

THE UNIVERSITY OF MANITOBA
AN ECONOMETRIC ANALYSIS OF THE CANADIAN AGRICULTURAL
LABOUR MARKET WITH SPECIFIC REFERENCE

TO THE PRAIRIE REGION

BY

WAYNE DOUGLAS JONES

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE

DEPARTMENT OF AGRICULTURAL ECONOMICS
AND FARM MANAGEMENT

WINNIPEG, MANITOBA

MAY, 1978

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ABSTRACT

AN ECONOMETRIC ANALYSIS OF THE CANADIAN AGRICULTURAL LABOUR MARKET WITH SPECIFIC REFERENCE TO THE PRAIRIE REGION

Wayne Douglas Jones

Major Advisor: Dr. E.W. Tyrchniewicz

The agricultural labour force declined by 713 thousand persons (60 percent) during the 1946 to 1974 period. This continual depletion of the agricultural labour force has led to a nation-wide shortage of qualified farm labour in recent years. Several reports have indicated that the lack of farm labour adversely affects the ability of Canadian agriculture to expand and develop. In view of possible world food shortages, the value of agriculture to the Canadian economy and the number of farm families affected, the problem of labour shortages restricting farm growth has become an important issue. The present study provides quantitative information about the market structure for farm labour in an attempt to aid policy-makers in the identification of specific economic problems, the selection of short-run and long-run solutions, the evaluation of existing policies and programs and the forecasting of future conditions.

The specific objectives of this study were: (1) to develop statistical estimates of the demand for and supply of hired, unpaid family and operator labour in agriculture for the Prairie provinces, the Prairie region and Canada as a whole; (2) to analyze the interrelations among the three components of the agricultural labour force; (3) to obtain short-run and long-run elasticities of demand and supply for each agricultural labour

component; (4) to examine the agricultural wage and employment characteristics of the Prairie region in light of the statistical results of this study; and (5) to derive some policy implications.

An economic model was developed from theories of demand for a factor of production, supply of labour to an industry, technological change, labour component interdependencies, secular influences in the labour force and lagged response to economic stimuli. Use of a Nerlove-type distributed lag model made it possible to separate short-run and long-run elasticities as well as to measure the demand and supply response lags. The procedure used to estimate the demand and supply relations was the Two-Stage Least Squares econometric technique, developed by Theil and Basmann. At the national level time series data from 1947 to 1973 were used. For the regional and provincial (Alberta, Saskatchewan, Manitoba) models time series data only from 1954 to 1973 were used due to the difficulty of obtaining some data.

One finding of this study was that disaggregation to the provincial level was useful. There was enough statistically significant evidence to indicate substantial differences among the agricultural labour markets of the three Prairie provinces. At the same time, however, it was shown that provincial time series data are not presently adequate for further studies in this area.

Experimentation on the interdependencies among the three components of the agricultural labour force lent support to the hypothesis of substitution between hired labour and unpaid family labour. Unpaid family labour and operator labour appeared to be complementary components.

These relationships generally held true in both the demand and supply equations. Hired labour and operator labour did not exhibit a consistent interdependent relationship.

The distributed lag hypothesis met with only partial statistical success which made it difficult to evaluate the findings. Although not conclusive, the results of this study suggest the supply of farm labour is more responsive to economic stimuli than the demand for farm labour. There was evidence that the demand for and supply of operator labour was less responsive to changes in economic conditions compared with the hired or unpaid family labour components. In addition, there was some indication that lagged responses were similar among the three Prairie provinces.

The predictive power of the model was tested by comparing a forecast for 1974 agricultural employment with actual employment levels. The equations were able to predict the trend reversal in agricultural employment which occurred in that year. Employment estimates were generally within ten percent of the reported level of employment.

The study concludes with a discussion on policy implications in the light of information obtained with respect to elasticities, component substitution and lagged responses.

ACKNOWLEDGEMENTS

I wish to express my gratitude to everyone who helped in the completion of this study. The following people are especially deserving of my sincere appreciation.

Dr. E.W. Tyrchniewicz, my major advisor, for his continuous guidance. His substantial knowledge of the subject and conscientious approach to research made a significant contribution to this study.

Dr. J.A. MacMillan and Dr. B. Tangri, the other members of the advisory committee, for their numerous suggestions and comments on the thesis.

The staff and students at the University of Manitoba for the many thought-provoking discussion experienced and constructive criticisms received.

And finally, a special acknowledgement is due to my wife, Kathy, for the excellent typing job and for the encouragement and understanding she provided all through graduate school.

TABLE OF CONTENTS

	Page
ABSTRACT.....	i
ACKNOWLEDGEMENTS.....	iv
LIST OF TABLES.....	ix
CHAPTER	
I INTRODUCTION.....	1
STATEMENT OF THE PROBLEM.....	1
PRIOR CONTRIBUTIONS TO THE ECONOMETRIC STRUCTURE OF THE AGRICULTURAL LABOUR MARKET.....	4
OBJECTIVES OF THIS STUDY.....	5
PROCEDURE.....	6
POLICY IMPLICATIONS.....	7
ORGANIZATION OF THIS STUDY.....	8
II BACKGROUND ANALYSIS.....	9
OVERVIEW OF THE AGRICULTURAL LABOUR FORCE.....	9
Agricultural Employment.....	9
Economic Issues.....	23
Government Involvement.....	28
ANALYSIS OF AGRICULTURAL EMPLOYMENT IN THE PRAIRIE REGION.....	35
REVIEW OF FARM LABOUR EMPLOYMENT IN 1975 AND 1976.....	39
III THE CONCEPTUAL FRAMEWORK.....	41
THE ECONOMIC THEORY.....	41
The Demand for Labour.....	41

CHAPTER

Page

	Technological Change.....	45
	The Supply of Labour.....	47
	Labour Component Interdependencies.....	50
	Secular Influences in the Labour Force.....	51
	Lagged Response to Economic Stimuli.....	52
	THE ECONOMIC MODEL.....	54
	The Market for Hired Labour in Agriculture.....	54
	Demand.....	54
	Supply.....	56
	The Market for Operator Labour in Agriculture.....	59
	Demand.....	61
	Supply.....	62
	The Market for Unpaid Family Labour in Agriculture.....	63
	Demand.....	64
	Supply.....	65
IV	THE EMPIRICAL FRAMEWORK.....	67
	THE STATISTICAL MODELS.....	67
	The Market for Hired Labour in Agriculture.....	69
	Demand.....	69
	Supply.....	69
	The Market for Operator Labour in Agriculture.....	70
	Demand.....	70
	Supply.....	70

CHAPTER	Page
The Market for Unpaid Family Labour in Agriculture.....	71
Demand.....	71
Supply.....	72
THE ESTIMATION PROCEDURE.....	72
The Calculation of Short-run and Long-run Elasticities.....	74
DATA PROBLEMS.....	77
Farm Employment.....	77
Farm Wages.....	78
Real Farm Prices.....	80
Agricultural Productivity.....	80
Nonfarm Wage Rate.....	81
V STATISTICAL RESULTS.....	83
PROCEDURE FOR MODEL EVALUATION.....	83
SUMMARY OF PRELIMINARY EXPERIMENTS.....	86
Hired Labour Market.....	88
Operator Labour Market.....	90
Unpaid Family Labour Market.....	93
RESULTS FROM MODEL IV.....	95
National Model.....	98
Regional Model.....	107
Provincial Models.....	110
MULTICOLLINEARITY PROBLEMS.....	120
UNDERIDENTIFICATION PROBLEMS.....	122
COMPARISON WITH AN EARLIER STUDY.....	123

CHAPTER	Page
VI SUMMARY AND IMPLICATIONS.....	128
SUMMARY OF THE STUDY.....	128
THE PREDICTIVE POWER OF THE MODEL.....	132
POLICY IMPLICATIONS.....	137
SUGGESTIONS FOR FURTHER RESEARCH.....	141
BIBLIOGRAPHY.....	144
APPENDICES.....	151
APPENDIX A: REVIEW OF LITERATURE.....	152
APPENDIX B: DATA SERIES USED IN ESTIMATION.....	164
APPENDIX C: RESULTS FROM THE THEORETICAL MODEL.....	180
The Market for Hired Labour in Agriculture.....	180
Demand.....	180
Supply.....	187
The Market for Operator Labour in Agriculture.....	190
Demand.....	190
Supply.....	197
The Market for Unpaid Family Labour.....	199
Demand.....	199
Supply.....	206
APPENDIX D: SIMPLE CORRELATION COEFFICIENT MATRICES.....	209

LIST OF TABLES

Table	Page
2.1 Employment in Agriculture; Canada and Regions, 1954-1974.....	10
2.2 Annual Absolute Changes in Agricultural Employment; Canada and Regions, 1954-1974.....	12
2.3 Annual Percent Changes in Agricultural Employment; Canada and Regions, 1954-1974.....	13
2.4 Agricultural Employment as a Percentage of Total Employment (All Industries); Canada and Regions, 1954-1974.....	14
2.5 Employment in Agriculture by Class of Worker; Canada, 1954-1974.....	16
2.6 Absolute Changes in Employment in Agriculture by Class of Worker; Canada, 1954-1974.....	17
2.7 Percent Changes in Employment in Agriculture by Class of Worker; Canada, 1954-1974.....	19
2.8 Monthly Employment in Agriculture; Canada and Regions, 1974.....	20
2.9 Monthly Employment in Agriculture by Class of Worker, Canada, 1974.....	22
2.10 Agricultural Price and Productivity Indices, Canada, for Selected Years, 1961-1974.....	24
2.11 Estimates of Average Wage Rates in Agriculture and Major Industries; Canada, for Selected Years, 1961-1974.....	25
2.12 Labour Standards; Legislative Coverage, by Province, of Agricultural Workers, June 1974.....	29
2.13 Employees Supplied to Canadian Agriculture by Various Government Programs; Canada, 1974.....	32
2.14 Summary of Full-Time Agricultural Courses, Canada and the Prairie Provinces, for Selected Years, 1969-70, 1970-71, 1971-72, 1972-73, 1973-74, and 1974-75.....	34

Table	Page
2.15 Farms Reporting Paid Labour by Size of Farm; Prairie Region, 1971.....	36
2.16 Farm Enterprise Specialization; Prairie Region, 1971.....	37
5.1 Estimates of Structural Demand and Supply Relationships for Agricultural Labour from Dynamic Model IV--Canada.....	99
5.2 Estimates of Elasticities of Adjustment, and Short-Run and Long-Run Elasticities Derived from Dynamic Model IV--Canada.....	100
5.3 Estimates of Structural Demand and Supply Relationships for Agricultural Labour from Dynamic Model IV--Prairie Region.....	108
5.4 Estimates of Elasticities of Adjustment, and Short-Run and Long-Run Elasticities Derived from Dynamic Model IV--Prairie Region.....	109
5.5 Estimates of Structural Demand and Supply Relationships for Agricultural Labour from Dynamic Model IV--Alberta.....	112
5.6 Estimates of Elasticities of Adjustment, and Short-Run and Long-Run Elasticities Derived from Dynamic Model IV--Alberta.....	113
5.7 Estimates of Structural Demand and Supply Relationships for Agricultural Labour from Dynamic Model IV--Saskatchewan.....	114
5.8 Estimates of Elasticities of Adjustment, and Short-Run and Long-Run Elasticities Derived from Dynamic Model IV--Saskatchewan.....	115
5.9 Estimates of Structural Demand and Supply Relationships for Agricultural Labour from Dynamic Model IV--Manitoba.....	116
5.10 Estimates of Elasticities of Adjustment, and Short-Run and Long-Run Elasticities Derived from Dynamic Model IV--Manitoba.....	117
5.11 Comparison of Short-Run Elasticities and Adjustment Mechanism from Both Studies.....	124

Table	Page
6.1 Comparison of Data for National Farm Labour Model IV--1973 and 1974.....	134
6.2 Actual and Predicted Levels of Price, Demand and Supply for Each Farm Labour Component-- Canada, 1974.....	136
B.1 Data Series Used in Estimation of National Models.....	165
B.2 Data Series Used in Estimation of Prairie Region Models.....	168
B.3 Data Series Used in Estimation of Models for Alberta.....	172
B.4 Data Series Used in Estimation of Models for Saskatchewan.....	176
B.5 Data Series Used in Estimation of Models for Manitoba.....	178
C.1 Estimates of Structural Demand and Supply Relationships for Hired Labour--Canada, 1947-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	181
C.2 Estimates of Structural Demand and Supply Relationships for Hired Labour--Prairie Region 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	182
C.3 Estimates of Structural Demand and Supply Relationships for Hired Labour--Alberta 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	183
C.4 Estimates of Structural Demand and Supply Relationships for Hired Labour--Saskatchewan 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	184
C.5 Estimates of Structural Demand and Supply Relationships for Hired Labour--Manitoba 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	185
C.6 Estimates of Structural Demand and Supply Relationships for Operator Labour--Canada, 1947-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	191

Table	Page	
C.7	Estimates of Structural Demand and Supply Relationships for Operator Labour--Prairie Region 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	192
C.8	Estimates of Structural Demand and Supply Relationships for Operator Labour--Alberta 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	193
C.9	Estimates of Structural Demand and Supply Relationships for Operator Labour--Saskatchewan 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	194
C.10	Estimates of Structural Demand and Supply Relationships for Operator Labour--Manitoba 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	195
C.11	Estimates of Structural Demand and Supply Relationships for Unpaid Family Labour--Canada, 1947-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	200
C.12	Estimates of Structural Demand and Supply Relationships for Unpaid Family Labour--Prairie Region 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	201
C.13	Estimates of Structural Demand and Supply Relationships for Unpaid Family Labour--Alberta 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	202
C.14	Estimates of Structural Demand and Supply Relationships for Unpaid Family Labour--Saskatchewan 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	203
C.15	Estimates of Demand and Supply Relationships for Unpaid Family Labour--Manitoba 1954-73, Regression Coefficients and Standard Errors, Static and Dynamic Models, Model IV.....	204
D. 1	Simple Correlation Coefficient Matrix for Variables in Canada Demand and Supply Equations.....	210
D.2	Simple Correlation Coefficient Matrix for Variables in Prairie Region Demand and Supply Equations.....	211

Table		Page
D.3	Simple Correlation Coefficient Matrix for Variables in Alberta Demand and Supply Equations.....	212
D.4	Simple Correlation Coefficient Matrix for Variables in Saskatchewan Demand and Supply Equations.....	213
D.5	Simple Correlation Coefficient Matrix for Variables in Manitoba Demand and Supply Equations.....	214

CHAPTER I

INTRODUCTION

Canadian agriculture has been characterized by rapid technological advancement, heavy capital investment and increasing farm size during the post-war period. The concomitant increase in the level of farm output exceeded the demand of both domestic and foreign markets thereby causing the price of agricultural products to fall in relation to other product prices and farm input prices. As a result, farm incomes and wages paid to hired farm labour have lagged behind the wages and salaries available off the farm. Moreover, Canada's post-war economic expansion created many new nonfarm employment opportunities with working conditions and fringe benefits considered preferable by the majority of the civilian labour force. The agricultural labour force consequently declined by 713 thousand persons (60.1 percent) from 1946 to 1974 as workers sought employment in industry.¹

STATEMENT OF THE PROBLEM

The industrial boom and resultant off-farm migration were beneficial to both agriculture and industry at first because it gave persons, unable to make a living on farms, the opportunity to leave agriculture while providing the labour needed for industrial growth.

¹The estimate of decline in agricultural employment was calculated using data for 1946 and 1974 from Statistics Canada, The Labour Force, Catalogue No. 71-001 monthly, Ottawa; Information Canada.

However, this continual depletion of the agricultural labour force has led to a nation-wide shortage of qualified farm labour in recent years. In addition, the complexity of farming associated with modern mechanization has altered the types of farm labour required. Agriculture must now compete directly with other sectors of the economy for highly skilled labour.

Several recent reports have indicated that the lack of skilled labour adversely affects the ability of Canadian agriculture to expand and develop.² In view of possible world food shortages, the value of agriculture to the Canadian economy (\$3.8 billion worth of exports in 1974),³ and the number of farms involved (300,118 farms in 1976),⁴ the problem of labour shortages restricting farm growth has become an important issue.

The Prairie region, with over half of Canada's net farm income and most of Canada's agricultural exports, faces perhaps the most acute shortage of farm labour. Prairie farms commonly utilize complicated and expensive equipment which require skillful operation and maintenance.

²See for example, Canadian Federation of Agriculture, "Farm Labour Problems," Project No. 412010, a paper presented at the Canadian Federation of Agriculture - Dairy Farmers of Canada Seminar, Ottawa, February, 1974, section 2; National Working Group on Agricultural Manpower, "Report of the National Working Group on Agricultural Manpower," Ottawa, January, 1974, pp. 1-3; and S.H. Lane and D.R. Campbell, Farm Labour in Ontario, Ontario Agricultural College; Department of Agricultural Economics, 1954, pp. 5-8.

³Agriculture Canada, Selected Agricultural Statistics For Canada, Ottawa; Economics Branch Publication, June, 1975, p. 123.

⁴Statistics Canada, 1976 Census of Canada, Catalogue 96-857 (SA-7), Ottawa; Information Canada, April, 1977, Table 1.

The declining rural population has reduced the amount of local labour while the flow of immigrants from Europe, once a good supply of farm labour, has almost stopped. Today, immigrants looking for agricultural employment come from places such as the Caribbean and are unable to operate typical prairie farm equipment. The low rate of unemployment in Saskatchewan combined with low farm wages reduce the chance of farm operators finding workers. The northern oil wells in Alberta and the hydro construction projects in Manitoba hire a large number of workers in the summer, who might otherwise have offered their services to farmers, by offering wages the farmers cannot match.

All levels of government have attempted to solve the problem with a wide range of policies and programs. Changes in the labour legislation applying to agriculture, the new Canada Farm Labour Pool system, increased involvement in foreign worker programs, and the promotion of agricultural training courses are a few examples of the attempt to promote the supply of qualified farm labour required for agricultural production.⁵ However, due to a lack of knowledge concerning the structure of the farm labour market these policies and programs may not be the most efficient method of solving the farm labour problem. Although several descriptive studies⁶

⁵For a brief description of government involvement in the agricultural manpower problem in Canada see, R.S. Rust and P.M. Stone, "Agricultural Manpower," Canadian Farm Economics, Vol. 10, No. 1, 1975, pp. 9-10.

⁶See for example, A.B. Andarawewa, The Structure of the Canadian Agricultural Labour Force, Agriculture Canada, Ottawa; Economics Branch Publication, April, 1970; and A. Foster and B. Proud, "Report on Wages and Hours of Work in Canadian Agriculture," a research report prepared for the International Labour Organization, Ottawa, September, 1970.

have reported the problem areas and possible solutions, additional quantitative knowledge of the factors determining the demand for and supply of farm labour would be of value to policy-makers in the identification of specific economic problems, the selection of short-run and long-run solutions, the evaluation of existing policies and programs, and in the forecasting of future conditions.

PRIOR CONTRIBUTIONS TO THE ECONOMETRIC STRUCTURE
OF THE AGRICULTURAL LABOUR MARKET⁷

Econometrics employs mathematics and statistics to study economic conditions. When economic theory is expressed in mathematical language, statistical methods can be applied to measure the stated relationships and to test hypotheses.⁸ A review of two econometric studies of agricultural labour markets illustrates the progress made in this area to date.

A study published by Yeh and Li⁹ in 1966 examined the markets for hired and family farm labour by region and for Canada as a whole. It was postulated that farm labour demanded was dependent on the farm wage rate, the relative profitability of farming, the availability of labour substitutes, and the level of technology. On the supply side, the farm

⁷See Appendix A, Review of Literature, for a review of studies of the agricultural labour market that are not econometric in nature.

⁸For an introduction to econometric analysis see, M.H. Yeh, Application of Simple and Multiple Regression Analysis to Economic Problems, Technical Bulletin No. 4, University of Manitoba; Department of Agricultural Economics and Farm Management, June, 1962.

⁹M.H. Yeh and L.K. Li, "A Regional Analysis of the Supply and Demand of Farm Labour in Canada," Canadian Journal of Agricultural Economics, Vol. 14, No. 2, 1966, pp. 15-31.

wage rate, the nonfarm wage rate adjusted by the rate of unemployment, and the level of technology were used as explanatory variables. Both demand and supply equations included a lagged dependent variable to account for the lag in response to economic stimuli.

In general, the empirical results were difficult to interpret due to lack of statistical significance, with the hired labour market posing the most problems. The study's main contribution was the provision of empirical evidence identifying the existence of demand and supply adjustment lags and regional variation in the Canadian farm labour market.

In a later U.S. study, Tyrchniewicz and Schuh¹⁰ extended previous work on agricultural labour markets by analyzing farm operator and unpaid family labour separately. They also measured the degree of substitution among farm operator, unpaid family and hired farm labour components. Considerable experimentation produced favourable results with most coefficients statistically significant and having the a priori expected sign. The study supported their hypothesis that three individual agricultural labour markets exist which exhibit a certain degree of interaction.

OBJECTIVES OF THIS STUDY

The general objective of this study is to provide information about the market structure for hired, unpaid family and operator labour

¹⁰E.W. Tyrchniewicz and G.E. Schuh, "Econometric Analysis of the Agricultural Labour Market," American Journal of Agricultural Economics, Vol. 15, No. 4, 1969, pp. 770-787.

at the provincial, regional, and national level with a view to pointing out policy implications for solving some agricultural labour problems.

The specific objectives of this study are as follows:

1. To develop statistical estimates of the demand for and supply of hired, unpaid family and operator labour in agriculture for the Prairie provinces, the Prairie region and Canada as a whole.

2. To analyze the inter-relations among the three components of the agricultural labour force.

3. To obtain short-run and long-run elasticities of demand and supply for each agricultural labour component.

4. To examine the agricultural wage and employment characteristics of the Prairie region in light of the statistical results of this study.

5. To derive some policy implications.

PROCEDURE

To accomplish the above objectives separate models will be developed for the hired, unpaid family and operator labour markets. Estimation will be by the two-stage least squares technique using time series data from 1954-1973. Each structural equation will be in the form of a Nerlove-type distributed lag model in order to characterize the lagged response to economic stimuli resulting from psychological, technological, and institutional factors.¹¹ This type of model also allows one to isolate and estimate short-run and long-run elasticities.

Estimates of the structural equations will be obtained for Canada and the Prairie region as well as for each Prairie province because of

¹¹An early discussion of these factors was presented by, , M. Nerlove, "Distributed Lags and Estimates of Long-Run Supply and Demand Elasticities: Theoretical Considerations," Journal of Farm Economics, Vol. 40, No. 3, 1958, pp. 301-311.

three considerations. First, the data employed in this study become less reliable, in statistical terms, as the level of disaggregation increases. Comparison of the provincial, regional and national levels may indicate specific data problems that would otherwise go unnoticed. Secondly, differences in the provincial, regional and national agricultural labour markets can be identified. Finally, the development of regional and national models allows the comparison of the present study to previous Canadian econometric studies, none of which extended their analysis to the provincial level.

POLICY IMPLICATIONS

The empirical findings of the present research could provide certain implications for policy. Some illustrations follow:

1. Considerable controversy exists over whether or not minimum wage laws should be applied to agriculture. Policy-makers are unsure as to what effect such a move would have on the demand for and supply of hired farm labour. The impact could range from no effect to large increases in supply and/or large decreases in demand depending on the price elasticities of hired farm labour demand and supply. With the results from this study the feasibility of extending the minimum wage laws to agriculture could be examined.

2. Assuming the short-run demand and supply curves prove to be inelastic, programs that shift either curve will have a major impact on the price of labour and a minor impact on the quantity of labour demanded or supplied. Conversely, if long-run demand and supply elasticities are greater than one, a shift in either curve would have a major impact on the level of employment and a minor impact on the wage rate. Empirical findings of this nature can be used to evaluate the short-run and long-run implications of various programs in order to determine the expected equilibrium condition resulting from the implementation of a program or set of programs and, therefore, which programs to implement to achieve a specific set of objectives.

3. If the study results show the demand for hired labour is negatively influenced by the supply of unpaid family labour and it is known that unpaid family labour is continuously declining; an increase in the demand for hired labour could occur. Recognition of the magnitude of this substitution effect may indicate a need for policies aimed at keeping more of the farm population on the farm in an attempt to reduce the demand for hired labour.

4. Measurement of the lagged response to economic stimuli by components of the farm labour force may also be important in policy development. If the study shows the supply of operator labour is slow to respond to economic stimuli, this fact should be considered when defining policy goals and when evaluating program performance. For example, if it takes three years for the supply of operator labour to fully change in response to a particular program both the predetermined goals and any annual program appraisal must take account of this time lag.

ORGANIZATION OF THIS STUDY

Chapter II provides a background for this analysis by supplying information concerning the agricultural labour force of Canada in general and of the Prairie region in particular. Chapter III covers the theoretical models used as a conceptual framework for the study while the methodology or statistical models employed are presented in Chapter IV. Chapter V presents the statistical results. The economic interpretation of these results and conclusions follow in Chapter VI. Supplementary material pertaining to the study is contained in the Appendices.

CHAPTER II

BACKGROUND ANALYSIS

In Chapter I the problems confronting the Canadian agricultural labour market were briefly introduced. The object of this chapter is to provide the reader with a basic knowledge of the farm labour force and related economic issues in order that the results and interpretations, presented later, may be better understood.

OVERVIEW OF THE AGRICULTURAL LABOUR FORCE

This section describes the recent changes and current situations with respect to the farm labour force under the headings of: (1) Agricultural Employment, (2) Economic Issues, and (3) Government Involvement.

Agricultural Employment

In recent decades, employment on Canadian farms has been declining both in absolute terms and as a proportion of the total labour force, although in 1974 farm employment increased slightly over the previous year.¹ Table 2.1 presents estimates of employment in agriculture. The Prairie region has always been the biggest employer of farm labour in Canada and accounted for just less than 50 percent of total agricultural

¹ Estimates of change in farm employment from 1973 to 1974, for both Canada and the regions, were calculated using data for 1973 and 1974 from Statistics Canada, The Labour Force, Catalogue No. 71-001 monthly, Ottawa; Information Canada. The size of the change falls within the bounds of statistical error present in Statistics Canada's labour force survey and therefore may or may not represent actual changes.