4,318
No. of Farm Leaving Agri.	-	353	592	79	393	261

It should be noted that the agriculture census underestimates total farm numbers for the Interlake area due to the variation in the quality of enumerators, incomplete enumeration, and a lack of comprehension of the data desired on the part of the census-farm operators.[16] Thus, the census farm operators distributions are adjusted upward in terms of 1968 farm numbers obtained from Interlake fact.[17] The following procedures are used for the adjustment. First, the census farm operator distribution was obtained from average of 1966 and 1971 census results based on total farm numbers obtained from the Interlake Fact. The results are used to estimate 1973's census distribution of farm operators using the Markov Chain approach explained above. Second, the average of

---

[16]Dominion Bureau of Statistics, Census of Canada, Agriculture, Manitoba, Catalogue No. 96-608 (1966), p. XIV.

[17]The farm numbers presented in the Interlake Fact are actual farm numbers since it was obtained from comprehensive survey to count all farms in the area during the beginning of the year to the end of the year in 1968, based on the statistics Canada definition of a farm.

adjusted 1968 and estimated 1973's census farm operators distribution represent 1971's distribution of farm operators to 1986 using the Markov Chain procedures.

The distribution of farm plant-scale in this study is based on "acreage", but the farm operators distribution summarized in Table (4.18) is based on "gross receipts". A conversion from "gross receipts" to "acreage" base is required. It is found that the correlation between gross receipts and farm size (acreages) is very high.[18] Therefore, the conversion is based on the distribution of farm numbers by gross receipts and by size class for 1968 in the Interlake area calculated from Table (4.19). This table also supports the conclusion that there is a high correlation between farm size and gross receipts in the study area. The projected farm number distributions for the target years in Table (4.20) are based on the assumption that the estimated distribution of farm number by gross receipts and by size class for 1968 is constant over time. (The ratio of receipts in constant dollars to acreage is constant.)

Given the above specified assumption, the distribution of farm numbers by size class is obtained by multiplying the transposed distribution of farm numbers by size and by gross receipts for 1968 calculated from Table (4.19) by the vector of projected farm numbers by gross receipts summarized in Table (4.18) for each target year. The results are presented in Table (4.20).

For the purpose of adjusting the trading coefficient matrix, the

---

[18]The estimated correlations for Alberta and Manitoba are 0.80 and 0.76 respectively for 1966 based on the data obtained from Agricultural Census, Dominion Bureau of Statistics.

TABLE 4.19

FARM NUMBERS BY SIZE CLASS AND BY GROSS RECEIPTS, INTERLAKE AREA, 1968[a]

Gross Receipts	Size Class			
	Less Than 239 Acres	240-759 Acres	Greater Than 760 Acres	Total
1. Greater than $15,000	43 (0.0877)	161 (0.3285)	286 (0.5836)	490 (1.0000)
2. $5,000 - $14,999	552 (0.2619)	988 (0.4689)	567 (0.2691)	2,107 (1.0000)
3. $2,500 - $4,999	387 (0.3081)	732 (0.5828)	137 (0.1099)	1,256 (1.0000)
4. Less than $2,499	1,492 (0.7228)	523 (0.2533)	49 (0.0237)	2,064 (1.0000)

[a]The values in the parentheses are the distribution of farm numbers by size class for each gross receipt class listed in the left-hand side of the table.

Source: Interlake Fact, Op. Cit.,Table 11.

TABLE 4.20

BASE YEAR AND PROJECTED FARM NUMBERS BY SIZE CLASS FOR THE TARGET YEARS, INTERLAKE AREA[a]

Size Class (Acres)	Base Year (1968)		Projections				
	Actual	Projected	1971	1976	1977	1981	1986
1. Great than 760	932	934	1,045	1,270	1,313	1,482	1,663
2. 239 - 759	2,243	2,276	2,154	1,930	1,894	1,751	1,613
3. Less than 239	2,742	2,707	2,365	1,772	1,686	1,346	1,042
Total Farm No.	5,917	5,917	5,564	4,972	4,893	4,579	4,318

[a]Estimated by multiplying the transposed distribution of farm numbers by size class and by gross receipts as shown in Table 4.19 by the projected farm numbers by gross receipts presented in Table 4.18.

projected farm numbers by size class for each target year need to be broken down in terms of sectors. In the long-run, numbers of farms engaged in livestock or crop production depend on the mechanization of farms and the demand forces for types of agricultural products, as well as government's agricultural policies. A livestock farm, for example, will not immediately change livestock production to pure crop production when the demand for crops are rapidly increased because of fixed factors, such as land and buildings. Fixed factors complicate the projections of future farm numbers by sector. A constant proportion of farm numbers by sector in 1968 for each farm size class (Table 4.21) is used to allocate the projected farm numbers by size class (via Table 4.20) into the two agricultural sectors for the study. The results are shown in Table (4.22).

Estimation of Each Target Year's Trading Coefficient Matrix

Different trading coefficients associated by farm size class in agricultural sectors are observed. In general, medium sized farms purchase a relatively higher portion of inputs from intermediate sectors and import less than small and large size farms. It should be emphasized that a statistical test was not employed to measure differences in trading coefficients by farm size class. Nevertheless, with this limitation in mind, the comparison still provides an indication that trading coefficients are different by farm size class resulting from different production techniques associated with each farm size. Farm numbers by size (plant-scale) tend to change over time and the change is not proportional. The numbers of large size farms tend to increase to 1986.

TABLE 4.21

FARM NUMBERS BY SIZE CLASS AND BY SECTOR, INTERLAKE AREA, 1968[a]

Sector	Size Class (No.)[b]			Total by Sector
	Small	Medium	Large	
1. Ag.-Livestock	1,782 (0.6498)	1,355 (0.6041)	717 (0.7693)	3,854 (0.6513)
2. Ag.-Crop & Other	960 (0.3502)	888 (0.3959)	215 (0.2307)	2,063 (0.3487)
Total by Size Class	2,742 (1.0000)	2,243 (1.0000)	932 (1.0000)	5,917 (1.0000)

[a]The size class is divided into three categories: small (less than 239 acres), medium (ranging from 240 to 549 acres), and large (over 760 acres).

[b]The values in the parentheses indicate the distribution of farm numbers by sector for each size class.

Source: Estimated from Farm Household Survey data.

TABLE 4.22

BASE YEAR AND PROJECTED FARM NUMBERS BY SECTOR AND BY SIZE CLASS FOR THE TARGET YEARS, INTERLAKE AREA[a]

Year	Sector	Size Class			Sector Total
		Small	Medium	Large	
1968	1. Ag.-Livestock	1,782	1,355	717	3,854
	2. Ag.-Crop & Other	960	888	215	2,063
	Size Total	2,742	2,243	932	5,917
1971	1. Ag.-Livestock	1,537	1,301	804	3,642
	2. Ag.-Crop & Other	828	853	241	1,922
	Size Total	2,365	2,154	1,045	5,564
1976	1. Ag.-Livestock	1,152	1,166	977	3,295
	2. Ag.-Crop & Other	620	764	293	1,677
	Size Total	1,772	1,930	1,270	4,972
1977	1. Ag.-Livestock	1,096	1,144	1,010	3,250
	2. Ag.-Crop & Other	590	750	303	1,643
	Size Total	1,686	1,894	1,313	4,893
1981	1. Ag.-Livestock	875	1,058	1,140	3,073
	2. Ag.-Crop & Other	471	693	342	1,506
	Size Total	1,346	1,751	1,482	4,579
1986	1. Ag.-Livestock	677	974	1,279	2,930
	2. Ag.-Crop & Other	365	639	384	1,388
	Size Total	1,042	1,613	1,663	4,318

[a]Estimated by multiplying the distribution of farm numbers of sector (as shown in Table 4.21) by the projected corresponding size class farm numbers for each target year (as shown in Table 4.20).

The trading coefficient of a sector is a weighted average of the coefficients of different levels of plant-scale included in the sector. The weights are the numbers of farms corresponding to each farm size. Since weights change relatively, as the sectors change, the trading coefficient of the sector can be expected to change. The specified equations (3.9), and (3.10) and (3.11) in Chapter 3 are used to estimate the trading coefficient matrix for each target year, given the estimated farm numbers for each farm size.

The computational procedures for estimating the trading coefficient matrix for each target year involves the following steps. First, the first two rows of the 1968 input-output table are replaced by the two new rows of aggregated sales which are estimated from multiplying the numbers of farms for each size class (plant-scale) by the average sales coefficient of the corresponding size. Second, the first two columns of the 1968 input-output table are replaced by the two new columns of aggregated purchases which are estimated from multiplying the numbers of farm for each size class by the average purchase coefficients of the corresponding size. Third, gross outputs by sector are then recalculated to derive composite sectoral trading coefficients based on equations (21) to (22b) summarized in Table (3.3), Chapter 3.

Appendix II presents the estimated trading coefficient matrix for each target year. It is observed from the comparison of each target year's trading coefficients that 6 out of 17 sector's trading coefficients will change between 1968 and 1981 due to the structural changes in agricultural sectors (sectors 1, 2, 4, 9, 10 and 16). Changes appear to taking place throughout the regional economy in such a way that the structural changes in agricultural sectors will cause first the structural changes in food and beverage manufacturing (sector 4) and farm equipment and building material (sector 9) sectors and then food store (sector 10) and personal service (sector 16) sectors. It requires approximately a 7 year time period to cause the structural changes in the latter two sectors (sectors 10 and 16) after the structural changes in agricultural sectors have occurred. The results show that systematic variation in trading coefficients for some sectors is caused by structural changes in agricultural sectors throughout their interdependence in the regional economy.

Regarding the trading coefficient changes in 6 sectors, the changes are not always systematic. Table (4.23) summarizes such changes. The agricultural sectors and farm equipment and building material sector tend to increase the purchase of inputs from intermediate sectors (see the intermediate subtotal in the table) and to decrease imports. A reverse direction of changes in trading coefficients is observed for food and beverage manufacturing, food store and personal service sectors. For the food and beverage manufacturing sector, the decrease in purchase of input from intermediate sectors is mainly due to a sharp reduction in input requirements from agricultural livestock sector. A reduction of 0.0144 dollar per dollar of output occurs from 1968 to 1971, although the purchase of input from agricultural crop sector increased.

From 1968 to 1971 agricultural livestock inputs into the food and beverage manufacturing and the food store sectors decrease from 0.5974 to 0.5712 dollars and from 0.0035 to 0.0034 dollars respectively for per dollar of output of these sectors, but inputs into the farm equipment and

TABLE 4.23

SUMMARY OF TRADING COEFFICIENT CHANGES OVER TIME, INTERLAKE AREA, FROM 1968 TO 1986[a]

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Ag.-Livestock	+	–	0	–	0	0	0	0	+	–	0	0	0	0	0	–	0
(2) Ag.-Crop & Other	+	+	0	+	0	0	0	0	–	+	0	0	0	0	0	–	0
(3) Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(4) Food and Bev. Mfg.	0	0	0	–	0	0	0	0	0	0	0	0	0	0	0	0	0
(5) Other Mfg.	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0
(6) Transportation	+	–	0	0	0	0	0	0	–	0	0	0	0	0	0	0	0
(7) Construction	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0
(8) Pet. Wholesale	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(9) Farm Equip. & Bldg. Mat.	–	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(10) Food Store	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(11) Other Retail	+	0	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0
(12) Auto Product & Service	–	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(13) Apparel & Shoes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(14) Furniture & Appl.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(15) Insurance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(16) Personal Service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(17) Other Service	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intermediate Subtotal	+	+	0	–	0	0	0	0	+	–	0	0	0	0	0	–	0
(18) Household	–	0	0	+	0	0	0	0	–	0	0	0	0	0	0	0	0
(19) Government	–	–	0	+	0	0	0	0	–	0	0	0	0	0	0	0	0
(20) Inventory Depletion	+	+	0	–	0	0	0	0	0	0	0	0	0	0	0	0	0
(21) Depre. & Retained Earn.	–	+	0	+	0	0	0	0	0	+	0	0	0	0	0	0	0
(22) Rent	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(23) Interest	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(24) Unallocated	+	+	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0
(25 Import (Rest of Man.)	–	–	0	+	0	0	0	0	0	+	0	0	0	0	0	+	0
(26) Import (Rest of Canada)	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[a] The signs, "+", "-" and "0" denote the positive change, negative change and no change respectively for each trading coefficient. For example, the "+" sign in the intersection of the first row and the first column indicated that there is an increase of agricultural livestock input into the agricultural livestock sector.

building material sector increase from 0.0488 to 0.0528 dollars. Other notable changes in coefficients include: (1) increase by 0.1 cents from the transportation sector into the agricultural livestock sector and decrease by 0.2 cents from the transportation sector into the agricultural crop sector from 1968 to 1971; (2) decrease by 0.3 cents and 0.8 cents, from the farm equipment and building material into the agricultural livestock and crop sectors respectively; (3) decrease by 0.7 cents, from the auto product and service sector into the agricultural livestock sector but increase by 0.4 cents from that into the agricultural crop sector; and (4) increase by 0.1 cents, from the other service sector into the agricultural crop sector. These changes result from the structural changes in agricultural sectors represented by increases in the numbers of large farms and decreases in the numbers of small farms over time.

Estimation of Each Target Year's Factor Input Requirement Coefficient Matrix

The derivation of the factor input (labor, gross fixed capital and land) requirement coefficient matrix for the base year (1968) is based on the 1968 Interlake social accounting system. Given the labor force and employment, land and capital accounts, the factor input requirement coefficient matrix for 1968 is derived according to the definitions given in the preceding chapter (see equation 3.14). The result is presented in Table (4.24). The coefficients show that agricultural livestock sector, for example, required 0.13783 man-year of labor, 0.29716 thousand dollars of gross fixed capital and 0.02192 thousand acres of land to produce a thousand dollars of livestock products in 1968. Similarly, the agricultural crop sector required 0.18069 man-year of labor, 0.35871 thousand dollars of gross fixed capital and 0.06748 thousand acres of land

TABLE 4.24

FACTOR INPUT REQUIREMENT COEFFICIENTS, INTERLAKE AREA, 1968

Sector	Labour Coefficient (Man Year Per $' 000 of Gross Output)	Capital Coefficient (thousand dollars per $' 000 of Gross Output)[a]	Land Coefficient (1,000 acres per $' 000 of Gross Output)
1. Ag.-Livestock	0.13783	0.29716	0.02192
2. Ag.-Crop & Other	0.18069	0.35871	0.06748
3. Mining	0.03902	0.31226	-
4. Food & Bev. Mfg.	0.02882	0.07375	-
5. Other Mfg.	0.05324	0.08991	-
6. Transportation	0.12512	0.20900	-
7. Construction	0.05085	0.20402	-
8. Petroleum Wholesale	0.01634	0.01534	-
9. Farm Equip. & Bldg. Mat.	0.02305	0.03978	-
10. Food Store	0.02590	0.02899	-
11. Other Retail	0.03393	0.04547	-
12. Auto Products & Service	0.02412	0.02252	-
13. Apparel & Shoes	0.04085	0.04934	-
14. Furniture & Appl.	0.03982	0.01656	-
15. Insurance	0.11718	0.54585	-
16. Personal Service	0.08116	0.05060	-
17. Other Services	0.11639	0.07951	-

[a]Capital coefficient in this column is gross fixed capital coefficient.

Source: Tables (4.1), (4.2), and (4.4).

to produce a thousand dollars of crop output in that year. The factor input requirement coefficients are used to estimate the amount of primary input required to produce the projected gross output in each target year.

The factor input requirement coefficients change over time due to: (1) the continuous shift of farm size in agricultural production and (2) the continuous change in the combination of factor inputs in production because of technological change or relative changes in factor prices. Consequently, for consistent projection of factor input requirements for each target year, the factor input requirement coefficients need to be adjusted over time. The remainder of this section describes the procedures used to adjust factor input requirement coefficients.

Adjustment for Changes in Factor Input Requirement Coefficients Caused by Farm Size Shift Similar to trading coefficients, the factor input requirement coefficients change over time. The factor input requirement coefficients are different for each farm size due to technical indivisibility associated with a definite productive capacity for a certain size of farm. The data obtained from farm household survey in the Interlake summarized in Table (4.25) indicate such differences. Consequently, the same procedures for adjusting trading coefficients are employed to adjust the factor input requirement coefficient changes over time based on the projected farm numbers by size class in each agricultural sector for every target year. In general, the computational procedures follow two steps: (1) the estimation of farm numbers by size class for each agricultural sector for each target year, and (2) the estimation of the target year's factor input requirement coefficients based on equation (3.15) presented in the preceding chapter (chapter 3).

TABLE 4.25

FACTOR INPUT REQUIREMENT COEFFICIENTS BY SIZE CLASS AND BY SECTOR IN AGRICULTURAL PRODUCTION, INTERLAKE, 1968

Sector	Type of Coefficients	Farm Size		
		Small	Medium	Large
Ag.-Livestock	1. Labour Coefficient[a]	0.15155	0.14294	0.07454
	2. Land Coefficient[b]	0.00846	0.02225	0.03784
	3. Gross Fixed Capital Coefficient[c]	0.10870	0.28869	0.55499
Ag.-Crop & Other	1. Labour Coefficient	0.39056	0.12574	0.06799
	2. Land Coefficient	0.04502	0.05028	0.12423
	3. Gross Fixed Capital Coefficient	0.20059	0.35290	0.49646

[a]Labour coefficient is in terms of man year per 1,000 dollars of gross output.

[b]Land coefficient is in terms of thousand acres of land per 1,000 dollars of gross output.

[c]Gross fixed capital coefficient is in terms of thousand dollars of gross fixed capital per 1,000 dollars of gross output.

Source: Estimated from Farm household survey data.

Adjustment for Changes in Factor Input Requirement Coefficients Caused by Shifts in Factor Input Combinations After adjusting factor input requirement coefficient changes caused by shifts in farm size, the next step is to measure changes caused by continuous change in the combination of inputs in production. As shown in Table (4.26), annual growth rates of factor inputs are not in the same proportion, providing that the combination of labor, capital and land inputs in production is different at any point of time. Thus, factor input requirement coefficients tend to change over time due to changes in factor input combinations because of technological change or relative price of factor inputs.

Since there is no time-series data available for the Interlake, the estimated annual growth rates of factor input average productivity for Manitoba (Table 4.26) are employed for present study assuming that there is no significant geographical difference in the growth rate of factor input average productivity in Manitoba. Given the growth rate in factor input average productivity over time, the factor input requirement coefficients for target year t are adjusted further by equation (3.16) of Chapter 3.

The adjusted primary input and gross fixed capital coefficients for each target year are presented in Table (VI.3), Appendix VI. The point which should be noted here is the nature of factor input requirement coefficients observed. In general, the labor and land requirement coefficients have tended to decrease but capital requirements increase over time since the 60's. It implies that production techniques tend to require more capital but less labor and land inputs to produce one unit of output in the last decade and it is likely to continue at a similar

TABLE 4.26

ESTIMATED ANNUAL GROWTH RATES OF FACTOR INPUT AVERAGE PRODUCTIVITIES, MANITOBA, 1961-1971

Sector	Annual Growth Rate of Gross Output at Const. Price[a] (%)	Annual Growth Rate of Factor Input Employed, 1961 - 1971 (%)			Annual Growth Rate of Factor Input Average Productivity[e] (%)		
		Labor	Capital	Land	Labor	Capital	Land
1. Ag.-Livestock	5.15	-	7.00[c]	0.58[c]	5.44[g]	-0.58	2.60[h]
2. Ag.-Crop & Other	3.45	-	7.00	0.58	5.44	-0.58	2.73
3. Mining	2.21	5.25[b]	0	-	-0.03	0	-
4. Food & Bev. Mfg.	2.40	1.50	6.25[d]	-	0.89	-3.62	-
5. Other Mfg.	1.76	1.50	6.25	-	0.26	-4.23	-
6. Transportation	5.40	1.25	6.50	-	4.10	-1.03	-
7. Construction	5.85	1.50	5.25	-	4.29	0.57	-
8. Pet. Wholesale	4.65	1.50	4.75	-	3.10	-0.10	-
9. Farm Equip. & Bldg. Mat.	4.65	1.50	4.75	-	3.10	-0.10	-
10. Food Store	4.39	3.50	4.75	-	0.86	-0.34	-
11. Other Retail	4.39	3.50	4.75	-	0.86	-0.34	-
12. Auto Product & Service	4.39	3.50	4.75	-	0.86	-0.34	-
13. Apparel & Shoes	4.39	3.50	4.75	-	0.86	-0.34	-
14. Furniture & Appl.	4.39	3.50	4.75	-	0.86	-0.34	-
15. Insurance	4.39	1.20	4.75	-	3.15	-0.34	-
16. Personal Service	4.39	3.75	4.75	-	0.62	-0.34	-
17. Other Services	4.39	3.75	4.75	-	0.62	-0.34	-

[a]Annual growth rate of gross output at constant price is obtained from Table 4.45.

[b]Annual growth rate of non-agricultural labour input is estimated in terms of data obtained from: Economic Development Advisory Board of Manitoba, Economic Development in Manitoba

TABLE 4.26

Continued

- the Challenge (Winnipeg, Manitoba: Queen's Printer, 1971), p. 144.

[c]Data employed to estimate annual growth rates of capital and land are obtained from: Manitoba Agriculture Yearbook, Op. Cit., 1961-1971. It should be noted that the growth rate of land inputs is based on the seeded acreages (total land-summer fallow).

[d]Data employed to estimate annual growth rate of capital input for non-agricultural sectors are obtained from: D.B.S., Private and Public Investment, Op. Cit., 1961-1971.

[e]Annual growth rate of factor input average productivity is estimated following its definition, similar to the method employed to estimate annual growth rate of gross output at constant price by

$$\Delta AP_i = \frac{1+\Delta GO_i}{1+\Delta Z_i} - 1$$

Where ΔAP_i = annual growth rate of average productivity of the i^{th} input:
ΔGO_i = annual growth rate of gross output at constant price; and
ΔZ_i = annual growth rate of the i^{th} factor input.

[g]The annual growth rate of average agricultural labor productivity is obtained from: Auer, Op. Cit., p. 74 Table c-1. However, the growth rate of 5.44% does not include the scale effect which is considered in the first step of estimating changes of labor requirement. The effects considered here are: effect of outmigration (1.95%), capital increase (1.66%) and other (1,83%).

[h]The annual growth rate of average land productivity by agricultural sectors is estimated from the following two steps using the data obtained from Manitoba Agricultural Yearbook. First, the growth rate of output per acre for each crop, wheat, oats, barley, mixed grain and hay, from 1961 to 1970 is estimated using five-year period average (from 1961-65 as the base period

TABLE 4.26

Continued

and 1966-70 as the terminal period). The estimated growth rate for each crop is weighted by ten-year average acreages planted to obtain the aggregate growth rate for crop and livestock sectors. It is assumed that 75% of wheat, oats and barley and 25% of mixed grain and hay are produced in the crop sector and the reverse combination is in the livestock sector.

rate of change in the future.

C. Construction of Expansion and Replacement Capital Coefficient Matrices

Two steps are employed to construct the expansion and replacement capital coefficient matrices for 1968. First, capacity for each sector is measured in terms of the input utilization rate to determine the key factor of constraint capacity concept discussed in the preceding chapter. Then the expansion and replacement capital coefficient matrices for 1968 are derived using the constructed capital account presented in Tables (4.6) and (4.7).

Measurement of Capacity

As stated in the preceding chapter, it is believed that using the input utilization rate to determine the key factor of constraint on capacity is a useful guide to capacity measurement. First, input utilization rates, the ratio of actual to potential input use, are estimated and compared. Then the factor or input that has the highest utilization rate is selected as the key factor in determining capacity for empirical estimation.

The problem is we do not know the level of factors available for some inputs in the empirical study. Since the model considers the labor input as the only constraining factor in non-agricultural sectors, the non-agricultural labor utilization rate is used to estimate the capacity for non-agricultural sectors. The procedures for estimating the potential non-agricultural labor force and employment are explained in Appendix I and the results have been summarized in Table (4.2). By means of the potential employment approach in determining capacity, the non-agricultural labor utilization rate is dependent upon the amount of the potential non-agricultural labor input being used in production, other things being equal. In this way, the capacity for the i^{th} sector is determined by the actual output level divided by the ratio of actual to potential non-agricultural labor input for that sector (i.e., equation 3.20 presented in the preceding chapter). Since there is no information concerning the ratio of actual to potential non-agricultural labor use for each non-agricultural sector, it is assumed that an overall estimate of non-agricultural labor utilization rate, (estimated by dividing total employment in non-agricultural sectors by potential non-agricultural labor force (Table 4.2)), prevails in all non-agricultural sectors.[19]

Given this assumption, the capacity for each non-agricultural sector is calculated by dividing the output level of the corresponding sector by the estimated overall non-agricultural labor utilization rate, 0.9871.

For agricultural sectors, land and agricultural labor are considered to be the factors determining the capacity level depending on their utilization rates. The input utilization rates are estimated to be 0.9155 and 0.9025 for agricultural labor force and land respectively in 1968 for overall agricultural production based on the data summarized in Tables (4.2) and (4.4). However, it should be noted that the land utilization rate is measured by dividing actual land planted or pastured

---

[19]The estimated overall non-agricultural labor utilization rate is 0.9871 (9361 ÷ 9484). The actual non-agricultural labor use includes those persons employed in the government sector and commuting summarized in Table (4.2), labor force and employment account.

during the year by the actual available agricultural land. One may argue that summer fallow is also a necessary production activity involved in agricultural production in order to maintain the fertility of the land for next year's production. If this is the case, the land is said to be fully utilized and the capacity for agricultural sectors must be determined by land utilization rate according to the criterion employed to estimate capacity for this study. The present study does not consider that summer fallow is a necessary activity in agricultural production because Manitoba farmers could more than double their output per acre given the proper incentives to the use of technological inputs such as fertilizer.[20] In addition, the estimated agricultural labor force and land utilization rates for 1968 are not much different so that the capacity measured either by the agricultural labor utilization rate or by land utilization rate is still a good proxy for actual measurement of capacity. For these reasons, the agricultural labor utilization rate is also employed to measure the capacity for agricultural sectors.

Once the utilization rate to be employed to estimate the capacity has been determined, further specifications are made to estimate the agricultural labor utilization rates for both agricultural sectors. First, the potential agricultural labor force (7,135 man-years in Table 4.2) is proportionately allocated to each agricultural sector according to the number of farm operators in the sector. The estimates are 4,647 and 2,488 man-years respectively for livestock and crop sectors. Then, the agricultural labor utilization rates for both agricultural sectors

---

[20] Commission on Targets for Economic Development, Manitoba to 1968 (Winnipeg, Manitoba: Queen's Printer, 1969), p. 61.

are computed by dividing the actual employment in the corresponding sector by the estimated potential agricultural labor force in that sector (i.e., 4,258 ÷ 4,647 = 0.9163 for livestock sector and 2,265 ÷ 2,488 = 0.9104 for crop sector). The estimated agricultural labor utilization rates are, therefore, to be 0.9163 and 0.9104 respectively for livestock and crop sectors for 1968 and these estimates are employed to derive the capacity levels for those sectors.

In order to estimate changes in capacity, the same procedures described above need to be applied to estimate the 1967's capacity level for each sector. Then the difference in capacity between 1967 and 1968 represents the change of capacity for a year period. Due to the data difficulties, it is assumed that the labor utilization rate is constant. Thus, the same utilization rate for each sector for 1968 is used for estimation of 1967's capacity level. In addition, the Manitoba gross output growth rate by sector are used to derive 1967's gross output from the base year (1968).

It should be noted that the methods do not purport to measure actual capacity changes in a given sector since the capacity may be changed through factor substitutions. The estimates are probably biased downward because of the substitution. The methods used are considered as a proxy for actual measurement of capacity changes by sector due to data difficulties at the regional level of this study. Table (4.27) presents the estimates of capacity and changes of capacity for the 17 producing sectors.

Estimation of Expansion and Replacement Capital Coefficient Matrices

Given the estimates of the capacity for each sector, the expansion

TABLE 4.27

ESTIMATES OF CAPACITY AND CHANGES IN CAPACITY FOR INTERLAKE AREA, 1968[a]

(Unit: equivalent to 1968 $' 000)

Sector	Capacity 1967	Capacity 1968	Changes in Capacity (1968 - 1967)
1. Ag.-Livestock	33,597.4	36,534.8	2,937.4
2. Ag.-Crop & Other	13,651.7	13,769.3	1,193.5
3. Mining	1,012.3	1,100.8	88.5
4. Food & Bev. Mfg.	4,400.3	4,577.1	176.5
5. Other Mfg.	21,292.0	22,248.7	956.7
6. Transportation	1,689.8	1,846.8	157.0
7. Construction	7,374.0	8,049.4	675.4
8. Petroleum Wholesale	8,708.7	9,470.2	761.5
9. Farm Equip. & Bldg. Mat.	5,367.0	5,836.3	469.3
10. Food Store	6,279.3	6,750.0	470.7
11. Other Retail	10,917.3	11,688.8	771.5
12. Auto Product & Services	20,799.3	22,310.1	1,510.8
13. Apparel & Shoes	1,187.7	1,256.9	69.2
14. Furniture & Appl.	478.0	511.2	33.2
15. Insurance	284.6	306.0	21.4
16. Personal Services	7,643.8	8,219.2	575.4
17. Other Services	1,520.2	1,634.7	114.5

[a]Estimation procedures are explained in the text.

and replacement capital coefficient matrices for 1968 can be computed by equations (27) and (28) summarized in Table (3.3), Chapter 3. The expansion capital coefficient matrix is computed by dividing the intersectoral expansion fixed capital transaction table (Table 4.6) for 1968 derived from the capital account by the estimate of changes in capacity during the period of 1967 to 1968 for each sector. Similarly, the replacement capital coefficient matrix is obtained by dividing the intersectoral replacement fixed capital transaction table (Table 4.7) for 1968, also derived from capital account, by the estimated capacity in 1968 for each sector.[21]

Tables (4.28) and (4.29) present the estimated expansion and replacement capital coefficient matrices. The elements of Table (4.28) indicate the purchase of capital goods from sector i by sector j in order to expand a unit of capacity. The elements of Table (4.29), however, indicate the purchase of capital goods from sector i by sector j in order to maintain the same level of capacity as the base year. The coefficients show, for example, that for each unit of capacity increase in the livestock sector, $0.716 of capital goods were purchased from the construction sector. The total of 2.4527 under the livestock column indicates that the livestock sector requires 2.4527 dollars of capital goods to expand a unit of capacity. Similar implications hold for each element of Table (4.29). In this case the required capital goods are used in maintaining the same level of capacity without any expansion.

---

[21]The derivation of intersectoral expansion and replacement capital transaction tables are given in Appendix I.

TABLE 4.28

ESTIMATED REPLACEMENT FIXED CAPITAL COEFFICIENTS (d_{ij})[a], INTERLAKE AREA, 1968

Producing Sector \ Purchasing Sector[b]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1. Ag.-Livestock																	
2. Ag.-Crop & Other																	
3. Mining																	
4. Food & Bev. Mfg.																	
5. Other Mfg.																	
6. Transportation																	
7. Construction	0.7160	0.7445	0.0633	0.0057	0.0045	0.1682	0.2824	0.0098	0.0247	0.0140	0.0242	0.0116	0.0361	0.0060	1.6729	0.0504	0.1598
8. Petroleum Wholesale	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000											
9. Farm Equip. & Bldg. Mat.	0.3329	0.0982	0.0000	0.0000	0.0001	0.0000	0.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10. Food Store																	
11. Other Retail	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0047	0.0002	0.0000
12. Auto Prod. & Service	0.2418	0.2514	0.0508	0.0164	0.0028	0.2204	0.5611	0.0131	0.0326	0.0183	0.0296	0.0148	0.0434	0.0060	2.1729	0.0615	0.2061
13. Apparel & Shoes																	
14. Furniture & Appl.	0.0010	0.0010	0.0000	0.0000	0.0000	0.0013	0.0022	0.0001	0.0000	0.0002	0.0001	0.0001	0.0000	0.0000	0.0093	0.0003	0.0009
15. Insurance																	
16. Personal Service																	
17. Other Service																	
Intermediate Subtotal	1.2922	1.0954	0.1142	0.0221	0.0074	0.3904	0.8509	0.0231	0.0573	0.0325	0.0539	0.0265	0.0795	0.0120	3.8598	0.1124	0.3668
Imports	1.1604	1.6501	0.8011	0.2527	0.1600	0.9376	1.0712	0.1286	0.1709	0.1245	0.2074	0.1104	0.2747	0.0512	3.5701	0.2742	0.5066
Total	2.4527	2.7455	0.9153	0.2749	0.1675	1.3280	1.9221	0.1517	0.2282	0.1570	0.2613	0.1270	0.3540	0.0633	7.4299	0.3867	0.8734

[a] The coefficients show the expandion fixed capital purchases from the sectors at the the left per dollar of increase in capacity by the secotr at the top.

[b] The sector number at the top is same as the sector number listed at the left of the table.

Source: Estimation procedures are explained in the text.

TABLE 4.29

ESTIMATED EXPANSION FIXED CAPITAL COEFFICIENTS $(b_{ij})^a$, INTERLAKE AREA, 1967-68

Producing Sector \ Purchasing Sector[b]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1. Ag.-Livestock																	
2. Ag.-Crop & Other																	
3. Mining																	
4. Food & Bev. Mfg.																	
5. Other Mfg.																	
6. Transportation																	
97. Construction	0.01717	0.02422	0.01768	0.00132	0.00139	0.01302	0.00647	0.00095	0.00248	0.00169	0.00277	0.00133	0.00320	0.00146	0.00457	0.00319	0.00342
8. Petroleum Wholesale																	
9. Farm Equip.& Bldg. Mat.	0.00798	0.00319	0.00000	0.00000	0.00000	0.00000	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
10. Food Store																	
11. Other Retail	0.00001	0.00002	0.00000	0.00000	0.00000	0.00000	0.00003	0.00001	0.00002	0.00002	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000	0.00007
12. Auto Product & Services	0.00580	0.00818	0.01393	0.00393	0.00235	0.01693	0.01286	0.00125	0.00320	0.00221	0.00337	0.00172	0.00387	0.00126	0.00632	0.00394	0.00434
13. Apparel & Shoes																	
14. Furniture & Appl.	0.00002	0.00003	0.00010	0.00002	0.00001	0.00006	0.00005	0.00000	0.00002	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000	0.00001	0.00000
15. Insurance																	
16. Personal Service																	
17. Other Services																	
Intermediate Subtotal	0.03098	0.03565	0.03171	0.00527	0.00376	0.03000	0.01950	0.00222	0.00572	0.00392	0.00616	0.00306	0.00707	0.00272	0.01089	0.00714	0.00783
Imports	0.02782	0.05371	0.22345	0.05954	0.08146	0.07208	0.02455	0.00638	0.01703	0.01508	0.02364	0.01162	0.02467	0.01046	0.00984	0.01745	0.01079
Total	0.05880	0.08936	0.25516	0.06481	0.08522	0.10208	0.04405	0.00860	0.02275	0.01900	0.02980	0.01468	0.03174	0.01318	0.02073	0.02460	0.01862

[a] The coefficients show the replacement fixed capital purchases from the sectors at the left to maintain the same level of capacity by the sector at the top.

[b] The sector number at the top is the same as the sector number listed at the left of the table.

Source: Estimation procedures are explained in the text.

D. Projection of Resource Constraints

Resource constraints in production include land and labor. In this section the procedures used to project these constraints for each target year are described. Land is included in the model as a constraint for agricultural production, but it is not defined as a constraint for non-agricultural production.

Projection of Land Constraint

Land constraint in the area is defined as the amount of land available for agricultural production within a certain time period, a year. The available land for agricultural production changes every year through its transformation to different uses. Therefore, future land available for agricultural production depends upon: (1) the rate of agricultural land transferred to urban and public use, and (2) the rate of other land transferred to agricultural land. Accordingly, the procedures employed to project future land available for agricultural production include two steps: (1) estimation of the amount of agricultural land transferred to urban and public use, and (2) estimation of the amount of other land transferred to agricultural land mainly through land clearing activity.

No information is available concerning the transformation of the land from agricultural use to urban and public use in the Interlake area. In consultation with Provincial authorities familiar with town planning, the authorities estimated, using township maps, an average of one percent expansion of town and public use land during the last decade and it is likely to continue at the similar rate of growth in the near future.[22] Thus, the agricultural land transferred to urban

[22] This was estimated by Mr. G.T. Tencha, Director of Planning Branch, Mr. A. Srutwa, Planner of Planning Branch, Dept. of Municipal Affairs.

and public use is estimated assuming one percent expansion of town and public use land in each year since the base year (1968). The estimates are summarized in row 3 of Table (4.30).

The next step is to measure the amount of other land transferred to agricultural use through land clearing activities. Land clearing activities are of two types: with and without the land clearing program. The first type of land clearing activity is, under the FRED Agreement, designed to assist farmers to expand cultivated acreages in order to increase agricultural production and income in the Interlake during the period 1968-1973, by means of an incentive of $4 per acre paid to farmers who clear brush on approved land.[23] The latter type of land clearing activity include brush clearing by farmers on their own land but without receiving any incentive payment from government. Since the land clearing program under FRED plan has been discontinued, it is necessary to separate the cleared land into two types in order to estimate the transformation of other land to agricultural land after the termination of the land clearing program.

The actual acres of land cleared by farmers under the land clearing program for each year were obtained from Mr. E.W. Somers, Department of Agriculture, Province of Manitoba, and are summarized in Table (IV.5), Appendix IV. The results shown in row 5 of Table (4.30) are accumulated acreages to the target year. In 1976, for example, the cleared land of 47.3 thousand acres were the accumulated results of 12.1 thousand, 9.0 thousand and 26.2 thousand acres of land cleared under land clearing

---

[23]The detailed description concerning the land clearing program under FRED plan is presented in Appendix IV.

TABLE 4.30

BASE YEAR AND PROJECTED LAND AVAILABLE FOR AGRICULTURAL USE WITHOUT AND WITH LAND CLEARING PROGRAM FOR THE TARGET YEARS, INTERLAKE AREA

(Unit: 1,000 Acres)

Items	Base Year 1968	Projections				
		1971	1976	1977	1980	1986
1. Land Available for Agri. Use Without Land Clearing in Year t-k[a]	-	1,687.6	1,765.9	1,906.9	1,942.1	2,089.5
2. Land Available for Agri. Use With Land Clearing Program in Year t-k	-	1,717.3	1,845.0	2.033.3	2,068.5	2,215.9
3. Transferred to Town & Public Use[b]	-	3.6	9.3	2.1	9.8	10.3
4. Cleared Land Without Land Clearing Program[d]	-	81.9	150.3	37.3	157.2	238.7
5. Cleared Land Under Land Clearing Program	29.8	49.4	47.3	0.0	0.0	0.0
6. Land Available for Agri. Use Without Land Clearing Program in Year t[c]	1,687.6	1,765.9	1,906.9	1,942.1	2,089.5	2,317.9
7. Land Available for Agri. Use With Land Clearing Program In Year t[a]		1,845.0	2,033.3	2,068.5	2,215.9	2,444.3

[a] Where K is the number of years between the current and previous target years.

[b] Agricultural land transferred to town and public use is estimated by assuming 1 percent expansion of town and public use land in each year since the base year (for detailed explanation see Appendix I, Estimation of Land Account Section). The figures presented in the table are the accumulated results of each K period of years in each target year.

[c] Land available for agricultural use without the land clearing program in year t is calculated by: 6 = 1 - 3 + 4.

[d] Land available for agricultural use with the land clearing program in year t (row 7) is then calculated by adding rows 2, 5 and 6, and subtracting row 3 (i.e., 7 = 2 + 5 + 6 - 3). The figures shown in this row are actual land cleared under the land clearing program.

program respectively in 1971, 1972 and in 1973 (See Table IV.5, Appendix IV).

Estimation of the amount of other land transferred to agricultural use without land clearing program is based on a simple regression (equation 31 summarized in Table 3.3, Chapter 3) using a time series data from 1962 to 1967 obtained from Year Book of Manitoba Agriculture[24] in which the cleared land under land clearing program was substracted from the total of cleared land for 1967 prior to estimation of the regression. The regression result is as follows:

$$\underset{}{\Delta UL_t} = \underset{(2,2185)}{10.29199} + \underset{(2.0281)}{1,80657\ t} \qquad R^2 = 0.5070 \quad D.F. = 4 \qquad (4.1)$$

Where ΔUL_t denotes the cleared land without land clearing program and t is the time span in which t=1 in 1962. The unit is 1,000 acres and the values in the parentheses are the t values.

Equation (4.1) then is employed to estimate the acreage of cleared land without land clearing program for each target year. The results are presented in row 4 of Table (4.30). Again, the figures shown in each target year are the accumulated results between two target years. It is worth noting that the regression may under-estimate the cleared land without land clearing program in the short-run and over-estimate that in the long-run when the most brush land have been cleared.[25] It is

---

[24]Manitoba Dept. of Agriculture, Agri. Year Book. Op. Cit., 1962 to 1967.

[25]The total cleared land in the Interlake obtained from Agriculture Year Book are compared with the estimates for four years, 1968 to 1971 as follows:

	1968	1969	1970	1971
Actual Cleared Land (1,000 Acres)	52.20	62.50	61.60	73.90
Estimated including with and without land clearing program (1,000 Acres)	52.61	57.41	46.28	40.46

estimated that the land available for agricultural use increased 39 percent during the period 1968 to 1986. The increase is mainly due to the considerable amount of brush land existing in the northern Interlake area.

Projection of the Labor Constraint

The procedures for estimating the labor constraint are described below. First, total population and labor force in the area are estimated by means of the demographic model estimated by Maki, Framingham and Sandell.[26]

Since the regional delineation employed by Maki et. al. is different from this study, some adjustments are required to estimate the Interlake area's population and labor force. The Interlake region, in this study, should cover the whole Northern Interlake and part of Trading Areas according to their delineation of regions. The municipalities of Rockwood, Rosser, St. Andrews and Woodland, and the incorporated town of Stonewall, Teulon, Selkirk and Winnipeg Beach in the Interlake area are in the other Trading Areas in their study.[27] Thus, the ratios of population between these municipalities and incorporated town, and trading area by sex for 1971 were estimated (the estimates are respectively 0.177 for male and 0.176 for female).[28] These ratios were then employed to estimate population by sex for those municipalities and incorporated towns for each target year. The sum of the populations

---

[26]Maki, Framingham and Sandell, Op. Cit.,

[27]Ibid., pp. 30-34.

[28]The data were obtained from: Government of Manitoba, Population of Manitoba, June, 1971, (Winnipeg: The Continuing Programs Secretariat, Planning and Priorities Committee of Cabinet, 1973).

in those municipalities and incorporated towns as well as the Northern Interlake area for each target year form the corresponding year's total population in the Interlake area.

The labor force then is estimated by multiplying the total population over 15 and less than 65 by the average participation rates by sex for Manitoba estimated by Maki et. al. for each target year.[29] The estimated results are summarized in Table (4.31). The model slightly overestimates the population due to the adjustment factors employed in this study.

TABLE 4.31

BASE YEAR AND PROJECTED POPULATION AND POTENTIAL LABOR FORCE FOR THE TARGET YEARS, INTERLAKE AREA

Year	Population			Potential Labor Force		
	Male	Female	Total	Male	Female	Total
1968	23,368	23,322	49,690	-	-	16,619
1971	26,271	24,427	50,698	12,048	5,413	17,365
1976	24,697	23,614	48,311	12,159	5,828	17,987
1977	24,397	23,472	47,869	12,072	5,859	17,931
1981	23,251	22,891	46,142	11,633	5,887	17,520
1986	22,026	22,126	44,152	10,738	5,372	16,310

Source: Adjusted to the Interlake based on Maki, Framingham and Sandell, Op. Cit., Series A.

E. Final Demand Projections

Because the change in each segment of final demand will lead to

---

[29] The estimated participation rates are as follows:

	1971	1975	1980	1990
Male	0.772	0.771	0.777	0.777
Female	0.361	0.386	0.401	0.401

a change in output and employment, final demand projections are required. This section presents the procedures followed, data used and estimated results of each component of the final demand vectors. First to be discussed is household consumption, then government expenditures, gross private capital formation and finally, inventory change, exports and unallocated sectors.

Projection of Household Demand

Household demand is considered as exogenous sector in the input-output system for the static and comparative static simulation. An independent projection of household demand for each target year is made for such simulations. Estimation of household sector final demand is crucial to impact studies since Interlake households represent the largest component of final demand. Decisions by Interlake consumers to spend an extra dollar for the product of a particular sector stimulates an economic chain reaction because of the linkage between consumers and the producing sectors on the one hand, and the inter-dependency among producing sectors on the other.

The general theory of demand suggests that the level of consumption is determined by consumers maximizing their utility subject to budget constraints. It follows that per capita consumption (CH_k) of commodity k is a function of prices and income level of the consumer. For this study, the first step, is to determine a set of demand and income elasticities indicating the relationships between quantity demanded of various commodities or commodity groups and prices, and the relationships between consumption and income in the Interlake. The second step is to develop per capita income and price change projections for each target year in order to project per capita consumption. Finally, the product of per capita consumption with the independent projections of Interlake population yields projections of total household expenditures by sectors.

Derivations of Demand and Income Elasticities Frisch[20] proposes an indirect method of estimating a system of demand equations, enabling consideration of both the income and price effects without the use of time-series consumer expenditure data. Given the want independence assumption and applying Frisch's indirect method, one only needs to estimate K income elasticities of demand from cross-section information and a parameter that Frisch called the "money flexibility of marginal utility of income" (often called simply "money flexibility").[31] All price elasticities can be derived from these k + 1 parameters. Frisch's proposal has been used in several econometric analyses[32] and the simplified assumptions are required to permit empirical estimation.

Consider the consumer who maximizes his utility function under a budget constraint, that is

$$\max \quad U(Q) = U(q_1, q_2, \ldots, q_n) \tag{4.2}$$

subject to

---

[30] R. Frisch, "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model with Many Sectors," Op. Cit., 177-196.

[31] k refers to the number of commodities or commodity groups being considered in the study. In addition, the want independence assumption according to Frisch, refers to commodities where, for example, "the marginal utility of using more electricity in the home can safely be regarded as independent of the quantity of swiss cheese consumed."

[32] A Survey of Frisch's proposal applied to analysis can be found in: A. DeJanvry, J. Bieri, and A. Nunez, "Estimation of Demand Parameters Under Consumer Budgeting: An Application to Argentina," American Journal of Agricultural Economics 54 (August, 1972), 442-430.

$$\sum_{k=1}^{n} Pc_k \, q_k = YD \tag{4.3}$$

where Pc_k and q_k are the k^{th} commodity price and quantity consumed; YD is equal to total expenditure in a given time period, henceforth referred to as "income".[33] The first order conditions for utility maximization in the n commodity case are given by

$$U_k - \beta Pc_k = o \; ; \; k=1, \ldots, n \tag{4.4}$$

$$YD - Pc_k \, q_k = o$$

where U_k is the marginal utility of commodity k, i.e., $(U_k = \frac{\partial u}{\partial q_k})$, and β is the marginal utility of income.

The demand equations corresponding to (4.2), subject to (4.3) can be represented as

$$q_k = q_k \, (Pc_1, Pc_2, \ldots, Pc_n, YD) \; ; \; k=1, \ldots, n \tag{4.5}$$

Given the assumption of "want-independence",[34] Frisch derives the following computational formulae for direct and cross demand elasticities from (4.4).[35]

$$e_{kk} = \frac{\partial q_k}{\partial pc_k} \frac{pc_k}{q_k} = -\mu_k \, (\theta_k - \frac{1-\theta_k \mu_k}{w} = - \mu_k \theta_k - \frac{1-\theta_k \mu_k}{w} \; ; \tag{4.6}$$

---

[33]It is assumed that saving in a given time period is also determined by consumer's utility function. Hence, saving is included as a commodity.

[34]The concept of "want-independence" is explained by Frisch by referring to commodities where, for example, "the marginal utility of using more electricity in the home can safely be regarded as independent of the quantity of swiss cheese consumed." See Frisch, Op. Cit., p. 178.

[35]For a summarized form of mathematical derivation of equations (4.6 and 4.7) refer to: P.S. George and G.A. King, Consumer Demand for Food Commodities in the U.S., With Projections for 1980, Giannini Foundation Monograph No. 26 (Berkleley: California Agri. Experiment Station, 1971), App. B.

$$e_{kh} = \frac{\partial q_k}{\partial pc_h} \frac{Pc_h}{q_k} = - \mu_k \theta_h \left(1 + \frac{\mu k}{w}\right) \text{ ; for } k \neq h \qquad (4.7)$$

where e_{kk} = the direct demand elasticity with respect to pc_k;

e_{kh} = cross demand elasticity with respect to pc_k;

μ_k = the income elasticity of the k^{th} commodity;

θ_k = the budget share of the k^{th} commodity i.e., $\theta_k = \frac{pc_k q_k}{YD}$; and

w = Frisch's "money flexibility" defined as $\frac{\partial \beta}{\partial YD} \frac{YD}{\beta}$.

Accordingly, if the value of w, μ_k, and θ_k are known, equations (4.6) and (4.7) may be used to obtain estimates of e_{kk} and e_{kh}. The μ_k can be obtained by fitting Engel functions using cross-section consumer expenditure survey data. Similarly, the values of θ_k can be calculated from cross-section consumer expenditure survey data. The difficulty of applying Frisch's proposal is to generate the value of w. The method used by DeJanvry et. al. is employed here to estimate w.

Conceptually money flexibility may be estimated either from equation (4.6) or (4.7) if the demand and income elasticity coefficients and the budget share for any commodity or commodity group are known. Further, estimates for various commodities or commodity groups should provide similar values of w if the assumption of want-independence is valid. The schedule of money flexibility should increase from large negative values toward zero as the level of real income increases, according to Frisch's proposal.[36] Following these concepts, DeJanvry et. al., searched the literature for empirical estimates of e_{kk} and e_{kh} for food

---

[36]Frisch, Op. Cit., p. 189.

over different time intervals and in different countries. Twenty-six empirical studies were obtained.[37] Using equation (4.6) the schedule of money flexibility for each study is estimated. These values of w were regressed on the average level of real income in the sampling intervals of each study, and the following equation of money flexibility was obtained (their equation 9):

$$\ell n(-w) = 1,5910 - 0.5205\ \ell n\left(\frac{YD}{PH}\right) \tag{4.8}$$

where $\frac{YD}{PH}$ represents the level of real income.

In a similar way, DeJanvry et. al. also obtained from the literature a series of money flexibilities which were derived from estimation of the parameters of cardinal utility functions and a system of demand equations where the assumption of additivity is made. Twenty-four estimates of w were obtained from different time intervals and in different countries. Again, these estimates of w were regressed on the average level of real income in the sampling intervals of each study. Their result is shown in equation (4.9) (their equation 10).

$$\ell n(-w) = 1,7595 - 0.5127\ \ell n\left(\frac{YD}{PH}\right) \tag{4.9}$$

The fit of both regressions was statistically significant and consistent with Frisch's proposal according to DeJanvry et. al.[38]

---

[37] DeJanvry et. al., Op. Cit., pp. 242-243.

[38] Frisch states that the w's tends to decrease from high negative values to zero when the real income increases over time. He further conjectures the w's values range from -10 for extremely low income to 0 for extremely high income levels. See: Frisch, Op. Cit., p. 189.

Therefore, if the real income levels for the period of study are known, w can be estimated using DeJanvry et. al.'s regression of money flexibility (equations 4.8) and (4.9).

Substitution of the estimated real per capita income of $1,475.7 in 1968 for the Interlake into equations (4.8) and (4.9) yields values of w of -1,20920 and -1.46149 respectively. The average value of w is -1,32937. Then the demand elasticity matrix, e_{kh}, is estimated by substituting w, μ_k and θ_k into equations (4.6) and (4.7). This recursive computational procedure is employed to estimate e_{kh} for each target year when the real income level is projected.

The income elasticities (μ_k) are estimated by Engel functions in log form based on 735 individual household data obtained from household survey in 1968.[39] The total household expenditures are arbitrary classified into 11 groups. The estimated income elasticities (μ_k) and budget share (θ_k) are presented in Table (4.32).

It should be noted that the R^2's are generally very low. This is not surprising when the cross-section data are employed.[40] Nevertheless, the estimated income elasticities are consistent with the generally observed results that demand for food is inelastic whereas demand for manufacturing products and services such as cars, recreation, personal

---

[39]The quality of survey data employed for this study refers to: MacMillian, Tung and Loyns, Op. Cit., p. 418.

[40]When individual budget data obtained from survey without any grouping are used to estimate Engel functions, the variations tend to be large and hence the R^2's are very low. The fit could likely be improved if a three-parameter Engel functions were used. See: C.E.V. Lesser, "Forms of Engel Functions", Econometrica, Vol. 31, No. 4 (October, 1963), pp. 694-703.

TABLE 4.32

ESTIMATED BUDGET SHARES AND ENGEL FUNCTIONS, INTERLAKE AREA, 1968[a]

	Budget Share θ_k	Engel Functions		
		Constant α_k	Income Elasticity μ_k	R^2
1. Meat	0.0697	1.5400 (1.8594)*	0.3613 (3.1345)**	0.0116
2. Dairy product	0.0298	0.9697 (1.2392)	0.3589 (3,2959)**	0.0129
3. Fruit & Vegetable	0.0389	1.0300 (1.3292)	0.3878 (3.5959)**	0.0153
4. Other Food	0.0363	2.8245 (3.8937)**	0.1523 (1.5089)	0.0270
5. Housing	0.0551	-2.2371 (6.3515)**	1.1306 (23.0638)**	0.3894
6. Clothing	0.0555	0.0611 (0.1674)	0.6125 (12.0618)**	0.1485
7. Transportation	0.2876	-8.8140 (10.3194)**	1.7990 (15.1337)**	0.2155
8. Health & Personal Care	0.0558	-6.3009 (5.9069)**	1.2748 (8.5866)**	0.0812
9. Recreation & Reading	0.1765	-5.3499 (10.1751)**	1.3486 (18.4288)**	0.2894
10. Tobacco & Alcohol	0.0770	-5.8458 (4.4300)**	1.1582 (6.3994)**	0.0456
11. Other Categories including saving	0.1178	-6.8528 (7.7398)**	1.3092 (10.6235)**	0.1192
Total Consumption	1.0000	3.6844 (24.8623)**	0.4851 (23.5606)**	0.4002

[a]The values in parentheses are the t-values.

*Significant at the five percent level for a two-tailed t test.

**Significant at the one percent level for a two-tailed t test.

care etc., is elastic. Income elasticities listed in Table (4.32) present percentage changes in the household budgets associated with a one percent change in household's per capita incomes. Thus, for a one percent income increase, a consumer in the Interlake is expected to increase his demand for meat by 0.36 percent, for dairy products by 0.36 percent, for housing by 1.13 percent.

The economic significance of income elasticities differentiation is that it causes uneven growth among industries. The income elasticities, therefore, not only reflect consumer's preference associated with income levels, but also provide some measure of the differential demand growth for sectors in the Interlake. The low income elasticities for agricultural products indicate that these sectors will decline in their shares in the consumers's budget as income increases.

The estimated demand elasticity matrix for each target year, using the recursive computational system, is presented in Appendix III. The validity of the estimates are tested by the following conditions:[41]

(1) On the income elasticities, the Engel aggregation condition:

$$\theta_1\mu_1 + \theta_2\mu_2 + \ldots + \theta_{11}\mu_{11} = 1 \qquad (4.10)$$

(2) On the demand elasticity matrix:

(i) the Cournot Aggregation condition;

$$\theta_1 e_{1h} + \theta_2 e_{2h} + \ldots + \theta_{11} e_{11h} = -\theta_h \qquad (4.11)$$

---

[41]When price and income elasticities are estimated within a complete utility maximization model, the specified conditions must hold and therefore such conditions can be employed to test the validity of the estimates. See: A.C. DeJanvry, "Measurement of Demand Parameters Under Separability", Unpublished Ph.D. Dissertation (Berkeley: Department of Agricultural Economics, University of California, Berkeley, 1968) p. 128.

(ii) the non-positivity of the diagonal elements condition;

$$e_{kh} \leq 0 \quad \text{for all } K \neq h \text{ and } k, h=1, . . ., 11) \qquad (4.12)$$

(iii) row restraint (homogenity) condition;

$$e_{k1} + e_{k2} + . . . + e_{k11} + \mu_k = 0 \quad (k=1, . . ., 11) \qquad (4.13)$$

A consistent test result is found only for the second condition (equation 4.12). The other tests were departed slightly from their postulated conditions.[42] This may be due to the results of our arbitrary grouping of commodities into separable groups and omission of the three-dimensional Engel function.[43] Nevertheless, the projected household expenditures by sector are only about 8-9% lower than the actual figures, as shown in the next two sections, using the estimated demand elasticity matrix and income elasticities associated with the corresponding levels of real income and consumer price indices.

Projection of Per Capita Real Income and Consumer Price Indices

Due to difficulties in obtaining time-series data on per capita personal disposal income for the Interlake, Manitoba's average growth rate of per capita personal disposal income from 1961 to 1967, is employed to project the area's per capita personal disposal income for each target year. It is expected that the real per capita personal disposal income

---

[42] The tests of (4.10) and (4.13) were both about 17% over the conditions. For (4.12), the errors range from 0.4% for health and personal care to 16% for meat.

[43] DeJanvry took the price elasticities, income elasticities, and budget shares to develop proportionality factors to identify the separable groups of commodities. Ibid., pp. 107-110. However, the method can not be applied to present study since the price elasticities are unknown. In addition, the groups classified by DeJanvry are not completely adaptable because non-food products were not classified.

(1968 base) will increase from 1,475.7 dollars in 1968 to 2,964.3 dollars in 1986, an assumed annual increase of $82.70 dollars per year.

A simple regression was employed to estimate the change in consumer price indices except for the food group, using the Winnipeg consumer price indices time-series data. The average change rates per year from 1969 to 1972 were employed to project each target years' consumer price indices for meat products, fruit and vegetable, other food and other commodities groups because a long time-series of price indices for these commodity groups were not available.

The subcomponents of food consumer price indices are estimated to more than triple by 1986 mainly due to high rates of increase in food price during the last two years (1970-1972). Thus, the regression likely over-estimates the future food price level. Table (III.2) in Appendix III presents the projected real per capita personal disposal income and consumer price indices.

Projections of Household Consumption Expenditure for 17 Sectors

The projection framework includes three steps. First, per capita consumption of different commodities are estimated using the demand interrelationship matrix developed above. The projections are based on the demand interrelationships with estimated demand elasticity matrices presented in Table (III.2), Appendix III. If the demand matrix for the target year t is denoted by CH_{kt}, the projection of per capita consumption of different commodities is made by

---

[44]Consumer price indices by subcomponents for food were obtained from Statistics Canada.

$$\ln CH_{kt} = \alpha_k + e_{kht} \ln (PC_{kt}/PH_t) + \mu_k \ln YD_t \qquad (4.14)$$

where CH_{kt} = per capita consumption of different commodities, expressed in natural logs;

μ_k = income elasticities derived from the base year;

YD_t = the level of real per capita income in target year t;

e_{kht} = the demand elasticity matrix in target year t; and

PC_{kt}/PH_t = the relative changes of consumer price index in target year t in which PH_t is the consumer price for all items, expressed in natural logs, and PC_{kt} is the price index of the k^{th} commodity.

When estimates of YD_t, e_{kht}, PH_t and PC_{kt} have been completed for each target year, an estimate of CH_{kt} can be obtained from equation (4.14), under the assumption of constant income elasticities. The inclusion of the dynamic demand elasticity matrix in the projection framework would partially cover some factors other than prices and income causing changes of per capita consumption such as changes in tastes and preference.[45]

The second step is to estimate total consumption expenditure of different commodities. Population is an important factor determining total consumption expenditure:

$$CT_{kt} = TP_t \, . \text{ Anti Log } [CH_{kt}] \qquad (4.15)$$

where CT_{kt} = estimated household consumption expenditures on the k^{th} commodity in the target year t; and

TP_t = total area population in the target year t and CH_{kt} as defined before.

The projected total population for the Interlake based on Maki, Framingham and Sandell shown in Table (4.31) is used as the area's total

---

[45]George and King, Op. Cit., pp. 94-95.

population for each target year.[46] In 1968, total area population was 49,690; in 1986, it was projected to be 44,152, a decrease of 5,538 persons (See Table 4.31).

The final step is to transfer the projected vector of total consumption expenditure, CT_{kt} into the 17 producing sectors. Additional information required in this step includes the level of consumer's purchase from outside the region and the proportion of commodity i purchased from sector j. Consumer's purchases are not all from the regional producing sectors. In the Interlake, about 20% of total household consumption was purchased from outside of the region in 1968.[47] Tiebout and Lane indicated that income and net price differential between regions are the key factors in relation to consumer's purchases of commodities from outside of the region.[48] When incomes increase, according to Tiebout and Lane Study, consumers consume more luxury goods that are normally produced outside of the region. Thus, income is expected to be positively related to consumer's purchases of commodities from outside the region. The net price differential is also expected to be positively related to consumer purchasing patterns. However, the net price differential between Winnipeg and the Interlake is negligible

---

[46]For more detailed discussions concerning projection of the area's total population using the demographic method see the discussion in the preceding section.

[47]See: Framingham, MacMillan and Sandell, The Interlake Fact., Op. Cit., Table 23.

[48]C.M. Tiebout and T. Lane, "The Local Service Sector in Relation to Economic Growth", in W.R. Maki and B.J.L. Berry (eds.), Research and Education for Regional and Area Development (Iowa: Iowa State University Press, 1966) pp. 95-109.

due to the competition between them. In addition, there are data difficulties associated with finding empirical relationships between income level and purchasing patterns for Interlake. Therefore, constant purchasing patterns are assumed for the present study.

Given the above assumptions, total household consumption expenditures for the 17 producing sectors are projected by the following system:

$$HD_{it} = \lambda_{ik} [C_k \cdot CT_{kt}] \qquad (4.16)$$

where HD_{it} = the household consumption expenditures for the i^{th} sector in target year t;

λ_{ik} = the patterns of household consumption expenditures of different commodities purchased from different sectors (26 sectors) in the base year. (See Table III.3, Appendix III); and

C_k = the portion of the k^{th} commodity or commodity groups purchased from outside of the region in the base year.

Table (4.33) summarizes the base year and projected household consumption expenditures for the 17 producing sectors for the target years. Total household consumption expenditures for the 17 producing sectors are projected to increase from $44.8 million in 1968 to $58.8 million in 1986, a rate of increase of about 2 percent compounded annually. Also, the allocations of personal income from one category of goods to another shifts over time. In 1968, Interlake households allocated 77.15 percent of the per capita total expenditures to foods and shelter , and 22.85 percent on services, transportation and other luxury goods.[49] In 1986, it is projected that 69.91 percent of per capita total expenditures will be allocated to food and shelter, a decline of about 7 percent, and 30 percent for transportation, services and other luxury goods. The

[49] In 1968, per capita total expenditures on food and shelter, and on transportation, services and other items were estimated $681 and $203 respectively. In 1980, it is projected that each consumer will spend $1,367 on food and shelter, and $590 on other items.

TABLE 4.33

BASE YEAR AND PROJECTED HOUSEHOLD CONSUMPTION EXPENDITURES BY SECTOR, INTERLAKE AREA, 1968-1986

(Unit: ' 000 1968 dollars)

Sector Number[a]	Base Year 1968	Projected 1971	1976	1977	1981	1986
1	1,600.1	1,496.3	1,422.6	1,409.9	1,361.5	1,308.4
2	332.9	279.5	267.8	265.8	257.8	248.8
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	56.5	53.6	65.3	67.6	76.7	87.9
6	190.7	225.7	275.7	285.0	325.7	375.7
7	1,612.9	1,876.6	2,273.9	2,352.4	2,667.7	3,062.0
8	4,587.0	5,110.6	5,952.8	6.119.8	6,789.1	7,627.3
9	454.0	526.6	640.6	663.2	754.1	868.2
10	5,543.6	5,706.9	6,059.4	6,130.7	6,406.5	6,748.5
11	10,028.4	11,339.6	11,850.2	11,954.3	12,357.2	12,859.0
12	12,861.1	11,752.3	13,164.9	13,461.6	14,662.0	16,238.3
13	1,146.8	1,600.7	1,730.9	1,755.5	1,842.3	1,937.7
14	438.0	552.0	668.8	691.9	784.6	900.6
15	140.7	138.7	185.0	194.8	234.8	287.7
16	4,842.2	4,494.5	4,709.5	4,751.2	4,906.3	5,090.7
17	996.2	799.2	939.4	966.3	1,069.0	1,191.0
Subtotal	44,831.1	45.952.8	50,206.8	51,070.0	54,495.3	58,831.8
18-24[b]	20,888.8	18,487.3	22,505.9	23,306.8	26,489.5	30,477.3
Imports	9,949.4	9,816.5	11,362.3	11,673.3	12,908.1	14,463.7
Total	75,669.3	74,256.6	84,075.0	86,050.2	93,892.9	103,772.8

[a]Sector number refers to Table 4.27.

[b]This column is obtained from the difference between total expenditures and imports plus subtotal of the 17 sectors.

Source: Estimation procedures are explained in the text and the base year figures are obtained from Table 4.1.

decreasing allocation of personal income for food and shelter in the expenditures budget reflect a higher standard of living of Interlake households in the future.

Projection of Governments' Expenditures

In the light of difficulties associated with data, different approaches are used to estimate Federal and Provincial Governments' expenditures, and Local Government expenditures for the 17 endogenous sectors.

Federal and Provincial Governments' Expenditures A simple method is employed to project Federal and Provincial Governments' expenditure for regional products for each target year. First, 1968 government expenditure survey data were used to generate base year (1968) estimates of Federal and Provincial Government purchases of regional products from each sector.[50] The estimates form the vector of Federal and Provincial demand for regional goods and services. Second, a simple regression on time (t) is employed to estimate Federal and Provincial Governments' expenditure functions using time-series data (from 1961 to 1966) obtained from MacMillan and Lu.[51] Then this equation (see footnote of Table 4.34) is used to project Federal and Provincial Government expenditures for each target year. Finally, these governments' demand for regional goods and services for each target year is estimated by multiplying the estimated target year's expenditure by the base year. The estimated results for

[50] The survey was conducted by Dr. James A. MacMillan and the data were compiled by Mr. Paul Molgat, Department of Agricultural Economics, U. of M. in 1969.

[51] MacMillan and Lu, Projections and Impact Models, Op. Cit., Table 26.

each target year are presented in Table (4.34).

From Table (4.34), it is observed that Federal and Provincial Governments' purchases of goods and services from 17 Interlake sectors are expected to increase from $1.1 million in 1968 to $2.0 million in 1986, a growth of about 100 percent over the 17 year period. Federal and Provincial expenditures are mostly on farm equipment and building material and other retail sectors.

Local Government Expenditures The estimation of local government expenditure is derived from a hypothesized local government expenditure function. The theoretical framework of local government expenditure functions is presented below.

Local public expenditure decisions are of two general categories.[52] First, current operating and maintenance expenditure budgets are based on past performance by function. Then a mill rate is established based upon expenditure and assessment estimates. Major categories of new expenditure are budgeted if a surplus of revenue from property tax collections and grants appears likely. Secondly, the council may determine the community's needs for a new facility such as water mains, sewer, or paving. In this case, the council requests a detailed budget from planning consultants and makes a decision concerning the feasibility of raising the mill rate or floating a bond issue. However, raising a bond issue plays a very minor role in the determination of local new expendiutres.[53]

---

[52] MacMillan, James A.,"A Framework for Simulating Area Economic Growth With Urban Consolidation", Regional Science Perspectives, Vol. 1, No. 1 (1971), pp. 121-143.

[53] Ibid., p. 137.

TABLE 4.34

BASE YEAR AND PROJECTED FEDERAL AND PROVINCIAL GOVERNMENT EXPENDITURES BY SECTOR, THE INTERLAKE AREA

(Unit: '000 1968 dollars

Sector Number[a]	Base Year 1968		Projections				
	Expenditure By Sector (1)	Dist. By Sector (%) (2)	1971 (3)	1976 (4)	1977 (5)	1981 (6)	1986 (7)
1	73.8	0.02	73.2	92.4	96.3	111.6	130.8
2	28.0	0.01	27.8	35.1	36.5	42.3	49.6
3	72.5	0.02	71.9	90.8	94.6	109.6	128.5
4	0.0	0.00	0.0	0.0	0.0	0.0	0.0
5	0.0	0.00	0.0	0.0	0.0	0.0	0.0
6	34.7	0.01	34.4	43.5	45.3	52.5	61.5
7	97.8	0.02	97.0	122.5	127.6	147.9	173.3
8	61.5	0.02	61.0	77.0	80.2	93.0	109.0
9	295.3	0.07	293.0	369.8	385.1	446.6	523.3
10	0.0	0.00	0.0	0.0	0.0	0.0	0.0
11	311.6	0.08	309.2	390.2	406.4	471.2	552.2
12	91.4	0.02	90.7	114.5	119.2	138.2	162.0
13	1.6		1.6	2.0	2.1	2.4	2.8
14	0.0	0.00	0.0	0.0	0.0	0.0	0.0
15	0.8	0.00	0.8	1.0	1.0	1.2	1.4
16	46.0	0.01	45.6	57.6	60.0	69.6	81.5
17	4.6		4.6	5.8	6.0	7.0	8.2
Subtotal	1,119.6	0.28	1,111.0	1,402.0	1,460.2	1,693.1	1,984.1
Other[b]	403,256.4	98.72	400,158.8	504.982.1	512,257.7	609,805.2	709,628.5
Total[c]	404,376.0	100.00	401,269.8	506,384.1	527,406.9	611,498.3	716,612.6

[a]Sector number refers to Table 4.27.

TABLE 4.34

Continued

[b]Other expenditures include wage payments, other payments and transfer payments to Local Governments.

[c]Total Federal and Provincial expenditure for each target year is projected from the following regression.

$$TFG_t = \underset{(9.6483)^{**}}{134{,}018.3} + \underset{(8.1473)^{**}}{21022.9t} \qquad R^2 = 0.9432$$

Where TFG_t is total Federal and Provincial Government expenditure and t is time with t=1 at 1961. The values in the parentheses are "t" values which are both significant at one percent level.

Accordingly, current local public expenditure decision processes can logically be divided into two parts, namely current operating and maintenance (or simply called basic), and new expenditures. The theoretical proposition is based on this classification since it meets the practical processes of local government expenditure decisions. The following assumptions are made to formulate the theoretical framework for empirical testing:

(a) Tax payers reveal their true preferences.

(b) Local public goods and services are not used to redistribute income.

(c) Local government decisions take into account all local preferences but none from outside the community and maximize individual as well as community utility.

Basically, the current basic local public expenditures are determined by the previous expenditures, by function or category, because previous expenditures (usually in terms of per capita) influence current basic expenditures in two ways. The previous expenditures help to commit a certain level of taxes and aid from other governments. Previous expenditures by category also influence current basic expenditures through the formal procedures of appropriation.[54] More specifically, previous expenditures determine current basic expenditures for the following two reasons:

(a) If previous expenditures are determined under Pareto optimal

---

[54]Sharkansky, Ira, "Some More Thoughts About the Determination of Government Expenditures", National Tax Journal, Vol. 20, No. 1 (March, 1967), pp. 171-179.

conditions and local government attempts to maintain such conditions in the current year, then the current basic expenditure is determined from previous expenditures by adjusting for factor price changes.

(b) Although the previous expenditures were determined under the condition of maximizing the community's utility, the performance of the expenditures over a year may indicate that the objective of maximizing the community's utility has not been achieved yet. Therefore, some adjustments may be required in order to achieve the objective. Under this situation, the adjustment of current basic expenditure is also based on the previous expenditure since that expenditure reveals the performance of such services.

Public goods, according to Head, possess the characteristics of jointness.[55] Jointness, according to Head, means that a good which is all consumed in common but for which the level of individual utility depends not only on the level of output of the good, but also on the size of the community consuming that output. Therefore, the output of local public goods is typically characterized by the cost of providing a certain level of quality and quantity of those goods.[56] Accordingly, local administrators who want to supply their community with a certain

---

[55]Head, John G., "Public Goods and Public Policy", Public Finance, Vol. 17, No. 3 (1962), pp. 197-219.

[56]Hirsch, Werner Z., "The Supply of Urban Public Services", in Perloff, Harvey S. and L. Wingo (eds), Issues in Urban Economics: Part III. (Baltimore: The Johns Hopkins Press, 1968), p. 480.

level of output of public goods need a method of evaluating the cost level. This evaluation should be in terms of satisfaction or utility for the community.[57] Therefore, Samuelson[58] and Musgrave's[59] formulation of the efficient output of public goods and services framework can theoretically be employed to support an alternative method of measuring the output of local public goods and services. They have shown that the output of public goods can be expanded to the point where the sum of individual marginal rates of substitution (MRS) for the goods equal marginal costs in which Pareto efficiency is achieved.

Since the local public goods are defined by Head's concept, the utility function of the i^{th} person in the community can be expressed as:

$$U_i = U_i \; (XY_i, \; XP_i) \qquad (4.17)$$

where XY_i = Pure private good, and

XP_i = the value of the local public good consumed by the i^{th} person.

The amount of local public good consumed by the i^{th} person (XP_i) however, depends upon its total amount of public good produced (XP), quality of the output (QU) and upon the size of population or user (TP) in the community. Protection, for example, XP represents the total services provided by a certain number of policemen in the community. QU

---

[57]Hoffman, Ronald F., "A Systematic Approach to a Practicable Plan for State Aid to Local Governments", Public Finance, Vol. 24, No. 1 (1969) pp. 1-28.

[58]Samuelson, Paul W., "The Pure Theory of Public Expenditure", Review of Economics and Statistics, Vol. 36 (Nov. 1954), pp. 387-89.

[59]Musgrave, Richard A., The Theory of Public Finance (New York: McGraw-Hill Book Company, 1959).

is the quality of the service of the policemen, and TP is the population size in the community. Hence,

$$XP_i = F_i\ (XP,\ QU,\ TP) \qquad (4.18)$$

Subject to the following first order conditions: $\frac{\partial XP_i}{\partial QU} > 0$ and $\frac{\partial XP_i}{\partial TP} < 0$.

Equation (4.18) implies that the classification of the scale characteristics of plant costs in the provision of the local public goods and services are relevant.[60] It follows that XP depends upon the cost of providing such local public goods and services (TC) given the level of QU and TP. Thus, equation (4.18) reduces to:

$$XP_i = F_i\ (TC:\ QU,\ TP) \qquad (4.19)$$

The optimal level of output of such local public goods that the i^{th} person will consume is determined by taking the partial derivative of equation (4.19) with respect to TC, holding QU and TP constant and equals the price that he pays, i.e.,

$$\frac{\partial XP_i}{\partial TC} = (MC:\ QU,\ TP) = P_{xi} \qquad (4.20)$$

Then the pareto optimal output of such local public goods in the community is the sum of equations (4.20)

$$\sum_{i=1}^{N} P_{xi} = \sum_{i=1}^{N} (MC:\ QU,\ TP) \qquad (4.21)$$

Assuming that each individual's MRS equals his share of the marginal

---

[60]Hirsch, Werner A., "Expenditure Implications on Metropolitan Growth and Consolidation", The Review of Economics and Statistics, Vol. 41 (August), 1959) pp. 333-339.

cost of XP (i.e., $P_{x1} = P_{x2} = \ldots P_{xi} = P_x$) then equation (4.21) can simply be represented by

$$P_x = \sum_{i=1}^{N} (MC\colon QU,\ TP) \tag{4.21}$$

This result implies that the price of a local public good is not simply equal to its marginal cost. It means that total cost of providing XP is somewhat dependent upon the level of TP and QU. However, the quality of service QU is very difficult to measure. It is hypothesized that the new local public expenditure is a function of population size, holding QU constant.

However, local government accounts do not provide sufficient information enabling us to distinquish new from basic expenditure in general. But both basic and new local public expenditures constitute current public expenditures by category. Hence, the hypothesized model to estimate local public expenditure is

$$TLG_{\ell t} = T_{\ell t} + \phi_{\ell t}\, TLG_{\ell t-1} + P_{\ell}\, TP_t\colon \ \ell=1, \ldots, 7 \tag{4.22}$$

where $TLG_{\ell t}$ = local public expenditure by ℓ^{th} function in year t,

$TLG_{\ell t-1}$ = previous local public expenditure by the ℓ^{th} function, and

TP_t = the community's population size in year t.

The hypothesized local government expenditure functions (4.22) were empirically tested using a total of 150 rural and urban municipalities in Manitoba in 1970 and 1971 as a set of cross-section data. The regression results are shown in Table (4.35). The lagged expenditure variable, $TLG_{\ell t-1}$ is significant at the one percent level in all cases. Except for a few cases, the population variable, TP_t is also significant

TABLE 4.35

ESTIMATED REGRESSION COEFFICIENTS OF LOCAL GOVERNMENT EXPENDITURE[a], LINEAR FORM, MANITOBA

Expenditure By Function	Constant (g.)	Population (po)	Lagged Expenditure (GE_{t-1})	R^2
Administration	1,25473	0.00424	0.77840	0.9539
	(0.5856)	(8.3879)**	(18.6453)**	
Public Work	3,26584	0.00539	0.87034	0.8630
	(0.5807)	(4.3090)**	(19.4243)**	
Protection	-1.20336	0.00023	1,11698	0.9621
	(0.9376)	(0.6026)	(41,1465)**	
Public Health & Welfare	-0.07056	0.00124	0.65899	0.8183
	(0.0659)	(4.0947)**	(12.0529)**	
Recreation & Cultural Facilities	-0.00020	-0.00046	1.49324	0.8955
	(0.00012	(1.0013)	(26.8212)**	
Environmental Health	0.59648	-0.00006	0.92150	0.9589
	(1.8034)*	(0.5694)	(43.3203)**	
Other Expenditure	-29.22717	0.00527	1.19616	0.9366
	(0.9484)	(0.6239)	(43.8426)**	
Total Current Expenditure	-10.16648	0.02307	0.92550	0.9784
	(0.6212)	(5.3419)**	(31.7806)**	

[a]The values in parentheses are the t-values of the regression coefficients.

*Significant at the five percent level for a two-tailed test.

**Significant at the one percent level for a two-tailed test.

Source: The data used to estimate these regression coefficients are obtained from: Urban Development and Municipal Affairs, Statistical Information Respecting the Municipalities of the Province of Manitoba and The Metropolitan Corporation of Greater Winnipeg (Winnipeg: Urban Development and Municipal Affairs, 1970 and 1971).

at one percent level. The R^2s' are in all cases greater than 0.80. Accordingly, these local government expenditure functions are employed to project total local government expenditures by category for each target year, in order to derive local government expenditures for each of the 17 sectors.

Projection of Local Government Expenditure for the 17 Sectors

Government Expenditure Survey data summarized in Table (4.36) indicates that local government expenditure for purchasing locally produced products is different in categories. For example, 66 percent of health and welfare expenditure in 1968 was spent on purchasing goods and services from the 17 producing sectors, while other types of expenditure accounted for only 6 percent (subtotal row of Table 4.37). In addition, the distribution of local government expenditure within the 17 producing sectors is different between categories. Health and Welfare represent 43% of total expenditure in the food store sector (sector No. 10) but none of the other types of expenditure represent purchase of goods and services from sector 10 except protection. Therefore, the procedures to project local government expenditure by sector are based on individual categories following the steps described below.

First, total government expenditures by category for each target year are estimated using the local government expenditure functions. Then the projected results are deflated to 1968 dollars since current prices for 1970 were used to estimate local government expenditure functions.[61]

---

[61] The Consumer Price Index is used to deflate the price difference between 1970 and 1968 which is estimated to be 8%. Each target year's population employed in this step is based on the results summarized in Table (4.31).

TABLE 4.36

BASE YEAR LOCAL GOVERNMENT EXPENDITURES BY SECTOR AND BY CATEGORY, INTERLAKE AREA, 1968[a]

(' 000 1968 dollars)

Sector Number[b] (1)	Administration (2)	Public Work (3)	Protection (4)	Health & Welfare (5)	Recreation & Culture (6)	Environ. Health (7)	Other[c] Expenditures (8)	Total Expenditures (9)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	45.0	0.2	0.0	0.0	0.0	0.0	45.2
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	7.6	3.2	0.0	0.1	0.2	0.1	0.0	11.2
6	0.2	32.1	0.3	0.3	0.0	3.4	0.0	36.3
7	0.6	4.3	0.2	0.0	0.5	0.0	63.5	69.1
8	9.7	93.2	3.2	4.2	2.0	5.5	0.0	117.8
9	0.0	34.1	0.0	0.0	0.0	0.0	32.1	66.2
10	0.0	0.0	2.5	109.1	0.0	0.0	0.0	111.6
11	61.7	49.5	11.6	7.9	9.6	8.4	5.2	153.9
12	58.0	557.6	19.0	25.0	12.1	33.3	0.0	705.0
13	33.3	0.0	0.0	0.0	0.0	0.0	0.0	33.3
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.6	0.1	0.0	0.2	0.1	0.4	0.1	1.5
16	58.2	5.0	3.6	20.0	11.6	41.5	6.9	146.8
17	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.5
Subtotal	230.1	824.1	40.6	166.9	36.1	92.8	107.8	1,498.4
Wage pay	250.4	425.8	216.9	7.9	72.5	133.5	0.0	1,107.0
Other pay	292.8	490.4	123.7	79.0	65.4	126.6	1,471.5	2,649.4
Total	773.3	1,740.3	381.2	253.8	174.0	352.9	1,578.3	5,254.8

[a]The allocation of local government expenditure by function to each sector was

TABLE 4.36

Continued

compiled by Mr. Paul Molgat, based on a government expenditure survey conducted by Dr. MacMillan, Department of Agricultural Economics, University of Manitoba in 1969.

[b]Sector number refers to Table(4.27).

[c]Other expenditures include capital expenditure and other expenditures such as debt charges, education, other governments and appropriation to own funds.

Source: Government expenditure survey data.

TABLE 4.37

DISTRIBUTION OF LOCAL GOVERNMENT EXPENDITURES BY SECTOR AND BY CATEGORY, INTERLAKE AREA, 1968

Sector Number[a] (1)	Adminis-tration (2)	Public Work (3)	Protec-tion (4)	Health & Welfare (5)	Recreation & Culture (6)	Environ. Health (7)	Other Expen-ditures (8)	Total Expen-ditures (9)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0259	0.0005	0.0	0.0	0.0	0.0	0.0086
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0098	0.0018	0.0	0.0004	0.0011	0.0003	0.0	0.0021
6	0.0003	0.0184	0.0008	0.0012	0.0	0.0096	0.0	0.0069
7	0.0008	0.0025	0.0005	0.0	0.0029	0.0	0.0402	0.0131
8	0.0125	0.0536	0.0084	0.0165	0.0115	0.0156	0.0	0.0224
9	0.0	0.0196	0.0	0.0	0.0	0.0	0.0203	0.0126
10	0.0	0.0	0.0066	0.4299	0.0	0.0	0.0	0.0212
11	0.0798	0.0284	0.0304	0.0311	0.0552	0.0238	0.0033	0.0293
12	0.0750	0.3204	0.0498	0.0985	0.0695	0.0944	0.0	0.1342
13	0.0431	0.0	0.0	0.0	0.0	0.0	0.0	0.0063
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0008	0.0001	0.0	0.0008	0.0006	0.0011	0.0001	0.0003
16	0.0753	0.0029	0.0094	0.0788	0.0667	0.1176	0.0044	0.0279
17	0.0003	0.0	0.0	0.0004	0.0	0.0006	0.0	0.0001
Subtotal	0.2976	0.4735	0.1065	0.6576	0.2075	0.2630	0.0683	0.2851
Wage pay	0.3238	0.2447	0.5690	0.0311	0.4167	0.3783	0.0	0.2107
Other Pay	0.3786	0.2818	0.3245	0.3113	0.3759	0.3587	0.9317	0.5042
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

[a]Sector number refers to Table 4.27

Source: Estimated from Table (4.36).

Second, it is assumed that the distributions of local government expenditure by category (via Table 4.37) remain constant through the studied periods. Then, the local government expenditures by 17 secotrs for each category in each target year are obtained by multiplying each category's estimated total local government expenditures from step one by the corresponding category's base year distribution. These results are presented in columns (2) to (8) of each table from Tables (4.38) to (4.42). Third, total local government expenditures by sector are obtained by summing up across each category (from columns (2) to (8)) for each sector in each target year.

From the estimated results, as shown in Tables (4.38) to (4.42), it is observed that local government expenditures will decrease slightly over time in terms of 1968 dollars in the Interlake mainly due to the reduction of population in the area.

Summary of the Projected Total Governments Expenditure for 17 Sectors The projected total governments expenditure for 17 sectors are summarized in Table (4.43). They are the sum of projected Federal and Provincial Governments, and Local Government expenditures for each sector for each target year. In spite of reduction in Local Government expenditure, total governments expenditures are expected to increase in the future since Federal and Provincial Governments will increase their expenditures rapidly through their revenue powers. However, a high proportion of increased total governments expenditures are concentrated on retail sectors. Total governments' expenditures on agricultural sectors are expected to increase 100 percent from the base year to 1986 but its share of total expenditure is relatively small.

TABLE 4.38

PROJECTED LOCAL GOVERNMENT EXPENDITURES BY SECTOR AND BY CATEGORY, INTERLAKE AREA, 1971

(Unit: ' 000 1968 dollars)

Sector Number[a] (1)	Administration (2)	Public Work (3)	Protection (4)	Health & Welfare (5)	Recreation & Culture (6)	Environ. Health (7)	Other Expenditures (8)	Total Expenditures (9)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	42.6	0.2	0.0	0.0	0.0	0.0	42.8
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	7.4	3.0	0.0	0.1	0.3	0.1	0.0	10.8
6	0.2	30.4	0.3	0.3	0.0	2.9	0.0	34.0
7	0.6	4.1	0.2	0.0	0.6	0.0	104.5	110.0
8	9.4	88.3	3.4	3.5	2.5	4.6	0.0	111.7
9	0.0	32.3	0.0	0.0	0.0	0.0	52.8	85.1
10	0.0	0.0	2.6	91.0	0.0	0.0	0.0	93.6
11	60.1	46.9	12.2	6.6	12.0	7.1	6.7	151.5
12	56.5	528.0	20.0	20.8	15.1	28.0	0.0	668.4
13	32.4	0.0	0.0	0.0	0.0	0.0	0.0	32.4
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.6	0.1	0.0	0.2	0.1	0.3	0.1	1.4
16	56.6	4.7	3.8	16.7	14.5	34.9	8.9	140.2
17	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.4
Subtotal	224.0	780.3	42.7	139.2	45.1	78.1	173.0	1,482.5
Wage pay	243.7	403.2	228.4	6.6	90.7	112.3	0.0	1,084.9
Other pay	285.0	464.4	130.2	65.9	81.8	106.5	2,002.7	3,136.6
Total	752.7	1,647.9	401.3	211.6	217.6	296.9	2,175.8	5,703.9

[a]Sector number refers to Table(4.27).

TABLE 4.39

PROJECTED LOCAL GOVERNMENT EXPENDITURES BY SECTOR AND BY CATEGORY, INTERLAKE AREA, 1976

(Unit: ' 000 1968 dollars)

Sector Number[a] (1)	Administration (2)	Public Work (3)	Protection (4)	Health & Welfare (5)	Recreation & Culture (6)	Environ. Health (7)	Other Expenditures (8)	Total Expenditures (9)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	42.3	0.2	0.0	0.0	0.0	0.0	42.5
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	7.3	3.0	0.0	0.1	0.3	0.1	0.0	10.7
6	0.2	30.2	0.3	0.2	0.0	2.9	0.0	33.8
7	0.6	4.0	0.2	0.0	0.6	0.0	102.7	108.1
8	9.3	87.6	3.4	3.5	2.5	4.6	0.0	110.9
9	0.0	32.1	0.0	0.0	0.0	0.0	51.9	84.0
10	0.0	0.0	2.6	89.8	0.0	0.0	0.0	92.4
11	59.3	46.5	12.2	6.5	12.1	7.1	6.6	150.3
12	55.8	524.2	20.0	20.6	15.2	28.0	0.0	663.7
13	32.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.6	0.1	0.0	0.2	0.1	0.3	0.1	1.4
16	55.9	4.7	3.8	16.5	14.6	34.9	8.8	139.2
17	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.4
Subtotal	221.2	774.7	42.7	137.4	45.4	78.1	170.2	1,469.6
Wage pay	240.7	400.3	228.1	6.5	91.1	112.4	0.0	1,079.0
Other pay	281.5	461.0	130.1	65.0	82.2	106.6	1,982.5	3,108.8
Total	743.4	1,636.0	400.8	208.9	218.6	297.1	2,152.7	5,657.5

[a] Sector number refers to Table(4.27).

TABLE 4.40

PROJECTED LOCAL GOVERNMENT EXPENDITURES BY SECTOR AND BY CATEGORY, INTERLAKE AREA, 1977

(Unit: ' 000 1968 dollars)

Sector Number[a] (1)	Administration (2)	Public Work (3)	Protection (4)	Health & Welfare (5)	Recreation & Culture (6)	Environ. Health (7)	Other Expenditures (8)	Total Expenditures (9)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	42.2	0.2	0.0	0.0	0.0	0.0	42.5
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	7.3	3.0	0.0	0.1	0.3	0.1	0.0	10.7
6	0.2	30.1	0.3	0.2	0.0	2.9	0.0	33.8
7	0.6	4.0	0.2	0.0	0.6	0.0	102.3	107.8
8	9.3	87.5	3.4	3.4	2.5	4.6	0.0	110.8
9	0.0	32.0	0.0	0.0	0.0	0.0	51.7	83.7
10	0.0	0.0	2.6	89.6	0.0	0.0	0.0	92.2
11	59.2	46.5	12.2	6.5	12.1	7.1	6.6	150.1
12	55.6	523.5	20.0	20.5	15.2	28.0	0.0	662.9
13	31.9	0.0	0.0	0.0	0.0	0.0	0.0	31.9
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.6	0.1	0.0	0.2	0.1	0.3	0.1	1.4
16	55.8	4.7	3.8	16.4	14.6	34.9	8.8	139.0
17	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.4
Subtotal	220.7	773.7	42.7	137.1	45.4	78.1	169.7	1,467.2
Wage pay	240.2	399.8	228.0	6.5	91.2	112.4	0.0	1,078.0
Other pay	280.8	460.4	130.0	64.9	82.2	106.6	1,978.8	3,103.7
Total	741.7	1,633.9	400.8	208.4	218.8	297.1	2,148.3	5,648.9

[a]Sector number refers to Table(4.27).

TABLE 4.41

PROJECTED LOCAL GOVERNMENT EXPENDITURES BY SECTOR AND BY CATEGORY, INTERLAKE AREA, 1981

(Unit: ' 000 1968 dollars)

Sector Number[a] (1)	Administration (2)	Public Work (3)	Protection (4)	Health & Wealfare (5)	Recreation & Culture (6)	Environ. Health (7)	Other Expenditures (8)	Total Expenditures (9)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	42.0	0.2	0.0	0.0	0.0	0.0	42.2
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	7.2	3.0	0.0	0.1	0.3	0.1	0.0	10.6
6	0.2	30.0	0.3	0.2	0.0	2.9	0.0	33.6
7	0.6	4.0	0.2	0.0	0.6	0.0	101.0	106.4
8	9.2	87.0	3.4	3.4	2.5	4.6	0.0	110.2
9	0.0	31.8	0.0	0.0	0.0	0.0	51.1	82.9
10	0.0	0.0	2.6	88.7	0.0	0.0	0.0	91.4
11	58.6	46.2	12.2	6.4	12.1	7.1	6.6	149.3
12	55.1	520.8	20.0	20.3	15.3	28.0	0.0	659.5
13	31.6	0.0	0.0	0.0	0.0	0.0	0.0	31.6
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.6	0.1	0.0	0.2	0.1	0.3	0.1	1.4
16	55.3	4.7	3.8	16.3	14.6	34.9	8.7	138.4
17	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.4
Subtotal	218.7	769.6	42.6	135.8	45.5	78.1	167.6	1,457.9
Wage pay	238.0	397.7	227.8	6.4	91.5	112.4	0.0	1,073.8
Other pay	278.3	458.0	129.9	64.3	82.5	106.6	1,964.1	3,083.7
Total	734.9	1,625.3	400.4	206.4	219.5	297.2	2,131.6	5,615.4

[a]Sector number refers to Table(4.27).

TABLE 4.42

PROJECTED LOCAL GOVERNMENT EXPENDITURES BY SECTOR AND BY CATEGORY, INTERLAKE AREA, 1986

(Unit: ' 000 1968 dollars)

Sector Number[a] (1)	Adminis-tration (2)	Public Work (3)	Protec-tion (4)	Health & Welfare (5)	Recreation & Culture (6)	Environ. Health (7)	Other Expen-ditures (8)	Total Expen-ditures (9)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	41.8	0.2	0.0	0.0	0.0	0.0	42.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	7.1	3.0	0.0	0.1	0.3	0.1	0.0	10.5
6	0.2	29.8	0.3	0.2	0.0	2.9	0.0	33.4
7	0.6	4.0	0.2	0.0	0.6	0.0	99.5	104.9
8	9.1	86.5	3.4	3.4	2.5	4.6	0.0	109.5
9	0.0	31.7	0.0	0.0	0.0	0.0	50.3	81.9
10.	0.0	0.0	2.6	87.8	0.0	0.0	0.0	90.4
11	58.0	45.9	12.2	6.4	12.2	7.1	6.5	148.3
12	54.5	517.6	19.9	20.1	15.3	28.1	0.0	655.6
13	31.3	0.0	0.0	0.0	0.0	0.0	0.0	31.3
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.6	0.1	0.0	0.2	0.1	0.3	0.1	1.4
16	54.7	4.6	3.8	16.1	14.7	35.0	8.7	137.6
17	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.4
Subtotal	216.4	765.0	42.6	134.3	45.7	78.2	165.2	1,447.2
Wage pay	235.5	395.2	227.6	6.4	91.8	112.5	0.0	1,068.9
Other pay	275.3	455.2	129.8	63.6	82.8	106.7	1,947.2	3,060.6
Total	727.2	1,615.4	400.0	204.2	220.4	297.3	2,112.3	5,576.7

[a]Sector number refers to Table(4.27).

TABLE 4.43

SUMMARY OF BASE YEAR AND PROJECTED TOTAL GOVERNMENT'S EXPENDITURES BY SECTOR FOR THE TARGET YEARS, INTERLAKE AREA

(Unit: $'000 1968 dollars)

Sector Number[a]	Base Year 1968	Projections				
		1971	1976	1977	1981	1986
1	73.8	73.2	92.4	100.1	111.6	130.8
2	28.0	27.8	35.1	38.0	42.3	49.6
3	117.7	114.8	133.3	140.7	151.9	170.5
4	0.0	0.0	0.0	0.0	0.0	0.0
5	11.2	10.8	10.7	10.7	10.6	10.5
6	71.0	68.5	77.2	80.8	86.1	94.9
7	166.9	207.0	230.6	240.1	254.3	278.2
8	179.3	172.7	187.9	194.0	203.2	218.5
9	361.5	378.1	453.7	484.0	529.5	605.3
10	111.6	93.6	92.4	92.0	91.4	90.4
11	465.5	460.7	540.5	572.5	620.5	700.5
12	796.4	759.1	778.2	786.0	797.7	817.5
13	34.9	34.0	34.0	34.0	34.1	34.1
14	0.0	0.0	0.0	0.0	0.0	0.0
15	2.3	2.2	2.4	2.5	2.6	2.8
16	192.8	185.8	196.8	201.3	207.9	219.1
17	5.1	5.0	6.2	6.7	7.4	8.6
Total	2,618.0	2,593.5	2,871.6	2,983.3	3,151.0	3,431.3

[a]Sector number refers to Table (4.27).

Sources: Table (4.36) and Tables (4.38) throughout (4.42).

Governments' expenditures on some sectors (sectors 5, 10 and 13) tends to decline.

Projection of Gross Private Capital Formation

As stated in the preceding chapter, private capital formation is not considered within the model for the static and comparative static simulations. The investment is determined exogenously. An independent projection of private capital formation (investment) for each target year is required for the model simulations. For the projection of gross private capital formation in the static and comparative static simulation models, Almon's "stock adjustment" model is employed as summarized in Table (3.3) Chapter 3 (equation 14).

Since there is no data on capital formation available for the Interlake, Manitoba private investment time-series data from 1950 to 1972 are employed to test the hypothesized gross investment functions (equation 14, Table 3.3). The regression results are presented in Table (4.44). All industries have statistically significant regression co-efficients at the 1 percent level for the lagged investment and the signs are positive as expected. However, change in the lagged gross output variable is not significant even at the 10 percent level for manufacturing and trade, finance and service industries. This indicates that further analysis is required to identify the private investment behaviour for these industries. However, the estimated regression coefficient of change in the lagged gross output variable is relatively small compared with the lagged investment variable and the statistical properties of the function are acceptable for these industries. Therefore, the estimated investment functions are employed to project gross private investment for

TABLE 4.44

ESTIMATED REGRESSION COEFFICIENTS OF INVESTMENT FUNCTIONS BY INDUSTRY, LINEAR FORM, MANITOBA[a]

(Unit: million dollars)

Sector	Constant γ_{jt}	Changes in Lagged Gross Output $(RX_{jt-1} - RX_{jt-2})$ ψ_{jt}	Lagged Investment (KI_{jt-1}) $\tilde{j}$	R^2
Primary Resource and Construction	6.98331 (0.7199)	0.00445 (2.7786)**	0.98661 (17.9641)**	0.9446
Manufacturing	12.48078 (1,1723)	0.00074 (0.2864)	0.84199 (7.4339)**	0.7442
Trade, Finance and Service	8.62291 (1.1146)	0.00057 (0.4334)	0.89144 (8.8644)**	0.8054
Gross Investment of Manitoba	20,30571 (8.8364)	0.01801 (0.9431)	0.94669 (13.6927)**	0.9082

[a]The values in parenthese are the t-values of regression coefficients.

**Significant at the one percent level for a two-tailed t test.

Sources: Investment figures are obtained from: Statistics Canada, Private and Public Investment in Canada, cat. No. 61-504 and gross outputs are obtained from: Premier and Provincial Treasurer, Manitoba Budget Statement and Economic Review, (Winnipeg: Queen's Printer for Manitoba), series from 1950 to 1972.

the target years.

Two assumptions are made in the projections. First, it is assumed that there is no regional differences in private gross investment behaviour in Manitoba. Second, it is further assumed that there is no difference in intra industry investment behaviour (e.g., there is no difference in investment behaviour between agricultural crop and livestock sectors). Given these assumptions, the demand for gross private investment or capital formation for the 17 producing sectors for each target year, ID_{it} is estimated by equation 15 summarized in Table 3.2, Chapter 3. To repeat, that is

$$ID_{it} = \tau_{ji} \cdot \sum_{j=1}^{17} KI_{jt} \tag{4.23}$$

Where $\sum_{j=1}^{17} KI_{jt}$ is the summation of KI_{jt} that is estimated from equation (14), given the levels of $(RX_{jt-1} - RX_{jt-2})$ and KI_{jt-1}; and τ_{ji} is the base year purchasing pattern of capital goods represented in percentage terms. The subscripts i and j represent row sectors and column sectors respectively.

Since gross output by sector is known for 1968 and 1967 the gross investment for 1969 is calculated by

$$ID_{j69} = \gamma_{jt} + \psi_{jt} [RX_{j68} - RX_{j67}] + L_j I_{j68} \tag{4.24}$$

Substituting the estimated ID_{j69} into (4.23), the demand for gross investment by the 17 producing sectors for 1969 is determined. When the model is complete for the simulation the gross output by the 17 producing sectors for 1969 can be obtained. Substitutions of the obtained 1969 and 1968 gross output as well as 1968's investment into (4.24) yield the estimate of gross investment for 1970. Then, equation (4.23) is used again to estimate the demand for capital goods from the 17 producing sectors for 1970. This recursive process is followed to obtain the final projections of demand for private gross capital goods from the 17 producing sectors for each target year associated with the simulation procedures.

Projections of Exports, Inventory Change and Unallocated Final Demand

Due to insufficient information for analyzing the regional export markets, the Manitoba growth rate of output by sector is employed to project the export sales, inventory change and sales to the unallocated sector by Interlake firms as discussed in the preceding Chapter. The first step is to estimate the Manitoba growth rate of output by sector. The estimated annual growth rates of gross output by sector in Manitoba are presented in Table (4.45) and the procedures as well as data employed to estimate such growth rates are summarized in the footnotes of the table.

The estimated annual growth rates of gross output at constant price are then employed to project exports, inventory changes and unallocated final demand for each target year, based on equations (16) to (18) presented in Table (3.3) of the preceding Chapter and the results are summarized in Table (4.46). Total demand for exports inventory change and the unallocated component is projected to increase from $71.9 million dollars in 1968 to $140.2 million dollars in 1986, an increase of 94 percent. Final demand for agricultural products is estimated to increase 127 percent from 1968 to 1986, and the personal service sector is projected to have the highest increases among the 17 producing sectors (mainly sales to tourists).

TABLE 4.45

ESTIMATED ANNUAL GROWTH RATES OF GROSS OUTPUT
BY SECTOR, MANITOBA, 1961-1970

Sector	Annual Growth Rate of Gross Output at Current Price (%)	Annual Growth Rate of Product Price Index (%)	Annual Growth Rate of Gross Output At Constant Price (1968)[f] (%)
1. Ag.-Livestock	6.79[c]	1.56[c]	5.15
2. Ag.-Crop & Other	5.06	1.56	3.45
3. Mining	3.80[b]	1.56	2.21
4. Food & Bev. Mfg.	4.00[a]	1.56	2.40
5. Other Mfg.	4.30	2.50[d]	1.76
6. Transportation	8.04	2.50	5.40
7. Construction	8.50	2.50	5.85
8. Pet. Wholesale	7.00	2.25[e]	4.65
9. Farm Equip. & Bldg. Mat.	7.00	2.25	4.65
10. Food Store	7.00	2.50	4.39
11. Other Retail	7.00	2.50	4.39
12. Auto Product & Services	7.00	2.50	4.39
13. Apparel & Shoes	7.00	2.50	4.39
14. Furniture & Appl.	7.00	2.50	4.39
15. Insurance	7.00	2.50	4.39
16. Personal Service	7.00	2.50	4.39
17. Other Services	7.00	2.50	4.39

[a]Annual growth rates of sectors 4 and 5 are obtained from: MacMillan Lu, Projection and Impact Models, *Op. Cit.*, p. 112.

[b]The data employed to estimate annual growth rates of gross output for mining, construction and other sectors from 8 to 17 are obtained from: Premier and Provincial

TABLE 4.45

Continued

Treasurer, Op. Cit., 1950-1971. Since no information is available for service sectors, it is assumed that their growth rates are same as trade sectors.

[c]The data employed to estimate annual growth rates of gross outputs and price index of agricultural product are obtained from: Manitoba Agricultural Yearbook, Op. Cit., 1961-1970. The growth rates of gross output by sector are estimated first by crop and livestock products and then converted to sectoral base. The conversion is made as 75% of crop and 25% of livestock products are produced in crop sector and 75% of livestock and 25% of crop products are produced in livestock sector. The growth rate is estimated on the basis ofafive-year period average. The average output from 1961-65 as a base period and the average output from 1966-70 as the terminal period.

[d]Based on the experience of inflation in Manitoba during the 60's, the Commission on Targetsfor Economic Development estimated that the inflation rate is at 2 to 3% per year. Accordingly, the growth rate of the price index for non-agricultural sectors except for wholesale sectors (sectors 8 and 9) is assumed to be 2.5% per annum (see: Commission On Targets for Economic Development, Manitoba to 1980, Qinnipeg, Manitoba, Queen's Printer, 1969, p. 5).

[e]The annual growth rate of price index for wholesale sectors are estimated on the basis of general wholesale price index from 1961 to 1971.

[f]Annual growth rate of gross output at constant price is calculated by

$$\text{(f.1)} \quad (1+ GP_i)^t = \left(\frac{1+\Delta CGP_i}{1+\Delta PP_i}\right)^t \quad \text{or} \quad \Delta GP_i = \frac{1+\Delta CGP_i}{1+\Delta PP_i} - 1$$

where ΔGP_i = annual growth rate of the i^{th} sector's gross output at constant price:
ΔPP_i = annual growth rate of price index for the i^{th} sector;
ΔCGP_i = annual growth rate of the i^{th} sector's gross output at current price; and
t = the periods from the base year to current year.

TABLE 4.45

Continued

Equation (f.1) is derived from the following procedures: Let Y_{oi} and Y_{ti} be the values of the i^{th} sector's gross output for the base year and current year t respectively; Q_{oi} and Q_{ti} be the quantities of the i^{th} sector's gross output for base and current year t; and P_{oi} and P_{ti} be the base year and current year's price indices for sector i, the values of gross output for both periods are estimated as:

(f.2) $Y_{oi} = Q_{oi} P_{oi}$

(f.3) $Y_{ti} = Q_{ti} P_{ti}$

By applying the growth rate concept, the value of gross output for current year is:

(f.4) $(1=\Delta CGP_i)^t Y_{oi} = (1+\Delta GP_i)^t Q_{oi} \times (1+\Delta PP_i)^t P_{oi}$

Hence, (f.5) $(1+\Delta CGP_i)^t = (1+\Delta GP_i)^t (1+\Delta PP_i)^t$

rearranging the terms of (f.5), we obtain (f.1).

TABLE 4.46

BASE YEAR AND PROJECTED EXPORTS, INVENTORY CHANGES AND UNALLOCATED COMPONENTS OF FINAL DEMAND FOR EACH TARGET YEAR, INTERLAKE AREA

(Unit: ' 000 1968 dollars)

Sector No.[a]	Base Year 1968	Projections				
		1971	1976	1977	1981	1986
1	24,922.2	28.974.3	37,244.2	39,162.2	47,874.4	61,538.7
2	10,916.5	12,085.8	14,319.4	14,813.4	16,965.8	20,101.4
3	845.0	902.3	1,006.5	1,028.7	1,122.7	1,252.4
4	3,729.8	4,004.8	4,509.0	4,617.2	5,076.7	5,715.8
5	21,714.8	22,881.6	24,967.2	25,406.6	27,242.9	29,726.0
6	506.9	593.5	772.1	813.7	1,004.3	1,306.3
7	1,024.5	1,215.0	1,614.5	1,708.9	2,145.3	2,850.6
8	148.7	170.4	213.9	223.9	268.5	337.0
9	225.8	258.8	324.8	333.9	407.7	511.7
10	987.2	1,123.0	1,392.1	1,453.2	1,725.7	2,139.3
11	629.2	715.8	887.3	926.2	1,099.9	1,363.5
12	2,669.4	3,036.6	3,764.3	3,929.5	4,666.3	5,784.6
13	58.2	66.2	82.1	85.7	101.7	126.1
14	32.4	36.9	45.7	47.7	56.6	70.2
15	44.5	50.6	62.8	65.5	77.8	96.4
16	3,080.3	3,469.9	4,301.4	4,490.3	5,332.2	6,610.0
17	325.7	370.5	459.3	479.5	569.4	705.8
Total	71,861.1	79,956.0	95,966.6	99,586.1	115,737.9	140,235.8

[a]Sector numbers refer to Table (4.47.)

Source: Estimation procedures are explained in the text and the base year figures are obtained from Table (4.1).

CHAPTER 5

SIMULATION RESULTS

This Chapter presents a summary of the simulation results, gives an interpretation of the results and points out some of the findings related to the Interlake area's gross output, employment, capital and land requirements with and without resource development programs. Alternative simulation models are first assessed in terms of simulation results and then the highlights of the simulation results without resource development programs are presented and discussed. The discussion of simulation results without resource development programs includes the presentation of simulated gross output, area income, and derived input requirements including manpower, capital and land.

The economic impacts of agricultural resource development programs including (1) drainage, (2) land clearing and demonstration, and (3) farm management training programs, on some selected regional economic development indicators in the Interlake area are simulated and presented in the third section. Finally, each agricultural resource development program is assessed in terms of its economic impacts on economic development indicators that are useful as a guide in selecting alternative programs for achieving objectives specified in the FRED plan.

It should be restated, however, that the results provided in this Chapter are conditional. They are the products of a number of assumptions about the behavior of the Interlake economy: growth of Interlake's population, expenditure and income relation, trends in exports and government expenditures, changes in trade coefficients, and resource and manpower requirement coefficients. Thus, the results presented in this Chapter are of qualified nature. They can be realized only to the extent that the underlying assumptions are fullfilled in the future.

A. Assessment of Alternative Simulation Models

The established goal variables (economic development indicators), gross output, employment, capital and land requirement, area income, factor input utilization rates etc. for the 17 sectors in the Interlake area for each target year projected from alternative projection models are presented in Table (VI.1), Appendix VI. Based on the projection results and comparisons with the historical observations, the dynamic simulation model is preferred to the other two simulation models for the following reasons.

First, the levels of output derived from the comparative static and dynamic simulation models compare closely, except for the capital producing sectors. In the aggregate, the difference between these two simulation models in 1971 is small, 1.4% difference. However, the magnitude of the difference is extended to 6% in 1986. At first glance, difference of that small magnitude in the 1968-1971 period (a period of less than five-years) between the static and dynamic simulation models would scarcely warrant the time effort and cost required to construct and implement a dynamic model. But the difference in the longer period is relatively large. In addition, the differences in individual sectors are relatively large in some cases, particularly for the major capital producing sectors (construction and auto product and service sectors) even in a very short time period. This is because the dynamic model takes into account the inter-sectoral effects of capital transactions as well as the inter-sectoral effects of sales on current account.

Second, the dynamic simulation models yields consistent projections of investment expenditures required to meet forecasted levels of output but the comparative static model underestimates those expenditures. As shown in Table VI.3, Appendix VI, the static and comparative static models underestimate the levels of investment in the area. Furthermore, the estimated investment expenditures are not consistent with the observed and expected patterns. A continuous decrease in investment over time is not consistent since capital intensive production technology is generally observed in Manitoba. The total private investment expenditures in Manitoba increased from $6,584 millions in 1961 to $8,601 millions in 1966 and to $11,275 millions in 1971.[1] The projected investment expenditures from the dynamic model increase over time which is consistent with the fact observed in Manitoba.

Third, the level of output generated from the static simulation model is decreased substantially due to the constraint of labor force and (seemingly) unrealistic assumptions underlying to the model. The factor utilization rates, either for the labor or for the land have not achieved the full utilization levels in the past (See Table VI.1, Appendix VI). The labor utilization rate maintained 90 to 96 percent in

---

[1]Dominion Bureau of Statistics, Private and Public Investment in in Canada, Op. Cit.

the last decade. Similarily, the land utilization rate is maintained at 86 to 91 percent. Such rates of factor input utilization could be maintained even without any government policy interference. The full utilization rates of labor and land projected from the static model are inconsistent with the past development process observed in the Interlake area.

In addition, the assumption of constant trading and factor input requirement coefficients is not consistent with the historically observed facts. As shown in Table (VI.3), Appendix VI, the factor input requirement coefficients in fact do change over time for the major sector, agriculture. The labor and land requirement coefficients decrease from one time period to another due to the structural changes in the agricultural sectors represented by continuous increase the numbers of large size farm and decrease the numbers of small size farm (Table VI.3).

As a result of structural changes in the agricultural sector, the labor requirement coefficients for that sector, in aggregate, have been reduced from 0.4403 in 1961 to 0.1246 in 1971 per thousand 1968 constant dollars (Table VI.3, Appendix VI). The forecasted labor requirement coefficient of 0.1234 for the agricultural sector, in aggregate, in 1971 is very close to the actually observed, 0.1246. The rate of reduction for the labor requirement coefficient in the agricultural sector was estimated to be 72 percent during the period of 1961-1971, but a 49 percent of reduction is projected for the period of 1971-1981. The lower rate of reduction for the labor requirement coefficient in agricultural sector for the next decade as compared with the last decade is as expected because the rate of increase the farm size associated with the mechanization process is expected to be slower than the last decade.

The projected land requirement coefficient of 0.0344 for the agricultural sector, in aggregate, for 1971 is 26 percent higher than the actually observed, 0.0272 due to the fact that the land productivity changes resulting from the resource development programs such as the drainage and farm management training programs are excluded in the primary input requirement coefficient projection submodel. Considering the land productivity increase, land requirement coefficients decrease resulting from the resource development programs started from 1968. The projected land requirement coefficient could be lower than the present result of 0.0344. The specified primary input requirement coefficient submodel can be used to project changes in the primary input requirement coefficients and that submodel does in fact explain the actual structural changes in agriculture.

The actual changes in trading coefficients are not obtainable from historical data and therefore, a comparison of the projected trading coefficient with actually observed can not be made. Two facts can be used to support change in trading coefficients over time. First, the projected farm numbers by farm size class is comparable to the actually observed. (See farm numbers by sector and by size class presented in Table VI.3, Appendix VI). In aggregate, the projected farm numbers are 1,045, 2,154 and 2,365 respectively for the large, medium and small farm size classes as compared with actually observed of 1,210, 2,682 and 1,675 in 1971. The model underestimates the numbers of large size farm and overestimates the numbers of small size farm because a higher value of capital stock was used in the farm number projection as compared with the actual changes in capital stock (See Table VI.5, Appendix VI). Nevertheless, the error is not large and projection results in the primary input requirement coefficient submodel yield consistent primary input requirement coefficients as shown above. Second, the trading coefficients are in fact different for different farm size class as shown in Table 4.14. Therefore, the trading coefficients can be expected to change as the primary input requirement coefficients due to the continuous shifts in economies of scale. Consequently, the specified submodel for adjusting trading coefficient changes can be employed to project the trade coefficients over time. Under the assumptions of the static simulation model, all trade coefficients and the average productivities of labor, land and of capital are constant over time. These assumptions reduce the livestock output by $5,860 thousand and the crop output by $3,086 thousand in 1976 as compared with dynamic simulation results because of out migration of farm labor force and constant productivities of labor and land assumptions. In fact, these productivities tend to change associated with the out migration of the farm labor force.[2] Consequently, the static simulation model substantially underestimates the levels of realized gross output for the region in the longer period. However, the difference is small for the short-run. As shown in Table (VI.1), the differences among three alternative simulation models are very small in 1971. The constraints of primary resource inputs become effective in production beyond 1973 (not shown in the Table but it is shown in computer output).

---

[2]Auer, Op. Cit., Appendix C.

Finally, as stated in the beginning Chapter, one of the objectives of this study is to measure the impacts of agricultural resource development programs. The dynamic simulation model is preferred to the other two models since the dynamic model takes into account the structural changes associated with agricultural resource development programs. The process of structural change in an economy resulting from resource development programs can conceptually be explained by the dynamic development process (induced-accerelator relation as explained in Chapter 3). First, when a resource development program is implemented, there is the creation of capital stocks required by the directly related sectors involved in the program. During the process of capital accumulation by the program in directly related sectors the output of sectors supplying the capital goods will experience an increased demand for their products, other things remaining unchanged. To meet the rising demand they will add to their own capital stocks which will increase the output of other capital-goods sectors whose investment requirements will also increase. After the necessary capital has been accumulated by the directly related sectors, the output of capital-goods producing sectors will fall. This will result in over capacity in the capital-goods producing sectors and hence they will reduce their expenditure for expansion and perhaps for replacement capital. Consequently, the capital-goods producing sectors may change their output discontinuously depending upon the forces of other economic effects associated with the resource development program. Thus, the dynamic simulation model is more appropriate for simulating the impacts of agricultural resource development programs.

Three significant results emerge from the above findings. The first is that despite the levels of output derived from the comparative static and dynamic models compare closely, the Interlake economic development is more likely following the dynamic process and is likely to continue in the future through the investment accelerator relationships represented by capital/output matrix and technological change represented by an increasing proportion of large farm size and reducing the proportion of small farms. Second, the projection results using alternative simulation models are similar if the period of time is about five years. It implies that the static simulation model can appropriately be employed for projection or impact studies when the analysis period is approximately less than 5-years for the Interlake because the simulation results between static and dynamic simulation models are very small. Since the present study period is more than 5-years, the analysis presented in the remaining sections, therefore, are based on the result of dynamic simulation model. Third, the specified submodels for adjusting trading coefficients and primary input requirement coefficients submodels (See Chapter 3) can be employed to project those coefficient changes because these submodels do explain the actual structural changes in agricultural sectors in the Interlake area. The structural changes are predictable through the farm number projection model as specified in Chapter 3.

B. Discussion of Dynamic Projection Results

This section presents and discusses the highlights of the dynamic simulation results without resource development programs. The discussions are mainly based on the established economic development indicators (i.e., goal variables) specified in five target years, 1971, 1976, 1977, 1981 and 1986. These goal variables include output, manpower, capital and land requirements, area income and factor input (labor and land) utilization rates.

Projected Realized Gross Output

Table (5.1) indicates indices (1968 = 100) of realized gross outputs derived from dynamic simulation model and the compound rates of growth from 1971 to 1986. The growth rate for the 1961-70 period is also shown in the table for the purpose of comparison of growth rate in different time periods.

Total realized gross output[3] for the combined 17 sectors is projected to increase (in 1968 dollars) from $147.9 million in 1968 to $213.2 million in 1981 and $248.2 million in 1986 implying a compound growth rate of about 2.81% annually between 1971 and 1986. This growth rate is about 2% less than the growth rate set as a target for Manitoba (5% target).[4] The growth rate[5] for agricultural output is projected to be about 1.6% lower than in the 1960's. Mining and manufacturing sectors, however, maintain the same rate of growth as the 1960's. Trade sectors' growth rates are in general far below the provincial average growth rates.

---

[3]Total realized gross output refers to sum of realized gross output produced by the 17 endogenous sectors.

[4]Report of the Commission on Targets for Economic Development in Manitoba, Op. Cit., p. 6.

[5]All of the growth rates given are based on compound rates, unless otherwise specified.

TABLE 5.1

INDICES AND COMPOUND GROWTH RATES OF REALIZED GROSS OUTPUT (RGO) TO 1986, INTERLAKE AREA[a]

Sector	1986 Indices of RGO, 1968=100	Compared Rate of Growth (%)	
		Growth Rate 1961-70	Projected (1971-86)
1. Ag.-Livestock	188.81	5.15	3.60
2. Ag.-Crop & Other	184.15	3.45	3.40
3. Mining	146.59	2.24	2.20
4. Food & Bev. Mfg.	154.52	2.44	2.45
5. Other Mfg.	137.19	1.80	1.75
6. Transportation	208.21	5.54	4.25
7. Construction	209.31	6.00	4.30
8. Pet. Wholesale	196.76	5.54	3.90
9. Farm Equip. & Bldg. Material	211.60	4.50	4.25
10. Food Store	135.47	4.50	1.30
11. Other Retail	136.07	4.50	1.75
12. Auto Product & Service	155.41	4.50	2.50
13. Apparel & Shoes	169.18	4.50	3.00
14. Furniture & Appl.	197.42	4.50	3.80
15. Insurance	198.97	4.50	3.80
16. Personal Service	147.43	4.50	2.25
17. Other Services	151.57	4.50	2.30
Total	167.83		2.90

[a]The projected results are based on the dynamic simulation model.

[b]The growth rates are annual compound growth rates.

Source: Table (VI.1), Appendix VI.

Table (5.2) gives percentage shares of six major groups of sectors in total realized gross output for the base and projection years obtained from the dynamic simulation model as well as annual growth rates for those major group sectors. Agriculture is projected to gain in its relative share of total realized gross output from 30% in 1968 up to 33.5% in 1986. Manufacturing is projected to gradually lose its relative share in total realized gross output from 18 percent in 1968 down to 15 percent in 1986, a net loss of 3 percent. An even larger loss of 3.4 percent appears to take place in the retail group by 1986. Service sectors will remain basically the same through the projection years.

It should be noted that losses in shares for some groups do not necessarily imply absolute reductions in the levels of future outputs. They only indicate that growth in those groups is projected to be at a relatively slower rate than others and hence they occupy a diminishing share in total realized gross output as the regional economy grows from one period of time to the other.

As shown in Table (5.1), also in Table (5.2), substantial differences in growth rates are observed among the growth rates of individual sectors. Agriculture livestock grows 3.6 percent per annum and in crop and other agriculture 3.4 percent is projected. High growth rates are observed throughout non-manufacturing and wholesale sectors. The construction sector with a growth rate of 4.30 percent per annum is followed by transportation with 4.25 percent. The farm equipment and building material sector is projected to have a high growth rate as is

TABLE 5,2

PERCENTAGE SHARES OF MAJOR SECTORS IN TOTAL REALIZED GROSS OUTPUT FOR BASE YEAR (1968) AND PROJECTION YEARS, 1977, 1981 AND 1986, INTERLAKE AREA

Sector[a]	1968		1977		1981		1986		1968-86 Growth Indix 1968=100	1968-86 Annual Growth (Compound) %
	$1,000 of RGO[b]	%	$1,000 of RGO[b]	%	$1,000 of RGO[b]	%	$1,000 of RGO[b]	%		
1. Agriculture	44,515.4	30.10	60,717.0	31.96	69,189.6	32.46	83,006.6	33.45	186.47	3.60
2. Manufacturing	26,479.8	17.91	31,316.9	16.49	33,767.7	15.84	37,111.5	14.95	140.15	2.00
3. Non-Manufacturing	9,768.6	6.61	14,137.6	7.44	16,650.7	7.81	20,426.9	8.23	209.11	4.20
4. Wholesale	15,109.0	10.22	21,570.1	11.35	25,210.7	11.83	30,583.4	12.32	202.42	4.00
5. Retail	41,968.6	28.38	50,490.9	26.58	55,283.4	25.93	62,046.3	25.00	147.84	2.20
6. Service	10,028.9	6.78	11,731.3	6.18	13,072.0	6.13	15,008.4	6.05	149.65	2.25
Total	147,870.3	100.00	189,963.8	100.00	213,174.1	100.00	248,183.1	100.00	167.83	2.90

[a]The major sectors are aggregated from 17 sectors in the following form:

Major Sector	17 Sector
(1) Agriculture	(1), (2), (3)
(2) Manufacturing	(4), (5)
(3) Non-Manufacturing	(6), (7)
(4) Wholesale	(8), (9)
(5) Retail	(10), (11), (12), (13), (14)
(6) Service	(15), (16), (17)

[b]RGO refers to realized gross output by sector

Source: Table (VI.1), Appendix VI.

the construction sector. Among retail trade sectors, the furniture and appliance sector and the auto product and service sector are expected to grow at 3.8 percent, and the other retail sector is projected to have the lowest growth rate among the 17 sectors.

Factors Associated With the Projected Growth

The Interlake economy will produce increasing quantities of goods and services if there is increased demand for these goods and services. Changes in the long-run demand for Interlake products depend primarily on growth in per capita consumption caused by changes in per capita real income. Per capita income is expected to reach $2,964, in constant 1968 dollars, by 1986, an increase of about 100 percent over that in 1968. As income rises, Interlake households generally tend to purchase, in absolute terms more clothing, consumer durable goods and services. Thus, total household expenditure from all 17 sectors is projected to increase from $75.6 million in 1968 to $103 million in 1986 implying a growth rate of about 1.8 percent annually (See Table 4.33 in Chapter 4). In addition to household demand, export demand is also an important factor in determining the growth of the Interlake's economy in the future, particularly for agricultural sectors.

The continuous changes in labor and land productivity are the most important factors determining the growth of the economy predicted for each target year. A given amount of resources will be more productive due to improved machinery and equipment and efficient production methods. Efforts were made in this study to qualify the extent of such structural changes both for intermediate production and primary resource input requirements based mainly on historical trends since 1960 (See Table 4.26, Chapter 4).

The capability of increasing land available for agricultural production will be the most important in realizing the growth in agricultural sectors projected for 1986. The fact observed from simulation models indicated that the land available, projected on the basis of historical trends (See Table 4.30, Chapter 4), will become the first constraining factor in agricultural production in 1976, given the estimated rates of increase in export demands and changes in land productivity. However, it may be that sudden technological advances not foreseen now could accelerate changes in land productivity in the future and the land will not be the limiting factor in agricultural production.

Growth rate differentials among sectors as observed from Table (5.1) as well as Table (5.2) are attributable to several factors. Consumer's tastes and preferences and area population play an important role. As income increases, Interlake households generally will spend more for consumer durable goods and less for food. Decreasing sales of agricultural sectors to households is to a large extent due to low income elasticities and declining area population. The high income elasticity of transportation commodities accounts for the relatively rapid growth projected for the transportation sector.

Another factor causing differential growth rates among sectors is change in the input structure. The input structure of a sector may change, if the sector changes its trade relations. A reduction of import inputs in the agricultural livestock sector, for example, causes relatively higher growth rates in wholesale sectors (sectors 8 and 9) than other sectors.[6] The trend toward capital intensive production methods in all segments of the economy particularly in agricultural sectors is another underlying reason for a relatively high growth rate in wholesale sectors and the construction sector.

Projected Employment

Labor requirements in man-years,[7] for the 17 sectors are projected and summarized in Table VI.1, Appendix VI. The procedures for projecting labor requirements by sector are also presented in that Appendix.

As shown in Table (VI.1), Appendix VI, total employment in the Interlake excluding the government sector and commuters was 10,834 man-years in 1968. Total employment in the 17 endogenous sectors is projected to decrease to about 9 thousand man-years in 1986, indicating decreasing labor requirements of one percent compounded annually between 1968-1986 (Table 5.3). The decrease in labor requirements in production over time is mainly due to the structural changes in agricultural sectors. The agricultural crop sector will require 1,171 man-years of labor to produce $23.1 million output in 1986, a decreasing 4 percent (compound) per annum from 1968-1986. Similarly, the agricultural livestock sector labor requirements will drop from an original level in the base year (4,258 in 1968) to 2,897 man-years in 1981, a decrease of about 40 percent.

---

[6]The import input coefficient for the agricultural livestock sector is predicted to reduce dramatically from 0.2545 in 1968 to 0.2363. On the other hand, the input purchases from farm equipment and building material sector is predicted to increase 1.5% from 0.0647 in the base year to 0.0657 in 1986.

[7]The terms employment and labor requirements are used synonymously in reference to the labor input required for production.

TABLE 5.3

INDICES AND GROWTH RATE OF LABOR REQUIREMENTS
BY 17 SECTORS, INTERLAKE

Sector	Labor Requirement Indices (1968=100)					Growth of Labor Requirement (%) (1985)
	1971	1976	1977	1981	1986	
1. Ag.-Livestock	94.62	79.90	77.29	68.03	60.15	-2.85
2. Ag.-Crop & Other	83.43	68.84	66.42	57.37	48.53	-4.00
3. Mining	105.64	117.90	120.73	131.58	146.67	2.20
4. Food & Bev. Mfg.	104.14	112.58	114.34	121.63	131.59	1.50
5. Other Mfg.	104.54	112.69	114.40	121.47	130.93	1.50
6. Transportation	99.91	100.35	100.44	100.70	101.01	0.15
7. Construction	99.47	99.23	99.13	98.68	98.14	-0.15
8. Pet. Wholesale	102.62	106.75	107.53	110.35	113.56	0.65
9. Farm Equip. & Bldg. Mat.	102.56	108.73	110.01	115.21	122.14	1.13
10. Food Store	101.63	106.15	107.07	110.90	116.11	0.80
11. Other Retail	108.99	111.31	111.76	113.65	116.11	0.80
12. Auto Product & Service	96.62	107.37	109.68	119.37	132.87	1.50
13. Apparel & Shoes	131.67	136.91	137.88	140.41	142.74	2.00
14. Furniture & Appl.	116.33	135.14	138.60	151.97	168.30	2.90
15. Insurance	95.77	103.40	104.53	109.33	113.85	0.75
16. Personal Service	98.95	108.40	110.45	119.24	131.91	1.50
17. Other Services	90.37	104.90	107.83	119.81	135.63	1.75
Intermediate Subtotal	96.29	90.01	89.02	85.76	83.94	-1.00

Source: Table (VI.1), Appendix VI.

The outmigration of labor from agriculture can largely be explained by (1) wage differentials existing between agricultural and non-agricultural sectors and (2) the rapid mechanization process associated with increases in average farm size per farm taking place in farming.[8] Therefore, it is likely that the labor drain in the future from agricultural sectors will be on the part of unskilled farm labor as technological changes calling for skilled and trained agricultural labor force.

In addition, the decrease in labor requirements in the future will not be uniform between agricultural sectors. The crop sector will decrease 4 percent (compound) per year from 1968 to 1986 followed by 2.85 percent for the livestock sector (Table 5.3). The observed decreasing rate differentials between livestock and crop sectors are explained by the nature of farm operations associated with mechanization.

It is observed from the same table that there is a tendency to increase labor requirements in non-agricultural sectors except for the construction sector which will almost maintain the constant level of employment during the projection period. In the manufacturing group the largest employer in non-agricultural sectors, the employment level is projected to increase from the base year of 1,299.6 man-years to 1,578.8 man-years in 1986. A rapid growth in labor requirements is found in the retail trade group. The furniture and appliance sector, for example, will increase its labor requirements 2.9 percent (compound)

---

[8] Other factors to be important in addition in off-farm migration are age, employment opportunities outside agriculture, education, and number of job holdings. See: J.A. MacMillan, F.L. Tung and J.R. Tulloch, Op. Cit.,

per year during the projection period and it is followed by apparel and shoes with 2.0 percent and auto product and service with 1.5 percent. The service group is also expected to increase labor requirements rapidly in relative terms.

Despite rapidly growing labor requirements in non-agricultural sectors, a net decrease of one percent per annum in total employment for the 17 producing sectors is projected, implying that the growth of labor requirements in non-agricultural sectors will not be able to offset the drain of unskilled or skilled agricultural labor from agricultural sectors.

Based on the demographic approach, the estimated labor force including Indian reserves will also decrease over time, from 17,976 man-years in 1968 to 16,310 man-years in 1986 as shown in Table (VI.5), Appendix VI.[9] The projected labor requirements are made comparable, with the projections of labor supply by adding an independent estimate of government employment and an assumed constant commuters to the 17-sector employment totals projected by the dynamic input-output simulation model. It appears that requirements for labor are below the levels of supplies throughout the projection years.[10] The primary reason for this lies with downward trends in labor coefficients as shown in Table (VI.3), Appendix VI. An examination of coefficients in the table (Table VI.3) reveals that the three largest employers, sectors 1, 2 and 5 experienced substantial

[9]The method employed to estimate the supply of labor over time has been discussed in Chapter 4.

[10]See "Factor Input Utilization Rates" portion of Table (VI.1), Appendix VI.

reductions in their labor coefficients. The agricultural livestock sector, for example, has required 0.127 man-years per $1,000 of gross output in 1968 and this will reduce to 0.044 man-years in 1986, a reduction of almost 65 percent within 18 years. Labor coefficients for the agricultural crop and other sector is expected to decline further, from 0.168 to 0.051 during the projection period. Similarly, the labor coefficient for the other manufacturing sector is also expected to decline although the rate of decline is not expected to be as high as the other two sectors. The downward trends in labor coefficients observed in these important sectors associated with the rather small labor requirement in other minor sectors results in a gradual decrease in labor requirements for the 17 producing sectors in the Interlake. Consequently, it is likely that a higher out migration rate could be anticipated in the Interlake if there were no specific government development policies for the area.

Projected Gross Fixed Capital Requirements

This section provides input-output projections of gross fixed capital requirements for the Interlake economy. The projected results are presented in Table (VI.1), Appendix VI.[11] In 1968, the 17 sectors combined have required a total of $20.7 million gross fixed capital for agricultural and non-agricultural uses. This total is projected to reach $52.8 million (in 1968 constant dollars) in 1986, implying an annual compound rate of increase of about 5 percent over the 18-year period.

[11]The procedures employed to project the gross fixed capital requirements are also discussed in Appendix VI.

Total gross output was shown to expand at a 2.9 percent rate (Table 5.1) as compared to a 5 percent rate of increase in total gross fixed capital requirements in the Interlake. Two factors account for the difference in these growth rates: (1) the increase in gross fixed capital coefficients caused by changes in capital intensive production processes in most sectors with particular reference to agricultural sectors; and (2) the low growth rates in gross output for most sectors.

The supply of gross fixed capital is from three different sources, namely, household savings, retained earnings and net foreign investment including partly direct investment by enterprises coming into the area and private and public mortgage lenders from outside of the region. No attempt was made to project the supply of capital in the present study due to data difficulties. However, it was observed in the base year that the gross fixed capital could not be fully provided by domestically generated savings and retained earnings (see Table 4.9). There was about 45% of gross fixed capital formation generated from foreign investment in 1968. Therefore, it is reasonable to conclude that additional capital supply to be financed externally by private and public institutions is needed in order to meet the increase in capital requirements during the projection period.

Projected Land Requirements

One of the objectives in the present study is to analyze the impact of the land clearing program on regional development to be discussed in the next section. Projections of future requirements for land provide the means to assess such a program. This section provides input-output projections of land requirements for the Interlake economy.

The projected land requirements for each target year are summarized in Table (VI.1), Appendix VI.[12] In 1968, the two agricultural sectors combined have required a total of 1,523 thousand acres of land including both good and poor land for agricultural uses. This total is projected to reach 2,301 thousand acres in 1986, an increase of about 51 percent over the 18-year period.

The available land estimated from historical trends discussed in Chapter 4 and summarized in Table (VI.5), Appendix VI indicates that the available land for agricultural uses will increase from 1,687.6 thousand acres in 1968 to 2,349.7 thousand acres in 1986, an increase of about 40 percent over the 18-year period.[13] It appears to be insufficient land to meet the requirements. As a result, land utilization rates are estimated to be greater than 97 percent as compared with 90 percent in the base year. (See the factor input utilization rate portion of Table VI.1). The primary reason for this lies with the downward trend in land coefficients. The compound rates of decline in the land coefficient are estimated to be 0.5 percent and 1.0 percent for livestock and crop sectors respectively. A relatively low rate of growth in average land productivities were observed[14] in the historical trends. Moreover, it is

---

[12]The procedures for estimating land requirements are summarized in Appendix VI.

[13]This rate of increase projected in terms of historical trend could overestimate the available land for agricultural uses if crown and other land is limit. However, in view of a high portion of uncultivated land existing in the Northern Interlake, the estimated available land for agricultural uses is plausible.

[14]The Commission on Targets for Economic Development in Manitoba reports that the land productivity in Manitoba could be doubled from 1966 to 1980. See: Manitoba to 1980, Op. Cit., p. 61. This implies that the estimated land productivity changes in the Interlake employed in the present study to adjust land coefficient changes over time are somewhat lower than the provincial average.

also possible that the capability of expansion of arable land is not high enough implying that there is a need for government policy to expand land supply or to ration the available supply between sectors.

Projected Area Income

Total area income projection procedures are discussed in Appendix VI and the projected results are presented in Table (VI.1) in the same Appendix.

As shown in the table (Table VI.1), total area income is projected to increase from $75 million in 1968 to $126.7 million (in 1968 constant dollars) in 1986, an increase of 3 percent (compound) per annum. Wage and salary income is projected to increase to $76.8 million in 1986 as compared to $44.8 million in 1968 (the sum of household income and government wage payments).

The values of the two major components of area income, namely farm income and non-farm income in total area income for base and the projection years are also given in Table (VI.1). It appears that farm income accounts for less than 30 percent of total area income. However, the share of farm income to total area income is expected to increase slightly over time. The combined effect of labor force shifts and increasing productivities in the agricultural sector results in the agricultural share increasing faster than non-agricultural sectors in the Interlake area.

The projected personal income for the Interlake is presented in Table (5.4). It should be noted that not all sources of personal income can be projected from the dynamic simulation model. The simulation model derives about 60 percent of personal income only and 40 percent is to be derived independently. The methods of deriving personal income are explained

TABLE 5.4

BASE YEAR AND PROJECTED PERSONAL INCOME FOR THE TARGET YEARS, INTERLAKE AREA

(Unit: ',000 1968 Dollars)

Sources of Personal Income	Base Year 1968	Projections 1971	1976	1977	1981	1986
1. Household Income From 17 Producing Sectors	32,058.6	34,862.3	40,170.8	44,316.6	46,354.0	54,046.6
2. Government Wage Payment	12,722.8	13,241.4	16,405.6	17,038.5	19,570.3	22,735.5
3. Rental, Interest, Dividend Income	10,595.8	11,482.7	13,230.8	13,610.9	15,273.9	17,782.3
4. Government Transfer Payment[a]	9,208.3	10,286.1	12,980.6	13,519.4	15,675.0	18,369.5
5. Non-Local Earnings[b]	9,925.3	10,793.4	12,436.9	12,791.6	14,351.2	16,732.8
Total Personal Income (1-5)	74,510.3	80,665.9	95,224.7	98,277.0	111,224.4	129,666.7
Per Capita Personal Income (Interlake)[c]	1.4995	1.5911	1.9711	2.0530	2.4105	2.9368
Per Capita Personal Income (Manitoba)	2.5980	3.0739	-	-	-	-

[a]Government transfer payment which excludes specific program payments (Such as manpower program) is projected by multiplying the base year percentage of transfer payment to total government expenditure by the projected total government expenditure as specified in Chapter 4.

[b]Non-local earnings received by Interlake residents are projected by multiplying the ratio of non-local to local earnings in the base year by the projected local earnings in each target year.

[c]Estimated total population in the Interlake is shown in Table (4.31), Chapter 4.

[d]Per capita personal income for Manitoba has been adjusted to 1968 constant dollars and is obtained from: Manitoba Budget, _Op_. _Cit_., 1973.

in the footnotes of the table. Personal income is projected to increase from $74.5 million in 1968 to $129.7 million in 1986, an increase at 3.1 percent (compound) per annum.

The per annum growth rate of each income component is particularily interesting. Government transfer payments with a growth rate of 4.0 percent per annum is followed by government wage payments with 3.25 percent and non-local earnings with 3.0 percent. The household income from the 17 producing sectors and rental and interest earning have the lowest rate, 2.9 percent. One implication of this result is that the increases of personal income in the Interlake in the future will be mainly due to the growth of transfer payments and government activities in the area.

Per capita personal income is often employed to indicate the economic well-being in an area. As shown in the last two rows of Table (5.4), the projected per capita personal income in the Interlake is expected to reach 2,937 dollars in 1986 from 1,500 dollars in 1968. The results are compared with Manitoba's personal income per capita. The Interlake is far below Manitoba's level of per capita personal income. However, the projection shows that the gap will remain the same in the future since the growth rates of personal income per capita for both are quite similar (3.6% for Interlake and 3.5% for Manitoba).[15]

C. Discussion of the Dynamic Impact Simulation Results

<u>The Scope</u>

---

[15] The growth rate of 3.5% per year was projected by the Commission on Targets for Economic Development. See: Manitoba to 1980, <u>Op</u>. <u>Cit</u>., p. 10.

As stated earlier, one of the purposes of this study is to measure the economic impacts of agricultural resource development programs on some selected regional economic development indicators in the Interlake area using the developed simulation models. The agricultural resource development programs to be simulated in the present study are: (1) drainage programs, (2) land clearing and demonstration programs, and (3) farm management training programs. The nature and the basic objective of each program are briefly discussed in the related portion of the next section as well as in Appendix IV.

The procedure used for this analysis is based on actual government expenditures invested in each agricultural resource development program listed above from 1968 through 1973. It should be noted that 1973 is the terminal year for each agricultural resource development programs except for the farm management training program. Separate runs are made for each program to determine the impacts of the actual investment on regional economic development indicators. The impacts of that investment are measured in terms of: (1) gross output, (2) income, (3) new employment and (4) government tax revenues from 1969 through 1977, the termination year of FRED plan.

Agricultural resource development programs proposed in the FRED plan are expected to have the effect of changing regional agricultural production. These changes occur because the quantity and quality of resource base (either land, agricultural labor force or both) available for agricultural production are altered by the program. In some cases, the agricultural commodity mix may change with the production of some crops increasing and other decreasing. The likely changes in agricultural production for individual programs are identified with specific procedures detailed in Appendix IV. After the changes in value of agricultural output are determined, the total impacts on the economic indicators for the area are estimated by the developed simulation model discussed in Chapter 3.

Most impact studies ignore the time staging of the development of additional new activities. In fact, a program stimulates structural change in an economy to affect output levels over a period of time. Therefore, the static model in either an open or closed system is not adequate when impacts of a program occur over a long period. Accordingly, the dynamic model is used to measure the impacts of each agricultural resource development program on each regional economic development indicator specified above in the Interlake area. Actually, the incidence of the impacts is not limited to the regional level. The impacts can be determined at three geographical levels - national, regional (Interlake), and subregional. Province-wide effects can be analyzed in terms of changes in imports and exports to the rest of Manitoba. Since the main objectives of agricultural resource development programs as discussed in Chapter 1 is to increase the level of income and the standard of living of the people residing in the area, this study only measures the impacts of such programs at the regional level.

Estimated Direct Effects of Agricultural Resource Development Programs

This section provides a summary of the estimated results, gives interpretation of the results of direct effects of each agricultural resource development programs. Detailed procedures including data sources used for estimates of direct effects and estimated results of each agricultural resource development programs are presented in Appendix IV.

As defined in Chapter 3, direct effects measure economic activity generated directly in the related sectors associated with the program. Thus, direct effects conceptually include three aspects: (1) direct effects associated with the actual program expenditure invested in the program either incurred by beneficiary or by government; (2) direct effects associated with the increases in production in the directly related sectors due to the program; and (3) direct effects associated with increase in the directly related sectors' household consumption due to increase in income generated from program expenditure and increase in production. However, the estimation procedures to measure these three aspects of direct effects in general differ for each program, depending upon the nature of the program.

Drainage Program The FRED plan includes manpower retraining, education, fisheries adjustment, the construction of highway and recreational facilities, drainage improvement and land clearing programs during the period 1967-68 to 1976-77. Of the $85 million to be invested in the Interlake over the ten-year agreement, about $7 million was designated for a number of drainage projects in the area. The drainage systems listed in the FRED agreement include: Long Lake, Upper Grassmere and Sturgeon Creek in the south end of the region, Boundary Drain and the Icelandic River in the center and Birch Creek Drain and the Fisher River in the northern half.[16] All these drainage systems were to be completed by 1973. The objectives of the drainage program are to provide a program that will adjust the operation of the agricultural sectors and assist in

[16] Canada Department of Forestry and Rural Development, Interlake Area of Manitoba: Federal-Provincial Rural Development Agreement, Op. Cit.,

increasing income and employment in the area.

One of the features of the drainage program is that it converts unarable land to arable land for agricultural production. Both quantity and quality of agricultural land are expected to increase through the drainage program. Thus, agricultural output tends to increase. Another feature of the program is that the conversion of unarable land to arable land is accumulated through the period of implementation of the program.

Given the features of the drainage program, the direct effects associated with the program include three aspects. First, the drainage expenditure can be considered as autonomous expenditures to the area economy. Thus, it will have a direct effect increasing the area's output for the related sectors through the additional demand for goods and services resulting from drainage expenditure. However, this type of direct effect does not have the feature of accumulation. When the program is terminated the direct effect associated with drainage expenditure is also terminated. Second, the reclaimed land resulting from the drainage system leads directly to increased agricultural production through three effects: a reclamation effect, a flooding effect and a productivity effect. This part of direct effect associated with the drainage program is accumulated over the implementation period since the drainage systems are designed to be completed in different time periods. Third, there is an induced farm household consumption effect associated with the drainage program through increases in net farm income and program expenditures. Data sources and methods employed to estimate these three aspects of direct effects associated with the drainage program are explained in Appendix IV and the results are summarized in Table IV.18 of the same Appendix.

Most of the direct changes in total output resulting from the drainage program are concentrated in agricultural sectors, non-manufacturing sectors and retail sectors. The direct effect associated with drainage expenditure terminated in 1973. However, the total direct effects are not reduced very much (5,766.5 thousand dollars in 1973 and 5,504.4 thousand in 1974) indicating that the accumulated direct effects resulting from increases in productivity and farm household consumption could compensate the losses of the first effect (the direct effect associated with drainage expenditure).

Land Clearing and Demonstration Program The land clearing and demonstration program is designed to assist farmers to expand cultivated acreage in order to increase agricultural production and farm income in the area. Under the FRED Agreement, an incentive grant of $4 per acre is paid to farmers who clear brush on approved land. In addition to the $4 per acre grant to farmers, there are other items of expenditures including forage seed purchases, salaries paid, demonstration and rental fees, and purchases of equipment and office supplies associated with the land clearing and demonstration program. All these expenditures associated with the program are incurred by government. These government expenditures on the land clearing and demonstration program constitute additional money flow to the area and have a direct effect on the regional economy, depending upon whether the work is done by the regional contractors or by a contractor outside the region. If all the works were done by the contractors outside the region there is expected to have no direct effect associated with government expenditures on the land clearing and demonstration program. This is not the case however.

Moreover, unlike the drainage program, the land clearing and demonstration program involves expenditure incurred by farmers. This expenditure as well as government expenditure is considered as autonomous expenditure to the area economy. An autonomous expenditure will have direct impact on the area economy during the implementation period. The estimated direct effect of government expenditure on land clearing and demonstration, and the expenditures incurred by farmers are summarized in Table (IV.19), Appendix IV. All of the direct changes in total output of the economy resulting from the implementation of the land clearing and demonstration program are concentrated in sectors 1, 2, 7 and 9. (See the first column of each year in Table IV.19).

When the brush land is cleared, agricultural output tends to increase, although it may take several years to bring newly cleared land into full production. The increase in agricultural production resulting from cleared land in turn will result in an increase in the purchase of inputs required in production and an increase in farm income. Since the land clearing program is ongoing in nature from 1968 to 1973, there are accumulated effects on cleared land. Thus, the derived demand for input requirements in production is also accumulated from 1968 to 1977, depending upon the portion of cleared land in production in each year after the land is completely cleared. Based on the particular consideration in deriving the demand for input requirements in production associated with the nature of land clearing program, the estimates for each year are summarized in the second column for each year, Table (IV.19), Appendix IV. Data sources and detailed procedures followed are presented in the relevant portion of the same Appendix.

One may consider that farm household purchases are likely to increase with increases in net farm income resulting from the additional sales of output produced from the cleared land. However, a specific consideration is required for the land clearing program since it involves clearing costs incurred by farmers. The increased net farm income from cleared land may be substituted for other types of expenditures such as paying back the debts associated with land clearing costs. Thus, the increased net farm income does not stimulate increased farm household consumption since such increase in net farm income are actually not a net increase from the farmers view point unless the debt is being paid back. Given this special consideration, the estimated increases in farm household consumption resulting from net farm income increase associated with the land clearing program are a relatively small portion of the total direct effects associated with this particular program in the earlier stage. (See the third column for each year in Table IV.19). However, such effect becomes large after the debts are paid back.

During the period of implementation, a large portion of derived demand is capital goods and services (Sectors 7, 9 and 12) because of the required work done by contractors. After the necessary work on land clearing is done, the derived demand for capital goods and services falls to a very small portion of total direct effects both in absolute and relative terms. Consequently, the derived total demand resulting from the land clearing and demonstration program tends to decrease after 1973 in spite of the accumulated effects resulting from increases in agricultural production and farm household consumption.

<u>Farm Management Training Program</u> The farm management training

program establishes contracts with farmers for specific five-month courses. This special program was initiated in the Interlake in 1968 and is now being extended to Manitoba and other provinces in Canada. Course sessions include instruction in soil and crop management, animal husbandry, farm accounting and business techniques, and applied science and mathematics. Selection of candidiates for the courses in the Interlake is made by special local committees set up by the area development boards. In general, selection is based on: (1) willingness to continue farming in future; (2) younger farmers whose education is higher than Grade VII and (3) present farm structure indicating the potential for sufficient size to ensure a long term stable income. All farmers received training allowances from the Canada Department of Manpower and Immigration.

There are three aspects of direct effects associated with farm management training programs: (1) direct effects associated with the actual program expenditure; (2) direct effects associated with increases in production in the directly related sectors; and (3) direct effects associated with increased farm household consumption purchases due to increases in net farm income. Moreover, there are accumulated direct effects associated with increases in production and in farm household consumption. Consequently, the derived demand increases over time. As shown in Table (IV.20), Appendix IV, the total increments in required input or derived demand associated with farm management training program increases from $279.7 thousand in 1969 to $780.2 thousand in 1977. Almost all of the total derived demands are generated from the second and third aspects of direct effects.

A farmer can produce more output with the same amount of primary resource inputs if his management ability is higher. Thus, the quantitive equivalence of these factors (labor and land) would produce more output due to management ability through the farm management training program. Consequently, the labor and land requirement coefficients are expected to reduce further induced by the effects of the program. This mechanism leads to increased agricultural output different from the other two programs (i.e., drainage and land clearing programs). The latter two programs stimulate increased agricultural output mainly resulting from increases in the quantities of the land input. This difference is important in relation to the simulation of impact of a program to be discussed in the next section.

Simulation Procedures

Given the concepts of the process of structural change associated with the specified resource development programs stated earlier, the simulation procedures follow the steps discussed in Chapter 3 using the dynamic simulation model. However, there are several points different in the projections. First, the derived demand resulting from agricultural resource development programs is added to the projected final demand to constitute the final demand vector. Second, the expansion of the resource base, mainly land, resulting from programs is also added to the available resources projected. Third, changes in labor and land productivities due to programs are considered in the simulation procedures. This adjustment takes into account the primary resource requirement coefficients and maximum output levels due to the resource constraints for impact simulations. Finally, the closed dynamic simulation model is employed to simulate the impacts of agricultural resource development programs. As explained in Chapter 3, five effects, direct, indirect, capital formation, induced consumption and induced capacity effects, are associated with agricultural resource development programs. In order to include the induced consumption effect, the household sector is made endogenous to the system. In equation (3.47) of the dynamic projection model the A_t matrix excluded the household sector, but it is included in the $\overset{*}{A}_t$ matrix for impact simulation.[17]

Of course, including the household sector in the system to account for induced consumption effects is based on the assumption that consumption of various goods and services changes proportionally with additional income. However, it is generally accepted that the proportionality assumption on consumption is not altogether consistent with facts. When income is low, people spend the money on food, clothes and shelter necessary for subsistence. If there is an increase in income, a part will be spent on something other then necessities. The above technique of evaluating income effects on consumption is not applicable, if we allow for non-proportional changes in consumption of various goods and services. It is possible to eliminate the assumption of proportionality by using an iterative method. This method starts with an open system to evaluate direct, indirect, capital formation, and induced capacity effects as dynamic

---

[17] It should be noted that the closed system can not appropriately be used to project gross output consistent with final demand because a large portion of personal income (See Table VI.1, Appendix VI) was exluded in the household column in the constructed input-output table. However, it is appropriate for impact simulation because for impact studies we assume that other things being constant, the increased income generated from increases in output resulting from the program induces consumption increases and results in additional changes in demand for a second iteration.

projection procedures. Then the possible change in consumption of various goods and services due to this change in income using the estimated Engel Curve is estimated as we did for estimating direct effects associated with farm household consumption increases through the program. The results are then considered as the increased final demand and used to reestimate the possible change in output using the open system. This gives us the first-round induced consumption effect. Repeat the process to compute the second-round, third-round, and so on, until the estimated induced consumption effect becomes very small. Then the sum of these effects from the first-round to the last round indicates the induced consumption effect. However, it would be expected that the cost of obtaining the desired accuracy of the induced consumption effects using the iterative method is very high and would scarcely warrant the time and effort required to obtain such accuracy. Consequently, the present study does not follow the iterative method.

Discussion of the Simulated Dynamic Impacts

Based on the procedures stated above, the simulated results of the impacts of agricultural resource development programs listed above on selected economic development indicators are summarized in this section. First to be discussed is the impact of the programs on changes in realized gross output, and then on household income and income distribution, new employment and finally, government revenues.

Impacts On Changes in Realized Gross Output The simulated dynamic impacts of each agricultural resource development programs on the 17 sectors are presented in Tables (VII.1) through (VII.3), Appendix VII. The last column of each the table shows the total impacts of that program generated from 1969 to 1977. These tables show the value of gross output increases by sector generated from the actual expenditures invested to the program from 1968 to the 1973, program termination year. These tables provide the following information. First, the magnitude of program impact on the producing sectors is shown. The drainage program has the largest impact on agricultural sectors, about 67 percent of total impact and the smallest impact on manufacturing sectors (only 0.35 percent). Similar comparisons can be made for each sector by reading down the column of Table (VII.1). The program impacts on agricultural gross output represent 66.5%, 61.0% and 64.6% of total impacts on gross output for drainage, land clearing and demonstration and farm management training programs, respectively. One policy implication immediately arises at this point. Given that one of the objectives of government is to increase agricultural production through alternative resource development programs, the type of programs that would have the most effect in stimulating increases in agricultural production is the drainage program since 66.5% of total gross output impacts is for agricultural sectors.

Second, these tables provide information to identify which program would have more viable long-run impact in order to achieve self-sustaining growth after the program being terminated. When the program is terminated, the direct effect associated with program expenditures reduced to zero and induced capacity effect is gradually reducing and reaches zero after a period of years. All that remains in effect a period of years after the program is terminated are the direct effects resulting from changes in production associated with program, indirect, capital formation and induced consumption effects. Thus, if these remaining effects could stimulate the magnitude of total impacts increases over time following program termination, such programs appear to cushion adjustments creating sustained steady growth. As shown in Table (VII.1), the total impact of drainage in 1973 (terminal year of the program) was estimated to be $21,372.5 thousand (total row). The total impact for 1974 was estimated to reduce to $20,918.7 thousand, $453.8 thousand less than the terminal year as results of excluding direct effects associated with program expenditures and reducing the induced capacity effect in 1973. However, other effects indirect, capital formation and induced consumption effects resulting from the drainage program are increasing over time since the total impacts are increasing although the increasing rate is negligible (on average the total impacts increase $18.6 thousand). It may take more than 24-years to achieve the 1973 level, other things unchanged.[18]

A similar comparisons can be made and the number of years required to maintain the same level of impact at the program terminal year can be estimated for the other two programs. For the land clearing and demonstration program, it requires only 2-years and then the total impacts maintain a certain rate of increase. For the farm management training program, there is no gestation period. Therefore, for the purpose of sustaining a steady growth through resource development programs, the farm management training program is the best since it has no gestation

---

[18]This 24-years is simply calculated by the difference between total impacts of $21,372.5 thousands in 1973, program termination year and total impacts of $20,918.7 thousands in 1974, the first year after the program is terminated, divided by average total impacts increase, $18.6 thousands per year.

time period and maintains a certain rate of steady growth in its magnitude of total impacts on the regional economy. The next is the land clearing and demonstration. The drainage program is last.

As summarized in Table (VI.2), Appendix VI, the three resource development programs contribute $13,119 thousand and $7,425 thousand in gross outputs for the agricultural and non-agricultural sectors respectively in 1971. Such impacts are simulated to increase to $18,545.6 thousand and $8,917.2 thousand for agricultural and non-agricultural sectors respectively in the terminal year of the FRED plan (1977). The three resource development programs contribute 11 percent of the simulated regional output in 1971 (7 percent in agricultural output and 4 percent for the non-agricultural output). Thus, there is a high portion of total output impacts on non-agricultural sectors (about 34 percent of total impact on output in non-agricultural sectors). This indicates that the linkage between agriculture and non-agriculture in the Interlake is high and any impact measurement ignoring non-agricultural sectors is not appropriate.

Impacts on Changes in Household Income and Income Distribution

Since one of the objectives of the resource development program is to improve the standard of living for the people residing in the area, it is more meaningful to measure impacts in terms of household income generated by each resource development program. Tables (VII.4) through (VII.6) show the estimated impact of each resource development program on household income by sector in the Interlake area for each target year. The method of estimating household income resulting from each resource development program is explained in the footnote of each table. The total household income generated from each resource development program as shown in the total row of each table for each year up to 1977 provides information concerning the impacts on changes in household income in a dynamic sense. The $1,945.4 thousand shown in the entry of the total row under the 1969 column in Table (VII.4), for example, indicates the amount of household income generated by the drainage program completed in 1968. The amount of household income generated from the same program in 1970 is increased to $2,926 thousand through the dynamic process explained by these economic effects resulting from the drainage systems that were completed in 1968 and in 1969 accumulated to 1970. The accumulated effects mainly through capital formation and induced capacity effects continue to the program terminal year. Consequently, the impacts of the drainage program on household income continuously increase over time up to 1973, from $1,945.4 thousand to $5,279.5 thousand. After the program is terminated, the capital formation and induced capacity effects are reduced but the other effects still remain. As a result, a slightly reduced household income generated from drainage program is observed in 1974. However, not all of the resource development programs will reduce the household income after the termination of the program. A program will tend to reduce its impact on household income or not depending upon whether or not the accumulated other economic effects, direct, indirect and induced consumption effects offset the loss of the other two effects (capital formation and induced capacity effects) due to the termination of the program. The land clearing and demonstration program, for example, does not decrease its impacts on household income due to the termination of the program. The omission of the accumulated effects of programs on the regional economy in the conventional impact analyses indeed underestimate the impact of a development program which is implemented over more than a one year period.

As shown in Table (5.5), the total impacts of each agricultural resource development program for each year are compared in terms of absolute and relative terms. Given the ten-year period in relation to the program objective, on average, per million dollars of program expenditure, impacts of $537.1 thousand and $121.0 thousand for farm and non-farm incomes respectively for the drainage program are projected. The farm management training program is in second place with per million dollars expenditure associated with the farm management training program of $505.6 and $121.6 thousand impacts for farm income and non-farm income respectively. The land clearing program ranks last among the three programs evaluated in terms of household income generated. However, it should be noted again, the comparison of the program impacts on farm income and non-farm income are based on the average of 9-years results. If the analysis is extended to a longer period, the results might be different because of the land clearing program gestation period relative to utilization of newly cleared land.

In addition, to evaluate alternative resource development programs, the impact analysis also provides information in answering the question "What will be the level of living standard in the Interlake by introducing the resource development programs?" Per capita income is employed to indicate the level of living standard in the present study.[19] Table (5.6)

---

[19] See: R.D. Bollman and J.A. MacMillan, Income Expenditure Relationships and Level of Living in the Interlake Area of Manitoba, Research Bulletin, No. 72-2 (Winnipeg: Department of Agricultural Economics, University of Manitoba, 1972) pp. 26-32.

TABLE 5.5

VALUES AND PERCENTAGE OF THE IMPACTS OF AGRICULTURAL RESOURCE DEVELOPMENT PROGRAMS ON FARM AND NON-FARM INCOME, INTERLAKE AREA, 1969-1977

Year	Values in 1,000 1968 Dollars						Percentage					
	Drainage		Land Clearing		Farm Manag. Train.		Drainage		Land Clearing		Farm Manag. Train.	
	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm	Farm	Non-Farm
1969	1,538.1	407.3	167.6	191.4	65.0	48.2	79.1	20.9	46.7	53.3	57.4	42.6
1970	2,352.6	573.4	284.8	162.3	304.3	85.0	80.4	19.6	63.7	36.3	78.2	21.8
1971	3,144.8	785.8	404.0	134.2	431.3	106.4	80.0	20.0	75.1	24.9	80.2	19.8
1972	3,897.0	957.8	527.7	146.8	517.4	118.1	80.3	19.7	78.2	21.8	81.4	18.6
1973	4,322.3	957.2	592.5	227.3	541.0	122.6	81.9	18.1	72.3	27.7	81.5	18.5
1974	4,285.9	900.2	684.8	121.2	559.5	125.5	82.6	17.4	85.0	15.0	81.7	18.3
1975	4,284.4	901.8	709.2	135.7	559.3	125.9	82.6	17.4	83.9	16.1	81.6	18.4
1976	4,282.6	904.2	759.3	149.5	559.0	126.0	82.6	17.4	83.6	16.4	81.6	18.4
1977	4,279.5	905.8	759.1	153.9	558.6	126.2	82.5	17.5	83.1	16.9	81.6	18.4
Average Per Year	3,598.6	810.4	543.2	158.0	455.0	109.3	81.6	18.4	77.5	22.5	80.6	19.4
Average Per Year Per Million Exp.[a]	537.1	121.0	126.3	36.7	505.6	121.4	81.6	18.4	77.5	22.5	80.6	19.4

[a]Average per year per million dollars of program expenditure is calculated by dividing the respective program's average per year impact by the respective programs' total expenditure and expressed in terms of per million dollars.

Source: Tables (VII.4) through VII.6), Appendix VII.

gives the estimated results. These results were computed by adding the impacts of all three resource development programs on household income to the projected personal income without any development program and divided by the projected population for each target year. It is based on the assumption that there is only household income in addition to personal income. This assumption may lead to underestimation of the impacts of resource development programs on personal income. The bais in estimation can be determined by the components of personal income as listed in Table (5.4) are negligible.

The three resource development programs are estimated to increase per capita personal income from $1,591.1 to $1,689.9 in 1971, an increase of 6.21 percent. An even larger increase of 7.27 percent appears to take place in 1976, increasing from $1,971.1 to $2,114.4. The rates of increase will not be maintained in 1977. Furthermore, the increased per capita personal income is mainly farm income. This can be seen from Table (5.6). Thus, we may expect to observe that the farm household income will increase relatively faster in the region because of the introduction of the resource development programs.

Impact on Employment One of the objectives specified in the FRED plan, as stated earlier, is to increase the employment opportunities for people residing in the area. This section summarizes the estimated impacts of resource development programs on employment (labor requirements.)[20]

---

[20]The employment impact for each sector resulting from each resource development program was estimated by multiplying the labor input requirement coefficients with program by the impact of the respective program on the realized gross output. The labor input requirement coefficients with each program are defined for the purpose of separating the labor

TABLE 5.6

SUMMARY OF RESOURCE DEVELOPMENT PROGRAMS CONTRIBUTIONS TO INCREASE IN FARM INCOME AND PER CAPITA PERSONAL INCOME, INTERLAKE AREA, 1971, 1976 AND 1977

Items	1971	1976	1977
Farm Income Without ARDP (1,000 1968 $)[a]	22,575.2	26,375.4	27,225.0
ARDP Contributions to Farm Income (1,000 1968 $)	3,980.1	5,600.9	5,597.2
By Drainage (1,000 1968 $)	3,144.8	4,282.6	4,279.5
By Land Clearing (1,000 1968 $)	404.0	759.3	759.1
By Farm Management Training (1,000 1968 $)	431.3	559.0	558.6
Percentage Increase in Farm Income Resulted From ARDP (%)	17.63	21.24	20.56
Level of Per Capita Personal Income With ARDP (1968 $)	1,689.9	2,114.4	2,193.7
Level of Per Capita Personal Income Without ARDP (1968 $)	1,591.1	1,971.1	2,053.0
ARDP Contributed to Increase in Per Capita Personal Income (1968 $)	98.8	143.3	140.7
Percentage Increase in Per Capita Personal Income by ARDP (%)	6.21	7.27	6.85

[a]Where ARDP appeared in the table refers to agricultural resource development programs.

Sources: (1) Farm income without ARDP was obtained from Table (10.11) and level of per capita personal income without ARDP was obtained from Table (10.12): (2) The population figures were obtained from Table (4.31): and (3) ARDP contributed to farm income and to increase in per capita personal income were obtained from Tables (5.20) through (5.22).

The estimated total employment impacts including direct, indirect, capital formation induced consumption and induced capacity effects over the period studied for the three agricultural resource development programs are summarized in Table (5.7).[21] The three resource development program, in total, create 1,523 man-year more job opportunities for the Interlake area in 1971 as compared with the dynamic projection results. Of the total of 1,523 man-year job opportunities, the agricultural sectors generate 1,290 man-years and the non-agricultural sectors create 232 man-years. The job opportunities generated in the agricultural sectors are expected to decrease faster than that of the non-agricultural sectors. For the agricultural sectors, the impacts of the three resource development programs on the employment reach to the peak in 1972 and then continuously decreasing from the peak of 1,382 man-year in 1972 to 1,028 man-year in 1977, a decrease of 26 percent as compared with the peak year. For the non-agricultural sector, the peak year of the employment impact

---

requirement coefficients without resource development program, as the required labor input per thousand dollars of gross output when the program was introduced into the economic system. A particular adjustment was made concerning the effect of resource development program in changing the labor input requirement coefficients. It is assumed that the resource development progams do not affect the labor input requirement coefficients for non-agricultural sectors since such programs are not directly related to non-agricultural sectors. The procedures for estimating changes in labor input requirement coefficients associated with each resource development program and the estimated labor input requirement coefficients with each program for agricultural sectors are summarized in sections A and B, Appendix V.

[21]The detailed employment impacts of the three resource development programs are presented in Tables (VII.7) to (VII.9), Appendix VII and summarized in Table (VI.2), Appendix VI.

TABLE 5.7

SUMMARY OF THE SIMULATED LABOR REQUIREMENTS WITH AND WITHOUT RESOURCE DEVELOPMENT PROGRAMS AND AVAILABLE LABOR FORCE, IN THE INTERLAKE AREA FROM 1969 TO 1977

Items	Labor Requirement in Year (Man-Year								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
(I) Impact on Agri. Employment									
By Drainage	654.0	852.0	962.1	1,001.3	928.7	807.1	675.0	724.6	687.7
By Land Clearing	76.3	117.7	158.1	191.3	199.5	214.0	206.9	206.5	193.8
By Farm Manag. Training	29.7	129.2	170.5	189.8	186.2	179.9	168.2	157.0	147.0
Subtotal	760.0	1,098.9	1,290.7	1,382.4	1,314.4	1,201.0	1,140.1	1,088.1	1,028.5
(II) Impact on Non-Agri Employment									
By Drainage	98.1	133.6	177.1	210.7	206.9	190.3	187.3	184.2	181.3
By Land Clearing	47.2	38.7	30.7	32.6	49.1	25.7	28.6	30.9	31.6
By Farm Manag. Training	12.5	20.6	24.8	26.8	27.3	27.5	27.2	26.7	26.2
Subtotal	157.8	192.9	232.6	270.1	283.3	243.5	243.1	241.8	239.1
(III) Total Impact on Employment	917.8	1,291.8	1,523.3	1,652.5	1,597.7	1,444.5	1,383.2	1,329.9	1,267.6
(IV) Total Projected Employment Without Any Development Program	-	-	15,729.2	-	-	-	-	15,374.0	15,334.8
(V) Total Employment Including With & Without Dev. Programs	-	-	17,252.5	-	-	-	-	16,703.9	16,602.4
(VI) Unutilized Labor	-	-	112.5	-	-	-	-	1,283.1	1,328.6
(VII) Total Labor Force Projected	-	-	17,365.0	-	-	-	-	17,987.0	17,931.0

Sources: Tables (VII.7) throughout (VII.9) and Table (VI.2).

resulting from the three resource development programs is in 1973 and the decrease in employment impact from the peak year (1973) to the FRED plan terminal year (1977) is about 16 percent as compared with 26 percent for the agricultural sectors. The decrease in employment impact in the agricultural sectors is faster than that of in the non-agricultural sector mainly due to (1) the labor requirement coefficients decrease over time in the agricultural sectors resulting from the resource development programs and such adjustments are not considered in the non-agricultural sectors for the present study and (2) the decrease of the impact on realized gross output due to the reduction of the direct effect associated with each resource development programs discussed above.

The drainage program has the largest employment impact among the three resource development program; the drainage program contributes 74 percent of total agricultural employment impacts in 1974. However, the employment impact for the drainage program decrease rapidly after the termination year, 1973, from the peak of 1,001 man-years in 1972 to 687 man-years in 1977. In contrast, the land clearing and demonstration program does not reduce the magnitude of the employment impact so rapidly as compared with the drainage as well as the farm management training programs because the former program has the gestitation period associated with indirect, capital formation and induced consumption effects.

As stated earlier, the model is constrained by the available primary inputs, labor and land. The resource development programs studied do not stimulate increases in the supply of labor in the area. Consequently, a relevant question that arises at this point is: Is there still enough available labor force for the increased labor requirements induced by the resource development programs? Table (5.7) gives the figures of the levels of employment with program effects and the supply of labor force over time. It appears from Table (5.7) that requirements for labor force are below the levels of supply throughout the planning years. However, the employment impacts which result from these three resource development programs appear to reduce the gap between the supply and demand for labor force during the periods of implementation. In 1971, for example, the total labor requirements with resource development program results (the impacts)are estimated to be 17,252.5 man-years. Of the total, 1,523.3 man-years are stimulated by the resource development programs and the remaining 15,729.2 man-years are the employment level without resource development programs. By comparing the supply of labor of 17,365 man-year, there is only 112.5 man-years of labor force unutilized. However, similar situations are not observed in 1976 and 1977. The unutilized labor force in the years after the programs were terminated (after 1973) are expected to increase from 112.5 man-years in 1971 to 1,283.1 man-years in 1976 and to 1,328.6 man-years in 1977 [See unutilized labor row, Table (5.7)]. The primary reason for this lies with downward trends in labor coefficients as shown in Tables (V.2) throughout (V.4), Appendix V. An examination of the labor input coefficient reductions through each resource development program reveals that the agricultural sectors will experience substantial reductions in their labor input requirement coefficients. Thus, despite the labor requirements (See Table (VI.4), Appendix VI) increase in the future in non-agricultural sectors as a result of resource development programs, a net decrease in total employment for the area still occurs. This implies that the resource development programs at planned levels will not be adequate for the purpose of creating an absolute increase in employment opportunities in the area in the long-run.

Impacts on Government Revenues The government revenues associated with each resource development program are the increased tax revenues from the program in the region. In fact, the effects of the resource development programs may extend to other related regions. Because the resource development programs emphasize the impacts on the regional economy, the incidence of the government revenues associated with those programs can be confined to only covering the program region. Given that consideration, the government revenues associated with the resource development programs are estimated by multiplying the government tax revenue coefficients as adjusted to each target year by the increased gross output resulting from the resource development programs. The estimated government revenues for program from 1969 to 1977 are presented in Tables (VII.10) through (VII.12), Appendix VII and are summarized in Table (VI.2), Appendix VI.

The three resource development programs, in total generate $5,161.4 thousand of government revenues in nine-year period (1969-77). $4,003.6 thousands are from the drainage program. Government revenue collected from the drainage program is still less than total expenditures ($6,69.6 thousand) invested on the drainage program (Table 5.8). The government can expect to collect 62 percent of the total expenditures invested on the three resource development programs within nine-years period. Among the three resource development programs, the government investment in the land clearing and demonstration program would have a better pay off since the government can expect to receive 90 percent of the expenditure back in

TABLE 5.8

A COMPARISON OF GOVERNMENT REVENUES AND EXPENDITURES ASSOCIATED WITH RESOURCE DEVELOPMENT PROGRAMS, INTERLAKE AREA

Items	Drainage Program	Land Clearing & Demonstration	Farm Management Training Program	Total
Government Revenue (1,000 1968 $)	4,003.6	637.9	519.9	5,161.4
Government Expenditure (1,000 1968 $)	6,693.6	707.1	897.2	5,297.9
% of Revenue to Expenditure	59.8	90.2	58.0	62.2

Sources: Tables (VII.10)throughout (VII.12) in Appendix VII and Tables (IV.1), (IV.5), and (IV.14) in Appendix IV.

nine-years period as compared to other two programs that are expected to have 58 to 60 percent only.

D. Aggregate Projection and Impact Results

Thus far the analyses are confined to discuss separately the dynamic projection results and the simulated impacts on selected economic development indicators. Separate discussions concerning the model results do not provide the entire picture for understanding the performance of the model. Also, it is difficult to justify the simulated impacts without combining the projection results since the projection results representing the economic performance without resource development programs. By aggregating both projection and impact results, one could justify the usefulness of the model by comparing the historical observations and the aggregate results of projection and impacts. For this reason, this section discusses the aggregate results of projections and impacts for 1971 and 1976, and wherever possible these figures are compared with the actual figures for 1971.

The total results of projection and simulated impacts from the three resource development programs for selected economic development indicators for 1971 and 1976 together with the actual figures are summarized in Table 5.9. The percentage difference between actually observed values and the aggregate results for each economic development indicator, if possible, is shown in the last column of the table.

The gross output for agriculture simulated from the model is considerably higher than the actual output for 1971. The model solution of 63 million dollars of agricultural output is about 13 million dollars

TABLE 5.9

A COMPARISON OF GOAL VARIABLES BETWEEN HISTORICAL OBSERVATIONS AND MODEL RESULTS FOR THE INTERLAKE AREA, 1971 AND 1976

Goal Variables	Historical Observations 1971	1971			1976			% Difference between Actually Observed and Model Results (1971)
		Projection	Impacts	Total	Projection	Impacts	Total	
I. Gross Output by Sector ('000 1968 Dollars)								
1. Agriculture and Mining	58,430.0[a]	50,184.0	13,119.1	63,303.1	58,840.1	18,537.1	77,377.2	8.3
2. Manufacturing	30,620.4	27,976.8	75.6	28,052.4	30,733.6	98.9	30,832.5	- 8.4
3. Non-Manufacturing	-	11,030.3	889.5	11,919.8	13,570.0	602.0	14,172.0	
4. Wholesale	-	16,986.7	2,692.8	19,758.0	20,742.1	3,583.1	24,325.2	
5. Retail Trade	44,700.0	44,102.7	3,315.4	47,418.1	49,354.8	4,007.1	53,406.5	6.0
6. Service	-	9,981.0	451.6	10,432.6	11,418.3	546.5	11,964.8	
7. Total Gross Output	-	160,261.0	20,544.0	180,805.0	184,658.9	27,411.7	212,070.6	
II. Employment (Man-Year)								
1. Agriculture	7,282.0	6,086.6	1,290.7	7,377.3	5,112.9	1,108.1	6,221.0	1.3
2. Other	9,392.0	9,642.6	232.6	9,875.2	10,261.1	221.8	10,482.9	5.1
3. Total	16,674.0	15,729.2	1,523.3	17,252.5	15,374.0	1,329.9	16,703.9	3.5
III. Land in Production ('000 Acres)	1,591.2	1,607.8	57.8	1,665.6	1,868.0	114.0	1,982.0	4.7
IV. Factor Input Utilization Rates (%)								
1. Labor	96.5	87.8	b	95.9	85.5	b	92.9	- 0.6
2. Land	90.6	92.7	b	90.3	98.4	b	97.5	- 0.4
V. Area Income ('000 1968 Dollars)								
1. Farm Income	25,387.1	22,575.2	5,950.4	28,525.6	26,375.4	8,379.5	34,754.9	12.4
2. Non-farm Income	59,212.9	58,393.3	1,446.9	59,840.2	67,840.5	1,661.0	69,501.6	1.1
3. Total	84,600.0	80,968.5	7,397.4	88,365.8	94,215.9	10,040.5	104,256.5	4.4
VI. Average Farm Income Per Farm (1968 Dollars)	4,560.3	4,057.4	1,069.5	5,126.8	5,304.8	1,685.3	6,990.1	12.4

[a] Excluding mining output.

[b] Excluded in the model

Sources: Tables VI.1 and VI.2 in Appendix VI.

higher than the actual agricultural production in 1971. This large difference between the agricultural production for model result and the actual production measured, 8.3 percent, in 1971 is explained by two reasons. First, the Federal Government inventory reduction for wheat production policy introduced in 1970 and low prices of agricultural output perhaps result in the actual production lower than the model result in 1971. The main purpose of such short-term policy was to reduce the 950 million bushels of wheat inventory in Canada due to low demand for exports. The assumption of average annual growth rate of Manitoba agricultural output during the period 1961-70 was employed to project the export demand for this study. This assumption overestimates the export demand for agricultural products and results in an overestimate of the agricultural production for 1971 because of low export demand for agricultural products in the world market and government special inventory reduction policy. Second, poor weather condition in 1971 affected the agricultural yield. A heavy snowfall in October and hail reduced the yield of major crops below the average.[22] Considering the natural condition in affecting agricultural production, the gross output for agriculture is estimated with reasonable accuracy.

The model estimates the 1971 gross output for non-agricultural sector, in general, very close to the actual output. The model underestimates the gross output for manufacturing and overestimates the gross output for retail trade for 1971. The underestimated manufacturing output

---

[22]Manitoba Department of Agriculture, Manitoba Agriculture Yearbook, _Op_. _Cit_., 1971, p. 5.

can probably be explained by the lower rate of growth in export demand used in the model. A 2.4 percent annual growth rate in export demand employed in the model as compared with 4 percent growth in Manitoba (See Table 4.45) could result in an underestimate of the export demand for food and beverage manufacturing and result in underestimate the output level.

The largest error is the estimated farm income. Again, this error can be attributed to the model dealing with the fluctuation of yields due to the nature of agricultural production. In some cases, the inaccuracy could be a result of the application of inappropriate method for projecting the export demand especially for those sectors their outputs are mainly for exports such as the manufacturing sectors. Therefore, in future studies, substantial effort should be made towards developing a better model for estimating the demand for exports. As indicated in the last column of the table (Table 5.9), none of the errors exceed 13 percent as compared with actual figures.

The performance of the Interlake economy is represented by a series of economic indicators listed in the left-hand side of Table 5.9. The Interlake area produced 180.8 million dollars of output in 1971 and is estimated to produce more than 212 million dollars in 1976. The three resource development programs contribute $20.5 million to total output in 1971 and 427.4 million in 1976. Without the three resource development programs, a compound growth rate of 2.9 percent annually between 1971 and 1976 could be expected instead of 3.3 percent with programs in the Interlake. The three resource development programs contribute 11 percent of total output to the Interlake in 1971 and 13 percent in 1976.

The three resource development programs generate increasing employment opportunities for Interlake people. An additional 1,300 jobs are attributable to the three resource development programs in 1976.

The area income is estimated to be $88 million if weather conditions were normal in 1971 as compared to actual figure of about $85 million. The three resource development programs contribute about 8 percent of total area income to the Interlake economy in 1971 and this contribution is estimated to be 10 percent of total area income by 1976. In addition, about 80 percent of area income generated from the three resource development programs is farm income. As a result, each farm, on average, has gained an additional thousand dollars of farm income due to the three resource development programs.

E. Evaluation of Alternative Resource Development Programs

The program impacts discussed in the preceding sections rely heavily on measurement and estimation. The results must be interpreted within the analytical framework and the assumptions upon which they rest. With this limitation in mind, the foregoing analysis provides information relevant to assessing the FRED plan and determining feasibility of proposed plans for rural development.

The three resource development programs now can be assessed in terms of their impacts on economic indicators that are useful as a guide in selecting alternative programs for achieving the objectives specified. The assessment is based on the following three criteria. The first criterion is "the bigger the better" principle proposed by Quirn.[23] This

[23]Two fundamental principles have been proposed by Quirin for program

principle indicates the magnitude of alternative resource development program impacts on the selected economic development indicators, given the same amount of public expenditures invested on the specified resource development programs within a certain time period. The criterion ignores the program impacts on income distribution. If a large portion of income impacts resulting from a resource development program is received by the high income bracket farmers, such a program is not consistent with the FRED plan objective. The second criterion to be employed to evaluate alternative resource development programs is the "effect on income distribution". The third criterion concerns evaluating alternative resource development programs based on the objectives of the FRED plan. Given the objectives specified in the FRED plan, one could evaluate alternative resource development programs by comparing the relative degree of achieving the objectives.

The Bigger the Better Criterion

The bigger the better criterion means that other things being equal, bigger impacts on the selected economic development indicators are preferable to smaller ones. For convenience in applying that criterion for program evaluation, the simulated results of the impacts of each agricultural resource development program on the selected regional economic development indicators in the preceding sections are converted

---

evaluation. The first is the "bigger the better" principle. That is, other things being equal, bigger benefits are preferable to smaller ones. The second is the "bird in the hand" principle. That is, other things being equal, early benefits are preferable to later benefits. See: G. David Quirin, The Capital Expenditure Decision (Homewood, Illinois: Richard D. Irwin, Inc., 1967) pp. 27-28.

to per million dollars of program expenditure basis and are summarized in Table (5.10).[24] However, it should be noted that each entry on Table (5.10) is the actual impacts of the resource development programs divided by the amount of program expenditures in million dollars. The results are, therefore, the actual impacts of each resource development programs on the selected regional economic development indicators associated with a million dollars of program expenditures. Entries in the table show the magnitude of actual impacts of per million dollars program expenditure associated with the programs listed at the top on the selected regional economic development indicators listed at the left-hand side of the table.

Based on "the bigger the better" principle criterion, the drainage program is better than the land clearing and demonstration program. The land clearing and demonstration program would require $0.16 expenditure to produce one dollar worth of output. However, it should be noted that the above results were based on the simulated impacts within 9-years period. While the land clearing program takes a longer time period to allow the cleared land to reach full utilization, the simulated impacts would be expected to increase.

If the objective of a resource development program is to increase household income the drainage program will be the best because it will have the largest impacts on household income. For a one million dollars of public expenditure associated with the drainage probram it can create

---

[24]The translation of impacts on each economic development indicator in terms of per million dollars of program expenditure is based on the assumption that the magnitude of investment does not alter the simulated program impacts.

TABLE 5.10

A COMPARISON OF THE AVERAGE ANNUAL (1969-77) IMPACT PER MILLION DOLLAR EXPENDITURE OF RESOURCE DEVELOPMENT PROGRAMS ON THE SELECTED REGIONAL ECONOMIC DEVELOPMENT INDICATORS, INTERLAKE AREA

Average (1969-77) Impacts on Selected Economic Indicators	Ave. Annual Impacts Per Million Exp.		
	Drainage	Land Clearing	Farm Management
(A) Realized Gross Output (1,000 1968 $)	2,671.1	686.1	2,592.2
Agriculture	1,776.3	418.6	1,674.5
Non-Agriculture	894.8	267.5	917.7
(B) Household Income (1,000 1968 $)	654.4	163.7	582.7
Agriculture	537.6	126.8	460.7
Non-Agriculture	116.8	36.9	121.8
(C) Employment (man-year)	148.6	48.8	195.3
Agriculture	122.5	40.6	168.1
Non-Agriculture	26.1	8.2	27.2
(D) Government Revenue (1,000 1968 $)	66.4	100.3	64.4
Agriculture	51.2	73.0	48.5
Non-Agriculture	15.2	27.3	15.9
(E) Undiscounted Impact-Expend. Ratios			
Gross Impact-Expenditure Ratios	24.04	6.18	23.33
Net Impact-Expenditure Ratio	5.93	1.47	5.66
Government Revenue-Expend. Ratio	0.60	0.90	0.58

$654.4 thousands of household income per annum during the period 1969-1977 (Table 5.10). On the other hand, the land clearing and demonstration program only can create $163.7 thousands of household income per annum given the same amount of public expenditure, a million dollars.

Suppose the objective of a resource development program is creating job opportunities for people residing in the area then the farm management training program is the best. Given a million dollars of public expenditure, the farm management training program can create 195 job opportunities as compared with 149 and 49 job opportunities respectively for the drainage program and the land clearing and demonstration program. As stated earlier, however, the employment impact is subject to change significantly over time due to the changes in labor requirement coefficients over time. In order to evaluate the impact of each resource development program on employment levels, therefore, the year to be considered needs to be established. Two different points in time are selected, one for the program terminal year (1973) and other for the terminal year of the plan (1977). As shown in Table (5.11), a million dollar investment on drainage is expected to create total of 169.6 and of 129.8 man-year employment figures in 1973 and in 1977 respectively. Given the same amount of investment on the farm management training program more total employment is expected at the same points in time, 212.9 men-year in 1973 and 178.1 in 1977. Similarly, total employment is estimated to be 58.1 and 52.6 man-years in 1973 and 1977 respectively for the land clearing program. Thus, the farm management training program will have the highest contribution to the Interlake in terms of total employment impacts associated with per million dollar of investment on that

TABLE 5.11

A COMPARISON OF EMPLOYMENT IMPACTS PER MILLION DOLLAR INVESTMENT ON EACH RESOURCE DEVELOPMENT PROGRAM, INTERLAKE AREA

	Labor Requirement in Year (Man-Year)[a]								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
(I) Impact on Agri. Employment									
By Drainage	97.7	127.3	143.7	149.6	138.7	120.6	114.3	108.3	102.7
By Land Clearing	17.8	27.5	36.9	44.6	46.6	49.9	48.3	48.2	45.2
By Farm Manag. Training	30.1	130.9	172.7	192.3	188.6	182.2	170.4	159.0	148.9
(II) Impact on Non-Ag. Employment									
By Drainage	14.1	20.0	26.5	31.5	30.9	28.4	28.0	27.5	27.1
By Land Clearing	11.0	9.0	7.2	7.6	11.5	6.0	6.7	7.2	7.4
By Farm Manag. Training	13.9	23.0	27.6	29.9	30.4	30.7	30.3	29.8	29.2
(III) Total Impact on Employment									
By Drainage	111.8	147.3	170.2	181.1	169.6	149.0	142.3	135.8	129.8
By Land Clearing	28.8	36.5	44.1	52.2	58.1	55.9	55.0	55.4	52.6
By Farm Manag. Training	44.0	153.9	200.3	222.2	219.0	212.9	200.7	188.8	178.1

[a]The employment impact of a million dollar investment on each agricultural resource development program for each year was computed by dividing the total impacts of the respective programs on the respective employment categories for each year by the actual total government expenditures invested into the respective programs.

particular program. The drainage program ranks second and again the land clearing program is last.

Turning to the impact of a million dollar investment in the resource development programs on non-agricultural (urban impact) employment, the jobs created are very small for all programs. The farm management training program is still the highest in creating non-agricultural employment but there are only about 30 man-years in 1973 and 29 in 1977 [Shown in Column 6, Table (5.11)]. It is observed that there is not much difference in non-agricultural employment impacts between the drainage and farm management training programs. However, the significant difference still remains between the land clearing program and the other two programs.

If the objective of a resource development program is for the purpose of increasing government revenue, the land clearing and demonstration program is better than the other two programs. A one million dollar public investment associated with the land clearing and demonstration program can generate $100.3 thousand of government revenue per annum (Table 5.10). The other two programs, the drainage and the farm management training programs, generated a similar amount of government revenue, around $65 thousands.

For convenience in applying the "bigger the better" principle for program evaluation, program impact-expenditure ratio is often used to evaluate the feasibility of government investment decisions.[25] With a

---

[25] The program impact expenditure ratio is the ratio between the simulated total impacts of a program and the expenditures associated with that program.

series of impacts of the program on output, household income, and government revenue, it is possible to use the program impact-expenditure ratio to evaluate the program. However, such ratio is just for the convenience of comparing the program impacts. The estimated undiscounted program impact-expenditure ratios for the three resource development programs are also summarized in the last portion of Table (5.10).

In evaluating the resource development program, one may apply impact-expenditure analysis in terms of different points of view. The rationale underlying the need for different view points is that the components of analysis and results vary depending on the interest group. The estimated government revenue-expenditure ratio for each resource development program, for example, is interesting to public administrators because it provides useful guidelines to them for allocating program expenditures from a government stand-point. In addition, the estimated government revenue-expenditure ratio also provides information for answering the question of how many years are required to allow the government to receive back directly from the program benefits for the expenditures associated with the program. Consequently, different impact-expenditure ratios are calculated for different interest groups.[26] The calculated different impact-expenditure ratios are (1) the gross impact-expenditure ratio,, (2) the net impact-expenditure ratio and (3) the government

---

[26]The discounted program Impact-Expenditure ratios for the simulated resource development programs were not calculated for two reasons. First, the outcome of discounted impacts and program expenditures depend heavily on the discount rate employed. Second, each program is simulated up to 1977 only. It is conceivable that the life time of each program studied would have different a life time period which will also affect the discounted impacts.

revenue-expenditure ratio. The gross impact-expenditure ratio refers to the ratio between the program impact on gross output and total expenditures associated with that program. The net impact-expenditure ratio is the ratio of the program impact on household income to total program expenditures. The government revenue-expenditure ratio represents the ratio of the program impact on government revenue to the program expenditures paid by government. Thus, the program expenditures incurred by farmers are excluded in the expenditure categories for calculation of the government revenue-expenditure ratio.

It is clear that the drainage program is the best according to the gross or net impact-expenditure ratio (Table 5.10). The farm management training program ranks second and the land clearing and demonstration program is last, given the estimated gross impacts within nine years. The estimated government revenue-expenditure ratio indicates that the land clearing and demonstration program is best. The drainage program ranks second and the farm management training program is last. However, the estimated government revenue-expenditure ratios for all programs are less than one indicating that government can not expect to recover the program revenue to pay back the expenditures of the program within nine years. Therefore, these programs were undertaken at a net cost to government.

In short, among the three alternatives, investment in the drainage program would have the maximum payoff, based on the bigger the better criterion. The drainage program has the highest gross impact-expenditure ratio and the net impact-expenditure ratio. But the land clearing and demonstration program would have the largest payoff from a government revenue point of view.

Effect on Income Distribution Criterion

Thus far the evaluation has emphasized the impacts of resource development programs on economic development indicators in aggregate terms. It would be more valuable, especially for program evaluation purposes, if the evaluation can be extended to measure program impacts on income distribution.

Based on data obtained from the Interlake land clearing evaluation survey held in 1971, 83 percent of participants in land clearing program were from the low income group (gross receipts less than 15,000 dollars in 1971). There was only 13 percent of clearing farmers with gross receipts more than 15,000 dollars.[27] This indicates that most of the increased farm income resulting from land clearing and demonstration program shown in Table VII.5 accrued to the low income farmers. A similar pattern of impact on income distribution is found for the farm management training program. 65 percent of train clients have a net income less than 4,800 dollars in 1968.[28] Consequently, 65 percent of simulated farm income resulting from the farm management training program as shown in Table VII.6 will be received by low income clients. However, a large portion (90%) of the measured farm income of the drainage program is received

---

[27] S.N. Pareek, "Benefits and Costs of Land Clearing in the Interlake Area of Manitoba", Unpublished Master Thesis (Winnipeg: Department of Agricultural Economics, University of Manitoba, 1972) p. 98.

[28] J.A. MacMillan, L.A. Bernat and J.J. Flager, Benefits and Costs of Manpower Services in the Interlake Rural Development Area, Research Bulletin No. 72-1 (Winnipeg: Department of Agricultural Economics, University of Manitoba, 1972) p. 38.

by large farmers.[29]

FRED Plan Objectives Criterion

As stated in Chapter 1, the objectives of the FRED plan are to increase the level of income, employment opportunities and the standard of living of the people residing in the area. Therefore, the last criterion for evaluating the three resource development programs is based on the results of each program in achieving the objectives specified in the FRED plan. Strictly speaking, such process for evaluating programs requires a series of weights associated with each objective. However, such weights are determined by policy-makers in terms of community preference and therefore this study does not intend to evaluate the three resource development programs by setting any weight for each objective. The evaluation process is merely based on the relative degree of achieving each objective specified in the FRED plan.

For the objective of increasing the level of income, the drainage and the farm management training programs would provide a quicker and lower cost alternative than the land clearing and demonstration program. In nine-years period (1969-77), one million dollars of expenditure invested on the drainage program would yield, on average, 1.78 million dollars of farm income per year (See Table 5.10). Hence, for the purpose of improving farm income, ignoring farm income distribution, the drainage program as well as the farm management training program could achieve such

[29] J.A. MacMillan, C.F. Framingham and F.L. Tung, "A Proposed Simulation Method for Measuring Structural Change and Rural Development Program Impacts", Canadian Journal of Agricultural Economics, Vol. 22 (May, 1974) (Forthcoming).

objective better than the land clearing and demonstration program.

Alternatively, for the objective of creating employment opportunities, the simulated results indicate that the farm management training program is best since a million dollar invested on that program could create 195 job opportunities for the people residing in the area as compared with 149 and 49 respectively for the drainage and the land clearing and demonstration programs. The drainage program requires 5,100 dollars of expenditures to create one additional job every year as compared to 6,730 and 20,400 dollars respectively for the drainage and the land clearing and demonstration programs.[30] Therefore, there are high social costs involved in creating job opportunity associated with the land clearing and demonstration program. High social costs exist because costs of the land clearing and demonstration program include not only the government incentive grant but also expenses incurred by farmers. The drainage program also involves the expenses incurred by farmers but the cost of creating per job is relatively smaller than that of the land clearing and demonstration program. Consequently, it is not as feasible to use the land clearing and demonstration program as a means of job creation in the Interlake area.

For the objective of improving the standard of living for the people resident in the Interlake area, the farm management training program could achieve that objective better than the other two programs. Within the

---

[30]The expenditures per job created associated with each program are obtained by dividing one million dollars of expenditures by the number of job created for the corresponding program listed in Table 5.9.

nine-year period simulated, the farm management training program creates $299.5 thousands of net farm income per annum for those farmers whose net income is less than 4,800 dollars in 1968.[31] The land clearing and demonstration program and the drainage program respectively generate net farm income of $105.2 and $53.8 thousands for low farm income class.[32] Thus, the drainage program is not feasible as a means of improving the stand of living for the low income farms in the Interlake area though such program generates high farm income impact since 90 percent of the generated farm income goes to the high income class farmers.

A conclusion is reached from the foregoing analysis that there is no consistently "best" resource development program related to impacts on any specified objectives in the FRED plan (i.e., selected regional economic development indicator). This result suggests a regional planner must first clearly define a set of objectives. Established objectives may not always be complementary as the case found in the present study. In this case trade-off decisions or a set of weights on objectives is required for program review.

---

[31] The net farm income of $299.5 thousands for the farm management training program is calculated by multiplying the annual agricultural household income, $460.7 thousands (Table 5.10) by the percentage of training clients whose net income is less than 4,800 dollars in 1968 (65% see effect on Income Distribution Criterion Section).

[32] The additional farm income for the low income class for the land clearing and demonstration program is the product of the household income for the agriculture, $126.8 thousands and 83 percent of participants in land clearing program that had gross receipts less than 15,000 dollars in 1968. For the drainage program the result of $53.8 thousands per annum is the product of $537.6 thousands of household income in agriculture and 10 percent of low income farms.

CHAPTER 6

SUMMARY AND CONCLUSIONS

A. Summary

Summary of Problematic Situation, Objectives of Study and Method of Analysis

The Interlake area of Manitoba is undergoing changes associated with adjustment of natural and human resources and social capital to changing market and technological conditions. Substantial underemployment exists in agriculture and fishing, and low income generally prevails in the region. Provincial and Federal Governments have been involved in attempts to improve this situation through the FRED plan. The broad objectives of this plan are to increase employment and income opportunities and to raise the standard of living in the Interlake area. These objectives are to be achieved by means of public investment in natural, social and human capital. Of the total of $85 million in FRED plan expenditure, $20 million is designated for agricultural resource development programs including drainage, land clearing and demonstration, and farm management training programs. In order to evaluate the resource development programs specified in the FRED plan, there is a need to identify more precisely the types of effects or impacts, and to measure the extent to which they affect the economy of the region.

Input-output models enable one to trace repercussions of a program on a regional economy. However, there are many limitations in applying input-output models to impact studies. One of these is the assumption relating to the stability of the trade and primary resource input coefficients over time. This limitation is more serious when the input-output model is applied to study the impacts of agricultural resource development programs on the regional economy because these programs are in fact designed to alter the technical and primary resource input coefficients.

The objectives of this study are: (1) to explore a method to incorporate changes in trade and primary resource input coefficients in an input-output model with particular reference to agricultural sectors; (2) to establish a set of economic development indicators to assess the impacts of a program for public concerns; (3) to project economic development indicators specified in five target years, 1971, 1976, 1977, 1981 and 1986, consistent with a set of final demands projected exogenously for these target years, using the modified input-output model; and (4) to simulate the impacts of the agricultural resource development programs (drainage, land clearing and demonstration and farm management training programs) on some selected economic development indicators and to assess these program effects for the Interlake FRED plan.

To achieve these objectives, a 24-sector input-output model for the Interlake area was developed. In this input-output model, 17 sectors were classified as endogenous and 7 sectors as exogenous. Agriculture was represented by two endogenous sectors. This division permitted detailed analysis of the structural changes in the agricultural sectors associated with and without resource development programs. Manufacturing was separated into only two sectors because it is a very small activity in the Interlake. Since service activities are major economic activities they were classified into 12 sectors including transportation, wholesale, retail sales and other types of services. The exogenous sectors included household, government, inventory, capital formation, unallocated, export to the rest of Manitoba, and export to Canada. In addition, the primary resource inputs required in association with production for the 17 endogenous sectors were estimated for the base year (1968) and adjusted to each target year. The primary resource inputs considered in this study were classified into three--labor, land and capital--in which land was considered in association with agricultural production only and capital was classified further into two categories, gross fixed expansion and gross fixed replacement capital based on normally accepted entrepreneurs' investment behavior.

Projections and impact analyses in this study required four sets of information: trade coefficient matrices adjusted to each target year, final demand, primary resource input coefficient matrices with and without resource development programs both for the basic year and projected to the target years, and the amount of primary resource input except capital available for production both with and without resource development programs projected to each target year.

The final demands were projected for four independent groups: household, government expenditure, capital formation and other including inventory change, exports to Manitoba and to Canada and unallocated final demands depending upon the specified simulation models. Household demand projections were based on the classical demand theory; that is the level of demand is determined by relative price, per capita income and the size of population, using 1968 household survey data and the Frisch's indirect method of deriving direct and cross demand elasticity matrices over time. Government expenditures were projected by a government expenditure function developed for the study. The Almon's "stock adjustment model" was employed to project capital formation. Because of insufficient information and the complexity of export and other final demands the projections of these components of final demands were based on the Manitoba growth rate of output by assuming the Interlake could maintain the same share of exports when provincial output increases over time.

The trade coefficients were adjusted to each target year by using the concept of productive capacity limitation by farm size class in agricultural production. Labor and land input coefficients were estimated for the base year (1968) and projected to the target years using historical information on yields and labor productivity changes from a variety of published sources. For impact analyses, the effects of the resource development programs on these primary input coefficients were combined with the autonomous changes without programs. The available labor force for each target year was projected by a demographic model and the available agricultural land was projected using historical trends in land utilization.

Having compiled the necessary data based on the methods described above, the model was constructed with three different systems, namely static, comparative static and dynamic systems, depending upon the underlying assumptions associated with the process of regional development. For the static system, trade coefficients and primary resource input coefficients were constant over time. In the comparative static system, the model permits trade coefficients and primary resource input coefficients to change from one time period to another. This system did not provide information on how the regional economic system changes from one level of output or income to another.

Unless the process of economic development is realized, the impact of any development program can not be measured. Therefore, the comparative static system was further modified to permit some causal relationships of the dynamic development process. In the dynamic system, the gross fixed expansion and replacement capital coefficient matrices were added to the trade coefficient matrix so that the capital formation sector was no longer as an exogenous sector.

Given the components of the model specified above, the impacts of resource development programs on the selected regional development indicators were determined by two different steps. The first step is to project the selected regional development indicators without resource development programs. This step included several stages. First, the procedure started with certain variables such as population, income, lagged output, etc. in the regional economy which were assumed to change autonomously. These autonomous variables were datum for the model to project the final demand vector over time. Given the projected final demand, the second stage was to project gross output consistent with final demand. It was determined through application of equation (1) in Table (3.3) of Chapter 3. However, such output can not be produced if the primary resource inputs were not available. Thus, the third stage determines the realized gross output based on the state of production techniques associated with the assumed alternative systems. In order to determine the realized gross output, the maximum output due to primary resource constraints was estimated. The realized gross output cannot be greater than the smallest gross output of resource constraints. The realized gross output was determined by comparing the estimated gross output consistent with final demand in stage 2 and the smallest gross output constrained by the primary resource inputs. Once the realized gross output for each target year was determined, the model continued to project the levels of selected economic development indicators to complete the first step.

The same procedures were employed for the second step to determine the impacts of each resource development program on the selected economic development indicators. However, prior to performing the simulation procedures, additional steps were required. First, the derived demands from each resource development program were independently estimated and added to the final demand vector projected. Second, changes in primary resource input coefficients and the available amount of primary resource input resulting from each resource development program were also estimated. Given the estimated new primary resource input coefficient matrix with the new set of resource constraints and the derived demand, the realized gross output associated with the program were simulated based on the stages employed in the first step. Then the model continued to simulate the levels of selected economic development indicators to complete the second step. The differences between the second and the first steps for each selected development indicator represent the impacts of the simulated resource development program on that indicator. The selected economic development indicators include: gross output, household income and income distribution, employment and government revenue.

Summary of the Results

The results of the study were presented and interpreted in Chapter 5. These results consisted of four parts. The first part presented and assessed the results of the alternative simulation models just described. The second part presented and discussed the dynamic projection results for the Interlake economy. The simulated impacts of the three resource development programs on the selected economic development indicators were presented and discussed in the third part. The last part presented the aggregate results of projection and impacts and compared them with the actual figures for some selected economic indicators in order to evaluate the performance of the dynamic simulation model. The three resource development programs, drainage, land clearing and farm management training programs, were also evaluated. A very brief summary of these results is presented below.

With reference to the assessment of alternative simulation models the following results are obtained;

(1) a comparison of the alternative simulation model results with historical observations show that the dynamic simulation model performs better than the other two, static and comparative static simulation models in terms of: (i) the dynamic simulation yields consistent projections of investment expenditures required to meet forecasted levels of output as compared with historical observations of the capital/output ratio for the agricultural sectors; (ii) the dynamic simulation model also yields consistent projections of factor input utilization rates due to the structural changes in the agricultural sectors represented by continuous increases in the numbers of larger sized farms and the decrease in the numbers of smaller sized farms; and (iii) the factor input coefficients and

trading coefficients have changed over time during the last decade and such changes are likely to continue as a result of continuous technological change and introduction of resource development programs.

Both the forecasted factor input requirement coefficients and the trading coefficients using the concept of productive capacity limitation by farm size class are very close to the actually observed coefficients. Consequently, it can be said that the specified adjusting trading coefficient and primary input requirement coefficient submodels can be employed to project changes in the trading coefficients and primary input requirement coefficients for the Interlake area. This is because these submodels do explain the actual structural changes in agriculture represented by shifts in the economies of scale through the reduction in the number of small farms and the increase in the number of large farms.

With reference to projection the following findings are noted:

(1) Total realized gross output for the 17 combined sectors is projected to in rease (1968 dollars) from $145.9 million in 1968 to $213.2 million in 1981 and $248.2 million in 1986. This implies a compound growth rate of about 2.8% annually based on the dynamic simulation system. The growth of the economy in the Interlake without resource development programs are attributed to the following factors. (i) The continuous increases in the final demands are one of the factors contributing to the growth of the Interlake economy. However, the increases in the final demands rely mainly on exports particularly for agricultural products and manufacturing. (ii) The continous changes in labor and land productivities are the most important factors in determining the growth of the economy as projected. A given amount of resources will be more

productive due to improved machinery and equipment and efficient production methods. Based on historical trends, the labor and land productivities were estimated to increase by about 2% per annum during the period of 1968 to 1986. (iii) The capability of increasing available land for agricultural production is very important in realizing the growth of agricultural production in the longer period. The results observed from the simulation model indicate that given the assumed rate of change in land productivity, the available land, projected on the basis of historical trends, will become the first constraining factor in agricultural production by 1978 and beyond.

(2) Employment levels in the 17 endogenous sectors are projected to decrease over time from 10,835 man-years in 1968 to 9,095 man-years in 1986, a decrease of about 1% per annum. This decrease in employment is mainly due to the structural changes in the agricultural sectors. The outmigration of labor from agriculture may be explained by, (i) wage differentials existing between agricultural and non-agricultural sectors, and (ii) the rapid mechanization process associated with increases in average farm size which is occuring in farming. In addition, the decrease in employment in the future will not be uniform between agricultural sectors. The crop sector will decrease by about 4% per annum from 1968 to 1986, the next highest being a 2.9% decrease in the livestock sector. This is due to the nature of farm operations in these two sectors. Unlike agricultural sectors, there is a tendnecy of increasing employment in non-agricultural sectors. However, despite a rapid increase in employment in non-agricultural sectors, a net decrease of 1% per annum in total employment for the 17 endogenous sectors can be expected. This

implies that the growth of employment in non-agricultural sectors alone will not be able to accommodate the outmigration of labor from agricultural sectors. Moreover, the projected employment levels in the 17 endogenous sectors are made comparable with the projected labor supply by adding an independent estimate of government employees and the commuters. It appears that the employment level will be below the level of potential supply in each target year.

(3) The land utilization rates are projected to reach a very high level after 1976. The rate is estimated to increase from 90% in the base year (1968) to greater than 97% after 1976. This rate could be explained by: (i) an insufficient downward trend in land coefficients, (ii) insufficient capability to expand arable land without government policy, and (iii) a combination of (i) and (ii).

(4) The model can be employed to project total area income and personal income by incorporating independent projections from some of the sources of both area and personal income. Government wage payments, rental income, interest, dividends and wage earnings in finance institutions, factor earning to non-residents and contributions by business need to be independently projected. However, the area income projected from the dynamic input-output model covers more than 60% of total area income. The area income is projected to increase from $75 million in 1968 to $126.7 million in 1986, an increase of 3% per annum. Area income from farm operations (farm income) accounts for less than 30% of the total area income. Personal income is projected to increase from $74.5 million in 1968 to $129.7 million in 1986, an increase 3.1% per annum. However, there is a tendency for personal income to become increasingly reliant

on government transfer payments and non-local earnings. Personal income generated from the 17 endogenous sectors is becoming smaller.

With reference to the impact analyses, the following findings emerge:

(1) The impacts of each resource development program on the selected economic development indicators are different from one period to another due to differences in the magnitude of the economic effects associated with each program. Economic effects include: direct, indirect, capital formation and induced consumption and capacity effects. The land clearing program will significantly reduce the magnitude of its impact on each of the selected economic development indicators when the implementation of the program ends since the capital formation effect is very large during the implementing period and therefore the low rate of increasing indirect and induced effects cannot compensate for the sudden disappearance of capital formation effect when the program was terminated. The other two programs, the drainage and farm management programs do not have as significant a time difference as the land clearing program.

(2) Over all, the impact of the simulated three resource development programs in the Interlake area lead to increased per capita personal income from $1,591 to $1,690 in 1971, and increase of 6.2 percent. An even higher rate of increase in per capita personal income, 7.3%, appears to take place up to 1976, but this rate will not be maintained after 1977. The increased per capita personal income is mainly due to farm income increase. It could be expected that the farm household income will increase relatively faster than non-agricultural household income in the near future in the Interlake because of the introduction of resource development programs.

With reference to evaluating the performance of the dynamic simulation model and program evaluation, the following results are obtained:

(1) The dynamic simulation model overestimates the agricultural gross output as well as farm income for 1971 due to the fact that the model cannot handle the fluctuations in agricultural production caused by weather conditions. Nevertheless, the dynamic simulation model, in general, performs reasonably well. All economic development indicators simulated from this model are very close to the actual 1971 figures. None of the errors exceed a deviation of 13% compared with the actual observations. Consequently, the estimated impacts from the model for the three resource development programs on the selected economic development indicators are considered to be the reliable estimates for evaluating the three resource development programs indicated below.

(2) All of the simulated resource development programs yield positive impacts on each of the selected economic development indicators during the study period. However, the magnitude of the impacts per million dollars of program expenditure is different for each program and for every selected economic development indicator. For the drainage program, a million dollars of drainage expenditure will have $654.4 thousand impact on household income while land clearing and farm management programs, on average, have $163.7 thousand and $582.7 thousand respectively in the 9-year period. The impact on employment from one million dollars of drainage expenditure is 148.6 man-years of job opportunities, but the farm management program will have an average employment impact of 195.3 man-years per year in the 9-year period. In general, the largest impact on household income is from the drainage, followed by the farm management

training and then the land clearing program. On the other hand, the farm management training program is ranked first, the drainage second and the land clearing program last based on the impact on employment. In general, among the three alternative, investment in the drainage programs would have the maximum payoff, based on the "bigger the better" criterion since the drainage program has the highest impact-expenditure ratio.

However, the drainage program ranks last when the evaluation is based on the program impact on income distribution since 90 percent of the total farm income generated from the drainage program is received by those farmers with gross receipts greater than 15,000 dollars. The land clearing and demonstration program ranks first, 83 percent of generated farm income being received by farms in the low income class.

The last criterion employed to evaluate the three resource development program is the level of achievement relative to the FRED plan objectives. The objectives of the FRED plan are to increase the level of income, employment opportunities and the standard of living. For the objective of increasing the level of income, the drainage and the farm management programs are almost the same, both programs generating 1.7 to 1.8 million dallars of farm income, on average, per million dollars of program expenditures. With respect to the creation of job opportunities, the farm management training program is best, 195 jobs being created per million dollars of program expenditures compared with 149 and 49 respectively for the drainage and the land clearing and demonstration programs. In relation to the objective of improving standard of living, the farm management program is also the best amont the three programs. This program generates $299 thousands of net farm income per annum for those farmers whose net income is less than $4,800 in 1968. The land clearing and demonstration program ranks second and the drainage program last.

In summary, there is no consistently "best" resource development program with respect to the objectives established in the FRED plan.

B. Conclusions

The results of the study were presented and interpreted in Chapter 5 and summarized in the above section. The discussions in this section include (i) a general appraisal of the data and model used in the study, (ii) implications of the results, and (iii) some suggestions for further studies.

General Appraisal of the Model and Data Used in the Study

It should be noted in the beginning that the discussions are confined to the dynamic simulation model and data used in this study. The limitations of the other two simulation models, static and comparative static models, will not be described here since any observable limitations have been discussed in Chapter 5.

The dynamic simulation model and data used in the study have limitations even though the projected and simulated impact results seem to be reasonable. Some of the limitations were recognized even before the simulated results were presented. But some limitations were not evident until the results were examined. However, these limitations could be avoided in the future if adequate data are available. These limitations are briefly discussed below.

The potentially most serious limitation in the present model is the assumption of constant trade coefficients in non-agricultural sectors. It may be true that technological changes in non-agricultural sectors are very slow because these sectors are not major economic activities in the area. But when the analysis is carried out over a longer time span, the constant trade coefficients in non-agricultural sectors might become crucial as evident in the preceding Chapter. This may be a serious limitation of the present model in analyzing the impact of resource development programs on a regional economy. For most rural areas, agriculture is the major industry and other industries exist only as the direct or indirect result of agriculture. While technological change occurs in agricultural sectors, sooner or later it will lead to structural changes in non-agricultural sectors. However, lacking information, it is not possible to determine the seriousness of this assumption.

Ignoring the capital constraint in the model is another limitation. If the available capital were one factor constraining production as it normally is, the observed rate of growth could be lower than the one projected. Because of the complexity of capital flows among regions, it is not easy to judge the validity of this assumption. Nevertheless, if one is willing to admit, the capital constraint in principle is applied to only for new investment. The biases caused by this incorrect assumption are thereby substantially reduced.

The assumption of constant composition of products for each sector could bias the simulated impacts of resource development programs. As stated in Chapter 3, a trade coefficient for a composite sector is a weighted average of the coefficients for the component products included in the composite sector where the weights are the relative output shares of each component product. The production for each component in the composite sector is not always expected to grow by the same proportion as the level of output increase for the composite sector. However, this type of influence on changes in trade coefficients is difficult to include in the present model because of data limitations.

The omission of price changes in the model is another limitation. The constant price ratio assumption used in the present model eliminates the substitution effect caused by relative price changes. In addition, the omission of price changes over time in the study prevents an analysis of the erosion in development impacts due to the decrease in purchasing power of program expenditures in later years of the plan due to inflation.

The model cannot handle weather conditions affecting the agricultural input-output relations. Ideally, a model employed to simulate the impacts of resource development programs should be able to consider natural condition in order to accurately measure impacts. In future studies, therefore, substantial effort would be required to identify and estimate the natural condition variables for inclusion in the present model.

A great deal of effort was put into estimating the coefficients and variables required for the model and in checking these coefficients and variables for accuracy, consistency and reasonableness. Still, some of the procedures used in data collection yielded coefficients that were not entirely satisfactory. The obvious effects of the limitations in the data collection procedures on the results are examined in the previous chapter as well as in the related appendices.

Implications of the Study Results

The results of this study have a number of implications that may be useful to policy makers. These implications are discussed systematically below according to their applications.

Implication for regional development planning and program evaluation In the evaluation of resource development programs, one of the required procedures is the assessment of future growth in the regional economy without such development programs. This procedure together with the impact of an agricultural resource development program on regional economic development, provides the ground for program evaluation.

The projection of the regional development process without development programs is not only one of the required procedures for measuring the impacts of development programs but it also provides insights to policy makers in formulating appropriate development programs and planning. As this study indicated, land will become a scarce resource input in agricultural production due to insufficient progress in land productivity and in expansion of arable land if there were no resource development programs introduced in the Interlake area. The implication of such a projection result is that there is a need for government policy to expand land supply or to rationalize the utilization of available land in order to raise aggregate agricultural output and farm income.

With the problem of scarce land in agricultural production indicated in the projection results, the regional development planners can formulate several resource development programs such as the three resource development programs analyzed in this study and measure the impacts of each alternative formulated resource development programs in relation to the problems. For this reason, the model used to measure the impacts needs to be able to account of structural changes in the economy caused by the formulated development programs. The results of this study imply that the dynamic simulation model obviously can serve such purposes satisfactory, even though some limitations still remain.

Implication for manpower policy The model results indicate that demand and supply of labor are clearly out of balance throughout the projection period. Without the three resource development programs, the problem of the high levels of unutilized labor in the Interlake will be extremely critical, since about 20 percent of labor will be unutilized in 1981. This is due to the fact that economic development which is motivated by technological changes in agriculture will continuously decrease the requirement of labor force for production. Employment in non-agricultural sectors is expected to increase but not fast enough to accommodate the outmovement of the unskilled farm labor force.

The three resource development programs have a substantial impact on employment stabilization in the Interlake area. A very high portion of the employment impact of the three resource development programs occurs in the agricultural sectors and structural changes require less labor over time in the agricultural sectors. However, the three resource development programs will not be able to maintain a high level of employment in the future. This implies that the three resource development programs cannot prevent the outmigration of agricultural labor force. In order to maintain the effectiveness of the three resource development programs, some complementary nonagricultural manpower training and education programs are desirable for improving the productivity of the agricultural labor force who take jobs in nonagricultural sectors in the Interlake or outside the area.

To the extent that some complementary manpower training and education programs are required, alternative development programs that will create jobs suitable for outmigration farmers also need to be formulated in the near future. The model did not provide sufficient information to indicate what kind of farm labor will be forced to leave agriculture. Detailed migration analysis is required to provide such information.[1]

Implication for resource development programs in the FRED plan

The introduction of resource development programs can stimulate the Interlake area's economic development measured either in terms of income generation or job creation. More specifically, each program introduced to the Interlake area provides positive impacts on all selected economic development indicators. However, the magnitude of the impacts on the selected economic development indicators is not equal. A one million dollar expenditure of public investment in the farm management training program could create more job opportunities than that of the other two programs. Yet it does not generate household income as high as the drainage program. Given the problems of low income and low growth rate in the area as projected, the above findings imply that government should expand the magnitude of the drainage program. However, the drainage program cannot solve the income distribution problem since 90 percent of increased income is for higher income classes.

In addition, the impacts of each resource development program on the selected economic development indicators are different from one time period to another because of the nature of the economic effects associated

[1] Tulloch and MacMillan, *Op. Cit.*, p. 124.

with each program. The economic effects associated with each program being measured include: direct, indirect, capital formation and induced consumption and capacity effects. Among these effects, capital formation and induced capacity effects are likely to be short-run; when the program is terminated, these two effects are reduced to near zero but the other three effects will remain or even strengthen depending upon the nature of the program. The drainage program has greater longer-run effects on the growth of the region since the impacts on the selected economic development indicators do not decrease significantly after the termination of the program. The land clearing program, however, significantly decreases its impacts on the selected economic development indicators when the program was terminated mainly due to the drop of capital formation effect which counts for a large portion of total economic effects during the period of implementation. It requires several years to regain the loss of capital formation effect since there is a gestation period with the utilization of the cleared land in production. The farm management training program has larger immediate impacts as well as longer-run impacts.

Governments could be more effective in their pursuit of development targets by making objectives more specific in terms of the selected economic development indicators and anlayzing the economic structural changes caused by particular programs.

To the extent that a set of objectives is clearly defined in relation to formulating development programs, the time-dimension also needs to be considered. Then the weight associated with each economic development indicator varies for short-run and long-run planning and such considerations could alter the allocation of expenditures to public investment

Suggested Areas for Further Study

The present study has identified, at least approximately, the importance of structural changes associated with and without resource development programs and measured the impacts of the three resource development programs, drainage, land clearing and farm management training programs, on the economic development indicators for the Interlake area. However, the impacts of resource development programs on the national and subregional levels are entirely ignored. Further study on the impacts of resource development programs on the national and subregional levels would also contribute prospects for expanding and checking on the present study. Additional efforts to measure the impacts of these programs on the national and subregional levels could reveal the leakages and feedback effects which are also important information for development planning.[2] In this regard, the application of an interregional input-output model is encouraged.

The dynamic simulation model specified in this study includes considerable detail, but still some components of the model need to be more specific in order to overcome the limitations described above and/or to increase the realism and, therefore, the usefulness of the model. The areas which are considered to offer prospects for further research are briefly described below.

(1) As stated earlier, the empirical input-output table is difficult to implement. Data and time requirements are extensive. Because of these difficulties, it would be desirable to investigate further techniques to

[2]A proportion of total impacts generated by a program will accrue to the other regions. This phenomena is commonly referred to as leakage. The leakages stimulate economic activity outside of the region and that exogenous activity may create additional requirements from industries within the study region. This is referred to as feedback.

to adjust and update input-output tables. More investigation could eliminate regional data requirements to some extend and improve projections or impact measurements. Research in this area could involve considerable work in testing the methods by comparing projections based on alternative methods with actual observations. In this direction, the methods of adjusting the changes in technical coefficients reviewed in Chapter 2 could become a guideline for interested researchers.

(2) Any bias in projection and impact measurement that might result from the assumption of constant composition of products for each sector, like the present model assumed, could be determined by conducting a special study to determine changes of the weight associated with each component in the composite sector over time. An approach of this kind may reveal the magnitude of biases in the impact measurement based on the present model.

(3) As in most studies, the present study estimated the impacts of resource development program on gross output in terms of 1968 constant prices. This constant price ratio assumption eliminated the substitution effect caused by relative price changes. It would be desirable to extend the present model to cover price changes as suggested by Johansen.[3] More research on model specification to consider price changes can be justified for at least two reasons: (a) price changes could improve projections, and (b) such an input-output model would be seemingly more appropriate than the present model for evaluation of government price support policy.

---

[3] Johansen, L., A Multi-Sectoral Study of Economic Growth (Amsterdam, Holland, North-Holland Publishing Company, 1960).

(4) The substitution between competitive imports and domestic production is another area suggested for further study. It is plausible that substitution between competitive imports and domestic production will occur when a region grows. Thus, there is a need to study further the area of incorporating changes in trade coefficients due to interaction between competitive imports and domestically produced products. In this regard, the regional input-output model should be constructed on the basis of physical production concepts which is very difficult at the regional level. Nevertheless, investigation in this area could reveal a good deal about the magnitude of biases in the impact study based on zero substitution between competitive imports and the domestic production assumption.

In summary, apart from the limitations and areas suggested for further study, the modified dynamic input-output model in this study is held to be successful in tracing out the principle forces determining the pattern of regional development and in measuring the impacts of resource development programs on a regional economy. The usefulness of applying the model to analyze other types of rural development programs probably has to be appraised with each particular case and often eliminating some limitations encountered in the present model.

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

Arrow, K.J. and M. Hoffenberg, A Time Series Analysis of Inter-Industry Demands. Amsterdam: North-Holland Publishing Company, 1959.

Bacharach, M., Biproportional Matrices and Input-Output Change. London: Cambridge University Press, 1970.

Barna, T. (ed.), Structural Interdependence and Economic Development: Proceedings of an International Conference on Input-Output Techniques. London: St. Martin's Press, 1963.

Baumol, W.J., Economic Dynamics, Third Edition. New York: The Mac-Millan Company, 1971.

Breit, W. and H.M. Hochman (eds.), Readings in Microeconomics, Second Edition. New York: Holt, Rinehart and Winston, Inc., 1971.

Carter, A.P. and A. Brady (eds.), Contributions to Input-Output Analysis. Amsterdam, Holland: North-Holland Publishing Company, 1970.

Carter, A.P. and A. Brady (eds.), Application of Input-Output Analysis. Amsterdam: North-Holland Publishing Co., 1970.

Chenery, H.B., P.G. Clark, and V.C. Pinna, The Structure and Growth of Italian Economy. Rome: United States Mutual Security Agency, 1953.

Ferguson, C.E., Microeconomic Theory, Revised Edition. Homewood: Richard D. Irwin Inc., 1969.

Friedman, I. and W. Alonson (eds.), Regional Development and Planning. Cambridge: The M.I.T. Press, 1964.

Gossling, W.F., Input-Output in the United Kingdom. London: Frank Cass and Company Ltd., 1970.

Isard, Walter, Methods of Regional Analysis. Cambridge, Mass: M.I.T. Press, 1963.

Johansen, L., A Multi-sectoral Study of Economic Growth. Amsterdam, Holland: North-Holland Publishing Company, 1960.

Leontief, W., Input-Output Economics. New York: Oxford University Press, 1966.

Leontief, W. et al., Studies in the Structure of the American Economy. New York: Oxford University Press, 1953.

Leven, C.L., J.B. Legler and P. Shapiro, An Analytical Framework for Regional Development Policy. Cambridge: The M.I.T. Press, 1971.

Lithwick, N.H., Economic Growth in Canada: A Quantitive Analysis. Toronto: University of Toronto Press, 1967.

MacMillan, J.A., C.M. Lu and C.F. Framingham, Regional Development Planning and Evaluation: An Impact Analysis of Manitoba's Interlake Area FRED Plan. Iowa: Iowa State University Press, (Forthcoming).

Maki, W.R. and L. Berry (eds.), Research and Education for Regional Growth. Iowa: Iowa State University Press, 1966.

Miernyk, W.H., Impact of the Space Program on a Local Economy. Parsons, West Virginia: West Virginia University Foundation, 1967.

Miernyk, W.A. et al., Simulating Regional Economic Development: An Interindustry Analysis of the West Virginia Economy. Lexington: Heath Lexington Books, 1970.

Musgrave, R.A., The Theory of Public Finance. New York: McGraw-Hill Book Company, 1959.

National Bureau of Economic Research (ed.), Problems of Capital Formation. Princeton: Princeton University Press, 1957.

Needlemen, L. (ed.), Regional Analysis. Middlesex, England: Penquin Books Ltd., 1968.

Perloff, H.A., E.S. Sunn, E.E. Lampard, and R.F. Muth, Regions, Resources and Economic Growth. Lincoln: University of Nebraska Press, 1960.

Perloff, H.A. and L. Wingo (eds.), Issues in Urban Economics: Part III. Baltimore: The Johns Hopkins Press, 1968.

Quirin, G.D., The Capital Expenditure Decision. Homewood, Illinois: Richard D. Irwin, Inc., 1967.

Richardson, Harry W., Elements of Regional Economics. Middlesex, England: Penquin Books Ltd., 1969.

Romans, J. Thomas, Capital Exports and Growth Among U.S. Regions. Middletown, Connecticut: Wesleyan University Press, 1965.

Samuelson, P.A., Foundations of Economic Analysis. New York: Harvard University Press, 1965.

Stone, R. and A. Brown, A Programme for Growth, Part I: A Computable Model of Economic Growth. London: Chapman and Hall Ltd., 1962.

Stone, R.J., J. Bates, and M. Bacharach, A Programme for Growth, Part III: Input-Output Relationships 1954-66. Cambridge: The M.I.T. Press, 1963.

Tilanus, C.B., Input-Output Experiments, The Netherlands 1948-1961. Rotterdam: Rotterdam University Press, 1966.

Articles and Periodicals

Airov, J., "Fiscal-Policy Theory in an Interregional Economy: General Interregional Multipliers and Their Application", Papers and Proceedings of the Regional Science Association, 19 (1967), pp. 83-108.

Alchian, A.A., "Costs and Outputs", Readings in Microeconomics. Edited by W. Breit and H.M. Hochman. New York: Holt, Rinehart and Winston Inc., 1971.

Almon, C., "Investment in Input-Output Models and the Treatment of Secondary Products", Applications of Input-Output Analysis. Edited by A.P. Carter and A. Brody. Amsterdam: North-Holland Publishing Co., 1970.

Anderson, Robert J., "A Note on Economic Base Studies and Regional Econometric Forecasting Models, Journal of Regional Science, 10 (1970), pp. 325-333.

Batra, R.N. and F.R. Casas, "A Model of Regional Income Differences and Economic Growth", Regional Science Perspectives, 2 (1972), pp. 19-40.

Barnard, J.R., J.A. MacMillan and W.R. Maki, "Evaluation Models for Regional Development Planning", Regional Science Association Papers, 23 (1969), pp. 117-40.

Borts, G.H., "Returns Equilization and Regional Growth", American Economic Review, 50 (1960), pp. 319-47.

Borts, G.H., "A Theory of Long-run International Capital Movements". Journal of Political Economy, 72 (1964), pp. 341-59.

Borts, G.H. and J.L. Stein, "Regional Growth and Maturity in the United States: A Study of Regional STructural Change", Schweizerische Zeitschrift fur Volkswirtchaft and Statistik, 98 (1962), pp. 290-321. Also Reprinted in L. Needleman (ed.), Cited in Books part.

Carter A.P., "Capital Coefficients As Economic Parameters: The Problem of Instability", Problems of Capital Formation. Edited by Bureau of Economic Research. Princeton: Princeton University Press, 1957.

Chenery, H.B. "Introduction", Application of Input-Output Analysis. Edited by A.P. Carter and A. Brady. Amsterdam: North-Holland Publishing Company, 1970.

Cornwall, J., "Role of Demand and Investment in Long-Term Growth", Quarterly Journal of Economics, 84 (1970), pp. 48-69.

Craddock, W.J., "Interrelation and Use of the Results Obtained With National and Regional Economic Models", National and Regional Economic Models of Agriculture, Economic Branch Publication No. 72-9. Ottawa: Canada Department of Agriculture, 1972.

Cumberland, J.H., "A Regional Interindustry Model for Analysis of Development Objectives", The Papers of the Regional Science Association, 17 (1966), pp. 85-103.

DeJanvry, A., J. Bieri, and A. Nunez, "Estimation of Demand Parameters Under Consumer Budgeting: An Application to Argentina" American Journal of Agricultural Economics, 54 (Aug., 1972), pp. 442-30.

Dent, W. and R. Ballintine, "A Review of the Transition Probabilities in Markov Chain", The Australian Journal of Agricultural Economics, 15 (August, 1971), pp. 69-81.

Doeksen, G.A. and D.F. Schreiner, "Simulating Short, Intermediate, and Long Run Effects of Private Investment on Employment by Industrial Groupings", Journal of Regional Science, 12 (Aug., 1972), pp. 219-32.

Frisch, R., "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model With Many Sectors, Econometrica, 27 (April, 1957), pp. 177-96.

Hartman, L.M., "The Input-Output Model and Regional Water Management", Journal of Farm Economics, 47 (1965), pp. 183-91.

Hartman, L.M. and D. Seekler, "Toward the Application of Dynamic Growth Theory to Regions", Journal of Regional Science, 7 (1967), pp. 167-73.

Head, J.G., "Public Goods and Public Policy", Public Finance, 17 (1962), pp. 197-219.

Hirch, W.Z., "The Supply of Urban Public Services", Issues in Urban Economics: Part III. Edited by Perloff, H.S. and L. Wingo. Baltimore: The Johns Hopkins Press, 1968.

Hirsch, W.A., "Expenditure Implications on Metropolitan Growth and Consolidation", The Review of Economics and Statistics, 41 (Aug., 1959), pp. 333-39.

Hoffman, R.F., "A Systematic Approach to a Practicable Plan for State Aid to Local Governments", Public Finance, 24 (1969), pp. 1-28.

Klein, L.R., "Some Theoretical Issues in the Measurement of Capacity", Econometrica, 28 (April, 1960), pp. 280-86.

Klein, L.R., "On the Interpretation of Professor Leontief's System", Review of Economic Studies, 20 (1952-53, pp. 11-72.

LaTourette, J.E., "Private and Public Capital and the Capital Coefficient in Canada", The Quarterly Review of Economics and Business, 12 (May, 1972), pp. 53-75.

Leontief, W.W., "The Dynamic Inverse", Contributions to Input-Output Analysis. Edited by A.P. Carter and A. Brody. Amsterdam: North-Holland Publishing Co., 1970.

Leontief, W.D. and A. Strout, "Multiregional Input-Output Analysis", Structural Interdependence and Economic Development: Proceedings of an International Conference on Input-Output Techniques. Edited by T. Barna. London: St. Martin's Press, 1963.

Lesser, C.E.V., "Forms of Engel Functions", Econometrica, 31 (Oct., 1963), pp. 694-703.

Leven, C.L., "The Economic Base and Regional Growth", Research and Education for Regional Growth. Edited by W.R. Maki, J. Brian, and L. Berry. Iowa: Iowa State University Press, 1966.

MacMillan, J.A., "A Framework for Simulating Area Economic Growth With Urban Consolidation", Regional Science Perspectives, 1 (Jan., 1971), pp. 121-43.

MacMillan, J.A., F.L. Tung, and R.M.A. Loyns, "Differences in Regional Household Consumption Patterns by Urbanization: A Cross-Section Analysis", Journal of Regional Science, 12 (Dec., 1972), pp. 417-24.

MacMillan, J.A., F.L. Tung, and J.R. Tulloch, "Migration Analysis and Farm Number Projection Models: A Synthesis, "American Journal of Agricultural Economics, 56 (May, 1974), pp. 292-299.

MacMillan, J.A., C.F. Framingham and F.L. Tung, "A Proposed Simulation Method for Measuring Structural Change and Rural Development Program Impacts", Canadian Journal of Agricultural Economics, 22 (May, 1974) (Forthcoming).

Matuszewski, T.I., P.R. Pitts, and J.A. Sawyer, "Linear Programming Estimates of Changes in Input Coefficients", Canadian Journal of Economics and Political Science, 30 (1964), pp. 203-10.

Meyer, J.R., "Regional Economics: A Survey", Regional Analysis. Edited by L. Needleman. Middlesex, England: Penquin Books Ltd., 1968.

Minabe, S., "Some Comments on the Role of Demand and Investment in Long-Term Growth", Quarterly Journal of Economics, 85 (1971), pp. 337-43.

Moore, F.T., "Regional Economic Reaction Paths", American Economic Review, 45 (December, 1955), pp. 133-148.

Morishima, M., "Prices, Interest, and Profits in a Dynamic Leontief System", Econometrica, 26 (1958), pp. 358-80.

Moses, L.N., "The Stability of Interregional Trading Patterns and Input-Output Analysis", American Economic Review, 40 (1955), pp. 803-32.

North, D.G., "Location Theory and Regional Growth", Journal of Political Economy, 63 (1955), pp. 243-58.

North, D.G., "Agriculture in Regional Economic Growth", Journal of Farm Economics, (1959), pp. 943-51.

Norton, G.A. and J.A. MacMillan, "Drainage Maintenance and Reconstruction Costs and Benefits: A Watershed Analysis", Canadian Journal of Agricultural Economics, Vol. 18 (1970), pp. 56-63.

Orcutt, G.H., "Simulation of Economic System", American Economic Review, 50 (1960), pp. 893-907.

Ozaki, I., "Economies of Scale and Input-Output Coefficients", Application of Input-Output Analysis. Edited by A.P. Carter and A. Brody. Amersterdam: North-Holland Publishing Co., 1970.

Perloff, H. and L. Wings, "National Resource Endowment and Regional Economic Growth", Regional Development and Planning. Edited by I. Friedman and W. Alonson. Cambridge: The M.I.T. Press, 1964.

Rogers, A., "Matrix Analysis of Interregional Population Growth and Distribution", Regional Science Association Paper, 18 (1966), pp. 177-95.

Samuelson, P.W., "The Pure Theory of Public Expenditure", Review of Economics and Statistics, 36 (Nov., 1954), pp. 387-89.

Sevaldson, M., "Change in Input-Output Coefficients", Structural Interdependence and Economic Development: Proceedings of an International Conference on Input-Output Techniques. Edited by T. Barna. London: St. Martin's Press, 1963.

Sharkansky, I., "Some More Thoughts About the Determination of Government Expenditures", National Tax Journal, 20 (March, 1967), pp. 171-79.

Smith, A., "Surveys in Applied Economics: Technical Progress", The Economic Journal, 82 (March, 1972), pp. 11-72.

Tiebout, C.M., "Exports and Regional Economic Growth", Journal of Political Economy, 64 (1956), pp. 160-64.

Tiebout, C.M., "Regional and Interregional Input-Output Models: An Appraisal", Southern Economic Journal, 24 (1957), pp. 140-47.

Tiebout, C.M., "The Urban Economic Base Reconsidered", Land Economics, 32 (1965), pp. 95-99.

Tiebout, C.M. and T. Lane, "The Local Service Sector in Relation to Economic Growth", Research and Education of Regional and Area Development. Edited by W.R. Maki and B.J.L. Berry. Iowa: Iowa State University Press, 1966.

Theil, H. and C.B. Tilanus, "The Demand for Production Factors and the Price Sensitivity of Input-Output Productions", Internal Economic Review, 5 (Sept., 1964), pp. 258-72.

Tulloch, J.R. and J.A. MacMillan, "A Micro-Analytic Model of Migration", Regional Science Perspective, (1973), pp. 105-26.

Wigley, K.J., "Production Models and Time Trends of Input-Output Coefficients", Input-Output in the United Kingdom. Edited by W.F. Gossling. London: Frank Cass and Company Ltd., 1970.

Yorgason, V.W. and D.E. Spears, "The Canadian Agricultural Production Function", Canadian Journal of Agricultural Economics, 19 (1971), pp. 66-76.

Research Reports

Bollman, R.D. and J.A. MacMillan, Income Expenditure Relationships and Level of Living in the Interlake Area of Manitoba, Research Bulletin No. 72-2. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1972.

Doeksen, G.A. and D. F. Schreiner, A Simulation Model for Oklahoma With Economic Projections from 1963 to 1980, Bulletin B-693. Oklahoma: Agricultural Experiment Station, Oklahoma State University, 1971.

Douglas, P.G. and J.A. MacMillan, Simulation of Economic Impacts of Highway Expenditures, Research Report No. 9. Winnipeg: Center for Transportation Studies, University of Manitoba, 1972.

Framingham, C.F., J.A. MacMillan and P.E. Nickel, Guideline for Community Planning, Extension Bulletin No. 73-1. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1973.

George, P.S. and G.A. King, Consumer Demand for Food Commodities in the U.S., With Projections for 1980, Giannini Foundation Monograph No. 26. Berkeley: California Agricultural Experiment Station, 1971.

Lee, I.M., Conditional Projections of California Economic Growth, Giannini Foundation Monograph No. 19. Berkeley: Giannini Foundation of Agricultural Economics, University of California Division of Agricultural Sciences, 1967.

MacMillan, J.A., Regional Systems for Development Planning in Manitoba, Research Bulletin No. 70-1. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1970.

MacMillan, James A. and C.M. Lu, Urban Impacts of Rural Resource Development Expenditures in the Interlake Area of Manitoba, Research Report No. 7. Winnipeg, Manitoba: Agassiz Center for Water Studies, University of Manitoba, 1973.

MacMillan, J.A. and C.M. Lu, Projection and Impact Models: Area Manpower Planning in the Interlake Region, Manitoba, Research Bulletin No. 72-5. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1972.

MacMillan, J.A., L.A. Bernat and J.J. Flagler, Benefits and Costs of Manpower Services in the Interlake Rural Development Area, Research Bulletin No. 72-1. Winnipeg: Department of Agri-Cultural Economics, University of Manitoba, 1972.

Maki, W.R. and J.A. MacMillan, Regional Systems for Development Planning in Manitoba, Research Bulletin No. 70-1. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1970.

Maki, W.R., R.E. Suttor, and J.R. Barnard, Simulation of Regional Product and Income With Emphasis on Iowa 1954-74, Agricultural and Home Experiment Station Research Bulletin 548. Iowa: Department of Economics, Iowa State University, 1966.

Maki, W.R., C.F. Framingham, and D.J. Sandell, Population Projections for Manitoba by Region and Town Size - Some Alternatives, 1971-1990, Research Bulletin No. 73-2. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1973.

Molgat, P. and J.A. MacMillan, Education in Area Economic Development, Research Report No. 10. Winnipeg: Center for Settlement Studies, the University of Manitoba, 1972.

Norton, G.A. and J.A. MacMillan, A Framework for Economic Planning of Watershed Drainage, Research Report No. 6. Winnipeg: Agassiz Center of Water Studies, University of Manitoba, 1972.

Rigaux, L.R. and R.H. Singh, Benefit-Cost Analysis of Agricultural Drainage Expenditures: A Pilot Project for South-Eastern Manitoba. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1973.

Shumway, C.R. et al., Regional Resource Use for Agricultural Production in California, 1961-65 and 1980, Giannini Foundation Monograph No. 25. California: Giannini Foundation of Agricultural Economic, University of California Division of Agricultural Science, 1970.

Skold, M.D. and A.J. Greer, Jr., The Impact of Agricultural Change On a Local Economy in the Great Plains, Technical Bulletin 106. Fort Collins: Colorado State University Experiment Station, 1969.

Zusman, P., California Growth and Trade, 1954-63: An Inter-industry Analysis Emphasizing Agriculture and Water Resource Development, Giannini Foundation Monograph No. 27. Berkeley: California Agricultural Experiment Station, University of California, 1971.

Government Documents

ARDA FRED Administration, FRED in the Interlake Year 3 (1969-70). Winnipeg: Published Under the Federal-Provincial FRED Agreement, 1971.

Auer, L., Canadian Agricultural Productivity, Staff Study No. 24. Ottawa: Economic Council of Canada, 1969.

Chernick, S.E., Interregional Disparities in Income, Staff Study No. 14. Ottawa: Economic Council of Canada, 1966.

Commission on Targets for Economic Development, Manitoba to 1980. Winnipeg: Queen's Printer, 1969.

Department of Forestry and Rural Development, Interlake Area of Manitoba: Federal-Provincial Rural Development Agreement. Ottawa: Queen's Printer and Controller of Stationary, 1967.

Dominion Bureau of Statistics, 1961, 1966 and 1971 Census of Canada, Agriculture. Ottawa: Queen's Printer.

Dominion Bureau of Statistics, The Labor Force, Cat. No. 71-001. Ottawa: Queen's Printer, Monthly.

Dominion Bureau of Statistics, 1961, 1966 and 1971 Census of Canada, Agriculture Manitoba. Ottawa: Queen's Printer.

Dominion Bureau of Statistics, Fixed Capital Flows and Stocks Manufacturing Canada 1926-1960, Methodology, Cat. No. 13-522. Ottawa: Queen's Printer, 1969.

Dominion Bureau of Statistics, Private and Public Investment in Canada, Cat. No. 61-504. Ottawa: Queen's Printer, Series from 1950-1972.

Dominion Bureau of Statistics, The 1961 Input-Output Table. Ottawa: Queen's Printer, 1963.

Economic Development Advisory Board of Manitoba, Economic Development in Manitoba - the Challenge. Winnipeg: Queen's Printer, 1971.

Eyvindson, Roger K. (ed.), National and Regional Economic Models of Agriculture, Economic Branch Publication No. 72/9. Ottawa: Canada Department of Agriculture, 1972.

Framingham, C.F., J.A. MacMillan, and D.J. Sandell, The Interlake Fact. Winnipeg: Hignell Printing Ltd., 1970.

Government of Manitoba, Population of Manitoba, June, 1971. Winnipeg: The Continuing Programs Secretariat, Planning and Priorities Committee of Cabinet, 1973.

Interlake FRED Plan, Interim Progress Report for Six Years. Winnipeg: published under the Federal-Provincial Agreement, 1973.

Interlake FRED Planners, Guidelines for Development, the Interlake Region of Manitoba. Winnipeg: FRED Plan Office, 1970.

Manitoba Department of Agriculture, Yearbook of Manitoba Agriculture. Winnipeg: Queen's Printer for Manitoba, from 1960 to 1972.

Office of the Appalachian Studies, Development of Water Resources in Appalachia, Main Report Part IV: Planning, Concepts, and Methods. Cincinnati: Office of Appalachian Studies, Corps of Engineers, 1969.

Premier and Provincial Treasurer, Manitoba Budget Statement and Economic Review. Winnipeg: Queen's Printer for Manitoba, Series From 1950 to 1972.

Urban Development and Municipal Affairs, Statistical Information Respecting the Municipalities of the Province of Manitoba and the Metropolitan Corporation of Greater Winnipeg. Winnipeg: Urban Development and Municipal Affairs, 1970 and 1971.

Unpublished Material

Brown, D.M., "Productive Capacity and Economic Growth in West Virginia", Unpublished ph.D. Dissertation, West Virginia: Department of Economics, West Virginia University, 1969.

DeJanvry, A.G., "Measurement of Demand Parameters Under Separability", Unpublished ph.D. Dissertation. Berkeley: Department of Agricultural Economics, University of California, Berkeley, 1968.

Demir, N., "Input-Output Projections of California Resource Requirements", Unpublished ph.D. Dissertation. California: Department of Agricultural Economics, University of California, Davis, 1970.

MacMillan, J.A., "An Assessment of Agricultural Training Needs in Manitoba". Winnipeg: Department of Agricultural Economics, University of Manitoba, 1973. (Mineographed).

Pareek, S.N., "Benefits and Costs of Land Clearing in the Interlake Area of Manitoba", Unpublished Master Thesis. Winnipeg: Department of Agricultural Economics, University of Manitoba, 1972.

APPENDICES

APPENDIX I

SOURCES AND ESTIMATION PROCEDURES FOR CAPITAL AND PRIMARY RESOURCE ACCOUNTS

Appendix I

SOURCES AND ESTIMATION PROCEDURE FOR CAPITAL AND PRIMARY RESOURCE ACCOUNTS

A. Estimation of Labor Force and Employment Account

Total labor force was obtained from MacMillan and Lu.[1] The total labor force obtained was broken down into two categories: Agricultural labor force and non-agricultural labor force. Agricultural labor force was estimated by the following procedures and the residual between total labor force and the estimated agricultural labor force is considered as non-agricultural labor force.

$$\begin{pmatrix}\text{Number of Farm Households}\\ \text{Including Farm Workers}\end{pmatrix} \times \begin{pmatrix}\text{Average Farm Household}\\ \text{Family Size}\end{pmatrix} = \begin{pmatrix}\text{Total Agri.}\\ \text{Population}\end{pmatrix}$$

$$\begin{pmatrix}\text{Total Agric.}\\ \text{Population}\end{pmatrix} \times \begin{pmatrix}\text{Ratio of Labor}\\ \text{Force to Population}\end{pmatrix} = \begin{pmatrix}\text{Potential Agri.}\\ \text{Labor Force}\end{pmatrix}$$

$$\begin{pmatrix}\text{Number of Farm Households}\\ \text{Including Farm Workers}\end{pmatrix} \times \begin{pmatrix}\text{\% of Absent Sons and}\\ \text{Daughters 16 yrs.}\\ \text{and Over}\end{pmatrix} = \begin{pmatrix}\text{No. of Absent Sons}\\ \text{and Daughters}\end{pmatrix}$$

$$\begin{pmatrix}\text{Potential Agri.}\\ \text{Labor Force}\end{pmatrix} - \begin{pmatrix}\text{No. of Absent Sons}\\ \text{and Daughters}\end{pmatrix} = \begin{pmatrix}\text{Agricultural}\\ \text{Labor Force}\end{pmatrix}$$

$$\begin{pmatrix}\text{Total Labor}\\ \text{Force}\end{pmatrix} - \begin{pmatrix}\text{Agricultural}\\ \text{Labor Force}\end{pmatrix} = \begin{pmatrix}\text{Non-agricultural}\\ \text{Labor Force}\end{pmatrix}$$

---

[1] MacMillan and Lu, Projection and Impact Models, op. cit. p. 41, Table 4.

where:

Number of farm households including farm workers	:	6.474[2]
Average farm household family size	:	4[3]
Ratio of labor force to population	:	0.358[4]
% of absent son and daughter per family	:	0.330[5]

On the employment side, employment figures for intermediate sectors were obtained from MacMillan and Lu[6] and employment in the government sector were obtained from the Interlake Fact (page 73) in which persons who are working under FRED programs are excluded. The residual between total employment and employment in the intermediate sector plus employment in government sector was classified as export which implies persons who are working in the outside of the area but resident in the area.

B. Estimation of Capital Account

Overall capital requirements of any sector consist of (1) capital required for the expansion of "productive capacity", and

---

[2]This figure was obtained from: Ibid., p. 122, Table 32.

[3]Average farm household family size was obtained from: Framingham, MacMillan and Sandell, The Interlake Fact, Op. Cit., Table 23.

[4]The ratio of labor force to population was derived from: Maki, W.R. and J.A. MacMillan, Regional Systems for Development Planning in Manitoba, Research Bulletin No. 70-1 (Winnipeg: Dept. of Agric. Economics, University of Manitoba, 1970), p. 91. Table 16.

[5]This percentage was derived from: Framingham, MacMillan and Sandell, The Interlake Fact, Op. Cit., Table 6, 7 and 8.

[6]MacMillan and Lu, Projection and Impact Models, Op. Cit., p. 6. Table 1.

(2) for the replacement of "maintaining productive capacity", and (3) inventories. The term productive capacity refers to the physical plant of a given sector. It may be measured by the value of the fixed capital which makes up the productive capacity. The estimation procedures for each component of capital are explained below.

Gross Fixed Capital Transaction

A major concern in constructing a gross fixed capital transaction table (Table 4.5 in Chapter 4), is the estimation of gross fixed capital transaction by the 17 producing sector in the area. In 1968, there were five producing sectors producing fixed capital goods - construction, farm equipment and building materials, other retail, auto product and service, and furniture and applicance sectors. The following steps are used to derive the flow of gross fixed capital goods between the producing (or sales) sectors and the purchasing sectors.

The first step is to derive gross fixed capital goods sales from the farm equipment and building material sector to other purchasing sectors. Business survey data indicate that the farm equipment and building material sector sold \$1,410.3 thousand gross fixed capital goods to other purchasing sectors, of which \$1,406.8 thousand was sold to the livestock and crop sectors (sectors 1 and 2) and \$3.5 thousand was sold to other business sectors. Then the value of gross fixed capital goods sold to agricultural sectors are proportionally allocated to livestock and crop sectors according to the ratios of current goods and services transactions between those two sectors and the farm equipment and building material sector. A similar approach is employed to allocate total sales of gross fixed capital goods ($3.5 thousand) to other business sectors. The results are shown in the row of farm equipment and building material of Table 4.5.

The second step is to allocate gross fixed capital goods sales from other producing sectors (sectors 7, 11, 12 and 14) to purchasing sectors. The procedures are as follows: First, gross fixed capital goods estimated from business survey data are allocated to (1) construction and (2) equipment, machinery and furniture categories by sector according to the proportion of construction, and equipment, machinery and furniture investment in 1968 in Manitoba obtained from Dominion Bureau of Statistics.[7] Then the shares of construction, and equipment, machinery and furniture capital goods by sector are estimated as shown in the columns of (4) and (5) in Table I.1 (i.e., θ_i and β_i). Secondly, the estimated share of construction is used to allocate gross fixed capital good (building) sales from the construction sector ($4,523.4 thousand) to each purchasing sector. A similar method is used to allocate other retail, auto product and service, and furniture and appliance sectors' total fixed capital goods (machinery, equipment and furniture) sales to purchasing sectors according to the estimated β_i.[8] The

---

[7]Dominion Bureau of Statistics, Private and Public Investment in Canada, Cat. No. 61-504, Op. Cit.,

[8]For livestock and crop sectors, the estimated gross fixed capital purchased from farm equipment and building material sector is subtracted from gross machinery equipment and furniture capital before the allocation procedure is made.

TABLE I.1

DISTRIBUTION OF GROSS FIXED CAPITAL FORMATION BY SECTOR, INTERLAKE AREA, 1968

Sector	Type of Gross Fixed Capital Formation (Unit: $1,000) Bldgs.[a] (1)	Equip & Machinery & Furniture (2)	Total Gross Fixed Capital (3)	Distribution of Building Capital By Sector (θ_i) (4)	Distribution of Equip., Machinery & Furniture Capital By Sector (β_i) (5)
1. Ag.-Livestock	5,691.6	1,512.9	7,204.5	0.5925	0.3950
2. Ag.-Crop	2,588.7	688.1	3,276.8	0.2695	0.1797
3. Mining	49.9	31.1	81.0	0.0052	0.0081
4. Food & Bev. Mfg.	14.7	33.8	48.5	0.0015	0.0088
5. Other Mfg.	71.9	88.2	160.1	0.0075	0.0230
6. Transportation	102.8	105.7	208.5	0.0107	0.0276
7. Construction	506.3	792.0	1,298.3	0.0527	0.2068
8. Pet. Wholesale	33.8	34.7	68.5	0.0035	0.0091
9. Farm Equipment	52.8	54.3	107.1	0.0055	0.0142
10. Food Store	36.4	37.4	73.8	0.0038	0.0098
11. Other Retail	102.3	99.4	201.7	0.0108	0.0260
12. Auto Products	94.6	97.2	191.8	0.0100	0.0254
13. Apparel & Shoes	12.1	12.5	24.6	0.0014	0.0033
14. Furniture & Appl.	1.1	1.0	2.1	0.0002	0.0003
15. Insurance	78.4	80.6	159.0	0.0082	0.0211
16. Personal Service	112.8	109.6	222.4	0.0118	0.0286
17. Other Service	49.3	50.7	100.0	0.0052	0.0132
Total	9,599.5	3,829.2	13,428.7	1.0000	1.0000

[a]Building Capital by Sector (Column 1) is calculated from the percentage of building capital to total investment in Manitoba (obtained from Dominion Bureau of Statistics, Private and Public Investment in Canada, Op. Cit.,) multiplying the corresponding sectors' total gross fixed capital (Column 3). The difference between Columns 1 and 2 is equipment, machinery and furniture gross fixed capital.

[b]Gross fixed capital changes in the agricultural sectors are estimated from household survey data and the remaining sectors are estimated from business survey data by C.M.Lu.

results are entered into rows 7, 11, 12 and 14 of Table 4.5.

The third step is to estimate gross fixed capital goods imported. Since no statistics are available for imports of gross fixed capital goods from the rest-of-Canada sector, it is assumed that all fixed capital goods are imported from the rest-of-Manitoba. Given this assumption, imported gross fixed capital goods by sector can be calculated from the difference between total gross fixed capital formation and gross fixed capital formation generated from the area in each sector, obtained from steps one and two. Total gross fixed capital formation includes both capital for replacement purpose and expansion of productive capacity purpose. That is estimated by summing fixed asset changes and capital consumption allowance.[9]

Expansion Fixed Capital and Replacement Fixed Capital Transactions

The estimated gross fixed capital transaction table contains capital requirements by sector for both expansion of production capacity and replacement purposes. For analytical purposes, there is a need to separate them out since one (expansion purpose) will create the capacity to increase the maximum output level and the other (replacement purpose) will not.

The estimated gross fixed capital transaction table implies the following identity:

$$GFC = (R+E)\ I + (R+E)\ 0 \qquad (I.1)$$

---

[9]The fixed asset changes and depreciation for business sectors were estimated by C.M. Lu. The fixed asset changes in agricultural sectors were estimated from household survey data.

where:

GFC = vector of gross fixed capital;

R = vector of purchases of fixed capital for replacement purpose;

E = vector of purchases of fixed capital for expansion purpose;

I = vector of purchases from Interlake Area;

0 = vector of purchases from the rest-of-Manitoba.

The right-hand side of equation (I.1) is from the purchasing sector point of view and the left-hand side is from the selling sector point of view. Thus, if R and E are known, the net fixed capital and replacement fixed capital transaction can be estimated from gross fixed capital transaction table.

It is assumed that each firm uses all capital consumption allowance fund for replacement purpose. Then the R is simply the ratio of depreciation to gross fixed capital and the E is equal to (1-R). Given the estimated R and E, I and 0 can be broken down to RI, RO, EI and EO by sector. The RI and RO constitute replacement fixed capital rows. The former is the row of intermediate subtotal and the latter is the row of import. The sum of RI and RO is equal to depreciation capital consumption allowance by sector. Thus, total of $7,263.8 in the entry of total fixed capital for replacement row under total fixed capital for replacement column in Table 4.7 represents total depreciation in the area (also shows in the entry of depreciation and retained earning row under total intermediate column of Table 4.1). The estimated vectors of R and E are employed to derive the sales of building capital from the construction sector to other purchasing sectors for expansion and replacement purposes. A similar approach is also employed to estimate machinery, equipment and furniture capital for both purposes. Then the estimated machinery, equipment and furniture capital for both purposes are further allocated proportionally to the 17 producing sectors in terms of estimated gross fixed capital transaction table.

Sources of Capital Formation

Household saving and depreciation and retained earning are derived from the intersectoral transaction table. Household savings are included in the entry of Table 4.1, depreciation and retained earning row under household column ($327 thousand). Since no information is available for capital export it is implicitly subtracted from gross foreign investment. Thus, foreign investment figures represent net foreign investment which are obtained by substracting the household saving and depreciation and retained earning from total investment.

C. Estimation of Land Account

Town and Public Use Land

Town and public use land includes such categories as public road, military reservation, park and town or urban areas in the Interlake Area. No information is available for this type of land. In consultation with provincial authorities familiar with town planning, the total town and public use land was estimated as 3 percent of total land area, using township maps. In addition, the authorities also estimated an average of one percent expansion of town and public use land during the last decade and it is likely to continue at the similar rate of growth in the near future.[10] Consequently, the amount of town and public use land was estimated to be 178.4 thousand acres (total land area x 0.03) in 1961 and one percent of expansion of such land was added from the base year (1961) to the subsequent years.

Agricultural Land

Strictly speaking, there is no precise definition of agricultural land. It is defined in this study as those lands that are suitable for farming under current farming methods. By virtue of land characteristics for farming, agricultural land is further divided into two different categories - good and poor agricultural land. Good agricultural land covers all improved land except other category of improved land and poor agricultural land is unimproved pasture.[11]

Acreages of good and poor agricultural lands for 1961, 1966 and 1971 were available from Dominion Bureau of Statistics, Census of Canada - Agriculture, Manitoba.[12] For 1968, good agricultural

---

[10]This figure was estimated using township may by Mr. G.J. Tencha, Director of Planning Branch, and Mr. A. Srutwa, planner of Planning Branch, Department of Municipal Affairs, Province of Manitoba.

[11]Dominion Bureau of Statistics classifies the following lands as other improved land: the area of barnyards, home gardens, lanes and roads on farms, cultivated land that were lying idle being neither summer fallow nor cropped and areas of new breaking that had not been seeded to a crop. See: Dominion Bureau of Statistics, Census of Canada, Agriculture Manitoba, Cat. No. 96-537, Op. Cit., p. ix.

[12]Ibid., 1961, 1966 and 1971.

land area was obtained from Interlake Fact.[13] Land under crops and summer fallow were estimated from 1968 Manitoba Agriculture Yearbook.[14] Since the Interlake area covers part of Districts 5 and 4, some adjustments were made according to 1966 agriculture census. For example, the 1966 agriculture census indicated that 20% of summer fallow in Division 5 was covered in the Interlake area (St. Andrews). Then this proportion was applied to adjust total acreages of summer fallow from the 1968 Manitoba Agriculture Year book for St. Andrews. A similar approach was employed to adjust District 4 in which three Municipalities were covered in the Interlake area.

The acreages of under crop land for 1968 were estimated by first summing up all cropland and adjusting it, using the same method as for summer fallow, to the area. Then the residual between estimated total good agricultural land and the sum of crop and summer fallow was considered as improved pasture for 1968.

There is no information available concerning unimproved pasture in 1966 and 1968. It was simply estimated by the average growth rate of 20.1 acres per annum which was obtained from the difference between 1961 and 1971 divided by 10 years.

The classification of agriculture sectors were based on total sales. The livestock sector, for example, includes those farms with

---

[13] Framingham, MacMillan and Sandell, Op. Cit., Table 11.

[14] Manitoba Department of Agriculture, Manitoba Agriculture, 1968 Yearbook (Winnipeg: Department of Agriculture, Province of Manitoba, 1968), p. 32.

50 percent of total sales of agricultural products obtained from livestock.[15] On the other hand, those farms with 50 percent of total sales of agricultural products obtained from crop production are classified in the crop sector. Accordingly, allocation of agricultural land to each agricultural sector was based on the proportion of land occupied by these sectors in 1968. The farm household survey data indicated that (1) 70% of total land in farms was in the livestock sector and 30% of that was in the crop and other sector, and (2) 25% of good agricultural land was in the livestock sector and 75% of such land was in the crop and other sector. By comparing the distribution of total land in farm and good agricultural land between agricultural sectors, the increased percentage of total land in farms for the agriculture livestock sector was mainly due to that sector occupying most of the poor agricultural land. Thus, the poor agricultural land was allocated to each agricultural sector according to the estimated distribution of total land in farms. That is 70% of total poor agricultural land (649.4 thousand acres in Table 4.7) in the agriculture livestock sector and 30% of which is in the agriculture crop and other sector. The other two types of lands, good agricultural land and good agricultural land under crops, were directly calculated on the basis of the obtained distribution of good agricultural land. Then the sum of good and poor agricultural lands constitute total agricultural land for each sector.

---

[15] See: MacMillan, Lu and Framingham, Op. Cit., Appendix A, Sector Definitions.

Crown, Lake and Other Land

This type of land was obtained by substracting town and public land, and agricultural land from total land area. Thus, it includes these lands as crown land that was not leased to farmer, rivers or lakes, woodland, and both improved and unimproved lands classified as other use.

APPENDIX II

ESTIMATED TRADING COEFFICIENT MATRIX FOR THE BASE YEAR AND THE TARGET YEARS

TABLE II.1

ESTIMATED TRADING COEFFICIENT MATRIX FOR THE BASE YEAR, 1968 INTERLAKE AREA[a]

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Ag.-Livestock	0.0357	0.0093	0.0000	0.6118	0.0000	0.0000	0.0000	0.0000	0.0468	0.0035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000
(2) Ag.-Crop and other	0.0223	0.0165	0.0000	0.0390	0.0000	0.0000	0.0000	0.0000	0.0203	0.0043	0.0000	0.0002	0.0000	0.0000	0.0000	0.0045	0.0000
(3) Mining	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(4) Food & Bev. Mfg.	0.0026	0.0005	0.0001	0.0309	0.0000	0.0000	0.0000	0.0000	0.0000	0.0275	0.0045	0.0000	0.0000	0.0000	0.0000	0.0406	0.0000
(5) Other Mfg.	0.0000	0.0001	0.0083	0.0001	0.0010	0.0011	0.0057	0.0003	0.0018	0.0002	0.0012	0.0020	0.0076	0.0008	0.0070	0.0018	0.0073
(6) Transportation	0.0055	0.0130	0.0552	0.0064	0.0068	0.0009	0.0084	0.0001	0.0202	0.0013	0.0148	0.0033	0.0073	0.0052	0.0718	0.0044	0.0180
(7) Construction	0.0000	0.0003	0.0143	0.0000	0.0062	0.0000	0.0276	0.0043	0.0007	0.0019	0.0032	0.0007	0.0005	0.0052	0.0000	0.0074	0.0167
(8) Pet. wholesale	0.0992	0.0684	0.0000	0.0099	0.0034	0.0918	0.0035	0.0024	0.0038	0.0024	0.0026	0.0020	0.0030	0.0065	0.0066	0.0041	0.0016
(9) Farm Equip. & Bldg. Mat.	0.0647	0.0687	0.0000	0.0008	0.0007	0.0000	0.0538	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000
(10) Food Store	0.0006	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
(11) Other retail	0.0043	0.0007	0.0000	0.0010	0.0014	0.0090	0.0032	0.0004	0.0014	0.0005	0.0018	0.0020	0.0010	0.0004	0.0086	0.0048	0.0417
(12) Auto Product & Service	0.0522	0.1051	0.0000	0.0007	0.0003	0.1094	0.0075	0.0058	0.0052	0.0012	0.0006	0.0031	0.0018	0.0077	0.0000	0.0030	0.0045
(13) Apparel & Shoes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(14) Furniture & Appl.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(15) Insurance	0.0011	0.0020	0.0000	0.0002	0.0000	0.0036	0.0010	0.0001	0.0005	0.0007	0.0008	0.0004	0.0006	0.0012	0.0043	0.0010	0.0009
(16) Personal service	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0009	0.0070
(17) Other Service	0.0013	0.0025	0.0000	0.0003	0.0003	0.0008	0.0070	0.0015	0.0003	0.0009	0.0016	0.0022	-0.0016	0.0109	0.0199	0.0039	0.0107
Intermediate Subtotal[b]	0.2895	0.2870	0.0779	0.7010	0.0258	0.2166	0.1180	0.0148	0.1011	0.0444	0.0323	0.0158	0.0255	0.0379	0.1182	0.0790	0.1083
(18) Household	0.2968	0.3246	0.2754	0.1240	0.2870	0.4285	0.1832	0.0795	0.1051	0.0915	0.1271	0.1300	0.1315	0.2010	0.6077	0.2585	0.3661
(19) Government	0.0249	0.0423	0.0598	0.0024	0.1737	0.0439	0.0090	0.0051	0.0215	0.0111	0.0208	0.0206	0.0345	0.0339	0.0169	0.0265	0.0178
(20) Inventory Depletion	0.0836	0.0781	0.0000	0.0014	0.0000	0.0000	0.0012	0.0000	0.0000	0.0003	0.0042	0.0025	0.0161	0.0054	0.0000	0.0000	0.0000
(21) Depre. & Retained Earning	0.1076	0.1633	0.3343	0.0886	0.1160	0.1329	0.0574	0.0113	0.0296	0.0249	0.0395	0.0194	0.0417	0.0153	0.0232	0.0324	0.0236
(22) Rent	0.0141	0.0073	0.0002	0.0000	0.0013	0.0013	0.0018	0.0000	0.0000	0.0000	0.0035	0.0022	0.0139	0.0244	0.0268	0.0054	0.0362
(23) Interest	0.0070	0.0109	0.0000	0.0004	0.0010	0.0146	0.0071	0.0112	0.0049	0.0024	0.0068	0.0041	0.0050	0.0057	0.0096	0.0073	0.0112
(24) Unallocated	0.0057	0.0103	0.0141	0.0023	0.0006	0.0270	0.0109	0.0024	0.0042	0.0046	0.0069	0.0036	0.0054	0.0123	0.0463	0.0111	0.0522
(25) Import (Rest of Manitoba)	0.2545	0.1495	0.2385	0.0806	0.3310	0.1345	0.4731	0.6808	0.7336	0.8208	0.7630	0.8040	0.7426	0.6696	0.1493	0.5758	0.3702
(26) Import (Rest of Canada)	0.0000	0.0048	0.0000	0.0006	0.0636	0.0026	0.1395	0.1949	0.0000	0.0003	0.0001	0.0003	0.0000	0.0000	0.0020	0.0040	0.0143

[a]The numbers with bracket in the top of the table correspond to the sector numbers listed in the left-hand side of the table.

[b]Subtotals do not add due to a rounding error.

[c]Sources and estimation procedures are explained in Chapter 4.

TABLE II.2

ESTIMATED TRADING COEFFICIENT MATRIX FOR TARGET YEAR 1971, INTERLAKE AREA[a]

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Ag.-Livestock	0.0370	0.0088	0.0000	0.5974	0.0000	0.0000	0.0000	0.0000	0.0488	0.0035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000
(2) Ag.-Crop & other	0.0228	0.0168	0.0000	0.0401	0.0000	0.0000	0.0000	0.0000	0.0196	0.0043	0.0000	0.0002	0.0000	0.0000	0.0000	0.0045	0.0000
(3) Mining	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(4) Food & Bev. Mfg.	0.0026	0.0005	0.0001	0.0321	0.0000	0.0000	0.0000	0.0000	0.0000	0.0275	0.0045	0.0000	0.0000	0.0000	0.0000	0.0406	0.0000
(5) Other Mfg.	0.0000	0.0001	0.0083	0.0001	0.0010	0.0011	0.0057	0.0003	0.0018	0.0002	0.0012	0.0020	0.0076	0.0008	0.0070	0.0018	0.0000
(6) Transportation	0.0059	0.0131	0.0552	0.0066	0.0068	0.0099	0.0084	0.0001	0.0201	0.0013	0.0148	0.0033	0.0073	0.0052	0.0718	0.0044	0.0073
(7) Construction	0.0000	0.0003	0.0143	0.0000	0.0062	0.0000	0.0276	0.0043	0.0007	0.0019	0.0032	0.0007	0.0005	0.0052	0.0000	0.0074	0.0180
(8) Pet. wholesale	0.1009	0.0684	0.0000	0.0103	0.0034	0.0918	0.0035	0.0024	0.0038	0.0024	0.0026	0.0020	0.0030	0.0065	0.0066	0.0041	0.0167
(9) Farm Equip. & Bldg. Mat.	0.0650	0.0684	0.0000	0.0008	0.0007	0.0000	0.0538	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0016
(10) Food store	0.0006	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
(11) Other retail	0.0044	0.0007	0.0000	0.0010	0.0014	0.0090	0.0032	0.0004	0.0014	0.0005	0.0018	0.0020	0.0010	0.0004	0.0086	0.0048	0.0000
(12) Auto Product & Service	0.0515	0.1055	0.0000	0.0008	0.0003	0.1094	0.0075	0.0058	0.0052	0.0012	0.0006	0.0031	0.0018	0.0077	0.0000	0.0030	0.0417
(13) Apparel & Shoes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0045
(14) Furniture & Appl.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(15) Insurance	0.0011	0.0020	0.0000	0.0002	0.0000	0.0036	0.0010	0.0001	0.0005	0.0007	0.0008	0.0004	0.0006	0.0012	0.0043	0.0010	0.0000
(16) Personal service	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0009	0.0009
(17) Other service	0.0013	0.0026	0.0000	0.0003	0.0003	0.0008	0.0070	0.0015	0.0003	0.0009	0.0016	0.0022	0.0016	0.0109	0.0199	0.0039	0.0070
Intermediate Subtotal[b]	0.2930	0.2872	0.0779	0.6896	0.0258	0.2106	0.1180	0.0148	0.1023	0.0444	0.0323	0.0158	0.0255	0.0379	0.1182	0.0789	0.1083
(18) Household	0.2967	0.3235	0.2754	0.1288	0.2870	0.4265	0.1832	0.0795	0.1050	0.0915	0.1271	0.1300	0.1315	0.2010	0.6077	0.2585	0.3661
(19) Government	0.0248	0.0418	0.0598	0.0025	0.1737	0.0439	0.0090	0.0051	0.0214	0.0111	0.0208	0.0206	0.0345	0.0339	0.0169	0.0265	0.0178
(20) Inventory Depletion	0.0857	0.0831	0.0000	0.0015	0.0000	0.0000	0.0012	0.0000	0.0000	0.0003	0.0042	0.0025	0.0161	0.0054	0.0000	0.0000	0.0000
(21) Depre. & Retained Earnings	0.1072	0.1642	0.3343	0.0920	0.1160	0.1329	0.0574	0.0113	0.0296	0.0249	0.0395	0.0194	0.0417	0.0153	0.0232	0.0324	0.0236
(22) Rent	0.0146	0.0078	0.0002	0.0000	0.0013	0.0013	0.0018	0.0000	0.0000	0.0000	0.0035	0.0022	0.0139	0.0244	0.0268	0.0054	0.0362
(23) Interest	0.0073	0.0113	0.0000	0.0004	0.0010	0.0146	0.0071	0.0112	0.0049	0.0024	0.0068	0.0041	0.0050	0.0057	0.0096	0.0073	0.0112
(24) Unallocated	0.0059	0.0105	0.0141	0.0024	0.0006	0.0270	0.0109	0.0024	0.0042	0.0046	0.0069	0.0036	0.0054	0.0123	0.0463	0.0111	0.0522
(25) Import (Rest of Manitoba)	0.2505	0.1487	0.2385	0.0837	0.3310	0.1345	0.4731	0.6808	0.7326	0.8208	0.7630	0.8040	0.7426	0.6696	0.1493	0.5759	0.3702
(26) Import (Rest of Canada)	0.0000	0.0049	0.0000	0.0006	0.0636	0.0026	0.1395	0.1949	0.0000	0.0003	0.0001	0.0003	0.0000	0.0000	0.0020	0.0040	0.0143

[a]The numbers with brackets in the top of the table correspond to the sector numbers listed in the left-hand side of the table.

[b]Subtotals do not add due to a rounding error.

[c]Source and estimation procedures are explained in Chapter 4.

TABLE II.3

ESTIMATED TRADING COEFFICIENT MATRIX FOR TARGET YEAR 1976, INTERLAKE AREA[a]

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Ag.-Livestock	0.0396	0.0079	0.0000	0.5712	0.0000	0.0000	0.0000	0.0000	0.0528	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0023	0.0000
(2) Ag.-Crop & other	0.0235	0.0174	0.0000	0.0405	0.0000	0.0000	0.0000	0.0000	0.0175	0.0041	0.0000	0.0002	0.0000	0.0000	0.0000	0.0044	0.0000
(3) Mining	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(4) Food & Bev. Mfg.	0.0026	0.0005	0.0000	0.0344	0.0000	0.0000	0.0000	0.0000	0.0000	0.0275	0.0045	0.0000	0.0000	0.0000	0.0000	0.0406	0.0000
(5) Other Mfg.	0.0000	0.0001	0.0001	0.0001	0.0010	0.0011	0.0057	0.0003	0.0018	0.0002	0.0012	0.0020	0.0076	0.0008	0.0070	0.0018	0.0073
(6) Transportation	0.0065	0.0133	0.0083	0.0071	0.0068	0.0009	0.0084	0.0001	0.0201	0.0013	0.0148	0.0033	0.0073	0.0052	0.0718	0.0044	0.0180
(7) Construction	0.0000	0.0003	0.0552	0.0000	0.0062	0.0000	0.0276	0.0043	0.0007	0.0019	0.0032	0.0007	0.0005	0.0052	0.0000	0.0074	0.0167
(8) Pet. wholesale	0.1043	0.0683	0.0143	0.0110	0.0034	0.0918	0.0035	0.0024	0.0038	0.0024	0.0026	0.0020	0.0030	0.0065	0.0066	0.0041	0.0016
(9) Farm Equip. & Bldg. Mat.	0.0653	0.0676	0.0000	0.0009	0.0007	0.0000	0.0538	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000
(10) Food Store	0.0006	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
(11) Other Retail	0.0044	0.0007	0.0000	0.0011	0.0014	0.0090	0.0032	0.0004	0.0014	0.0005	0.0018	0.0020	0.0010	0.0004	0.0086	0.0048	0.0417
(12) Auto Product & Service	0.0500	0.1062	0.0000	0.0008	0.0003	0.1094	0.0075	0.0058	0.0052	0.0012	0.0006	0.0031	0.0018	0.0077	0.0000	0.0030	0.0045
(13) Apparel & Shoes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(14) Furniture & Appl.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(15) Insurance	0.0011	0.0021	0.0000	0.0002	0.0000	0.0036	0.0010	0.0001	0.0005	0.0007	0.0008	0.0004	0.0006	0.0012	0.0043	0.0010	0.0009
(16) Personal Service	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0009	0.0070
(17) Other Service	0.0013	0.0029	0.0000	0.0003	0.0003	0.0008	0.0070	0.0015	0.0003	0.0009	0.0016	0.0022	0.0016	0.0109	0.0199	0.0039	0.0107
Intermediate Subtotal	0.2993	0.2872	0.0779	0.6675	0.0258	0.2166	0.1180	0.0148	0.1041	0.0441	0.0323	0.0158	0.0255	0.0379	0.1182	0.0787	0.1083
(18) Household	0.2961	0.3203	0.2754	0.1379	0.2870	0.4265	0.1832	0.0795	0.1048	0.0915	0.1271	0.1300	0.1315	0.2010	0.6077	0.2585	0.3661
(19) Government	0.0247	0.0409	0.0598	0.0026	0.1737	0.0439	0.0090	0.0051	0.0214	0.0111	0.0208	0.0206	0.0345	0.0339	0.0169	0.0265	0.0178
(20) Inventory Depletion	0.0896	0.0923	0.0000	0.0016	0.0000	0.0000	0.0012	0.0000	0.0000	0.0003	0.0042	0.0025	0.0161	0.0054	0.0000	0.0000	0.0000
(21) Depre. & Retained Earning	0.1062	0.1662	0.3343	0.0986	0.1160	0.1329	0.0574	0.0113	0.0295	0.0250	0.0395	0.0194	0.0417	0.0153	0.0232	0.0324	0.0236
(22) Rent	0.0155	0.0089	0.0002	0.0000	0.0013	0.0013	0.0018	0.0000	0.0000	0.0000	0.0035	0.0022	0.0139	0.0244	0.0268	0.0054	0.0362
(23) Interest	0.0077	0.0121	0.0000	0.0004	0.0010	0.0146	0.0071	0.0112	0.0049	0.0024	0.0068	0.0041	0.0050	0.0057	0.0096	0.0073	0.0112
(24) Unallocated	0.0064	0.0109	0.0141	0.0026	0.0006	0.0270	0.0109	0.0024	0.0042	0.0046	0.0069	0.0036	0.0054	0.0123	0.0463	0.0111	0.0522
(25) Import (Rest of Manitoba)	0.2441	0.1484	0.2385	0.0896	0.3310	0.1345	0.4731	0.6808	0.7311	0.8210	0.7630	0.8040	0.7426	0.6696	0.1493	0.5760	0.3702
(26) Import (Rest of Canada)	0.0000	0.0051	0.0000	0.0007	0.0636	0.0026	0.1395	0.1949	0.0000	0.0003	0.0001	0.0003	0.0000	0.0000	0.0020	0.0040	0.0143

[a]The numbers with brackets in the top of the table correspond to the sector numbers listed in the left-hand side of the table.

[b]Subtotals do not add due to a rounding error.

[c]Source estimation procedures are explained in Chapter 4.

TABLE II.4

ESTIMATED TRADING COEFFICIENT MATRIX FOR TARGET YEAR 1977, INTERLAKE AREA[a]

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Ag.-Livestock	0.0401	0.0078	0.0000	0.5674	0.0000	0.0000	0.0000	0.0000	0.0536	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0023	0.0000
(2) Ag.-Crop & other	0.0235	0.0174	0.0000	0.0405	0.0000	0.0000	0.0000	0.0000	0.0172	0.0041	0.0000	0.0002	0.0000	0.0000	0.0000	0.0044	0.0000
(3) Mining	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(4) Food & Bev. Mfg.	0.0026	0.0005	0.0000	0.0347	0.0000	0.0000	0.0000	0.0000	0.0000	0.0275	0.0045	0.0000	0.0000	0.0000	0.0000	0.0406	0.0000
(5) Other Mfg.	0.0000	0.0001	0.0001	0.0001	0.0010	0.0011	0.0057	0.0003	0.0018	0.0002	0.0012	0.0020	0.0076	0.0008	0.0070	0.0018	0.0073
(6) Transportation	0.0066	0.0133	0.0083	0.0071	0.0068	0.0009	0.0084	0.0001	0.0201	0.0013	0.0148	0.0033	0.0073	0.0052	0.0718	0.0044	0.0180
(7) Construction	0.0000	0.0003	0.0552	0.0000	0.0062	0.0000	0.0276	0.0043	0.0007	0.0019	0.0032	0.0007	0.0005	0.0052	0.0000	0.0074	0.0167
(8) Pet. Wholesale	0.1048	0.0683	0.0143	0.0111	0.0034	0.0918	0.0035	0.0024	0.0038	0.0024	0.0026	0.0020	0.0030	0.0065	0.0066	0.0041	0.0016
(9) Farm Equip. & Bldg. Mat.	0.0654	0.0674	0.0000	0.0009	0.0007	0.0000	0.0538	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000
(10) Food Store	0.0006	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
(11) Other Retail	0.0045	0.0007	0.0000	0.0011	0.0014	0.0090	0.0032	0.0004	0.0014	0.0005	0.0018	0.0020	0.0010	0.0004	0.0086	0.0048	0.0417
(12) Auto Product & Service	0.0498	0.1063	0.0000	0.0008	0.0003	0.1094	0.0075	0.0058	0.0052	0.0012	0.0006	0.0031	0.0018	0.0077	0.0000	0.0030	0.0045
(13) Apparel & Shoes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(14) Surniture & Appl.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(15) Insurance	0.0011	0.0021	0.0000	0.0002	0.0000	0.0036	0.0010	0.0001	0.0005	0.0007	0.0008	0.0004	0.0006	0.0012	0.0043	0.0010	0.0009
(16) Personal Service	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0009	0.0070
(17) Other Service	0.0013	0.0029	0.0000	0.0003	0.0003	0.0008	0.0070	0.0015	0.0003	0.0009	0.0016	0.0022	0.0016	0.0109	0.0199	0.0039	0.0107
Intermediate Subtotal	0.3003	0.2871	0.0779	0.6642	0.0258	0.2166	0.1180	0.0148	0.1046	0.0441	0.0323	0.0158	0.0255	0.0379	0.1182	0.0787	0.1083
(18) Household	0.2959	0.3196	0.2754	0.1393	0.2870	0.4265	0.1832	0.0795	0.1047	0.0915	0.1271	0.1300	0.1315	0.2010	0.6077	0.2585	0.3661
(19) Government	0.0247	0.0407	0.0598	0.0027	0.1737	0.0439	0.0090	0.0051	0.0214	0.0111	0.0208	0.0206	0.0345	0.0339	0.0169	0.0265	0.0178
(20) Inventory Depletion	0.0902	0.0940	0.0000	0.0016	0.0000	0.0000	0.0012	0.0000	0.0000	0.0003	0.0042	0.0025	0.0161	0.0054	0.0000	0.0000	0.0000
(21) Depre. & Retained Earning	0.1060	0.1665	0.3343	0.0995	0.1160	0.1329	0.0574	0.0113	0.0295	0.0250	0.0395	0.0194	0.0417	0.0153	0.0232	0.0324	0.0236
(22) Rent	0.0156	0.0090	0.0002	0.0000	0.0013	0.0013	0.0018	0.0000	0.0000	0.0000	0.0035	0.0022	0.0139	0.0244	0.0268	0.0054	0.0362
(23) Interest	0.0078	0.0123	0.0000	0.0004	0.0010	0.0146	0.0071	0.0112	0.0049	0.0024	0.0068	0.0041	0.0050	0.0057	0.0096	0.0073	0.0112
(24) Unallocated	0.0065	0.0110	0.0141	0.0026	0.0006	0.0270	0.0109	0.0024	0.0042	0.0046	0.0069	0.0036	0.0054	0.0123	0.0463	0.0111	0.0522
(25) Import (Rest of Manitoba)	0.2432	0.1485	0.2385	0.0905	0.3310	0.1395	0.4731	0.6808	0.7307	0.8210	0.7630	0.8040	0.7426	0.6696	0.1493	0.5760	0.3702
(26) Import (Rest of Canada)	0.0000	0.0052	0.0000	0.0007	0.0636	0.0026	0.1395	0.1949	0.0000	0.0003	0.0001	0.0003	0.0000	0.0000	0.0020	0.0040	0.0143

[a]The numbers with brackets in the top of the table correspond to the sector numbers listed in the left-hand side of the table.

[b]Subtotals do not add due to a rounding error.

[c]Sources and estimation procedures are explained in Chapter 4.

TABLE II.5

ESTIMATED TRADING COEFFICIENT MATRIX FOR
TARGET YEAR 1981, INTERLAKE AREA[a]

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Ag.-Livestock	0.0419	0.0072	0.0000	0.5513	0.0000	0.0000	0.0000	0.0000	0.0568	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0023	0.0000
(2) Ag.-Crop & other	0.0239	0.0178	0.0000	0.0406	0.0000	0.0000	0.0000	0.0000	0.0158	0.0041	0.0000	0.0002	0.0000	0.0000	0.0000	0.0043	0.0000
(3) Mining	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(4) Food & Bev. Mfg.	0.0026	0.0005	0.0000	0.0362	0.0000	0.0000	0.0000	0.0000	0.0000	0.0275	0.0045	0.0000	0.0000	0.0000	0.0000	0.0406	0.0000
(5) Other Mfg.	0.0000	0.0001	0.0001	0.0001	0.0010	0.0011	0.0057	0.0003	0.0018	0.0002	0.0012	0.0020	0.0076	0.0008	0.0070	0.0018	0.0073
(6) Transportation	0.0071	0.0134	0.0083	0.0074	0.0068	0.0009	0.0084	0.0001	0.0201	0.0013	0.0148	0.0033	0.0073	0.0052	0.0718	0.0044	0.0180
(7) Construction	0.0000	0.0003	0.0552	0.0000	0.0062	0.0000	0.0276	0.0043	0.0007	0.0019	0.0032	0.0007	0.0005	0.0052	0.0000	0.0074	0.0167
(8) Pet. Wholesale	0.1071	0.0681	0.0143	0.0116	0.0034	0.0918	0.0035	0.0024	0.0038	0.0024	0.0026	0.0020	0.0030	0.0065	0.0066	0.0041	0.0016
(9) Farm Equip. & Bldg. Mat.	0.0656	0.0668	0.0000	0.0009	0.0007	0.0000	0.0538	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000
(10) Food Store	0.0006	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
(11) Other Retail	0.0045	0.0007	0.0000	0.0011	0.0014	0.0090	0.0032	0.0004	0.0014	0.0005	0.0018	0.0020	0.0010	0.0004	0.0086	0.0048	0.0417
(12) Auto Product & Service	0.0487	0.1067	0.0000	0.0009	0.0003	0.1094	0.0075	0.0058	0.0051	0.0012	0.0006	0.0031	0.0018	0.0077	0.0000	0.0030	0.0045
(13) Apparel & Shoes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(14) Furniture & Appl.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(15) Insurance	0.0010	0.0021	0.0000	0.0002	0.0000	0.0036	0.0010	0.0001	0.0005	0.0007	0.0008	0.0004	0.0006	0.0012	0.0043	0.0010	0.0009
(16) Personal Service	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0009	0.0070
(17) Other Service	0.0013	0.0031	0.0000	0.0004	0.0003	0.0008	0.0070	0.0015	0.0003	0.0009	0.0016	0.0022	0.0016	0.0109	0.0199	0.0039	0.0167
Intermediate Subtotal	0.3044	0.2869	0.0779	0.6506	0.0258	0.2166	0.1180	0.0148	0.1064	0.0441	0.0323	0.0158	0.0255	0.0379	0.1182	0.0787	0.1083
(18) Household	0.2952	0.3168	0.2754	0.1449	0.2870	0.4265	0.1832	0.0795	0.0045	0.0915	0.1271	0.1300	0.1315	0.2010	0.6077	0.2585	0.3661
(19) Government	0.0245	0.0401	0.0598	0.0028	0.1737	0.0439	0.0090	0.0051	0.0213	0.0111	0.0208	0.0206	0.0345	0.0339	0.0169	0.0265	0.0178
(20) Inventory Depletion	0.0928	0.1005	0.0000	0.0017	0.0000	0.0000	0.0012	0.0000	0.0000	0.0003	0.0042	0.0025	0.0161	0.0054	0.0000	0.0000	0.0000
(21) Depre. & Retained Earning	0.1051	0,1681	0.3343	0.1036	0.1160	0.1329	0.0574	0.0113	0.0295	0.0250	0.0395	0.0194	0.0417	0.0153	0.0232	0.0324	0.0236
(22) Rent	0.0162	0.0098	0.0002	0.0000	0.0013	0.0013	0.0018	0.0000	0.0000	0.0000	0.0035	0.0022	0.0139	0.0244	0.0268	0.0054	0.0362
(23) Interest	0.0081	0.0128	0.0000	0.0005	0.0010	0.0146	0.0071	0.0112	0.0048	0.0024	0.0068	0.0041	0.0050	0.0057	0.0096	0.0073	0.0112
(24) Unallocated	0.0069	0.0114	0.0141	0.0027	0.0006	0.0270	0.0109	0.0024	0.0042	0.0046	0.0069	0.0036	0.0054	0.0123	0.0463	0.0111	0.0522
(25) Import (Rest of Manitoba)	0.2395	0.1489	0.2385	0.0942	0.3310	0.1345	0.4731	0.6808	0.7292	0.8211	0.7630	0.8040	0.7426	0.6696	0.1493	0.5760	0.3702
(26) Import (Rest of Canada)	0.0000	0.0053	0.0000	0.0007	0.0636	0.0026	0.1395	0.1949	0.0000	0.0003	0.0001	0.0003	0.0000	0.0000	0.0020	0.0040	0.0143

[a]The numbers with brackets in the top of the table correspond to the sector numbers listed in the left-hand side of the table.

[b]Subtotals do not add due to a rounding error.

[c]Sources and estimation procedures are explained in Chapter 4.

TABLE II.6

ESTIMATED TRADING COEFFICIENT MATRIX FOR TARGET YEAR 1986, INTERLAKE AREA[a]

Sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Ag.-Livestock	0.0438	0.0067	0.0000	0.5366	0.0000	0.0000	0.0000	0.0000	0.0604	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0023	0.0000
(2) Ag.-Crop and other	0.0242	0.0180	0.0000	0.0407	0.0000	0.0000	0.0000	0.0000	0.0146	0.0041	0.0000	0.0002	0.0000	0.0000	0.0000	0.0043	0.0000
(3) Mining	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(4) Food & Bev. Mfg.	0.0027	0.0006	0.0000	0.0375	0.0000	0.0000	0.0000	0.0000	0.0000	0.0275	0.0045	0.0000	0.0000	0.0000	0.0000	0.0406	0.0000
(5) Other Mfg.	0.0000	0.0001	0.0001	0.0001	0.0010	0.0011	0.0057	0.0003	0.0018	0.0002	0.0012	0.0020	0.0076	0.0008	0.0070	0.0018	0.0073
(6) Transportation	0.0075	0.0134	0.0083	0.0077	0.0068	0.0009	0.0084	0.0001	0.0200	0.0013	0.0148	0.0033	0.0072	0.0052	0.0718	0.0044	0.0180
(7) Construction	0.0000	0.0002	0.0552	0.0000	0.0062	0.0000	0.0276	0.0043	0.0007	0.0019	0.0032	0.0007	0.0005	0.0052	0.0000	0.0074	0.0167
(8) Pet. Wholesale	0.1092	0.0680	0.0143	0.0120	0.0034	0.0918	0.0035	0.0024	0.0038	0.0024	0.0026	0.0020	0.0030	0.0065	0.0066	0.0041	0.0016
(9) Farm Equip. & Bldg. Mat.	0.0657	0.0661	0.0000	0.0000	0.0007	0.0000	0.0538	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000
(10) Food Store	0.0006	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
(11) Other Retail	0.0045	0.0007	0.0000	0.0012	0.0014	0.0090	0.0032	0.0004	0.0014	0.0005	0.0018	0.0020	0.0010	0.0004	0.0086	0.0048	0.0417
(12) Auto Product & Service	0.0476	0.1072	0.0000	0.0009	0.0003	0.1094	0.0075	0.0058	0.0051	0.0012	0.0006	0.0031	0.0018	0.0077	0.0000	0.0030	0.0045
(13) Apparel & Shoes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(14) Furniture & Appl.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
(15) Insurance	0.0010	0.0021	0.0000	0.0002	0.0000	0.0036	0.0010	0.0001	0.0005	0.0007	0.0008	0.0004	0.0006	0.0012	0.0043	0.0010	0.0009
(16) Personal Service	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0009	0.0070
(17) Other Service	0.0013	0.0033	0.0000	0.0004	0.0003	0.0008	0.0070	0.0015	0.0003	0.0009	0.0016	0.0022	0.0016	0.0109	0.0199	0.0039	0.0107
Intermediate Subtotal	0.3083	0.2865	0.0779	0.6381	0.0258	0.2166	0.1180	0.0148	0.1086	0.0441	0.0323	0.0158	0.0255	0.0379	0.1182	0.0787	0.1083
(18) Household	0.2944	0.3136	0.2754	0.1501	0.2870	0.4265	0.1832	0.0795	0.1042	0.0915	0.1271	0.1300	0.1315	0.2010	0.6077	0.2585	0.3661
(19) Government	0.0244	0.0396	0.0598	0.0029	0.1737	0.0439	0.0090	0.0051	0.0213	0.0111	0.0208	0.0206	0.0345	0.0339	0.0169	0.0265	0.0178
(20) Inventory Depletion	0.0953	0.1071	0.0000	0.0017	0.0000	0.0000	0.0012	0.0000	0.0000	0.0003	0.0042	0.0025	0.0161	0.0054	0.0000	0.0000	0.0000
(21) Depre. & Retained Earning	0.1042	0.1697	0.3343	0.1073	0.1160	0.1329	0.0574	0.0113	0.0294	0.0250	0.0395	0.0194	0.0417	0.0153	0.0232	0.0324	0.0236
(22) Rent	0.0168	0.0106	0.0002	0.0000	0.0013	0.0013	0.0018	0.0000	0.0000	0.0000	0.0035	0.0022	0.0139	0.0244	0.0268	0.0054	0.0362
(23) Interest	0.0084	0.0133	0.0000	0.0005	0.0010	0.0146	0.0071	0.0112	0.0048	0.0024	0.0068	0.0041	0.0050	0.0057	0.0096	0.0073	0.0112
(24) Unallocated	0.0072	0.0118	0.0141	0.0028	0.0006	0.0270	0.0109	0.0024	0.0042	0.0046	0.0069	0.0036	0.0054	0.0123	0.0463	0.0111	0.0522
(25) Import (Rest of Manitoba)	0.2363	0.1495	0.2385	0.0976	0.3310	0.1345	0.4731	0.6808	0.7275	0.8211	0.7630	0.8040	0.7426	0.6696	0.1493	0.5760	0.3702
(26) Import (Rest of Canada)	0.0000	0.0054	0.0000	0.0008	0.0636	0.0026	0.1395	0.1949	0.0000	0.0003	0.0001	0.0003	0.0000	0.0000	0.0020	0.0040	0.0143

[a]The numbers with Brackets in the top of the table correspond to the sector numbers listed in the left-hand side of the table.

[b]Subtotals do not add due to a rounding error.

[c]Sources and estimation procedures are explained in Chapter 4.

APPENDIX III

ESTIMATED DEMAND ELASTICITY MATRICES, AND PROJECTED REAL PER CAPITA DISPOSAL INCOME AND CONSUMER PRICE INDICES FOR EACH TARGET YEAR, INTERLAKE

TABLE III.1

ESTIMATED DEMAND ELASTICITY MATRICES EMPLOYED IN HOUSEHOLD EXPENDITURE PROJECTIONS FOR THE TARGET YEARS, INTERLAKE AREA[a]

	Commodity Groups[b]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1968	1. Meat Product	-0.29610	-0.00779	-0.00986	-0.01158	-0.00259	-0.01060	0.03988	-0.00039	0.00238	-0.00304	0.00030
	2. Dairy Product	-0.01806	-0.28381	-0.00980	-0.01150	-0.00258	-0.01053	0.03962	-0.00039	0.00237	-0.00302	0.00030
	3. Fruit & Vegetable	-0.01952	-0.00837	-0.30888	-0.01243	-0.00278	-0.01138	0.04281	-0.00042	0.00256	-0.00326	0.00032
	4. Other Food	-0.00767	-0.00329	-0.00416	-0.12203	-0.00109	-0.00447	0.01681	-0.00016	0.00100	-0.00128	0.00013
	5. Housing	-0.05690	-0.02439	-0.03086	-0.03623	-0.87778	-0.03319	0.12480	-0.00122	0.00745	-0.00950	0.00094
	6. Clothing	-0.03083	-0.01321	-0.01672	-0.01963	-0.00440	-0.48923	0.06761	-0.00066	0.00404	-0.00515	0.00051
	7. Transportation	-0.09054	-0.03881	-0.04911	-0.05765	-0.01292	-0.05280	-1.18523	-0.00195	0.01186	-0.01511	0.00149
	8. Health & Pers. Care	-0.06416	-0.02750	-0.03480	-0.04085	-0.00915	-0.03742	0.14071	-0.98197	0.00840	-0.01071	0.00106
	9. Recreation & Reading	-0.06787	-0.02909	-0.03681	-0.05433	-0.00968	-0.03958	0.14886	-0.00146	-1.02846	-0.01133	0.00112
	10. Tobacco & Alcohol	-0.05829	-0.02497	-0.03161	-0.03712	-0.00832	-0.03400	0.12784	-0.00125	0.00764	-0.90063	0.00096
	11. Other	-0.06589	-0.02824	-0.03574	-0.04196	-0.00940	-0.03846	0.14451	-0.00142	0.00863	-0.01100	-0.00596
1971	1. Meat Product	-0.30389	-0.00771	-0.00974	-0.01153	-0.00210	-0.01033	0.04402	0.00018	0.00428	-0.00232	0.00153
	2. Dairy Product	-0.01786	-0.29167	-0.00968	-0.01146	-0.00208	-0.01026	0.04372	0.00018	0.00426	-0.00231	0.00152
	3. Fruit & Vegetable	-0.01930	-0.00827	-0.31733	-0.01238	-0.00225	-0.01109	0.04724	0.00019	0.00460	-0.00249	0.00164
	4. Other Food	-0.00758	-0.00325	-0.00411	-0.12538	-0.00088	-0.00438	0.01855	0.00007	0.00181	-0.00098	0.00065
	5. Housing	-0.05627	-0.02412	-0.03048	-0.03609	-0.90124	-0.03233	0.13774	0.00055	0.01341	-0.00727	0.00480
	6. Clothing	-0.03049	-0.01307	-0.01651	-0.01955	-0.00355	-0.50221	0.07462	0.00030	0.00726	-0.00394	0.00260
	7. Transportation	-0.08954	-0.03838	-0.04851	-0.05743	-0.01044	-0.05145	-1.20443	0.00088	0.02133	-0.01156	0.00763
	8. Health & Pers. Care	-0.06345	-0.02720	-0.03437	-0.04070	-0.00740	-0.03646	0.15530	-1.00816	0.01512	-0.00819	0.00541
	9. Recreation & Reading	-0.06712	-0.02877	-0.03636	-0.04305	-0.00783	-0.03857	0.16430	0.00066	-1.05119	-0.00867	0.00572
	10. Tobacco & Alcohol	-0.05767	-0.02471	-0.03123	-0.03698	-0.00672	-0.03312	0.14110	0.00057	0.01373	-0.92396	0.00491
	11. Other	-0.06515	-0.02793	-0.03530	-0.04180	-0.00760	-0.03744	0.15950	0.00064	0.01552	-0.00842	-1.03045
1976	1. Meat Product	-0.32445	-0.00748	-0.00942	-0.01142	-0.00078	-0.00962	0.05493	0.00168	0.00931	-0.00044	0.00479
	2. Dairy Product	-0.01734	-0.31240	-0.00936	-0.01134	-0.00078	-0.00955	0.05457	0.00167	0.00924	-0.00044	0.00475
	3. Fruit & Vegetable	-0.01873	-0.00803	-0.33964	-0.01226	-0.00084	-0.01032	0.05896	0.00180	0.00999	-0.00047	0.00514
	4. Other Food	-0.00736	-0.00315	-0.00397	-0.13423	-0.00033	-0.00405	0.02316	0.00071	0.00392	-0.00019	0.00202
	5. Housing	-0.05461	-0.02342	-0.02949	-0.03573	-0.96314	-0.03009	0.17189	0.00525	0.02912	-0.00138	0.01498
	6. Clothing	-0.02958	-0.01269	-0.01597	-0.01936	-0.00133	-0.53675	0.09312	0.00284	0.01578	-0.00075	0.00811
	7. Transportation	-0.08689	-0.03726	-0.04692	-0.05685	-0.00390	-0.05788	-1.25513	0.00835	0.04634	-0.00220	0.02383
	8. Health & Pers. Care	-0.06158	-0.02640	-0.03325	-0.04029	-0.00276	-0.03393	0.19382	-1.07730	0.03283	-0.00156	0.01689
	9. Recreation & Reading	-0.06514	-0.02793	-0.03517	-0.04262	-0.00292	-0.03589	0.20504	0.00626	-1.11119	-0.00165	0.01786
	10. Tobacco & Alcohol	-0.05594	-0.02399	-0.03021	-0.03660	-0.00251	-0.03083	0.17609	0.00538	0.02983	-0.98556	0.01534
	11. Other	-0.06324	-0.02712	-0.03415	-0.04137	-0.00284	-0.03484	0.19905	0.00608	0.03372	-0.00160	-1.09511

TABLE III.1 (Continued)

		Commodity Groups[b]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1981	1.	Meat Product	-034130	-0.00730	-0.00916	-0.01132	0.00029	-0.00903	0.06387	0.00291	0.91342	0.00110	0.00745
	2.	Dairy Product	-0.01690	-0.32938	-0.00910	-0.01125	0.00029	-0.00897	0.06345	0.00289	0.01333	0.00109	0.00840
	3.	Fruit & Vegetable	-0.01826	-0.00783	-0.35790	-0.01215	0.00032	-0.00969	0.06856	0.00312	0.01440	0.00118	0.00800
	4.	Other Food	-0.00717	-0.00308	-0.00386	-0.14147	0.00012	-0.00381	0.02692	0.00123	0.00566	0.00046	0.00314
	5.	Housing	-0;05325	-0.02284	-0.02867	-0.03543	-1.01384	-0.02825	0.19987	0.00910	0.04199	0.00344	0.02332
	6.	Clothing	-0.02885	-0.01237	-0.01553	-0.01919	0.00050	-0.56505	0.10828	0.00493	0.02275	0.00186	0.01263
	7.	Transportation	-0.08473	-0.03634	-0.04562	-0.05638	0.00146	-0.04496	-1.29665	0.01447	0.06685	0.00548	0.03710
	8.	Health & Pers. Care	-0.06004	-0.02575	-0.03233	-0.03995	0.00104	-0.03186	0.22536	-1.13393	0.04735	0.00388	0.02629
	9.	Recreation & Reading	-0.06352	-0.02724	-0.03420	-0.04226	0.00110	-0.03370	0.23841	0.01085	-1.16034	0.00411	0.02781
	10.	Tobacco & Alcchol	-0.05455	-0.02340	-0.02937	-0.03630	0.00094	-0.02894	0.20475	0.00934	0.04302	-1.03601	0.02389
	11.	Other	-0.06166	-0.02645	-0.03320	-0.04103	0.00107	-0.03272	0.23144	0.01953	0.94862	0.00399	-1.14807
1986	1.	Meat Product	-0.35520	-0.00715	-0.00895	-0.01124	0.00118	-0.00854	0.07125	0.00392	0.01681	0.00237	0.00965
	2.	Dairy Product	-0.01655	-0.34339	-0.34339	-0.01117	0.00117	-0.00849	0.07078	0.00390	0.01670	0.00236	0.00959
	3.	Fruit & Vegetable	-0.01788	-0.00767	-0.37298	-0.01207	0.00127	-0.00917	0.07648	0.00421	0.01805	0.00255	0.01036
	4.	Other Food	-0.00702	-0.00301	-0.00377	-0.14745	0.00050	-0.00350	0.03003	0.00165	0.00709	0.00100	0.00407
	5.	Housing	-0.05212	-0.02236	-0.02800	-0.03518	-1.05569	-0.02674	0.22296	0.91227	0.05261	0.00742	0.03020
	6.	Clothing	-0.02824	-0.01211	-0.01517	-0.01906	0.00200	-0.58841	0.12079	0.00665	0.02850	0.00402	0.01636
	7.	Transportation	-0.08294	-0.03558	-0.04455	-0.05598	0.00589	-0.04254	-1.33092	0.91953	0.98372	0.01181	0.04805
	8.	Health & Pers. Care	-0.05877	-0.02521	-0.02521	-0.03967	0.00417	-0.03015	0.25140	-1.18067	0.05932	0.00837	0.03405
	9.	Recreation & Reading	-0.06218	-0.02667	-0.03340	-0.04197	0.00441	-0.03189	0.26595	0.01464	-1.20090	0.00885	0.03602
	10.	Tobacco & Alcohol	-0.05340	-0.02291	-0.02868	-0.03604	0.00379	-0.02739	0.22840	0.91257	0.05390	-1.07765	0.03094
	11.	Other	-0.06036	-0.02589	-0.03242	-0.04074	0.00428	-0.03096	0.25818	0.01421	0.06092	0.00859	-1.19177
1990	1.	Meat Product	-o.36617	-0.00703	-0.00878	-0.01118	0.00188	-0.00816	0.07707	0.00472	0.01949	0.00338	0.01139
	2.	Dairy Product	-0.01612	-0.35445	-0.00872	-0.01111	0.00187	-0.00811	0.07656	0.00469	0.01936	0.00335	0.01131
	3.	Fruit & Vegetable	-0.01757	-0.00754	-0.38488	-0.01200	-.60202	-0.00876	0.08273	0.00507	0.02092	0.00362	0.01222
	4.	Other Food	-0.00690	-0.00296	-0.00370	-0.15217	0.00070	-0.00344	0.03240	9.00199	0.00822	0.00142	0.00480
	5.	Housing	-0.05124	-0.02198	-0.02747	-0.03499	-1.08871	-0.02554	0.24118	0.01478	0.06100	0.01056	0.03563
	6.	Clothing	-0.02776	-0.01191	-0.01488	-0.01896	0.00319	-0.60684	0.13066	0.00801	0.03304	0.00572	0.01930
	7.	Transportation	-0.08153	-0.03498	-0.04371	-0.05567	0.00938	-0.04064	-1.35797	0.02351	0.09706	0.01681	0.05669
	8.	Health & Pers. Care	-0.05777	-0.02479	-0.30397	-0.03945	0.00665	-0.02880	0.27194	-1.21756	0.06878	0.01191	0.04017
	9.	Recreation & Reading	-0.06112	-0.02622	-0.03276	-0.04174	0.00703	-0.03046	0.28769	0.01763	-1.23291	0.01260	0.04250
	10.	Tobacco & Alcohol	-0.05249	-0.02252	-0.02814	-0.03584	0.00604	-0.02616	0.24707	0.01514	0.06249	-1.11051	0.03650
	11.	Other	-0.05933	-0.02546	-0.03181	-0.04052	0.00682	-0.02957	0.27928	0.01711	0.07063	0.01223	-1.22626

[a] The numbers in the top of the table are corresponding to the numbers in the left-hand side of the table.

[b] Sources and estimation procedures are explained in Chapter 4.

TABLE III.2

PROJECTED REAL PER CAPITA PERSONAL DISPOSAL INCOME AND CONSUMER PRICE INDICES FOR THE TARGET YEARS, INTERLAKE AREA

	Base Year 1968	Projections 1971	1976	1977	1981	1986
Per Capita Real Disposal Income ($)[a]	1,475.7	1,723.8	2,137.3	2,824.5	2,550.8	2,964.3
Price Indices[b]						
1. Meat product	100.0	132.3	186.2	196.9	240.0	293.9
2. Dairy product	100.0	130.3	180.8	190.9	231.3	281.8
3. Fruit & Veg.	100.0	122.5	160.0	167.5	197.5	235.0
4. Other Food	100.0	105.7	115.2	117.1	124.7	134.2
5. Housing	100.0	105.6	112.2	113.6	118.9	125.5
6. Clothing	100.0	100.0	107.9	109.4	115.7	123.6
7. Transportation	100.0	108.4	118.5	120.5	128.6	138.7
8. Health & Care	100.0	109.5	124.4	127.4	139.3	154.2
9. Rec. & Reading	100.0	105.2	115.8	117.9	126.5	137.1
10. Tobacco & Al.	100.0	98.7	107.0	108.6	115.2	123.4
11. Other	100.0	112.6	133.6	137.8	154.6	175.6
All Items	100.0	104.2	112.7	114.4	121.1	129.6

[a]The projection of per capita real disposal income is based on the assumption that the average growth rate of disposal income for the Interlake is the same as Manitoba's rate which was estimated to growth $87.2 per year.

[b]Except food groups, other components of consumer price indices are estimated from the following simple regression derived from 1949-1971 time-

TABLE III.2

Continued

series data for Winnipeg City and then converted to 1968 base.

1. Housing = 75.0225 + 1.3291t	(67.3567)** (17.0510)**	R^2 = 0.9297
2. Clothing = 63.6499 + 1.5787t	(28.9052)** (10.2437)**	R^2 = 0.8267
3. Transportation = 61.9587 + 2.0197t	(39.9587)** (18.4305)**	R^2 = 0.9392
4. Health & Care = 40.8399 + 2.9838t	(22.6001)** (23.5928)**	R^2= 0.9620
5. Recreating & Reading = 56.2082 + 2.1290t	(30.7588)** (16.6473)**	R^2 = 0.9265
6. Tobacco & Al. = 60.9240 + 1.6438t	(33.5780)** (12.9450)**	R^2 = 0.8840
7. All Items = 65.3010 + 1.6916t	(45.5251)** (16.8512)**	R^2 = 0.9281

The values in parentheses are the t-values. Where t is time trend in which t=1 at 1949.

The subcomponents of food and other consumer price indices are estimated from simple average change rate between 1959 and 1972. The change rates were estimated to be:

1. Meat Product : 10.77
2. Dairy product : 10.10
3. Fruit & Vegetable: 7.50
4. Other food : 1.90
5. Other : 4.2

Sources: (1) Statistics Canada, National Accounts, Income and Expenditures, Cat. No. 13-502 (Ottawa: Queen's Printer, 1961-71) and (2) Statictics Canada, Prices and Price Indexes, Cat. No. 62-002 (Ottawa: Queen's Printer, 1949-1971).

TABLE III.3

PERCENTAGE DISTRIBUTION OF HOUSEHOLD CONSUMPTION EXPENDITURES BY SECTOR AND BY DIFFERENT COMMODITY GROUPS, INTERLAKE, 1968

Sector No.[b]	Commodity Groups (%)[c]										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	26.70	0.00	21.62	4.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	3.50	0.00	3.84	2.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	1.60	2.00	1.72	0.00	15.68	0.00	0.88	0.00	3.20	0.51	0.00
9	0.00	0.00	0.00	0.00	2.11	0.00	0.44	0.00	0.00	0.00	0.00
10	20.10	42.50	27.46	20.14	5.10	25.02	0.18	19.25	4.28	10.85	0.00
11	48.10	55.50	45.36	33.55	8.13	39.98	0.26	30.75	4.28	17.23	0.00
12	0.00	0.00	0.00	0.00	2.33	5.00	78.20	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.13	30.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	2.30	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	3.01	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	39.50	0.00	0.00	0.00	0.00	6.40	51.19	79.78
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	4.05	0.00	0.00
18–26	0.00	0.00	0.00	0.00	56.40	0.00	17.03	0.00	70.75	20.22	20.22
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[a]Read down from each column indicates the commodity in the top purchased by consumer from each corresponding left-hand side sector. The value of 26.70 in the first element of Column (1), for example, represents that 26.70% of meat product was purchased from sector (1), agriculture lifestock sector.

TABLE III.3

Continued

[b]Sector number refers to Table 4.27, Chapter 4.

[c]Commodity groups refers to Table 4.32, Chapter 4.

Source: Interlake household expenditure survey data.

APPENDIX IV

PROCEDURES FOR ESTIMATING DIRECT EFFECT OF AGRICULTURAL RESOURCE DEVELOPMENT PROGRAMS IN THE INTERLAKE AREA

APPENDIX IV

PROCEDURES FOR ESTIMATING DIRECT EFFECT OF AGRICULTURAL RESOURCE DEVELOPMENT PROGRAMS IN THE INTERLAKE AREA

A. Estimation of the Direct Effect of the Drainage Program

The drainage systems listed in the FRED agreement include: Long Lake, Upper Grassmere and Sturgeon Creek in the south end of the region, Boundary Drain and the Icelandic River in the center and Birch Creek Drain and the Fisher River in the northern half.[1] A total of 7 million dollars was designated for drainage projects in the area. This amount of program expenditure is budgeted for the period of 1968 to 1973 in terms of the scheduled plan to complete drainage systems. The drainage program expenditures can be considered as expenditures autonomous to the area economy and have successful in increasing productivity of directly related sectors through the following mechanism.[2]

Direct Effects Associated With the $7 Million Investment Expenditure On Drainage Program

The $7 million of drainage program expenditure represents additional money flows in the regional economy during the period of reconstruction (from 1968 to 1973). Allocation of $7 million of

---

[1]Canada Department of Forestry and Rural Development, Interlake Area of Manitoba: Federal-Provincial Rural Development Agreement, Op. Cit.,

[2]J.A. MacMillan and C.M. Lu, Urban Impacts of Rural Resource Development Expenditures in the Inerlake Area of Manitoba, Op. Cit., p. 38.

program expenditure to related sectors in the input-output model is based on detailed items of expenditure for 1967-68 provided by the Water Resources Branch, Department of Mines, Resources and Environmental Management, Province of Manitoba. During the year of 1967-68 the total FRED expenditures on drainage was $1,022.1 thousand that were allocated to 26 sectors according to the obtained detailed items of expenditure from the Water Resources Branch. The distribution of such expenditure is employed to allocate each year's drainage program expenditure to the related sectors during the implementation or construction periods (from 1968-73). The results are summarized in Table IV.1. The total drainage expenditure for each year is actual except for 1973.

Direct Effects Resulting From Changes in Agricultural Production Through Drainage

The public investment on the drainage system leads directly to increased agricultural production through three effects: a reclamination effect, a flooding effect and a productivity effect.[3] The reclamation effect occurs when the Water Table is stabilized, after completion of construction of drainage systems permitting use of additional acres previously too wet for agricultural production and changes in the nature of land suitable for different type of agricultural production. The rough grazing may, through drainage, be used as improved pasture or for the production of crops is a

[3] G.A. Norton and J.A. MacMillan, "Drainage Maintenance and Reconstruction Costs and Benefits: A Watershed Analysis", Canadian Journal of Agricultural Economics, Vol. 18 (1970), pp. 56-63.

TABLE IV.1

ALLOCATION OF THE DRAINAGE EXPENDITURES BY SECTOR, INTERLAKE AREA, 1969 TO 1973

Sector	Drainage Exp. in 1968		Drainage Expenditure in Year ($1,000)				
	Expenditure ($1,000)	Distribution (%)	1969	1970	1971	1972	1973
1. Ag.-Livestock	104.8	10.05	126.1	127.5	124.4	118.9	71.0
2. Ag.-Crop & Other	42.9	4.11	51.6	52.1	50.9	48.6	29.0
3. Mining	0.0	0.00	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.00	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.0	0.00	0.0	0.0	0.0	0.0	0.0
6. Transportation	0.0	0.00	0.0	0.0	0.0	0.0	0.0
7. Construction	200.6	19.24	241.4	244.0	238.2	227.8	135.9
8. Pet. Wholesale	0.0	0.00	0.0	0.0	0.0	0.0	0.0
9. Farm Equip & Bldg Material	0.5	0.05	0.6	0.6	0.6	0.6	0.4
10. Food Store	0.0	0.00	0.0	0.0	0.0	0.0	0.0
11. Other Retail	6.5	0.62	7.8	7.9	7.7	7.3	4.4
12. Auto Product & Service	0.0	0.00	0.0	0.0	0.0	0.0	0.0
13. Apparel & Shoes	0.0	0.00	0.0	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0	0.00	0.0	0.0	0.0	0.0	0.0
15. Insurance	0.0	0.00	0.0	0.0	0.0	0.0	0.0
16. Personal Service	13.7	1.32	16.6	16.7	16.3	15.6	9.2
17. Other Services	0.7	0.07	0.9	0.9	0.9	0.8	0.5
Intermediate Subtotal	369.8	35.46	445.0	449.7	439.0	419.6	250.4
18. Household	78.5	7.53	94.5	95.5	93.2	89.2	53.2
Other Payment Sectors	594.4	57.01	715.4	723.1	705.8	674.7	402.7
Payment Subtotal	672.9	64.54	809.9	818.6	799.0	673.9	455.9
Total Drainage Expenditure[a]	1,042.6	100.00	1,254.9	1,368.3	1,238.0	1,183.5	706.3

[a]Total drainage expenditure for each year is expressed in 1968 constant dollars deflated by consumer price indix. The data are obtained from: Interlake FRED plan, Progress Report, Dec. 31, 1973, p. 102.

typical example. Productivity effects on land through drainage is the result from an improvement in growing conditions or from a reduction in the cost of production. Finally, flooding effects occur when a system of drains alters the incidence and periodicity of floods in the watershed. However, these three effects associated with the drainage system are overlapping. One may consider the reclamation effect of changing the nature of land for different types of agricultural production as a productivity effect. Similarly, the flooding effect can be viewed as a productivity effect in practical estimation. Therefore, the present study does not estimate the increase of agricultural production according to these three effects.

The procedure for calculating direct effects resulting from changes in agricultural production through drainage follows three steps. First, acres of reclaimed land associated with $1,042.6 thousand of drainage expenditure estimated from the sample obtained from farms covered in the Icelandic river watershed is converted to a per thousand dollar figure and applied to the total drainage expenditure for each year.[4] In the Icelandic river watershed, 54,259 acres of improved pasture land were converted to arable land; 46,804 acres of rough pasture land were converted to improved pasture land; and 22,822 acres of rough grazing land were converted to improved

---

[4]G.A. Norton and J.A. MacMillan, A Framework for Economic Planning of Watershed Drainage, Research Report No. 6 (Winnipeg, Manitoba: Agassiz Center of Water Studies, University of Manitoba, 1972).

pasture land. Based on 1968 farm household survey, 74.6% of total farms were classified as livestock farms and 25.4% as crop farms. The land reclaimed through drainage is 92,418 acres for livestock farms (i.e.: 74.6% of total reclaimed land) and 31,467 acres for crop farms. Total acreage of the reclaimed land per thousand dollars of drainage program expenditure is estimated to be 88.64 acres and 30.18 acres for the livestock and crop sectors respectively. Total reclaimed land through the drainage program for each year by sector is the product of the respective sample estimates of the reclaimed land per thousand dollars of drainage program expenditure and the respective year's actual total drainage program expenditure. The 111,234 acres of the reclaimed land for the livestock sector in 1969 as shown in Table IV.2, for example, is estimated by multiplying the sample estimate of the reclaimed land for livestock (88.64 acres) by the actual total drainage program expenditure in 1969 ($1,254.9 thousand). The 37,873 acres of the reclaimed land for crop sector in 1969 to obtained by the same method (i.e., 30.18 acres x $1,254.9 thousand).

Since the drainage program is of an ongoing nature, there are accumulated effects on reclaimed land. The reclaimed land in 1970, for example, is the sum of the reclaimed land in 1969 and additional newly reclaimed land in 1970. The accumulation process continues to the terminal year of the program. The accumulated reclaimed land resulting from the drainage program for a ten-year period (from 1968 to 1977) is shown in the last three columns of Table IV.2.

TABLE IV.2

ESTIMATED TOTAL RECLAIMED LAND BY SECTOR THROUGH THE DRAINAGE PROGRAM, INTERLAKE AREA, 1968 TO 1977

(Unit: Acre)

Year	Reclaimed Land in Year			Accumulated Reclaimed Land in Year		
	Livestock Sector (1)	Crop Sector (2)	Total (3)	Livestock Sector (4)	Crop Sector (5)	Total (6)
1968	92,418	31,467	123,885	92,418	31,467	123,885
1969	111,234	37,873	149,107	203,652	69,340	272,992
1970	112,422	38,277	150,699	316,074	108.213	424,287
1971	109,736	37,363	147,099	425,979	145,576	571,555
1972	104,095	35,718	140,623	530,884	181,294	712,178
1973	62,606	21,316	83,922	593,490	202,610	796,100
1974	-	-	-	593,490	202,610	796,100
1975	-	-	-	593,490	202,610	796,100
1976	-	-	-	593,490	202,610	796,100
1977	-	-	-	593,490	202,610	796,100

Sources and estimation procedures are explained in Appendix IV.

The second step calculates total amounts of gross receipts per year for both sectors in order to derive the increased input demand associated with the reclaimed land through the drainage program. Based on the 1968 farm household survey, the average gross receipts per acre for livestock and crop sectors in the Interlake are estimated to be $16.95 and $15.54 respectively. Consequently, total gross receipts from the reclaimed land due to drainage in 1969 are estimated to be $3,451.9 thousand and $1,077.5 thousand ($16.95 x 203,652 acres and $15.54 x 69,340 acres) for livestock and crop sectors respectively.[5] It is assumed that the yield from the reclaimed land does not change from the date of completing the drainage system to 1977.

The final step is to estimate the derived demand for inputs per year. The input purchasing pattern of farms benefitting from drainage is assumed to be the same as the adjusted purchasing pattern of farms in the Interlake for the derivation of input

---

[5]According to Rigaux and Singh Study on Benefit-cost of agricultural drainage in the South-Eastern region of Manitoba, the average annual benefit per acre was estimated to be $6.88 based on 1965-7 average price. (See: L.R. Rigaux and R.H. Singh, Benefit-Cost Analysis of Agricultural Drainage Expenditures: A Pilot Project for South-Eastern Manitoba. Winnipeg: Department of Agricultural Economics, University of Manitoba, March, 1973, p. 82).

However, the drainage problem in the Interlake region is much more serious than South-Eastern area. Thus, the benefits resulting from drainage in the former region are expected to be higher than the latter region. Nonetheless, a detailed study on benefit-cost of drainage in Manitoba is in progress using similar approach employed for South-Eastern region by Rigaux and Singh, it is hoped that in the near future a comparable figures concerning to the benefits of drainage among regions in Manitoba will be available and possible to check the present estimates.

purchases due to the increase in production associated with the reclaimed land. The derived demand for inputs associated with the reclaimed land for each year from 1969 to 1977 is calculated by multiplying the input coefficients of the respective sector (livestock or crop sector) as adjusted to the respective year by the estimated corresponding sector's gross receipts of the respective year associated with the reclaimed land. The sum of the estimated derived input demands for the respective year from livestock and crop sectors constitutes the respective year's input purchase associated with the increases in production from the reclaimed land through the drainage program. The results are summarized in Table IV.3.

Direct Effects Due to Increases in Net Farm Income Associated With Drainage Expenditures

One may consider that the net farm income increase associated with additional acres of crop and improved pasture land through drainage represents an additional money flow into the regional economy. If such is the case, the increased net farm income (as shown in household row of Tables (IV.1) and (IV.3) will derive additional purchases of goods and services from the area. The estimated Engel curve in Chapter 4 is employed to derive such effects. While the estimated net farm income associated with the reclaimed land is based on 1968 constant dollars, the price effects on consumption can be neglected. Thus, it is simply estimated by using the Engel curve and converting it to the related sectors. Based on this procedure,

TABLE IV.3

ESTIMATED INCREMENTS IN INPUT PURCHASES ASSOCIATED WITH INCREASES IN PRODUCTION ON THE RECLAIMED LAND THROUGH THE DRAINAGE PROGRAM, INTERLAKE AREA, 1969 TO 1977

(Unit: ' 000 1968 dollars)

Purchase From Sector	Estimated Incremented Input Purchases in Year								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Ag.-Livestock	134.4	210.5	287.1	361.7	408.7	413.4	418.8	423.2	428.0
2. Ag.-Crop & Other	95.2	149.2	202.6	253.7	284.9	287.5	288.9	291.2	291.2
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	9.5	14.8	19.9	24.8	27.7	27.7	27.7	27.7	27.7
5. Other Mfg.	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
6. Transportation	33.3	52.6	72.2	90.9	102.9	104.9	105.9	107.3	108.3
7. Construction	0.3	0.5	0.7	0.8	0.9	0.9	0.9	0.9	0.9
8. Pet. Wholesale	417.9	652.4	883.3	1,106.9	1,243.5	1,250.2	1,257.2	1,264.3	1,269.3
9. Farm Equip & Bldg Mat.	297.1	462.7	624.1	777.0	869.3	869.7	870.4	869.7	870.1
10. Food Store	2.2	3.4	4.6	5.7	6.4	6.4	6.4	6.4	6.4
11. Other Retail	15.9	24.7	33.4	41.6	46.5	46.5	46.5	46.5	47.5
12. Auto Product & Service	293.0	454.8	610.5	758.5	845.2	842.5	840.1	837.4	835.7
13. Apparel & Shoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15. Insurance	6.0	9.3	12.5	15.5	17.4	17.4	17.4	17.7	17.7
16. Personal Service	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17. Other Service	7.2	11.3	15.3	19.3	21.6	21.9	21.9	22.2	22.2
Intermediate Subtotal(1-17)	1,312.1	2,046.3	2,766.2	3,456.8	3,875.2	3,889.3	3,902.4	3,914.7	3,925.2
18. Household	1,373.3	2,133.9	2,874.1	3,578.7	3,997.5	3,993.6	3,990.4	3,987.1	3,982.9
Other Sectors (19026)	1,844.3	2,858.7	3,843.0	4,779.6	5,333.5	5,323.6	5,314.4	5,306.7	5,300.1
Total	4,529.7	7,038.9	9,483.3	11,815.1	13,206.2	13,206.5	13,207.2	13,207.8	13,208.2

Sources and estimation procedures are explained in this appendix.

the estimated household consumption increases due to increases in farm income resulting from the drainage program are summarized in Table IV.4. This increased household consumption would have direct and indirect effects throughout the regional economy.

B. Estimation of the Direct Effects of the Land Clearing and Demonstration Program

The land clearing and demonstration program is designed to assist farmers to expand cultivated acreage in order to increase agricultural production and income in the area. Under the FRED Agreement, an incentive grant of $4 per acre is paid to farmers who clear brush on approved land. In addition to the $4 per acre grant to farmers, there are other items of expenditures including forage seed purchases, salaries paid, demonstration and rental, and purchases of equipment and office supplies associated with the land clearing and demonstration program. Thus, there are conceptually three aspects of direct effects associated with the land clearing and demonstration program under the FRED plan: (1) direct effects associated with government expenditure on the land clearing and demonstration program, (2) direct effects associated with clearing costs incurred by farmers on land clearing, and (3) direct effects associated with increases in input purchases due to increases in agricultural production from the cleared land. The following three sections discuss the procedures for estimating those three aspects of direct effects associated with the land clearing and demonstration program.

TABLE IV.4

ESTIMATED FARM HOUSEHOLD CONSUMPTION INCREASES DUE TO INCREASES IN FARM INCOME DERIVED FROM THE RECLAIMED LAND THROUGH THE DRAINAGE PROGRAM, INTERLAKE AREA, 1969 TO 1977

(Unit: ' 000 1968 dollars)

Sector	Farm Household Consumption Increases in Year								
	1969	1970	1971	1972	1973	1974	1975	1976	1976
1. Ag.-Livestock	29.7	34.4	38.1	41.1	42.6	42.4	42.4	42.4	42.4
2. Ag.-Crop & Other	5.5	6.3	6.9	7.4	7.6	7.6	7.6	7.6	7.6
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.9	1.5	2.3	3.0	3.4	3.4	3.4	3.4	3.4
6. Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7. Construction	31.8	50.9	70.4	89.4	100.1	98.5	98.4	98.3	98.2
8. Pet. Wholesale	69.8	111.6	154.3	196.3	219.8	216.3	216.1	215.9	215.6
9. Farm Equip & Bldg Mat.	8.9	14.4	20.1	25.8	29.0	28.5	28.5	28.5	28.5
10. Food Store	104.8	138.3	169.7	199.1	215.1	212.7	212.6	212.4	212.3
11. Other Retail	172.4	225.2	274.3	320.0	344.8	341.1	340.9	340.7	340.4
12. Auto Product & Service	77.3	153.2	247.1	353.6	418.6	408.6	408.1	407.5	406.8
13. Apparel & Shoes	28.3	36.7	43.9	50.1	53.3	52.0	52.9	52.9	52.8
14. Furniture & Appl.	9.3	15.0	20.7	26.3	29.4	29.0	28.9	28.9	28.9
15. Insurance	2.2	4.7	7.9	11.6	13.8	13.5	13.5	13.4	13.4
16. Personal Service	44.6	63.0	82.3	101.7	112.7	111.1	111.0	110.9	110.8
17. Other Services	13.6	23.3	33.8	44.4	50.5	49.6	49.6	49.5	49.4
Total	599.0	878.8	1,171.8	1,469.9	1,640.9	1,615.1	1,613.6	1,612.1	1,610.2

Sources and estimation procedures are explained in this Appendix.

Direct Effects Associated With Government Expenditure on the Land Clearing and Demonstration Program

Based on the MacMillan and Lu Study, it was estimated that $617.3 thousand were spent by government on land clearing in the Interlake for 72,886 acres of land cleared during 1968-70 under the FRED land clearing agreement.

Table (IV.5) gives the actual acres of land cleared by farmers under the land clearing and demonstration programs and government expenditures including grant to farmers for each year. These government expenditures spend on the land clearing and demonstration program in each year from 1969 to 1973 (1973 is the termination year of the program) represent an additional money flow into the regional economy that will have an impact on the regional economy to stimulate production and income increases.

In order to measure the impact of government expenditure on the regional economy, the government expenditures associated with the land clearing and demonstration program need to be allocated into related sectors. According to the MacMillan and Lu study, the government expenditures associated with the land clearing and demonstration program during 1968-70 were spent in the form as shown in the first column of Table IV.6 obtained from Land Clearing Section, Manitoba Department of Agriculture.[6] The estimated distribution of government expenditures by sector, based on the 1968-1970

---

[6]MacMillan and Lu, Urban Impacts of Rural Resource Development Expenditures in the Interlake Area of Manitoba, Op. Cit., p. 46, Footnote 46.

TABLE IV.5

ACTUAL LAND CLEARED AND GOVERNMENT EXPENDITURES UNDER THE LAND CLEARING AND DEMONSTRATION PROGRAM, INTERLAKE AREA, 1967-68 TO 1972-73

Year	Actual Land Cleared By Farmers (Acres)	Government Expenditures on the Land Clearing and Demonstration ($)
1967-68	29,670	35,981
1968-69	29,670	127,300
1969-70	19,732	171,709
1970-71	12,103	102,750
1971-72	8,997	232,951
1972-73	26,174	63,000
Total	126,346	733,691

Sources: (1) Actual acres of land cleared by farmers under the land clearing and demonstration program for each year were obtained from: Mr. E.W. Somer, Department of Agriculture, Province of Manitoba, and (2) Government expenditures associated with the land clearing and demonstration program, including grant paid to farmers for each year were obtained from: Interlake FRED Plan, Interim Progress Report, published under the Federal-Provincial Agreement, Dec. 31, 1973, p. 3.

spending pattern, as shown in the second column of Table IV.6, is used to allocate each year's government expenditures associated with the land clearing and demonstration program into related sectors by assuming that the government expenditure spending pattern associated with the land clearing and demonstration program is constant for each year. Consequently, the government expenditures by sector for each year during the program period (from 1967-68 to 1972-73 is calculated by multiplying the respective year's actual government expenditures associated with the land clearing and demonstration program as shown in the last column of Table IV.5 by the estimated distribution by

TABLE IV.6

GOVERNMENT EXPENDITURES ON THE LAND CLEARING AND DEMONSTRATION PROGRAM BY SECTOR, INTERLAKE AREA, 1968-70

Sector	Government Expenditure by Sector	
	Exp. ($1,000)	Distribution (%)
1. Ag.-Livestock	189.8	30.75
2. Ag.-Crop & Other	101.9	16.51
3. Mining	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0
5. Other Mfg.	0.0	0.0
6. Transportation	0.0	0.0
7. Construction	13.9	2.25
8. Pet. Wholesale	0.0	0.0
9. Farm Equip. & Bldg. Material	9.3	1.51
10. Food Store	0.0	0.0
11. Other Retail	0.0	0.0
12. Auto Product & Services	4.6	0.75
13. Apparel & Shoes	0.0	0.0
14. Furniture & Appl.	0.0	0.0
15. Insurance	0.0	0.0
16. Personal Service	0.0	0.0
17. Other Services	0.0	0.0
Intermediate Subtotal	319.5	51.77
18. Household	162.0	26.24
Other Sectors (19-26)	135.8	21.99
Total	617.3	100.00

Source: MacMillan and Lu, Urban Impacts of Rural Resource Development Expenditures in the Interlake Area of Manitoba, Op. Cit., p. 46.

sector (i.e. the last column of Table IV.6). The estimated results are summarized in Table IV.7. It should be noted that the results shown in Table IV.7 have been deflated to 1968 constant dollars using general consumer price indices.[7] Thus, the last row of Table IV.7 is not directly comparable with government expenditure as shown in Table IV.5.

<u>Direct Effects Associated With Clearing Costs Incurred by Farmers on Land Clearing</u>

The estimation of additional money flow into the regional economy due to land clearing costs incurred by farmers is based on the estimates made by MacMillan and Lu in the R.M. of Bifrost. According to their estimation, total clearing costs incurred by farmers in the R.M. of Bifrost were $176.6 thousand for clearing 4,722 acres in the period 1967-1971.[8] Of the $176.6 thousand of clearing costs over a three-year period, $81.6 thousand was paid by farmers to the contractor and $95.0 thousand was farm costs. By considering the portion of work done by contractors outside the area (25% of total work done) and unpaid farm labor cost ($23,750) which have no multiplier effects, the estimated total clearing costs incurred by farmers on land clearing which will have multiplier effects were $132.5 thousand for clearing 4,722 acres. Average clearing costs were estimated to be $28.1 per acre. Total clearing costs incurred

---

[7]The consumer price indice have been projected to 1986 as shown in Appendix III.

[8]*Op. Cit.*, pp. 49-50.

TABLE IV.7

GOVERNMENT EXPENDITURES ON THE LAND CLEARING AND DEMONSTRATION PROGRAM BY SECTOR, INTERLAKE AREA, 1967-68 TO 1972-73

(Unit: '000 1968 dollars)

Sector	Estimated Government Expenditures by Sector in Fiscal Year					
	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73
1. Ag.-Livestock	11.1	38.8	51.5	30.4	76.7	18.0
2. Ag.-Crop & Other	5.9	20.9	27.7	16.3	36.3	9.7
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.0	0.0	0.0	0.0	0.0	0.0
6. Transportation	0.0	0.0	0.0	0.0	0.0	0.0
7. Construction	0.8	2.8	3.8	2.2	5.0	1.3
8. Pet. Wholesale	0.0	0.0	0.0	0.0	0.0	0.0
9. Farm Equip & Bldg Mat.	0.5	1.9	2.5	1.5	3.3	0.9
10. Food Store	0.0	0.0	0.0	0.0	0.0	0.0
11. Other Retail	0.0	0.0	0.0	0.0	0.0	0.0
12. Auto Product & Service	0.3	0.9	1.3	0.7	1.7	0.4
13. Apparel & Shoes	0.0	0.0	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0	0.0	0.0	0.0	0.0	0.0
15. Insurance	0.0	0.0	0.0	0.0	0.0	0.0
16. Personal Service	0.0	0.0	0.0	0.0	0.0	0.0
17. Other Services	0.0	0.0	0.0	0.0	0.0	0.0
Intermediate Subtotal	18.6	65.3	86.8	51.1	114.0	30.3
18. Household	9.4	33.1	44.0	25.9	57.7	15.4
Other Sectors (19-26)	8.0	27.9	36.7	21.7	48.3	12.9
Total[a]	36.0	126.3	167.5	98.7	220.0	58.6

[a]Total government expenditures on the land clearing and demonstration program from 1968-69 to 1972-73 have been deflated to 1968 dollars based on general consumer price indices and therefore are not directly comparable with Table IV.5.

[b]Sources and estimation procedures are explained in this Appendix.

by farmers were then allocated to the related sector as shown in the first column of Table IV.8 according to their payments.

Given the estimate of average clearing costs per acre in Bifrost, total clearing costs incurred by farmers for the Interlake per year are estimated by multiplying the average clearing cost per acre by total acreages cleared each year and these results are allocated to the 26 sectors according to the above estimated distribution of total clearing costs incurred by farmers in Bifrost. The results are shown in columns 3 to 9, Table IV.8.

Direct Effects Associated With Increases in Input Purchases Due to Increases in Agricultural Production From the Cleared Land

After completion of land clearing, agricultural output tends to increase, although it may take several years to bring newly cleared land into full production. The increase in farm production associated with the cleared land in tern will result in increases in the purchases of agricultural inputs required in production and increases in farm income.

Two steps are involved in deriving the required input purchases for production associate with the cleared land. First, total acres of the cleared land in production are estimated and these estimates are then employed to derive total gross receipts and the required input purchases. To estimate total acres of cleared land in production for each year, the weighted average percentage of total cleared land in production for each year is calculated using the data obtained from the Interlake Land Clearing Evaluation Survey (1971).[9] The results

[9] The data concerning to the total acres of land cleared and total acres in production for each year for different soil type obtained from the Land Clearing Survey were synthesized in Pareek, Benefit and Costs of Land Clearing in the Interlake Area of Manitoba, Op. Cit., Table 8, Appendix C.

TABLE IV.8

ESTIMATED DIRECT EFFECTS ASSOCIATED WITH CLEARING COSTS INCURRED BY FARMERS ON LAND CLEARING, INTERLAKE AREA, 1967-68 TO 1972-73

(Unit: ' 000 1968 dollars)

Sector	Clearing Costs in Bifrost		Clearing Costs Incurred By Farmers in Year					
	Costs($1,000)	Dist.(%)	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73
1. Ag.-Livestock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Ag.-Crop & Other	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	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6. Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7. Construction	61.2	46.19	385.1	385.1	256.1	157.1	116.8	339.7
8. Pet. Wholesale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9. Farm Equip & Bldg Mat.	47.4	35.77	298.2	298.2	198.3	121.7	90.4	263.1
10. Food Store	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11. Other Retail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12. Auto Product &Service	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13. Apparel & Shoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15. Insurance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16. Personal Service	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17. Other Services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Intermediate Subtotal	108.6	81.96	683.3	683.3	454.4	278.8	207.2	602.8
18. Household	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Sectors (19-26)	23.9	18.04	150.4	150.4	100.1	61.3	45.6	132.7
Total	132.5	100.00	833.7	833.7	554.5	340.1	252.8	735.5

Sources and estimation procedures are explained in this Appendix are summarized in Table IV.9 and the procedures for calculating the weighted percentage of cleared land in production for each year are explained in the footnotes of the Table. The estimated weighted percentage of cleared land in production for each year then is employed to derive total acres of cleared land in production for each year during the period 1968-1977. This is calculated by multiplying the total acres of land cleared in each year by the estimated weighted percentage of total cleared land in production. For example, the total cleared land completed in 1967-68 fiscal year in production in 1968 as shown in the entry of first row of column 1, Table IV.10, is calculated by multiplying the estimated first year's weighted percentage of total land in production (10.43% in the last column of Table IV.9) by the total acres of land cleared in 1967-68 (as shown in the first column of Table IV.5). Similarly, the total acres of cleared land in production in 1969 is calculated by multiplying the second year's weighted percentage of total acres of cleared land in production (58.12%) by the total acres of land cleared in 1967-68 (29,670 acres). Thus, each column of Table (IV.10) represents the total acres of cleared land in production in the year indicated in left-hand side and the land was cleared in the year indicated in the top of the Table. Total acres of cleared land in production for each year then is the sum of each entry across each row as shown in the last colum of the Table. For example, in 1969 there were 20,339 acres of the cleared land in production of which 17,244 acres were cleared in 1967-68 fiscal year and 3,095 acres were

TABLE IV.9

ESTIMATED WEIGHTED PERCENTAGE OF CLEARED LAND IN PRODUCTION IN EACH YEAR, INTERLAKE AREA, 1967-68 TO 1972-73

	Acres of Cleared Land in Production in Each Year By Soil Type			Percentage of Cleared Land in Production for Each Year by Soil Type[c]			Weighted % of Cleared Land in Production for Each Year[d]
	3	4	5	3	4	5	
Sample Size	33	27	30				
Total No. of Acres Cleared	1,346	1,247	1,851				
Total Acres in Production							
First Year After Land Cleared	115	97	253	8.54	7.78	13.67	10.43
Second Year After Land Cleared	640	773	668	47.55	61.99	36.09	58.12
Third Year After Land Cleared	805	763	1,170	59.81	61.19	63.21	61.62
Fourth Year After Land Cleared[a]				90.25	90.25	90.25	90.25
Weight[b]	0.3029	0.28006	0.41.65				

[a]The percentage of cleared land in production for the fourth year is obtained by assuming that the cleared land after three years becomes normal agricultural land and therefore almost all cleared land can be used in production. Thus, the land utilization rate in 1968 (90.25%) is used for the fourth and beyond.

[b]The weight for each soil class is the portion of that class divided by the total acres of land cleared for all classes.

[c]The percentage of cleared land in production for each year by soil type is the respective year's total acres in production divided by total acres cleared by soil type and multiplied by 100.

[d]The weighted percentage of cleared land in production for each year is calculated by summing up the products of the respective year's percentage of cleared land in production for each soil type and its weights. For example, the 10.43 percent of cleared land in production in the first year was obtained from the following calculation: 8.54% x 0.3029 + 7.78% x 0.2806 + 13.67% x 0.04165.

Source: S.N. Pareek, Benefits and Costs of Land Clearing in the Interlake Area of Manitoba, *Op. Cit.*, Table 6.

TABLE IV.10

ESTIMATED TOTAL ACRES OF CLEARED LAND IN PRODUCTION UNDER THE LAND CLEARING AND DEMONSTRATION PROGRAM, INTERLAKE AREA, 1967-68 TO 1976-77

(Unit: Acres)

Year[a]	Estimated Cleared Land in Production in Different Year[a]						Estimated Total Acres of Cleared Land in Production[b]
	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	
1968	3,095	0	0	0	0	0	3,095
1969	17,244	3,095	0	0	0	0	20,339
1970	18,283	17,244	2,058	0	0	0	37,585
1971	26,777	18,283	11,468	1,262	0	0	57,790
1972	26,777	26,777	12,159	7,034	938	0	73,685
1973	26,777	26,777	17,808	7,458	5,229	2,730	86,779
1974	26,777	26,777	17,808	10,923	5,544	15,212	103,041
1975	26,777	26,777	17,808	10,923	8,120	16,128	106,533
1976	26,777	26,777	17,808	10,923	8,120	23,622	114,027
1977	26,777	26,777	17,808	10,923	8,120	23,622	114,027

Sourcees: Tables (IV.8) and (IV.9)

newly cleared land completed in 1968-69. The same explanation is implied for each entry of the last column of the Table.

The second step is to derive the gross receipts and the required input purchase resulting from the cleared land in production. The gross receipts from cleared land for each year were derived by multiplying the average gross receipts at 1968 constant price per authorized acre for 1970 by the total acres of cleared land in production obtained from step 1.[10]

Based on the Interlake Land Clearing Evaluation Survey (1971), about 75% of cleared land was utilized for livestock production and only 25% was used for crop farming.[11] This ratio of utilization of the cleared land is employed to allocate the estimated total gross receipts into the livestock and crop sectors in order to derive the inputs required for production.[12] Then the required input purchases for production are derived from the adjusted input coefficients of the corresponding sector multiplying the estimated gross receipts of that

---

[10]According to MacMillan and Lu study (Op. Cit., p. 49), the average gross receipts per authorized acre for 1970 were $21.04. Farm product price index growth rate was estimated to be 1.56% per year. Thus, the average gross receipts per authorized acre for 1970 at 1968 price are $20.40 [$21.04 \div (1 + 0.0156)^2$].

[11]Pareek, Benefits and Costs of Land Clearing in the Interlake Area of Manitoba, Op. Cit., p. 112(a).

[12]The average gross receipts per acre may be different from the livestock production and crop production. Since no detailed information is available concerning the difference in gross receipts per acre between livestock and crop production on the cleared land, it is assumed that such difference is very small and, therefore, can be neglected in impact analysis.

sector for each year.

Based on the procedures described above, the estimated input purchases associated with increases in production on the cleared land through the land clearing and demonstration program from 1969 to 1977 for the Interlake are summarized in Table IV.11.

Direct Effects Due to Increases in Net Farm Income Associated With the Land and Demonstration Clearing Program

For impact analysis, one may consider that farm household purchases are likely to increase with an increase in net farm income resulting from the additional sales of output produced from the cleared land. However, a specific consideration is required for the land clearing and demonstration program since it involves clearing costs incurred by farmers. The increased net farm income from the cleared land may be substituted for other types of expenditures such as paying back the debts associated with land clearing costs. Hence, the increased net farm income from the cleared land does not stimulate farm household consumption until the debts are completely paid back. This is more likely the case in the Interlake and, therefore, the increases in net farm income resulting from the cleared land represents no increase in actual farm household purchases within a certain period.

Based on the sample in the R.M. of Bifrost employed in MacMillan and Lu Study, the average clearing costs excluding unpaid farm labor cost incurred by farmers were estimated to be $32.4 per acre. The farm income including labor income associated with cleared

TABLE IV.11

ESTIMATED INCREMENTS IN INPUT PURCHASES ASSOCIATED WITH THE INCREASED PRODUCTION ON CLEARED LAND THROUGH THE LAND CLEARING AND DEMONSTRATION PROGRAM, INTERLAKE AREA, 1969 TO 1977

(Unit: ',000 1968 dollars)

Sector	Estimated Input Purchases in Year								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Ag.-Livestock	12.2	22.7	35.3	45.5	54.2	65.1	68.1	73.7	74.5
2. Ag.-Crop & Other	8.7	16.2	25.1	32.2	38.1	45.6	47.4	51.1	51.1
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.9	1.6	2.4	3.1	3.7	4.4	4.5	4.8	4.8
5. Other Mfg.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
6. Transportation	3.1	5.8	9.1	11.7	13.9	16.9	17.6	19.1	19.2
7. Construction	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
8. Pet. Wholesale	38.1	70.8	109.4	140.2	166.0	198.1	206.0	221.7	222.6
9. Farm Equip & Bldg Mat.	27.2	50.4	77.6	98.9	116.6	138.5	143.3	153.2	153.2
10. Food Store	0.2	0.4	0.6	0.7	0.8	1.0	1.0	1.1	1.1
11. Other Retail	1.4	2.7	4.1	5.2	6.2	7.3	7.6	8.1	8.3
12. Auto Product & Service	27.1	50.0	76.6	97.4	114.4	135.4	139.6	149.0	148.7
13. Apparel & Shoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15. Insurance	0.5	1.0	1.6	2.0	2.3	2.8	2.9	3.1	3.1
16. Personal Service	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17. Other Services	0.7	1.2	1.9	2.5	2.9	3.5	3.6	4.0	4.0
Intermediate Subtotal	120.2	222.9	343.8	439.6	519.2	618.7	641.8	689.1	690.9
18. Household	125.9	232.7	357.7	455.7	536.3	636.2	657.2	702.8	702.1
Other Payment Sectors	168.8	311.1	477.5	607.8	714.5	846.9	874.1	934.2	933.1
Total	414.9	766.7	1,179.0	1,503.1	1,770.0	2,101.8	2,173.1	2,326.1	2,326.1

Sources and estimation procedures are explained in this Appendix.

land in production through the land clearing and demonstration program is estimated to be $6.1 per acre per year.[13] By considering an approximately $4 per acre grant to farmer for land clearing, the average clearing costs incurred by farmers are reduced to $28.4 per acre.[14] Thus, it will take approximately 6 years to pay back the cost including interest charges incurred by farmers. This implies that there will have no impact on increase in farm household purchases due to increases in farm income associated with cleared land in production within a 6-year period.

Given the specific consideration of the nature of the land clearing and demonstration program, an alternative method is employed to estimate direct effects due to increases in net farm income associated with the land clearing and demonstration program. First, the net farm income increases associated with cleared land that will have induced effects in increasing farm household purchases for each year is estimated by multiplying the average net farm income per acre ($6.1) by the total acres of cleared land after 6 years. Thus, the cleared land completed in 1967-68 will have no net farm income increases to induce farm household purchases until 1973. But it will have such effects after 1973. Similarly, the cleared land

[13] It is estimated by dividing farm income derived from increases in agricultural production as shown in the household row of Table (IV.11) by total acres of cleared land in production as shown in the last column of Table (IV.10).

[14] Government has paid $451,384 in grants to farmers for clearing 126,346 acres in the period 1967-68 to 1972-73. This information was provided by Mr. E.W. Somers, Manitoba Department of Agriculture.

done in 1968-69 will have additional net farm income to induce increasing farm household purchase from 1975. The estimates for each year following the procedures explained above are summarized in Table (IV.12) (from columns (1) to (6)). The sum across each row of the table from columns (1) to (6) constitutes the respective year's net farm income increases associated with the cleared land in production and that will have induced effects to increase farm household purchase resulting from the land clearing and demonstration program.

Second, government expenditures for the land clearing and demonstration program include not only the grant paid to farmers for land clearing but also other expenditures associated with the program mainly for demonstration of new and improved practices in land development and utilization. Thus, these other expenditures yield additional household income that will have induced effects to increase household purchases during the period of implementation. Such increases in household income were estimated (see Table (IV.7)) and reproduced in column (8) of Table (IV.12). Total farm income increases due to the land clearing and demonstration program that will have induced effects to increase household purchases are obtained by adding the net farm income increase associated with the cleared land and the household income increase associated with the government expenditures for land clearing and demonstration program (i.e., Columns (7) and (8)).

Finally, the household consumption increases due to increases

TABLE IV.12

ESTIMATED FARM HOUSEHOLD INCOME INCREASES ASSOCIATED WITH THE LAND CLEARING AND DEMONSTRATION PROGRAM, INTERLAKE AREA, 1968 TO 1977

Year	Estimated Net Farm Income Increases Associated With Cleared Land Through the Land Clearing and Demonstration Program in Year[a]							Farm Hsld Income Increase Resulting from the Land Clearing Program Expend.[b]	Total Farm Hsld Income Increase Due to Land Clearing Prog.[c]
	1967-68 (1)	1968-69 (2)	1969-70 (3)	1970-71 (4)	1971-72 (5)	1972-73 (6)	Total (7)	(8)	(9)
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	9.4
1969	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.1	33.1
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.0	44.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.9	25.9
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.7	57.7
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	15.4
1974	163.0	0.0	0.0	0.0	0.0	0.0	163.0	0.0	163.0
1975	163.3	163.3	0.0	0.0	0.0	0.0	326.6	0.0	326.6
1976	163.3	163.3	108.6	0.0	0.0	0.0	435.2	0.0	435.2
1977	163.3	163.3	108.6	66.6	0.0	0.0	501.8	0.0	501.8

[a]Obtained from household row, Table (IV.7).

[b]Obtained from Household row of Table (IV.7).

[c]The sum of Columns (7) and (8).

[d]Additional sources and estimation procedures are explained in this Appendix.

in net farm income for each year is estimated, as employed in estimating the drainage program, by multiplying the Engel function by the increased net farm income and converting it to the related sectors. The results are summarized in Table (IV.13).

C. Estimation of Direct Effects of the Farm Management Training Program

The special five-month (November to March) courses for farmers were initiated in the Interlake in 1968. Course sessions include instruction in soil and crop management, animal husbandry, farm accounting and business techniques, and applied science and mathematics. Selection of candidates for the courses in the Interlake is made by special local committees set up by the area development boards. Selection of farmer-student was based on: willingness to continue farming in future, younger farmers whose education is higher than Grade VII and farmers present farm structure that should be potentially of sufficient size to ensure a long term stable income. Suggested size would be 500 cultivated acres for grain operation or a 200-cow herd plus sufficient pasture land for a straight cow-calf operation.[15] All farmers received training allowances from the Canada Department of Manpower and Immigration.

The direct effects associated with the farm management training programs include three aspects: direct effects associated with government expenditure, direct effects associated with the increases

---

[15] ARDA FRED Administration, FRED in the Interlake year 3 (1969-70), published Under the Federal-Provincial FRED Agreement.

TABLE IV.13

ESTIMATED FARM HOUSEHOLD CONSUMPTION INCREASES DUE TO INCREASES IN FARM INCOME DERIVED FROM THE CLEARED LAND THROUGH THE LAND CLEARING & DEMONSTRATION PROGRAM, INTERLAKE AREA, 1969 TO 1977

(Unit: '000 1968 Dollars)

Sector	Farm Household Consumption Increases in Year								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Ag.-Livestock	7.9	8.7	7.3	9.6	6.1	13.7	17.4	19.3	20.3
2. Ag.-Crop & Other	1.8	1.9	1.7	2.1	1.5	2.8	3.5	3.8	3.9
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2
6. Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7. Construction	0.4	0.6	0.3	0.8	0.2	2.7	5.8	8.0	9.4
8. Pet. Wholesale	1.5	1.9	1.3	2.5	0.9	6.6	13.6	18.4	21.4
9. Farm Equip & Bldg Mat.	0.1	0.2	0.1	0.2	0.0	0.7	1.6	2.2	2.6
10. Food Store	18.7	20.6	17.2	22.7	14.4	34.1	46.3	53.2	57.1
11. Other Retail	31.8	35.2	29.3	38.7	24.7	57.9	78.1	89.3	95.7
12. Auto Product & Service	0.7	0.9	0.6	1.1	0.4	3.4	8.2	12.1	14.9
13. Apparel & Shoes	2.7	3.2	2.3	3.8	1.7	7.3	11.1	13.3	14.5
14. Furniture & Appl.	0.1	0.2	0.1	0.2	0.1	0.8	1.7	2.4	2.8
15. Insurance	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3
16. Personal Service	11.5	12.1	11.1	12.7	10.2	16.0	19.7	22.0	23.4
17. Other Services	0.1	0.1	0.1	0.2	0.0	0.8	1.9	2.8	3.4
Total[a]	77.5	85.7	71.2	94.8	60.1	146.8	209.2	247.2	270.0

[a]Entries may not add to totals due to rounding.

[b]Sources and estimation procedures are explained in this Appendix.

in inputs required through an increase in agricultural production and direct effects associated with farm household consumption increase through increases in net farm income and training allowance paid to farmers (clients). The procedures for estimating each aspect of direct effects are systematically described below.

Direct Effects Associated With Government Expenditures for Farm Management Training Program

The numbers of graduates and government expenditures including allowance and administrative costs for farm management training program for the period of 1967-68 to 1972-73 are shown in Table (IV.14). The data and procedures for estimating government expenditures are explained in the footnotes of the table.

The effects of the additional government expenditure on implementing the farm management training program on the regional economy are dependent upon spending patterns. Among which, the government expenditure on allowance is directly paid to the client as household income.[16] The question concerns the spending pattern of administrative costs. In this study, it is assumed that the spending pattern of government expenditure on administrative costs for this particular program is the same as the pattern of regular educational expenditure. The distribution of per dollar of educational expenditure to the 17

---

[16]This may bias the allocation of allowance expenditure since it includes commuting allowance. The commuting allowance covers 1.9 percent of total allowance expenditure.

TABLE IV.14

NUMBER OF GRADUATES AND TRAINING COSTS FOR THE FARM MANAGEMENT TRAINING PROGRAM IN THE INTERLAKE AREA, 1967-68 TO 1972-73

Year	Number of Graduates[a]	Total Training Costs[b] ($)		Average Training Cost Per Graduate ($)	
		Training Allowance[c]	Administrative Cost	Training Allowance	Administrative Cost
1967-68	48	75,696.0	18,480	1,577.0	385.0
1968-69	202	318,554.0	77,770	1,577.0	385.0
1969-70	107	168,739.0	41,195	1,577.0	385.0
1970-71	73	115,121.0	28,105	1,577.0	385.0
1971-72	20	23,279.3	7,700.0	1,164.0	385.0
1972-73	16	16,437.9	6,160.0	1,027.4	385.0
Total	466	7.7,827.2	179,410		

[a]Data obtained from Mr. E.W. Somer, FRED co-ordinator, Manitoba Department of Agriculture and indicate actual graduates.

[b]Total training costs for the period 1967-68 to 1970-71 are estimated in terms of Manpower study: J.A. MacMillan et. al., Benefits and Costs of Manpower Services in the Interlake Rural Development Area, Op Cit., p. 22, and for the period 1971-72 to 1972-73 are obtained from : J.A. MacMillan, An Assessment of Agricultural Training Needs in Manitoba, Report to the Manitoba Agricultural Training Committee, Winnipeg: Department of Agricultural Economics, University of Manitoba, Sept. 1973, p. 32.

[c]The training allowance includes commuting allowance.

producing sectors is shown in Column 1 of Table (IV.15).[17] Consequently, the estimated government expenditure on administrative costs for each year is allocated to the related sectors in terms of the distribution of educational expenditure. The result is shown in Columns 2 to 7, Table IV.15. However, it should be noted that the household row of the table from Columns 2 to 7 includes training allowance. Also the total government expenditure listed in Table (IV.15) for the years after 1967-68 is not comparable to that in Table (IV.14) since the former has been deflated to 1968 constant dollars.

Direct Effects Associated With Increases in Input Purchases Due to Increases in Agricultural Production Through Farm Management Training Program

Like other programs, the farm management training program also will have direct effects associated with increases in input purchases due to increases in agricultural production. But the increases in production are the result of changes in the quality of farm management through management training. The changes of quality may be explained by its abilities in managing the nature of soil under crop production, animal husbandry and business techniques. Thus, the effects of the farm management training program may result in increasing (1) the net farm income of the clients without any increases in production or (2) the net farm income with increases in production. The latter case was found for the Interlake according to MacMillan

[17] Paul Molgat and J.A. MacMillan, Op. Cit., p. 20.

TABLE IV.15

ESTIMATED GOVERNMENT EXPENDITURE BY SECTOR FOR THE FARM MANAGEMENT TRAINING PROGRAM IN THE INTERLAKE AREA, 1967-68 TO 1972-73[a]

Sector	Dist. of Educational Exp. by Sector[b]	Government Expenditure by Sector in Year[c]					
		1967-68	1968-69	1969-70	1970-71	1971-72	1972-73
1. Ag.-Livestock	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
2. Ag.-Crop & Other	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
3. Mining	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.0005	0.0*	0.2	0.1	0.1	0.0*	0.0*
6. Transportation	0.0032	0.2	1.0	0.5	0.4	0.1	0.0*
7. Construction	0.0020	0.2	0.6	0.3	0.2	0.0*	0.0*
8. Pet. Wholesale	0.0272	2.1	8.6	4.5	3.0	0.6	0.4
9. Farm Equip & Bldg Mat.	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
10. Food Store	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
11. Other Retail	0.0179	1.4	5.7	2.9	2.0	0.4	0.3
12. Auto Product & Service	0.0068	0.5	2.1	1.1	0.8	0.1	0.1
13. Apparel & Shoes	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
15. Insurance	0.0002	0.0*	0.1	0.0*	0.0*	0.0*	0.0*
16. Personal Service	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
17. Other Services	0.0046	0.3	1.5	0.8	0.5	0.1	0.1
Intermediate Subtotal	0.0624	4.7	19.8	10.2	7.0	1.3	0.9
18. Household[d]	0.6205	65.5	273.2	142.4	95.5	21.0	15.2
Other Sectors (19-26)	0.3171	24.0	100.2	52.2	35.0	7.0	4.9
Total	1.0000	94.2	393.2	204.8	137.5	29.3	21.0

*Denotes that expenditures are less than 400 dollars.

[a]The government expenditures have been deflated to 1968 constant dollars based on general consumer price indices.

TABLE IV.15

Continued

[b]The distribution of educational expenditures by sector is calculated in terms of data obtained from: Molgat and MacMillan, education in Area Economic Development, Op. Cit., Table 2.

[c]Allocation of administrative costs to sector is based on the distribution of educational expenditure by sector in Column 1 of the Table.

[d]The figures in this row include commuting allowance deflated to 1968 dollars.

et. al. Study.[18]

Based on the random sample of 26 farms out of a total of 202 farms operated by those completing the farm management program, the average output increased from $7,381 in 1968 (before the service) to $11,307 in 1969 (after the service period).[19] The output increase per farm (per client) is $3,656 (which is equivalent to 3,600 at 1968 constant dollars). Accordingly, the total output increases for each year from 1969 to 1977 can be estimated by the following procedures assuming that the average output increase per client is constant over time. First, the accumulated training clients are estimated for each year from 1968 to 1977 and then that figures are multiplied by the estimated increases per year per farm (per client).[20]

Secondly, for estimation of input purchases due to increases in production, the increased total output is divided into livestock and crop sectors according to the assumption that 75% of a total clients belong to livestock operators and 25% to crop farmers. As before, the adjusted input coefficients for each year are

---

[18] MacMillan, Bernat and Flagler, Op. Cit.,

[19] MacMillan and Lu, Urban Impacts of Rural Resource Development Expenditures in the Interlake Area of Manitoba, Op. Cit., p. 53.

[20] This assumption is reasonable. According to the survey for the agricultural training need study, for 2 out of 8 training clients whose gross output increased $6,000 in 1972 for the farm size greater than $15,000 and over class. In most samples the increases range from $2,000 to $4,000. See: J.A. MacMillan, An Assessment of Agricultural Training Needs in Manitoba, Op. Cit., Table in page 38.

used to estimate the required input purchases from producing sectors for producing the increased output resulting from the farm management training program. The results are shown in Table (IV.16).

Direct Effects Due to Increase in Net Farm Income Associated With Farm Management Training Program

Unlike the land clearing and demonstration program, there is only a very small amount of cost incurred by the clients attending to the farm management training program. Consequently, the government expenditure on allowance (at least 98% of allowance) and the increased net farm income resulting from the farm management training program are considered as additional income to the area. This additional income will result in additional purchases of goods and services from the region.

The same procedures as employed to derive increases in purchases of goods and services resulting from net farm income increase through the drainage program are employed here. Engel Curves are used to estimate the demand for goods and services by commodity groups associated with the increases in net farm income and converting them to a sector basis in terms of purchasing patterns of household expenditure in 1968. Table (IV.17) shows the estimated results for each year.

D. Summary

This section presents the results of direct effects of each agricultural resource development programs summarized from previous sections. These summary tables provide information concerning the

TABLE IV.16

ESTIMATED INCREMENTS IN INPUT PURCHASES ASSOCIATED WITH INCREASES IN PRODUCTION THROUGH THE FARM MANAGEMENT TRAINING PROGRAM, INTERLAKE AREA, 1969 TO 1977

(Unit: '000 1968 Dollars)

Sector	Estimated Input Purchase in Year								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Ag.-Livestock	5.2	27.1	39.1	47.6	50.3	52.7	53.4	54.0	54.6
2. Ag.-Crop & Other	3.7	19.3	27.8	33.6	35.4	37.0	37.1	37.4	37.4
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.4	1.9	2.7	3.3	3.4	3.5	3.5	3.5	3.5
5. Other Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6. Transportation	1.3	6.9	10.0	12.2	13.0	13.7	13.8	14.0	14.1
7. Construction	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
8. Pet. Wholesale	16.1	84.4	121.1	146.7	154.2	160.6	161.5	162.4	163.0
9. Farm Equip & Bldg Mat.	11.5	60.1	85.9	103.4	108.3	112.2	112.3	112.2	112.3
10. Food Store	0.1	0.4	0.6	0.7	0.8	0.8	0.8	0.8	0.8
11. Other Retail	0.6	3.2	4.5	5.5	5.7	5.9	5.9	5.9	6.0
12. Auto Product & Service	11.5	59.6	84.8	101.9	106.3	109.8	109.5	109.1	108.9
13. Apparel & Shoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Furniture & Appl.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15. Insurance	0.2	1.2	1.7	2.1	2.2	2.3	2.3	2.3	2.3
16. Personal Service	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17. Other Services	0.3	1.5	2.1	2.6	2.7	2.9	2.9	2.9	2.9
Intermediate Subtotal[a]	50.8	265.7	380.7	459.8	482.5	501.5	503.1	504.7	506.0
18. Household	53.3	277.4	396.0	476.6	498.4	515.6	515.2	514.8	514.2
Other Sectors (19-26)	71.4	370.9	528.5	635.7	664.3	686.6	685.4	684.2	683.5
Total	175.5	914.0	1,305.2	1,572.1	1,645.2	1,703.7	1,703.7	1,703.7	1,703.7

[a]Entries may not add to totals due to rounding.

[b]Sources and estimation procedures are explained in this Appendix.

TABLE IV.17

ESTIMATED FARM HOUSEHOLD CONSUMPTION INCREASES DUE TO INCREASES IN FARM INCOME THROUGH THE FARM MANAGEMENT TRAINING PROGRAM, INTERLAKE AREA, 1969 TO 1977

(Unit: '000 1968 Dollars)

Sector	Farm Household Consumption Increases in Year								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Ag.-Livestock	17.4	19.1	20.1	20.2	20.5	20.5	20.5	20.5	20.5
2. Ag.-Crop & Other	3.5	3.7	3.9	3.9	4.0	4.0	4.0	4.0	4.0
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6. Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7. Construction	5.8	7.7	9.2	9.3	9.7	9.7	9.7	9.7	9.7
8. Pet. Wholesale	13.5	17.7	21.0	21.2	22.0	22.1	22.1	22.0	22.0
9. Farm Equip & Bldg Mat.	1.6	2.1	2.5	2.6	2.7	2.7	2.7	2.7	2.7
10. Food Store	46.3	52.2	56.5	56.8	57.8	57.9	57.9	57.8	57.8
11. Other Retail	78.1	87.8	94.7	95.3	96.8	97.0	97.0	96.9	96.9
12. Auto Product & Service	8.1	11.5	14.4	14.7	15.4	15.4	15.4	15.4	15.4
13. Apparel & Shoes	11.1	13.0	14.4	14.5	14.7	14.8	14.8	14.8	14.8
14. Furniture & Appl.	1.7	2.3	2.7	2.7	2.8	2.9	2.9	2.9	2.9
15. Insurance	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
16. Personal Service	19.7	21.7	23.2	23.3	23.6	23.7	23.7	23.6	23.6
17. Other Services	1.9	2.7	3.3	3.3	3.5	3.5	3.5	3.5	3.5
Total[a]	209.1	241.9	266.5	268.5	274.0	274.6	274.5	274.4	274.2

[a]Entries may not add to totals due to rounding.

[b]Sources and estimation procedures are explained in this Appendix.

magnititude of different types of direct effects associated with alternative resource development programs. Table IV.18 shows the estimated direct effects of the drainage program for each year from 1969 to the FRED plan terminal year, 1977. Tables IV.19 and IV.20 present the estimated direct effects for the land clearing and farm management training programs.

TABLE IV.18

SUMMARY OF INCREMENTS IN REQUIRED INPUT PURCHASES ASSOCIATED WITH THE DRAINAGE PROGRAM, INTERLAKE AREA, 1969 TO 1977

(Unit: ', 000 1968 Dollars)

Sector	1969				1970				1971				1972			
	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total
1. Ag.-Livestock	126.1	134.4	29.7	290.2	127.5	210.5	34.4	372.4	124.4	287.1	38.1	449.6	118.9	361.7	41.1	521.7
2. Ag.-Crop & Other	51.6	95.2	5.5	152.3	52.1	149.2	6.3	207.6	59.9	202.6	6.9	260.4	48.6	253.7	7.4	309.7
3. MMining	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
4. Food & Bev. Mfg.	0.0	9.5	0.0	9.5	0.0	14.8	0.0	14.8	0.0	19.9	0.0	19.9	0.0	24.8	0.0	24.8
5. Other Mfg.	0.0	0.1	0.9	1.0	0.0	0.2	1.5	1.7	0.0	0.2	2.3	2.5	2.5	0.3	3.0	3.3
6. Transportation	0.0	33.3	0.0	33.3	0.0	52.6	0.0	52.6	0.0	72.2	0.0	72.2	0.0	90.9	0.0	90.9
7. Construction	241.4	0.3	31.8	273.5	244.0	0.5	50.9	295.4	238.2	0.7	70.4	309.3	227.8	0.8	89.4	318.0
8. Pet. Wholesale	0.0	417.9	69.8	487.7	0.0	652.4	111.6	764.0	0.0	883.3	154.3	1,037.6	0.0	1,106.9	196.3	1,303.2
9. Farm Equip & Bldg Mat.	0.6	297.1	8.9	306.6	0.6	462.7	14.4	477.7	0.6	624.1	20.1	644.8	0.6	777.0	25.8	803.4
10. Food Store	0.0	2.2	104.8	107.0	0.0	3.4	138.3	141.7	0.0	4.6	169.7	174.3	0.0	5.7	199.1	204.8
11. Other Retail	7.8	15.9	172.4	196.1	7.9	24.7	225.2	257.8	7.7	33.4	274.3	315.4	7.3	41.6	320.0	368.9
12. Auto Product & Service	0.0	293.0	77.3	370.3	0.0	454.8	153.2	608.0	0.0	610.5	247.1	857.6	0.0	758.5	353.6	1,112.1
13. Apparel & Shoes	0.0	0.0	28.3	28.3	0.0	0.0	36.7	36.7	0.0	0.0	43.9	43.9	0.0	0.0	50.1	50.1
14. Furniture & Appl.	0.0	0.0	9.3	9.3	0.0	0.0	15.0	15.0	0.0	0.0	20.7	20.7	0.0	0.0	26.3	26.3
15. Insurance	0.0	6.0	2.2	8.8	0.0	9.3	4.7	14.0	0.0	12.5	7.9	20.4	0.0	15.5	11.6	27.1
16. Personal Service	16.6	0.0	44.6	61.2	16.7	0.0	63.0	79.7	16.3	0.0	82.3	98.6	15.6	0.0	101.7	117.3
17. Other Services	0.9	7.2	13.6	21.7	0.9	11.3	23.3	35.5	0.9	15.3	33.8	50.0	0.8	19.3	44.4	64.5
Total (1.-17)[b]	445.0	1,312.1	599.0	2,356.1	449.7	2,046.3	878.8	3,374.8	439.0	2,766.2	1,171.8	4,377.0	419.6	3,456.8	1,469.9	5,346.3

TABLE IV.18 (Continued)

Sector	1973 (I)	1973 (II)	1973 (III)	1973 Total	1974 (I)	1974 (II)	1974 (III)	1974 Total	1975 (I)	1975 (II)	1975 (III)	1975 Total	1976 (I)	1976 (II)	1976 (III)	1976 Total	1977 (I)	1977 (II)	1977 (III)	1977 Total
1. Ag.-Livestock	71.0	408.7	42.6	522.3	c	413.4	42.4	455.8	c	418.8	42.4	461.2	c	423.2	42.4	465.6	c	428.0	42.4	470.4
2. Ag.-Crop & Other	29.0	284.9	7.6	321.5		287.5	7.6	295.1		288.9	7.6	296.5		219.2	7.6	298.8		291.2	7.6	298.8
3. Mining	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
4. Food & Bev. Mfg.	0.0	27.7	0.0	27.7		27.7	0.0	27.7		27.7	0.0	27.7		27.7	0.0	27.7		27.7	0.0	27.7
5. Other Mfg.	0.0	0.3	3.4	3.7		0.3	3.4	3.7		0.3	3.4	3.7		0.3	3.4	3.7		0.3	3.4	3.7
6. Transportation	0.0	102.9	0.0	102.9		104.9	0.0	104.9		105.9	0.0	105.9		107.3	0.0	107.3		108.3	0.0	108.3
7. Construction	135.9	0.9	100.1	236.9		0.9	98.5	99.4		0.9	98.4	99.3		0.0	98.3	99.2		0.9	98.2	99.1
8. Pet. Wholesale	0.0	1,243.5	219.8	1,463.3		1,250.2	216.3	1,466.5		1,257.2	216.1	1,473.3		1,264.3	215.9	1,480.2		1,269.3	215.6	1,484.9
9. Farm Equip & Bldg Mat.	0.4	869.3	29.0	898.7		869.7	28.5	898.2		870.4	28.5	989.9		869.7	28.5	898.2		870.1	28.5	898.6
10. Food Store	0.0	6.4	215.1	221.5		6.4	212.7	219.1		6.4	212.6	219.0		6.4	212.4	218.8		6.4	212.3	218.7
11. Other Retail	4.4	46.5	344.8	395.7		46.5	341.1	387.6		46.5	340.9	387.4		46.5	340.7	387.2		47.5	340.4	387.9
12. Auto Product & Ser.	0.0	845.2	418.6	1,263.8		842.5	408.6	1,251.1		840.1	408.1	1,248.2		837.4	407.5	1,244.9		835.7	406.8	1,242.5
13. Apparel & Shoes	0.0	0.0	53.3	53.3		0.0	52.9	52.9		0.0	52.8	52.8		0.0	52.8	52.8		0.0	52.8	52.8
14. Furniture & Appl.	0.0	0.0	29.4	29.4		0.0	29.0	29.0		0.0	28.9	28.9		0.0	28.9	28.9		0.0	28.9	28.9
15. Insurance	0.0	17.4	13.8	31.2		17.4	13.5	30.9		17.4	13.5	30.9		17.7	13.4	31.1		17.7	13.4	31.1
16. Personal Service	9.2	0.0	112.7	121.9		0.0	111.1	111.1		0.0	111.0	111.0		0.0	110.9	110.9		0.0	110.8	110.8
17. Other Services	0.5	21.6	50.5	72.6		21.9	49.6	71.5		21.9	49.6	21.5		22.2	49.5	71.7		22.2	49.4	71.6
Total	250.4	3,875.2	1,640.9	5,766.5		3,889.3	1,615.1	5,504.4		3,902.4	1,613.6	5,516.0		3,914.7	1,612.1	5,526.8		3925.2	1,610.2	5,535.4

[a] The Roman Numerals indicated in the top of the Table for each year represents the incremented required inputs purchases derived from: (I) direct effects associated with the $7 million investment expenditure on drainage program: (II) direct effects resulted from changes in agricultural production through drainage: and (III) direct effects due to increases in net farm income associated with drainage program.

[b] Entries may not add to totals due to rounding

[c] Blank indicated that there is no such kind of direct effects incurred in that particular year.

Sources: Tables (IV.1) and (IV.2).

TABLE IV.19

SUMMARY OF INCREMENTS IN REQUIRED INPUT PURCHASES ASSOCIATED WITH LAND CLEARING PROGRAM AND DEMONSTRATION, INTERLAKE AREA,[a] 1969 TO 1977

Sector	1969				1970				1971				1972			
	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total
1. Ag.-Livestock	38.8	12.2	7.9	58.9	51.5	22.7	8.7	82.9	30.4	35.3	7.3	73.0	67.7	45.5	9.6	122.8
2. Ag.-Crop & Other	20.9	8.7	1.8	31.4	27.7	16.2	1.9	45.8	16.3	25.1	1.7	43.1	36.3	32.2	2.1	70.6
3. Mining	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
4. Food & Bev. Mfg.	0.0	0.9	0.0	0.9	0.0	1.6	0.0	1.6	0.0	2.4	0.0	2.4	0.0	3.1	0.0	3.1
5. Other Mfg.	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
6. Transportation	0.0	3.1	0.0	3.1	0.0	5.8	0.0	5.8	0.0	2.1	0.0	9.1	0.0	11.7	0.0	11.7
7. Construction	387.9	0.0	0.4	388.3	259.9	0.1	0.6	260.6	159.3	0.1	0.3	159.7	121.8	0.1	0.8	122.7
8. Pet. Wholesale	0.0	38.1	1.5	39.6	0.0	70.8	1.9	72.7	0.0	109.4	1.3	110.7	0.0	140.2	2.5	142.7
9. Farm Equip & Bldg Mat.	300.1	27.2	0.1	327.4	200.8	50.4	0.2	251.4	123.2	77.6	0.1	200.9	93.7	98.9	0.2	192.8
10. Food Store	0.0	0.2	18.7	18.9	0.0	0.4	20.6	21.0	0.0	0.6	17.2	17.8	0.0	0.7	22.7	23.4
11. Other Retail	0.0	1.4	31.8	33.2	0.0	2.7	35.2	37.9	0.0	4.1	29.3	33.4	0.0	5.2	38.7	43.9
12. Auto Product & Service	0.9	27.1	0.7	28.7	1.3	50.0	0.9	52.2	0.7	76.6	0.6	77.9	1.7	97.4	1.1	100.2
13. Apparel & Shoes	0.0	0.0	2.7	2.7	0.0	0.0	3.2	3.2	0.0	0.0	2.3	2.3	0.0	0.0	3.8	3.8
14. Furniture & Appl.	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.2
15. Insurance	0.0	0.5	0.0	0.5	0.0	1.0	0.0	1.0	0.0	1.6	0.0	1.6	0.0	2.0	0.0	2.0
16. Personal Service	0.0	0.0	11.5	11.5	0.0	0.0	12.1	13.1	0.0	0.0	11.1	11.1	0.0	0.0	12.7	12.7
17. Other Services	0.0	0.7	0.1	0.8	0.0	1.2	0.1	1.3	0.0	1.9	0.1	2.0	0.0	2.5	0.2	2.7
Total (1-17)[b]	748.6	120.2	77.5	946.3	541.2	222.9	85.7	849.8	329.9	343.8	71.2	744.9	321.2	439.6	94.8	855.6

TABLE IV.19 (Continued)

Sector	1973				1974				1975				1976				1977			
		(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total
1. Ag.-Livestock	18.0	54.2	6.1	78.3	c	65.1	13.7	78.8	c	68.1	17.4	85.5	c	73.7	19.3	93.0	c	74.5	20.3	94.8
2. Ag.-Crop & Other	9.7	38.1	1.5	49.3		45.6	2.8	48.4		47.4	3.5	50.9		51.1	3.8	54.9		51.1	3.9	55.0
3. Mining	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
4. Food & Bev. Mfg.	0.0	3.7	0.0	3.7		4.4	0.0	4.4		4.5	0.0	4.5		4.8	0.0	4.8		4.8	0.0	4.8
5. Other Mfg.	0.0	0.0	0.0	0.0		0.1	0.0	0.1		0.1	0.1	0.2		0.1	0.2	0.3		0.1	0.2	0.3
6. Transportation	0.0	13.9	0.0	13.9		16.9	0.0	16.9		17.6	0.0	17.6		19.1	0.0	19.1		19.2	0.0	19.2
7. Construction	341.0	0.1	0.2	341.3		0.2	2.7	2.9		0.2	5.8	6.0		0.2	8.0	8.2		0.2	9.4	9.6
8. Pet. Wholesale	0.0	166.0	0.9	166.9		198.1	6.6	204.7		206.0	13.6	219.6		221.7	18.4	240.1		222.6	21.4	244.0
9. Farm Equip & Bldg Mat.	264.0	116.6	0.0	380.6		138.5	0.7	139.2		143.3	1.6	144.9		153.2	2.2	155.4		153.3	2.6	155.9
10. Food Store	0.0	0.8	14.4	15.2		1.0	34.1	35.1		1.0	46.3	47.3		1.1	53.2	54.3		1.1	57.1	58.2
11. Other Retail	0.0	6.2	24.7	30.9		7.3	59.9	65.2		7.6	78.1	85.7		8.1	89.3	97.4		8.3	95.7	104.0
12. Auto Product & Ser.	0.4	114.4	0.4	115.2		135.4	3.4	138.8		139.6	8.2	147.8		149.0	12.1	161.1		148.7	14.9	163.6
13. Apparel & Shoes	0.0	0.0	1.7	1.7		0.0	7.3	7.3		0.0	11.1	11.1		0.0	13.3	13.3		0.0	14.5	14.5
14. Furniture & Appl.	0.0	0.0	0.1	0.1		0.0	0.8	0.8		0.0	1.7	1.7		0.0	2.4	2.4		0.0	2.8	2.8
15. Insurance	0.0	2.3	0.0	2.3		2.8	0.0	2.8		2.9	0.1	3.0		3.1	0.2	3.3		3.1	0.3	3.4
16. Personal Service	0.0	0.0	10.2	10.2		0.0	16.0	16.0		0.0	19.7	19.7		0.0	22.0	22.0		0.0	23.4	23.4
17. Other Services	0.0	2.9	0.0	2.9		3.5	0.8	4.3		3.6	1.9	5.5		4.0	2.8	6.8		4.0	3.4	7.4
Total	633.1	519.2	60.1	1,212.4		618.7	146.8	765.5		641.8	209.2	851.0		689.1	247.2	936.3		690.9	270.0	960.9

[a]The Roman Numerals indicated in the top of the Table for each year represents the incremented required input purchased derived from: (I) direct effects associated with government expenditure for land clearing program and clearing costs incurred by farmers; (II) direct effects resulting from changes in agricultural production in the cleared land through land clearing program; and (III) direct effects due to increase in net farm income from cleared land through land clearing program.

[b]Entries may not add to toals due to rounding.

[c]Blank indicated that there is no such kind of direct effects incurred in that particular year.

Sources: Tables (IV.7), (IV.11) and (IV.12).

TABLE IV.20

SUMMARY OF INCREMENTS IN REQUIRED INPUT PURCHASES ASSOCIATED WITH THE FARM MANAGEMENT TRAINING PROGRAM, INTERLAKE AREA[a], 1969 TO 1977

(Unit: 1,000 1968 Dollars)

Sector	1969				1970				1971				1972			
	(I)	(II)	(III)	Total	(I)	(II)	(II)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total
1. Ag.-Livestock	0.0	5.2	17.4	22.6	0.0	27.1	19.1	46.2	0.0	39.1	20.1	59.2	0.0	47.6	20.2	67.8
2. Ag.-Crop & Other	0.0	3.7	3.5	7.2	0.0	19.3	3.7	23.0	0.0	27.8	3.9	31.7	0.0	33.6	3.9	37.5
3. Mining	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
4. Food & Bev. Mfg.	0.0	0.4	0.0	0.4	0.0	1.9	0.0	1.9	0.0	2.7	0.0	2.7	0.0	3.3	0.0	3.3
5. Other Mfg.	0.2	0.0	0.1	0.3	0.1	0.0	0.2	0.3	0.1	0.0	0.2	0.3	0.0	0.0	0.2	0.2
6. Transportation	1.0	1.3	0.0	2.3	0.5	6.9	0.0	7.4	0.4	10.0	0.0	10.4	0.1	12.2	0.0	12.3
7. Construction	0.6	0.0	5.8	6.4	0.3	0.1	7.7	8.1	0.2	0.1	9.2	9.5	0.0	0.1	9.3	9.4
8. Pet. Wholesale	8.6	16.1	13.5	38.2	4.5	84.4	17.7	106.6	3.0	121.1	21.0	145.1	0.6	146.7	21.2	168.5
9. Farm Equip & Bldg Mat.	0.0	11.5	1.6	13.1	0.0	60.1	2.1	62.2	0.0	85.9	2.5	88.4	0.0	103.4	2.6	106.0
10. Food Store	0.0	0.1	46.3	46.4	0.0	0.4	51.8	52.2	0.0	0.6	56.5	57.1	0.0	0.7	56.8	57.5
11. Other Retail	5.7	0.6	78.1	84.4	2.9	3.2	87.8	93.9	2.0	4.5	94.7	101.2	0.4	5.5	95.3	101.2
12. Auto Product & Ser.	2.1	11.5	8.1	21.7	1.1	59.6	11.5	72.2	0.8	84.8	14.4	100.0	0.1	101.9	14.7	116.7
13. Apparel & Shoes	0.0	0.0	11.1	11.1	0.0	0.0	13.0	13.0	0.0	0.0	14.4	14.4	0.0	0.0	14.5	14.5
14. Furniture & Appl.	0.0	0.0	1.7	1.7	0.0	0.0	2.3	2.3	0.0	0.0	2.7	2.7	0.0	0.0	2.7	2.7
15. Insurance	0.1	0.2	0.1	0.4	0.0	1.2	0.2	1.4	0.0	1.7	0.3	2.0	0.0	2.1	0.3	2.4
16. Personal Service	0.0	0.0	19.7	19.7	0.0	0.0	21.7	21.7	0.0	0.0	23.2	23.2	0.0	0.0	23.3	23.3
17. Other Services	1.5	0.3	1.9	3.7	0.8	1.5	2.7	5.0	0.5	2.1	3.3	5.9	0.1	2.6	3.3	6.0
Total (1-17)[b]	19.8	50.9	209.1	279.7	10.2	265.7	241.9	517.8	7.0	380.7	266.5	654.2	1.3	459.8	268.5	729.6

TABLE IV.20 (Continued)

Sector	1973				1974				1975				1976				1977			
	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total	(I)	(II)	(III)	Total
1. Ag.-Livestock	0.0	50.3	20.3	70.8	c	52.7	20.5	73.2	c	53.4	20.5	73.9	c	54.0	20.5	74.5	c	54.6	20.5	75.1
2. Ag.-Crop & Other	0.0	35.4	4.0	39.4		37.0	4.0	41.0		37.1	4.0	41.1		37.4	4.0	41.4		37.4	4.0	41.4
3. Mining	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
4. Food & Bev. Mfg.	0.0	3.4	0.0	3.4		3.5	0.0	3.5		3.5	0.0	3.5		3.5	0.0	3.5		3.5	0.0	3.5
5. Other Mfg.	0.0	0.0	0.2	0.2		0.0	0.2	0.2		0.0	0.2	0.2		0.0	0.2	0.2		0.0	0.2	0.2
6. Transportation	0.0	13.0	0.0	13.0		13.7	0.0	13.7		13.8	0.0	13.8		14.0	0.0	14.0		14.1	0.0	14.1
7. Construction	0.0	0.1	9.7	9.8		0.1	9.7	9.8		0.1	9.7	9.8		0.1	9.7	9.8		0.1	9.7	9.8
8. Pet. Wholesale	0.4	154.2	22.0	176.6		160.6	22.1	182.7		161.5	22.1	183.6		162.4	22.0	184.4		163.0	22.0	185.0
9. Farm Equip & Bldg.Mat.	0.0	108.3	2.7	111.0		112.2	2.7	114.9		112.3	2.7	115.0		112.2	2.7	114.9		112.3	2.7	115.0
10. Food Store	0.0	0.8	57.8	58.6		0.8	57.9	58.7		0.8	57.9	58,7		0.8	57.8	58.6		0.8	57.8	58.6
11. Other Retail	0.3	5.7	96.8	102.8		5.9	97.0	102.9		5.9	97.0	102.9		5.9	96.9	102.8		6.0	96.9	102.9
12. Auto Product & Ser.	0.1	106.3	15.4	121.8		109.8	15.4	125.2		109.5	15.4	124.9		109.1	15.4	124.5		108.9	15.4	124.3
13. Apparel & Shoes	0.0	0.0	14.7	14.7		0.0	14.8	14.8		0.0	14.8	14.8		0.0	14.8	14.8		0.0	14.8	14.8
14. Furniture & Appl.	0.0	0.0	2.8	2.8		0.0	2.9	2.9		0.0	2.9	2.9		0.0	2.9	2.9		0.0	2.9	2.9
15. Insurance	0.0	2.2	0.3	2.5		2.3	0.3	2.6		2.3	0.3	2.6		2.3	0.3	2.6		2.3	0.3	2.6
16. Personal Service	0.0	0.0	23.6	23.6		0.0	23.7	23.7		0.0	23.7	23.7		0.0	23.6	23.6		0.0	23.6	23.6
17. Other Services	0.1	2.7	3.5	6.3		2.9	3.5	6.4		2.9	3.5	6.4		2.9	3.5	6.4		2.9	3.5	6.4
Total (1-17)	0.9	482.5	274.0	757.4		501.5	274.6	776.1		503.1	274.5	777.6		504.7	274.4	779.1		506.0	274.2	780.2

[a]The Roman Numerals indicated in the top of the Table for each year represents the incremented required input purchases derived from: (I) direct effects associated with government expenditure for farm management training program: (II) direct effects from changes in agricultural production through farm management training program; and (III) direct effects due to increases in net farm income resulting from farm management training program.

[b]Entries may not add to totals due to rounding.

[c]Blank indicates that there is no such kind of effects incurred in that particular year.

Sources: Tables (IV.15), (IV.16) and (IV.17).

APPENDIX V

CALCULATED INCOME COEFFICIENTS BY SECTOR AND PROCEDURES FOR ESTIMATING LABOR PRODUCTIVITY OR LABOR INPUT CO-EFFICIENT CHANGES OVER TIME RESULTING FROM AGRICULTURAL RESOURCE DEVELOPMENT PROGRAMS IN THE INTERLAKE AREA

TABLE V.1

CALCULATED INCOME COEFFICIENTS BY SECTOR FOR BASE YEAR AND EACH TARGET YEAR, INTERLAKE AREA[a], 1969 TO 1977

Sector	Income Coefficients in Year									
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Ag.-Livestock	0.2968	0.2967	0.2967	0.2967	0.2966	0.2965	0.2963	0.2962	0.2961	0.2959
2. Ag.-Crop & Other	0.3246	0.3240	0.3237	0.3235	0.3229	0.3223	0.3217	0.3210	0.3203	0.3196
3. Mining	0.2754	0.2754	0.2754	0.2754	0.2754	0.2754	0.2754	0.2754	0.2754	0.2754
4. Food & Bev. Mfg.	0.1240	0.1256	0.1271	0.1288	0.1305	0.1323	0.1341	0.1360	0.1379	0.1393
5. Other Mfg.	0.2870	0.2870	0.2870	0.2870	0.2870	0.2870	0.2870	0.2870	0.2870	0.2870
6. Transportation	0.4265	0.4265	0.4265	0.4265	0.4265	0.4265	0.4265	0.4265	0.4265	0.4265
7. Construction	0.1832	0.1832	0.1832	0.1832	0.1832	0.1832	0.1832	0.1832	0.1832	0.1832
8. Pet. Wholesale	0.0795	0.0795	0.0795	0.0795	0.0795	0.0795	0.0795	0.0795	0.0795	0.0795
9. Farm Equip & Bldg Mat.	0.1051	0.1051	0.1050	0.1050	0.1049	0.1049	0.1048	0.1048	0.1048	0.1047
10. Food Store	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915
11. Other Retail	0.1271	0.1271	0.1271	0.1271	0.1271	0.1271	0.1271	0.1271	0.1271	0.1271
12. Auto Product & Service	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300
13. Apparel & Shoes	0.1315	0.1315	0.1315	0.1315	0.1315	0.1315	0.1315	0.1315	0.1315	0.1315
14. Furniture & Appl.	0.2010	0.2010	0.2010	0.2010	0.2010	0.2010	0.2010	0.2010	0.2010	0.2010
15. Insurance	0.6077	0.6077	0.6077	0.6077	0.6077	0.6077	0.6077	0.6077	0.6077	0.6077
16. Personal Service	0.2585	0.2585	0.2585	0.2585	0.2585	0.2585	0.2585	0.2585	0.2585	0.2585
17. Other Services	0.3661	0.3661	0.3661	0.3661	0.3661	0.3661	0.3661	0.3661	0.3661	0.3661

[a]The definition and method of estimating income coefficient refer to Chapter 5.

APPENDIX V-A

PROCEDURES FOR ESTIMATING CHANGES IN LABOR INPUT COEFFICIENTS IN AGRICULTURAL SECTORS RESULTING FROM THE FARM MANAGEMENT TRAINING PROGRAM OVER TIME

The labor productivity in agricultural sectors are expected to increase through the effect of better management resulting from the farm management training program. There is a need to consider such changes for the analysis of employment impact. The estimation procedures include the following three steps.

First, changes in output per client due to the farm management training program are estimated. Based on the method employed to estimate changes in output per client explained in Appendix IV, the output per client resulting from the farm management training program was estimated to increase from original $7,381 to $11,307, an increase in output of 53.19 percent.

Secondly, the ratio of clients to total farm numbers over time are calculated in order to estimate average agricultural labor productivity changes in the area resulting from the farm management training program. The results are summarized in Column 3, Table IV.2. Then, the average labor productivity increases due to the farm management training program over time is estimated by multiplying the percentage of increase in output per client (which represents the ratio of change in output resulting from the program) by the ratio of clients to total farm numbers in the respective year (Column 3 of Table IV.2). The results are shown in Column 4 of Table IV.2.

Finally, changes in labor input coefficients in agricultural

TABLE V.2

SUMMARY OF THE PROCEDURES FOR ESTIMATING LABOR PRODUCTIVITY CHANGES AND CHANGES IN LABOR INPUT COEFFICIENTS FOR AGRICULTURAL SECTORS OVER TIME DUE TO FARM MANAGEMENT TRAINING PROGRAMS, INTERLAKE AREA, 1969-1977

Year	Accumulated No. of Clients	Projected Total Farm Numbers	Ratio of (1) to (2)	Changes in Ave. Labor Productivity [(3) x 0.5319]	Labor Input Coefficients	
					Livestock Sector	Crop & Other Sector
	(1)	(2)	(3)	(4)	(5)	(6)
1969	48	5799	0.00828	0.00440	0.12932	0.16753
1970	250	5681	0.04401	0.02341	0.11975	0.15538
1971	357	5564	0.06416	0.03413	0.11155	0.14441
1972	430	5445	0.07897	0.04200	0.10395	0.13426
1973	450	5326	0.08449	0.04494	0.09725	0.12489
1974	466	5207	0.08949	0.04760	0.09094	0.11610
1975	466	5088	0.09159	0.04872	0.08511	0.10790
1976	466	4972	0.09372	0.04985	0.07965	0.10014
1977	466	4894	0.09522	0.05065	0.07468	0.09335

Sources: Tables (IV.14), and (4.20).

sectors are estimated by equation (24) in Table 3.3, Chapter 3. It is based on the assumption that changes in average labor productivities over time for both livestock and crop and other sectors are the same. The results are summarized in Columns (5) and (6).

APPENDIX V-B

PROCEDURES FOR ESTIMATING CHANGES IN LABOR INPUT COEFFICIENTS IN AGRICULTURAL SECTORS RESULTING FROM THE DRAINAGE AND LAND CLEARING AND DEMONSTRATION PROGRAM OVER TIME

Unlike the farm management training program, the increased labor productivities in agricultural sectors through the drainage or the land clearing and demonstration program are mainly the results of changes in input combinations such as changes in farm size and changes in land productivity. Thus, given the amount of labor input associated with larger farm size and higher land productivity, the labor productivity is expected to increase. Because of this, it is not necessary to say that the increased output resulting from the drainage or the land clearing and demonstration program would have to be associated with increases in labor requirements. The increased output (the impacts on gross output) might be entirely attributed to the result of the increased labor productivity or land productivity without any additional labor input increases. Consequently, an analysis of the employment impact needs to consider such effects on labor input coefficients. Since there is no information on changes in land productivity resulting from either the drainage program or from the land clearing and demonstration program and it has been assumed that the reclaimed land and newly cleared land have the same productivity as other lands currently in production, the changes in labor input coefficients resulting from those two programs are mainly incurred by the results of changes in inputs combination (i.e., increases in farm size per farm).

Given the assumption specified, two steps are employed to estimate changes in labor input coefficients for agricultural sectors resulting from the drainage and land clearing and demonstration programs. First, the increased farm size per farm resulting from each program over time is estimated. This was done by adding the reclaimed land (as shown in Table (IV.2), Appendix IV) or the cleared land (as shown in Table (IV.10), Appendix IV) to the available land without the resource development program (as estimated in Chapter 4) divided by the projected total farm numbers. Secondly, it is assumed that the increased farm size would proportionally reduce the labor input requirement coefficients. Based on this assumption, the reduction of labor input coefficients is calculated by multiplying the percentage of farm size increase in each year due to each program by the respective year's projected labor input coefficients. Substracting the reduction constitutes a new series of labor input coefficients which may be distinguished from the projected one to define as "labor input coefficients with the program". The estimated results for the drainage program are shown in Table V.3. Those for the land clearing and demonstration program are summarized in Table V.4.

TABLE V.3

SUMMARY OF THE ESTIMATION PROCEDURES AND ESTIMATED LABOR INPUT COEFFICIENTS RESULTING FROM THE DRAINAGE PROGRAM, INTERLAKE AREA, 1969 - 1977[a]

Year	Average Farm Size Per Farm in Year			Reduction in Coefficients		Labor Input Coeff. With Drainage	
	Without Program (Acres) (1)	With Drainage (Acres) (2)	% Increase (3)	Livestock (4)	Crop (5)	Livestock (6)	Crop (7)
1969	295.0	316.3	7.22	0.0094	0.0121	0.1203	0.1556
1970	305.5	353.5	15.71	0.0192	0.0246	0.1027	0.1317
1971	316.7	392.9	24.06	0.0275	0.0350	0.0869	0.1107
1972	328.8	433.8	31.93	0.0342	0.0433	0.0731	0.0924
1973	341.8	475.5	39.12	0.0393	0.0494	0.0612	0.0769
1974	355.7	508.6	42.99	0.0405	0.0505	0.0537	0.0670
1975	370.7	527.1	42.19	0.0372	0.0461	0.0510	0.0631
1976	386.5	546.6	41.42	0.0342	0.0420	0.0484	0.0594
1977	400.2	562.9	40.65	0.0315	0.0384	0.0460	0.0561

[a]Labor input coefficient is defined as labor input requirement per thousand dollars of gross output by sector.

Sources: Tables (4.3), (4.20) and (IV.2).

TABLE V.4

SUMMARY OF THE ESTIMATION PROCEDURES AND ESTIMATED LABOR INPUT COEFFICIENTS RESULTING FROM THE LAND CLEARING AND DEMONSTRATION PROGRAM, INTERLAKE AREA, 1969 - 1977[a]

Year	Average Farm Size Per Farm in Year			Reduction in Coefficients		Labor Input Coeff. With L. Clearing	
	Without Program (Acres) (1)	With Land Clearing (Acres) (2)	% Increase (3)	Livestock (4)	Crop (5)	Livestock (6)	Crop (7)
1969	295.0	298.5	1.19	0.0015	0.0020	0.1284	0.1657
1970	305.5	312.1	2.16	0.0026	0.0034	0.1193	0.1429
1971	316.7	327.0	3.25	0.0034	0.0047	0.1110	0.1410
1972	328.8	342.3	4.11	0.0044	0.0056	0.1029	0.1301
1973	341.8	358.1	4.77	0.0048	0.0060	0.0957	0.1203
1974	355.7	375.5	5.57	0.0052	0.0065	0.0890	0.1110
1975	370.7	391.6	5.64	0.0050	0.0062	0.0832	0.1030
1976	386.5	409.4	5.92	0.0049	0.0060	0.0777	0.0954
1977	400.2	423.5	5.82	0.0045	0.0055	0.0730	0.0890

[a]See the footnote of Table V.3.

Sources: Tables (4.3), (4.20) and (IV.5).

APPENDIX VI

CHARACTERISTICS OF THE MODEL RESULTS, SYSTEM VARIABLES AND EXOGENOUS VARIABLES

APPENDIX VI

CHARACTERISTICS OF THE MODEL RESULTS, SYSTEM VARIABLES AND EXOGENOUS VARIABLES

A. Introduction

This appendix summarizes selected model results and presents the values of system and exogenous variables used in the models.[1] The first two tables (Tables VI.1 and VI.2) present the results for goal variables derived from projection and impact simulation models. The available historical series for each goal variable are presented in the table to permit comparison of the model results with historical data. The last portion of Table (VI.2) summarizes the projection and impact results.

Tables (VI.3) and (VI.4) present the values of system variables. The system variables are the variables included in the second stage of the model simulation procedures such as household expenditures, government expenditures, farm numbers by size class, etc. All the system variables are derived from the system of equations. The procedures for estimating each system variable have been outlined in Chapter 4. To permit comparison, the historical series for the system variables are also presented in the beginning of Table (VI.3).

The values of exogenous variables employed in the models are summarized in Tables (VI.5) and (VI.6). The exogenous variables are those variables included in the first stage of the model simulation procedures. Thus, these exogenous variables are <u>datum</u> for the models and if incorrect would distort

---

[1]Model specifications refer to Chapter 3.

the model results. For this reason, the historical observations for the exogenous variables are also presented in the beginning of Table (VI.5).

It should be noted that some goal variables for the historical observations are not directly obtainable. The following section discusses the estimation procedures used.

B. Estimation Procedures for Some Selected Variables

Gross Output by Sector

Agricultural gross output The estimation procedures for the agricultural gross output for 1971 include the following three steps. First, the values of major agricultural output for livestock and crop are estimated in terms of physical production and then convert to value terms based on 1971 price levels obtained from the Linear Programming Model of Manitoba.[2] Other minor crops and other livestock production including other field crops, other grains, vegetables, fruits, greenhouse products, other poultry and horses are obtained directly from the value of products sold by assuming that there is no inventory. The assumption of no inventory changes may result in inaccurate estimation of the value of other crop and other livestock production. Nevertheless, the bias is negligible because the other product category accounts for only 5 persent of total production.

Second, the above values of agricultural output are based on 1971 farm product prices. In order to compare with the model results which are based on 1968 constant dollars, the estimated value of agricultural output is converted

[2] C.F. Framingham, W.J. Craddock and L. Baker, "Alternative Futures for Manitoba Agriculture", Unpublished Draft Research Bulletin, Department of Agricultural Economics, University of Manitoba, 1974.

to the 1968 base proportionally to the price index of farm products obtained from the Manitoba Agriculture Yearbook. The price index of farm products in 1971 is 7 percent less than 1968's farm product prices.[3]

Third, the values of fish products, fur output and forest production are included in the model results but excluded in the above estimation. Service to agriculture is also included in agriculture output. Thus, the third step estimates the fishing products and agricultural service values of output produced in 1971. The fish output is estimated to be $1,016.3 thousand 1968 dollars based on the average output per fisherman and the number of fishermen in the Interlake (209) obtained from the Annual Report of Manitoba Department of Mines, Resources and Environment. Since there is no information available for the values of output for fur products and service to agriculture, it is assumed that these outputs are constant.[4] The sum of those values of outputs and the results of step two constitutes the estimate of gross agricultural output for 1971.

Due to the complex procedures and data requirements in estimating the major agricultural output in step one, an alternative approach is used to estimate the agricultural gross output for 1966 and 1961. It is assumed that the ratio between the values of agricultural products sold and agricultural output in the Interlake is the same for Manitoba. Given that assumption, the agricultural output is estimated by dividing the value of agricultural products

---

[3]The Price Index of Farm Products are 105 and 98 respectively for 1968 and 1971 based on 1961 base. See: Manitoba Department of Agriculture, Manitoba Agriculture Yearbook (Winnipeg: Manitoba Department of Agriculture, 1971) p.81.

[4]The values of output for fur products and service to agriculture are estimated to be $845.5 and $165.9 thousand respectively for 1968.

sold by the ratio.[5] After completion of the above procedure, the gross output for agriculture is estimated according to the second and third steps described above.

Gross output of retail trades The value of output of the trade sectors is defined to include the cost of goods purchased and the trade margin.[6] Thus, the output of the trade sectors includes the sales plus net inventory changes. Direct sales by manufacturers to household consumers, whether by mail or door-to-door salesman, are excluded in these related sectors since activities are counted in the manufacturing sectors. Retail sales of wholesalers and service business are also excluded.[7]

The value of output as defined above for retail trade sectors is available for 1961, 1966 and 1971 detailed to the Census division level. The three census years' outputs are given for the Interlake area. It should be noted that the Interlake area covers only part of Division 5. For this reason, the output of retail sectors for the Interlake portion of Division 5 is based on the statistics in the Interlake Fact. The Interlake percentage of Census Division 5 is used to adjust the output of retail sectors for the Interlake area for 1961 and 1971 assuming that the percentage is constant over time.

By definition, the value of output for retail sectors also include the net changes in inventory. Due to lack of information, the difference in

---

[5]The ratios between the values of agricultural products sold and agricultural output for the Manitoba are estimated to be 0.7327 and 0.6892 respectively for 1966 and 1961.

[6]J.A. MacMillan, C.M. Lu and C.F. Framingham, op. cit.

[7]Dominion Bureau of Statistics, Census of Canada, Introduction and General Review (Ottawa: Queen's Printer, 1966).

inventory between 1966 and 1961 for retail trade is assumed to be the net change within the five year period. The average net change is assumed to be the net inventory change for that year and added to the estimate of gross sales for the retail sectors to obtain the value of gross output for the retail sectors for that particular year. The estimate is then converted to the 1968 constant dollars in terms of consumer price index.

Gross output of manufacturing sectors The value of output for the manufacturing sectors, by definition, consists of: (1) total value of shipment of goods, which includes goods manufactured from their own plant either at their own plant or at a branch plant in the area, (2) total value of shipment of goods manufactured not from their own plant or branch, and any operations performed by the establishment's own employees such as sales and service, and (3) changes in inventory of finished goods, processing and supplies.[8]

The total value of shipments for the sales and service item is not available for 1971. Thus, the value of output for the manufacturing sector for 1970 is presented instead of 1971. In addition, there are no inventory change statistics available even for Manitoba. The average inventory change associated with the total value of shipment in the Interlake area obtained from the Interlake business survey (1968) is employed to estimate net inventory changes for each census year. In the Interlake, for 1968, the net inventory change in the manufacturing sectors was estimated to be $7.139 per thousand dollars of value of shipment. Consumer price index is also employed to deflate the value of output to the base year (1968).

---

[8]J.A. MacMillan, C.M. Lu and C.F. Framingham, op. cit.

Labor Requirements by Sector

Projections of labor requirements in man-years for each sector for each target year were estimated by multiplying the labor requirement coefficients shown in Tables VI.3 and VI.4 by the projected gross output for the 17 sectors. An independent estimate of government employment is based on the estimated 1.5 percent compound rate of growth in public administration profession projected by MacMilland and Lu using the shift-share analysis.[9]

Two steps are used to estimate the labor requirements by sector for the historical observations. The first step estimates the labor requirements for the agricultural sectors. The agricultural labor requirements include three components: operator, hired farm labor and unpaid farm family labor. The number of operators are obtained directly from the Agriculture Census. It is assumed that each operator represents 1 man-year of labor input. The hired farm labor is converted to the man-year basis in terms of total weeks of hired labor divided by 52 (weeks). The unpaid farm family labor is obtained by multiplying the ratio between unpaid farm family labor worked on farm and total numbers of farm operator in 1961 by the estimates of total farm numbers for 1966 and 1971. The sum of these three components, operator, hired farm labor and unpaid farm family labor, constitute the estimate of labor requirements in the agricultural sectors. The second step is to derive the labor requirements in the non-agricultural sectors including government employees and commuters. It is obtained by subtracting farm labor requirements from total employment.

---

[9] J.A.MacMillan and C.M. Lu, Projection and Impact Models, op. cit., p. 59.

Capital and Land Requirements by Sector

The gross fixed capital requirement for each sector in each target year is projected by multiplying the gross fixed capital requirement coefficients in each target year as shown in Tables VI.3 and VI.4 by the corresponding target year's gross output estimated by each model as shown in Tables VI.1 and VI.2. The projected land requirements are the product of the land coefficients and the respective projected gross output for each projection model.[10]

The gross fixed capital requirements for the historical observations are not estimated due to insufficient information. The land requirements for the historical observations are obtained from the agriculture census. The adjustment factor for Division 5 is based on the ratio of the number of farms in St. Andrews and total farm numbers of Division 5 in 1966. A similar procedure is employed to adjust the land requirements for the historical observations for Division 9.[11]

Factor Input Utilization Rates

The utilization rate is a measure of utilized inputs relative to available inputs within a certain time of period multiplied by 100. Thus, the land utilization rate is the ratio of land requirement to land available for each target year multiplied by 100. Similarly, the labor utilization rate is the ratio of labor requirement to labor force for each target year multiplied by 100.

---

[10]The definitions of gross fixed capital requirement and land requirement coefficients refer to Chapter 4.

[11]The estimated ratios are 0.2293 and 0.900 respectively for Division 5 and Division 9.

The labor force and land available for each target year are presented in Tables (VI.5) and (VI.6).

Area Income[12]

Total area income projections are based on two separate procedures; one refers to input-output projection and another refers to independent projections. The input-output income projection is directly derived from each projection and simulation models. The income sources projected by this procedure include household income generated from the 17 producing sectors, business taxes and net income of incorporated business, retaining earning and capital depreciation allowance. The area income generated from these sources is the product of the corresponding payment coefficients as adjusted to the target years and the respective projected realized gross output.

Not all sources of area income can be derived from the input-output simulation model mainly due to the nature of the input-output table constructed. The government wage payments, rental income, interest, dividends and wage earnings in finance institutions, factor earning to non-residents and contributions by business are independently projected using the methods described below:

1. Government wage payments are obtained from the projection of government expenditure specified in Chapter 4. It was estimated by the following two steps. First. The wage payments by governments are estimated by multiplying the base year percentage of wage payments to total government expenditure by the projected total government expenditure. Local government was broken down by categories. Second, the sum of the estimated wage payments by different levels of governments in the Interlake constitutes total wage payment by government.

---

[12] The area income is the income generated from all factors in the area either such factors are own by residents or by foreigners.

2. Rental income, factor earnings and contributrions by business (items 6,7 and 8) are projected by multiplying the base year ratio of such earning to gross output (it was calculated as 0.07165, 0.01202 and 0.00163 for items 6, 7 and 8, respectively in 1968) by the corrssponding target year realized gross output.

The area income for the historical series is derived from personal income basis. In the Interlake, the area income constituted 80 percent of total personal income in 1968.[13] This ratio is used to estimate the area income for the historical observation in 1971 based on personal income by Census Division obtained from the Market Surveys.[14]

Area Income by Sources

The farm income includes farm labor income, tax paid to government from farm operation, returns to farm operators, factor earning to non-residents from farm operation and contributions by farm operators. The first three categories of farm income are projected from the projection and simulation models and the other two categories are obtained by the following procedures. Factor earning to non-residents from farm operations are obtained by multiplying the ratio of total imports by agricultural secotrs to total imports by the 17 producing sectors in the base year by each projected target year's factor earning to non-residents. A similar method is employed to estimate contributions by farm operators. In this case, the ratio is the total payment to unallocated sector by agricultural sectors and total payment to the same payment sector by the 17 producing sectors. The product of this ratio and projected total contributions by business for each target year yields the portion of contributions by farm

---

[13]See C.F. Framingha, J.A. MacMillandand D.J. Sandell, The Interlake Fact, op. cit., Table 22.

[14]The Financial Post, Market Surveys 1972 (Toronto: Maclean-Hunter Ltd., 1972).

operators. Non-farm income is the residual of total area income and the projected farm income.

No information is available for farm income at the regional level. Therefore, the following procedures are employed to estimate the farm income for the historical observations. First, the ratio of the net farm income to the agricultural gross output for Manitoba is employed to estimate the net farm income for the Interlake based on the estimated agricultural gross output discussed above. It is assumed that the production cost is the same for the Interlake and Manitoba.[15] Second, the ratio of the retained earning and depreciation to the agricultural gross output for the Interlake area in 1968 is employed to estimate the value of the depreciation and retained earnings.[16] Then the farm income is the sum of the net farm income and the depreciation and retained earning derived from the above two steps.

[15]The ratios of the net farm income to the agricultural gross output are 0.2854, 0.3307 and 0.2238 respectively for 1971, 1966 and 1961, based on data obtained from: Manitoba Agriculture Yearbook, op. cit., 1961, 1966 and 1971.

[16]The ratio of the depreciation and retained earning to the agricultural gross output is estimated to be 0.1355 for the Interlake in 1968 based on data obtained for the 1968 Interlake Input-Output Table (see Table 4.1).

Table VI.I

A Comparison of the Values of Selected Goal Variables Between Model Projection Results and Historical Series[a]

Variables	Historical Series				Results of Static Projection Model				
	1961	1966	1968	1971	1971	1976	1977	1981	1986
GROSS OUTPUT BY SECTOR ($1,000 1968)									
Agriculture and Mining Subtotal	24,719.0	35,061.5	44,515.4	58,430.0	50,154.9	61,790.6	61,234.9	66,609.1	60,526.9
Agriculture--Livestock	--[b]	--	30,893.2	--	35,217.6	44,197.6	43,053.2	46,433.2	42,144.6
Agriculture--Crop and Other	--	--	12,535.6	--	13,789.7	16,310.8	16,871.0	18,745.8	17,014.4
Mining	--	--	1,086.6	--	1,147.6	1,282.2	1,310.7	1,430.1	1,367.9
Manufacturing Subtotal	16,936.3	27,862.3	26,479.8	30,620.4[c]	27,962.9	30,690.9	31,268.8	33,694.9	33,344.0
Food and Beverage Manufacturing	--	--	4,518.1	--	4,831.2	5,442.4	5,574.1	6,135.6	5,696.0
Other Manufacturing	--	--	21,961.7	--	23,131.7	25,248.5	25,694.7	27,559.3	27,648.0
Non-Manufacturing Subtotal	--	--	9,768.6	--	10,089.8	10,932.5	11,147.9	11,767.5	12,309.8
Transportation	--	--	1,823.0	--	2,022.8	2,423.3	2,513.5	2,528.6	2,295.0
Construction	--	--	7,945.6	--	8,067.6	8,509.2	8,634.4	9,238.9	10,014.8
Wholesale Subtotal	--	--	15,109.0	--	16,572.2	19,512.4	20,167.0	20,956.6	19,021.0
Petroleum Wholesale	--	--	9,348.0	--	10,437.5	12,479.3	12,921.4	12,965.9	11,768.4
Farm Equipment and Building Material	--	--	5,761.0	--	6,134.7	7,033.1	7,245.6	7,990.7	7,252.6
Retail Trade Subtotal	25,716.7	32,174.9	41,968.6	44,700.0	43,637.0	48,122.4	49,103.1	52,863.0	52,996.5
Food Store	--	--	6,663.0	--	6,946.9	7,573.0	7,706.6	8,260.1	8,390.4
Other Retail	--	--	11,538.0	--	12,952.5	13,790.1	13,966.2	14,682.5	14,587.9
Auto Product Sales and Service	--	--	22,022.3	--	21,433.1	24,183.4	24,801.2	27,468.2	27,792.4
Apparel and Shoes	--	--	1,240.7	--	1,701.6	1,847.9	1,876.1	1,748.6	1,587.1
Furniture and Appliance	--	--	504.6	--	602.9	728.0	753.0	703.6	638.7
Service Subtotal	--	--	10,028.9	--	9,969.7	11,384.2	11,693.3	12,944.1	12,625.6
Insurance	--	--	302.1	--	316.2	396.0	414.3	419.0	380.3
Personal Service	--	--	8,113.2	--	8,178.1	9,239.1	9,472.7	10,481.8	10,213.9
Other Services	--	--	1,613.6	--	1,475.4	1,749.1	1,806.3	2,043.3	2,031.4
Total Gross Output	--	--	147,870.3	--	158,386.3	182,433.4	184,615.0	198,835.2	190,823.8
LABOR REQUIREMENTS BY SECTOR (MAN-YEARS)									
Agriculture and Mining Subtotal	10,884.0	--	6,565.4	7,282.0	6,835.2	8,405.1	8,354.5	9,103.4	8,265.4
Agriculture--Livestock	--	--	4,258.0	--	4,479.4	5,621.6	5,476.0	5,906.0	5,360.5
Agriculture--Crop and Other	--	--	2,265.0	--	2,311.0	2,733.5	2,827.4	3,141.6	2,851.5
Mining	--	--	42.4	--	44.8	50.0	51.1	55.8	53.4
Nonagriculture and Other Subtotal	5,707.0	--	9,361.0	9,392.0	4,448.3	4,954.7	5,066.0	5,437.7	5,374.6
Food and Beverage Manufacturing	--	--	130.4	--	139.2	156.9	160.7	176.8	164.2
Other Manufacturing	--	--	1,169.2	--	1,231.5	1,344.2	1,367.9	1,467.2	1,471.9
Transportation	--	--	228.1	--	253.1	303.2	314.5	316.4	287.2
Construction	--	--	404.5	--	410.2	432.7	439.0	469.8	509.2
Petroleum Wholesale	--	--	152.7	--	170.5	203.9	211.1	211.8	192.2
Farm Equipment and Building Material	--	--	132.8	--	141.4	162.1	167.0	184.2	167.2
Food Store	--	--	172.6	--	179.9	196.1	199.6	213.9	217.3
Other Retail	--	--	393.2	--	439.5	467.9	473.9	498.2	495.0
Auto Product Sales and Service	--	--	532.4	--	516.9	583.2	598.1	662.4	670.3
Apparel and Shoes	--	--	51.5	--	69.5	75.5	76.6	71.4	64.8
Furniture and Appliance	--	--	20.2	--	24.0	29.0	30.0	28.0	25.4
Insurance	--	--	35.4	--	37.1	46.5	48.6	49.1	44.6
Personal Service	--	--	658.5	--	663.8	749.9	768.8	850.7	829.0
Other Services	--	--	187.8	--	171.7	203.6	210.2	237.8	236.4
Intermediate Sector Subtotal	--	--	10,834.7	--	11,283.5	13,359.8	13,420.5	14,541.1	13,640.0
Government	--	--	3,957.0	--	3,957.0	3,957.0	3,957.0	2,978.9	2,670.0
Commuting	--	--	1,092.3	--	1,092.3	670.2	553.5	0.0	0.0
Total Labor Requirements	16,591.0	--	15,884.0	16,674.0	16,332.8	17,987.0	17,931.0	17,520.0	16,310.0
Unutilized Labor Force	--	--	2,092.0	613.0	1,032.2	0.0	0.0	0.0	0.0

Continued

Table VI.I (continued)

Variables	Results of Comparative Static Projection Model 1971	1976	1977	1981	1986	Results of Dynamic Projection Model 1971	1976	1977	1981	1986
GROSS OUTPUT BY SECTOR ($1,000 1968)										
Agriculture and Mining Subtotal	50,154.9	58,821.4	60,696.3	69,160.1	82,956.3	50,184.0	58,840.1	60,716.9	69,189.6	83,006.6
Agriculture--Livestock	35,217.6	41,176.0	42,456.3	48,321.7	58,329.4	35,217.0	41,176.0	42,456.3	48,321.7	58,329.4
Agriculture--Crop and Other	13,789.7	16,363.2	16,929.3	19,408.3	23,043.3	13,819.4	16,381.7	16,949.8	19,437.6	23,084.3
Mining	1,147.6	1,282.2	1,310.7	1,430.1	1,592.6	1,147.6	1,282.4	1,310.8	1,430.3	1,592.9
Manufacturing Subtotal	27,962.9	30,714.4	31,295.3	33,735.4	37,063.7	27,976.8	30,733.6	30,716.9	33,767.8	37,111.5
Food and Beverage Manufacturing	4,831.2	5,465.7	5,600.4	6,175.8	6,981.2	4,838.3	5,466.0	5,600.7	6,176.2	6,981.9
Other Manufacturing	23,131.7	25,248.7	25,694.9	27,559.6	30,082.5	23,138.5	25,267.6	25,116.2	27,591.6	30,129.6
Non-Manufacturing Subtotal	10,090.4	10,987.4	11,208.3	12,258.6	13,925.0	11,030.3	13,570.0	14,137.6	16,650.7	20,426.9
Transportation	2,022.8	2,477.1	2,575.6	3,015.9	3,678.0	2,054.4	2,523.5	2,628.3	3,095.2	3,795.7
Construction	8,067.6	8,510.3	8,632.7	9,242.7	10,247.2	8,975.9	11,046.5	11,509.3	13,555.5	16,631.2
Wholesale Subtotal	16,572.2	19,762.5	43,977.4	23,521.6	28,050.9	16,986.7	20,742.1	21,570.1	25,210.7	30,583.4
Petroleum Wholesale	10,437.5	12,715.9	13,196.6	15,291.8	18,323.4	10,511.4	12,742.4	13,226.7	15,337.8	18,392.9
Farm Equipment and Building Material	6,134.7	7,046.6	7,259.2	8,229.8	9,727.5	6,475.3	7,999.7	8,343.4	9,872.9	12,190.5
Retail Trade Subtotal	43,637.0	48,061.4	49,029.0	53,116.4	58,874.8	44,102.7	49,354.8	50,490.9	55,283.4	62,045.3
Food Store	6,946.9	7,573.7	7,707.4	8,261.4	9,026.1	6,947.2	7,573.8	7,707.4	8,261.4	9,026.2
Other Retail	12,952.5	13,795.6	13,972.5	14,692.8	15,658.1	12,960.1	13,811.9	13,991.0	14,720.5	15,699.2
Auto Product Sales and Service	21,433.1	24,116.2	24,720.0	27,328.5	31,107.5	21,889.0	25,388.2	26,157.7	29,459.5	34,225.7
Apparel and Shoes	1,701.6	1,847.9	1,876.1	1,979.2	2,099.0	1,701.6	1,847.9	1,876.1	1,979.2	2,099.0
Furniture and Appliance	602.9	728.0	753.0	854.5	984.1	604.8	733.0	758.7	862.8	996.2
Service Subtotal	9,969.7	11,392.2	11,701.5	13,027.9	14,942.7	9,981.0	11,418.3	11,731.3	13,072.0	15,008.4
Insurance	316.2	396.0	413.5	487.4	591.4	317.4	399.9	417.9	493.9	601.1
Personal Service	8,178.1	9,239.2	9,472.5	10,481.9	11,959.4	8,178.4	9,239.9	9,473.6	10,483.1	11,961.6
Other Services	1,475.4	1,757.0	1,815.5	2,058.6	2,391.9	1,485.2	1,778.5	1,839.8	2,095.0	2,445.7
Total Gross Output	158,386.3	179,739.3	184,386.2	204,810.1	235,823.1	160,261.0	184,658.9	189,963.8	213,174.1	248,183.1
LABOR REQUIREMENTS BY SECTOR (MAN-YEARS)										
Agriculture and Mining Subtotal	6,083.6	5,111.1	4,942.3	4,334.6	3,786.8	6,086.6	5,112.9	4,944.4	4,336.7	3,793.9
Agriculture--Livestock	4,027.1	3,402.1	3,290.9	2,896.9	2,561.0	4,029.1	3,402.1	3,290.9	2,896.9	2,561.0
Agriculture--Crop and Other	2,011.7	1,659.0	1,600.3	1,381.9	1,163.6	2,012.7	1,660.8	1,602.3	1,384.0	1,170.7
Mining	44.8	50.0	51.1	55.8	62.2	44.8	50.0	51.2	55.8	62.2
Nonagriculture and Other Subtotal	4,283.5	4,492.7	4,540.0	4,742.9	5,033.2	4,346.3	4,639.8	4,701.1	4,955.0	5,300.5
Food and Beverage Manufacturing	135.8	146.8	149.0	158.6	171.5	135.8	146.8	149.1	158.6	171.6
Other Manufacturing	1,221.9	1,316.6	1,336.4	1,418.5	1,528.4	1,222.3	1,317.5	1,337.5	1,420.2	1,530.8
Transportation	226.0	224.7	224.5	223.8	223.3	227.9	228.9	229.1	229.7	230.4
Construction	361.7	309.2	300.8	272.2	244.6	402.4	401.4	401.0	399.2	397.0
Petroleum Wholesale	156.5	162.7	163.8	168.0	172.8	156.7	163.0	164.2	168.5	173.4
Farm Equipment and Building Material	129.2	127.2	127.1	127.6	129.4	136.2	144.4	146.1	153.0	162.2
Food Store	175.4	183.2	184.8	191.4	200.4	175.4	183.2	184.8	191.4	200.4
Other Retail	428.4	437.1	439.0	446.1	455.4	428.6	437.7	439.5	446.9	456.6
Auto Product Sales and Service	503.4	543.1	551.9	589.6	643.0	514.5	571.7	584.0	635.6	707.5
Apparel and Shoes	67.7	70.5	71.0	72.3	73.5	67.8	70.5	71.0	72.3	73.5
Furniture and Appliance	23.4	27.1	27.8	30.4	33.6	23.5	27.3	28.0	30.7	34.0
Insurance	33.7	36.2	36.7	38.2	39.7	33.9	36.6	37.0	38.7	40.3
Personal Service	651.6	713.7	727.2	785.1	868.5	651.6	713.8	727.3	785.2	868.6
Other Services	168.8	194.6	200.0	221.1	249.1	169.7	197.0	202.5	225.0	254.7
Intermediate Sector Subtotal	10,367.1	9,603.8	9,482.3	9,077.5	8,820.0	10,432.9	9,752.7	9,645.5	9,291.7	9,094.9
Government	4,204.0	4,529.0	4,597.0	4,879.0	5,256.0	4,204.0	4,529.0	4,597.0	4,879.0	5,256.0
Commuting	1,092.3	1,092.3	1,092.3	1,092.3	1,092.3	1,092.3	1,092.3	1,092.3	1,092.3	1,092.3
Total Labor Requirements	15,663.4	15,225.1	15,171.6	15,048.8	15,168.3	15,729.2	15,374.0	15,334.8	15,263.0	15,443.2
Unutilized Labor Force	1,701.6	2,761.9	2,759.4	2,471.2	1,141.7	1,635.8	2,613.0	2,596.2	2,257.0	866.8

Continued

Table VI.I (continued)

Variables	Historical Series 1961	1966	1968	1971	Results of Static Projection Model 1971	1976	1977	1981	1986
GROSS FIXED CAPITAL REQUIREMENTS BY SECTOR ($1,000 1968)									
Agriculture and Mining Subtotal	--	--	14,016.1	--	14,603.8	17,947.3	17,828.8	19,416.6	17,645.2
Agriculture--Livestock	--	--	9,180.1	--	9,657.4	12,120.0	11,806.2	12,733.0	11,557.0
Agriculture--Crop and Other	--	--	4,496.7	--	4,588.0	5,426.9	5,613.3	6,237.0	5,661.0
Mining	--	--	339.3	--	358.4	400.4	409.3	446.6	427.2
Nonagriculture Subtotal	--	--	6,606.4	--	6,979.5	7,702.6	7,865.6	8,405.6	8,405.0
Food and Beverage Manufacturing	--	--	333.7	--	356.3	401.4	411.1	452.5	420.1
Other Manufacturing	--	--	1,974.6	--	2,079.8	2,270.1	2,310.2	2,477.9	2,485.9
Transportation	--	--	381.0	--	422.8	506.5	525.3	528.5	479.7
Construction	--	--	1,623.0	--	1,646.0	1,736.0	1,761.6	1,884.9	2,043.2
Petroleum Wholesale	--	--	143.4	--	160.1	191.4	198.2	198.9	180.5
Farm Equipment and Building Material	--	--	229.2	--	244.1	279.8	288.3	317.9	288.5
Food Store	--	--	193.2	--	201.4	219.5	223.4	239.4	243.2
Other Retail	--	--	526.9	--	589.0	627.1	635.1	667.6	663.3
Auto Product Sales and Service	--	--	497.1	--	482.6	544.5	558.5	618.5	525.8
Apparel and Shoes	--	--	62.2	--	84.0	91.2	92.6	86.3	78.3
Furniture and Appliance	--	--	8.4	--	10.0	12.1	12.5	11.7	10.6
Insurance	--	--	164.9	--	172.6	216.6	226.2	228.7	207.6
Personal Service	--	--	410.5	--	413.8	467.5	479.3	530.3	516.7
Other Services	--	--	128.3	--	117.3	139.1	143.6	162.5	161.5
Total	--	--	20,692.5	--	21,583.3	25,649.9	25,694.4	27,822.2	26,050.2
LAND REQUIREMENTS BY AGRICULTURAL SECTOR ($1,000 ACRES)									
By Sector									
Agriculture--Livestock	--	--	677.2	--	712.4	894.1	870.9	939.3	852.5
Agriculture--Crop and Other	--	--	845.9	--	863.1	1,020.9	1,055.9	1,173.3	1,064.9
Total Land Requirements	1,129.5	1,449.7	1,523.1	1,591.2	1,575.5	1,915.0	1,926.8	2,112.6	1,917.4
FACTOR INPUT UTILIZATION RATES (PERCENT)									
Labor	--	--	95.6	96.5	94.1	100.0	100.0	100.0	100.0
Land	86.3	90.0	90.3	90.6	88.9	99.1	97.8	98.9	80.4
AREA INCOME ($1,000 1968)									
Input-Output Projections									
Household Income from the 17 Sectors	--	--	32,058.6	--	34,558.0	40,259.8	40,588.7	43,849.4	41,748.8
Business Tax Revenues	--	--	6,587.9	7,600.0	7,018.6	7,901.6	8,015.5	8,634.4	8,430.4
Retained Earnings	--	--	11,074.5	--	72,056.7	14,060.5	14,165.4	15,326.8	14,499.5
Total Area Income from Input-Output Projections	--	--	49,721.0	57,300.0	53,633.3	62,221.9	62,769.6	67,810.6	64,678.7
Independent Projections									
Government Wage Payments	--	--	12,722.3	--	13,241.4	16,405.6	17,038.5	19,570.3	22,735.5
Rental, Dividends and Interest Incomes	--	--	10,595.8	--	11,482.7	13,230.8	13,610.9	15,273.9	17,782.3
Factor Earnings to Nonresidents	--	--	1,777.2	--	1,926.0	2,219.2	2,283.0	2,561.9	2,982.7
Contribution by Business	--	--	240.5	--	260.6	300.3	309.0	346.7	403.6
Total Area Income from Independent Projection	--	--	25,335.8	--	26,910.7	32,155.9	33,241.4	35,190.0	43,904.1
Total Area Income (A+B)	--	--	75,056.8	84,600.0	80,544.0	94,377.8	96,011.0	103,000.6	108,582.8
AREA INCOME BY SOURCES ($1,000 1968)									
Farm Income	8,881.5	16,345.7	20,052.1	25,387.1	22,427.3	27,618.7	27,424.5	29,869.2	27,110.4
Nonfarm Income	--	--	55,004.7	59,212.9	58,116.7	66,759.1	68,586.5	73,131.4	81,472.4
Total Area Income	--	--	75,056.8	84,600.0	80,544.0	94,377.8	96,011.0	103,000.6	108,582.8
AVERAGE FARM INCOME PER FARM ($1968)	1,285.1	2,579.0	3,388.9	4,560.3	3,790.3	4,667.7	4,634.9	5,048.0	4,581.8

Continued

Variables	Results of Comparative Static Projection Model 1971	1976	1977	1981	1986	Results of Dynamic Projection Model 1971	1976	1977	1981	1986
GROSS FIXED CAPITAL REQUIREMENTS BY SECTOR ($1,000 1968)										
Agriculture and Mining Subtotal	17,088.5	23,095.4	24,430.0	30,684.5	40,789.5	17,096.5	23,103.4	24,439.1	30,698.5	40,811.3
Agriculture--Livestock	11,426.7	15,643.0	16,564.6	20,917.9	28,064.4	11,432.3	15,643.0	16,564.6	20,917.9	28,064.4
Agriculture--Crop and Other	5,303.4	7,052.0	7,456.1	9,320.0	12,227.8	5,306.1	7,060.0	7,465.2	9,334.0	12,249.5
Mining	358.4	400.4	409.3	446.6	497.3	358.1	400.4	409.3	446.6	497.4
Nonagriculture Subtotal	7,080.7	8,020.7	8,233.8	9,176.9	10,576.4	7,293.2	8,600.4	8,888.5	10,142.0	11,975.2
Food and Beverage Manufacturing	369.8	443.3	459.6	531.5	637.5	369.8	443.3	459.7	513.5	637.6
Other Manufacturing	2,155.2	2,496.3	2,570.7	2,891.4	3,349.0	2,155.8	2,498.1	2,572.9	2,894.7	3,354.3
Transportation	439.4	562.4	590.9	721.1	926.2	442.9	572.9	602.9	740.1	955.8
Construction	1,618.2	1,659.1	1,673.4	1,751.4	1,887.4	1,800.3	2,153.5	2,231.0	2,568.6	3,063.2
Petroleum Wholesale	161.6	196.6	204.3	237.7	286.2	161.7	197.0	204.7	238.4	287.3
Farm Equipment and Building Material	245.0	282.6	291.4	331.7	394.0	258.4	320.8	334.9	397.9	493.8
Food Store	203.5	225.6	230.4	250.3	278.2	203.5	225.6	230.4	250.3	278.2
Other Retail	595.1	644.6	655.1	698.3	757.0	595.4	645.4	656.0	699.7	759.0
Auto Product Sales and Service	487.2	558.0	574.0	643.2	744.7	497.9	587.5	607.3	693.4	819.4
Apparel and Shoes	84.8	93.7	95.5	102.1	110.1	84.8	93.7	95.4	102.1	110.1
Furniture and Appliance	10.1	12.4	12.9	14.8	17.3	10.1	12.5	13.0	14.9	17.5
Insurance	174.3	222.2	232.8	278.1	343.2	175.1	224.3	235.2	281.8	348.8
Personal Service	418.0	480.4	494.2	554.4	643.4	418.1	480.4	494.3	554.4	643.5
Other Services	118.7	143.6	148.8	171.1	202.2	119.3	145.3	150.8	174.1	206.8
Total	24,169.2	31,116.1	32,663.8	39,861.4	51,365.9	24,389.7	31,703.8	33,327.6	40,840.5	52,786.5
LAND REQUIREMENTS BY AGRICULTURAL SECTOR ($1,000 ACRES)										
By Sector										
Agriculture--Livestock	755.8	861.7	880.2	963.2	1,083.7	727.4	861.7	880.2	963.2	1,083.7
Agriculture--Crop and Other	897.4	1,005.2	1,026.0	1,113.2	1,215.6	880.4	1,006.3	1,027.3	1,114.9	1,217.8
Total Land Requirements	1,653.2	1,866.9	1,906.2	2,076.4	2,299.3	1,607.8	1,868.0	1,907.5	2,078.1	2,301.5
FACTOR INPUT UTILIZATION RATES (PERCENT)										
Labor	88.8	81.5	81.5	80.6	85.0	87.8	85.5	85.5	87.1	94.7
Land	93.2	96.6	96.8	97.2	96.4	92.7	98.4	98.5	48.9	98.0
AREA INCOME ($1,000 1968)										
Input-Output Projections										
Household Income from the 17 Sectors	34,577.5	39,394.1	40,436.1	45,036.2	52,098.5	34,862.3	40,170.8	41,316.6	46,354.0	54,046.6
Business Tax Revenues	7,012.0	7,803.1	7,973.1	8,705.3	9,773.8	7,040.1	7,879.6	8,059.9	8,835.0	9,965.6
Retained Earnings	12,077.6	13,798.0	14,170.0	15,816.3	18,338.9	12,155.4	14,009.6	14,409.9	16,175.7	18,870.7
Total Area Income from Input-Output Projections	53,667.1	60,995.2	62,579.2	69,557.8	80,211.2	54,057.8	62,060.0	63,786.4	71,364.7	82,882.9
Independent Projections										
Government Wage Payments	13,241.4	16,405.6	17,038.5	19,570.3	22,735.5	13,241.4	16,405.6	17,038.5	19,570.3	22,735.5
Rental, Dividends and Interest Incomes	11,482.7	13,230.8	13,610.9	15,273.9	17,782.3	11,482.7	13,230.8	13,610.9	15,273.9	17,782.3
Factor Earnings to Nonresidents	1,926.0	2,219.2	2,283.0	2,561.9	2,982.7	1,926.0	2,219.2	2,283.0	2,561.9	2,982.7
Contribution by Business	260.6	300.3	309.0	346.7	403.6	260.6	300.3	309.0	346.7	403.6
Total Area Income from Independent Projection	26,910.7	32,155.9	33,241.4	35,190.0	43,904.1	26,910.7	32,155.9	33,241.4	35,190.0	43,904.1
Total Area Income (A+B)	80,577.8	93,151.1	95,820.6	104,747.8	124,115.3	80,968.5	94,215.9	97,027.8	106,555.6	126,787.0
AREA INCOME BY SOURCES ($1,000 1968)										
Farm Income	22,406.2	26,207.2	27,027.1	30,719.6	36,723.6	22,575.2	26,375.4	27,225.0	30,944.9	36,989.4
Nonfarm Income	58,171.6	66,943.9	68,793.5	74,028.2	87,391.7	58,393.3	67,840.5	69,802.8	75,610.7	89,797.6
Total Area Income	80,577.8	93,151.1	95,820.6	104,747.8	124,115.3	80,968.5	94,215.9	97,027.8	106,555.6	126,787.0
AVERAGE FARM INCOME PER FARM ($1968)	4,027.0	5,271.0	5,523.6	6,708.8	8,504.8	4,057.4	5,304.8	5,564.1	6,758.0	8,566.3

[a]The procedures for estimating each variable either for historical series or for model results are described in the content of this appendix. [b]—denotes data unavailable. [c]1970 figures.

Sources: Historical series for the gross output by sector are estimated on the basis of the following statistics: (1) Dominion Bureau of Statistics, 1961 Census of Canada, Vol. V (Part 3), Census of Agriculture (5.3), Manitoba, Cat. No. 96-537 (Ottawa: Queen's Printer); Dominion Bureau of Statistics, 1966 Census of Canada, Vol. V, Agriculture (Western Provinces), Manitoba, Cat. No. 96-608 (Ottawa: Queen's Printer); and Statistics Canada, 1971 Census of Canada, Vol. IV (Part 3), Census of Agriculture (4.3), Manitoba, Cat. No. 96-708 (Ottawa: Information Canada). (2) Province of Manitoba, Department of Agriculture and Conservation, Report on Crops, Live Stock, Etc., Produced in Manitoba in 1961, Crop Bulletin No. 140 (Winnipeg: Queen's Printer, 1962); Manitoba Department of Agriculture, Yearbook of Manitoba Agriculture 1966 (Winnipeg: Queen's Printer, [1967]); and Manitoba Department of Agriculture, Manitoba Agriculture 1971 Yearbook (Winnipeg: Queen's Printer, [1972]). (3) Statistics Canada, Manufacturing Industries of Canada: Geographical Distribution, Cat. No. 31-209 (Ottawa: Information Canada, annual). (4) Manitoba Department of Industry and Commerce, Management Productivity and Manpower Branch, Labour Force Variables: Special Tabulations of the 1971 Census by Regions (Winnipeg: Management Productivity and Manpower Branch. 1974). (5) The Financial Post, Survey of Markets 1972 (Toronto: Maclean-Hunter Ltd., 1972). (6) Charles F. Framingham, James A. MacMillan, and David J. Sandell, The Interlake Fact, prepared and distributed by the Planning and Priorities Committee of Cabinet Secretariat (Winnipeg: Hignell Printing, November, 1970). (7) James A. MacMillan and Chang-mei Lu, Projection and Impact Models: Area Manpower Planning in the Interlake Region, Manitoba, Research Bulletin No. 72-5 (Winnipeg: Department of Agricultural Economics, University of Manitoba, November, 1972). (8) Statistics Canada, Farm Net Income, Cat. No. 21-202 (Ottawa: Information Canada, 1971). (9) Manitoba Department of Mines, Resources and Environmental Management, Annual Report (Winnipeg: Queen's Printer, 1971).

Table VI.II

Summary of Program Impacts on Goal Variables and Effects on Dynamic Model Simulation Results[a]

Variables	Results of Dynamic Impact Simulation Models: Drainage Program			Land Clearing and Demonstration Program			Farm Management Training Program			Total Impact			Results of Dynamic Simulation Model (Sum of Projection and Impact)		
	1971	1976	1977	1971	1976	1977	1971	1976	1977	1971	1976	1977	1971	1976	1977
GROSS OUTPUT BY SECTOR ($1,000 1968)															
Agriculture and Mining Subtotal	10,367.8	14,177.1	14,182.4	1,330.4	2,511.0	2,513.5	1,420.9	1,849.0	1,849.8	13,119.1	18,537.1	18,545.7	63,303.1	77,377.2	79,262.5
Agriculture--Livestock	7,798.8	10,676.4	10,682.5	982.9	1,864.8	1,867.3	1,056.5	1,374.0	1,374.9	9,838.2	13,915.2	13,924.7	45,055.2	55,091.2	56,381.0
Agriculture--Crop and Other	2,568.9	3,500.6	3,499.8	347.5	646.2	646.2	364.4	475.0	474.9	3,280.8	4,621.8	4,620.9	17,100.2	21,003.5	21,570.7
Mining	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	1,147.7	1,282.5	1,310.8
Manufacturing Subtotal	58.0	75.3	72.4	8.3	12.8	13.1	9.3	10.8	10.8	75.6	98.9	96.3	28,052.4	30,832.5	30,813.2
Food and Beverage Manufacturing	43.7	58.8	55.8	5.8	10.4	10.7	7.5	8.8	8.8	57.0	78.0	75.3	4,895.3	5,544.0	5,676.0
Other Manufacturing	14.3	16.5	16.6	2.5	2.4	2.4	1.8	2.0	2.0	18.6	20.9	21.0	23,157.1	25,288.5	25,137.2
Non-Manufacturing Subtotal	621.5	467.4	469.2	217.1	73.2	75.8	50.9	61.4	61.6	889.5	602.0	606.6	11,919.8	14,172.0	14,744.2
Transportation	125.2	169.7	170.9	20.0	30.0	30.4	18.0	23.1	23.2	163.2	222.8	224.5	2,217.6	2,746.3	2,852.8
Construction	496.3	297.7	298.3	197.1	43.2	45.4	32.9	38.3	38.4	726.3	379.2	382.1	9,702.2	11,425.7	11,831.4
Wholesale Subtotal	2,035.9	2,763.0	2,770.0	378.1	464.8	470.3	278.8	355.3	356.3	2,692.8	3,583.1	3,596.6	19,758.0	24,325.2	25,166.7
Petroleum Wholesale	1,266.7	1,741.7	1,747.7	149.8	286.8	291.4	175.8	222.3	223.1	1,592.3	2,250.8	2,262.2	12,182.2	14,993.2	15,488.9
Farm Equipment and Building Material	769.2	1,021.3	1,022.3	228.3	178.0	178.9	103.0	133.0	133.2	1,100.5	1,332.3	1,334.4	7,575.8	9,332.0	9,677.8
Retail Trade Subtotal	2,598.9	3,061.0	3,062.3	309.1	522.8	541.9	407.4	463.3	463.6	3,315.4	4,047.1	4,067.8	57,418.1	53,406.5	54,558.7
Food Store	322.1	387.3	387.6	43.1	83.2	87.8	76.9	82.5	82.6	442.1	553.0	558.0	7,389.3	8,131.4	8,265.4
Other Retail	598.7	710.7	712.3	81.8	152.7	160.7	139.2	148.6	148.8	819.7	1,012.0	1,021.8	13,779.3	14,823.9	15,012.8
Auto Product Sales and Service	1,384.4	1,832.6	1,831.8	174.5	262.8	267.5	168.4	207.6	207.6	1,727.3	2,303.0	2,306.9	23,616.3	27,691.2	28,464.6
Apparel and Shoes	74.4	87.6	87.7	7.5	19.3	20.6	18.5	19.7	19.7	100.4	126.6	128.0	11,802.0	1,974.5	2,004.1
Furniture and Appliance	219.3	42.8	42.9	2.2	4.8	5.3	4.4	4.9	4.9	225.9	52.5	53.1	830.7	785.5	811.8
Service Subtotal	350.7	417.9	418.2	45.8	67.0	70.0	55.1	61.6	61.6	451.6	546.5	549.8	10,432.6	11,964.8	12,281.0
Insurance	28.9	40.6	40.6	3.1	5.0	5.1	3.1	4.0	4.0	35.1	49.6	49.7	352.5	449.5	467.6
Personal Service	228.7	259.2	259.5	33.3	47.4	49.5	40.7	44.7	44.7	302.7	351.3	353.7	8,481.1	9,591.2	9,827.3
Other Services	93.1	118.1	118.1	9.4	14.6	15.4	11.3	12.9	12.9	113.8	145.6	146.4	1,599.0	1,924.1	1,986.2
Total Gross Output	16,032.8	20,958.7	20,974.5	2,288.8	3,651.6	3,684.6	2,222.4	2,801.4	2,803.7	20,544.0	27,411.7	27,462.8	180,805.0	212,070.6	217,426.0
LABOR REQUIREMENTS BY SECTOR (MAN-YEARS)															
Agriculture and Mining Subtotal	962.1	744.6	687.7	158.1	206.5	193.8	170.5	157.0	147.0	1,290.7	1,108.1	1,028.5	7,377.3	6,221.0	5,972.9
Agriculture--Livestock	677.7	516.7	491.4	109.1	144.9	136.3	117.9	109.4	102.7	904.7	771.0	730.4	4,933.8	4,173.1	4,021.3
Agriculture--Crop and Other	284.4	227.9	196.3	49.0	61.6	57.5	52.6	47.6	44.3	386.0	337.1	298.1	2,393.7	1,997.9	1,900.4
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.8	50.0	51.2
Nonagriculture and Other Subtotal	177.1	164.2	181.3	30.7	30.9	31.6	24.8	26.7	26.2	232.6	221.8	239.1	9,875.2	10,482.9	10,629.5
Food and Beverage Manufacturing	1.2	1.5	1.5	0.2	0.3	0.3	0.2	0.2	0.2	1.6	2.0	2.0	137.4	148.8	151.1
Other Manufacturing	0.8	0.9	0.9	0.1	0.1	0.1	0.1	0.1	0.1	1.0	1.1	1.1	1,223.3	1,318.6	1,338.6
Transportation	13.9	15.4	14.9	2.2	2.7	2.7	2.0	2.1	2.0	18.1	20.2	19.6	246.0	249.1	248.7
Construction	22.3	10.8	10.4	8.8	1.6	1.6	1.5	1.4	1.3	32.6	13.8	13.3	435.0	415.2	414.3
Petroleum Wholesale	18.9	22.3	21.7	2.2	3.7	3.6	2.6	2.8	2.8	23.7	28.8	28.1	180.4	191.8	192.3
Farm Equipment and Building Material	16.2	18.4	17.9	4.8	3.2	3.1	2.2	2.4	2.3	23.2	24.0	23.3	159.4	168.4	169.4
Food Store	8.1	9.4	9.3	1.1	2.0	2.1	1.9	2.0	2.0	11.1	13.4	13.4	186.5	196.6	198.2
Other Retail	19.8	22.5	22.4	2.7	4.8	5.1	4.6	4.7	4.7	27.1	32.0	32.2	455.7	469.7	471.7
Auto Product Sales and Service	32.5	41.3	40.9	4.1	5.9	6.0	4.0	4.7	4.6	40.6	51.9	51.5	555.1	623.6	635.5
Apparel and Shoes	3.0	3.3	3.3	0.3	0.6	0.8	0.7	0.8	0.8	4.0	4.7	4.9	71.8	75.2	75.9
Furniture and Appliance	8.5	1.6	1.6	0.1	0.2	0.2	0.2	0.2	0.2	8.8	2.0	2.0	32.3	29.3	30.0
Insurance	3.1	3.7	3.6	0.3	0.5	0.5	0.3	0.4	0.4	3.7	4.6	4.5	37.5	41.2	41.5
Personal Service	18.2	20.0	19.9	2.7	3.7	3.8	3.2	3.5	3.4	24.1	27.2	27.1	675.7	741.0	754.4
Other Services	10.6	13.1	13.0	1.1	1.6	1.7	1.3	1.4	1.4	13.0	16.1	16.1	182.7	213.1	218.6
Intermediate Sector Subtotal	1,139.2	908.8	869.0	188.8	237.4	225.4	195.3	183.7	173.2	1,523.3	1,329.9	1,267.6	11,956.2	11,082.6	10,913.1
Government	--[b]	--	--	--	--	--	--	--	--	--	--	--	4,204.0	4,529.0	4,597.0
Commuting	--	--	--	--	--	--	--	--	--	--	--	--	1,092.3	1,092.3	1,092.3
Total Labor Requirements	--	--	--	--	--	--	--	--	--	--	--	--	17,252.5	16,703.9	16,602.4
Unutilized Labor Force	--	--	--	--	--	--	--	--	--	--	--	--	112.5	1,283.1	1,328.6

Continued

Table VI.II (continued)

	Results of Dynamic Impact Simulation Models												Results of Dynamic Simulation Model (Sum of Projection and Impact)		
	Drainage Program			Land Clearing and Demonstration Program			Farm Management Training Program			Total Impact					
	1971	1976	1977	1971	1976	1977	1971	1976	1977	1971	1976	1977	1971	1976	1977
GROSS FIXED CAPITAL REQUIREMENTS BY SECTOR ($1,000 1968)															
Agriculture and Mining Subtotal	3,517.9	5,564.6	5,709.3	452.0	986.9	1,013.1	483.0	726.7	745.5	4,452.9	7,278.2	7,467.9	21,549.4	30,381.6	31,907.0
Agriculture—Livestock	2,531.6	4,056.0	4,167.9	319.0	708.4	728.5	343.0	522.0	536.4	3,193.6	5,286.4	5,432.8	14,625.9	20,929.4	21,937.4
Agriculture—Crop and Other	986.3	1,508.6	1,541.4	133.0	278.5	284.6	140.0	204.7	209.1	1,259.3	1,991.8	2,035.1	6,565.4	9,051.8	9,560.3
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	358.1	400.4	409.3
Nonagriculture Subtotal	288.5	304.1	305.6	68.8	49.4	51.4	34.8	41.8	42.0	392.1	395.3	399.0	7,685.3	8,995.7	9,257.5
Food and Beverage Manufacturing	3.3	4.5	4.6	0.4	0.8	0.8	0.5	0.7	0.7	4.2	6.0	6.1	374.0	449.3	465.8
Other Manufacturing	1.3	1.6	1.7	0.2	0.2	0.2	0.1	0.2	0.2	1.6	2.0	2.1	2,157.4	2,500.1	2,575.0
Transportation	27.0	38.5	39.2	4.3	6.8	7.0	3.8	5.2	5.3	35.1	50.5	51.5	478.0	623.4	654.4
Construction	99.5	58.0	57.8	39.5	8.4	8.8	6.6	7.4	7.4	145.6	73.8	74.0	1,945.9	2,227.3	2,305.0
Petroleum Wholesale	19.5	26.9	27.0	2.3	4.4	4.5	2.7	3.4	3.4	24.5	34.7	34.9	186.2	231.7	239.6
Farm Equipment and Building Material	30.7	41.0	41.0	9.1	7.1	7.1	4.1	5.3	5.3	43.9	53.4	53.4	302.3	374.2	383.3
Food Store	9.4	11.5	11.6	1.2	2.4	2.6	2.2	2.4	2.4	12.8	16.3	16.6	216.3	241.9	247.0
Other Retail	27.5	33.2	33.4	3.7	7.1	7.5	6.4	6.9	7.0	37.6	47.2	47.9	633.0	692.6	703.9
Auto Product Sales and Service	31.5	42.4	42.5	4.0	6.0	6.2	3.8	4.8	4.8	39.3	53.2	53.5	537.2	640.7	660.9
Apparel and Shoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84.8	93.7	95.4
Furniture and Appliance	3.7	0.7	0.7	0.0	0.0	0.1	0.0	0.0	0.0	3.7	0.7	0.8	13.8	13.2	13.8
Insurance	15.9	22.8	22.9	1.7	2.7	2.9	1.7	2.2	2.2	19.3	27.7	28.0	194.4	252.0	263.2
Personal Service	11.7	13.5	13.5	1.7	2.4	2.5	2.0	2.3	2.3	15.4	18.2	18.3	433.5	498.6	512.6
Other Services	7.5	9.5	9.7	0.7	1.1	1.2	0.9	1.0	1.0	9.1	11.6	11.9	128.4	156.9	162.7
Total	3,806.4	5,868.7	6,014.9	520.8	1,036.3	1,064.5	517.8	768.5	787.5	4,845.0	7,673.5	7,866.9	29,234.7	39,377.3	41,194.5
LAND REQUIREMENTS BY AGRICULTURAL SECTOR ($1,000 ACRES)															
By Sector															
Agriculture—Livestock	0.0	0.0	0.0	43.3	85.5	85.5	0.0	0.0	0.0	43.3	85.5	85.5	770.7	947.2	965.7
Agriculture—Crop and Other	0.0	0.0	0.0	14.5	28.5	28.5	0.0	0.0	0.0	14.5	28.5	28.5	894.9	1,034.8	1,055.8
Total Land Requirements	0.0	0.0	0.0	57.8	114.0	114.0	0.0	0.0	0.0	57.8	114.0	114.0	1,665.6	1,982.0	2,021.5
FACTOR INPUT UTILIZATION RATES (PERCENT)															
Labor	—	—	—	—	—	—	—	—	—	—	—	—	95.9	92.9	92.6
Land	—	—	—	—	—	—	—	—	—	—	—	—	90.3	97.5	97.7
AREA INCOME ($1,000 1968)															
Input-Output Projections															
Household Income from the 17 Sectors	3,930.6	5,186.8	5,185.3	538.2	908.8	913.0	537.7	685.0	684.8	5,006.5	6,780.6	6,783.1	39,868.8	46,951.4	48,099.7
Business Tax Revenues	398.9	522.1	521.6	50.9	92.0	92.2	55.4	69.6	69.6	505.2	683.7	683.4	7,545.3	8,563.3	8,743.3
Retained Earnings	1,477.0	1,966.0	1,966.1	204.7	348.7	350.1	204.0	261.4	261.4	1,885.7	2,576.2	2,577.6	14,041.1	16,565.8	16,987.5
Total Area Income from Input-Output Projections	5,806.5	7,675.0	7,673.0	793.8	1,349.5	1,355.3	797.1	1,016.0	1,015.8	7,397.4	10,040.5	10,044.1	61,455.2	72,100.5	73,830.5
Independent Projections															
Government Wage Payments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13,241.4	16,405.6	17,038.5
Rental, Dividends and Interest Incomes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11,482.7	13,230.8	13,610.9
Factor Earnings to Nonresidents	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,926.0	2,219.2	2,283.0
Contributions by Business	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	260.6	300.3	309.0
Total Area Income from Independent Projections	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26,910.7	32,155.9	33,241.4
Total Area Income (A+B)	5,806.5	7,675.0	7,673.0	793.8	1,349.5	1,355.3	797.1	1,016.0	1,015.8	7,397.4	10,040.5	10,044.1	88,365.8	104,256.5	107,071.9
AREA INCOME BY SOURCES ($1,000 1968)															
Farm Income	4,703.4	6,405.1	6,400.9	601.2	1,137.2	1,137.0	645.8	837.2	836.7	5,950.4	8,379.5	8,374.6	28,525.6	34,754.9	35,599.6
Nonfarm Income	1,103.0	1,269.9	1,272.1	192.6	212.3	218.3	151.3	178.9	179.1	1,446.9	1,661.0	1,669.5	59,840.2	69,501.6	71,472.3
Total Area Income	5,806.5	7,675.0	7,673.0	793.8	1,349.5	1,355.3	797.1	1,016.0	1,015.8	7,397.4	10,040.5	10,044.1	88,365.8	104,256.5	107,071.9
AVERAGE FARM INCOME PER FARM ($1968)	845.3	1,288.2	1,308.2	108.1	228.7	232.4	116.1	168.4	171.0	1,069.5	1,685.3	1,711.6	5,126.8	6,990.1	7,275.6

[a]The procedures for estimating each variable are described in the content of this appendix. [b]—denotes that variable is excluded in the model.

Source: Appendix VII.

Table VI.III

A Comparison of the Values of Selected System Variables Between Historical Series and those Employed in the Simulation Models[a]

System Variables	Historical Series				In the Static Projection Model				
	1961	1966	1968	1971	1971	1976	1977	1981	1986
HOUSEHOLD EXPENDITURES ($1,000 1968)									
Purchased from the 17 Sectors	--[b]	--	44,831.1	--	45,952.8	50,206.8	51,070.0	54,495.3	58,831.8
Imports	--	--	9,949.4	--	9,816.5	11,362.3	11,673.3	12,908.1	14,463.7
Other	--	--	20,888.8	--	18,487.3	22,505.9	23,306.8	26,489.5	30,477.3
Total Household Expenditures	--	--	75,669.3	--	74,256.6	84,075.0	86,050.2	93,892.9	103,772.8
GOVERNMENT EXPENDITURES ($1,000 1968)									
Local Government Expenditure									
Purchased from the 17 Sectors	--	--	1,498.4	--	1,482.5	1,469.6	1,467.2	1,457.9	1,447.2
Wage Payment	--	--	1,107.0	--	1,084.9	1,079.0	1,078.0	1,073.8	1,068.9
Other Payment	--	--	2,649.4	--	3,136.6	3,108.8	3,103.7	3,083.7	3,060.6
Total Local Government Expenditure	--	--	5,254.8	--	5,703.9	5,657.5	5,648.9	5,615.4	5,576.7
Provincial and Federal Government Expenditure									
Purchased from the 17 Sectors	--	--	1,119.6	--	1,111.0	1,402.0	1,460.2	1,693.1	1,984.1
Wage and Other Payments	--	--	403,256.4	--	400,158.8	504,982.1	512,257.7	609,805.2	709,628.1
Total Provincial and Federal Government Expenditures	--	--	404,376.0	--	401,269.8	506,384.1	527,406.9	611,498.3	716,612.6
Total Government Expenditures									
Purchased from the 17 Sectors	--	--	2,618.0	--	2,593.5	2,871.6	2,983.3	3,151.0	3,431.3
Wage and Other Payments	--	--	407,012.8	--	404,380.2	509,170.0	530,072.5	613,962.7	718,758.0
Total	--	--	409,630.8	--	406,973.7	512,041.6	533,055.8	617,113.7	722,189.3
EXPORTS, INVENTORY CHANGE AND UNALLOCATED FINAL DEMAND ($1,000 1968)	--	--	71,861.1	--	79,956.0	95,966.6	99,586.1	115,737.9	140,235.8
INVESTMENT									
Purchased from the 17 Sectors	--	--	8,239.2	--	7,519.7	6,717.3	6,596.4	6,181.6	5,765.0
Imports	--	--	12,453.2	--	*[c]	*	*	*	*
Total Investment	--	--	20,692.5	--	*	*	*	*	*
FINAL DEMAND BY SECTOR ($1,000 1968)									
Agriculture and Mining Subtotal	--	--	42,399.3	--	43,954.0	54,521.3	56,949.8	67,888.0	84,800.6
Agriculture--Livestock	--	--	29,179.7	--	30,543.8	38,759.2	40,668.4	49,347.5	62,977.9
Agriculture--Crop and Other	--	--	12,256.9	--	12,393.1	14,622.3	15,115.7	17,265.9	20,399.8
Mining	--	--	962.7	--	1,017.1	1,139.8	1,165.7	1,274.6	1,422.9
Nonagriculture and Mining Subtotal	--	--	88,846.6	--	92,067.0	101,240.1	103,236.1	111,677.3	123,462.7
Food and Beverage Manufacturing	--	--	3,736.2	--	4,004.8	4,509.0	4,617.2	5,076.7	5,715.8
Other Manufacturing	--	--	21,782.5	--	22,946.0	25,043.2	25,484.9	27,330.2	29,824.4
Transportation	--	--	768.6	--	887.0	1,124.3	1,177.7	1,415.4	1,776.2
Construction	--	--	7,337.2	--	7,426.9	7,806.8	7,918.0	8,461.0	9,355.8
Petroleum Wholesale	--	--	4,915.0	--	5,453.7	6,354.6	6,534.7	7,260.8	8,182.8
Farm Equipment and Building Material	--	--	2,451.6	--	2,450.9	2,569.1	2,601.3	2,749.6	2,972.2
Food Store	--	--	6,644.2	--	6,923.5	7,543.9	7,676.1	8,223.6	8,978.2
Other Retail	--	--	11,177.1	--	12,520.6	13,282.0	13,441.0	14,081.3	14,926.5
Auto Product Sales and Service	--	--	18,672.3	--	17,639.2	19,575.5	20,007.6	21,845.1	24,443.6
Apparel and Shoes	--	--	1,259.9	--	1,700.8	1,847.0	1,875.2	1,978.2	2,037.9
Furniture and Appliance	--	--	502.2	--	597.2	721.9	746.9	848.0	977.1
Insurance	--	--	187.5	--	191.5	250.2	262.8	315.2	386.9
Personal Service	--	--	8,085.3	--	8,150.2	9,207.7	9,440.5	10,446.4	11,919.8
Other Services	--	--	1,327.0	--	1,174.7	1,404.9	1,452.2	1,645.8	1,905.5
Total of the 17 Sectors	--	--	131,245.9	--	136,021.0	155,761.4	160,185.9	179,565.3	208,263.3

Continued

Table VI.III (continued)

System Variables	In the Comparative Static Projection Model 1971	1976	1977	1981	1986	In the Dynamic Projection Model 1971	1976	1977	1981	1986
HOUSEHOLD EXPENDITURES ($1,000 1968)										
Purchased from the 17 Sectors	45,952.8	50,206.8	51,070.0	54,495.3	58,831.8	45,952.8	50,206.8	51,070.0	54,495.3	58,831.8
Imports	9,816.5	11,362.3	11,673.3	12,908.1	14,463.7	9,816.5	11,362.3	11,673.3	12,908.1	14,463.7
Other	18,487.3	22,505.9	23,306.8	26,489.5	30,477.3	18,487.3	22,505.9	23,306.8	26,489.5	30,477.3
Total Household Expenditures	74,256.6	84,075.0	86,050.2	93,892.9	103,772.8	74,256.6	84,075.0	86,050.2	93,892.9	103,772.8
GOVERNMENT EXPENDITURES ($1,000 1968)										
Local Government Expenditure										
Purchased from the 17 Sectors	1,482.5	1,469.6	1,467.2	1,457.9	1,447.2	1,482.5	1,469.6	1,467.2	1,457.9	1,447.2
Wage Payment	1,084.9	1,079.0	1,078.0	1,073.8	1,068.9	1,084.9	1,079.0	1,078.0	1,073.8	1,068.9
Other Payment	3,136.6	3,108.8	3,103.7	3,083.7	3,060.6	3,136.6	3,108.8	3,103.7	3,083.7	3,060.6
Total Local Government Expenditure	5,703.9	5,657.5	5,648.9	5,615.4	5,576.7	5,703.9	5,657.5	5,648.7	5,615.4	5,576.7
Provincial and Federal Government Expenditure										
Purchased from the 17 Sectors	1,111.0	1,402.0	1,460.2	1,693.1	1,984.1	1,111.0	1,402.0	1,460.2	1,693.1	1,984.1
Wage and Other Payments	400,158.8	504,982.1	512,257.7	609,805.2	709,628.1	400,158.8	504,982.1	512,257.7	609,805.2	709,628.1
Total Provincial and Federal Government Expenditures	401,269.8	506,384.1	527,406.9	611,498.3	716,612.6	401,269.8	506,384.1	527,406.9	611,498.3	716,612.6
Total Government Expenditures										
Purchased from the 17 Sectors	2,593.5	2,871.6	2,983.3	3,151.0	3,431.3	2,593.5	2,871.6	2,983.3	3,151.0	3,431.3
Wage and Other Payments	404,380.2	509,170.0	530,072.5	613,962.7	718,758.0	404,380.2	509,170.0	530,072.5	613,962.7	718,758.0
Total	406,973.7	512,041.6	533,055.8	617,113.7	722,189.3	406,973.7	512,041.6	533,055.8	617,113.7	722,189.3
EXPORTS, INVENTORY CHANGE AND UNALLOCATED FINAL DEMAND ($1,000 1968)	79,956.0	95,966.6	99,586.1	115,737.9	140,235.8	79,956.0	95,966.6	99,586.1	115,737.9	140,235.8
INVESTMENT										
Purchased from the 17 Sectors	7,519.7	6,717.3	6,591.3	6,184.9	5,801.5	9,146.6	10,765.1	11,117.5	12,699.2	15,237.7
Imports	*	*	*	*	*	*	*	*	*	*
Total Investment	*	*	*	*	*	*	*	*	*	*
FINAL DEMAND BY SECTOR ($1,000 1968)										
Agriculture and Mining Subtotal	43,954.0	54,521.3	56,949.8	67,888.0	84,800.6	43,954.0	54,521.3	56,949.8	67,888.0	84,800.6
Agriculture--Livestock	30,543.8	38,759.2	40,668.4	49,347.5	62,977.9	30,543.8	38,759.0	40,668.4	49,347.5	62,977.9
Agriculture--Crop and Other	12,393.1	14,622.3	15,115.7	17,265.9	20,399.8	12,393.1	14,622.3	15,115.7	17,265.9	20,399.8
Mining	1,017.1	1,139.8	1,165.7	1,274.6	1,422.9	1,017.1	1,139.8	1,165.7	1,274.6	1,422.9
Nonagriculture and Mining Subtotal	92,067.0	101,240.1	103,236.1	111,677.3	123,462.7	84,547.3	94,522.8	96,639.7	105,495.7	117,697.7
Food and Beverage Manufacturing	4,004.8	4,509.0	4,617.2	5,076.7	5,715.8	4,004.8	4,509.0	4,617.2	5,076.7	5,715.8
Other Manufacturing	22,946.0	25,043.2	25,484.9	27,330.2	29,824.4	22,946.0	25,043.2	25,484.9	27,330.2	29,824.4
Transportation	887.0	1,124.3	1,177.7	1,415.4	1,776.2	887.0	1,124.3	1,177.7	1,415.4	1,776.2
Construction	7,426.9	7,806.8	7,915.2	8,462.8	9,375.8	3,298.6	4,119.0	4,296.6	5,067.3	6,190.8
Petroleum Wholesale	5,453.7	6,354.6	6,534.7	7,260.8	8,182.8	5,453.7	6,354.6	6,534.7	7,260.8	8,182.8
Farm Equipment and Building Material	2,450.9	2,569.1	2,600.4	2,750.1	2,978.4	1,163.5	1,419.1	1,472.0	1,691.3	1,985.2
Food Store	6,923.5	7,543.9	7,676.1	8,223.6	8,978.2	6,923.5	7,543.9	7,676.1	8,223.6	8,978.2
Other Retail	12,520.6	13,282.0	13,441.0	14,081.3	14,926.5	12,516.1	13,278.0	13,437.0	14,077.6	14,923.0
Auto Product Sales and Service	17,639.2	19,575.5	20,006.2	21,846.0	24,453.8	15,548.0	17,707.4	18,173.2	20,126.0	22,840.4
Apparel and Shoes	1,700.8	1,847.0	1,875.2	1,978.2	2,097.9	1,700.8	1,847.0	1,875.2	1,978.2	2,097.9
Furniture and Appliance	597.2	721.9	746.9	848.0	977.2	588.9	714.5	739.6	841.2	970.8
Insurance	191.5	250.2	262.8	315.2	386.9	191.5	250.2	262.8	315.2	386.9
Personal Service	8,150.2	9,207.7	9,440.5	10,446.4	11,919.8	8,150.2	9,207.7	9,440.5	10,446.4	11,919.8
Other Services	1,174.7	1,404.9	1,452.2	1,645.8	1,905.5	1,174.7	1,404.9	1,452.2	1,645.8	1,905.5
Total of the 17 Sectors	136,021.0	155,761.4	160,185.9	179,565.3	208,263.3	128,501.3	149,044.1	153,589.5	173,383.7	202,498.3

Continued

Table VI.III (continued)

System Variables	Historical Series				In the Static Projection Model				
	1961	1966	1968	1971	1971	1976	1977	1981	1986
FARM NUMBERS BY GROSS RECEIPT CLASS									
By Gross Receipt Class									
Less than $2,500	4,416	3,127	2,605	2,242	2,605	2,605	2,605	2,605	2,605
$ 2,500-$ 4,999	1,435	1,458	1,286	1,147	1,286	1,286	1,286	1,286	1,286
$ 5,000-$ 9,999	728	1,014	1,007	1,181	1,007	1,007	1,007	1,007	1,007
$10,000-$14,999	192	365	433	411	433	433	433	433	433
$15,000-$24,999	95	233	340	334	340	340	340	340	340
$25,000 and Over	45	141	246	252	246	246	246	246	246
Total Farm Numbers	6,911	6,338	5,917	5,567	5,917	5,917	5,917	5,917	5,917
Numbers of Operators leaving Agriculture	—	573	421	350	421	0	0	0	0
FARM NUMBERS BY SECTOR AND BY SIZE CLASS									
Agriculture--Livestock									
Small (less than 239 acres)	—	—	1,782	—	1,782	1,782	1,782	1,782	1,782
Medium (240-759 acres)	—	—	1,355	—	1,355	1,355	1,355	1,355	1,355
Large (greater than 760 acres)	—	—	717	—	717	717	717	717	717
Total	2,848[d]	1,947[d]	3,854	2,379[d]	3,854	3,854	3,854	3,854	3,854
Agriculture--Crop and Other									
Small (less than 239 acres)	—	—	960	—	960	960	960	960	960
Medium (240-759 acres)	—	—	888	—	888	888	888	888	888
Large (greater than 760 acres)	—	—	215	—	215	215	215	215	215
Total	1,502[a]	1,247[a]	2,063	874[a]	2,063	2,063	2,063	2,063	2,063
All Farms									
Small (less than 239 acres)	2,614	2,044	2,742	1,675	2,742	2,742	2,742	2,742	2,742
Medium (240-759 acres)	3,603	3,255	2,243	2,682	2,243	2,243	2,243	2,243	2,243
Large (greater than 760 acres)	694	1,039	932	1,210	932	932	932	932	932
Total	6,911	6,338	5,917	5,567	5,917	5,917	5,917	5,917	5,917
FACTOR INPUT REQUIREMENT COEFFICIENTS BY SECTOR									
Labor Coefficients (Man-year per $1,000 Gross Output)									
Agriculture--Livestock	—	—	0.13782	—	0.13783	0.13783	0.13783	0.13783	0.13783
Agriculture--Crop and Other	—	—	0.18069	—	0.18069	0.18069	0.18069	0.18069	0.18069
Mining	—	—	0.03902	—	0.03902	0.03902	0.03902	0.03902	0.03902
Food and Beverage Manufacturing	—	—	0.02882	—	0.02882	0.02882	0.02882	0.02882	0.02882
Other Manufacturing	—	—	0.05324	—	0.05324	0.05324	0.05324	0.05324	0.05324
Transportation	—	—	0.12512	—	0.12512	0.12512	0.12512	0.12512	0.12512
Construction	—	—	0.05085	—	0.05085	0.05085	0.05085	0.05085	0.05085
Petroleum Wholesale	—	—	0.01634	—	0.01634	0.01634	0.01634	0.01634	0.01634
Farm Equipment and Building Material	—	—	0.02305	—	0.02305	0.02305	0.02305	0.02305	0.02305
Food Store	—	—	0.02590	—	0.02590	0.02590	0.02590	0.02590	0.02590
Other Retail	—	—	0.03393	—	0.03393	0.03393	0.03393	0.03393	0.03393
Auto Product Sales and Service	—	—	0.02412	—	0.02412	0.02412	0.02412	0.02412	0.02412
Apparel and Shoes	—	—	0.04085	—	0.04085	0.04085	0.04085	0.04085	0.04085
Furniture and Appliance	—	—	0.03982	—	0.03982	0.03982	0.03982	0.03982	0.03982
Insurance	—	—	0.11718	—	0.11718	0.11718	0.11718	0.11718	0.11718
Personal Service	—	—	0.08116	—	0.08116	0.08116	0.08116	0.08116	0.08116
Other Services	—	—	0.11639	—	0.11639	0.11639	0.11639	0.11639	0.11639
Total Agriculture	0.4403	—	0.15020	0.12460	*	*	*	*	*

Continued

Table VI.III (continued)

System Variables	In the Comparative Static Projection Model					In the Dynamic Projection Model				
	1971	1976	1977	1981	1986	1971	1976	1977	1981	1986
FARM NUMBERS BY GROSS RECEIPT CLASS										
By Gross Receipt Class										
Less than $2,500	2,169	1,442	1,345	959	638	2,169	1,442	1,345	959	638
$ 2,500-$ 4,999	1,129	845	800	621	451	1,129	845	800	621	451
$ 5,000-$ 9,999	970	857	826	701	547	970	857	826	701	547
$10,000-$14,999	469	491	481	442	366	469	491	481	442	366
$15,000-$24,999	428	554	559	577	520	428	554	559	577	520
$25,000 and Over	399	783	882	1,279	1,796	399	783	882	1,279	1,796
Total Farm Numbers	5,564	4,972	4,893	4,579	4,318	5,564	4,972	4,893	4,579	4,318
Numbers of Operators leaving Agriculture	353	592	79	393	261	353	592	79	393	261
FARM NUMBERS BY SECTOR AND BY SIZE CLASS										
Agriculture--Livestock										
Small (less than 239 acres)	1,537	1,152	1,096	875	667	1,537	1,152	1,096	875	667
Medium (240-759 acres)	1,301	1,166	1,144	1,058	984	1,301	1,166	1,144	1,058	974
Large (greater than 760 acres)	804	977	1,010	1,140	1,279	804	977	1,010	1,140	1,279
Total	3,642	3,295	3,250	3,073	2,930	3,642	3,295	3,250	3,073	2,930
Agriculture--Crop and Other										
Small (less than 239 acres)	828	620	590	471	365	828	620	590	471	365
Medium (240-759 acres)	853	764	750	693	639	853	764	750	693	639
Large (greater than 760 acres)	241	293	303	342	384	241	293	303	342	384
Total	1,922	1,677	1,643	1,506	1,388	1,922	1,677	1,643	1,506	1,388
All Farms										
Small (less than 239 acres)	2,365	1,772	1,686	1,346	1,032	2,365	1,772	1,686	1,346	1,032
Medium (240-759 acres)	2,154	1,930	1,894	1,751	1,623	2,154	1,930	1,894	1,751	1,623
Large (greater than 760 acres)	1,045	1,270	1,313	1,482	1,663	1,045	1,270	1,313	1,482	1,663
Total	5,564	4,972	4,893	4,579	4,318	5,564	4,972	4,893	4,579	4,318
FACTOR INPUT REQUIREMENT COEFFICIENTS BY SECTOR										
Labor Coefficients (Man-year per $1,000 Gross Output)										
Agriculture--Livestock	0.11441	0.08262	0.07751	0.05995	0.04391	0.11441	0.08262	0.07751	0.05995	0.04391
Agriculture--Crop and Other	0.14565	0.10138	0.09453	0.07120	0.05071	0.14565	0.10138	0.09453	0.07120	0.05071
Mining	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902
Food and Beverage Manufacturing	0.02806	0.02685	0.02661	0.02569	0.02457	0.02806	0.02685	0.02661	0.02569	0.02457
Other Manufacturing	0.05283	0.05214	0.05201	0.05147	0.05081	0.05283	0.05214	0.05201	0.05147	0.05081
Transportation	0.11901	0.09073	0.08715	0.07421	0.06071	0.11901	0.09073	0.08715	0.07421	0.06071
Construction	0.04483	0.03634	0.03484	0.02945	0.02387	0.04483	0.03634	0.03484	0.02945	0.02387
Petroleum Wholesale	0.01491	0.01280	0.01241	0.01098	0.00943	0.01491	0.01280	0.01241	0.01098	0.00943
Farm Equipment and Building Material	0.02103	0.01806	0.01751	0.01550	0.01331	0.02103	0.01806	0.01751	0.01550	0.01331
Food Store	0.02524	0.02418	0.02398	0.02317	0.02220	0.02524	0.02418	0.02398	0.02317	0.02220
Other Retail	0.03307	0.03169	0.03142	0.03036	0.02909	0.03307	0.03169	0.03142	0.03036	0.02909
Auto Product Sales and Service	0.02350	0.02252	0.02233	0.02158	0.02067	0.02350	0.02252	0.02233	0.02158	0.02067
Apparel and Shoes	0.03981	0.03815	0.03782	0.03655	0.03502	0.03981	0.03815	0.03782	0.03655	0.03502
Furniture and Appliance	0.03881	0.03718	0.03687	0.03562	0.03413	0.03881	0.03718	0.03687	0.03562	0.03413
Insurance	0.10677	0.09143	0.08864	0.07830	0.06705	0.10677	0.09143	0.08864	0.07830	0.06705
Personal Service	0.07967	0.07725	0.07677	0.07490	0.07262	0.07967	0.07725	0.07677	0.07490	0.07262
Other Services	0.11425	0.11077	0.11009	0.10740	0.10413	0.11425	0.11077	0.11009	0.10740	0.10413
Total Agriculture	*	*	*	*	*	*	*	*	*	*

Continued

Table VI.III (continued)

System Variables	Historical Series 1961	1966	1968	1971	In the Static Projection Model 1971	1976	1977	1981	1986
Capital Coefficients ($1,000 per $1,000 Gross Output)									
Agriculture--Livestock	--	--	0.27422	--	0.27422	0.27422	0.27422	0.27422	0.27422
Agriculture--Crop and Other	--	--	0.33272	--	0.33272	0.33272	0.33272	0.33272	0.33272
Mining	--	--	0.31226	--	0.31226	0.31226	0.31226	0.31226	0.31226
Food and Beverage Manufacturing	--	--	0.07375	--	0.07375	0.07375	0.07375	0.07375	0.07375
Other Manufacturing	--	--	0.08991	--	0.08991	0.08991	0.08991	0.08991	0.08991
Transportation	--	--	0.20900	--	0.20900	0.20900	0.20900	0.20900	0.20900
Construction	--	--	0.20402	--	0.20402	0.20402	0.20402	0.20402	0.20402
Petroleum Wholesale	--	--	0.01534	--	0.01534	0.01534	0.01534	0.01534	0.01534
Farm Equipment and Building Material	--	--	0.03978	--	0.03978	0.03978	0.03978	0.03978	0.03978
Food Store	--	--	0.02899	--	0.02899	0.02899	0.02899	0.02899	0.02899
Other Retail	--	--	0.04547	--	0.04547	0.04547	0.04547	0.04547	0.04547
Auto Product Sales and Service	--	--	0.02252	--	0.02252	0.02252	0.02252	0.02252	0.02252
Apparel and Shoes	--	--	0.04934	--	0.04934	0.04934	0.04934	0.04934	0.04934
Furniture and Appliance	--	--	0.01656	--	0.01656	0.01656	0.01656	0.01656	0.01656
Insurance	--	--	0.54585	--	0.54585	0.54585	0.54585	0.54585	0.54585
Personal Service	--	--	0.05060	--	0.05060	0.05060	0.05060	0.05060	0.05060
Other Services	--	--	0.07951	--	0.07951	0.07951	0.07951	0.07951	0.07951
Land Coefficients (1,000 acres per $1,000 Gross Output)									
Agriculture--Livestock	--	--	0.02023	--	0.02023	0.02023	0.02023	0.02023	0.02023
Agriculture--Crop and Other	--	--	0.06259	--	0.06259	0.06259	0.06259	0.06259	0.06259
Total Agriculture	0.04570	0.04130	0.03510	0.02720	*	*	*	*	*
TRADING COEFFICIENTS	--	--	See App. II	--	Constant as 1968 for all projection period				

System Variables	In the Comparative Static Projection Model 1971	1976	1977	1981	1986	In the Dynamic Projection Model 1971	1976	1977	1981	1986
Capital Coefficients ($1,000 per $1,000 Gross Output)										
Agriculture--Livestock	0.32460	0.37990	0.39016	0.43289	0.48114	0.32460	0.37990	0.39016	0.43289	0.48114
Agriculture--Crop and Other	0.38396	0.43097	0.44043	0.48020	0.53064	0.38396	0.43097	0.44043	0.48020	0.53064
Mining	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226
Food and Beverage Manufacturing	0.07643	0.08110	0.08207	0.08606	0.09132	0.07643	0.08110	0.08207	0.08606	0.09132
Other Manufacturing	0.09317	0.09887	0.10050	0.10491	0.11133	0.09317	0.09887	0.10050	0.10491	0.11133
Transportation	0.21559	0.22704	0.22941	0.23911	0.25181	0.21559	0.22704	0.22941	0.23911	0.25181
Construction	0.20057	0.19495	0.19385	0.18949	0.18418	0.20057	0.19495	0.19385	0.18949	0.18418
Petroleum Wholesale	0.01539	0.01546	0.01548	0.01554	0.01562	0.01539	0.01546	0.01548	0.01554	0.01562
Farm Equipment and Building Material	0.03990	0.04010	0.04014	0.04031	0.04051	0.03990	0.04010	0.04014	0.04031	0.04051
Food Store	0.02929	0.02979	0.02989	0.03030	0.03082	0.02929	0.02979	0.02989	0.03030	0.03082
Other Retail	0.04594	0.04673	0.04689	0.04753	0.04835	0.04594	0.04673	0.04689	0.04753	0.04835
Auto Product Sales and Service	0.02275	0.02314	0.02322	0.02354	0.02394	0.02275	0.02314	0.02322	0.02354	0.02394
Apparel and Shoes	0.04984	0.05070	0.05087	0.05157	0.05246	0.04984	0.05070	0.05087	0.05157	0.05246
Furniture and Appliance	0.01673	0.01702	0.01707	0.01731	0.01761	0.01673	0.01702	0.01707	0.01731	0.01761
Insurance	0.55145	0.56092	0.56284	0.57056	0.58035	0.55145	0.56092	0.56284	0.57056	0.58035
Personal Service	0.05112	0.05199	0.05217	0.05289	0.05380	0.05112	0.05199	0.05217	0.05289	0.05380
Other Services	0.08033	0.08171	0.08199	0.08311	0.08454	0.08033	0.08171	0.08199	0.08311	0.08454

Continued

Table VI.III (continued)

System Variables	In the Comparative Static Projection Model					In the Dynamic Projection Model				
	1971	1976	1977	1981	1986	1971	1976	1977	1981	1986
Land Coefficients (1,000 acres per $1,000 Gross Output)										
Agriculture--Livestock	0.02160	0.02093	0.02073	0.01993	0.01858	0.02160	0.02093	0.02073	0.01993	0.01858
Agriculture--Crop and Other	0.06592	0.06143	0.06061	0.05736	0.05275	0.06592	0.06143	0.06061	0.05736	0.05275
Total Agriculture	*	*	*	*	*	*	*	*	*	*
TRADING COEFFICIENTS	See Appendix II					See Appendix II				

[a]The procedures for estimating each variable are described in the content of this appendix.

[b]-- denotes data unavailable.

[c]* denotes that variable is not employed in the simulation models.

[d]Commercial farm only.

Source: See Table VI.I.

Table VI.IV

Summary of the Values of Selected System Variables Employed in the Dynamic Impact Simulation Models[a]

Variables	Drainage Program			Land Clearing and Demonstration Program			Farm Management Training Program			Total		
	1971	1976	1977	1971	1976	1977	1971	1976	1977	1971	1976	1977
FINAL DEMAND BY SECTOR ($1,000 1968)												
Agriculture and Mining Subtotal	710.0	764.4	769.2	116.1	147.9	149.8	90.9	115.9	116.5	917.0	1,028.2	1,035.5
Agriculture--Livestock	449.6	465.6	470.4	73.0	93.0	94.8	59.2	74.5	75.1	581.8	633.1	640.3
Agriculture--Crop and Other	260.4	298.8	298.8	43.1	54.9	55.0	31.7	41.4	41.4	335.2	395.1	395.2
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nonagriculture and Mining Subtotal	3,667.0	4,762.4	4,766.2	628.8	788.4	811.1	563.3	663.2	663.7	4,859.1	6,214.3	6,241.0
Food and Beverage Manufacturing	19.9	27.7	27.7	2.4	4.8	4.8	2.7	3.5	3.5	25.0	36.0	36.0
Other Manufacturing	2.5	3.7	3.7	0.0	0.3	0.3	0.3	0.2	0.2	2.8	4.2	4.2
Transportation	72.2	107.3	108.3	9.1	19.1	19.2	10.4	14.0	14.1	91.7	140.4	141.6
Construction	309.3	99.2	99.1	159.7	8.2	9.6	9.5	9.8	9.8	478.5	117.2	118.5
Petroleum Wholesale	1,037.6	1,480.2	1,484.9	110.7	240.1	244.0	145.1	184.4	185.0	1,293.4	1,904.7	1,913.9
Farm Equipment and Building Material	644.8	898.2	898.6	200.9	155.4	155.9	88.4	114.9	115.0	934.1	1,168.5	1,169.5
Food Store	174.3	218.8	218.7	17.8	54.3	58.2	57.1	58.6	58.6	249.2	331.7	608.6
Other Retail	315.4	387.2	387.9	33.4	97.4	104.0	101.2	102.8	102.9	450.0	587.4	594.8
Auto Product Sales and Service	857.6	1,244.9	1,242.5	77.9	161.1	163.6	100.0	124.5	124.3	1,035.5	1,530.5	1,530.4
Apparel and Shoes	43.9	52.8	52.8	2.3	13.3	14.5	14.4	14.8	14.8	60.6	80.9	82.1
Furniture and Appliance	20.7	28.9	28.9	0.1	2.4	2.8	2.7	2.9	2.9	23.5	34.2	34.6
Insurance	20.4	31.1	31.1	1.6	3.3	3.4	2.0	2.6	2.6	24.0	37.0	37.1
Personal Service	98.6	110.9	110.8	11.1	22.0	23.4	23.2	23.6	23.6	132.9	156.5	157.8
Other Services	50.0	71.7	71.6	2.0	6.8	7.4	5.9	6.4	6.4	57.9	84.9	85.4
Total of the 17 Sectors	4,377.0	5,526.8	5,535.4	744.9	936.3	960.9	654.2	779.1	780.2	5,776.1	7,242.5	7,276.5
FARM NUMBERS BY GROSS RECEIPT CLASS												
By Gross Receipt Class												
Less than $2,500	2,169.0	1,442.0	1,345.0	2,169.0	1,442.0	1,345.0	2,169.0	1,442.0	1,345.0	—[b]	—	—
$2,500-$4,999	1,129.0	845.0	800.0	1,129.0	845.0	800.0	1,129.0	845.0	800.0	—	—	—
$5,000-$9,999	970.0	857.0	826.0	970.0	857.0	826.0	970.0	857.0	826.0	—	—	—
$10,000-$14,999	469.0	491.0	481.0	469.0	491.0	481.0	469.0	491.0	481.0	—	—	—
$15,000-$24,999	428.0	554.0	559.0	428.0	554.0	559.0	428.0	554.0	559.0	—	—	—
$25,000 and Over	399.0	783.0	882.0	399.0	783.0	882.0	399.0	783.0	882.0	—	—	—
Total Farm Numbers	5,564.0	4,972.0	4,893.0	5,564.0	4,972.0	4,893.0	5,564.0	4,972.0	4,893.0	—	—	—
Numbers of Operators Leaving Agriculture	353.0	592.0	79.0	353.0	592.0	79.0	353.0	592.0	79.0	—	—	—
FARM NUMBERS BY SECTOR AND BY SIZE CLASS												
Agriculture--Livestock												
Small (Less than 239 Acres)	1,537.0	1,152.0	1,096.0	1,537.0	1,152.0	1,096.0	1,537.0	1,152.0	1,096.0	—	—	—
Medium (240-759 Acres)	1,301.0	1,166.0	1,144.0	1,301.0	1,166.0	1,144.0	1,301.0	1,166.0	1,144.0	—	—	—
Large (Greater than 760 Acres)	804.0	977.0	1,010.0	804.0	977.0	1,010.0	804.0	977.0	1,010.0	—	—	—
Total	3,642.0	3,295.0	3,250.0	3,642.0	3,295.0	3,250.0	3,642.0	3,295.0	3,250.0	—	—	—
Agriculture--Crop and Other												
Small (Less than 239 Acres)	828.0	620.0	590.0	828.0	620.0	590.0	828.0	620.0	590.0	—	—	—
Medium (240-759 Acres)	853.0	764.0	750.0	853.0	764.0	750.0	853.0	764.0	750.0	—	—	—
Large (Greater than 760 Acres)	241.0	293.0	303.0	241.0	293.0	303.0	241.0	293.0	303.0	—	—	—
Total	1,922.0	1,677.0	1,643.0	1,922.0	1,677.0	1,643.0	1,922.0	1,677.0	1,643.0	—	—	—
All Farms												
Small (Less than 239 Acres)	2,365.0	1,772.0	1,686.0	2,365.0	1,772.0	1,686.0	2,365.0	1,772.0	1,686.0	—	—	—
Medium (240-759 Acres)	2,154.0	1,930.0	1,894.0	2,154.0	1,930.0	1,894.0	2,154.0	1,930.0	1,894.0	—	—	—
Large (Greater than 760 Acres)	1,045.0	1,270.0	1,313.0	1,045.0	1,270.0	1,313.0	1,045.0	1,270.0	1,313.0	—	—	—
Total	5,564.0	4,972.0	4,893.0	5,564.0	4,972.0	4,893.0	5,564.0	4,972.0	4,893.0	—	—	—

Continued

Table VI.IV (continued)

Variables	Drainage Program			Land Clearing and Demonstration Program			Farm Management Training Program			Total		
	1971	1976	1977	1971	1976	1977	1971	1976	1977	1971	1976	1977
FACTOR INPUT REQUIREMENT COEFFICIENTS BY SECTOR												
Labor Coefficients (Man-Year per $1,000 Gross Output)												
Agriculture--Livestock	0.08690	0.04840	0.04600	0.11100	0.07770	0.07300	0.11155	0.07965	0.07468	—	—	—
Agriculture--Crop and Other	0.11070	0.05940	0.05610	0.14100	0.09540	0.08900	0.14441	0.10014	0.09335	—	—	—
Mining	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	0.03902	—	—	—
Food and Beverage Manufacturing	0.02806	0.02685	0.02661	0.02806	0.02685	0.02661	0.02806	0.02685	0.02661	—	—	—
Other Manufacturing	0.05283	0.05214	0.05201	0.05283	0.05214	0.05201	0.05283	0.05214	0.05201	—	—	—
Transportation	0.11091	0.09073	0.08715	0.11091	0.09073	0.08715	0.11091	0.09073	0.08715	—	—	—
Construction	0.04483	0.03634	0.03484	0.04483	0.03634	0.03484	0.04483	0.03634	0.03484	—	—	—
Petroleum Wholesale	0.01491	0.01280	0.01241	0.01491	0.01280	0.01241	0.01491	0.01280	0.01241	—	—	—
Farm Equipment and Building Material	0.02103	0.01806	0.01751	0.02103	0.01806	0.01751	0.02103	0.01806	0.01751	—	—	—
Food Store	0.02524	0.02418	0.02398	0.02524	0.02418	0.02398	0.02524	0.02418	0.02398	—	—	—
Other Retail	0.03307	0.03169	0.03142	0.03307	0.03169	0.03142	0.03307	0.03169	0.03142	—	—	—
Auto Product Sales and Service	0.02350	0.02252	0.02233	0.02350	0.02252	0.02233	0.02350	0.02252	0.02233	—	—	—
Apparel and Shoes	0.03981	0.03815	0.03782	0.03981	0.03815	0.03782	0.03981	0.03815	0.03782	—	—	—
Furniture and Appliance	0.03881	0.03718	0.03687	0.03881	0.03718	0.03687	0.03881	0.03718	0.03687	—	—	—
Insurance	0.10677	0.09143	0.08864	0.10677	0.09143	0.08864	0.10677	0.09143	0.08864	—	—	—
Personal Service	0.07967	0.07725	0.07677	0.07967	0.07725	0.07677	0.07967	0.07725	0.07677	—	—	—
Other Services	0.11425	0.11077	0.11009	0.11425	0.11077	0.11009	0.11425	0.11077	0.11009	—	—	—
Capital Coefficients ($1,000 per $1,000 Gross Output)												
Agriculture--Livestock	0.32460	0.37990	0.39016	0.32460	0.37990	0.39016	0.32460	0.37990	0.39016	—	—	—
Agriculture--Crop and Other	0.38396	0.43097	0.44043	0.38396	0.43097	0.44043	0.38396	0.43097	0.44043	—	—	—
Mining	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	0.31226	—	—	—
Food and Beverage Manufacturing	0.07643	0.08110	0.08207	0.07643	0.08110	0.08207	0.07643	0.08110	0.08207	—	—	—
Other Manufacturing	0.09317	0.09887	0.10050	0.09317	0.09887	0.10050	0.09317	0.09887	0.10050	—	—	—
Transportation	0.21559	0.22704	0.22941	0.21559	0.22704	0.22941	0.21559	0.22704	0.22941	—	—	—
Construction	0.20057	0.19495	0.19385	0.20057	0.19495	0.19385	0.20057	0.19495	0.19385	—	—	—
Petroleum Wholesale	0.01539	0.01546	0.01548	0.01539	0.01546	0.01548	0.01539	0.01546	0.01548	—	—	—
Farm Equipment and Building Material	0.03990	0.04010	0.04014	0.03990	0.04010	0.04014	0.03990	0.04010	0.04014	—	—	—
Food Store	0.02929	0.02979	0.02989	0.02929	0.02979	0.02989	0.02929	0.02979	0.02989	—	—	—
Other Retail	0.04594	0.04673	0.04689	0.04594	0.04673	0.04689	0.04594	0.04673	0.04689	—	—	—
Auto Product Sales and Service	0.02275	0.02314	0.02322	0.02275	0.02314	0.02322	0.02275	0.02314	0.02322	—	—	—
Apparel and Shoes	0.04984	0.05070	0.05087	0.04984	0.05070	0.05087	0.04984	0.05070	0.05087	—	—	—
Furniture and Appliance	0.01673	0.01702	0.01707	0.01673	0.01702	0.01707	0.01673	0.01702	0.01707	—	—	—
Insurance	0.55145	0.56092	0.56284	0.55145	0.56092	0.56284	0.55145	0.56092	0.56284	—	—	—
Personal Service	0.05112	0.05149	0.05217	0.05112	0.05149	0.05217	0.05112	0.05149	0.05217	—	—	—
Other Services	0.08033	0.08171	0.08199	0.08033	0.08171	0.08199	0.08033	0.08171	0.08199	—	—	—
Land Coefficients (1,000 Acres per $1,000 Gross Output)												
Agriculture--Livestock	0.02160	0.02093	0.02073	0.02160	0.02093	0.02073	0.02160	0.02093	0.02073	—	—	—
Agriculture--Crop and Other	0.06592	0.06143	0.06061	0.06592	0.06143	0.06061	0.06592	0.06143	0.06061	—	—	—
TRADING COEFFICIENTS	See Appendix II			See Appendix II			See Appendix II					

[a]The procedures for estimating each variable are explained in the content of this appendix.

[b]--Excluded.

Table VI.V

A Comparison of the Values of Exogenous Variables Employed in the Projection Models and Historical Series[a]

Variables	Historical Series				Static Projection Model				
	1961	1966	1968	1971	1971	1976	1977	1981	1986
Population	50,898.0	51,773.0	49,690.0	50,698.0	50,698.0	48,311.0	47,869.0	46,142.0	44,152.0
Per Capita Personal Disposal Income ($1968)	--[b]	--	1,475.7	1,739.9	1,723.8	2,137.3	2,324.5	2,550.8	2,964.3
Price Indices--Winnipeg (1968 = 100)									
Meat Product	82.6	95.2	100.0	115.5	132.3	186.2	196.9	240.0	293.9
Dairy Product	82.6	95.2	100.0	120.2	130.3	180.8	190.9	231.3	281.8
Fruit and Vegetable	82.6	95.2	100.0	129.4	122.5	160.0	167.5	197.5	235.0
Other Food	82.6	95.2	100.0	130.5	105.7	115.2	117.1	124.7	134.2
Housing	92.4	94.6	100.0	108.9	105.6	112.2	113.6	118.9	125.5
Clothing	77.7	87.7	100.0	106.2	100.0	107.9	109.4	115.7	123.6
Transportation	86.6	92.5	100.0	111.1	108.4	118.9	120.5	128.6	138.7
Health and Personal Care	76.7	88.2	100.0	112.2	109.5	124.4	127.4	139.3	154.2
Recreation and Reading	82.2	87.4	100.0	112.3	105.2	115.8	117.9	126.5	137.1
Tobacco and Alcohol	77.9	90.1	100.0	101.0	98.7	107.0	108.6	115.2	123.4
Other Items	84.6	92.5	100.0	108.8	112.6	133.6	137.8	154.6	175.6
All Items	84.6	92.5	100.0	106.9	104.2	112.7	114.4	121.1	129.6
Labor Force	16,591.0	--	16,619.0	17,287.0	17,365.0	17,987.0	17,931.0	17,520.0	16,310.0
Agricultural Land Use (1,000 Acres)									
Under Crop	629.3	709.5	760.7	795.8	*[c]	*	*	*	*
Improved Pasture	99.5	115.1	113.0	133.9	*	*	*	*	*
Summer Fallow	179.3	161.4	164.5	165.7	*	*	*	*	*
Unimproved Pasture	400.7	625.1	649.4	661.5	*	*	*	*	*
Total	1,308.0	1,611.1	1,687.6	1,756.9	1,765.9	1,906.9	1,942.1	2,089.5	2,317.9
Change in Total Days Off-farm Work--Manitoba (1,000 Days)	0.0	81.3	--	36.9	*	*	*	*	*
Mean Census Division Operators Less Than 35 Years (Percent)	0.0	11.6	--	--	*	*	*	*	*
Mean Census Division Operators Greater Than 60 Years (Percent)	0.0	19.3	--	--	*	*	*	*	*
Change in Total Agricultural Capital Stock--Manitoba ($Million)	0.0	567.1	--	227.1	*	*	*	*	*

Continued

Table VI.V (continued)

Variables	Comparative Static Projection Model					Dynamic Projection Model				
	1971	1976	1977	1981	1986	1971	1976	1977	1981	1986
Population	50,698.0	48,311.0	47,869.0	46,142.0	44,152.0	50,698.0	48,311.0	47,869.0	46,142.0	44,152.0
Per Capita Personal Disposal Income ($1968)	1,723.8	2,137.3	2,324.5	2,550.8	2,964.3	1,723.8	2,137.3	2,324.5	2,550.8	2,964.3
Price Indices--Winnipeg (1968 = 100)										
Meat Product	132.3	186.2	196.9	240.0	293.9	132.3	186.2	196.9	240.0	293.9
Dairy Product	130.3	180.8	190.9	231.3	281.8	130.3	180.8	190.9	231.3	281.8
Fruit and Vegetable	122.5	160.0	167.5	197.5	235.0	122.5	160.0	167.5	197.5	235.0
Other Food	105.7	115.2	117.1	124.7	134.2	105.7	115.2	117.1	124.7	134.2
Housing	105.6	112.2	113.6	118.9	125.5	105.6	112.2	113.6	118.9	125.5
Clothing	100.0	107.9	109.4	115.7	123.6	100.0	107.9	109.4	115.7	123.6
Transportation	108.4	118.9	120.5	128.6	138.7	108.4	118.9	120.5	128.6	138.7
Health and Personal Care	109.5	124.4	127.4	139.3	154.2	109.5	124.4	127.4	139.3	154.2
Recreation and Reading	105.2	115.8	117.9	126.5	137.1	105.2	115.8	117.9	126.5	137.1
Tobacco and Alcohol	98.7	107.0	108.6	115.2	123.4	98.7	107.0	108.6	115.2	123.4
Other Items	112.6	133.6	137.8	154.6	175.6	112.6	133.6	137.8	154.6	175.6
All Items	104.2	112.7	114.4	121.1	129.6	104.2	112.7	114.4	121.1	129.6
Labor Force	17,365.0	17,987.0	17,931.0	17,520.0	16,310.0	17,365.0	17,987.0	17,931.0	17,520.0	16,310.0
Agricultural Land Use (1,000 Acres)										
Under Crop	*	*		*	*	*	*	*	*	*
Improved Pasture	*	*		*	*	*	*	*	*	*
Summer Fallow	*	*		*	*	*	*	*	*	*
Unimproved Pasture	*	*		*	*	*	*	*	*	*
Total	1,765.9	1,906.9	1,942.1	2,089.5	2,317.9	1,765.9	1,906.9	1,942.1	2,089.5	2,317.9
Change in Total Days Off-farm Work—Manitoba (1,000 Days)	81.3	81.3		81.3	81.3	81.3	81.3	81.3	81.3	81.3
Mean Census Division Operators Less Than 35 Years (Percent)	11.6	11.6		11.6	11.6	11.6	11.6	11.6	11.6	11.6
Mean Census Division Operators Greater Than 60 Years (Percent)	19.3	19.3		19.3	19.3	19.3	19.3	19.3	19.3	19.3
Change in Total Agricultural Capital Stock--Manitoba ($Million)	567.1	567.1		567.1	567.1	567.1	567.1	567.1	567.1	567.1

[a]The procedure for estimating each variable either for historical series or for model results are described in the content of this Appendix. [b]--denotes data unavailable. [c]* excluded.

Source: See Table VI.I.

Table VI.VI

Summary of the Values of Exogenous Variables Employed in the Dynamic Impact Simulation Models

	Dynamic Impact Simulation Models								
	Drainage Program			Land Clearing and Demonstration Program			Farm Management Training Program		
	1971	1976	1977	1971	1976	1977	1971	1976	1977
POPULATION	50,698	48,311	47,869	50,698	48,311	47,869	50,698	48,311	47,869
AGRICULTURAL LAND USE (1,000 ACRES)									
Total	1765.9	1906.9	1942.1	1845.0	2033.3	2068.5	1765.9	1906.9	1942.1
CHANGE IN TOTAL DAYS OFF-FARM WORK--MANITOBA (1,000 DAYS)	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3
MEAN CENSUS DIVISION PERCENTAGE OF OPERATORS LESS THAN 35 YEARS OLD (PERCENT)	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6
MEAN CENSUS DIVISION PERCENTAGE OF OPERATORS GREATER THAN 60 YEARS OLD (PERCENT)	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
CHANGE IN TOTAL CAPITAL STOCK--MANITOBA ($ MILLION)	567.1	567.1	567.1	567.1	567.1	567.1	567.1	567.1	567.1

APPENDIX VII

THE SIMULATED IMPACTS OF RESOURCE DEVELOPMENT PROGRAM ON GROSS OUTPUT, HOUSEHOLD INCOME, EMPLOYMENT AND GOVERNMENT REVENUES BY SECTOR IN THE INTERLAKE AREA, 1969 TO 1977

TABLE VII.1

ESTIMATED IMPACTS OF THE DRAINAGE PROGRAM ON INTERLAKE AREA'S REALIZED GROSS OUTPUT BY SECTOR DURING THE PERIOD 1969-77

(Unit: '000 1968 Dollars)

Sector	Impacts on Realized Gross Output in Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock[a]	3,812.5	5,828.0	7,798.8	9,673.8	10,741.4	10,666.1	10,672.4	10,676.4	10,682.5	80,551.9
2. Ag.-Crop & Other[a]	1,256.1	1,925.1	2,568.9	3,182.6	3,527.4	3,497.2	3,498.0	3,500.6	3,499.8	26,455.7
Agri. Subtotal	5,068.6	7,753.1	10,367.7	12,856.4	14,268.8	14,163.3	14,170.4	14,177.0	14,182.3	107,007.6
3. Mining	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
4. Food & Bev. Mfg.	23.3	33.4	43.7	53.3	57.2	55.6	55.7	58.8	55.8	433.8
5. Other Mfg.	7.7	10.8	14.3	17.4	17.9	16.5	16.5	16.5	16.6	134.2
6. Transportation	62.1	92.8	125.2	155.0	168.9	166.9	168.1	169.7	170.9	1,279.6
7. Construction	385.0	443.2	496.3	539.1	457.3	296.1	296.9	297.7	298.3	3,509.9
8. Pet. Wholesale	615.7	939.5	1,266.7	1,578.5	1,742.3	1,724.6	1,733.1	1,741.7	1,747.7	13,089.8
9. Farm Equip&Bldg Mat.	386.2	579.9	769.2	947.7	1,040.6	1,019.9	1,021.4	1,021.3	1,022.3	7,808.5
10. Food Store	186.9	252.5	322.1	383.5	401.1	386.3	386.8	387.3	387.6	3,094.1
11. Other Retail	349.4	470.3	598.7	711.5	740.7	708.7	709.7	710.7	712.3	5,712.0
12. Auto Product & Ser.	665.4	1,010.9	1,384.4	1,744.0	1,898.9	1,834.3	1,833.6	1,832.6	1,831.8	14,035.9
13. Apparel & Shoes	44.8	59.5	74.4	87.0	90.4	87.4	87.4	87.6	87.7	706.2
14. Furniture & Appl.	16.0	24.2	219.3	277.8	44.3	42.8	42.8	42.8	42.9	752.9
15. Insurance	13.4	20.3	28.9	37.3	41.3	40.3	40.3	40.6	40.6	303.0
16. Personal Service	131.5	177.2	228.7	274.6	280.1	258.3	258.8	259.2	259.5	2,127.9
17. Other Services	44.4	66.8	93.1	116.5	122.6	117.6	117.7	118.1	118.1	914.9
Non-agri Subtotal	2,931.8	4,181.4	5,665.1	6,923.3	7,103.7	6,755.4	6,768.9	6,781.7	6,792.2	53,903.5
Total	8,000.4	11,934.5	16,032.8	19,779.7	21,372.5	20,918.7	20,939.3	20,958.7	20,974.5	160,911.1

[a]The entries in these two rows include the increased agricultural production from the reclaimed land as shown in Appendix IV.

[b]The estimation procedures are explained in Chapter 5.

TABLE VII.2

ESTIMATED IMPACTS OF THE LAND CLEARING AND DEMONSTRATION PROGRAM ON INTERLAKE AREA's REALIZED GROSS OUTPUT BY SECTOR DURING THE PERIOD 1969-77

(Unit: ' 000 1968 Dollars)

Sector	Impacts on Realized Gross Output in Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock[a]	403.5	688.1	982.9	1,280.2	1,447.1	1,678.5	1,740.6	1,864.8	1,867.3	11,953.0
2. Ag.-Crop & Other	147.9	249.1	347.5	458.1	506.7	582.3	603.1	646.2	646.2	4,187.1
Agri. Subtotal	551.4	937.2	1,330.4	1,738.3	1,953.8	2,260.8	2,343.7	2,511.0	2,513.5	16,140.1
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	4.8	5.5	5.8	7.3	8.1	8.6	9.5	10.4	10.7	70.7
5. Other Mfg.	4.2	3.3	2.5	2.6	4.5	1.8	2.1	2.4	2.4	25.8
6. Transportation	19.1	19.4	20.0	23.9	32.3	25.9	27.6	30.0	30.4	228.6
7. Construction	441.1	307.8	197.1	168.4	400.5	32.0	37.9	43.2	45.4	1,673.4
8. Pet. Wholesale	84.6	118.0	149.8	194.4	224.2	243.7	262.2	286.8	291.4	1,855.1
9. Farm Equip&Bldg Mat.	367.2	287.0	228.3	227.1	423.2	158.2	165.6	178.0	178.9	2,213.5
10. Food Store	51.4	50.9	43.1	54.0	54.9	58.9	73.6	83.2	87.8	557.8
11. Other Retail	95.8	95.3	81.8	102.4	107.1	110.7	136.0	152.7	160.7	1,042.5
12. Auto Product & Ser.	158.1	169.5	174.5	217.2	268.1	223.2	240.5	262.8	267.5	1,981.4
13. Apparel & Shoes	9.4	9.4	7.5	10.1	9.9	12.2	16.5	19.3	20.6	114.9
14. Furniture & Appl.	2.8	2.7	2.2	2.7	3.4	2.8	3.9	4.8	5.3	30.6
15. Insurance	2.5	2.8	3.1	3.8	4.6	4.2	4.5	5.0	5.1	35.6
16. Personal Service	40.1	39.4	33.3	39.6	45.1	36.9	42.8	47.4	49.5	374.1
17. Other Services	11.1	10.1	9.4	11.3	14.9	10.6	12.5	14.6	15.4	110.1
Non-agri. Subtotal	1,292.2	1,121.3	958.4	1,064.8	1,600.8	929.7	1,035.2	1,140.6	1,171.1	10,314.1
Total	1,843.6	2,058.5	2,288.8	2,803.1	3,554.6	3,190.5	3,378.9	3,651.6	3,684.6	26,454.2

[a]Entries in these two rows include the increased agricultural production from the cleared land through land clearing and demonstration program as shown in Appendix IV.

[b]The estimation procedures are explained in Chapter 5.

TABLE VII.3

ESTIMATED IMPACTS OF THE FARM MANAGEMENT TRAINING PROGRAM ON INTERLAKE AREA'S REALIZED GROSS OUTPUT BY SECTOR DURING THE PERIOD 1969-77

(Unit: '000 1968 Dollars)

Sector	Impacts on Realized Gross Output in Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock[a]	161.0	745.9	1,056.5	1,267.5	1,326.0	1,372.7	1,373.5	1,374.0	1,374.9	10,052.0
2. Ag.-Crop & Other[a]	53.3	256.4	364.4	437.9	458.2	474.7	474.7	475.0	474.9	3,469.5
Agri Subtotal	214.3	1,002.3	1,420.9	1,705.4	1,784.2	1,847.4	1,848.2	1,849.0	1,849.8	13,521.5
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	3.6	6.1	7.5	8.4	8.6	8.8	8.8	8.8	8.8	69.4
5. Other Mfg.	1.0	1.5	1.8	1.8	1.9	2.0	2.0	2.0	2.0	16.0
6. Transportation	5.5	13.4	18.0	20.8	21.8	22.7	22.9	23.1	23.2	171.4
7. Construction	15.6	26.4	32.9	35.8	37.3	38.1	38.2	38.3	38.4	301.0
8. Pet. Wholesale	50.1	130.5	175.8	203.3	212.9	220.1	221.2	222.3	223.1	1,659.3
9. Farm Equip&Bldg Mat.	18.5	73.5	103.0	122.7	128.4	132.9	133.0	133.0	133.2	978.2
10. Food Store	54.7	68.3	76.9	79.7	81.7	82.5	82.5	82.5	82.6	691.4
11. Other Retail	100.5	123.9	139.2	143.7	147.1	148.4	148.5	148.6	148.8	1,248.7
12. Auto Product & Ser.	49.0	125.7	168.4	193.8	202.1	207.8	207.7	207.6	207.6	1,569.7
13. Apparel & Shoes	12.8	16.2	18.5	19.1	19.5	19.7	19.7	19.7	19.7	164.9
14. Furniture & Appl.	2.4	3.6	4.4	4.6	4.7	4.9	4.9	4.9	4.9	39.3
15. Insurance	0.9	2.3	3.1	3.7	3.8	4.0	4.0	4.0	4.0	29.8
16. Personal Service	27.1	35.5	40.7	42.9	44.0	44.6	44.7	44.7	44.7	368.9
17. Other Services	6.0	9.3	11.3	12.0	12.6	12.8	12.8	12.9	12.9	102.6
Non-agri Subtotal	347.7	636.2	801.5	892.3	926.4	949.3	950.9	952.4	953.9	7,410.6
Total	562.0	1,638.5	2,222.4	2,597.7	2,710.6	2,796.7	2,799.1	2,801.4	2,803.7	20,932.1

[a]Entries in these two rows include the increased agricultural production resulted from the farm management training program as shown in Appendix IV.

[b]The estimation procedures are explained in Chapter 5.

TABLE VII.4

SIMULATED IMPACTS OF THE DRAINAGE PROGRAM ON HOUSEHOLD INCOME BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: ' 000 1968 Dollars)

Sector	Impacts on Household Income in Year									
	1969	1970	1971	1972	1973	1974	1975	1976	1977	
1. Ag.-Livestock[a]	1,131.2	1,729.4	2,313.8	2,869.5	3,185.4	3,161.0	3,161.5	3,161.6	3,161.0	23,874.4
2. Ag.-Crop & Other[a]	406.9	603.2	831.0	1,027.5	1,136.9	1,124.9	1,122.9	1,121.0	1,118.5	8,512.8
Agri. Subtotal	1,538.1	2,352.6	3,144.8	3,897.0	4,322.3	4,285.9	4,284.4	4,282.6	4,279.5	32,387.2
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	2.9	4.3	5.6	7.0	7.6	7.5	7.6	7.7	7.9	58.1
5. Other Mfg.	2.2	3.1	4.1	5.0	5.2	4.7	4.7	4.8	4.8	38.6
6. Transportation	26.5	39.6	53.4	66.1	72.0	71.2	71.7	72.4	72.9	545.8
7. Construction	70.5	81.2	91.0	98.8	83.8	54.3	54.4	54.6	54.7	643.3
8. Pet. Wholesale	49.0	74.7	100.7	125.5	138.5	137.1	137.8	138.5	139.0	1,040.8
9. Farm Equip&Bldg Mat.	40.6	60.9	80.8	99.5	109.2	106.9	107.0	107.0	107.0	818.9
10. Food Store	17.1	23.1	29.5	35.1	36.7	35.4	35.4	35.4	35.5	283.2
11. Other Retail	44.4	59.8	76.1	90.4	94.2	90.1	90.2	90.4	90.6	726.2
12. Auto Product & Ser.	86.5	131.4	180.0	226.8	246.8	238.5	238.4	238.3	238.2	1,824.9
13. Apparel & Shoes	5.9	7.8	9.8	11.4	11.9	11.5	11.5	11.5	11.5	92.8
14. Furniture & Appl.	3.2	4.9	44.1	55.8	8.9	8.6	8.6	8.6	8.6	151.3
15. Insurance	8.2	12.4	17.5	22.7	25.1	24.5	24.5	24.7	24.7	184.3
16. Personal Service	34.0	45.8	59.1	71.0	72.4	66.8	66.9	67.0	67.1	550.1
17. Other Services	16.3	24.4	34.1	42.7	44.9	43.1	43.1	43.3	43.3	335.2
Non-agriculture Subtotal	407.3	573.4	785.8	957.8	957.2	900.2	901.8	904.2	905.8	7,293.5
Total	1,945.4	2,926.0	3,930.6	4,854.8	5,279.5	5,186.1	5,186.2	5,186.8	5,185.3	39,680.7

[a]These entries across these two rows include farm household income directly associated with the increased agricultural production as shown in Table IV.4, Appendix IV.

[b]The entry of each row (income generated) is calculated by multiplying the realized gross output generated (as shown in Table VII.1) by income coefficients (percent payments to households including self-employee income and profit as well as employment wage paid) as adjusted to the target year shown in Table V.1, Appendix V.

TABLE VII.5

SIMULATED IMPACTS OF THE LAND CLEARING AND DEMONSTRATION PROGRAM ON HOUSEHOLD INCOME BY SECTOR, INTERLAKE AREA, 1969-1967

(Unit: ' 000 1968 Dollars)

Sector	Impacts On Household Income In Year[b]									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock[a]	119.7	204.2	291.6	379.8	429.2	497.4	515.6	552.3	552.5	3,542.3
2. Ag.-Crop & Other[a]	47.9	80.6	112.4	147.9	163.3	187.4	193.6	207.0	206.6	1,346.7
Agricultural Subtotal	167.6	284.8	404.0	527.7	529.5	684.8	709.2	759.3	759.1	4,889.0
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4. Food & Bev. Mfg.	0.6	0.7	0.7	1.0	1.1	1.2	1.3	1.4	1.5	9.5
5. Other Mfg.	1.2	1.0	0.7	0.7	1.3	0.5	0.6	0.7	0.7	7.4
6. Transportation	8.2	8.3	8.5	10.2	13.8	11.0	11.8	12.8	13.0	97.6
7. Construction	80.8	56.4	36.1	30.9	73.4	5.9	7.0	7.9	8.3	306.7
8. Pet. Wholesale	6.7	9.4	11.9	115.5	17.8	19.4	20.9	22.8	23.2	147.6
9. Farm Equip&Bldg Mat.	38.6	30.2	24.0	23.8	44.4	16.6	17.4	18.6	18.7	232.3
10. Food Store	4.7	4.7	3.9	4.9	5.0	5.4	6.7	7.6	8.0	50.9
11. Other Retail	12.2	12.1	10.4	13.0	13.6	14.1	17.3	19.4	20.4	132.5
12. Auto Product & Ser.	20.6	22.0	22.7	28.3	34.9	29.0	31.3	34.2	34.8	257.8
13. Apparel & Shoes	1.2	1.2	1.0	1.3	1.3	1.6	2.2	2.5	2.7	15.0
14. Furniture & Appl.	0.6	0.6	0.4	0.6	0.7	0.6	0.8	1.0	1.1	6.4
15. Insurance	1.5	1.7	1.9	2.3	2.8	2.5	2.7	3.0	3.1	21.5
16. Personal Service	10.4	10.2	8.6	10.2	11.7	9.5	11.1	12.3	12.8	96.8
17. Other Services	4.1	3.8	3.4	4.1	5.5	3.9	4.6	5.3	5.6	40.3
Non-agriculture Subtotal	191.4	162.3	134.2	146.8	227.3	121.2	135.7	149.5	153.9	1,422.3
Total	359.0	447.1	538.2	674.5	819.8	806.0	844.9	908.8	913.0	6,311.3

[a]These entries across these two rows include farm household income directly associated with the increased agricultural production as shown in Table IV.8, Appendix IV.

[b]The entry of each row (income generated) is calculated by multiplying the realized gross output generated (as shown in Table VII.2) by income coefficients (percent payments to households including self-employee income and profit as well as employment wage paid) as adjusted to the target year shown in Table V.1, Appendix V.

TABLE VII.6

SIMULATED IMPACTS OF THE FARM MANAGEMENT TRAINING PROGRAM ON HOUSEHOLD INCOME BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: ' 000 1968 Dollars)

Sector	Impacts on Household Income In Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77
1. Ag.-Livestock[a]	47.8	221.3	313.4	376.0	393.3	406.8	406.9	406.9	406.8	2,979.2
2. Ag.-Crop & Other[a]	17.2	83.0	117.9	141.4	147.7	152.7	152.4	152.1	151.8	1,116.2
Agriculture Subtotal	65.0	304.3	431.3	517.4	541.0	559.5	559.3	559.0	558.6	4,095.4
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.5	0.8	1.0	1.1	1.1	1.2	1.2	1.2	1.2	9.3
5. Other Mfg.	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	4.7
6. Transportation	2.4	5.7	7.7	8.9	9.3	9.7	9.8	9.8	9.9	73.2
7. Construction	2.9	4.8	6.0	6.6	6.8	7.0	7.0	7.0	7.0	55.1
8. Pet. Wholesale	4.0	10.4	14.0	16.2	16.9	17.5	17.6	17.7	17.7	132.0
9. Farm Equip&Bldg Mat.	1.9	7.7	10.8	12.9	13.5	13.9	13.9	13.9	14.0	102.5
10. Food Store	5.0	6.2	7.0	7.3	7.5	7.5	7.6	7.6	7.6	63.3
11. Other Retail	12.8	15.8	17.7	18.3	18.7	18.9	18.9	18.9	18.9	158.9
12. Auto Product & Ser.	6.4	16.4	21.9	25.2	26.3	27.0	27.0	27.0	27.0	204.2
13. Apparel & Shoes	1.7	2.1	2.4	2.5	2.6	2.6	2.6	2.6	2.6	21.7
14. Furniture & Appl.	0.5	0.7	0.9	0.9	1.0	1.0	1.0	1.0	1.0	8.0
15. Insurance	0.6	1.4	1.9	2.2	2.3	2.4	2.4	2.4	2.4	18.0
16. Personal Service	7.0	9.2	10.5	11.1	11.4	11.5	11.6	11.6	11.6	95.5
17. Other Services	2.2	3.4	4.1	4.4	4.6	4.7	4.7	4.7	4.7	37.5
Non-agriculture Subtotal	48.2	85.0	106.4	118.1	122.6	125.5	125.9	126.0	126.2	983.9
Total	113.2	389.3	537.7	635.5	663.6	685.0	685.2	685.0	684.8	5,079.3

[a]These entries across these two rows include farm household income directly associated with the increased agricultural production as shown in Table IV.6, Appendix IV.

[b]The entry of each row is calculated by multiplying the realized gross output generated (as shown in Table VII.3) by income coefficients as adjusted to the target year shown in Table V.I; Appendix V.

TABLE VII.7

SIMULATED EMPLOYMENT IMPACT OF THE DRAINAGE PROGRAM BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: Man-Year)

Sector	Employment Impact In Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock	458.6	598.5	677.7	707.2	657.4	572.8	544.3	516.7	491.4	5,224.6
2. Ag.-Crop & Other	195.4	253.5	284.4	294.1	271.3	234.3	220.7	227.9	196.3	2,157.9
Agricultural Subtotal	654.0	852.0	962.1	1,001.3	928.7	807.1	765.0	724.6	687.7	7,382.5
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.7	1.0	1.2	1.5	1.6	1.5	1.5	1.5	1.5	12.0
5. Other Mfg.	0.4	0.6	0.8	1.0	0.9	0.9	0.9	0.9	0.9	7.3
6. Transportation	7.5	10.7	13.9	16.5	17.3	16.4	15.9	15.4	14.9	128.5
7. Construction	18.8	20.7	22.3	23.2	18.9	11.7	11.3	10.8	10.4	148.1
8. Pet. Wholesale	10.0	14.4	18.9	22.8	24.4	23.5	22.9	22.3	21.7	180.9
9. Farm Equip&Bldg Mat.	8.6	12.6	16.2	19.3	20.6	19.6	19.0	18.4	17.9	152.2
10. Food Store	4.8	6.4	8.1	9.6	10.0	9.5	9.4	9.4	9.3	76.5
11. Other Retail	11.8	15.7	19.8	23.3	24.1	22.9	22.7	22.5	22.4	185.2
12. Auto Product & Ser.	15.9	24.0	32.5	40.6	43.9	42.0	41.7	41.3	40.9	322.8
13. Apparel & Shoes	1.8	2.4	3.0	3.4	3.5	3.4	3.4	3.3	3.3	27.5
14. Furniture & Appl.	0.6	1.0	8.5	10.7	1.7	1.6	1.6	1.6	1.6	28.9
15. Insurance	1.5	2.2	3.1	3.9	4.2	3.9	3.8	3.7	3.6	29.9
16. Personal Service	10.6	14.2	18.2	21.7	22.0	20.2	20.1	20.0	19.9	166.9
17. Other Retail	5.1	7.7	10.6	13.2	13.8	13.2	13.1	13.1	13.0	102.8
Non-Agri. Subtotal	98.1	133.6	177.1	210.7	206.9	190.3	187.3	184.2	181.3	1,569.5
Total	752.1	985.6	1,139.2	1,212.0	1,135.6	997.4	952.3	908.8	869.0	8,952.0

Sources and estimation procesures are explained in Appendix VI.

TABLE VII.8

SIMULATED EMPLOYMENT IMPACT OF THE LAND CLEARING AND DEMONSTRATION PROGRAM BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: Man-Year)

Sector	Employment Impact in Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock	51.8	82.1	109.1	131.7	138.5	149.4	144.8	144.9	136.3	1,088.6
2. Ag.-Crop & Other	24.5	35.6	49.0	59.6	61.0	64.6	62.1	61.6	57.5	475.5
Agricultural Subtotal	76.3	117.7	158.1	191.3	199.5	214.0	206.9	206.5	193.8	1,564.1
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	2.0
5. Other Mfg.	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	1.2
6. Transportation	2.3	2.2	2.2	2.5	3.3	2.5	2.6	2.7	2.7	23.0
7. Construction	21.5	14.4	8.8	7.2	16.5	1.3	1.4	1.6	1.6	74.3
8. Pet. Wholesale	1.3	1.8	2.2	2.8	3.1	3.3	3.5	3.7	3.6	25.3
9. Farm Equip&Bldg Mat.	8.2	6.2	4.8	4.6	8.4	3.0	3.1	3.2	3.1	44.6
10. Food Store	1.3	1.3	1.1	1.4	1.4	1.5	1.8	2.0	2.1	13.9
11. Other Retail	3.2	3.2	2.7	3.4	3.5	3.6	4.4	4.8	5.1	33.9
12. Auto Product & Ser.	3.8	4.0	4.1	5.1	6.2	5.1	5.5	5.9	6.0	45.7
13. Apparel & Shoes	0.4	0.4	0.3	0.4	1.4	0.5	0.6	0.6	0.8	4.4
14. Furniture & Appl.	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	1.2
15. Insurance	0.3	0.3	0.3	0.4	0.5	0.4	0.4	0.5	0.5	3.6
16. Personal Service	3.2	3.2	2.7	3.1	3.6	2.9	3.3	3.7	3.8	29.5
17. Other Services	1.3	1.2	1.1	1.3	1.7	1.2	1.4	1.6	1.7	12.5
Non-Agri. Subtotal	47.2	38.7	30.7	32.6	49.1	25.7	28.6	30.9	31.6	315.1
Total	123.5	156.4	188.8	223.9	248.6	239.7	235.5	237.4	225.4	1,879.2

Sources and estimation procedures are explained in Appendix VI.

TABLE VII.9

SIMULATED EMPLOYMENT IMPACT OF THE FARM MANAGEMENT TRAINING PROGRAM BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: Man-Year)

Sector	Employment Impact In Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock	20.8	89.3	117.9	131.8	129.0	124.8	117.0	109.4	102.7	942.7
2. Ag.-Crop & Other	8.9	39.9	52.6	58.0	57.2	55.1	51.2	47.6	44.3	414.8
Agricultural Subtotal	29.7	129.2	170.5	189.8	186.2	179.9	168.2	157.0	147.0	1,357.5
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.7
5. Other Mfg.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9
6. Transportation	0.7	1.6	2.0	2.2	2.2	2.2	2.2	2.1	2.0	17.2
7. Construction	0.8	1.2	1.5	1.5	1.5	1.5	1.5	1.4	1.3	12.2
8. Pet. Wholesale	0.8	2.0	2.6	2.9	3.0	3.0	2.9	2.8	2.8	22.8
9. Farm Equip&Bldg Mat.	0.4	1.6	2.2	2.5	2.5	2.6	2.5	2.4	2.3	19.0
10. Food Store	1.4	1.7	1.9	2.0	2.0	2.0	2.0	2.0	2.0	17.0
11. Other Retail	3.4	4.1	4.6	4.7	4.8	4.8	4.8	4.7	4.7	40.6
12. Auto Product & Ser.	1.2	3.0	4.0	4.5	4.7	4.8	4.7	4.7	4.6	36.2
13. Apparel & Shoes	0.5	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	6.7
14. Furniture & Appl.	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6
15. Insurance	0.1	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	3.1
16. Personal Service	2.2	2.9	3.2	3.4	3.5	3.5	3.5	3.5	3.4	29.1
17. Other Services	0.7	1.1	1.3	1.4	1.4	1.4	1.4	1.4	1.4	11.5
Non-Agri. Subtotal	12.5	20.6	24.8	26.8	27.3	27.5	27.2	26.7	26.2	219.6
Total	42.2	149.8	195.3	216.6	213.5	207.4	195.4	183.7	173.2	1,577.1

Sources and estimation procedures are explained in Appendix VI.

TABLE VII.10

SIMULATED IMPACT OF THE DRAINAGE PROGRAM ON GOVERNMENT REVENUE BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: '000 1968 Dollars)

Sector	Impact on Government Revenue in Year									Total (1979-77)
	1969	1970	1971	1972	1973	1974	1975	1976	1977	
1. Ag.-Livestock	94.6	144.5	193.4	239.9	266.4	263.5	263.6	263.7	263.9	1,993.5
2. Ag.-Crop & Other	52.9	80.7	107.4	132.4	416.0	144.4	143.8	143.2	142.4	1,093.2
Agricultural Subtotal	147.5	225.2	300.8	372.3	412.4	407.9	407.4	406.9	406.3	3,086.7
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	1.1
5. Other Mfg.	1.3	1.9	2.5	3.0	3.1	2.9	2.9	2.9	2.9	23.4
6. Transportation	2.7	4.1	5.5	6.8	7.4	7.3	7.4	7.5	7.5	56.2
7. Construction	3.5	4.0	4.5	4.8	4.1	2.7	2.7	2.7	2.7	31.7
8. Pet. Wholesale	3.2	4.8	6.5	8.1	8.9	8.8	8.9	8.9	9.0	67.1
9. Farm Equip&Bldg Mat.	8.3	12.4	16.5	20.3	22.3	21.8	21.9	21.9	21.9	167.3
10. Food Store	2.1	2.8	3.6	4.2	4.4	4.3	4.3	4.3	4.3	34.3
11. Other Retail	7.3	9.8	12.5	14.8	15.4	14.6	14.8	14.8	14.8	118.8
12. Auto Product & Ser.	13.7	20.8	28.6	36.0	39.2	37.8	37.8	37.8	37.8	289.5
13. Apparel & Shoes	1.5	2.1	2.6	3.0	3.1	3.0	3.0	3.0	3.0	24.3
14. Furniture & Appl.	0.5	0.8	7.4	9.4	1.5	1.5	1.5	1.5	1.5	25.6
15. Insurance	0.2	0.3	0.5	0.6	0.7	0.7	0.7	0.7	0.7	5.1
16. Personal Service	3.5	4.7	6.1	7.3	7.4	6.9	6.9	6.9	6.9	56.6
17. Other Services	0.8	1.2	1.2	2.1	2.2	2.1	2.1	2.1	2.1	15.9
Non-Agri. Subtotal	48.7	69.8	98.1	120.5	119.8	114.5	115.0	115.2	115.3	916.9
Total	196.2	295.0	398.9	492.8	532.2	522.4	522.4	522.1	521.6	4,003.6

Sources and estimation procedures are explained in Appendix VI.

TABLE VII.11

SIMULATED IMPACT OF THE LAND CLEARING AND DEMONSTRATION PROGRAM ON GOVERNMENT REVENUE BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: ' 000 1968 Dollars)

Sector	Impact on Government Revenue in Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock	10.0	17.1	24.4	31.7	35.9	41.5	43.0	46.1	46.1	295.8
2. Ag.-Crop & Other	6.2	10.4	10.3	19.1	21.0	24.0	24.8	26.4	26.3	168.5
Agri. Subtotal	16.2	27.5	34.7	50.8	56.9	65.5	67.8	72.5	72.4	464.3
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.7	0.6	0.4	0.5	0.9	0.3	0.4	0.4	0.4	4.6
6. Transportation	0.8	0.9	0.9	1.1	1.4	1.1	1.2	1.3	1.3	10.0
7. Construction	4.0	2.8	1.8	1.5	3.6	0.3	0.3	0.4	0.4	15.1
8. Pet. Wholesale	0.4	0.6	0.8	1.0	1.2	1.3	1.3	1.5	1.5	9.6
9. Farm Equip&Bldg. Mat.	7.9	6.2	4.9	4.9	9.1	3.4	3.5	3.8	3.8	47.5
10. Food Store	0.6	0.6	0.5	0.6	0.6	0.7	0.8	0.9	1.0	6.3
11. Other Retail	2.0	2.0	1.7	2.1	2.2	2.3	2.8	3.2	3.3	21.6
12. Auto Product & Ser.	3.2	3.5	3.6	4.5	5.5	4.6	5.0	5.4	5.5	40.8
13. Apparel & Shoes	0.3	0.3	0.3	0.4	0.3	0.4	0.6	0.7	0.7	4.0
14. Furniture & Appl.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	1.1
15. Insurance	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
16. Personal Service	1.1	1.1	0.9	1.1	1.2	1.0	1.1	1.3	1.3	10.1
17. Other Services	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.3	2.1
Non-Ag. Subtotal	21.3	19.0	16.2	18.1	26.5	15.8	17.4	19.5	19.8	173.6
Total	37.5	46.5	50.9	68.9	83.4	81.3	85.2	92.0	92.2	637.9

Sources and estimation procedures are explained in Appendix VI.

TABLE VII.12

SIMULATED IMPACT OF THE FARM MANAGEMENT TRAINING PROGRAM ON GOVERNMENT REVENUE BY SECTOR, INTERLAKE AREA, 1969-1977

(Unit: '000 1968 Dollars)

Sector	Impact on Government Revenue in Year									Total
	1969	1970	1971	1972	1973	1974	1975	1976	1977	(1969-77)
1. Ag.-Livestock	4.0	18.5	26.2	31.4	32.9	33.9	33.9	33.9	34.0	248.7
2. Ag.-Crop & Other	2.2	10.7	15.2	18.2	19.0	19.6	19.5	19.4	19.3	143.1
Agri. Subtotal	6.2	29.2	41.4	49.6	51.9	53.5	53.4	53.3	53.3	391.8
3. Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Food & Bev. Mfg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Other Mfg.	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.6
6. Transportation	0.2	0.6	0.8	0.9	1.0	1.0	1.0	1.0	1.0	7.5
7. Construction	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
8. Pet. Wholesale	0.3	0.7	0.9	1.0	1.1	1.1	1.1	1.1	1.1	8.4
9. Farm Equip&Bldg Mat.	0.4	1.6	2.2	2.6	2.8	2.9	2.9	2.9	2.9	21.2
10. Food Store	0.6	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	7.7
11. Other Retail	2.1	2.6	2.9	3.0	3.1	3.1	3.1	3.1	3.1	26.1
12. Auto Product & Ser.	1.0	2.6	3.5	4.0	4.2	4.3	4.3	4.3	4.3	32.5
13. Apparel & Shoes	0.4	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	5.9
14. Furniture & Appl.	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6
15. Insurance	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
16. Personal Service	0.7	0.9	1.1	1.1	1.2	1.2	1.2	1.2	1.2	9.8
17. Other Services	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.7
Non-Agri. Subtotal	6.2	11.3	14.0	15.3	16.1	16.3	16.3	16.3	16.3	128.1
Total	12.4	40.5	55.4	64.9	68.0	69.8	69.7	69.6	69.6	519.9

Sources and estimation procedures are explained in Appendix VI.