THE UNIVERSITY OF MANITOBA

AN ANALYSIS OF THE OFF-FARM WORK BEHAVIOUR OF ENTERING FARM OPERATORS IN THE PRAIRIE PROVINCES

by

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ABSTRACT

Governments in Canada have expressed concern that the future supply of entering farm operators will not be adequate to ensure production of food and fiber at the family farm level. Policies have been instituted by both federal and provincial governments to aid operators to enter agriculture and to maintain the occupation of farmer. Several authors have suggested that entry into agriculture has become difficult because financial barriers to entry have been rising relative to farm incomes, and that off-farm work by the operator represents a potential solution to this problem. This suggestion constitutes the primary focus of the thesis.

One interpretation of this suggestion is that off-farm work by entrants is a matter of financial necessity. An alternative interpretation is that entering farm operators choose to devote some time to nonfarm occupations because the returns to their expertise are relatively high. In this context off-farm work is a matter of opportunity cost.

The object of this thesis is to increase information about the work behaviour of entering farm operators in order to analyze the factors which influence their decision to work off the farm. Specifically, the objectives are:

1. to summarize information on entry into agriculture and on part-time farming;
2. to develop a conceptual model to analyze the off-farm work behaviour of entering farm operators in the Prairie provinces; and

3. to draw conclusions from the background information and the analytical model.

Two models are developed from the theories of the supply of and demand for labor and from Bollman's kinked demand for labor curve. The first employs data from the 1978 Agricultural Enumerative Survey for Saskatchewan and a multivariate logit technique. The second uses data from the 1966-1971-1976 Agriculture Population Linkage and the technique of ordinary least squares. The models are specified to differentiate the views that entrants engage in off-farm work as a matter of opportunity cost or to reach a target income (the financial necessity notion).

The major conclusion from the multivariate analysis is that work decisions of entering farm operators reflect opportunity cost rather than financial compulsion. This result does not support any policy initiations to encourage off-farm work to overcome barriers to entry into agriculture. Another conclusion is that there are structural differences in the work behaviour of entrants in the three Prairie provinces. This implies that if policies designed to affect work behaviour were to be formulated, they would have different impacts depending upon the province in question.

The final conclusion, based on descriptive statistics, is that there are significant differences between entering and established farmers. Entering farmers are; more likely to work off the farm, younger, and better educated. They also have less fixed capital (land, machinery and livestock) and a lower level of output than established farmers. This implies that policies which influence these factors will impact differently on entering and established farmers.

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Chapter I

INTRODUCTION

The structure of the agricultural production industry refers to the number, size and concentration of farms which comprise the sector.[1] Changes in the number of farms are the result of differences in the number of farmers entering and exiting the industry. These changes are of interest because they dictate the availability of an important resource, entrepreneurial talent, for the production of food and fiber at the farm level.

The family farm is the basic production unit in Canadian agriculture. In 1978 Agriculture Canada estimated that 53 percent of the total labor force in agriculture were self-employed operators, 19.5 percent were family workers and 27.5 percent were hired workers.[2] Furthermore, 91.3 percent of farms in Canada in 1976 were operated by private individuals, 4.1 percent were partnerships, 3.9 percent incorporated family farm businesses and only 0.7 percent were classified as other types of corporations or other types of organization.[3] The family farm is, therefore, responsible for a major portion of the output of the agricultural industry. (In 1971 the percentage of family farms was approximately the same

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[1] R. Hildreth, K. Krause, and P. Nelson, Jr. 'Organization and Control of the U.S. Food and Fiber Sector,' American Journal of Agricultural Economics 55, (December 1973) p. 851.

[2] R.E. Lopez, Labour Supply, Output Supply and Input Demand of the Household-Family Firm Unit unpublished paper, Ottawa, March 1979, p. 1.

[3] Statistics Canada, 1976 Census of Agriculture, Ottawa, 1976.

as in 1976. In that year family farms had 79.8 percent of gross agricultural sales).[4] Given that governments are interested in the preservation of the family farm and in light of the value of agricultural exports to Canada and potential world food shortages, the number of farm operators is an important issue.

There is some concern that the future will not yield a sufficient supply of new entrepreneurs for the agricultural industry in Canada. The concern is evidenced by programs which have as their target group entering farm operators.

Loans are available, for example, under the Farm Credit Act to allow young farmers (under 35 years of age) to phase into farming over a five year period. Applicants must demonstrate, by a written plan of operation, their ability to make farming their principal occupation within five years. In the 1979-80 period, loans to farmers under 35 years of age accounted for approximately 72 percent of the total loans granted under the Farm Credit Act.[5]

Saskatchewan's FarmStart program is available to farmers or potential farmers within the province whose net worth is less than $113,000 and who have $18,000 or less in net income. An objective of the program is to assist farmers and potential farmers in developing viable farm units.[6]

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[4] P. Shaw, 'Canada's Farm Population,' Statistics Canada, Census Analytical Study, Catalogue No. 99-750, Ottawa, 1979, p. 122.

[5] The Western Producer, Prairie Farm Policy Guide, 1980-81 pp. 39-40.

[6] Ibid, p. 49.

In 1980 Alberta's minister of agriculture stated that 'The future of agriculture in Alberta relies on the recruitment of young farmers into the industry' and 'In recognition of the difficulties confronting a starting farmer, such as rising land values and escalated interest rates, a modified beginning farmer loan program will be instituted by this government.[7]

Programs geared toward entering farmers also exist in New Brunswick (Farm Adjustment Loans), Nova Scotia (Establishment of New Farmers - Interest Forgiveness) and Prince Edward Island (Family Farm Development Program).[8] The availability of these programs demonstrates federal and provincial government desire to assist entering farm operators.

Agriculture Canada has, as one of its policy priorities, part-time farming. This priority is in terms of present policies on part-time farming and the need for new policies specifically for part-time farmers. Coincident with this interest is the observation by several authors that there is a relationship between entry into agriculture and off-farm work by entering operators. Steeves (1979) argues that among the most important barriers to entry into agriculture is the high capital investment required to establish a viable commercial operation. He concludes that participation in off-farm labor markets constitutes an important stepping-stone into farming. The conclusion is based on the fact that of the farmers working more that 228 days off the farm in

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[7] Alberta Agriculture, Communications Division, 'Beginning Farm Loan Program Announced,' April 1980.

[8] Agriculture Canada, Policies and Programs for Agriculture: Atlantic Provinces, Policy, Planning and Economics Branch, Publication No. 78/8, Ottawa, 1978.

1971, nearly 43 percent were recent entrants.[9] (A recent entrant is defined as someone that was not farming in 1966 but was farming in 1971.)

Herndier (1973) proposes that off farm work is a potential mechanism for entry into agriculture. Kaldor and Jetton (1966) conducted a study on 191 entrants to agriculture in Iowa and found that 64 percent of them engaged in some off-farm work during their first year of farming. Coffman (1979) names high capital requirements, rapid inflation of land values and potential operating losses for entering farmers as barriers to entry into agriculture. He suggests that significant off-farm earnings for at least one family member presents a possible solution to the problem. Carlin and Ghelfi (1979) indicate that off-farm work by farm operators may be a factor in helping young farm operators get started or expand their operations by providing capital. The discussion presented by these authors suggests that off-farm work may have a significant impact on the ability of potential farmers to enter the industry and maintain the occupation of farmer.

1.1 STATEMENT OF THE PROBLEM

Government interest in the number of entering farm operators dictates a demand for information on entry and entrants. Data on the characteristics of entrants and established farmers may indicate whether these groups differ and if so, how they differ. Analysis of these characteristics may provide policy makers with a better framework within which to formulate policies which will assist the target group, entrants. If

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[9] A. Steeves, 'Mobility Into and Out of Canadian Agriculture,' Journal of Rural Sociology, 1979, pp. 579-580.

off-farm work is necessary to the success of potential farmers, governments may wish to initiate policies to promote off-farm work to assist entering farmers. It is, therefore, important to understand what motivates entrants to engage in nonfarm employment activities. Increased information about entry, the characteristics of entrants and the work behaviour of entrants will permit governments to evaluate existing policies aimed at aiding entrants and to formulate future policies more efficiently. Specifically, policy makers could determine whether off-farm work by entering entrepreneurs should be encouraged, simply allowed to exist, or discriminated against.

1.2 OBJECTIVES OF THE STUDY

The first objective of this thesis is to summarize information on the entry process and on part-time farming in Canada and to provide background data that could facilitate a better understanding of entrants. The second and major objective is to develop a conceptual framework to analyze the off-farm work behaviour of entering farm operators in the Prairie provinces. The final objective is to draw conclusions from the information gained from the analytical model and the background data.

1.3 SCOPE OF THE STUDY

This study deals with farm operators in the Prairie provinces only. Barriers to entry (in the form of high land prices, escalating interest rates, etc.) will be alluded to but will not be discussed in detail. Since entry almost always requires the acquisition of some unit of land, and conversely exit almost always involves the release of land, entry is

a function of exit.[10] The role of the exit process will not, however, be discussed in depth. Neither the factors which motivate entry nor the role of geographic mobility will be dealt with in the context of this research.

1.4 ORGANIZATION OF THE THESIS

The first chapter of this thesis presents a brief introduction to the issue of the availability of entreprenurial talent for the production of food at the family farm level. Chapter 1 also states the problem and indicates the objectives and scope of the study. Chapter 2 presents some relevant background information on entry into agriculture and on part-time farming. The purpose of the background information is to facilitate a better understanding of entry into agriculture. Since part-time farming by entering farm operators is a central issue in this thesis, some background data on part-time farming is also useful. Chapter 3 describes the theoretical bases for the study of the off-farm work behaviour of entering farm operators. Various human capital models are discussed, and Bollman's kinked demand for labor curve (which is a human capital model) is introduced. A target income notion of what motivates entering operators to work off the farm is also described. Chapter 4 outlines the conceptual models and the data used to evaluate the importance of several variables to the decision of entrants to participate in nonfarm employment activities. Chapter 5 presents an analysis of the emperical results and Chapter 6 provides a summary of the study,

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[10] R. Schneider, 'An Evaluation of Disciplinary Analysis of Entry and Exit in Commercial Agriculture,' unpublished Ph.D. Thesis, University of Missouri-Columbia, 1976, p. 94.

the conclusions and limitations and, finally, suggestions for further research.

Chapter II

BACKGROUND TO THE PROBLEM

Chapter 1 introduced the issues of the availability of operator management skills and the off-farm work behaviour of entering farm operators . The relationship between these issues is of central importance to this study. Chapter 1 also stated the problem, objectives, and scope of the study, as well as describing the organization of the thesis. The purpose of this chapter is to provide a brief background to changes in, and the current situation of, the farm operator component of the agricultural labor force in Canada. Some information on the process of entry to the occupation of farm operator will be presented along with an introduction to the phenomenon of part-time farming in Canada. The details provided should facilitate a better understanding of the conceptual models and results discussed later in the thesis.

The term farm labor force refers to farm operators, unpaid labor and hired workers. Three stages in the development of the farm labor force in Canada may be distinguished. The first was a period of rapid growth, from the time the country was settled until approximately 1919. The second period from 1920-1941 was one of relative stability and the third, extending from 1942 to the present, has been one of continual decline.[11]

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[11] International Labour Office, Why Labour Leaves the Land, La Tribune de Geneve, Geneva, 1960, pp. 32-33.

The operator portion of the labor force is of particular interest in this thesis. The contribution of the operator to production at the farm level may be separated into two components--labor and management. The management function refers to entrepreneurship or coordination and supervision (Jabbar, 1977). Although it is difficult to quantify, several studies (Furtan and Bollman, 1979; Barichello, 1979; Labadan, 1970) indicate that the accumulation of human capital by farm operators has a positive effect on the decision making ability of farmers and consequently, on agricultural production.

If a higher level of production is a desirable goal for Canadian agriculture, a higher level of education for farm operators is also desirable. Huffman (1980) points out, however, that farmers with more education are more likely to reallocate their time from self-employed farm work to off-farm work than operators with lower levels of education in response to changes in economic conditions. Table 1 suggests entry into agriculture is positively correlated with the education of the operator. Of the 30,355 census farm operators with less than five years of schooling, only 20.3 percent were entrants. At the other end of the scale, of 5,275 census farm operators with a university degree, 51.9 percent were entrants. As the level of schooling increases, so does the proportion of farm operators at each level that are entrants. Entrants with a high degree of human capital and accumulated skills may have much to offer to the industry in terms of management skills. The role of human capital will be discussed further when the theoretical framework is developed.

Table 1

Rate of Entry of Census-farm Operators by Level of Schooling, 1966-1971, Canada

Level of Schooling	Number of Census-farm Operators	Number of Entrants, 1966-1971	Rate of Entry
Less that Grade 5	30,335	6,165	20.3
Grade 5-8	184,235	37,885	20.6
Grade 9-11			
- No vocational	91,505	23,115	25.3
- Some vocational	13,585	4,650	34.2
- Total	105,090	27,765	26.4
Grade 12-13			
- No vacational	25,605	8,630	33.7
- Some vocational	6,695	2,975	44.4
- Total	32,295	11,605	35.9
University			
- Some university	9,960	3,690	37.1
- University degree	5,275	2,735	51.9
- Total	15,235	6,425	42.2
TOTAL	367,195	89,835	24.5

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match and Agriculture - Population Linkage, unpublished tabulations.

Jones (1978) points out that operator labor is the most complex labor component in agriculture, since operators perform two distinct functions. As farm managers, they wish to maximize profits by efficient allocation of resources while as suppliers of labor they try to maximize income by offering their services to the occupation that will provide the highest rate of return for their effort.[12]

Recent statistics indicate that the number of census-farm operators[13] in Canada has declined from 429,731 in 1966 to 337,807 in 1976 (refer to Table 2). Tables 3, 4 and 5 present the corresponding statistics for the three Prairie provinces. Although the decline in the number of operators appears to be bottoming out, it is possible that it resulted in government interest in the supply of entering farm operators. It is interesting to observe that while the percent of farmers exiting in the 1966-1971 period and the 1971-1976 period are approximately equal in each table, the percent entering in the latter period is greater in each case. Whether or not this trend continues for the 1976-1981 period remains to be seen.

Coincident with the changes in farm numbers have been certain consequences for rural communities. Larger holdings and a smaller farm population result in greater distances between farm homes and hence a higher cost of rural services per inhabitant. In 1956, the Royal Commission on Agriculture and Rural Life in the Province of Saskatchewan pointed out

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[12] W. Jones, 'An Econometric Analysis of the Canadian Agricultural Labour Market with Specific Reference to the Prairie Region,' unpublished Master's Thesis, University of Manitoba, 1978, p. 59.

[13] A census farm operator is an individual who operated an agricultural holding with gross sales of $50 or more in 1971, or $1200 or more in 1976.

Table 2

Number and Percent of Census-Farm Operators(a) Who Entered(b) and Exited(c) Between 1966 and 1971 and Between 1971 and 1976, Canada(d)

	1966		1971		1976
Number of Census-Farm Operators	429,731		365,334		337,807
Net Change		-64,397		-27,527	
Percent Change		-14.9		-7.5	
Gross Exit(c)	152,354		129,922		-
Percent Exiting	35.4		35.5		-
Gross Entry(b)	-		87,957		102,395
Percent Entering	-		24.0		30.3

(a) Operators of institutional farms were excluded.

(b) An entrant is an individual who was a census-farm operator in the latter period, but not in the former period.

(c) An exiter is an individual who was a census-farm operator in the former period, but not in the latter period.

(d) Excludes operators of farms in the Yukon and Northwest Territories.

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match. Cited by R.D. Bollman, "Entry and Exit Functions for Farmers," 1980.

Table 3

Number and Percent of Census-Farm Operators(a) Who Entered(b) and Exited(c) Between 1966 and 1971 and Between 1971 and 1976, Manitoba

	1966		1971		1976
Number of Census-Farm Operators	28,105		24,140		22,770
Net Change		-3,965		-1,370	
Percent Change		-14.1		-5.7	
Gross Exit(c)	10,855		9,675		-
Percent Exiting	38.6		40.1		-
Gross Entry(b)	-		7,095		8,310
Percent Entering	-		29.4		36.5

(a) Operators of institutional farms were excluded.

(b) An entrant is an individual who was a census-farm operator in the latter period, but not in the former period.

(c) An exiter is an individual who was a census-farm operator in the former period, but not in the latter period.

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match. Cited by R.D. Bollman, "Entry and Exit Functions for Farmers," 1980.

Table 4

Number and Percent of Census-Farm Operators(a) Who Entered(b) and Exited(c) Between 1966 and 1971 and Between 1971 and 1976, Saskatchewan

	1966		1971		1976
Number of Census-Farm Operators	62,005		56,785		54,025
Net Change		-5,220		-2,760	
Percent Change		-8.4		-4.9	
Gross Exit(c)	23,145		20,905		-
Percent Exiting	37.3		36.8		-
Gross Entry(b)	-		17,930		18,145
Percent Entering	-		31.6		33.6

(a) Operators of institutional farms were excluded.

(b) An entrant is an individual who was a census-farm operator in the latter period, but not in the former period.

(c) An exiter is an individual who was a census-farm operator in the former period, but not in the latter period.

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match. Cited by R.D. Bollman, "Entry and Exit Functions for Farmers," 1980.

Table 5

Number and Percent of Census-Farm Operators(a) Who Entered(b) and Exited(c) Between 1966 and 1971 and Between 1971 and 1976, Alberta

	1966		1971		1976
Number of Census-Farm Operators	46,170		41,375		39,755
Net Change		-4,795		-1,620	
Percent Change		-10.4		-3.9	
Gross Exit(c)	18,520		17,045		-
Percent Exiting	40.1		41.2		-
Gross Entry(b)	-		13,730		15,410
Percent Entering	-		33.2		38.8

(a) Operators of institutional farms were excluded.

(b) An entrant is an individual who was a census-farm operator in the latter period, but not in the former period.

(c) An exiter is an individual who was a census-farm operator in the former period, but not in the latter period.

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match. Cited by R.D. Bollman, "Entry and Exit Functions for Farmers," 1980.

some difficulties with building up an adequate community life with a dwindling population. The problems included the high cost of maintaining roads, stores, post offices and schools and of providing social amenities.[14] As mentioned earlier the rate of population decrease has declined. The arguments presented in 1956, however, still apply. Aside from the problems of the community as a whole, individuals who are forced to migrate to urban areas frequently do not have the necessary job skills to adjust to urban life.

Solutions to the problems of rural depopulation discussed above may be facilitated by either discouraging preretirement exit or encouraging entry. Since the focus of this thesis is on entry, further information about means of entry is of interest.

Driver (1961) discusses methods and problems of beginning farmers in becoming established in agriculture. His study is concerned with operators who are entering the industry through the family farm. He discards the agricultural ladder theory (the 'rungs' of which are (1) unpaid, family labor, (2) hired worker or non-farm employee, (3) tenant operator, and (4) owner-operator) in favor of the farm family process.[15] The family farm cycle is defined by Gilson (1959) as a process in which the family farm progresses through a cycle once every generation. It starts

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[14] Op. cit., International Labour Office, p. 40.

[15] H.C. Driver, 'Methods and Problems of Beginning Farmers in Becoming Established in Farming,' unpublished Master's Thesis, University of Manitoba, 1961, Abstract.

with beginning farmers and ends with their retirement. Their offspring, in turn, go through the same type of cycle during their lifetimes on the farm.[16]

Driver's study deals only with farmers who are entering the industry through direct involvement with the family farm. Kaldor and Jetton (1966) deal with entering farm operators that have lived on farms for the greater part of their lives. They find that in the year proceeding entry about half the entrants in their sample were, however, engaged in off-farm work. They therefore reject the agricultural ladder concept and discard the theory that farm laborers assume entrepreneurial roles.[17]

Down (1979) examines the characteristics of farm entrants and their enterprises in southern Ontario for the years from 1966 to 1976. Three conceptual models of the entry process; the Agricultural Ladder, the Business Life-Cycle Theory and the Heady and Jensen Model are discussed. The agricultural ladder theory comprises three stages: the early stage consisting of work on the family farm with the parent in charge, the intermediate stage where potential operators are in the process of acquiring the farm by some type of formal agreement plus the accumulation of capital and machinery and the final stage in which they become full-time independent operators.[18] The theory is appropriate only for farm born

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16 J.C. Gilson, 'Family Farm Business Arrangements,' Department of Agricultural Economics and Farm Management, University of Manitoba, Bulletin No. 1, May 1959, pp. 6-7, quoted by H. Driver, ibid., p. 19.

17 Kaldor and Jetton, Op. cit., p. 739.

18 J.B. Down, 'An Examination of the Characteristics of Farm Entrants and Their Enterprises in Southern Ontario for the Years 1966-1976' unpublished Master's Thesis, University of Guelph, 1979, p. 3.

participants and gives no indication of the quality or quantity of resources required to progress up the ladder. It is therefore dismissed by Down as inadequate.

The business life-cycle theory postulates that the farm business goes through phases of a life cycle along with the operator and family while the Heady and Jensen model describes the farm entry process as a movement through categories of farm size.

Down analyzes the following characteristics of entrants: age, off-farm work, farm organization (proprietorship, partnership, non-family corporation), ownership characteristics (tenancy arrangements), enterprise type, gross farm sales and amount of land operated.[19]

The study concludes that the important characteristics that determine the difference between entrants and established farmers are as follows:

- entrants were typically younger
- entrants had a higher incidence of off-farm work
- entrants had a higher tenancy rate
- entrants received a lower volume of gross farm sales
- entrants tended to operate a smaller land base.[20]

Some descriptive statistics tabulated for this thesis confirm that most of Down's conclusions apply to the Prairie province (see Table 6). In 1971, the entrants sampled were younger (an average of 41.8 years as compared to 49.2 years), had a higher mean incidence of off-farm work (62.5 percent versus 40.9 percent reporting some days of off-farm work), had a lower mean value of agricultural products sold ($8,050 versus

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[19] Ibid., pp. 18-23.

[20] Ibid., p. 40.

Table 6

A Comparison of Selected Characteristics, Entrants and Established Farmers, 1971, Prairie Provinces

Characteristic	Mean Value for Entrants				Mean Value for Established Farmers			
Sample Size	Manitoba 2,504	Saskatchewan 5,624	Alberta 5,328	Prairies 13,456	Manitoba 11,161	Saskatchewan 21,376	Alberta 17,439	Prairies 49,476
Percent Reporting Some Off-Farm Work	63.1	57.0	58.2	62.5	42.9	37.0	44.7	40.9
Days of Off-Farm Work	71.7	58.9	88.1	72.7	37.7	26.5	38.5	33.0
Age of the Operator	42.0	41.2	42.4	41.8	49.2	49.5	48.8	49.2
Years of Schooling of the Spouse	8.3	8.3	9.1	8.6	8.5	9.0	9.1	9.0
Value of Machinery and Equipment ($,000)	7.761	9.657	9.087	9.096	12.541	14.389	15.246	14.306
Acres of Land (,00)	3.87	6.55	5.32	5.58	5.56	8.51	8.38	7.86
Value of Livestock ($,000)	5.284	6.064	8.954	7.066	7.991	8.129	14.866	10.457
Value of Agricultural Products ($,000)	7.985	7.339	8.852	8.050	9.912	9.717	14.730	11.511
Years of Schooling of the Operator	9.7	10.1	10.4	10.1	9.0	9.5	9.8	9.5

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match and Agriculture-Population Linkage.

$11,511) and, on average, operated a smaller land base (558 acres as compared to 786 acres).

Those entrants reporting off-farm employment worked more than twice as many days off the farm (on average) as established farmers. They had a slightly higher level of education (10.1 years of schooling versus 9.5 years) but their spouses had slightly less years of schooling than the spouses of the established farmers, (8.6 and 9.0 years, respectively). Entrants also had a lower mean value of machinery and equipment and of livestock than the established farmers. The means for each characteristic were significantly different at the 5 percent level.

These statistics indicate there are differences between entering and established farmers which may justify the existence of policies geared specifically for the entering group. A test of the hypothesis that entrants differ from established farmers in terms of off-farm work behaviour is reported in Chapter 5.

The life-cycle theory discussed above was proposed by Boehlje to account for the fact that neither the entry nor the exit decision are completely discrete single-period phenomena. The theory is described by Schneider (1976) as being in keeping with the actual nature of farm firms, especially of the family type.

> This concept portrays the farm firm as going through a life-cycle consisting of three stages: entry, or the acquisition of a capital mass of resources; growth, or the extension of resource constraints; and exit or disinvestment. These stages roughly correspond to or follow the aging process of the operator.[21]

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[21] M. Boehlje, "The Entry-Growth-Exit Processes in Agriculture," Southern Journal of Agricultural Economics, July 1973, pp. 23-24, quoted in Schneider p. 112.

Steeves (1981) explains the "graduation hypothesis" as the process by which entrants who find the capital requirements for entry into full-time commercial agriculture prohibitive are forced to work part-time off the farm for a number of years in order to earn wage or salary income. This off-farm income may then be invested in 'building up the capital value of the farm to the point where it becomes sufficient to support a full-time commitment.'[22] Steeves points out that there is also an argument that entry (and exit) is closely supervised by financial institutions.[23] Banks, credit unions and the Farm Credit Corporation

> scrutinize the qualifications of entrants and normally require a viable plan of operation prior to investing their resources. By and large they are interested in those farm operators who are prepared to make an exclusive commitment to the farm operation as a viable commercial enterprise.[24]

Steeves states that 'such an argument would imply substantial barriers to entry by those who had little capital but wished to build up equity through off-farm work'[25] and that

> It would appear that increasingly, entry into commercial agriculture is controlled by the financial institutions or by the possibility of substantial inheritance of the old family farm through intergenerational transfer.[26]

These studies are discussed to provide information on the process of entry. The other important aspect of this study is the way in which farmers allocate their time between on and off-farm work. While several

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[22] A. Steeves, 'Part-time Farming As A Facilitator of Entry Into And Exit From Full-time Farming,' Department of Sociology and Anthropology, Carleton University, Ottawa, 1981, p. 1.

[23] Ibid.

[24] Ibid.

[25] Ibid., p. 2.

[26] Ibid.

authors have suggested that part-time farming may facilitate entry into agriculture, little empirical work has been completed in the area. The importance of part-time farming to the industry as a whole has, however, been well documented. In 1971, over 50 percent of Canadian census-farm operators participated in off-farm work and over 35 percent of each food commodity was produced by operators with off-farm work. Furthermore, over 50 percent of the total income of farm operators was from off-farm work (Bollman,1978). Results from the 1976 census of agriculture indicate that over 30 percent of census farm operators reported some days of off-farm work. (It should be noted, however, that the definition of census-farm operator changed between 1971 and 1976.) For farmers in 1976 with more than $1200 in gross sales from agricultural products, the relationship between off-farm earned income and total income for farmers was as follows: Canada - 42%, Manitoba - 38%, Saskatchewan - 20%, Alberta - 48%.

Several roles have been suggested for part-time farming in Canada. Bollman (1979a) states that food production by farm operators with some off-farm employment is a significant proportion of total food production. One of the conclusions from his study of off-farm work by farmers is that part-time farming

> exist in a stable equilibrium situation. The allocation of only part of the operator's labour to farm activities and the allocation of the remaining labour to off-farm activities can represent an efficient resource allocation.[27]

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[27] R.D. Bollman, 'Off Farm Work by Farmers,' Statistics Canada, Ottawa, 1979, pp. 175-176.

Shaw (1979) states that at the provincial level, the off-farm contribution to total farm family income always exceeds the farm contribution. It is usually two to three times more important than farm self-employment income.[28] Bollman (1979a) also suggests that part-time farming may be viewed as 'a solution to the problems of low incomes among farmers' as well as 'a solution to the problem of rural depopulation.'[29]

Herndier (1973) claims that part-time farming has three potential major roles in agricultural adjustment;

1. to help people get established in farming;
2. to ease the transition out of farming; and
3. to combine the two sources of income as a way of life.[30]

As discussed earlier, other authors have proposed part-time farming as a potential mechanism for entry into agriculture. Tables 7, 8, 9 and 10 indicate entry streams for farm operators that entered the industry between 1966 and 1971 for Canada and the Prairie provinces. At the national level, 46.4 percent of entrants in this period were part-time farmers in 1971; 53.6 percent were full-time. Nearly half of those who were part-time in 1971 had exited from the industry by 1976, approximately 20 percent had become full-time farmers and 30 percent remained in the status of part-time farmer. (Of the 47,115 entrants who were full-time in 1971, only 8.8 percent became part-time farmers, 50.3 percent exited and 40.9 percent remained full-time.) Approximately an

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[28] P. Shaw, op. cit., 'Canada's Farm Population,' p. 123.

[29] R. Bollman, op. cit., p.177

[30] G. Herndier, 'An Evaluation of the Effectiveness of PART-TIME FARMING As an Adjustment Vehicle,' unpublished Master's Thesis, University of Saskatchewan, 1973, p. iv.

Table 7

What Happened to the 1966 Entrants? Canada

1966			1971			1976	
	Number	Percent		Number	Percent		Number	Percent
Entrant(1)	87,955	100.00	Part-time(2)	40,840	46.5	Exiter	18,930	46.4
						Part-time(2)	12,865	31.5
						Full-time(2)	9,045	22.5
						(sub-total	40,840	100.0)
			Full-time(2)	47,115	53.6	Exiter	23,695	50.3
						Part-time(2)	4,160	8.8
						Full-time(2)	19,260	40.9
						(sub-total	47,115	100.0)
			(total	87,955	100.0)			

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match, unpublished tabulations.

(1) An entrant is a census-farm operator who has started farming (in the 1966-1971 period, in this table).

(2) A part-time farmer is a census-farm operator who reported "some days of off-farm work" in the previous year. Thus, a full-time farmer is a census-farm operator with no days of off-farm work. (Operators of institutional farms and farms in the Yukon and Northwest Territories are excluded.)

Table 8

What Happened to the 1966 Entrants? Manitoba

1966			1971		1976	
	Number	Percent	Number	Percent	Number	Percent
Entrant(1)	6,350	100.00				
		Part-time(2)	2,830	44.6	Exiter	1,240	43.8
					Part-time(2)	835	29.5
					Full-time(2)	760	26.9
					(sub-total	2,830	100.0)
		Full-time(2)	3,520	55.4	Exiter	1,635	46.4
					Part-time(2)	315	8.9
					Full-time(2)	1,565	44.5
					(sub-total	3,520	100.0)
		(total	6,350	100.0)		

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match, unpublished tabulations.

(1) An entrant is a census-farm operator who has started farming (in the 1966-1971 period, in this table).

(2) A part-time farmer is a census-farm operator who reported "some days of off-farm work" in the previous year. Thus, a full-time farmer is a census-farm operator with no days of off-farm work. (Operators of institutional farms are excluded.)

Table 9

What Happened to the 1966 Entrants? Saskatchewan

1966			1971			1976	
	Number	Percent	Number	Percent		Number	Percent
Entrant(1)	15,350	100.00					
			Part-time(2)	5,810	37.9		
						Exiter	2,135	36.7
						Part-time(2)	1,660	28.6
						Full-time(2)	2,015	34.7
						(sub-total	5,810	100.0)
			Full-time(2)	9,540	62.1		
						Exiter	4,255	44.6
						Part-time(2)	745	7.8
						Full-time(2)	4,540	47.6
						(sub-total	9,540	100.0)
			(total	15,350	100.0)		

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match, unpublished tabulations.

(1) An entrant is a census-farm operator who has started farming (in the 1966-1971 period, in this table).

(2) A part-time farmer is a census-farm operator who reported "some days of off-farm work" in the previous year. Thus, a full-time farmer is a census-farm operator with no days of off-farm work. (Operators of institutional farms are excluded.)

Table 10

What Happened to the 1966 Entrants? Alberta

1966			1971			1976	
	Number	Percent	Number	Percent		Number	Percent
Entrant(1)	14,060	100.00					
			Part-time(2)	6,860	48.8	Exiter	12,910	42.4
						Part-time(2)	2,385	34.8
						Full-time(2)	1,560	22.7
						(sub-total	6,860	100.0)
			Full-time(2)	7,200	51.2	Exiter	3,515	48.8
						Part-time(2)	725	10.1
						Full-time(2)	2,960	41.1
						(sub-total	7,200	100.0)
			(total	14,060	100.0)			

Source: Canada, Statistics Canada, 1966-1971-1976 Census of Agriculture Match, unpublished tabulations.

(1) An entrant is a census-farm operator who has started farming (in the 1966-1971 period, in this table).

(2) A part-time farmer is a census-farm operator who reported "some days of off-farm work" in the previous year. Thus, a full-time farmer is a census-farm operator with no days of off-farm work. (Operators of institutional farms are excluded.)

equal proportion of farmers who entered full-time and part-time in the 1966-1971 period had exited by 1976.

The results for the Prairie provinces do not differ substantially from those for Canada. In Manitoba, the respective proportions entering full and part-time were 55.4 percent and 44.6 percent; in Saskatchewan 62.1 percent and 37.9 percent; in Alberta 51.2 percent and 48.8 percent. The number of 1966-1971 entrants in Saskatchewan who were part-time in 1971 is slightly lower than in the other provinces.

In summary, several roles for part-time farming have been suggested. It may be a way for farm operators to allocate their labor resource efficiently while being involved in food production. It is a potential means for alleviating the low income problems of farm operators and their families. It may be an adjustment mechanism to help farmers enter the industry and to ease the process of exit from agriculture. Finally it could present a solution to the problem of rural depopulation. The suggestion that part-time farming is a mechanism for entry into agriculture will be investigated in Chapter 4 of this thesis.

Chapter III

THEORETICAL BASES AND REVIEW OF RELATED STUDIES

The first two chapters stated the problem, objectives and scope of the study and provided background information on entry into the occupation of farm operator and on part-time farming. The purpose of this chapter is to describe the theoretical bases for studies of the work behaviour of entering farm operators. In order to do so, the supply of and demand for operator labor are discussed as is the theory of the accumulation of human capital. Finally, the kinked demand for labor curve and a target income model to explain participation in off-farm work are introduced.

The decision to become a farm operator is assumed to be based on the desire to maximize utility. Conceptually, this goal is met by allocating time between work (on-farm or on-farm and off-farm) and leisure subject to a budget constraint. The factors that influence the decision are of two types: monetary and non-monetary.

Schneider (1976) points out that it is difficult to develop an operational generalized conceptual model to serve as a source for testing hypotheses on entry.

> The conventional profit-motivated competition regulated explanation of economic activity does not serve adequately for present purposes. The farm entrepreneur, especially in the family farm setting, has other, possibly overriding, goals and motivations.[31]

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[31] Op. cit., Schneider, p. 104.

The other goals and motivations refer to the working and living conditions that are perceived as being available with 'farm life'. Farm operators may be attracted by the opportunity to be independent (self-employed). They may also find the atmosphere of rural living appealing for themselves and their families.

As mentioned earlier, no attempt will be made to evaluate quantitatively the factors which motivate the entry process. The farm operators discussed in this thesis have already entered the industry so their decisions have already been made. The way in which they allocate their time can, however, be examined in a supply-demand context, keeping these other factors in mind. In order to apply the standard supply-demand analysis for labor two assumptions must be made. The first is that agriculture is a competitive industry. The second is that farm operators are utility maximizing individuals.

3.1 SUPPLY OF OPERATOR LABOR

According to Rees (1973) the purpose of the theory of the supply of labor is to show how utility maximizing decision makers respond to changes in the opportunities that they face.[32] Indifference curve analysis may be used to explain how an individual who is not self-employed can trade hours of leisure for consumption in the market (see Figure 1). In a one day period the person will work 24-H hours (where H is hours of leisure) and will earn W(24-H) (where W is the real wage rate) which will be used to buy consumption goods (C). The daily budget constraint is, therefore, C=W(24-H). In this example the individual will maximize

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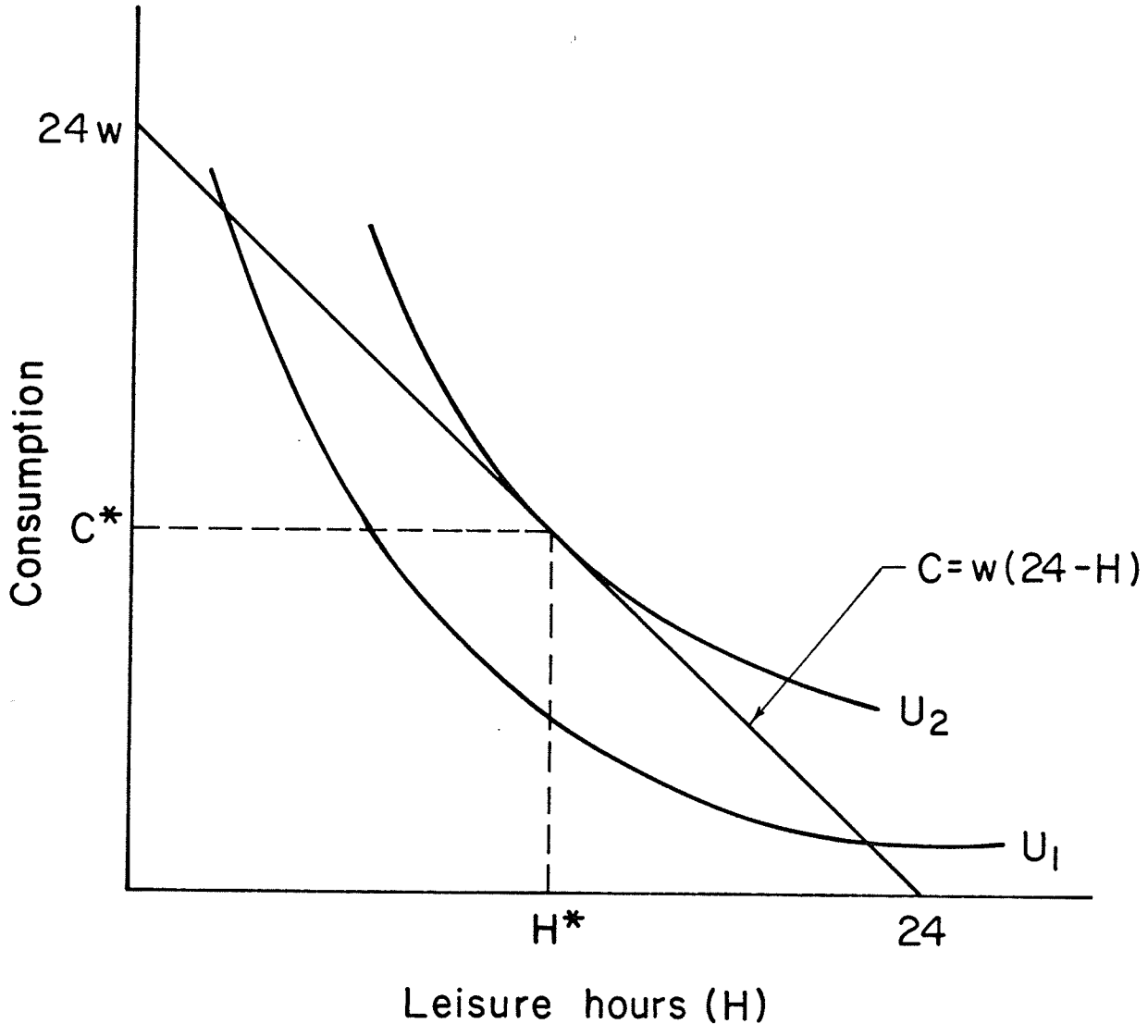
[32] A. Rees, The Economics of Work and Pay, Harper and Row, Publishers Inc., New York, 1973, p. 22.

Figure 1

Utility-maximizing Choice of Hours of Work
for a Non Self-employed Individual



Source: W. Nicholson, Intermediate Microeconomics and Its Application, p. 368.

utility by working 24-H* hours and consuming C*. At this point the marginal rate of substitution of H for C is equal to the real wage rate.

Labor-leisure choices may be affected by the real wage rate assuming that individuals have some choice in selecting hours of work. When the wage rate rises, so does the price of leisure. There will be a substitution effect and the effect on hours of leisure will be negative, ceteris paribus. At the same time, however, there will be an income effect. Since leisure is a normal good, the income effect will be positive. Without explicit knowledge of the individual's preferences it is impossible to predict whether a change in the real wage rate will cause an increase or a decrease in the demand for leisure (or conversely, the supply of labor).[33]

The supply of labor curve for individuals is obtained by calculating the number of hours that they are willing to work at each real wage rate. The supply of labor curve can either be upward sloping or 'backward bending.' The former indicates that at high wage rates the individual chooses to work longer hours so the substitution effect of a higher wage rate outweighs the income effect. The backward bending supply curve indicates that once real wages exceed a certain level, even higher wages induce the individual to work fewer hours. The income effect at relatively high wage rates outweighs the substitution effect.[34] In the short run the supply of labor curve for the individual is almost always more inelastic than in the long run.

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[33] W. Nicholson, Intermediate Microeconomics and Its Applications, The Dryden Press, Illinois, 1975, pp. 366-372.

[34] Ibid., p. 373.

In the case of self-employed individuals, the marginal rate of substitution is not constant. It is determined by the hours of work which are in turn determined simultaneously with the level of output of the business.[35] This is true in the case of farm operators. Their supply of labor is influenced not only by the real wage rate for off-farm work, but also by the level of farm output. The marginal rate of substitution depends, therefore, on the number of hours of farm work.

Bollman (1979a) specifies the supply of operator's labor in a family farm context as part of a larger model to explain off-farm work by farmers. The variables that he chooses for the supply portion of the model are the number of non-working family members (as a proxy for the size of the consumption bundle), the spouse's years of schooling and presence or absence of vocational training (as a measure of the spouse's wage rate), the unemployment rate and population density in the census district, the years of schooling and presence or absence of non-agricultural vocational training of the operator (as a proxy for the wage rate faced by the operator), and non-earned income of the family. The remainder of the model and the results obtained will be discussed with the explanation of the kinked demand for labor curve.

Jones (1978) estimated a simultaneous model to explain the supply and demand for operator labor on the farm (also models for unpaid family labor and hired labor) in the Prairie provinces from 1954-1973. This model was similar to the model in the the study by Tyrchniewicz and Schuh (1969), an econometric analysis of the agricultural labor market. The

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35 R. Bollman 'Off-farm Work by Farmers: An Application of The Kinked Demand for Labour,' Canadian Journal of Agricultural Economics, Vol 27, No. 3, November, 1979, p.48.

variables used in the supply of operator labor equation and the expected signs on each coefficient are as follows: adjusted nonfarm wage rate as a measure of the returns available if the operator were to leave farming (-), the size of the labor force (+), a trend variable (?), owner's equity per farm (+), supply lagged one period (+), hired labor (-), unpaid family labor (-) and net farm income (+). (The dependent variable is operator labor supplied to agriculture or operator labor employed in agriculture.)

For the Prairie region as a whole, the trend variable and the size of the labor force are positive and significant, the nonfarm wage, hired labor and unpaid family labor are negative and significant. The other variables are insignificant at the 5 percent level. All results are consistent with the signs hypothesized with the exception of the insignificance of owner's equity, operator labor lagged and net farm income.

When disaggregated to the provincial level, the results indicate that there are differences among the labor markets for the three provinces. Jones reported that unpaid family labor and operator labor appear to be complements, hired labor and unpaid family labor appear to be substitutes but no consistent relationship exists between operator and hired labor.

3.2 DEMAND FOR OPERATOR LABOR

The basic purpose of a theory of the demand for labor is to determine how much labor employers will want to employ at different wage rates . This is true whether or not individuals are self-employed and, therefore, demanding their own labor (and perhaps the labor of others).

The theory of the demand for labor is an application of the marginal productivity theory of the demand for factors of production. Generally speaking, two or more factors cooperate in the production of a given output. Since labor is one factor of production and the result of the combination of factors is the final product, the demand for labor is a derived demand. An employer will engage more labor as long as the value of the marginal output is greater than the wage that must be paid at the margin. The relationship between marginal productivity and the amount of labor employed is governed by the Law of Diminishing Returns.[36]

This law is static in the sense that it assumes a given level of technical knowledge. Under these static conditions, and in a single input case, the lower the wage the greater the amount of labor demanded. Thus the demand for labor is downward sloping (see Figure 2).

The case of two or more inputs is more complex. A change in the price of one factor will result in a change in the demand of not only that factor but other factors as well, since the employer will want to choose a new cost-minimizing bundle of inputs.[37] There are substitution and output effects to be considered in this case. When the price of labor falls, the substitution effect would ceteris paribus cause more labor to be purchased (holding output constant). It is not, however, legitimate to hold output constant. The change in the capital/labor price ratio will cause a shift in the firm's marginal cost curve and a higher level of output will be chosen (see Figure 3). The substitution effect

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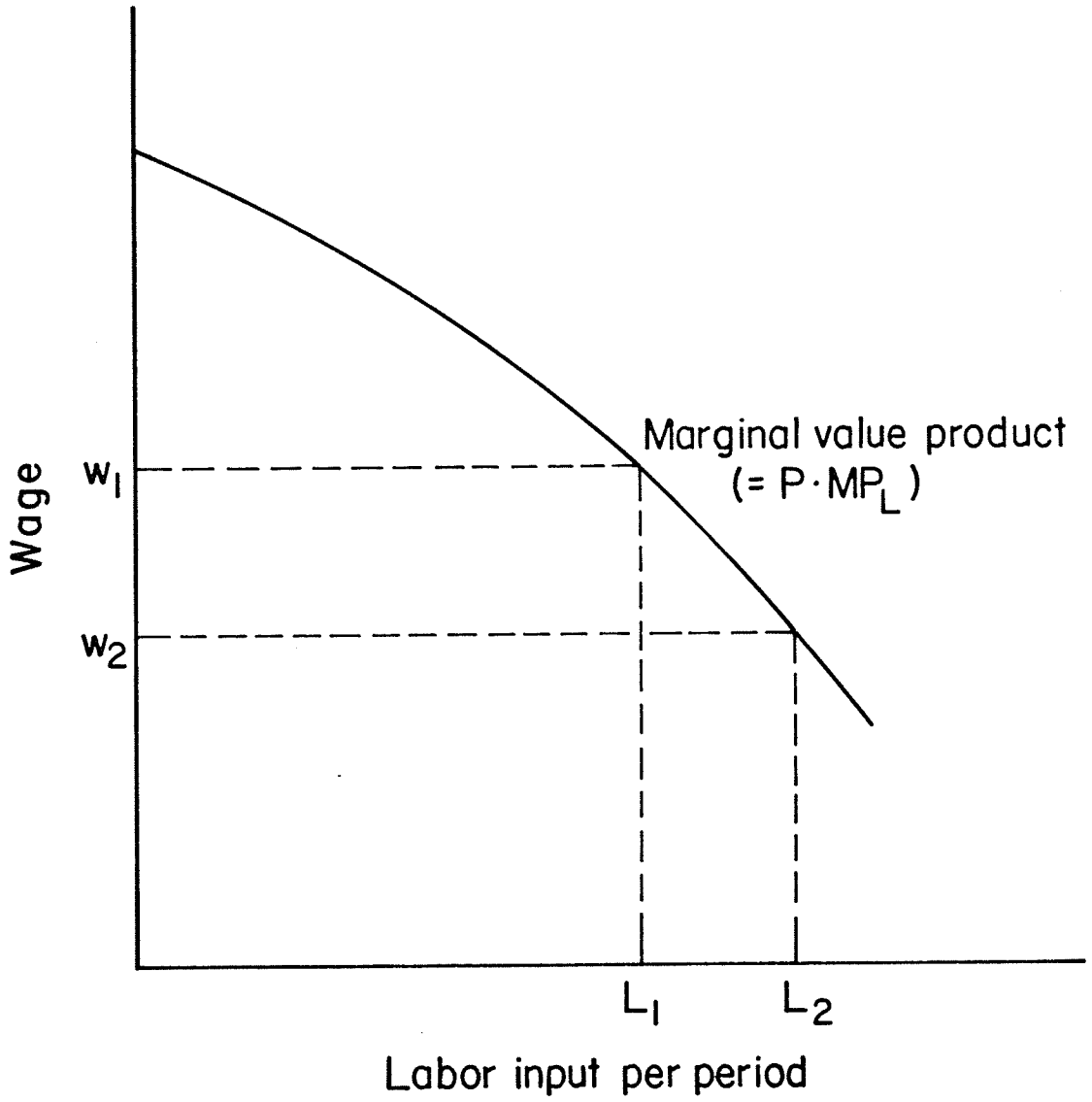
[36] K.W. Rothschild, 'The Demand for Labour' in Readings in Labor Market Analysis, J.F. Burton, L.K. Benham, W.M. Vaughn III, R.J. Flanagan, editors, Holt, Rinehart and Winston, Inc., U.S.A., 1971, p. 22.

[37] Nicholson, op. cit., p. 347.

Figure 2

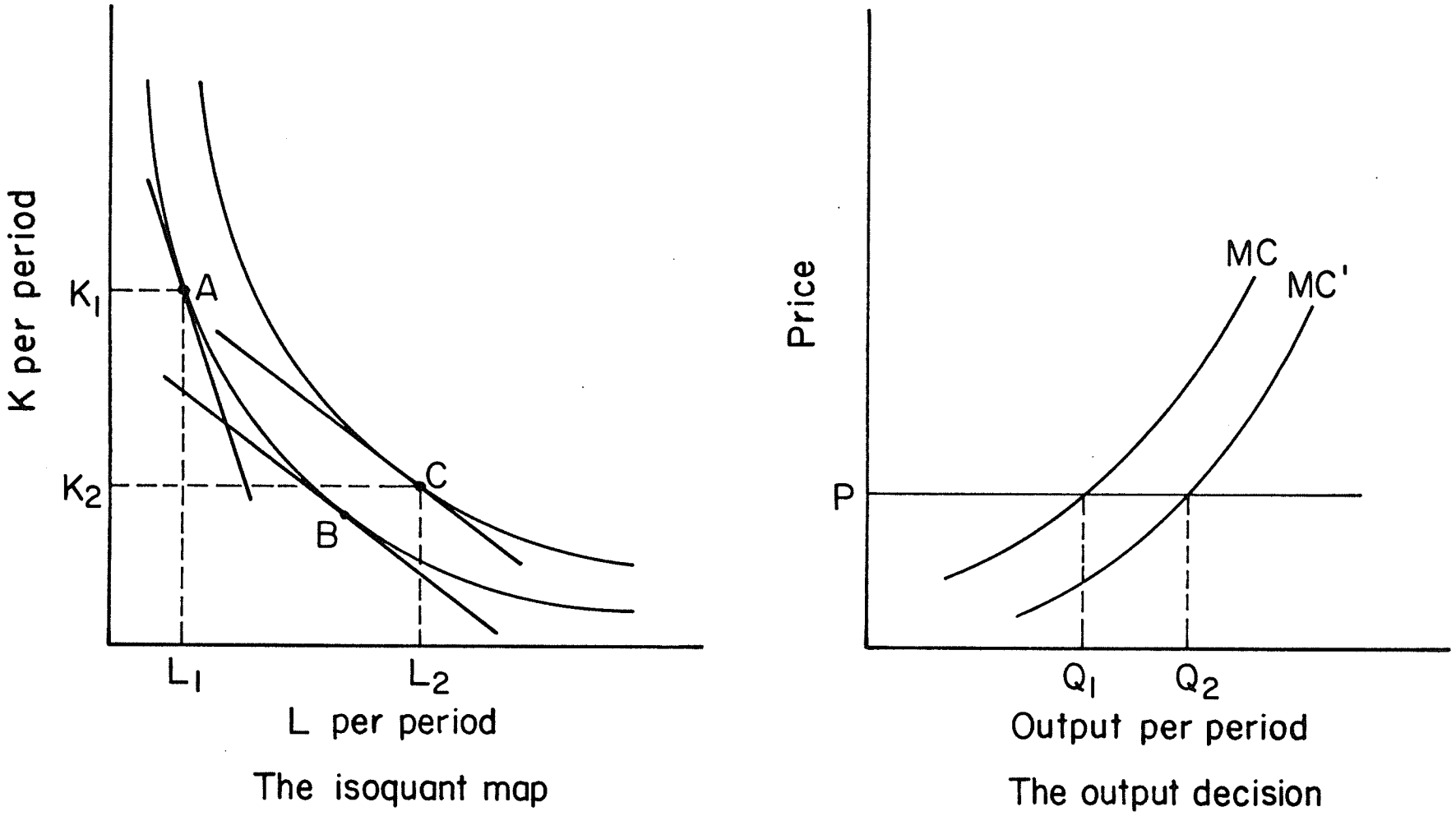
Choice of Labor Input in the Single Input Case



Source: W. Nicholson, Intermediate Microeconomics and Its Application, p. 346.

Figure 3

Substitution and Output Effects of a Decrease in the Price of a Factor



Source: W. Nicholson, Intermediate Microeconomics and Its Application, p. 348.

is shown by a move from point A to point B, the output effect by a move from point B to point C. Thus both effects act to cause an increase in the demand for labor when the price of labor falls.

The study by Bollman (1979a) specifies the demand for operator labor both on and off the farm. Demand for operator labor on the farm is a function of the value of agricultural products sold, total acres on the farm, the value of machinery and equipment, the value of livestock, the sum of expenditures on variable inputs, the amount paid for hired labor, the number of unpaid family workers. Demand for operator labor off the farm is influenced by; the operators' years of schooling and whether or not they have taken agricultural vocational course (as a proxy for the off-farm wage), the male unemployment rate in the census division where the operator resides and the population density in the census division where the operator resides.

Jones (1978) estimates the demand for operator labor on the farm as a function of the real farm price index (+), an index of productivity (-), a trend variable (?), demand for operator labor lagged one period (+), hired labor (-), unpaid family labor (-) and net farm income (+). (Hypothesized signs are shown in brackets.) As mentioned earlier, the equation is a part of a simultaneous system to solve for supply and demand. For the Prairie region the real farm price index, the productivity index, operator labor lagged and unpaid family labor are positive and significant. Net farm income is negative and significant. This result is contrary to hypothesis as is the positive sign on unpaid family labor. The sign on the productivity index variable is also unexpected. The results at the provincial level differed somewhat. (Jones suggests

that this may be the result of the way in which data had to be estimated at the provincial level.)

3.3 HUMAN CAPITAL AND WORK BEHAVIOUR

The theory on the accumulation of human capital and the way in which individuals allocate their time over the life-cycle is important to the understanding of the work behaviour of entering farm operators.

Blinder and Weiss (1976) describe four distinct phases in an individual's life-cycle: schooling, on-the-job training (OJT), work, and retirement.[38] Human capital is accumulated during the schooling phase and most of the on-the-job training phase (the time profile of human capital shows it peaking near the end of the OJT phase and declining thereafter).[39] More than one cycle may occur within the lifetime of an individual (although the authors define a "normal" life cycle as one in which schooling comes first, followed by OJT, work and then retirement).[40] A cycling path can be broken down into several "quasi life cycles" and can thus allow an individual to be involved with more than one occupation during a lifetime. The operators are assumed to be utility maximizing individuals free to allocate their daily time budget among leisure, work and education.[41] Steeper (1975) states that human capital does not differ conceptually in any way from physical capital and that individuals change occupations when the discounted lifetime utility flow

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[38] A. Blinder and Y. Weiss, 'Human Capital and Labor Supply: A Synthesis,' Journal of Political Economy, 1976, pp. 451-452.

[39] Ibid., p. 466.

[40] Ibid., p. 461.

[41] Ibid., p. 470.

that they expect from their portfolio of human and physical capital following the change is greater than that which they expect from their existing portfolio.[42]

Huffman (1980) discusses the role of human capital in farm and off-farm work decisions and concludes that the education of both the farm operator and the spouse are important to the off-farm participation rate.[43] Thus, Huffman's model employs the underlying notion of the kinked demand for labor curve, which will be described next.

3.4 THE KINKED DEMAND FOR LABOR CURVE

The notion that the decision to work off-farm is a matter of opportunity cost is proposed by Bollman (1978). Under his theory the demand for the operator's labor is divided into two portions: a downward sloping portion, VV^1, for on-farm work and a horizontal portion, ZZ^1, for off-farm work (see Figure 4). The horizontal portion assumes that the farmer is a price taker in the off-farm job market. The height of the horizontal portion is determined by the off-farm wage which is in turn determined by the education and age of the operator. As the wage rises, the opportunity cost of working on the farm becomes higher. As the downward sloping portion of the curve moves outward (due to increased size of the farm, increased value of agricultural products sold, increased labor requirements, etc.) holding the off-farm wage constant,

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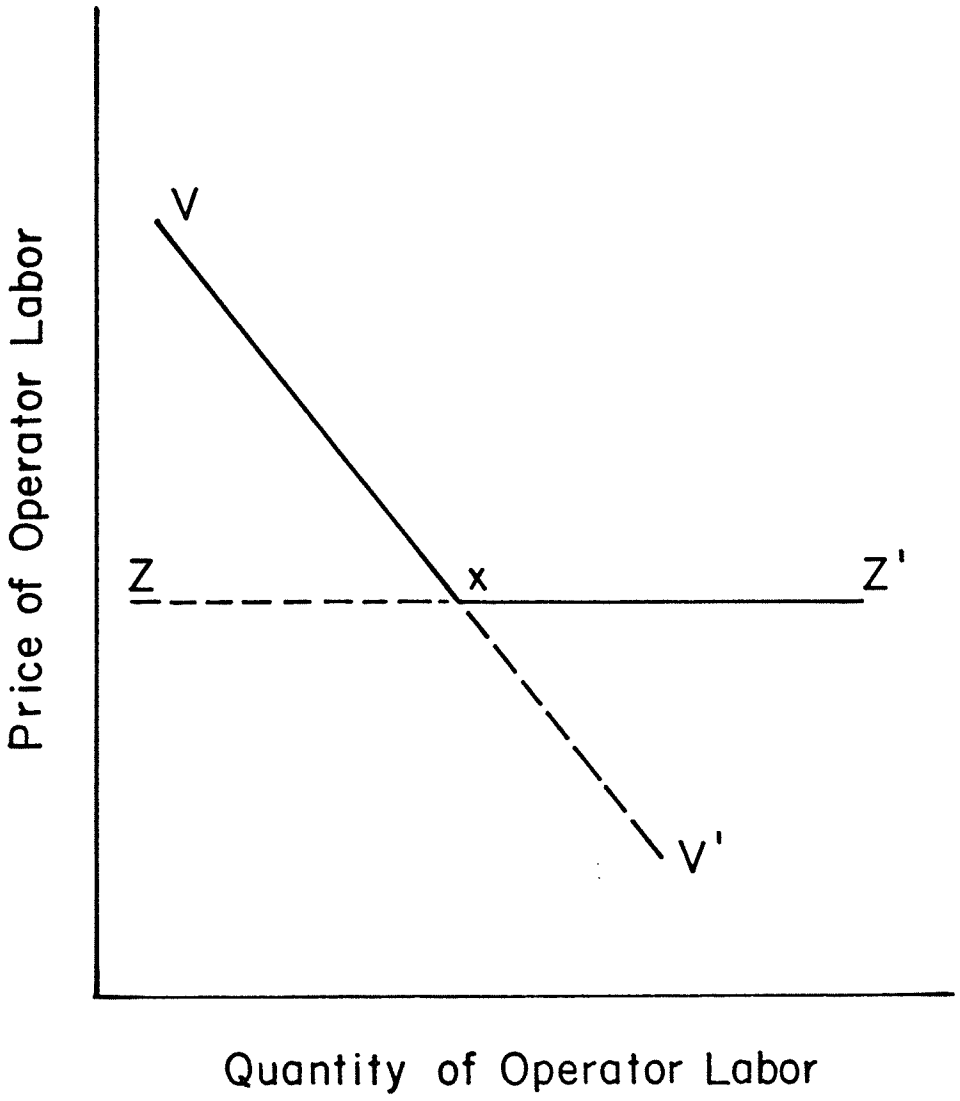
42 N. Steeper, 'A Portfolio Adjustment Applied to U.S. Farmer's Families, 1945-1970,' unpublished Ph.D. Thesis, North Carolina State University, 1975, p. 4.

43 W.E. Huffman, 'Farm and Off-Farm Work Decisions: The Role of Human Capital,' The Review of Economics and Statistics, February 1980, p. 21.

Figure 4

The Kinked Demand For Labor Curve



Source: R.D. Bollman, 'Off Farm Work by Farmers,' p. 30.

the farm operator will devote more time to on-farm work.[44] The demand curve facing the operator is thus kinked and is represented in Figure 4 by the line VXZ^1.

The amount of time allocated by the operator to farm and off-farm work is determined (in terms of the kinked demand curve) by whether the supply of labor curve is to the left or the right of the kink. The operator's supply of labor curve shifts depending on the price of consumption goods, the real wage rate facing the operator, and the real wage rate facing the operator's spouse (or other members of the family) in the case of a family farm. If the supply of labor curve falls to the left of the kink, then the operator is a full-time farmer. If, however, the supply curve falls to the right of the kink, then the operator devotes some time to off-farm employment activities. Figure 5 shows an equilibrium solution with some off-farm work. The operator works a total of OC hours during the year. Of these hours, OB are worked on the farm, and BC are worked off the farm. According to Bollman, the total number of hours worked, the number of hours worked on and off the farm, and the labor return per marginal hour of work all depend on the relative positions of the operator's demand for labor on and off the farm and the operator's supply of labor.[45]

The kinked demand for labor curve incorporates the human capital theory discussed earlier. Shifts in the demand for operator labor on

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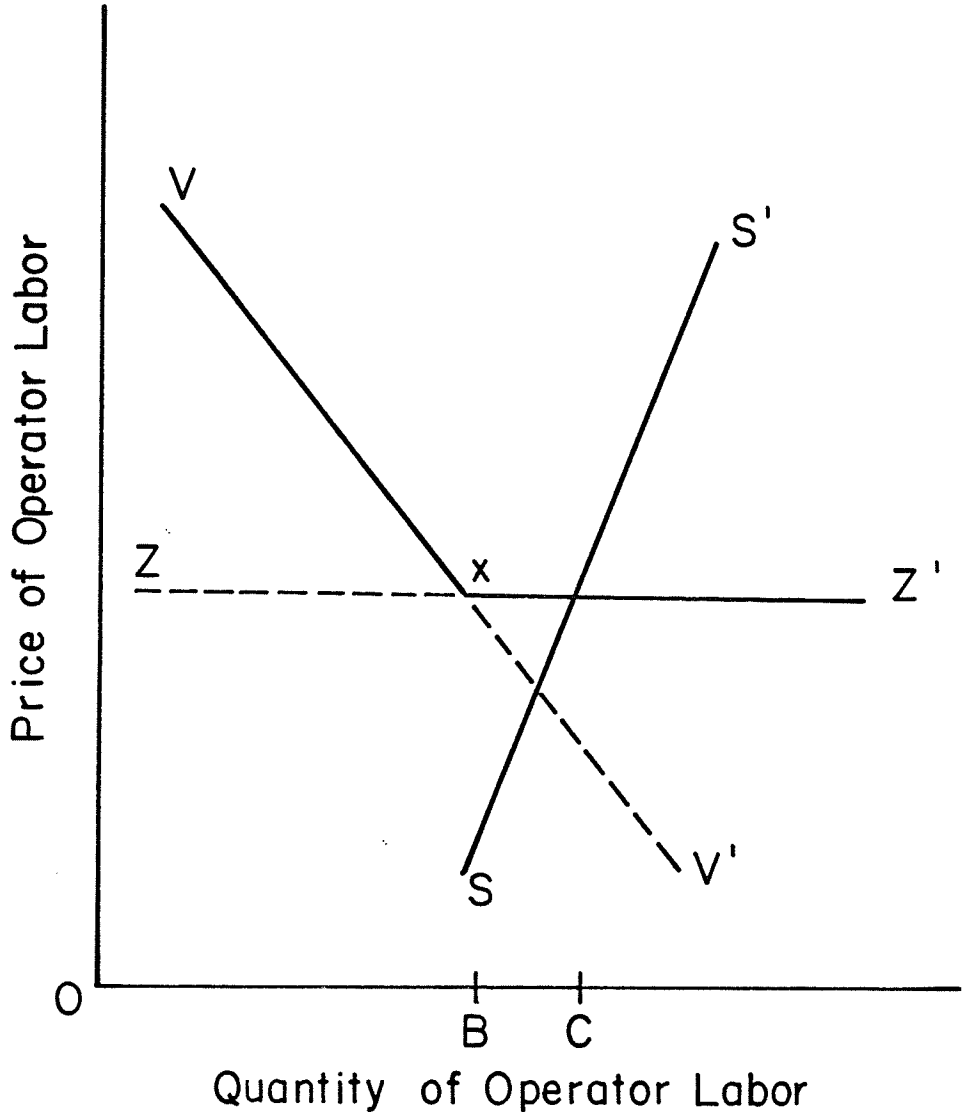
[44] R.Bollman, op. cit., 'Off-farm Work by Farmers: A Study With a Kinked Demand for Labour Curve' pp. 25-36.

[45] Ibid.

Figure 5

Equilibrium Solution With Some Hours of Off-farm Work



Source: R.D. Bollman, 'Off Farm Work by Farmers,' p. 33.

and off the farm and in the supply of labor are influenced by the returns to the operator's marginal hour of labor. These returns are influenced by the level of education of the operator (and, in the case of the supply of labor, by the spouse's education level). Thus the supply of and demand for operator labor, the human capital approach to explaining work behaviour, and the kinked demand for labor curve are all closely related. The conceptual models used to investigate the off-farm work behaviour of entering farm operators are based on the kinked demand model. The models and data used to estimate the relationships are described in Chapter 4.

3.5 A TARGET INCOME APPROACH TO MULTIPLE JOBHOLDING

The phenomenon of occupational diversity[46] is explained by Sharir (1976) as the result of financial pressures which indicate that individuals have some notion of how much they should earn.[47] Sharir cites Katona's theory of consumer behaviour in support of the notion of the target income. This theory suggests that work effort may be the function of predetermined consumption needs or wants.[48] The study assumes that the stream of (consumption) expenditures is given and that an earnings target motivates work choices.[49] The empirical model developed by Sharir postulates a positive relationship between the magnitude of debt and the

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[46] Occupational diversity in the context of this study refers to the potential ability of a farm operator to combine farm and off-farm work.

[47] S. Sharir, 'Work Choices Under an Earning Target: The Case of Multiple Jobholding,' Research Paper No. 77-1, Department of Economics, University of Alberta, 1976, p. 2.

[48] Ibid. p. 4.

[49] Ibid., p. 23.

probability that an individual is a multiple job holder. The dependent variable in the model is either the number of multiple jobholders, the number of multiple jobholders per household, or the multiple jobholding rate. The state of the economy is controlled for by the use of the unemployment rate. The growth of the economy is adjusted for by the number of households and a time trend variable is included in the analysis. The proxy used in the model for the earnings target is real private debt per household. The results support the hypothesis and are interpreted to imply that consumption aspirations, or the earnings target, have a positive effect on multiple jobholding.[50]

The theory associated with the target income model suggests that off-farm work is necessary as a mechanism for entry into agriculture. Nonfarm income contributes to an earnings target that is perceived by the entering farm operator as necessary to overcome financial entry barriers. Thus the entrant engages in off-farm employment activities in order to meet the financial obligations associated with starting the farming business. The operator has a predetermined level of consumption and must meet a certain earnings target. The target income notion will be investigated further in the next chapter.

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[50] Ibid., p. 19.

Chapter IV

THE CONCEPTUAL MODEL

The previous chapter introduced the theoretical bases for studies of the supply of and demand for labor. The purpose of this chapter is to introduce the conceptual models used to explain the off-farm work behaviour of entering farm operators. Two models are used since the availability of two different data sets permits the investigation of slightly different aspects of work behaviour. The variables will be defined and described and the hypothesized relationships will be proposed. A brief discussion of the techniques used to estimate the relationships will be presented. Finally, the data employed in the analyses will be described.

4.1 MODEL 1

The discussion presented in the introduction to this thesis suggests that the supply of entering farm operators may not be adequate to meet the needs of the agricultural industry primarily because financial barriers to entry have been rising relative to farm income. One way to investigate whether or not this is the case is to measure the ratio of capital per farm to net income per farm and to observe how it has changed over time. At the national level, the ratio has increased from 17:1 in 1971 to 33:1 in 1980.[51] For Manitoba, the ratio increased from

[51] Statistics Canada, 'Farm Net Income,' Catalogue No. 21-202P, Ottawa, 1970-1980.

13:1 in 1971 to 144:1 in 1980. (The ratio for 1980 reflects a particularly poor year for Manitaba farmers. In 1979 the ratio was 28:1.) In Saskatchewan the ratio increased from 11:1 in 1971 to 36:1 in 1980, while in Alberta it changed from 7:1 to 34:1. Several authors propose that off-farm work by entering operators presents a potential solution to the problem. One interpretation of this is that off-farm work has become necessary for many entrants into agriculture due to the severe financial obligations of farm entry. An alternative interpretation of the off-farm work behaviour of entrants is that they prefer some off-farm work to total involvement in farming. (This assumes that the operator's choice set includes an off-farm occupation.) Rather than leave an alternative occupation, new farmers may wish to continue to work there part-time because the returns to their expertise are relatively high. Thus off-farm work may be a matter of choice rather than of financial compulsion. The model in this section will attempt to differentiate these two views.

An entering farmer may choose a certain number of hours of farm and off-farm work in order to consume a bundle of goods and services to maximize utility subject to a budget constraint. A set of variables, (other than hours worked), b_i, determines farm income. These variables are the value of land, buildings and machinery (CAPITAL), the education of the operator and the spouse (SCHOP and SPSCH) and whether or not the farm is a single proprietorship (FARMORG). A second set of variables, c_i, determines potential off-farm hourly earnings. These variables are the operator's years of education (SCHOP) and the operator's work experience in years (WRKEXP). It is assumed that entering operators prefer

farm to off-farm work.[52] This is referred to as a utility maximizing model of off-farm work choice.

Rather than maximize utility, an entering farmer may attempt to achieve some target income. If this target depends on the financial obligation of starting an agricultural operation, then the larger the operation the larger the target, other factors held constant. The target income is a function of the variables CAPITAL and FARMORG. Under the utility maximizing model, farm income is determined by capital investment, (CAPITAL), the type of farm organization, (FARMORG), and the years of schooling of the operator and the spouse (SCHOP and SPSCH). The variables which determine the income target are thus a subset of the variables which determine farm income. Under the target income model, however, the decision-making process of the operator is somewhat different. The off-farm work decision is now determined by whether on-farm income satisfies the target income before it becomes more lucrative for the farmer to work off the farm. This assumes that the operator has no preference between farm and off-farm work if the return for the marginal unit of work is the same.[53]

Under this model of target income the effects of CAPITAL and FARMORG and the decision to work off the farm are ambiguous. Larger farms impose greater financial obligations to encourage off-farm work, but they also increase on-farm income to discourage off-farm work. The concern about off-farm work as a financial necessity for farm entrants implies that higher values of CAPITAL and FARMORG increase the likelihood of

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[52] Op. Cit., Schneider, p. 104.

[53] Bollman, op. cit., 'Off Farm Work by Farmers,' p. 29.

off-farm work. This is a maintained hypothesis adopted as part of the target income model. The alternative hypothesis generates similar predictions to those of the utility maximizing model. The target income satisficer under this alternative hypothesis is, therefore, indistinguishable from a utility maximizer and is treated as part of the utility maximizing model.

The dependent variable used in Model 1 is dichotomous in nature and reflects whether or not an entering farm operator works off the farm or has any off-farm employment earnings. It takes a value of zero if the entrant performed no hours of work off the farm and had no off-farm employment income and one otherwise. Off-farm work includes any work done for wages or salaries, any nonfarm self-employment activity and any custom work performed by the operator. The variable is called OFFWORK.

The first independent variable (CAPITAL) is a measure of the present market value of land and buildings plus the total market value of machinery. The target income theory discussed earlier proposes a positive relationship between the magnitude of debt and the probability that an individual is a multiple job holder. For an entering farm operator then, a higher value of CAPITAL would mean an increase in the probability that the farmer has some off-farm employment, assuming that the operator has borrowed to finance the purchase of these assets.

If however, the decision to work off the farm is a matter of maximizing utility, the hypothesized relationship is negative. A larger investment in land, buildings and machinery would likely result in a higher return to the marginal hour of labor input on the farm. The value of the marginal product shifts outward and the opportunity cost of working off the farm increases, other factors held constant.

Another independent variable in the model describes the effect of the organization of the farming business on the dependent variable. The variable takes a value of 0 if the operation is a single proprietorship and 1 if it is a partnership or a corporation, and is called FARMORG. The target income theory suggests that FARMORG is negatively related to OFFWORK since under an arrangement other than a single proprietorship, the financial obligation involved in starting the farm business would be shared. The operator would require a lower target income to finance his share of the capital necessary to maintain participation in the industry.

The opportunity cost theory proposes that the relationship will be positive. The existence of a partnership or corporation shifts the value of the marginal product (for the individual) inward since on-farm earnings must be shared. Thus the opportunity cost of working on the farm is greater with a partnership or corporate structure. The signs on the remaining variables are the same under both models.

The years of schooling of the operator (SCHOP) is considered important to the decision to work off the farm. It is, in part, a measure of the accumulated human capital of the recent entrants. The operator's education may have an impact on both potential on and off farm earnings. If a higher level of education makes the entering operator a more efficient manager, the value of the marginal product shifts outward and the effect on OFFWORK will be negative. At the same time, a higher level of education increases the potential wage level available to the farmer in off-farm work and a positive relationship results. The predicted relationship between SCHOP and OFFWORK is, therefore ambiguous. The estima-

tion of the empirical model may determine whether or not one of these relationships over-shadows the other.

The level of schooling of the operator's spouse (SPSCH) is expected to have a negative impact on the dependent variable. The number of years of education completed by the spouse is used as a measure of potential off-farm earnings. As the wage level increases, the spouse may find it more lucrative to work off the farm. The returns to labor on the farm will, therefore, be concentrated on the operator, whose opportunity cost of working on the farm will decline.

Finally, the relationship between OFFWORK and the potential years of work experience of the entering farmer will be investigated. The variable (WRKEXP) subtracts the years of schooling of the operator from the operator's age. Controlling for other factors, as the potential off-farm work experience increases, human capital increases as does the opportunity cost of work on the farm.

The proposed relationship is, therefore:

$$\text{OFFWORK} = a + b_1\ \text{CAPITAL} + (b_2+c_1)\ \text{SCHOP} + b_3\ \text{SPSCH} + b_4\ \text{FARMORG} + c_2\ \text{WRKEXP} + u$$

Table 11 summarizes the relationship and indicates the hypothesized signs associated with the utility maximizing model and the target income model. The utility maximizing model proposes a negative sign on capital and a positive sign on the farm organization variable (FARMORG). The target income model hypothesizes a positive sign on capital and a negative sign on FARMORG. Both models propose a negative sign on SPSCH, years of schooling of the spouse and a positive sign for WRKEXP, the years of work experience of the operator. The sign of SCHOP, years of

Table 11

Variable Description and Hypothesized Relationships
(Model 1)

Variable Name	Variable Description	Expected Sign Utility Maximizing Model	Expected Sign Target Income Model
OFFWORK	= 1 if the operator had some days of off-farm work in 1977 or some off-farm employment income in 1977; = 0 otherwise	dependent variable	
CAPITAL	market value of land and buildings, machinery and equipment	-	+
SCHOP	years of schooling of the operator	?	?
SPSCH	years of schooling of the spouse	-	-
FARMORG	= 0 if the operation is a single proprietorship = 1 otherwise	+	-
WRKEXP	work experience of the operator (age of the operator minus years of schooling)	+	+

schooling of the operator is ambiguous under both models. As a further test of the opportunity cost approach, the difference in work behaviour of entering and established farmers will be examined. Theory would suggest that the two groups would allocate their time (between farm and nonfarm work) differently since human capital depreciates over time. In other words, established farmers may find that as they become more experienced in farm work and as their off-farm work skills deterioriate, they will find it more lucrative to work on the farm. The model will, therefore be estimated for entrants, established farmers and for the entire farm population and the results will be compared. The signs and significance of the independent variable will be observed to see whether they support the target income notion or the utility maximizing notion.

4.1.1 Empirical technique.

As discussed earlier, the model to explain the choice between on and off-farm work has a dichotomous dependent variable. A variety of models may be specified to analyze the behaviour of this type of model.

A common method for this type of econometric analysis is the ordinary least squares regression (OLS). One major problem with the use of OLS in this context is the violation of the $0 \leq E\ (Y_i \mid X_i) \leq 1$ condition (where Y is the dependent variable and X_i's the independent). It is quite common for the estimates in an OLS model to lie outside the [0,1] range, making interpretation of the estimated probabilities difficult.

Another important consideration when using OLS in the case of a dichotomous dependent variable is that OLS results in a heteroskedastic error term. The estimated coefficients are unbiased but inefficient.

An alternate technique for the estimation of the equation is a multivariate logit model. The logit model is based on the cumulative logistic probability function

$$P_i = F(Z_i) = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-(\alpha + \beta X_i)}}$$

where e is the base of natural logarithms (e = 2.718) and P_i represents the probability that an individual will make a certain choice, given knowledge of Xi. The equation to be estimated is obtained from the cummulative logistic probability function as follows:

$$(1 + e^{-Z_i}) P_i = 1$$

$$e^{-Z_i} = \frac{1-P_i}{P_i}$$

$$e^{-Z_i} = \frac{P_i}{1-P_i}$$

$$Z_i = \log\left(\frac{P_i}{1-P_i}\right)$$

$$\log\left(\frac{P_i}{1-P_i}\right) = \alpha + \beta X_i$$

The dependent variable is the logarithm of the odds that a particular choice will be made. Multivariate logit analysis will ensure that predicted probabilities will lie within the [0,1] interval. Furthermore,

because it is a maximum likelihood estimation procedure, it yields coefficient estimates that are asymptotically unbiased, efficient and consistent.[54]

The dependent variable under this model becomes

$$OFFWORK = \log \frac{P_i}{1-P_i}$$

which is the log of the odds that an entrant will work some hours off the farm. It should be noted that because the dependent variable is the log of the odds that the operator will engage in off- farm employment, the interpration of the coefficients is somewhat difficult.

4.1.2 Data description.

The data used to estimate Model 1 was taken from the 1978 Saskatchewan Agriculture Enumerative Survey (AES). The AES is a probability survey conducted by Statistics Canada across Canada from 1972 to 1977. In 1978, it was conducted in the Atlantic provinces, Quebec, Ontario, Saskatchewan and British Columbia. The questionnaire used in Saskatchewan in 1978 was unique due to the addition of several sections of information. These sections supplied data on the value of machinery and equipment, land and buildings, nonfarm income received by the operator, years of farming and a fairly detailed set of questions on farm labor patterns.[55]

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[54] R.S. Pindyck and D.L. Rubinfeld, Econometric Models and Economics Forecasts, second edition (New York: McGraw-Hill Book Company, 1981) p. 311.

[55] Statistics Canada, Documentation for the Release of Tape from the 1978 SAskatchewan Enumerative Survey, Ottawa, 1979, p. 1.

The survey sampled 4,150 farms, 142 of which were termed specified farms and were sampled with probability 1. The remainder of the farms were sampled with a probability of less than 1 and an expansion factor was attached to each. The expansion factor was used to blow up the data for each sampled farm in the area sample to produce estimates at the provincial level.[56]

The 1978 Saskatchewan AES provided a sample of usable records of the activities of individual farmers as at July 1, 1977. Of the farmers on the file, 495 were identified as entrants (those that had been farming less than five years on July 1, 1977). The micro-data provided the information to construct the multivariate logit model described previously.

4.2 MODEL 2

The kinked demand for labor curve was developed by Bollman (1978) to estimate the probability that a census-farmer reports some off-farm work.[57] This model uses a dichotomous dependent variable to determine the characteristics associated with off-farm work and to estimate the impact of a change in any of the characteristics on the probability of reporting off-farm work.[58] Bollman estimated the equation for all farmers in Canada. The equation in this thesis will be estimated for entering farm operators in the Prairie provinces.

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[56] Ibid., p. 2

[57] R.D. Bollman, 'Off Farm Work by Farmers,' Statistics Canada, Census Analytic Study, Catalogue No. 99-756, Ottawa, 1979, p. 41.

[58] Ibid.

The dependent variable OFFWORK takes a value of 1 if any days of off-farm work are reported by the entrant (including custom work performed off the holding) or if any off-farm employment income is reported, otherwise it has a value of 0.

The independent variables are grouped in the following manner: demand for operator's labor on the farm, demand for operator's labor off the farm, supply of operator's labor and conditioning variables. Bollman (1979a) explains the conditioning variables by saying that they are introduced in order to take into account the variables that are not expected to be randomly distributed among individuals. Thus, a better estimate of the effect solely attributable to a relevant variable is obtained; in other words, the analysis can proceed stating that all other influences are held constant.[59] The model estimated in this thesis will follow the format described above.

4.2.1 Demand for operator labor on the farm.

Theoretically, the demand for operator labor on the farm is a function of the prices of the other factors of production for that farm. Data on prices are not available for this study so other variables are used as proxies for prices. In order to do this, it is necessary to assume that prices are fixed. Differences in behaviour are the result of different preferences. This is a common assumption in cross-section analysis.[60]

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[59] Ibid., p. 124.

[60] Ibid., p. 109.

The variables used to explain the demand for the farmer's labor on the farm are the value of agricultural products sold (SALES) the total acres of land (LAND), the value of machinery and equipment (MACH), the value of livestock (VL), the value of variable inputs (VIN), the amount of wages paid to hired labor (WGPD), the number of unpaid family members who help on the farm (NUFM), and the operator's level of education (SCHOP). The operator's level of education is included as a measure of accumulated human capital, which impacts upon returns to labor on the farm.

The variable SALES is a measure of the scale of the farming operation. As the scale of the operation increases, the demand for operator labor on the farm will also increase and the probability of working off the farm will decrease. The expected sign on the variable is negative. As discussed in the description of Model 1, the target income theory would propose that the higher the level of capital (LAND, MACH, VL) involved in the new operation, the higher the expected debt level and the more likely the entering operator is to work off the farm. Under this theory, then, one would expect a positive sign on these three variables.

The utility maximizing model suggests that an increase in capital will shift the value of the marginal product to the right. The hypothesized signs on the variables which indicate the capital invested in the operation are thus negative.

It is expected that the wages paid to hired workers and the number of unpaid family workers are substitutes for the operator's labor. The hypothesized signs on these variables are positive.

The years of schooling completed by the operator and whether or not the operator has a non-agricultural vocational training course are, in part, a measure of the human capital accumulated. As discussed earlier, an increase in education is likely to make the operator a more valuable asset to the farm business and, therefore, increase the demand for operator labor on the farm (decrease the probability of off-farm work).

4.2.2 Demand for operator labor off the farm.

In theory, the demand for operator labor off the farm is a function of the price of operator labor and the commuting distance to the off-farm job (which affects the total wage received by the operator. The variables used to estimate the demand for the operator's labor off the farm are the operator's years of schooling (SCHOP), whether or not the operator has any non-agricultural vocational training (VT), the unemployment rate for males in the census division where the operator resided (MU) and the percent of the population that was urban in the census district (PCURB).

The years of schooling and the vocational training variables are used as proxies for the wage rate available to the operator (price of operator labor). It is expected that as the potential off-farm wage rate rises, the opportunity cost of working on the farm will increase and the operator will work in a nonfarm job. The hypothesized signs on these variables is, therefore, positive.

The male unemployment rate variable was used to measure the general degree of demand for off-farm employment in the census division. A negative relationship is proposed between OFFWORK and MU since as the unemployment rate increases, the demand for labor is expected to decrease.

The percent of the population that is urban is meant as a measure of the commuting costs faced by the operator. It is a proxy for employment density. A higher urban population could indicate more jobs and less commuting time and the hypothesized relationship is positive.

4.2.3 Supply of operator labor.

The variables which influence the supply of operator labor are the price of consumption goods (estimated here by the size of the consumption bundle), the potential wage rate of the operator, the potential wage rate of the spouse and non-earned income.[61]

A good indication of the size of the consumption bundle for the family is the number of family members. Those family members who work on the farm have already been accounted for in the section dealing with the demand for operator labor on the farm. It was hypothesized there that the larger the number of unpaid family workers, the higher the probability of off-farm work. In this section, the larger the family the larger the consumption bundle and the higher the probability of off-farm work. To include the unpaid working family members in both categories would constitute double counting.[62] Thus only the non-working family members (TNWFM) are considered in this portion of the analysis. As previously explained the hypothesized relationship between OFFWORK and TNWFM is positive.

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[61] Ibid., p. 117.

[62] Ibid., p. 118.

The potential wage rate of the operator is measured as discussed earlier. The relationship expected here is positive, since at higher wage rates (at least up to a relatively high rate) the operator is willing to supply more labor.

The potential wage rate of the spouse is proxied by the years of education completed by the spouse (SPSCH) and SVT, a variable indicating whether or not the spouse has any vocational training. A negative sign is expected on these variables since as the potential wage rate increases, the spouse will be more likely to work off the farm. On- farm returns will be concentrated with the operator, who will thus be less likely to work off the farm.

The probability that the spouse will be able to obtain work off the farm is influenced by the unemployment rate (represented here by the male unemployment rate (MU) in the census division where the operator resides). As discussed earlier, MU is expected to have a negative impact on the probability that the operator will work off the farm, Pr(OFFWORK). At the same time, an increase in MU implies a decrease in nonfarm work opportunities for the spouse. If the spouse is less likely to work off the farm, then Pr(OFFWORK) increases. The sign on the variable MU is, therefore, ambiguous since it depends on which effect is stronger.[63] The same argument may be presented for the variable used to measure the cost of commuting (PCURB).

The variable to measure non-earned income is defined as:

> The total family income minus the wages and salaries, farm self-employment income, non-farm self-employment income and other government income received by all family members.[64]

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[63] Ibid., p. 119.

Non-earned income (NEI) was defined in this way so that labor supply would not affect it in any way. The hypothesized relationship between NEI and OFFWORK is negative since a larger value of non-earned income would decrease the supply of operator labor.

4.2.4 Conditioning variables.

A number of conditioning variables are included in the analysis for reasons discussed earlier. These variables include the age and sex of the operator, the number of months of residence on the farm, the type of organization (proprietorship or otherwise) and the type of operation (dairy, wheat, etc.) on the farm in question.

The age of the operator may influence factors which impact on demand for operator labor on and off the farm and on supply of operator labor. Bollman (1979a) suggests that age may be a proxy for the degree of disequilibrium in the capital stock, differences in the utility functions of individuals, attitudes toward risk and differences in the state of health as well as other factors. He also hypothesizes that age is important when considering the question of occupational choice. Over time, an individual may accumulate human capital that is occupation specific. Once this occurs, the cost of switching occupations becomes larger as the potential wage rate in the alternate occupation declines relatively.[65] The opportunity to be a multiple job holder may also decrease.

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[64] Ibid.

[65] Ibid., pp. 122-123.

The sex of the operator is included as a variable in the analysis to take into consideration the fact that in 1971, 3.8 percent of census-farm operators were female.[66] The variable SEX will have a value of 1 if the operator is female, and 0 if the operator is male.

A measure to take into account the number of months that the operator resides on the farm is included in the analysis as a series of dummy variables (MON5-8, MON1-4, MON-0). The variables indicate whether the operator lived 5 to 8, 1 to 4 or 0 months on the farm. The 9-12 months class is the omitted group.

The type of operation, whether single proprietorship or otherwise (institutional farms are excluded) is included as a conditioning variable, although as discussed in Model 1 it may be hypothesized to have a negative relationship with OFFWORK under the target income theory and a positive relationship under the human capital theory.

Finally, a series of dummy variables is included to investigate the impact of different types of enterprises on the probability of off-farm work. The omitted class is dairy farms. The types of enterprises considered are livestock, poultry, wheat, small grains, field crops, fruit and vegetables, forestry, miscellaneous specialty, mixed livestock, mixed field crops and mixed other.

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[66] Ibid., p. 124.

4.2.5 Model summary.

The model to be estimated is as follows:

Dependent Variable OFFWORK

a CONSTANT

Demand for Operator Labor on the Farm

$$b_1 \text{ SALES} + b_2 \text{ LAND} + b_3 \text{ MACH} + b_4 \text{ VL} + b_5 \text{ VIN} + b_6 \text{ WGPD} + b_7 \text{ NUFM} + b_8 \text{ SCHOP}$$

Demand for Operator Labor Off the Farm

$$c_1 \text{ SCHOP} + c_2 \text{ VT} + c_3 \text{ MU} + c_4 \text{ PCURB}$$

Supply of Operator Labor

$$d_1 \text{ SCHOP} + d_2 \text{ VT} + d_3 \text{ SPSCH} + d_4 \text{ SVT} + d_5 \text{ MU} + d_6 \text{ PCURB} + d_7 \text{ TNWFM} + d_8 \text{ NEI}$$

Conditioning Variables

$$e_1 \text{ AGE} + e_2 \text{ FARMORG} + e_3 \text{ SEX} + e_4 \text{ MON5-8} + e_5 \text{ MON1-4} + e_6 \text{ MON-0} + e_7 \text{ LIVST} + e_8 \text{ POULT} + e_9 \text{ WHT} + e_{10} \text{ SMGRN} + e_{11} \text{ FLDCRP} + e_{12} \text{ FRVEG} + e_{13} \text{FOREST} + e_{14} \text{ MSP} + e_{15} \text{ MLV} + e_{16} \text{ MFCR} + e_{17} \text{ MOTH}$$

Table 12

Variable Description and Hypothesized Signs
(Model 2)

Variable Name	Variable Descripttion	Expected Sign Utility Maximizing Model	Expected Sign Target Income Model
OFFWORK	=1 if the operator had some days of off-farm work or some off-farm employment income in 1971; =0 otherwise	dependent variable	
SALES	value of agricultural products sold ($,000)	-	-
LAND	total acres of land (,00)	-	+
MACH	value of machinery and equipment ($,000)	-	+
VL	value of livestock ($,000)	-	+
VIN	variable inputs ($,000)	+	+
WGPD	hired labor ($,000)	+	+
NUFM	number of unpaid family members that usually worked on the farm	+	+
SCHOP	years of schooling of the operator		
VT	non-agricultural vocational training of the operator (=1 if yes; =0 if no)	+	+
PCURB	percent of the total population in the census division that was non-rural		
MU	male unemployment rate in the census division where the operator resides		
SPSCH	years of schooling of the spouse	-	-
SVT	spouse has vocational training (=1 if yes; =0 if no)	-	-
TNWFM	total non-working family members	+	+

Variable Name	Variable Descripttion	Expected Sign Utility Maximizing Model	Expected Sign Target Income Model
NEI	non earned income ($,000) = total family income minus wages and salaries, farm self-employment income and other government income received by all family members	-	-
FARMORG	type of business organization of the farm (=1 if single proprietorship; =0 otherwise, institutional farms are excluded)	+	-
AGE	Age of the operator in years		
SEX	sex of the operator (=1 if female; =0 if male)		
MON5-8	operator resided on the farm 5-8 months (=1 if yes; =0 if no)		
MON1-4	operator resided on the farm 1-4 months (=1 if yes; =0 if no)		
MON-0	operator did not reside on the farm (=1 if yes; =0 if no)		
LIVST	the type of farm was livestock (=1 if yes; =0 if no)		
POULT	the type of farm was poultry (=1 if yes; =0 if no)		
WHT	the type of farm was wheat (=1 if yes; =0 if no)		
SMGRN	the type of farm was small grain (=1 if yes; =0 if no)		
FLDCRP	the type of farm was field crop (=1 if yes; =0 if no)		
FRVEG	the type of farm was fruit and vegetable (=1 if yes; =0 if no)		

Variable Name	Variable Descripttion	Expected Sign Utility Maximizing Model	Expected Sign Target Income Model
FOREST	the type of farm was forestry (=1 if yes; =0 if no)		
MFCR	the type of farm was mixed field crop (=1 if yes; =0 if no)		
MSP	the type of farm was miscellaneous specialty (=1 if yes; =0 if no)		
MLV	the type of farm was mixed livestock (=1 if yes; =0 if no)		
MOTH	the type of farm was mixed other (=1 if yes; =0 if no)		

Table 12 summarizes the model and the signs expected for each variable (with the exception of the conditioning variables, for which no a priori signs are hypothesized).

4.2.6 Empirical technique.

As described earlier, an appropriate method for a model with a dichotomous dependent variable is the multivariate logit model. Bollman (1979a) compared the results for the kinked demand for labor model for Canada under linear, probit and logit specifications and found that 'the OLS results provide a good approximation to the probit and logit results' and that 'the OLS estimates are computationally easier and less expensive to produce.[67] The method of ordinary least squares will be used for this model on the basis of this result as the estimated equation is similar to the one formulated by Bollman. Furthermore, the same data base was employed in both studies, although Bollman's study was estimated for all of Canada while this thesis concentrates on the Prairie provinces.

4.2.7 Data description.

The micro data for this estimation is from the 1971 Agriculture-Population Linkage. The 1966-1971-1976 Census of Agriculture Match provides a longitudinal data base that permits the analysis of gross flows into and out of the status of census farmer. It thus allows the identification of farm operators who entered the industry between 1966 and 1971 or between 1971 and 1976. The Census of Agriculture Match was created by us-

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[67] Ibid. p. 154.

ing a name and address match to identify farmers appearing in more than one Census of Agriculture in the 1966-1976 period. All census farm operators participate in the Census of Agriculture every five years. A one-third sample of farmers also completed the long form of the Census of Population in 1971. In 1971, the Census of Agriculture Match data was linked with the 1971 Census of Population data on farm operators. The linkage with the 1971 Census of Population provides information on individual farm operators that is not available from the Census of Agriculture (such as sex of the operation, education of operator and spouse, number of unpaid family members working on the farm, non-earned income and total non-working family members). These variables are of crucial importance to this study and the group of entrants thus examined here are those that entered between 1966 and 1971. The data provides information on approximately 63,000 entrants in the three Prairie provinces; 22,767 in Alberta, 27,000 in Saskatchewan and 13,665 in Manitoba. The observations constitute a one-third sample of all census-farm operators in the Prairie provinces. Of these operators, 13,456 are entrants: 5,328 are in Alberta, 5,524 in Saskatchewan, and 2,504 in Manitoba.

Chapter V

ANALYSIS OF EMPIRICAL RESULTS

This chapter examines the empirical relationships corresponding to the models specified in Chapter 4. The probability that an entering farm operator will have some days of off-farm work is estimated based on these relationships and the impacts of the variables affecting the decision to work off the farm are analyzed for each model. Finally, the results from the tests for a structural difference between the work behaviour of entering and established farmers are presented and discussed. Model 1 is estimated using micro data from the 1978 Agricultural Enumerative Survey for Saskatchewan. Model 2 employs micro data from the 1966-1971-1976 Census of Agriculture Match and Agriculture-Population Linkage. Conceptually, the two models are very similar. They differ principally because of the data bases to which they are applied.

5.1 MODEL 1

Hypothesis testing in a logit model should be done by a likelihood ratio test. In a large sample, however, the maximum likelihood estimates of the coefficients are approximately normally distributed. Statistical significance can therefore be tested by examining the t-statistic in the usual way.[68] A five percent level of significance is

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[68] R.S. Pindyck and D.L. Rubinfeld, Econometric Models and Economic Forecasts, second edition, (New York: McGraw-Hill Book Company, 1981) p. 311.

considered sufficient to reject null hypotheses and accept alternate hypotheses for one tailed t-tests applied to all variables for which a priori signs are hypothesized. In the case where the sign of the variable is not hypothesized, a two-tailed test is necessary. (The same method for testing hypotheses will be observed in the analysis of Model 2. Since both models have a sufficiently large number of degrees of freedom, the critical t-value for a one-tailed test is 1.65; for a two-tailed test it is 1.96.)

The estimated equation for this model is:

$$OFFWORK = a + b_1\ CAPITAL + (b_2 + c_1)\ SCHOP + b_3\ SPSCH + b_4\ FARMORG + c_2\ WRKEXP + u$$

The results are presented in Table 13. Although two of the coefficients are insignificant, the coefficient of b in particular supports the utility maximizing model and thus fails to support the target income model. The sign of SCHOP, ambiguous under both models, is positive and significant, implying that the operator's years of schooling has a stronger impact on the demand for labor off the farm that it does on the demand for labor on the farm. Thus the contribution of education to potential off-farm earnings exceeds education's contribution to on-farm earnings (through superior farm management) so that the more educated entrants are more likely to work off the farm (Huffman, 1980). The sign on SPSCH is negative and significant as predicted. Finally, an F-test of the hypothesis that there is no relationship between the dependent and the set of independent variables is rejected at the 5 percent level of significance. In summary, regression results are significant and support the utility maximizing model.

Table 13

Results of Multivariate Logit Model for Entering Farmers
Saskatchewan, 1977

Variable	Coefficient	Estimate	Asymptotic t-statistic
OFFWORK (=0 if the operator reported no off-farm work and had no off-farm employment income =1 otherwise)	dependent variable		
CONSTANT	a	-0.702	1.12
CAPITAL (market value of land and buildings, machinery and equipment)	b_1	-0.000002*	3.0
SCHOP (years of schooling of the operator)	b_2+c_1	0.120*	2.61
SPSCH (years of schooling of the spouse)	b_3	-0.029*	1.69
FARMORG (=0 if the operation is a single proprietorship; =1 otherwise)	b_4	0.275	.83
WRKEXP (age of the operator minus years of schooling)	c_2	0.014	1.09

*Indicates significance at the 5 percent level.

n=495

It is interesting to compare the results for the entering farm operators to those of the established farmers presented in Table 14. One would expect from the utility maximizing model that as farmers become experienced in farming and as their off-farm work skills deteriorate, the effect of the variables CAPITAL, SCHOP, SPSCH and FARMORG on farm earnings would begin to dominate the effect of SCHOP and WRKEXP on off-farm earnings (in terms of their impact on the off-farm work decision). The results from the established farmers equation support this hypothesis. The coefficient on the variable SCHOP indicates that its effect on the decision to work off the farm is negligible. The effect of the operator's education in encouraging off-farm work is concentrated among entering farmers as expected because their recent work experience and/or schooling imparts a higher opportunity cost to farm work. A Chow test rejects (at the 5 percent level of significance) the hypothesis that there is no difference in the off-farm work behaviour of entering and established farmers.

The significant negative coefficient for WRKEXP may be explained by the fact that WRKEXP measures age less school leaving age rather than actual off-farm work experience. The variable is, therefore, highly correlated with farm experience for established farmers and reflects again the declining market value of off-farm work skills combined with the rising value of on-farm work skills. The reason for the positive sign on SPSCH in the equation for entering farmers is not clear.

Table 14

Results of Multivariate Logit Model for Established Farmers
Saskatchewan, 1977

Variable	Coefficient	Estimate	Asymptotic t-statistic
OFFWORK (=0 if the operator reported no off-farm work and had no off-farm employment income =1 otherwise)	dependent variable		
CONSTANT	a	1.192	.65
CAPITAL (market value of land and buildings, machinery and equipment)	b_1	-0.000004*	11.81
SCHOP (years of schooling of the operator)	b_2+c_1	0.003	.17
SPSCH (years of schooling of the spouse)	b_3	-0.020*	2.64
FARMORG (=0 if the operation is a single proprietorship; =1 otherwise)	b_4	0.177	1.06
WRKEXP (age of the operator minus years of schooling)	c_2	-0.046*	12.11

*Indicates significance at the 5 percent level.

n=3655

5.2 MODEL 2

The estimated equation for this model is:

$$\begin{aligned}OFFWORK = {} & a + b_1 SALES + b_2 LAND + b_3 MACH + b_4 VL + b_5 VIN \\ & + b_6 WGPD + b_7 NUFM + (b_8 + c_1 + d_1) SCHOP \\ & + (c_2 + d_2) VT + (c_3 + d_3) PCURB + (c_4 + d_4) MU \\ & + d_5 SPSCH + d_6 SVT + d_7 TNWFM + d_8 NEI + e_1 AGE \\ & + e_2 FARMORG + e_3 SEX + e_4 MON5\text{-}8 + e_5 MON1\text{-}4 \\ & + e_6 MON\text{-}0 + e_7 LIVST + e_8 POULT + e_9 WHT \\ & + e_{10} SMGRN + e_{11} FLDCROP + e_{12} FRVEG + e_{13} FOREST \\ & + e_{14} MSP + e_{15} MLV + e_{16} MFCR + e_{17} MOTH + u\end{aligned}$$

where:

OFFWORK = 1 if the operator has some days of off-farm work or some off-farm employment income; = 0 otherwise.

SALES = value of agricultural products sold ($,000)

LAND = total acres of land (,00)

MACH = value of machinery and equipment ($,000)

VL = value of livestock ($,000)

VIN = variable inputs ($,000)

WGPD = hired labor ($,000)

NUFM = number of unpaid family members that usually worked on the farm

SCHOP = years of schooling of the operator

VT = non-agricultural vocational training of the operator (=1 if yes; =0 if no)

PCURB = percent of the total population in the census division where the operator resides that was

non-rural

MU = male unemployment rate in the census division where the operator resides

SPSCH = years of schooling of the operator's spouse

SVT = spouses's vocational training (=1 if yes; =0 if no)

TNWFM = total non-working family members

NEI = non-earned income ($,000) = total family income minus wages and salaries, farm self-employment income and other government income received by all family members

AGE = age of the operator in years

FARMORG = type of business organization of the farm (=0 if single proprietorship; =1 otherwise; institutional farms are excluded)

SEX = sex of the operator (=1 if female; =0 if male)

MON5-8 = operator resided on the farm 5-8 months (=1 if yes; =0 if no)

MON1-4 = operator resided on the farm 1-4 months (=1 if yes; =0 if no)

MON-0 = operator did not reside on the farm (=1 if yes; =0 if no)

LIVST = the type of farm was livestock (=1 if yes; =0 if no)

POULT = the type of farm was poultry (=1 if yes; =0 if no)

WHT = the type of farm was wheat (=1 if yes; =0 if no)

SMGRN = the type of farm was small grain (=1 if yes; =0 if no)

FLDCRP = the type of farm was field crop (=1 if yes; =0 if no)

FRVEG = the type of farm was fruit and vegetable (=1 if yes; =0 if no)

FOREST = the type of farm was forestry (=1 if yes; =0 if no)

MSP = the type of farm was miscellaneous specialty (=1 if yes; =0 if no)

MLV = the type of farm was mixed livestock (=1 if yes; =0 if no)

MFCR = the type of farm was mixed field crop (=1 if yes; =0 if no)

MOTH = the type of farm was mixed other (=1 if yes; =0 if no)

The results from the regression for the Prairie provinces are presented in Table 15. As hypothesized, an increase in farm output will result in a higher demand for the operator's labor on the farm and an ensuing decrease of 0.04 percent in the probability of reporting some off-farm work.

Also, as predicted under the utility maximizing model, an increase in any of the variables representing the level of capital on the farm (LAND, MACH, VL) result in a decrease in the probability of reporting some off-farm work by 0.06 percent for each 100 acres of land and 0.33 percent and 0.08 percent, respectively for an increase of $1,000 in MACH or VL. These inputs are complements to operator labor.

Table 15

Results from Ordinary Least Squares Equation for Entering Farm Operators in the Prairie Provinces, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.42	12.05
SALES	b_1	-0.0004*	1.65
LAND	b_2	-0.0006*	1.65
MACH	b_3	-0.0033*	9.41
VL	b_4	-0.0008*	2.51
VIN	b_5	0.00003*	3.34
WGPD	b_6	0.005*	3.89
NUFM	b_7	-0.010*	2.00
SCHOP	$b_8+c_1+d_1$	0.009*	6.68
VT	c_2+d_2	0.107*	8.09
PCURB	c_3+d_3	-0.001*	3.75
MU	c_4+d_4	0.047*	10.21
SPSCH	d_5	0.008*	9.75
SVT	d_6	0.013	0.92
TNWFM	d_7	0.020*	5.64
NEI	d_8	-0.00001*	5.67
AGE	e_1	-0.006*	20.80
FARMORG	e_2	-0.005	0.41
SEX	e_3	-0.111*	6.69
MON5-8	e_4	0.135*	7.41
MON1-4	e_5	0.228*	11.29
MON-0	e_6	0.120*	12.78
LIVST	e_7	0.103*	4.27
POULT	e_8	0.231*	5.58
WHT	e_9	0.103*	4.14
SMGRN	e_{10}	0.025*	4.62
FLDCRP	e_{11}	0.218*	6.78
FRVEG	e_{12}	0.246*	3.70
FOREST	e_{13}	0.268*	2.94
MSP	e_{14}	0.295*	8.01
MLV	e_{15}	0.002	0.04
MFCR	e_{16}	0.025	0.71
MOTH	e_{17}	0.196*	7.30

*Indicates significance at the 5 percent level.

n = 13,456
F = 80.29
$\bar{R}^2$ = .16

An increase of $1,000 in the amount of variable inputs used on the farm results in an increase in OFFWORK of 0.003 percent indicating that variable inputs are substitutes for operator labor.

The amount of hired labor used on the farm is a substitute for operator labor. An increase of $1,000 in the amount of wages paid causes a 0.5 percent increase in the probability of reporting some off-farm work. Unpaid family labor is, contrary to expectations, complementary with operator labor.[69] This may be the result of a desire by the operator to work closely with family labor in order to supervise and to prepare family members to take over the farm.

As in the case in Model 1, the schooling of the operator has a stronger effect on the demand for operator labor off the farm than on the demand for operator labor on the farm (or the supply of operator labor), and the sign is positive. Non-agricultural vocational training also increases the probability that the operator will report some days of off-farm work.

The variable PCURB has conflicting effects on supply of and demand for operator labor. It was hypothesized that PCURB, the percent of the population in the census district that was non-farm (a proxy for the cost of commuting) would have a positive effect on the demand for operator labor off the farm and on the supply of labor by the operator and the spouse. The positive effect on the supply of the spouse's labor appears to have a stronger impact than the other effects and the sign on the variable PCURB is negative. This result is unexpected. The same

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69 The study by Jones (1978) also found unpaid family labor and operator labor to be complementary components. Op. Cit., W. Jones, An Econometric Analysis of the Canadian Agricultural Labour Market With Specific Reference to the Prairie Region, p. 131.

conflicting effects act on the measure of the unemployment rate in the census division (MU), and the resulting sign is positive.

Contrary to expectation, the years of schooling of the spouse has a positive effect on the dependent variable. The relationship may be explained by Mincer (1969) who proposes that there are two factors which affect the labor supply of the spouse. The first factor in this case is the presence of a high income for the operator (negative effect) and the second is the response of the spouses's labor supply to own potential income (positive effect). If the spouse perceives the operator as having a high income and thus chooses to work less off the farm, the effect on OFFWORK may be positive.[70] In the estimated relationship however the spouse's level of vocational training has an insignificant impact on OFFWORK. The reasons for this result are not clear. As expected, the total number of non-working family members has a positive impact on the probability that the operator works some hours off the farm while non-earned income has a negative effect.

An analysis of the conditioning variables reveals that the operator's age, sex and months of residence on the farm each have a significant impact on the dependent variable. The age of the operator is negatively related to participation in off-farm work with each additional year decreasing the probability of off-farm work by 0.6 percentage points. If the farm operator is female, the probability of reporting some days of off-farm work is lower by 11.1 percent. If the operator lives on the

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70 J. Mincer 'Labor Force Participation of Married Women' in Universities - National Bureau Committee for Economic Research, Aspects of Labor Economics, Princeton, Princeton University Press, 1962. Cited in Richard Perlman Labor Theory U.S.A., John Wiley and Sons, Inc., 1969, p. 22.

farm for less than twelve months, the probability of reporting some off-farm work is higher by; 13.5 percent if the operator resides five to eight months on the farm, 22.8 percent if the operator resides one to four months on the farm, and 12 percent if the operator does not reside on the farm. The probability of participating in off-farm work is higher for all types of operations except mixed livestock and mixed field crops than it is for a dairy operation. The $\bar{R}^2$ for this model is 0.16 which indicates that 16 percent of the variation in the dependent variable can be explained by the independent variables. This value is typical for cross-section studies using a dichotomous dependent variable.[71] The F-test rejects the hypothesis that there is no relationship between the dependent and independent variables. Finally, a Chow test rejects the hypothesis that there is no structural difference between the off-farm work behaviour of entering and established farmers.

The result from the regressions for the individual Prairie provinces are presented in Tables 16, 17 and 18. There are some differences between these regressions and the one for the Prairie provinces collectively. The first difference is that for the individual provincial regressions the variable SALES does not have a significant impact on the probability that the operator will work off the farm. This result is unexpected but may be explained by the fact that value of agricultural products (SALES), land and machinery are all measures of the scale

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[71] R.D. Bollman, 'Off-Farm Work by Farmers: A Study with a Kinked Demand for Labour Curve,' unpublished Ph.D. Thesis, Universiy of Toronto, 1978, p. 259.

Table 16

Results from Ordinary Least Squares Equation for Entering Farm Operators in Manitoba, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.448	6.02
SALES	b_1	-0.0007	1.32
LAND	b_2	-0.008*	3.45
MACH	b_3	-0.002	1.38
VL	b_4	-0.002*	1.85
VIN	b_5	0.001	0.44
WGPD	b_6	0.009*	3.87
NUFM	b_7	-0.026*	2.05
SCHOP	$b_8+c_1+d_1$	0.007*	1.93
VT	c_2+d_2	0.088*	2.63
PCURB	c_3+d_3	-0.001*	2.10
MU	c_4+d_4	0.052*	5.64
SPSCH	d_5	0.004*	2.05
SVT	d_6	0.035	1.01
TNWFM	d_7	0.031*	3.47
NEI	d_8	-0.00001*	2.24
AGE	e_1	-0.006*	7.68
FARMORG	e_2	-0.047	1.48
SEX	e_3	-0.057	1.29
MON5-8	e_4	0.143*	2.84
MON1-4	e_5	0.263*	4.29
MON-0	e_6	0.060*	2.65
LIVST	e_7	0.132*	2.81
POULT	e_8	0.273*	3.61
WHT	e_9	0.224*	4.35
SMGRN	e_{10}	0.155*	3.12
FLDCRP	e_{11}	0.204*	3.14
FRVEG	e_{12}	0.197*	2.01
FOREST	e_{13}	0.115	0.67
MSP	e_{14}	0.265*	3.62
MLV	e_{15}	0.141*	1.99
MFCR	e_{16}	-0.079	1.03
MOTH	e_{17}	0.207*	3.80

*Indicates significance at the 5 percent level.

n = 2,504
F = 11.05
$\bar{R}^2$ = .13

Table 17

Results from Ordinary Least Squares Equation for Entering Farm Operators in Saskatchewan, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.395	5.38
SALES	b_1	-0.0004	0.76
LAND	b_2	-0.002*	2.45
MACH	b_3	-0.002*	3.54
VL	b_4	-0.001*	1.71
VIN	b_5	-0.002	0.68
WGPD	b_6	0.027*	3.60
NUFM	b_7	-0.017*	-1.99
SCHOP	$b_8+c_1+d_1$	0.01*	4.49
VT	c_2+d_2	0.14*	6.32
PCURB	c_3+d_3	-0.001*	-2.50
MU	c_4+d_4	0.022*	3.06
SPSCH	d_5	0.008*	6.75
SVT	d_6	-0.003	0.13
TNWFM	d_7	0.005	0.85
NEI	d_8	-0.00001*	2.71
AGE	e_1	-0.007*	14.30
FARMORG	e_2	0.215	1.10
SEX	e_3	-0.108*	-4.58
MON5-8	e_4	0.127*	4.53
MON1-4	e_5	0.276*	7.96
MON-0	e_6	0.172*	12.29
LIVST	e_7	0.061*	2.54
POULT	e_8	0.494*	4.51
WHT	e_9	0.189*	2.99
SMGRN	e_{10}	0.204*	3.19
FLDCRP	e_{11}	0.365*	4.10
FRVEG	e_{12}	0.566*	3.00
FOREST	e_{13}	-0.519	0.97
MSP	e_{14}	0.453*	4.85
MLV	e_{15}	0.481	0.64
MFCR	e_{16}	0.144	1.91
MOTH	e_{17}	0.286*	4.28

*Indicates significance at the 5 percent level.

n = 5,624
F = 37.81
$\bar{R}^2$ = .18

Table 18

Results from Ordinary Least Squares Equation for Entering Farm Operators in Alberta, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.427	8.18
SALES	b_1	-0.0004*	1.05
LAND	b_2	-0.00001	0.02
MACH	b_3	-0.004*	8.10
VL	b_4	-0.001*	1.95
VIN	b_5	0.01*	3.39
WGPD	b_6	0.003	1.25
NUFM	b_7	0.0004	0.05
SCHOP	$b_8+c_1+d_1$	0.009*	4.42
VT	c_2+d_2	0.066*	3.64
PCURB	c_3+d_3	-0.001*	2.11
MU	c_4+d_4	0.057*	6.63
SPSCH	d_5	0.008*	6.42
SVT	d_6	0.01	0.55
TNWFM	d_7	0.026*	5.17
NEI	d_8	-0.00001*	5.03
AGE	e_1	-0.007*	14.56
FARMORG	e_2	-0.004	0.23
SEX	e_3	-0.117*	4.25
MON5-8	e_4	0.149*	5.60
MON1-4	e_5	0.179*	6.78
MON-0	e_6	0.106*	6.91
LIVST	e_7	0.113*	3.75
POULT	e_8	0.139*	2.60
WHT	e_9	0.151*	4.28
SMGRN	e_{10}	0.122*	3.81
FLDCRP	e_{11}	0.194*	4.95
FRVEG	e_{12}	0.198*	1.92
FOREST	e_{13}	0.319*	3.03
MSP	e_{14}	0.266*	5.76
MLV	e_{15}	0.021	0.40
MFCR	e_{16}	0.06	1.26
MOTH	e_{17}	0.193*	5.56

*Indicates significance at the 5 percent level.

n = 5,328
F = 37.99
$\bar{R}^2$ = .19

of the operation and could, therefore, be collinear. It is not clear, however, why SALES is significant in the aggregate but not in the individual regressions.

For Manitoba and Saskatchewan the value of land and buildings has a significant impact on OFFWORK; for Alberta the variable is insignificant. The variables MACH and VIN are insignificant in the equation for Manitoba, while the other inputs (livestock, hired labor and unpaid family labor) have a significant impact on OFFWORK and the same signs as the regression for the Prairies. In the Saskatchewan equation, value of machinery, value of livestock, wages paid and unpaid family labor are significant, the value of variable inputs is not. For Alberta the only inputs which are significant to the probability of participating in off-farm work are value of machinery, livestock and variable inputs.

For Manitoba the years of schooling of the operator does not appear to affect the dependent variable but non-agricultural vocational training does. The remainder of the results are similar to those for the regression on the Prairies.

The results for Saskatchewan are basically the same as those for the Prairies with the exception of those variables already mentioned and the variable TNWFM (total-non working family members) which does not affect the probability that the operator will report some off-farm work. The results for Alberta are also similar to those of the Prairies with the exception of the differences in the variables which affect the demand for operator labor on the farm (the inputs).

The R^2 for the Manitoba, Saskatchewan and Alberta models are 0.13, 0.18, and 0.19, respectively and the F-statistics are all significant at

the 5 percent level . A Chow test rejects the hypothesis that there is no difference in the off-farm work behaviour of entering operators in the three provinces. Thus, the estimation of three separate equations would seem appropriate.

The regression results for established farmers in the Prairie provinces as a region and individually and have been estimated and are presented in Tables 19, 20, 21 and 22. For the Prairie region the signs on the variables are the same as those in the equation for entering operators with the exception of NUFM (number of unpaid family workers) which is insignificant and FARMORG which is positive (and was unsigned in the equation for entrants). The $\bar{R}^2$ in the equation are 0.09 and the F-statistic is 155.91. The results at the individual provincial level are also similar to those for entrants in the three provinces.

In summary, the kinked demand model explains adequately the off-farm work behaviour of entering operators. The equation for the Prairie provinces as a region and for each individual province are statistically significant and in general the signs on the variables are as hypothesized in the conceptual model.

The variable SALES (value of agricultural products) has a negative impact on OFFWORK (the probability that the entrant will report some days of off-farm work) in the Prairie equation and is insignificant in the others. The signs of the variables LAND, MACH and VL (acres of land, value of machinery and value of livestock) are negative in most cases and when not negative they are insignificant. This implies that policies which encourage an increase in fixed capital for entering farm operators will result in a decrease in the probability that they will

Table 19

Results from Ordinary Least Squares Equation for Established Farm Operators in the Prairie Provinces, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.528	26.20
SALES	b_1	-0.0007*	6.35
LAND	b_2	-0.0003*	1.94
MACH	b_3	-0.003*	16.75
VL	b_4	-0.0004*	2.81
VIN	b_5	0.003*	5.07
WGPD	b_6	0.014*	11.32
NUFM	b_7	0.000`9	20.34
SCHOP	$b_8+c_1+d_1$	0.005*	6.02
VT	c_2+d_2	0.098*	10.77
PCURB	c_3+d_3	-0.002*	11.67
MU	c_4+d_4	0.048*	18.93
SPSCH	d_5	0.003*	6.36
SVT	d_6	0.013	1.52
TNWFM	d_7	0.018*	8.80
NEI	d_8	-0.00001*	8.87
AGE	e_1	-0.008*	36.62
FARMORG	e_2	0.028	3.43
SEX	e_3	-0.032*	2.55
MON5-8	e_4	0.163*	13.32
MON1-4	e_5	0.274*	14.07
MON-0	e_6	0.149*	26.73
LIVST	e_7	0.043*	3.71
POULT	e_8	0.065*	2.46
WHT	e_9	0.070*	5.75
SMGRN	e_{10}	0.081*	6.71
FLDCRP	e_{11}	0.187*	8.74
FRVEG	e_{12}	0.103*	1.72
FOREST	e_{13}	0.318*	3.87
MSP	e_{14}	0.281*	9.14
MLV	e_{15}	-0.006	0.38
MFCR	e_{16}	0.047	2.81
MOTH	e_{17}	0.142*	8.61

*Indicates significance at the 5 percent level.

n = 49,976
F =155.91
$\bar{R}^2$ = .09

Table 20

Results from Ordinary Least Squares Equation for Established Farm Operators in Manitoba, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.520	13.48
SALES	b_1	-0.003*	6.40
LAND	b_2	-0.009*	7.19
MACH	b_3	-0.0002	0.39
VL	b_4	-0.002*	3.46
VIN	b_5	0.010*	5.61
WGPD	b_6	0.012*	5.05
NUFM	b_7	-0.003	0.47
SCHOP	$b_8+c_1+d_1$	0.006*	3.30
VT	c_2+d_2	0.112*	5.22
PCURB	c_3+d_3	-0.002*	6.11
MU	c_4+d_4	0.056*	12.29
SPSCH	d_5	0.006*	5.01
SVT	d_6	0.006	0.34
TNWFM	d_7	0.028*	6.45
NEI	d_8	-0.00001*	4.26
AGE	e_1	-0.008*	18.46
FARMORG	e_2	0.047*	2.72
SEX	e_3	-0.026	0.98
MON5-8	e_4	0.239*	6.57
MON1-4	e_5	0.250*	4.73
MON-0	e_6	0.132*	8.39
LIVST	e_7	0.055*	2.90
POULT	e_8	0.023	0.60
WHT	e_9	0.135*	6.15
SMGRN	e_{10}	0.082*	4.01
FLDCRP	e_{11}	0.158*	4.40
FRVEG	e_{12}	0.093	1.30
FOREST	e_{13}	0.311*	2.54
MSP	e_{14}	0.304*	5.98
MLV	e_{15}	-0.003	0.13
MFCR	e_{16}	0.108*	3.34
MOTH	e_{17}	0.169*	5.82

*Indicates significance at the 5 percent level.

n = 11,161
F = 43.82
$\bar{R}^2$ = .11

Table 21

Results from Ordinary Least Squares Equation for Established Farm Operators in Saskatchewan, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.506	12.54
SALES	b_1	-0.002*	6.84
LAND	b_2	-0.002*	4.20
MACH	b_3	-0.001*	4.87
VL	b_4	-0.001*	1.69
VIN	b_5	0.010*	3.44
WGPD	b_6	0.030*	8.96
NUFM	b_7	-0.0003	0.08
SCHOP	$b_8+c_1+d_1$	0.006*	4.69
VT	c_2+d_2	0.067*	4.53
PCURB	c_3+d_3	-0.001*	3.14
MU	c_4+d_4	0.017*	4.34
SPSCH	d_5	0.003*	4.99
SVT	d_6	0.017	1.34
TNWFM	d_7	0.014*	4.12
NEI	d_8	-0.00001*	6.32
AGE	e_1	-0.007*	22.26
FARMORG	e_2	0.038*	2.75
SEX	e_3	-0.065*	3.48
MON5-8	e_4	0.116*	7.38
MON1-4	e_5	0.249*	8.87
MON-0	e_6	0.188*	21.98
LIVST	e_7	0.070*	2.29
POULT	e_8	0.111	1.61
WHT	e_9	0.111*	3.65
SMGRN	e_{10}	0.093*	3.05
FLDCRP	e_{11}	0.239*	3.62
FRVEG	e_{12}	-0.167	0.67
FOREST	e_{13}	0.520*	2.71
MSP	e_{14}	0.227*	3.15
MLV	e_{15}	0.040	1.15
MFCR	e_{16}	0.033	0.96
MOTH	e_{17}	0.129*	3.59

*Indicates significance at the 5 percent level.

n = 21,376
F = 61.87
$\bar{R}^2$ = .09

Table 22

Results from Ordinary Least Squares Equation for Established Farm Operators in Alberta, 1971

Variable	Coefficient	Estimate	t-Statistic
CONSTANT	a	0.567	16.73
SALES	b_1	-0.0005*	3.57
LAND	b_2	0.0001	0.53
MACH	b_3	-0.003*	13.13
VL	b_4	-0.0003	1.59
VIN	b_5	0.002*	2.74
WGPD	b_6	0.012*	7.95
NUFM	b_7	0.003	0.78
SCHOP	$b_8+c_1+d_1$	0.003	1.97
VT	c_2+d_2	0.101*	7.36
PCURB	c_3+d_3	-0.001*	6.75
MU	c_4+d_4	0.057*	11.01
SPSCH	d_5	0.003*	3.38
SVT	d_6	0.002	0.14
TNWFM	d_7	0.018*	5.75
NEI	d_8	-0.00001*	6.01
AGE	e_1	-0.009*	25.02
FARMORG	e_2	0.02	1.53
SEX	e_3	0.003	0.14
MON5-8	e_4	0.250*	10.79
MON1-4	e_5	0.291*	9.31
MON-0	e_6	0.187*	14.05
LIVST	e_7	0.061*	3.60
POULT	e_8	0.098*	2.34
WHT	e_9	0.116*	5.73
SMGRN	e_{10}	0.136*	7.48
FLDCRP	e_{11}	0.178*	6.15
FRVEG	e_{12}	0.123	1.04
FOREST	e_{13}	0.235	1.82
MSP	e_{14}	0.274*	6.14
MLV	e_{15}	0.021	0.82
MFCR	e_{16}	0.104*	3.99
MOTH	e_{17}	0.183*	7.07

*Indicates significance at the 5 percent level.

n = 17,439
F = 69.82
R^2 = .11

engage in off farm work. They are complements to operator labor on the farm. The variable, non-labor variables inputs (VIN), is positive for the Prairies and for Alberta and insignificant for Manitoba and Saskatchewan.

In general hired labor (WGPD) is a substitute for operator labor but unpaid family labor (NUFM) is a complement to operator labor. The signs on these variables are positive and negative, respectively. This could indicate that a government program to subsidize hired farm labor will result in a higher probability of off-farm work by entering farmers.

An increase in the level of schooling of the operator (SCHOP and VT) generally increases the probability of off-farm work. Contrary to the hypothesis, the same result occurs for an increase in the schooling of the spouse (SPSCH and SVT). This result suggests that promoting education for entrants may also promote off-farm work by the group.

The variable used to measure commuting costs (PCURB) consistently exhibits a negative effect on OFFWORK indicating that as the percent of the population in the census district that is urban increases (meaning that commuting costs likely decrease) the probability that the operator participates in off-farm work decreases. This result is unexpected as is the result that as the unemployment rate (MU) increases so does OFFWORK.

In general, the total number of non-working family members (TNWFM) has a positive effect on OFFWORK. This is the expected result since TNWFM is used as a proxy for the size of the family's consumption bundle. Non-earned family income has, as predicted, a negative impact on the probability that the operator will work off the farm.

In general the signs of the conditioning variables are consistent for all four equations. An increase in the age of the operator has a negative effect on OFFWORK. Whether or not the farm is a single proprietorship (FARMORG) has no impact on the dependent variable. If the operator is female the probability of off-farm work decreases. The probability that the operator participates in off-farm work increases if the operator does not reside twelve months on the farm. For almost all types of farms the operator is more likely to work off the farm than if the farm was a dairy operation.

5.3 COMPARISON OF THE MODELS

It seems most appropriate to compare the results for Model 1 (which deals with Saskatchewan only) with the results for Saskatchewan in Model 2. The dependent variable (OFFWORK) is comparable in the two models. For entering farm operators in Model 1 the market value of land, building, machinery and equipment in dollars is represented by the variable CAPITAL. The coefficient of the variable is -0.000002 (or -0.002 if CAPITAL was measured in thousands of dollars). In Model 2, the coefficient of the variable which measures the market value of machinery and equipment is -0.002 and the coefficient of land (in hundreds of acres) is -0.002. The coefficient of VL (value of livestock capital) is also -0.002.

The years of schooling of the operator has a positive impact on the probability of off-farm work by the operator in both Model 1 and Model 2. The coefficients are 0.120 and 0.01, respectively. The sign on years of schooling of the spouse differ between the models; it is negative as predicted, for Model 1 and positive for Model 2.

In both models the variable FARMORG (indicating whether or not the farm is a single proprietorship) is insignificant. The variable WRKEXP is not directly comparable between models.

The results from both models support the argument that the decision by the entering farm operator to allocate some time to off-farm work is a matter of choice rather than of financial compulsion.

Each model is estimated for established farmers as well as entrants. The signs on some variables in Model 1 are different for entering and established farmers. This result is expected since the life-cycle theory (Blinder and Weiss, 1976) suggests that over time the work behaviour of farm operators change as they gain experience in farm work and as their off-farm work skills depreciate. Model 1 supports this hypothesis. The variable SCHOP is significant for entering farmers but not for established farmers. This indicates that over time, the off-farm work skills deteriorate to the point that they no longer impact on the decision of whether or not to allocate time to off-farm work. The variable WRKEXP is negative and significant for established farmers (it is insignificant for entrants). This suggests that as the operator gains experience in farm work, the probability of working off the farm declines. In Model 2 the signs of the coefficients are generally the same as in the equations for entering farmers. This result is unexpected for reasons previously stated. The sign on the variable FARMORG becomes positive in the regressions for established farmers in Model 2. This indicates that if the operation is not a single proprietorship, the probability that the operator works off the farm increases. Thus, the results from Model 1 support the hypothesis that over time the work behaviour of farm operators change; the results from Model 2 do not.

In each model the set of independent variables has a significant impact on the dependent variable as evidenced by an F-test. Model 1 is estimated using the multivariate logit technique, Model 2 by the ordinary least squares technique.

5.4 COMPARISON TO THE RESULTS FROM OTHER STUDIES

Studies by Huffman and Bollman estimate the probability that farm operators will engage in off-farm work. The models in both studies use a dichotomous dependent variable in their estimation. Huffman finds a negative relationship between the log of farm output and the log of the odds that the operator participates in off-farm work. The wage rate and the education of the operator both have a positive effect on the dependent variables as does the education of the spouse; the wage rate of the spouse has a negative impact. The age of the operator and age squared have no influence on the odds (in favor) of farmers' off-farm labor force participation. It is difficult to compare the coefficients directly since a number of Huffman's independent variables enter the regression in natural logarithmic form. In general, however, the results appear to be consistent with those for this study (with the exception of the insignificance of the age of the operator).

Bollman used the ordinary least squares technique to explain the probability of off-farm work by farm operators for Canada and by province. For the Prairie provinces, the results from the Bollman study and from this study are similar. While the magnitude of the coefficients is different in most cases, the signs are generally the same. Bollman divides total land into improved acres and unimproved acres and reports a

negative relationship between improved acres and the dependent variable (and no relationship with unimproved acres). He uses the male labor force participation rate as an independent variable (in place of the male unemployment rate) and reports that it has a negative influence on the probability that a farm operator reports off-farm work. He also indicates that the education of the spouse has either a negative or insignificant effect on the dependent variable.

Both Huffman and Bollman estimate their equations for all farmers rather than for entrants. This may explain discrepancies in some of the results. In general, however, the results from both models are similar to the results obtained in this study.

Chapter VI

SUMMARY AND CONCLUSIONS

6.1 SUMMARY

Governments in Canada have expressed concern that the future supply of entering farm operators will not be adequate to ensure production of food and fiber at the family farm level. Policies have been instituted by both federal and provincial governments to aid operators to enter agriculture and maintain the occupation of farmer. Several authors have suggested that entry into agriculture has become difficult because financial barriers to entry have been rising relative to farm incomes, and that off-farm work by the operator represented a potential solution to the problem.

One interpretation of this suggestion was that off-farm work by entrants was a matter of financial necessity. An alternative interpretation of the off-farm work behaviour of entrants was that they chose to devote some time to nonfarm occupations because the returns to their expertise were relatively high. In this context off-farm work was a matter of opportunity cost. Operators worked off the farm not because they had to, but because the opportunity cost of not doing so was too high.

The object of this thesis was to increase information about the work behaviour of entering farm operators in order to analyze what motivated them to work off the farm. Some statistics on the gross flows of census farm operators into and out of agriculture were presented as was a dis-

cussion of the potential roles of part-time farming. A number of characteristics of entering and established farmers were compared and indicated that there were significant differences between the two groups. The purpose of this background information was to facilitate a better understanding of the entering operator component of the farm labor force.

The empirical portion of the study tested the ability of two conceptual models to explain the probability that an entrant would report some days of off-farm work. The first model utilized micro data from the 1978 Saskatchewan Agricultural Enumerative Survey (provided by Statistics Canada). The second model employed longitudinal data from the 1966-1971-1976 Census of Agriculture Match and Agriculture-Population Linkage (also provided by Statistics Canada). In general, the models performed adequately and supported the hypothesis that off-farm work by entrants was a matter of opportunity cost rather than financial compulsion. Both models indicated that the level of fixed capital on the farm had an inverse relationship with the probability that the operator would work off the farm. They also suggested that the schooling of the operator positively affected the rate of off-farm employment participation. They produced, however, conflicting results concerning the role of the spouse's education in determining the operator's off-farm work behaviour.

The results from Model 2 indicated that hired labor was a substitute for operator labor on the farm while unpaid family labor and operator labor were complements. The results also suggested that as the size of the consumption bundle for the family increased, the probability that

the operator worked some days off the farm also increased. The age of the operator had an inverse impact on the probability that the operator was a multiple jobholder.

The results for the Prairie region were similar to those for each province, but the Chow test indicated that there are structural differences in the work behaviour of entrants in Manitoba, Saskatchewan and Alberta. In Manitaba and Saskatchewan total acres of land had a significant (and negative) impact on the probability that the operator would work off the farm, Pr(OFFWORK). In Alberta no relationship existed between acres of land and Pr(OFFWORK). In Saskatchewan and Alberta the relationship between the value of machinery and Pr(OFFWORK) was negative; in Manitoba it had no impact. In Manitoba and Saskatchewan the amount of hired labor was important to the off-farm work behaviour of entrants; in Alberta it was not. Schooling of the operator impacted on Pr(OFFWORK) in Saskatchewan and Alberta but not in Manitoba. These were the major areas in which the three provinces differed. They suggested that the production functions were different depending on the province in question.

6.2 CONCLUSIONS AND LIMITATIONS

The first conclusion of this study is that there are significant differences between entering and established farmers. Important characteristics which determine the difference are summarized in Chapter 2, Table 6. According to the statistics, entrants are more likely to work off the farm and work more days off-farm than are established farmers. Entrants are typically younger and better educated and have less land, ma-

chinery and livestock than established farmers. Finally, entrants have a lower level of output, or lower value of agricultural sales than established farmers. On the basis of these differences, it appears that governments are justified in establishing programs specifically aimed at entering farm operators. Programs which provide entrants with capital to expand their level of land, machinery and livestock may assist them to grow to a more viable size and to maintain the occupation of farmer.

The major conclusion from both econometric models is that the work decisions of entering farm operators reflect opportunity costs rather than financial compulsion. This conclusion contradicts claims that off-farm work should be promoted as a significant mechanism for entry to overcome barriers to entry. The results do not support any policy initiatives to encourage off-farm work to overcome barriers to entry into agriculture.

The results from the analysis indicate that there are structural differences in the work behaviour of entrants in the three Prairie provinces. If policies to affect the demand for operator labor on the farm or off the farm or the total supply of operator labor were to be formulated, they would have slightly different impacts depending upon the province in question. For example, a program to subsidize land for entering farm operators would decrease the probability of off-farm work, Pr(OFFWORK), in Manitoba and Saskatchewan but would have no effect in Alberta. A program to subsidize machinery would decrease Pr(OFFWORK) in Saskatchewan and Alberta but have no effect in Manitoba.

There are, of course, limitations to the analysis. The 1978 Agricultural Enumerative Survey (AES) for Saskatchewan is a probability survey

with a complex sample design. The econometric analysis for this thesis employed a computer software package called Statistical Analysis System (SAS), which was designed to analyze simple random samples. There is some evidence that the variances of the coefficient estimates for Model 1 are underestimated because, in this case, SAS is used to analyze a complex rather than simple random sample. If the variances are underestimated, the t-statistics are overestimated and the results from Model 1 are less significant. It is not known by precisely how much the variances are underestimated or how the selection of observations from the data set affects the bias. The result may be different, for example, if the entire set of observations is used for analysis from the result if only farm entrants are selected. Further investigation into this problem is being undertaken.

The 1978 AES for Saskatchewan does not provide any data on the geographic location of the farm and its proximity to urban areas. Thus, variation in off-farm employment opportunities among farmers could not be considered in Model 1. Kada (1980) found that in Wisconsin the proportion of farm income from off-farm work did not depend on proximity to metropolitan areas[72] suggesting that the effect on off-farm work decisions may not be strong. The variation in employment opportunities may be smaller in Saskatchewan than in other provinces in Canada which have more large urban centres. In this sense, it is not clear that Saskatchewan is typical of off-farm labor practices. (For farm entrants and established farmers the percentage in Saskatchewan reporting some days of off-farm work was the lowest of the three Prairie provinces.)

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[72] R. Kada, Part-Time Family Farming, Centre for Academic Publications Japan, Tokyo, 1980.

The data for Model 1 are from 1977; the data for Model 2 are basically from 1971. It is not clear that the labor patterns in 1971 and 1977 reflect the current agricultural situation. While the interest rates in 1977 especially appeared high by historical standards they now seem very attractive. Whether this has affected off-farm work behaviour awaits investigation.

The quality of the longitudinal data base employed in Model 2 may be restricted by the quality of the name-and-address match used to create the base. A certain percentage of error is inevitable. Census of Agriculture questionnaires from 1971 that were not matched with 1966 questionnaires provided information on entrants. If the questionnaires were unmatched for reasons other than the fact that the operator entered between 1966 and 1971, the operator is still considered as an entrant. The data base provides, however, a unique opportunity for the analysis of gross flows of labor in agriculture as well as entry and exit studies.

Information on off-farm wage levels of the operator and spouse is not available in either data base employed in this thesis. Data on the debt level of the farmers would also be useful for the analysis but are not available. Information regarding how farm operators enter agriculture would be of interest but at present there is no way of knowing where the entrants came from.

6.3 SUGGESTIONS FOR FURTHER RESEARCH

Results from the 1981 Censuses of Agriculture and Population will become available in 1982. Subsequently the 1981 Census of Agriculture will be matched with the longitudinal data base already in existence, resulting in a 1966-1971-1976-1981 Census of Agriculture Match. Finally the 1981 Census of Population will be linked to the matched data. The variables from Model 2 of this thesis will be available on the new data base. The equation for entering farmers could thus be estimated for entrants from the 1976-1981, 1971-1981,or 1961-1981 periods and the results could be compared. Research could also be conducted to observe the 1966-1971 entrants in terms of the changes in their work behaviour and farming operations.

The regression analysis from this thesis could be performed at the Canada level and for the other provinces. The analysis could also be done for different types of farming operations. This would permit interregional comparisons and comparisons by farm type.

It would be interesting to separate the entrants from this or subsequent studies into two groups: hobby farmers and commercial farmers, and to compare their work behaviour. Although the means for defining each group may be somewhat arbitrary, the analysis could prove valuable for policy makers that are interested in the part-time farming issue.

According to Bollman,

> existence of off-farm work by farmers does not necessarily arise from market imperfections. The implication of this result is for policies designed to improve the efficiency of food production. Many public policies that apply to farmers discriminate against the part-time farmer. If the objective of the policy is the efficient production of food, all food producers whether they are full-time or part-time farmers should be eligible.[73]

Based on this conclusion, off-farm work by entering farm operators may represent an efficient allocation of resources from the perspective of the individual farmer despite the fact that it is not a necessary mechanism for entry into farming. Policies which require entering farm operators to make farming their principal occupation within a prescribed length of time are discriminatory. Whether this discrimination is benificial or detrimental depends on the perspective from which the problem is viewed. Some evidence exists to support the hypothesis that part-time farming has an adverse effect on technical efficiency on farms even when factors such as farm size and age and education of the operator are held constant.[74] More research is needed to investigate the relationship between technical efficiency in agriculture and the global resource allocation problem.

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[73] R. Bollman, 'Off Farm Work by Farmers,' op. cit., p.176.

[74] Freshwater, D., W. Simpson, M. Kapitany, 'Are Part-Time Farmers Efficient? An Analysis of Technical Efficiency in Saskatchewan Agriculture,' unpublished paper, Department of Agricultural Economics, University of Manitoba, 1982, p. 14.

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