REGIONAL AND FARM LEVEL ADJUSTMENTS IN THE DAIRY INDUSTRY

REGIONAL AND FARM LEVEL ADJUSTMENTS IN SOUTHERN ONTARIO'S DAIRY INDUSTRY 1968 - 1974

By

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A Thesis

Submitted to the School of Graduate Studies

in Partial Fulfilment of the Requirements

for the Degree

Doctor of Philosophy

McMaster University

May 1975.

DOCTOR OF PHILOSOPHY (1975) McMASTER UNIVERSITY
(Geography) Hamilton, Ontario

TITLE: Regional and Farm Level Adjustments in Southern Ontario's Dairy Industry 1968 - 1974

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NUMBER OF PAGES: xiii, 211

ABSTRACT

Through legislation introduced in 1965 a new institutional setting was established for the dairy industry in Ontario. This legislation, known as The Milk Act 1965, provided for the formation of the Milk Commission of Ontario and the Ontario Milk Marketing Board. Since its formation the Marketing Board has played an important role in restructuring the dairy industry and producing a shift in the location of fluid milk production in Southern Ontario.

The analysis of regional data showed that over the six year period from June 1968 to June 1974, the combination of high attrition rates among regular fluid milk producers and their replacement by new shippers in more outlying areas had increased the distance that fluid milk was being transported. High land values contributed to the rapid attrition of fluid milk producers in the more urbanized areas. At the same time the programmes of the Board such as price and transportation pooling, quota negotiability and the graduated entry of industrial producers into the fluid milk market were having an impact. The net effect of these economic and institutional factors was to produce a shift in fluid milk production to locations more distant from the primary Toronto market.

Because of the importance of the graduate entrant milk producer or new fluid milk shipper in this regional supply

shift, attention focused on this group of producers. Based on the location of graduate entrant milk producers over the 1968 to 1972 period, two sample study areas were selected. A random sample of 200 graduate entrant milk producers in the two areas were selected for interviewing. The concentration of graduate entrant milk producers in Eastern and Western Ontario made some regional comparisons possible.

In terms of fluid milk quota holdings, dairy herd management levels and acres in corn in 1973, there were no significant differences. Eastern Ontario was characterized by significantly larger industrial milk quotas, milking herds, farms and percentage income derived from milk sales. On the other hand, Western Ontario was distinctive in having significantly larger milking herd averages and incomes from milk sales.

Herd enlargement behaviour among the random sample of graduate entrant milk producers was related to personal, management, and farm characteristics in a series of predictive multiple regression models. Throughout the analysis the economic variables, herd size and farm size in 1968, accounted for the greatest variation in the dependent variable. This was not entirely unexpected for in previous studies milking herd size was an important predictor variable. However, the inverse relationship between herd enlargement and milking herd size in 1968 was not evident in previous studies. The presence of fluid milk quota purchases in a number of the cases reflected the importance of the institutional factor

in farm level adjustment. The positive relationship between herd enlargement and land additions reflects the importance of available land resources for dairy herd expansion. The role of immigrant Dutch dairymen was significant in accounting for herd expansion in Western Ontario.

The highest level of explanation was obtained in the Eastern Ontario cases indicating that the models were most suitable in an area where dairying was the dominant agricultural activity.

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to Dr. Lloyd Reeds for his advice, guidance and encouragement throughout the conduct of this study. In addition, thanks must also be given to Drs. Gentilcore and Hoffman for their many helpful suggestions.

I am also indebted to the staff of the Ontario Milk Marketing Board and the Ontario Ministry of Agriculture and Food for their kind assistance. The cooperation of the farmers interviewed, who gave so freely of their time, is also gratefully acknowledged. Finally, the financial support of the Ontario Milk Marketing Board which made this study possible is much appreciated.

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CHAPTER 1

INTRODUCTION

The Problem

Agricultural adjustment is normally a slow continuous process. Occasionally, because of a restriction on adjustment in the past, a new institutional setting, the nature of the change, and economic factors, the change is accelerated and marked by a distinctive spatial pattern. This appears to have been the case with the dairy industry in Southern Ontario since 1968. The application of a geographical approach to the problem of adjustment in the dairy industry can provide answers to a number of questions related to the process of change at both the macro and micro levels.

A new Milk Act for Ontario was legislated in 1965 as a result of the recommendations of the Report of the Ontario Milk Industry Inquiry Committee. This Act provided for the establishment of the Milk Commission of Ontario and the Ontario Milk Marketing Board. The Commission was given responsibility for administering the Act, while the Board was granted authority to purchase, transport, and sell milk. With these powers, the Ontario Milk Marketing Board was able to initiate a number of programmes which were to have a

major role to play in restructuring the dairy industry.

While the policies of the producer controlled Marketing Board have been instrumental in permitting adjustment, their impact cannot be isolated from economic forces such as the cost-price squeeze. However, the institutional setting and the economic factor are basic to an understanding of the several adjustments examined in this thesis. The adjustments examined in this study are threefold: (1) a major exit of producers from the dairy industry; (2) a marked shift from the industrial to the fluid milk market, permitted under the graduate entrant programme; and (3) herd enlargement, resulting in greater dependence on dairying as a source of farm income. The first two changes are examined at the macro-level, the last one at the micro-level. The base year for assessing the adjustments at both the regional and farm levels is 1968.

Emphasis in the study is on those producers who have remained in dairying and have made the latter two adjustments. More specifically, the new fluid milk producers[1] who have transferred from the industrial to the fluid milk market have been selected for a detailed study of herd

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[1]These producers are referred to as graduate entrant producers. The term is derived from the fact that these milk producers transfer to the fluid milk market in a gradual manner, receiving 20 per cent of their free quota allotment in September of the first year, 40 per cent in the second year ... until at the beginning of the fifth year they have received their full quota allotment.

enlargement behaviour. These producers are playing a role of growing importance and will be a key group in the future of the dairy industry in Southern Ontario.

The purpose of this thesis is to examine agricultural adjustment in dairying at both the macro or county level and the micro or farm level. Attention at the regional level is on describing and accounting for changes in market orientation and number of producers. Adjustments at the micro level, measured in terms of herd enlargement over the 1968 to 1973 period, will be related to personal, management, and farm characteristics in a predictive model.

There are a number of compelling reasons for a study of this type. First, many previous studies have concentrated on the macro level without any attempt to relate changes at this level to the micro level. The primary focus in this study is on herd enlargement at the farm level. Because herd enlargement results in milk supply increases, this study is particularly important during the current period of declining milk production. However, the regional changes are also considered in order to provide background for the farm level adjustments.

Second, the significance of the institutional factor in facilitating agricultural adjustment will be emphasized. The role of institutional factors in restricting adjustment

in the dairy industry of Southern California has been noted.[1] One can hypothesize that recent changes in the institutional setting in Ontario has accelerated the regional adjustments in the supply pattern for fluid milk. Furthermore, Marketing Board policies such as quota negotiability may have a bearing on herd expansion behaviour at the farm level.

Third, by looking at the farm adjustments a better understanding of the complex factors associated with change will be gained and an increased knowledge of producer behaviour will result. Conneman noted that: "Characteristics of the operator such as age, education, and family composition may be as important as land, labour and capital in determining output response."[2] Through the inclusion of some of these variables in the predictive model, it will be possible to assess their influence on herd-enlargement behaviour.

Finally, by selecting a sample of graduate entrant producers in Eastern and Western Ontario, the basis for a comparison of dairy operations in widely different physical

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[1]Gordon J. Fielding, "The Los Angeles Milkshed: A Study of the Political Factor in Agriculture," Geographical Review, Vol. 44, 1964, pp. 1 - 12.

[2]G.J. Conneman, A Methodological Study of Representative Farm Groups and Alternative Methods of Analyzing and Projecting Changes in Milk Production, Unpublished Ph.d. thesis, Pennsylvania State University, 1967, p.63.

environments has been established. This will lead to a further understanding of the importance of land capability and its relationship to farm level adjustments.

Contributions of Current Research

Although there is no attempt to establish any general theory of agricultural adjustment in this study, a number of important contributions are made. Through emphasizing the role of a specific factor, such as the institutional setting, and by formulating the problem with generalization in mind, a better basis may be established for future theoretical development.

The recent reorganization of the dairy industry in Ontario offers a good opportunity to assess the role of the institutional factor in agricultural adjustment. Through mapping the farm location of all industrial milk producers transferring to the fluid milk market over the 1968 to 1972 period, a detailed record of the spatial pattern is provided. This has utility for stratified areal sampling, and through annual updating can be useful in monitoring dairy industry adjustment. When this pattern is examined in conjunction with the pattern of attrition among dairy producers, it is possible to identify those areas which will play a more important role in the dairy industry in the future.

Through the removal of locational constraints in the form of restricted market access, and variations in market price and transportation costs, the Ontario Milk Marketing Board provided the basis for a major location shift in the supply of fluid milk in Southern Ontario. In establishing a uniform price and transportation rate for producers throughout Southern Ontario, the Marketing Board eliminated the two key factors which can impact agricultural land-use patterns. This in effect made Southern Ontario a uniform plain with respect to milk market price and per unit transportation costs. Under these conditions, two adjustment possibilities appear: (1) greater specialization and an increase in the size of dairy operations in the high land value areas; and (2) a shift of fluid milk production to more distant locations where lower land values prevail.

The role of the institutional factor can also be assessed at the farm level for the purchase of fluid milk quota has come about as a result of the Marketing Board's quota negotiability policy. Since the purchase of fluid milk quota enables the producer to obtain a higher price for his total milk production, such purchases may reflect the higher economic aspirations of these producers. In addition, quota purchasing behaviour may be positively associated with herd enlargement, and together may provide an indication of the competitive position of the dairy enterprise in the overall farm operation. This in turn

can have implications for land-use decisions and the appearance of the cultural landscape.

In looking at herd enlargement, attention is on one of the means of increasing milk supply. The identification of factors associated with herd enlargement is particularly important during this period of declining milk production and could have policy implications. More specifically, the identification of factors associated with herd enlargement behaviour could be useful in selecting target groups for Provincial Government policies and programmes designed to increase milk production.

The selection of independent variables was made with the objective of including a number of personal characteristics of the farm operator and a measurement of dairy herd management ability. In the review of literature, frequent reference was made to the importance of the managerial aspect and the difficulties associated with its measurement. Thus the use of a new measurement of herd management ability is considered to be one of the contributions of this study. The gel test, averaged over a period of one year, has been selected as an index of management in this study. This particular statistic is available on a monthly basis from a central testing lab and may be indirectly related to milk production and income from milk sales.

Thesis Overview

A review of literature on regional and farm-level adjustments is undertaken in chapter two. Recent non-geographical and geographical works are emphasized. Chapter three examines the role of the institutional setting in the Ontario dairy industry. Problems giving rise to the changes of the mid-1960's are first examined. This is followed by a discussion of the reorganization of the industry, the function of milk quotas and pricing and the role of the Canadian Dairy Commission. The methodology employed in the study is the subject of chapter four. Attention is given to the measurement of variables, the collection of data and the techniques of analysis.

Background for the farm-level adjustments is provided by looking at regional adjustments in producer numbers over a six year period. The importance of the graduate entrant programme in bringing about changes in the pattern of fluid milk production and the number of industrial milk producers becomes clear in chapter five. A predictive multiple regression model, using herd enlargement since 1968 as the dependent variable, is developed in chapter six. Attention is on relating changes in the dependent or response variable to a number of socio-economic and managerial

characteristics of the farm operator. The results and findings from the study are summarized in chapter seven.

CHAPTER 2

REVIEW OF LITERATURE ON ADJUSTMENT IN THE DAIRY INDUSTRY

Introduction

The purpose of this chapter is to review the relevant literature on adjustment in the dairy industry. This topic has been the subject of study by geographers, economists, agricultural economists, and sociologists. Themes, analytical procedures, and scale of study have varied accordingly. In this review, special attention is given to the model or analytical procedure employed, and the identification of factors contributing to, or involved in, the process of change.

Initial emphasis is on the contributions of other disciplines in the field of agricultural adjustment within the dairy industry. Geographical studies are then reviewed. Finally, the contribution of previous work on agricultural adjustments in the dairy industry is summarized.

Non-geographical Contributions

One analytical procedure commonly used in studies of agricultural adjustment is the linear programming model.

The purpose of the analysis is to identify an optimal pattern of flow, or location of production and processing facilities in order to minimize costs or maximize profits. Snodgrass and French[1] examined the problem of interregional competition in the dairy industry in the United States using a series of linear programming models. One of the specific objectives of the study was "to solve with use of linear programming models, the optimal resource pattern for moving dairy products from surplus to deficit areas, location of processing firms, and location of production."[2] The optimal pattern was then compared to the existing pattern in order to point out the degree of difference. From these differences, it was possible to indicate the adjustments necessary to reduce the misallocation of resources in the dairy industry.

The basic data input used to determine the optimal resource distribution consisted of production and transportation costs for the regions identified in the model. Thus economic considerations were paramount in determining the desired industry adjustments necessary to minimize

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[1]Milton M. Snodgrass and Charles E. French, Linear Programming Approach to the Study of Interregional Competition in Dairying, Purdue University, Agricultural Experiment Station, 1958.

[2]Ibid, p. 4.

total industry costs. However, the authors noted in their summary that: "the accuracy of the findings of this study and their subsequent use are limited more by inadequate data than by analytical procedure or model."[1]

The linear programming model has been applied to the Ontario dairy industry[2] with the objective of the analysis being to develop an optimal pattern of movement for fluid milk. In both Ontario studies, findings were that the actual and optimal patterns were quite similar. Consequently, it was concluded that rationality, defined in terms of cost minimization, prevailed in the location and transportation of fluid milk.

Another approach to the study of adjustment in the dairy industry is to attempt to predict the rate of structural change, using Markov Chain processes. Markov Chain analysis provides a forecast, based on projecting the rate of change that occurred over some period in the past into the future. As a result, it does not make allowance for changes in the forces which produced a particular rate

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[1] Ibid, p. 2.

[2] See for example: G.S. Nelson, An Analysis of the Efficiency of Fluid Milk Flows in Central and Western Ontario, Unpublished M.Sc. thesis, University of Guelph, 1967; and George R. Grant, Roy McCulloch, and Dale Dilamarter, Perspective on Milk Supplies from Central Ontario, Economics Branch, Ontario Ministry of Agriculture and Food, Toronto, 1972.

of change in the past. In addition, the technique does not explain the factors which underlie or produce the change. Typically, changing herd size or farm numbers are used as an index of structural change in the dairy industry.

Furniss and Gustafsson[1] used census data on changes in herd size distribution of census farms over the 1961 to 1966 period to establish probabilities of change for the various herd size categories. These probabilities were then used in order to estimate the number of census farms with milk cows in 1971 and 1981. These estimates were made for Canada as a whole, as well as for Ontario and Quebec. The authors add their own note of caution, stating that: "the accuracy of these projections ... will depend upon how realistic the change from 1961 to 1966 is as an estimator of future farm growth or decline."[2]

In the case of Ontario, the 1971 projection for the number of farms with milking cows was 39,586.[3] This over-estimates the 1971 census figure of 35,053 by 5,533 farms or 12.93 per cent. Consequently, it can be concluded that the rate of adjustment from 1961 to 1966 has accelerated

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[1] I.F. Furniss and Bengt Gustafsson, "Projecting Canadian Dairy Farm Structure Using Markov Processes," Canadian Journal of Agricultural Economics, Vol. 16 (1968), pp. 64 - 78.

[2] Ibid, p. 71.

[3] Ibid, p. 73.

over the 1966 to 1971 period.

Markov Chain analysis can also be applied at the farm level when producer panel data are available.[1] However, the same basic problem was noted in the following statement: "The data presented seem to indicate that the basic probabilities changed even over a relatively short period of time. Thus, the period of time for which the transition probabilities are valid is open to question."[2]

A major theme in the literature on adjustment in the dairy industry is that of adoption or rejection of modern technology and management practices. Although rural sociology has dominated the work in this field, other disciplines have made important contributions as well. A study on the communication and acceptance of recommended farm practices among dairy farmers in Australia was undertaken by Wilkening, Tully, and Presser.[3] The authors examined the social and psychological characteristics of

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[1] A producer panel consists of a group of farmers questioned and revisited over time to determine the adjustments that are taking place and the factors associated with the adjustment.

[2] G.J. Conneman, A Methodological Study of Representative Farm Groups and Alternative Methods of Analyzing and Projecting Changes in Milk Production, Unpublished Ph.D. thesis, Pennsylvania State University, 1967, p. 154.

[3] E.A. Wilkening, Joan Tully, and Hartley Presser, "Communication and Acceptance of Recommended Farm Practices among Dairy Farmers of Northern Victoria," Rural Sociology, Vol.27 (1962) pp. 116 - 197.

farmers and the role of management factors as they affected the adoption of different types of farm practices.

The study noted that there was no single overall measure of managerial skill. However, attempts were made at measuring management by (1) an index of record keeping, and (2) the method of deciding on major improvements. Examination of the association between management items and the adoption of technical practices revealed no statistically significant results, leading the authors to conclude that the attempt to arrive at a general measure of managerial skill was unsuccessful.[1]

In the Canadian context, Verner and Gubbels[2] undertook a study of one hundred dairy farmers in the Lower Fraser Valley. A primary objective in the research was to relate the role of socio-economic characteristics and information-seeking behaviour to the adoption of ten innovations considered necessary for successful dairy farming. Every producer in the sample was assigned a score for each reported stage in the adoption process for each of the ten innovations, resulting in a composite measure of adoption. Through the use of Partial Correlation Coefficients, it was

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[1] Ibid, p. 117.

[2] Coolie Verner and Peter M. Gubbels, The Adoption of Innovations by Dairy Farm Operators in the Lower Fraser Valley, Agricultural Research Council of Canada, Paper No. 11, 1967.

possible to identify statistically significant associations between the composite adoption score and the socio-economic and information-seeking characteristics of the dairy farmers.[1]

Ethnic influences were examined as a separate topic. Although no statistically significant association was evident between the adoption score and the ethnic groups, some significant differences were noted among the ethnic groups. The manner in which the Dutch dairy farmers were different was of special interest. Verner and Gubbels reported that:[2] (1) the Dutch farmers reported higher participation in adult education courses in agriculture and significantly more indicated they enjoyed dairying very much; (2) Dutch farmers had higher daily milk quotas and sold more milk annually; (3) more of the farmers from other countries had immigrated prior to 1945, while more of those born in the Netherlands came after 1946; (4) farmers from other countries hired no farm labour and used more unpaid family labour, while native born farmers used less unpaid family labour and hired more farm labour; and (5) immigrants from other countries reported no income from other sources, while native born farmers reported more income from other sources. It is expected that some of these differences may manifest them-

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[1] Ibid, pp. 15 - 20.

[2] Ibid, p. 24.

selves in greater milking herd expansion.

Agricultural economists have also been involved in the study of the adoption of modern dairy practices. The emphasis in these studies was on the association between the adoption of these practices and production factors. Instead of concentrating on a small random sample, both of the studies discussed used mail questionnaires for data collection. In the earlier study, W. James White[1] undertook a mail survey of more than 76,000 Canadian manufacturing milk and cream producers. The objective of the study was to indicate the association between six modern dairy practices and seven farm characteristics. Correlation analysis was used for this purpose. The results showed that the adoption of such technology as bulk tanks and pipeline milkers was influenced by the number of cows milking, the share of income received from dairy sales, the type of market to which the milk was sold, investment in land and buildings, and the age of the farm operator.[2]

More recently, Sahi[3] collected some 51,000 mail

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[1]W. James White, "The Adoption of Modern Dairy Practices," Canadian Journal of Agricultural Economics, Vol. 16 (1968), pp. 29 - 39.

[2]Ibid, p. 29.

[3]R.K. Sahi, Structural and Technological Change in the Dairy Industry, Economics Branch, Agriculture Canada, Ottawa, 1973.

questionnaires and used a more refined technique to look at the same problem. In this study, the author assigned different weights to the adoption of certain practices to calculate an index of adoption. Using the adoption index as a dependent variable in a multiple regression model, Sahi related adoption to six farm and farm operator characteristics. The independent or predictor variables in this study were: the level of dependence on dairy income, the age of the operator, the education of the operator, the value of farm assets, the herd size, and production per cow. Separate models were run for the cream, manufacturing milk and fluid sectors. Although the majority of independent variables were significant in each of the models, herd size was the strongest variable in all of the models.[1]

Another approach to the study of adjustment in the dairy industry involves analysis of supply response. This approach is most readily identified with agricultural economics. In the past, these studies have stressed time-series analysis of aggregate data. However, more recent work has shown a shift to the use of individual farm units and producer panel data. This has made it possible to relate individual response to changes in aggregate supply. In one such study, Conneman[2] attempted to project milk

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[1] Ibid, p. 68.

[2] Conneman, A Methodological Study of Representative Farm Groups.

supply increases using both Markov Chain process and multiple regression analysis. Although Conneman and others[1] have emphasized the importance of non-physical variables in determining supply-response, the problem becomes one of measuring factors such as managerial ability. This is the same problem that Wilkening and others encountered in their study of the dairy industry in Australia.[2]

The work by Conneman is of special interest because of his use of a predictive model employing farm level data. The multiple regression model using the stepwise procedure is one of the analytical techniques that Conneman used in this study. Change in milk production over the 1960 to 1964 period, measured in both absolute and percentage terms, is the response variable in the model. Although Conneman acknowledges the importance of the personal characteristics of the farm operator in supply-response decisions, the selection of independent variables reflects an economic orientation, (table 2 - 1). Two considerations apparently entered into the selection of these independent variables: (1) the hypothesized relationship with the dependent variable; and (2) their ease of quantification.

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[1]Harold O. Carter, "Representative Farms - Guides for Decision Making," Journal of Farm Economics, Vol. 45 (1963) pp. 1448 - 55; and James S. Plaxico, and Luther G. Tweeten, "Representative Farms for Policy and Projection Research," Journal of Farm Economics, Vol. 45 (1963) pp. 1458 - 65.

[2]Wilkening et al, "Communication and Acceptance," pp. 191 - 96.

TABLE 2 - 1

VARIABLES UTILIZED BY CONNEMAN IN MULTIPLE REGRESSION MODELS [1]

Dependent Variable

Y = absolute change in milk production between 1960 - 61 and 1963 - 64

Z = percentage change in milk production between 1960 - 61 and 1963 - 64

Independent Variables

X_1 = crop acres operated (owned and rented) in June 1960

X_2 = pounds of milk sold per cow during the 1960 - 61 production year

X_3 = number of crop acres per cow in 1960 season

X_4 = net price per cwt. received for milk between 1960 - 61 and 1963 - 64 in dollars

X_5 = barn capacity in June 1960 (number of stalls)

X_6 = change in net price per cwt. received for milk between 1960 - 61 and 1963 - 64 in dollars

X_7 = size of labour force in the 1960 - 61 period (in annual man equivalents: total months of labour/12)

X_8 = age of operator in June 1960

X_9 = index of mechanization in June 1960

X_{10} = method of delivering milk (bulk or can) in period 1960 - 1964 (bulk variable - dummy: 1 if yes, 0 if no)

X_{11} = number of cows in June 1960

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[1] G.J. Conneman, A Methodological Study of Representative Farm Groups and Alternative Methods of Analyzing and Projecting Changes in Milk Production, Unpublished Ph.D. thesis, Pennsylvania State University, 1967, p. 160.

A number of regression models were developed in which the farm groups were selected on the basis of region, milk market, size of operation, and type of operation.[1] Absolute and percentage change in milk production were considered for each of the farm groupings. The results of the various models showed that the independent variables in the equations explained a relatively small portion of the change in milk production over the study period. One of the reasons for this low level of explanation may have been provided by the author when he noted that: "For individual farms, change is frequently dominated by personal characteristics."[2] The only such variable included in the model was the age of the farm operator. The comments by Plaxico and Tweeten must be considered relevant in this context for they observed that:

> "Over the years, farm management research has shown that nonphysical (i.e. human, institutional, etc.) variables have a profound impact on farm organization, production efficiency and earnings. For example, there is ample evidence that the level of managerial skill possessed by the operator is an important variable .... Unfortunately, it is difficult to quantify several of the nonphysical variables mentioned and even more difficult to determine their distribution within a population."[3]

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[1]Classified as exit farms, entry farms, and continuous farms, depending on whether the farms had ceased milk production during the 1960 - 64 period, began milk production during this period or were in continuous production over the entire period.

[2]Conneman, A Methodological Study of Representative Farm Groups, pp. 214 - 15.

[3]Plaxico and Tweeten, Representative Farms, p. 1463.

Undoubtedly, this consideration provides a partial explanation for Conneman's emphasis on the economic and size-related independent variables.

Geographical Contributions

The earlier work on adjustment in the dairy industry stressed a combination of a descriptive and regional approach. Typical of this approach is the work of Loyal Durand Jr.[1] in his study of dairying in the North Country of New York State. The author traced the adjustments which have occurred in this area since 1800. Durand identified several eras over this time period and related production and processing changes to factors such as increased competition from other regions, changing export markets, and changing technology.

Regional trends in the milk industry of England and Wales over the period 1933 to 1955 was the subject of work by Simpson.[2] Through the mapping and description of trends in dairy cattle numbers, and milk sales per acre, the author established the regional pattern of adjustment in

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[1] Loyal Durand Jr. "The Historical and Economic Geography of Dairying in the North Country of New York State." Geographical Review, Vol. 57 (1967) pp. 24 - 47.

[2] E.S. Simpson, "Milk Production in England and Wales," Geographical Review, Vol. 49 (1959) pp. 95 - 111.

the dairy industry. The author relates these changes to a series of policy decisions made by the Marketing Board and points out the importance of the institutional factor in promoting adjustments in the dairy industry. This study is particularly relevant to the Ontario situation for the marketing system introduced in Ontario was patterned after the British system.

Fielding also examined the role of the institutional factor in the dairy industry of Southern California.[1] The author focused on the interregional competition between two milksheds for the Los Angeles market. Through the use of area price fixing and the allocation of milk to different classes of utilization and price, the region with the lowest overall production and marketing costs was prevented from effectively competing for the market. Fielding concluded that by institutionally directed pricing and restrictive land use zoning favouring dairy enclaves, the higher cost production area was maintaining its market advantage.[2]

In a recent study, Frederic[3] attempted to establish

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[1]Gordon J. Fielding, "The Los Angeles Milkshed: A Study of the Political Factor in Agriculture," Geographical Review, Vol. 44 (1964) pp. 1 - 12.

[2]Ibid, p. 1.

[3]Paul B. Frederic, An Analysis of Spatial Disappearance: The Case of Dairying in a Cash Grain Region, Unpublished Ph.D. thesis, University of Illinois at Urbana-Champaign, 1973.

if spatial regularities existed in the disappearance of a form of behaviour as it does in the adoption of innovations. The abandonment of dairying in a cash grain area in East Central Illinois was used as a case study. One aspect of the research involved identifying the farm and farm operator characteristics that best distinguish between units that continued in dairying from those that abandoned it. Multiple stepwise discriminant analysis was used for this purpose. The conclusion reached from the analysis was: "In general, dairy farmers with units that have a low technological level, who perceive fair cow prices to be low, who do not own most of the land they farm, and who have a small herd have a fairly high probability of dropping milk production."[1] With respect to the motivation for shifting out of dairying, the author noted that the relative profitability of cash crops in East Central Illinois attracted a substantial number of farmers away from milk production.[2]

The work by Horner[3] on changes in the dairy industry of Southern Ontario provides another example of the historical approach to the study of agricultural adjustment.

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[1] Ibid, p. 141.

[2] Ibid, p. 139.

[3] John Horner, Changing Patterns in the Production and Utilization of Milk in Southern Ontario, Unpublished M.A. thesis, University of Toronto, 1967.

The purpose of the study was: "to determine as accurately as possible, the spatial patterns and changes which occurred in the production and utilization of milk between 1910 and 1961."[1] Horner used Lorenz curves to show changes in concentration of production over time and in addition, mapped the changing spatial patterns. An explanation of these patterns and their changes over time was also undertaken.

One of the conclusions reached in the study was that a strong positive correlation existed between the production of fluid milk and land and building values.[2] As the highest land and building values were in the vicinity of Toronto, this reflected the market-oriented nature of the fluid milk industry in the early 1960's. However, Horner noted that there was a trend towards a more dispersed pattern of fluid milk production resulting from the movement of fluid milk shippers to locations more distant from the Toronto market.[3] The author attributed this trend to fluid milk producers who were capitalizing on the land values in the immediate Toronto area by selling their farms, but continuing in milk production at locations more distant to the market. The

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[1] Ibid, p. 29.

[2] Ibid, p. 108.

[3] Ibid, pp. 109 - 110.

recent study by Maas and Reeds[1] on farmer-migration within the Toronto-Centred Region focused on this migration and behaviour pattern among dairy farmers.

Although Horner's work was completed before the programmes of the Ontario Milk Marketing Board were implemented, the author could foresee the direction of future adjustments: ..."there could be a substantial shift in milk production from the more productive land towards that with fewer alternative opportunities."[2] Horner attributed this expected shift in milk production patterns to two factors: (1) under the price-pooling programme regular fluid milk producers would receive less money for their milk and would cease production; and (2) the transportation pooling arrangement would remove the locational constraints from fluid milk production at more distant locations resulting in greater production in these areas. The mapping of regional adjustments in the dairy industry of Southern Ontario since 1968 indicates that this has in fact occurred and will continue under the present institutional setting.

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[1]D.R. Maas and L.G. Reeds, Farmer-Migration Within the Toronto-Centred Region: Research in Progress on Migration Differentials, McMaster University, Department of Geography, 1972.

[2]Horner, Changing Patterns in the Production, pp. 117 - 18.

Previous Contributions

From the review of literature on adjustment in the dairy industry, one cannot identify a general theory accounting for agricultural adjustment. Two things do emerge: (1) an inventory of analytical tools that can be utilized to deal with the problem of adjustment; and (2) the identification of a wide variety of variables associated with adjustment in the dairy industry. The literature can generally be grouped into regional or farm level studies, although some work such as the studies by Conneman and Frederic attempt to deal with the problem at both levels.

At the macro level, the focus is on regional and industry change and on interregional competition, with data typically coming from census material, government agencies, or in some cases from the use of mail questionnaires. Linear programming, Markov Chain processes, and multiple regression techniques have all been utilized in the analysis of the data.

The micro-level studies have been concerned with two themes: (1) the acceptance and diffusion of production-increasing technology; and (2) supply response at the farm level. In distinguishing between these two approaches, one must recognize the implicit assumption that the adoption of modern technology and enlargement of productive capacity

are causally related. However, in both types of studies, the literature has emphasized the identification and association of the variables influencing adjustment. Table 2 - 2 indicates the range of variables associated with farm-level adjustment in the dairy industry. It is from this range of variables that the independent variables used in this study have been selected. The techniques of analysis for dealing with farm-level adjustments have ranged from simple and multiple regression analysis to discriminant analysis and the use of Markov Chain processes.

TABLE 2 - 2

FACTORS ASSOCIATED WITH DAIRY FARM ADJUSTMENT[1]

Type of Adjustment	Factors Influencing Adjustment
Adoption of Modern Technology or Management Practices	Institutional Marketing Board Policy Government Policy Personal Age of operator Education level Family size Family composition Economic Farm size Herd size Market emphasis Managerial Herd management Crop management Bookkeeping
Increase in Size of Operating Unit and Greater Specialization in Dairying	Location Land quality Climate Ethnic Dutch or non-Dutch
Decrease in Size of Operating Unit and Greater Diversification	Communication Contact with agricultural representative, fieldmen or equipment salesmen Reading of journals Radio and Television Neighbourhood contacts
Discontinuation of Dairy Enterprise	Attitudes and Aspirations Credit Dairying as a way of life Life style expectations Current level of Technology Presence of a bulk tank Use of a pipeline milker Free stall barns Change in resource base Land purchase or rental Drainage improvement Increased use of fertilizer

[1] These variables were identified in the review of literature and served as a basis for the selection of independent variables in this study. In a number of studies similar variables were employed, e.g. age and herd size were commonly used, however no indication of their frequency of use is given.

CHAPTER 3

THE INSTITUTIONAL SETTING OF THE ONTARIO DAIRY INDUSTRY

Introduction

The purpose of this chapter is to provide background information on the institutional framework within which the dairy industry operates. Consideration must be given to the role of both Provincial and Federal agencies which have been recently established to formulate dairy policy and programmes. At the Provincial level, the producer-controlled Ontario Milk Marketing Board has been playing a major role in developing policies for the supply and marketing of milk. However, the Milk Commission of Ontario still retains overall responsibility for regulation and Provincial dairy policy development. The Federal Government is represented in the dairy industry by the Canadian Dairy Commission. Generally, the Provincial organizations are more concerned with the fluid milk sector, quality control, extension services, and the marketing of dairy products within the Province. On the other hand, the Federal agency has generally been involved in providing support prices for industrial milk, in purchasing surplus dairy products, and in exporting or storing these surpluses.

The first part of the chapter deals with the Provincial situation. Initial consideration is given to the problems facing the industry in the late 1950's and early 1960's. These problems resulted in the establishment of the Ontario Milk Industry Inquiry Committee[1] and the reorganization of the milk industry in Ontario through the Milk Act of 1965. Considerable attention is given to the programmes and policies of the Ontario Milk Marketing Board as these have been instrumental in bringing about the recent adjustments in the Ontario dairy industry. Discussion of milk quotas and pricing policies follows. The fourth part of the chapter discusses the formation, role and policies of the Canadian Dairy Commission as it affects the milk producer in Ontario.

Problems Giving Rise to Change in the Ontario Dairy Industry

When the Ontario Milk Industry Inquiry Committee was established in May 1963, it was given the responsibility of looking into all matters pertaining to the milk industry. The Report, which came out in January 1965, recommended a number of major changes for unifying the industry and dealing with the problems besetting the industry in the early

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[1] Also known as the Hennessey Report after the Chairman of the Committee, Professor S.G. Hennessey of the University of Toronto.

1960's. The Inquiry Committee identified a number of problems which were threatening the industry. These problems can be summarized under the general headings of division within the industry, inequitable treatment of producers, and rigid regulations which were outmoded and not capable of handling the changes which were occurring in the industry. These changes were occurring as a result of advancing technology both on the farm and in the processing sector.

Four producer organizations evolved out of the adversity of the 1930's, reflecting the division of markets typical of that period. These groups were the Ontario Whole Milk Producers' League, representing the fluid milk producers; the Ontario Cheese Producers' Association, the Ontario Concentrated Milk Producers' Association, and the Ontario Cream Producers' Association. Numerous attempts were made in the late 1950's and early 1960's to bring these organizations together into one producer association. The desirability of such amalgamation was being emphasized by a technological change taking place in the processing sector during this time period. Multi-product plants, processing a variety of dairy products were becoming more common. As a result, the jurisdiction originally defined for the various producer associations was becoming increasingly overlapped and blurred.

The price negotiated for fluid milk was much higher than that paid for milk going to other end uses, thereby

putting the whole milk producers in an enviable position within the industry. Related to this problem was the difficulty experienced by nearly all producers who attempted to gain entry to the fluid milk market. The nature of the restrictions on entry is the subject of the following remarks:

> "The fluid milk business is the most institutionalized aspect of the dairy industry. For at least ten or fifteen years it has been very difficult if not impossible to obtain a quota. When more milk is required, the farmers who have quota usually receive a quota increase...."[1]

By 1965, there were 179 separate agreements in the province concerning price, terms and conditions of sale of fluid milk. Furthermore, these awards provided for 83 different prices ranging from $4.19 per hundredweight in a market in Southern Ontario to $6.50 for a market in Northern Ontario.[2] As suggested by the wide range of prices and agreements, inequitable treatment was a fact of life among the fluid milk shippers as well. The following statement provides some insight into the nature of this problem:

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[1]John Horner, Changing Spatial Patterns in the Production and Utilization of Milk in Southern Ontario, Unpublished M.A. thesis, University of Toronto, 1967, p. 109.

[2]R.G. Marshall and S.H. Lane, Fluid Milk Pricing and Quota Policies in Ontario, 1965 - 1969, Department of Agricultural Economics, University of Guelph, AE/71/5, p. 21.

> "If you are fortunate enough to ship to a dairy that is increasing in business and going ahead, you can probably get a higher base or quota without any effort on your part. On the other hand, if you are shipping to a dairy that is going downhill, the situation is reversed and there is nothing that you can do about it."[1]

The dairies that were in the first category were generally in the rapidly growing Toronto market, a factor that gave rise to the market orientation of the fluid milk industry in the pre-1968 period. The discontent among producers was further accentuated by changing technology. Introduction of bulk tanks among industrial producers was resulting in a decrease in milk quality differences between industrial and fluid milk producers.

A final example of the problems facing the dairy industry during this period can be drawn from the processing sector of the milk industry. A number of distribution areas were established under the Milk Industry Act. These areas were, for the most part, highly artificial and permitted price differences which protected the inefficient.[2] The net effect of these distribution areas was to prevent many distributors with superior operating efficiency from extending their activities to neighbouring markets where they could compete effectively. This in turn prevented these

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[1] Report of the Ontario Milk Industry Inquiry Committee, 1965, p. 35.

[2] Ibid, p. 37.

distributors from making capital investments which they might otherwise have made in order to achieve even greater efficiency.

Division also existed among the various processor organizations and between this group and the milk producers. The Ontario Concentrated Milk Manufacturers' Association expressed their fears in a submission to the Milk Industry Inquiry Committee: "The producer has been acting and no doubt thinking that the only solution is a producer-developed, producer-controlled, and producer-operated plan solely for the benefit of the producer."[1] The effect of all the problems and divisions within the industry in the early 1960's was to make some type of change in the structure and organization of the industry imperative. It was to these problems that the Ontario Milk Industry Inquiry Committee directed its efforts when it was established in 1963.

Reorganization of the Dairy Industry in Ontario

One of the most immediate results of the Report of the Ontario Milk Industry Inquiry Committee was a new Milk Act legislated in 1965. This Act provided for the formation of the Milk Commission of Ontario to oversee and regulate the dairy industry and the Ontario Milk Marketing Board to

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[1] Ibid, p. 44.

represent the milk producers of the Province.

The Milk Commission of Ontario replaced the Milk Industry Board which had been unconvincing and ineffective in dealing with the problems facing the dairy industry.[1] With broader powers than the old Board, the Commission was charged with the responsibility of ensuring that an adequate supply of quality product was available at a reasonable price. While some seventeen responsibilities and objectives were outlined for the Commission in the Hennessey Report, these can be summarized as: (1) to act as an Appeal Tribunal for the Milk Industry; (2) to co-operate with the Canadian Dairy Commission, other agencies, and other provinces on dairy matters; (3) to maintain liaison with all groups in the industry - processors, producers, transporters, and consumers; (4) to formulate general policies and rules governing the affairs of the industry as a whole; (5) to establish long-range plans for the industry in order to facilitate adjustments; and (6) to provide for quality control through the Milk Industry Branch.[2] On April 1, 1973 an amendment to the Milk Act[3] was introduced giving the Commission expanded powers in the field of selecting, developing, and maintaining research programmes and monitoring the effects of

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[1] Ibid, pp. 48 - 50.

[2] Ibid, pp. 50 - 52.

[3] Bill 245, Ontario Legislature, Queen's Park, Toronto.

existing and new policies. In addition, the Milk Industry Branch, which is responsible for quality testing, and the Commission have been separated. When the Ontario Milk Marketing Board was established in 1965, it adopted as a guiding principle equitable treatment of milk producers. With the authority to purchase, transport, and sell milk, the Board was in a position to initiate a number of policies and programmes which would have a major impact on the supply of milk in Ontario.

From its very outset in 1965, the Board gave continuous study to the development of pooling policies.[1] By March 1, 1968, Group I pooling went into effect for the entire province, with provisions for entry to the pool by qualified industrial producers commencing on September 1, 1968. In conjunction with the pooling arrangement, the Ontario Milk Marketing Board became the sole first buyer and seller of milk and proceeded to develop a data processing system for the centralized payment of producers. Each fluid shipper and subsequently each new fluid milk shipper or graduate entrant milk producer, was allotted a quota based on his total milk shipments during a base period.[2]

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[1] Marshall and Lane, Fluid Milk Pricing, pp. 26 - 28.

[2] This period was established as August, 1965 to July, 1966, excluding the months of April, May, and June, when large volumes of milk were coming onto the market.

The Board policy which evolved was that the pool would be made up of only fluid milk requirements plus a ten per cent margin to accommodate possible variations in fluid milk utilization. By restricting the size of the fluid milk pool for Ontario, the Board made individual producers responsible for continuous maintenance of their quotas. This move represented a departure from the Milk Industry Inquiry Committee's recommendations. Through a payout ratio established on the basis of fluid milk consumption, the burden of surplus milk was shared equally among all milk producers. This decision to limit the size of the fluid milk pool based on fluid consumption was critical in that it gave rise to a partial supply management system. Mestern observed that the system was partial in that it covered the fluid market only and was limited in application to Ontario.[1] Excess shipments of milk by Pool I producers were used for manufacturing purposes and entered into the Canadian wide market for industrial milk. However, this excess eventually came into a supply management system known as the market sharing quota, which attempted to balance the supply and demand of industrial milk at the national level. This system was initially introduced at the Federal level in 1970, but is administered in Ontario by the Ontario Milk Marketing Board.

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[1] H.J. Mestern, "The Evolution of Supply Management in the Canadian Dairy Industry," Canadian Farm Economics, December, 1972, pp. 12 - 16.

Industrial milk producers who previously had limited access to the higher priced fluid milk market were allowed free entry into the Pool I market provided they met certain quality standards and were shipping industrial milk continuously since the base period.[1] These new Pool I shippers, or graduate entrant producers, were given free quota related to their base period production. In the first year, they were paid Pool I blend prices on 20 per cent of their quota, in the second year 40 per cent ... until at the end of the fourth year they were receiving blended Pool I prices on their entire allotted quota. However, these graduate entrant producers could and in many cases did purchase additional Pool I quota at the going market rate.

In addition, the Board introduced a three phase programme to pool transportation costs throughout Southern Ontario. The final phase in this programme was completed in January, 1973. As a result, the milk producer in Bruce county was receiving the same price for his milk and paying the same transportation costs per hundredweight as the producer in York county. The net effect of the series of Board

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[1] Marshall and Lane, Fluid Milk Pricing, p. 32 outlined these conditions: (a) farm premises and facilities meeting Grade A requirements, (b) milk testing Grade 1 or 2, resazurin test in two of three months prior to entering the pool, (c) bulk tank capable of storing at least 2½ days production, and (d) an active Federal subsidy eligibility quota.

programmes was to remove the market entry restrictions and the locational constraints for industrial milk producers. Consequently, the new institutional arrangements contributed to a major geographical shift in the fluid milk industry. Marshall and Lane commented on this aspect of the Marketing Board policies:

> "It can be assumed that this permitted flexibility in resource mobility not previously possible and, since opportunity costs vary considerably from region to region as well as from producer to producer, the efficiency of resource use in milk production has been enhanced."[1]

Milk Quotas and Pricing in Ontario

In the past, fluid milk producers in Ontario would typically be holding up to three different quotas for milk providing for a number of different payment levels.[2] Each fluid milk producer has a Group I Pool Quota that has been allotted by the Ontario Milk Marketing Board. In many cases this has been supplemented by purchased quota. The Group I Pool shippers are paid a weighted blend of class 1 and 2

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[1] Marshall and Lane, Fluid Milk Pricing, p. 29

[2] For more complete discussion of the quota and pricing system in Ontario the reader is referred to Roy McCulloch, Milk Prices and Payment Flows in Ontario, Economics Branch, Ontario Ministry of Agriculture and Food, Toronto, 1972.

prices on from 84 to 90 per cent of their quota holdings.[1] The actual percentage in any given month, known as the pay-out ratio, depends on Board sales in these price classes.

Most Group I Pool producers ship more milk than they are paid for at the Group I blend price. These excess fluid shipments are covered by individual holdings of market sharing quota. For this milk they are paid at the industrial milk blend price, which is the weighted average of class 3 to class 6 milk prices. Shipments in excess of the market sharing quota are assessed a levy which brings the price of this milk in line with world price levels. In addition, some of the Group II Pool milk going for industrial purposes is covered by a subsidy eligibility quota, granted and paid for by the Canadian Dairy Commission. These quotas and levies are administered through the Ontario Milk Marketing Board.

The subsidy eligibility quota, established in 1967, was based on butterfat content which is the common denominator for milk and cream shippers. This programme resulted in direct payment to producers on the level of butterfat required to meet domestic requirements. However, at this

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[1] This is the range that has appeared in practice over the last several years. There is nothing in the Board policy which restricts the payout to this range. However, one of the results of including all industrial milk under this arrangement would be to substantially reduce the payout ratio.

level of butterfat production, the production of solid-non-fat in the form of skim milk powder exceeds the Canadian consumption by some 170 to 200 million pounds annually.[1] Recently, a change in the system resulted in the combination of the subsidy eligibility quota and the market sharing quota in order to simplify the system.

The pricing of milk can be more readily understood by looking at some of the unique features of the milk marketing system in Ontario. This system is characterized by three features: (1) a producer-controlled marketing Board which acts as the exclusive buyer and seller of milk; (2) a supply management programme operated through various pools and quotas which share the available milk markets among producers; and (3) a price discrimination system which attempts to maximize farmers' revenue.[2] Emphasis in this section is on describing how this price discrimination system operates and its role in the current milk shortage situation.

The Ontario Milk Marketing Board charges dairies and processing plants different prices for milk depending on the end-product utilization, (table 3 - 1). The price classification system was introduced in April 1970, under the authorization of the Milk Commission of Ontario. Three additional classes have been introduced to differentiate

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[1]Mestern, "The Evolution of Supply Management," p. 14.

[2]McCulloch, Milk Prices and Payment Flows, p. 1.

TABLE 3 - 1

CLASSIFICATION AND PRICE OF MILK AND MILK PRODUCTS TO THE PRODUCER, JANUARY, 1974

Category	Product	Price	
Class 1	fluid milk	S. Ont. N. Ont.	$9.13 $9.70
Class 2	concentrated liquid milk		$8.69
Class 3	fluid creams, cottage cheese, yoghurt and fluid plant inventories		$5.54
Class 4	ice cream mixes, confectionery products, puddings, soups, sterilized infant foods		$5.39
Class 4(a)	specialty cheese (Jan. 16)		$6.64
Class 4(b)	brick and colby cheese (Jan. 16)		$6.70
Class 5	butter, casein, condensed and evaporated milk, skim milk powder, whole milk powder, fluid plant losses up to two percent, and industrial plant inventories		$5.16
Class 5(a)	cheddar cheese		$6.29
Class 6	new products		$5.16

Source: Ontario Milk Producer, January, 1974, p.30. The price is based on 3.5 per cent butterfat with a price differential of each 0.1 per cent variation in butterfat above or below 3.5 per cent for all classes of milk of 8.5 cents per cwt.

among the various categories of cheeses. Although frequent price changes have occurred for the various categories, there have been no recent changes in the system. In order to prevent processing plants from switching low priced milk to higher priced end usage, the Milk Industry Branch[1] provides a plant audit service.

At present, all dairies are entitled to purchase all the fluid milk they are willing to pay for at the fixed price, (Classes 1 and 2). Similarly, processing plants can acquire all the milk they are willing to pay for with the exception of Classes 5 and 5a milk supplies. Because Class 5 is the lowest priced category, the current milk shortage problem is restricted to this residual class. In order to guarantee supplies to processors of Class 5 products, the Ontario Milk Marketing Board introduced a Plant Supply Quota to ration the available supply of Classes 5 and 5a milk. One of the requirements of this quota is that the plants must accept milk at all times. This means that when there are short term diversions of milk from other uses or when seasonal surpluses appear these plants play a vital role for

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[1]The Milk Industry Branch is a branch of the Ontario Ministry of Agriculture and Food which is charged with the responsibility of providing regulatory service to the dairy industry and includes farm inspections as well as plant audits.

the industry.[1] However, their annual milk requirements are considerably below their current demand. Furthermore, the price classification system does not permit them to pay more for supplies of Classes 5 and 5a milk.

Under the present arrangement, milk used for the federally supported products (Classes 5 and 5a) is priced by setting the price of 100 pounds of milk equal to a yield factor times the federal product price minus an allowance for processor margin.[2] The market price for butter and skim milk powder typically coincides with the support price for these products. In the latter part of 1974, the cheddar cheese price has been above the support level and increasing in a regular manner. However, changes in Class 5a prices bring forth corresponding changes in the price of Class 4b products because the differential between these categories is determined by a formula.

The Canadian Dairy Commission

Established as a Crown Corporation in 1966, the Canadian Dairy Commission assumed responsibility for

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[1]Short term diversions to processing plants with Plant Supply Quota occur on holiday weekends when other plants are not operating. The seasonal surpluses come during the months of May, June, and July, when milk production peaks.

[2]McCulloch, Milk Prices and Payment Flows, pp.36 - 37.

national dairy policy and programmes in April, 1967. The stated objectives of the Canadian Dairy Commission were: (1) to provide efficient producers of milk and cream with the opportunity of obtaining a fair return for their labour and investment; and (2) to provide consumers of dairy products with a continuous and adequate supply of high quality dairy products.[1] In the first year of its operation the Commission continued the policies which pre-dated its formation. This involved the offer to purchase dairy products such as butter, skimmed milk powder, and cheddar cheese, products which at the same time were receiving Federal Government price supports. It also involved the payment of direct subsidies to producers based on the previous year's production and a holdback of a share of the subsidy which was used to export surplus products such as skimmed milk powder and butter.

During the 1967 - 68 dairy year,[2] the Canadian Dairy Commission introduced subsidy eligibility quotas to all producers of industrial milk and cream, with the quota being based on producer's sales during the 1966 - 67 dairy year. The purpose of the programme was to provide the Commission

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[1] W. James White, "The Canadian Dairy Industry in Retrospect," Canadian Journal of Agricultural Economics, June, 1971, p. 11.

[2] The dairy year for the Canadian Dairy Commission begins on April 1st and ends on March 31st.

with a means to control: (1) total production; (2) the distribution of wealth among manufacturing milk and cream producers; and (3) to restrict entry into the industry.[1] Since April, 1968, several changes have occurred in the programme. The subsidy eligibility quota became freely negotiable in Ontario and Quebec in 1970, when a supply management programme was introduced for industrial milk. Prior to that time, the subsidy quota could only be transferred with the purchase of a herd. It was at this time that market sharing quota was introduced to cover all milk used for manufacturing purposes.[2] Under this scheme each producer, whether industrial or fluid, was provided with a share of the Canadian industrial milk market. However, the subsidy eligibility quota which was based on butterfat was retained and paid directly by the Canadian Dairy Commission. The Ontario Milk Marketing Board administers the market sharing quota and makes deductions or levies for over quota milk production and forwards these payments to the Federal Government.

Because the subsidy eligibility quota was introduced during a period of surplus milk production, it was initially

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[1] White, "The Canadian Dairy Industry," p. 12.

[2] This role has evolved over time for fluid milk producers. Initially these producers were excluded and at present there are limitations on the extent to which they participate.

used as a vehicle for restricting milk production. This was accomplished by restricting the amount of production covered by subsidy quota at the individual level, by varying the subsidy level, and by increasing deductions on milk sales in excess of subsidy quota. The introduction of market sharing quota complicated the system and made it difficult for the individual producers to know how to respond. Consequently, the two systems were combined during the current dairy year in order to make it more responsive to supply-demand conditions. In addition subsidy levels have increased, the amount of production covered by subsidy increased, and the levy on within quota and over quota production reduced.[1]

The market sharing quota system is national in scope and covered six provinces and approximately 95 per cent of industrial milk and cream in 1972.[2] If a province does not fill its annual allotted quota, the quota shifts to provinces that have utilized their quota more fully. This has been a recent source of concern for the Ontario dairy industry for in the past year there was a major shift of market

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[1]This levy is used to help defray the costs of exporting surplus dairy products such as skimmed milk powder. It should be distinguished from the over quota levy which is assessed on production over the producer's quota. The over quota levy is designed to bring domestic prices in line with world prices.

[2]Mestern, "The Evolution of Supply Management," p. 15.

sharing quota from Ontario to Quebec.

The above discussion of the role of the Canadian Dairy Commission highlights the web of complexity that has grown up in the Canadian dairy industry. This dual government role stems from the Canadian Constitution which gives provincial governments jurisdiction over the marketing of agricultural products within its boundaries, while the Federal government's jurisdiction covers trade at the international level and between provinces. As a consequence, the provincial authorities generally have control over the fluid milk industry while the Federal government exercises major control in the industrial milk and cream sectors of the industry.[1] However, in the future greater coordination can be anticipated as an attempt is made to foster more co-operation in the development of dairy policy.

In summary, it would appear that government policy, both federal and provincial, played a major role in the dairy industry of Ontario. Furthermore, this role is likely to continue in the future. When the Ontario Milk Marketing Board is included in this institutional framework, it is clear that the adjustments which have occurred in the producing sector of the industry since 1968 can be partly

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[1] An exception to this division can be noted in the Federal government's subsidy introduced in October, 1973. This was an attempt by the federal authorities to stabilize the price of fluid milk to the consumers.

attributed to Board policy. At present the discriminatory pricing system attempts to maximize returns to producers. However, it has also resulted in two classes of milk producers: (1) those participating in Pool I and receiving top price for milk covered by Pool I quota; and (2) those producers who are in Pool II and receive a blend price of Classes 3 to 6 milk. It is this differential in price between these two groups of producers that provides the economic incentive for transfer to Pool I through the graduate entrant programme.

CHAPTER 4

METHODOLOGY

Introduction

This chapter outlines the procedure used in the measurement of variables, the manner in which the data was collected, the techniques of analysis, and a summary of material covered in chapters one to four. Initial concern is with the selection of a measurement of adjustment for both the regional and farm level data. Simple descriptive statistics of the variables used in the multiple regression model are presented and the problem of assessing farm level management levels concludes section one. Section two deals with the regional and farm level data collection and the problem of selection of a sample group, sample areas, and individual farms for interviewing. In section three, attention focuses on the mapping technique used for the regional data, the methods of testing for statistical association and differences, and the use of a predictive multiple regression model. Finally, section four summarizes the first four chapters and briefly outlines the contents of chapters five, six and seven.

Measurement of Variables

The Measurement of Adjustment. The first problem to arise relates to the selection of an index of adjustment for both regional and farm level changes. A wide range of possibilities exist for measuring adjustment at both levels. However, at the macro level the number of milk producers was selected for more detailed consideration, with fluid and industrial producers treated separately. Availability of county level data played a major role in the decision to use number of producers and changes in producer numbers as the measurement of regional adjustment.

In developing a model relating to farm adjustment, the selection of a suitable variable involved several considerations: (1) the desirability of using a variable that reflected structural change within the dairy industry; (2) ease of measurement; and (3) the necessity of establishing changes over the 1968 to 1973 period. Given these considerations, herd enlargement was selected as the variable used to measure farm adjustment.

Examination of changing herd size in Ontario from 1951 to 1971 (table 4 - 1) indicates that two processes have been operating over this twenty year period. First, attrition has resulted in a reduction in herd numbers from 106,687 in 1951 to 35,053 in 1971, with most of this attrition occurring in the smaller herd size categories. By

TABLE 4 - 1

CHANGING HERD STRUCTURE OF THE ONTARIO DAIRY INDUSTRY 1951 TO 1971

Herd Size	Number of Farms 1951	1956	1961	1966	1971	Absolute Change 1951 to 1971
1 Cow	11,590	9,741	5,785	3,616	2,875	- 8,715
2 Cows	9,409	6,215	3,912	2,388	1,638	- 7,771
3 - 7	33,895	22,992	14,426	8,014	4,428	- 29,467
8 - 12	28,797	24,819	16,341	9,229	4,399	- 24,398
13 - 17	12,630	14,458	12,079	7,673	4,070	- 8,560
18 - 32	9,238	14,302	15,937	14,220	9,681	+ 443
33 - 47	886	1,899	3,240	4,610	5,064	+ 4,178
48 - 62	160	367	762	1,404	1,880	+ 1,720
63 - 77	36	88	208	389	585	+ 549
78 - 92	23	45	82	158	195	+ 172
93 +	23	22	75	164	238	+ 215
Totals	106,687	94,948	72,847	51,865	35,053	- 71,634

Source: Dominion Bureau of Statistics and Statistics Canada; Catalogue 96-536 (Vol. V part 2) Bull. 5.2 - 2 1961 and Catalogue 96-707 (Vol. IV part 2) Bull. 4.2 - 2 1971. Figures refer to all farms reporting and are much larger than the number of commercial dairy farms. For example, in 1971 there were only 17,718 commercial farms.

focusing on changes in number of producers under the section on regional adjustment, some indication of the regional variations in the attrition rate will be provided. Second, enlargement of milking herds has been taking place, with all herds larger than the 18 - 32 category showing an increase during the 1951 to 1971 period. However, it should be noted that since 1961, the number of herds in this particular size category has shown a substantial decrease. Larger herds have shown consistent increases. Furthermore, with the cost-price squeeze and technological advances, this trend towards larger operating units and greater specialization in dairying is likely to continue. Thus focus on herd enlargement satisfies the first requirement of having a variable that reflects structural changes within the industry.

In addition, herd size and changes in herd size are factors that a dairy farmer can most readily relate to, thereby contributing to accuracy of recall. Data on herd size and changes in herd size over the 1968 to 1973 period was collected from a questionnaire, (Appendix I).

Table 4 - 2 provides a breakdown of the type of changes in herd size since 1968 among the graduate entrant milk producers interviewed. One can note that Western Ontario was characterized by slightly higher herd expansion and herd reduction behaviour, while Eastern Ontario has a higher percentage of producers undertaking no herd size changes. Some indication of the distribution of herd size

TABLE 4 - 2

TYPE OF HERD SIZE CHANGE AMONG GRADUATE ENTRANT MILK PRODUCERS SINCE 1968

	Total Sample		Eastern Ontario		Western Ontario	
	No.Farms	%	No.Farms	%	No.Farms	%
Expansion	141	73.1	45	66.2	96	76.8
No Change	45	23.3	22	32.4	23	18.4
Reduction	7	3.6	1	1.4	6	4.8
Total	193	100.0	68	100.0	125	100.0

Data Source: Farm Interviews

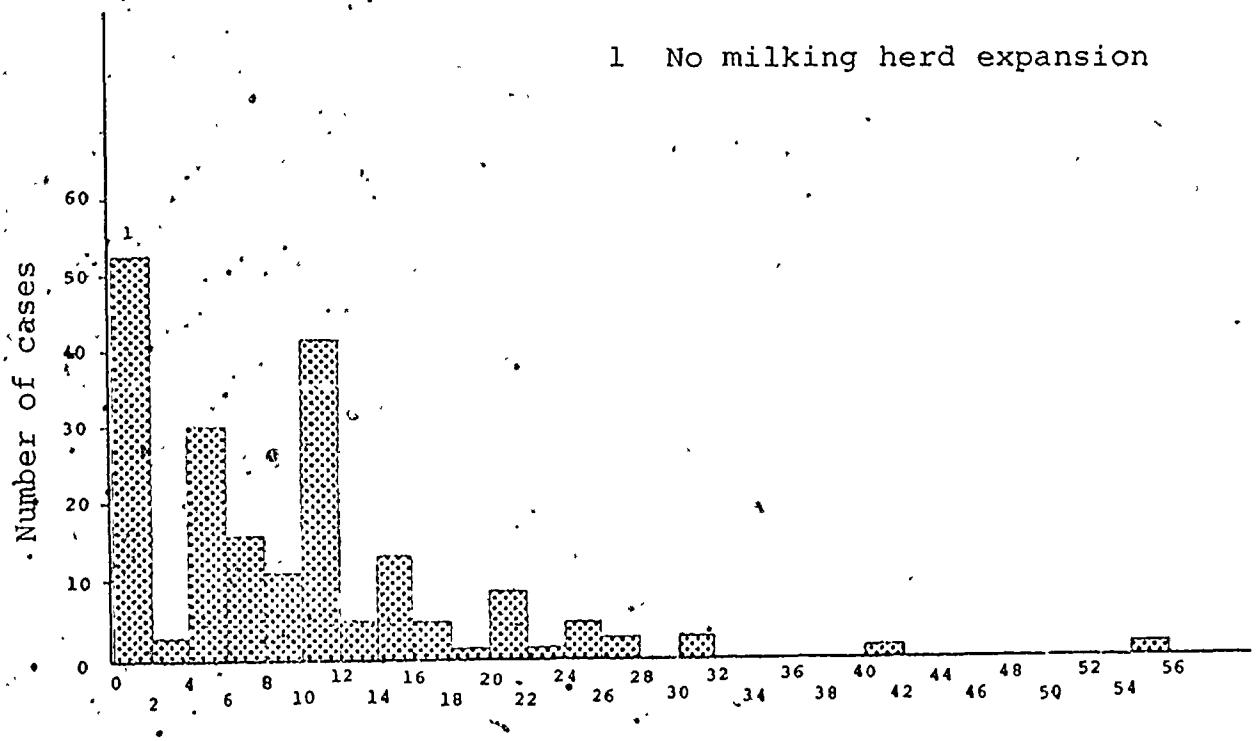
changes since 1968 is provided in figure 4 - 1. The median herd expansion group for the total sample is ten to twelve milking cows.

Measuring the Independent Variables. A number of problems developed in the measurement of the independent variables in the model: (1) including variables in the model that could only be measured on a presence-absence basis; (2) establishing a value for some variables for the base year of 1968; (3) making certain assumptions with respect to the variables; and (4) developing a measurement for managerial ability.

Two dichotomous or dummy variables were included in the model. The first such variable was the bulk tank variable. When the producer had a bulk tank for storage and

Figure 4 - 1

MILKING HERD EXPANSION SINCE 1968



Data Source : Farm Interviews

handling of milk in 1968 a " 1 " was assigned; a " 0 " was assigned when the producer did not have a bulk tank in 1968. The aggregate figures for this statistic among the graduate entrant milk producers are presented in table 4 - 3. It can

TABLE 4 - 3

PRESENCE OF A BULK TANK IN 1968

	Total Sample		Eastern Ontario		Western Ontario	
	No. Farms	%	No. Farms	%	No. Farms	%
Bulk Tank in 1968	123	63.7	46	67.6	77	61.6
No Bulk Tank in 1968	70	36.3	22	32.4	48	38.4
Total	193	100.0	68	100.0	125	100.0

Data Source: Farm Interviews

be noted that a higher percentage of the graduate entrant milk producers interviewed in Eastern Ontario had bulk tank facilities in 1968. This may reflect the fact that the dairy enterprise in Eastern Ontario has played a more dominant role in the agricultural economy of the region than in Western Ontario.

The second variable measured on a presence-absence basis was the ethnic factor. In this case attention focused on the immigrant Dutch Canadians because of their frequent mention in the literature. A " 1 " was assigned when this

characteristic was present; a " 0 " when it was absent. In addition to the immigrant Dutch Canadians, two small but distinctive groups of producers were also identified. The total and regional distribution of the four groups of producers is identified in table 4 - 4. Two observations are

TABLE 4 - 4

ETHNIC GROUPING OF GRADUATE ENTRANT MILK PRODUCERS

	Total Sample		Eastern Ontario		Western Ontario	
	No.Farms	%	No.Farms	%	No.Farms	%
Immigrant Dutch	69	35.8	30	44.1	39	31.2
Mennonites	18	9.3	0	00.0	18	14.4
French Canadians	17	8.8	17	25.0	0	00.0
Others	89	46.1	21	30.9	68	54.4
Total	193	100.0	68	100.0	125	100.0

Data Source: Farm Interviews

in order: (1) the Mennonites and French Canadians are found only in Western and Eastern Ontario respectively; and (2) the immigrant Dutch Canadians comprised a greater percentage of the graduate entrant milk producers in Eastern Ontario than in Western Ontario.

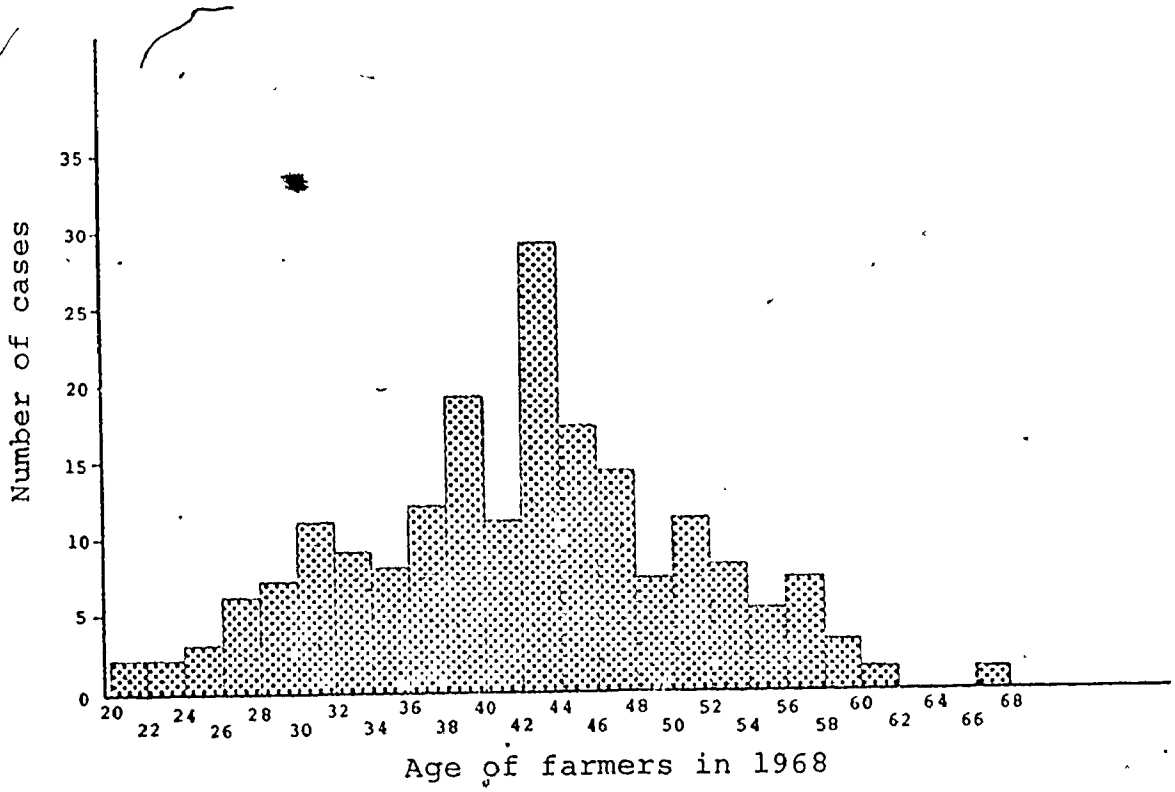
For three of the variables it was necessary to estab-

lish a value for the base period. The age of the farm operator in 1968 was determined by subtracting five from the value given in the interview. Although this establishes the age for 1968, it does not provide a base month. Figure 4 - 2 gives a detailed breakdown of the age distribution of the graduate entrant milk producers interviewed. The median age category for the producers in 1968 was 42 - 44 years. The size of the milking herd was calculated by subtracting the increase in herd size from the current herd size to arrive at a figure for 1968. The distribution of herd size in 1968 is shown in figure 4 - 3. In 1968 the median herd size category of the graduate entrant milk producers was 25 to 29 milking cows. The farm size in 1968 was arrived at by taking land purchase and rental figures from the farm size provided in the interview. Figure 4 - 4 gives a breakdown of the distribution of farm size in 1968. The median farm size category in 1968 among the milk producers interviewed was 175 - 200 acres.

In three cases the values were taken directly from the questionnaire: (1) additions of tile drainage since 1968; (2) additions of land since 1968; and (3) fluid milk quota purchases since 1968. Table 4 - 5 shows the number and percentage of farms adding tile drainage since 1968. A major regional difference can be noted with respect to this variable. Only 26.5 per cent of the farmers interviewed in Eastern Ontario had added tile drainage since 1968, while

Figure 4 - 2

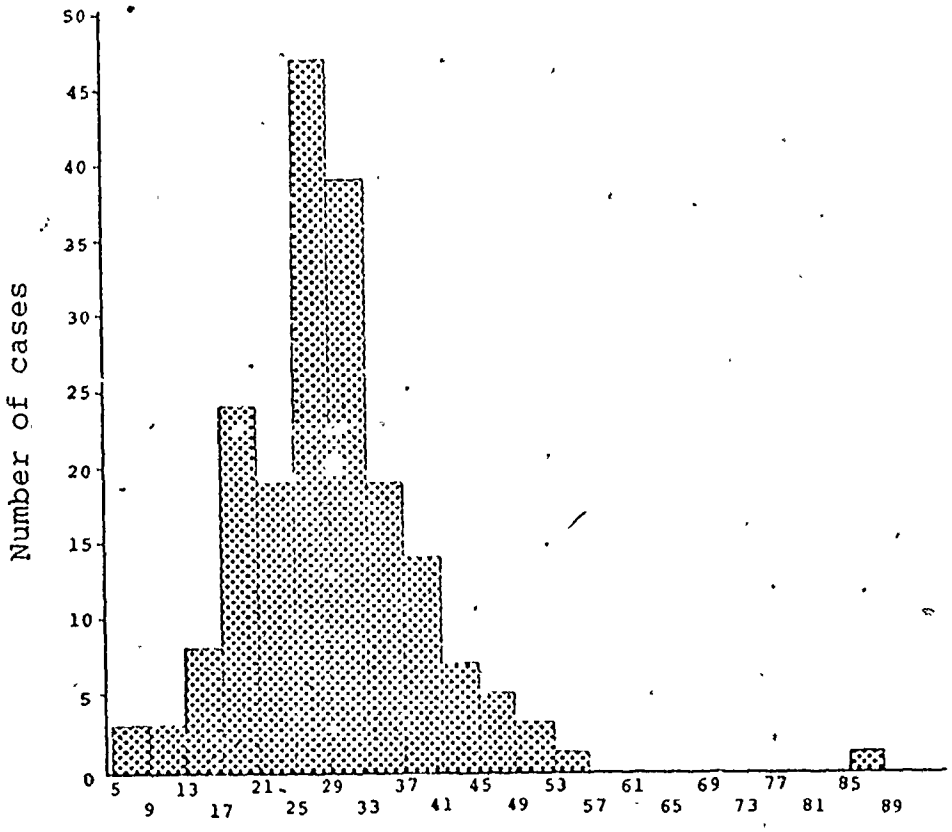
AGE OF FARMERS INTERVIEWED



Data Source : Farm Interviews

Figure 4 - 3

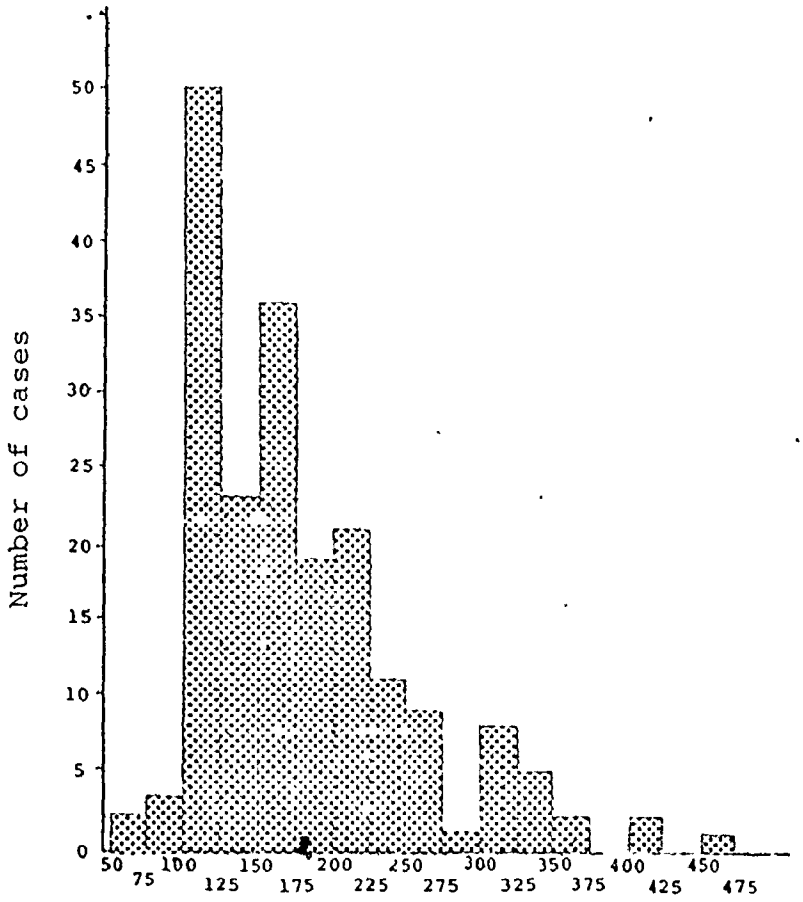
SIZE OF MILKING HERD IN 1968



Data Source : Farm Interviews

Figure 4 - 4

FARM SIZE IN 1968



Data Source : Farm Interviews

TABLE 4 - 5

ADDITIONS OF TILE DRAINAGE SINCE 1968

	Total Sample		Eastern Ontario		Western Ontario	
	No. Farms	%	No. Farms	%	No. Farms	%
Tile Drainage since 1968	79	40.9	18	26.5	61	48.8
No tile drainage since 1968	114	59.1	50	73.5	64	51.2
Total	193	100.0	68	100.0	125	100.0

Data Source: Farm Interviews

48.8 per cent of the milk producers in Western Ontario had added tile drainage.

Table 4 - 6 indicates that 52.8 per cent of the milk

TABLE 4 - 6

LAND ADDITIONS SINCE 1968*

	Total Sample		Eastern Ontario		Western Ontario	
	No. Farms	%	No. Farms	%	No. Farms	%
Land Additions	91	47.2	35	51.5	56	44.8
No Land Additions	102	52.8	33	48.5	69	55.2
Total	193	100.0	68	100.0	125	100.0

* Includes land purchases and land rentals
Data Source: Farm Interviews

producers interviewed had acquired additional land since 1968 through purchase or rental. Some 51.5 per cent of the producers in Eastern Ontario had added to their land resource base while 44.8 per cent of the producers in Western Ontario had made such additions.

The quota purchasing behaviour of the graduated entrant milk producers interviewed is shown in table 4 - 7.

TABLE 4 - 7

FLUID MILK QUOTA PURCHASES SINCE 1968

	Total Sample		Eastern Ontario		Western Ontario	
	No.Farms	%	No.Farms	%	No.Farms	%
Quota Purchases	92	47.7	32	47.1	59	47.2
No Quota Purchases	101	52.3	36	52.9	66	52.8
Total	193	100.0	68	100.0	125	100.0

Data Source: Farm Interviews

The outstanding aspect of this statistic is the fact that there is virtually no difference in quota purchasing behaviour between milk producers in Eastern and Western Ontario.

For the remaining three independent variables, assumptions were necessary in order to make the factors operational in the model. In the case of education level, the

assumption was that the farm operator had not advanced his formal education since 1968. Because many of the farmers interviewed were in the middle age category, this assumption was quite realistic. Each year of night school at agricultural college in Holland was counted as a year of formal education. Figure 4 - 5 provides a detailed distribution of the education among the graduate entrant milk producers interviewed and indicates that the median education category is between 9 and 10 years.

In the case of land capability the assumption was made that the average percentage of classes 1 and 2 land in the township applied to all farms interviewed in that township. The distribution of farms by township land capability values is shown in figure 4 - 6. The large number of farms in the 77 to 87 per cent categories reflect the larger number of farmers interviewed in Western Ontario. This is probably the weakest variable in terms of measurement for variations about the township average could be considerable in some of the townships in Eastern Ontario.[1] However, the variable was included because it was felt that some effort should be made to assess the role of land capability.

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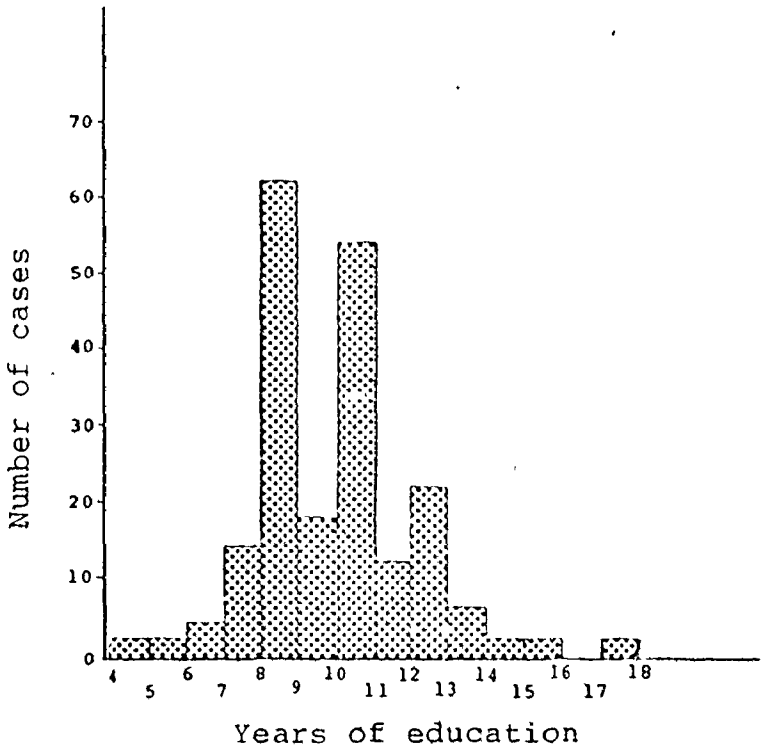
[1]This is the best data readily available at present. In the near future land capability data on an individual basis will be available from the Rural Land Assessment Program currently in progress.

Figure 4 - 5

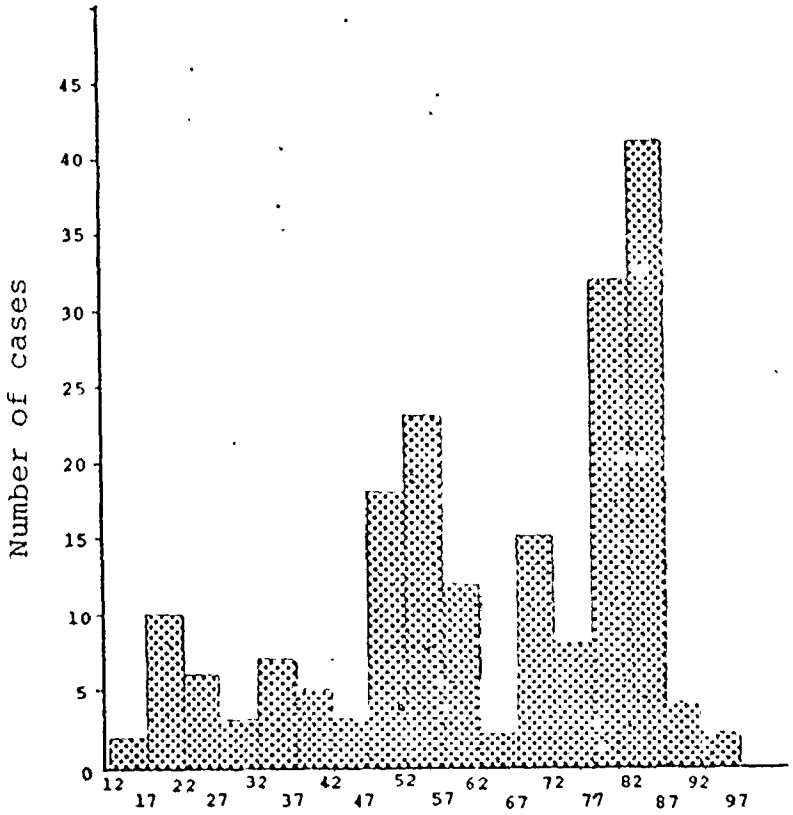
EDUCATION OF FARMERS INTERVIEWED



Data Source : Farm Interviews

Figure 4 - 6

PERCENTAGE CLASS 1 AND 2 LAND CAPABILITY



Percentage class 1 and 2 land

Date Source : Farm Interviews

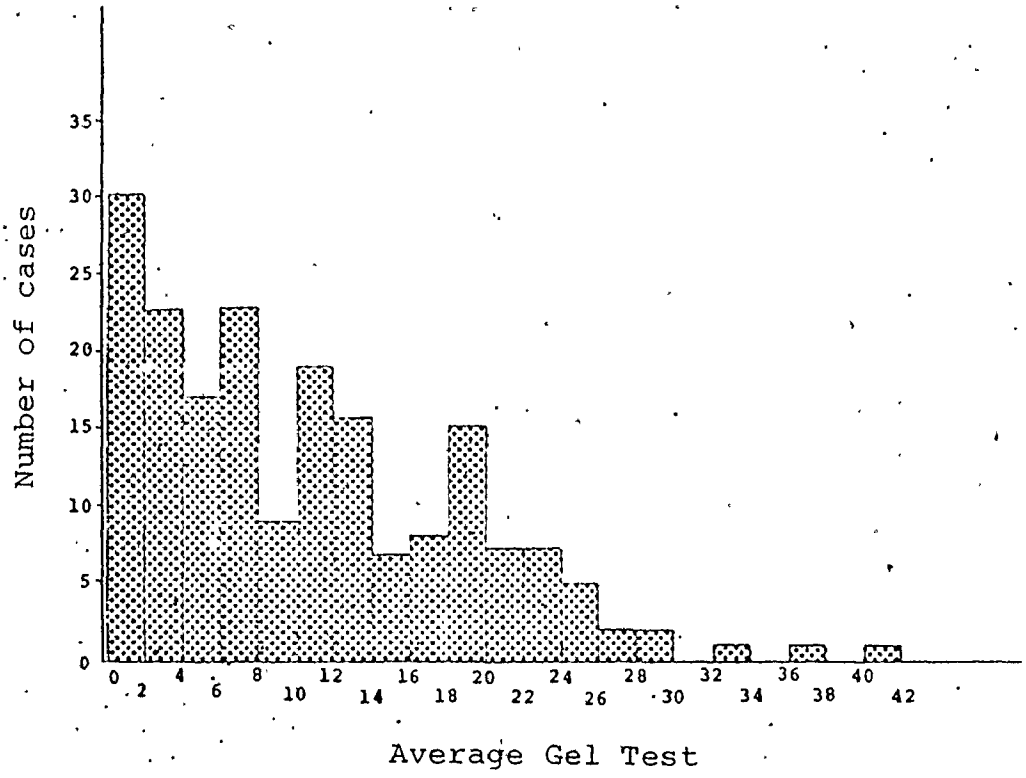
Finally, the gel test average, measured over the period August 1972 to July 1973, was used to indicate the level of management. The assumption with respect to this variable was that herd management over this period was at the same level in 1968. Because herd management is more likely to improve over time than deteriorate, the gel test values used in the model probably overestimates 1968 management levels. As a result, a further assumption was necessary: the error was uniformly distributed among the graduate entrant milk producers interviewed. The distribution of herd management levels among the graduate entrant milk producers interviewed is shown in figure 4 - 7. The median value for gel test average for the total sample was in the 8 - 10 gel test category.

The Problem of Measuring Management on Dairy Farms.

As noted in the review of literature, the assessment of farm management level is a difficult problem. Furthermore, it was indicated that the management variable was particularly important in any evaluation of farm performance and decision-making. The alternatives in this situation would appear to be threefold: (1) employ an index of management based on the use of certain equipment or practices; (2) categorize the dairy farmers into three or four management groups based on the appearance of the farm, the condition of the barn, and the use of certain practices; or (3) use a single measurement of herd management based on milk quality.

Figure 4 - 7

AVERAGE GEL TEST VALUES



Data Source : Farm Interviews

The use of an index of management based on the presence of certain equipment or practices presents problems of interpretation. For example, while a free stall barn may result in cleaner and healthier cows, and less work, a dairyman who is also selling purebred cattle may wish to show his animals and prefer to use a single tie system. Thus, the presence of a free stall barn may be more of a measure of size than of herd management. On the other hand, a meaningful judgement of a dairy farmer's management level requires assessment by a dairy specialist and should be based on barn inspection.

When a single measurement of herd management based on milk quality is employed, only one aspect of overall farm management is being measured. In addition to herd management, crop management and record keeping are important aspects of farm management. The use of a single measurement of milk quality raises the question of which one of a series of possible indicators of milk quality should be used. In spite of these limitations, emphasis in this study is on the use of a single measurement of herd management in the belief that this may be an important factor affecting the decision to expand the size of the milking herd. Furthermore, the availability and reliability of data on milk quality favoured the use of a single measurement of herd management. This eliminated the necessity of making subjective decisions on a producer's level of management.

In this study, the gel test average[1] has been selected to indicate the level of herd management among the 200 dairy farmers interviewed. The gel test measures the level of mastitis in a dairy herd. Mastitis is the dairy industry's number one disease problem, which results in reduced milk production and the loss of millions of dollars to milk producers each year.[2] Three factors have been cited as major causes of mastitis: mechanical, bovine, and human.[3] The mechanical element is related to milking equipment, with faulty or below capacity equipment producing udder stress resulting in injury which speeds up mastitis infection. The cow's resistance to infection constitutes the bovine factor. Finally, the human factor deals with the operation of equipment, the hygiene programme, teat dipping, and the treatment of infected cows. However, of the three factors cited above, the single most important factor is that of management as noted in the following comment:

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[1]The test derives its name from the fact that a jelly-like precipitate forms when a reagent is added to milk having a high leukocyte (white blood cell) count.

[2]"Editorial", Ontario Milk Producer, Vol. 48, No. 10 (1973) p. 3.

[3]"Milk Management", Ontario Milk Producer Supplement, September, 1971, p. 10.

> "There is one major cause for mastitis --- the dairyman. Mastitis, in most cases, is simply the result of poor management. The average dairyman can, if he wants to, control mastitis by practising two simple control procedures --- teat dipping and dry cow therapy."[1]

In order to reduce the possibility of abnormally high values for any particular month not related to the general management level, the monthly readings were averaged over an entire year. Used in this manner, the gel test average provides a good measurement of herd management levels among dairy farmers.

Data Collection

Regional Data Inputs. The pattern of fluid and industrial milk producers[2] for Southern Ontario[3] was mapped for June, 1968. The county breakdown of the number of fluid milk producers on a monthly basis has been collected by the

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[1] "Editorial", Ontario Milk Producer, Vol. 48, No. 10 (1973) p. 3.

[2] Under the Ontario Milk Marketing Board terminology, these producers are referred to as Group I Pool and Group II Pool producers respectively.

[3] This consists of eleven producer regions comprised of forty-two counties. In June, 1968, this area accounted for 90.34 per cent of the fluid milk producers and 99.16 per cent of the industrial milk producers. Since 1968, Muskoka has been added to the Southern Ontario Pool by the Marketing Board. However, it has been excluded in this study. See figure 4 - 8 for counties in the study area.

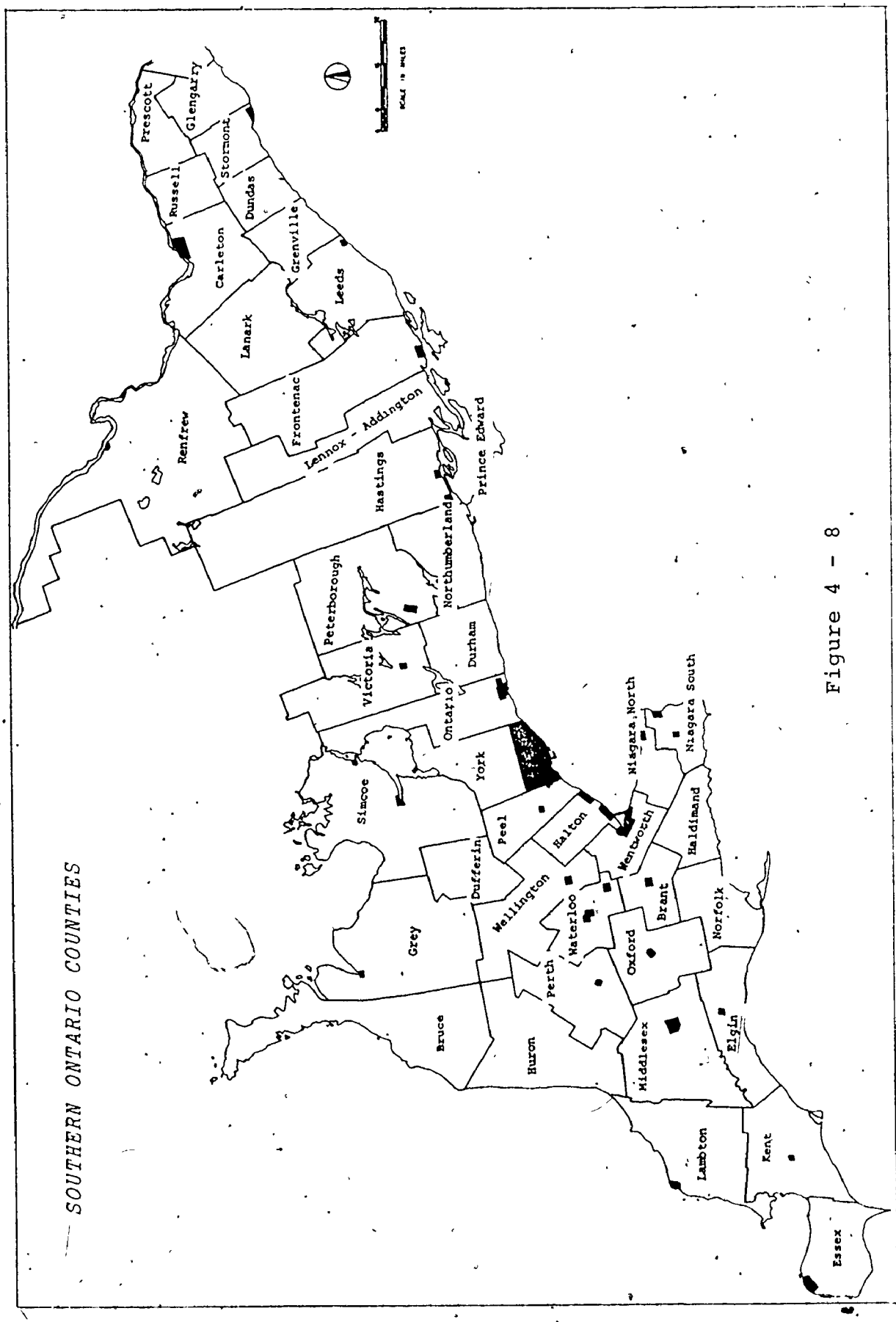
SOUTHERN ONTARIO COUNTIES
Prescott
Glengarry
Russell
Stormont
Dundas
Carleton
Grenville
Leeds
Lanark
Renfrew
Frontenac
Lennox - Addington
Hastings
Prince Edward
Peterborough
Northumberland
Victoria
Durham
Ontario
York
Simcoe
Peel
Halton
Niagara, North
Niagara South
Haldimand
Wentworth
Dufferin
Wellington
Brant
Norfolk
Grey
Waterloo
Oxford
Perth
Bruce
Huron
Middlesex
Elgin
Lambton
Kent
Essex

Figure 4 - 8

Ontario Milk Marketing Board since March, 1968. Consequently, there was no problem in obtaining data on the number of fluid milk producers. In the case of industrial milk producers, this data has only been available since June, 1970. In order to arrive at figures for June, 1968, the dropout rate from June, 1970 to June, 1974 was projected back to 1968.[1] Thus, June, 1968 was selected as the base period for mapping the number of both fluid and industrial milk producers.

Selection of Sample Group, Sample Areas, and Individual Farms. The graduate entrant milk producers[2] were selected for a more detailed study of herd enlargement behaviour for several reasons: (1) the response to the graduate entrant programme has been an important factor leading to a change in the spatial structure of the dairy industry in Southern Ontario; (2) commitment to the graduate entrant programme involves a longer term commitment to the dairy industry; and (3) because of the opportunities for

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[1] It is important to use the same month each year when examining this statistic as there are a number of seasonal industrial milk producers. The month of June represents the maximum number of industrial milk producers in any given year.

[2] The term is derived from the fact that the industrial milk producers transferred to the fluid milk market in a gradual manner, receiving 20 per cent of their free quota allotment in September of their first year, 40 per cent in the second year ... until the end of the fourth year they had received their total allotment.

increased income provided by participation in the programme, herd enlargement was expected to be an important adjustment occurring on these dairy farms.

In order to select sample areas for interviewing, the farm location of all graduate entrant milk producers over the 1968 to 1972 period was mapped, (figure 4 - 9). The county, township, lot, and concession locations were available from the Ontario Milk Marketing Board for all graduate entrant milk producers. These were mapped on the 1972 county road maps (scale one inch to four miles) for Southern Ontario. Through the use of two grids, the pattern was transferred to a smaller scale map (one inch to sixteen miles). This was then reduced to produce figure 4 - 9.

Three considerations were paramount in the selection of townships and individual producers for interviewing: (1) the sample townships should be contiguous if possible in order to reduce travel time and field expenses; (2) the study areas should represent two widely different physical environments for comparative purposes; and (3) the sample of individual producers should be chosen in a random fashion for purposes of statistical testing. In order to identify the townships in which there was a concentration of graduate entrant milk producers, a choropleth map was constructed with the mapping categories established on the basis of quartiles. Attention was focused on those townships in the upper quartile, having at least thirteen graduate entrant

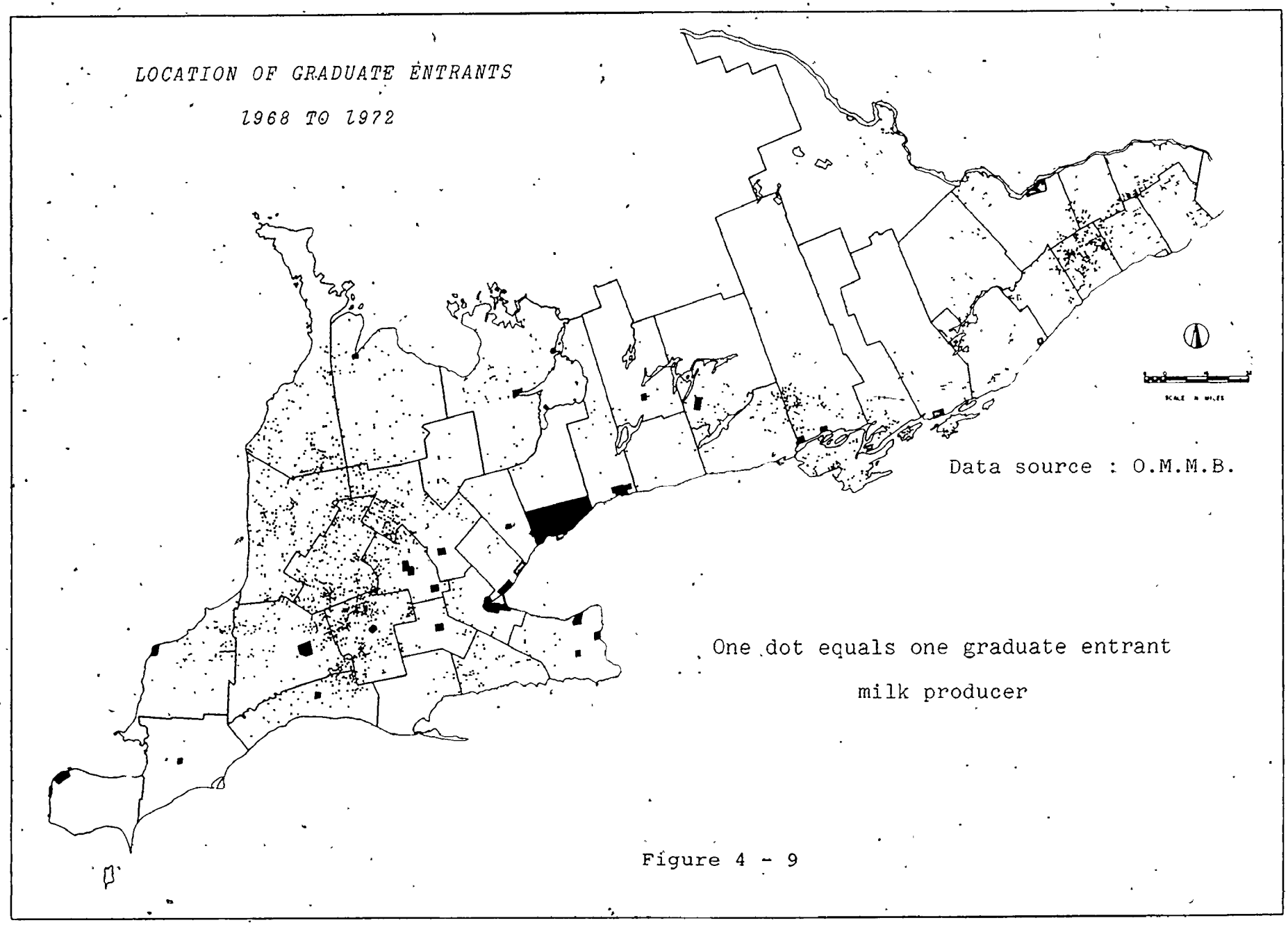
LOCATION OF GRADUATE ENTRANTS
1968 TO 1972
Data source : O.M.M.B.
One dot equals one graduate entrant
milk producer

Figure 4 - 9

milk producers over the period 1968 to 1972. There were sixty-five townships in this category. Fifty-one of the sixty-five townships in the upper quartile were selected for sampling, (figure 4 - 10). This consisted of a contiguous seventeen township bloc in Eastern Ontario and a core area of twenty-five townships in Western Ontario with outliers of two, three and four townships. These two major concentrations accounted for 1,245 of the 2,560 graduate entrant producers in Southern Ontario over the 1968 to 1972 period. These 1,245 producers were treated as two separate strata with the Eastern bloc having 448 graduate entrant milk producers, and the Western bloc having 797. A random sample of 200 producers with replacements was selected from these two areas: 70 in Eastern Ontario, and 130 in Western Ontario. This represents approximately 15 per cent of the total number of graduate entrant milk producers in each area. Figure 4 - 11 shows the location of the 200 producers interviewed over the period from October,1973 to February,1974.

Farm Data Inputs. The farm level data used in this study was derived from two sources: (1) a farm interview, conducted over the period October, 1973 to February, 1974; and (2) producer status reports[1] available from the Ontario

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[1]These are current files on each milk producer covering such statistics as milk shipments, milk quality, and income from milk sales. Because this serves as a basis for payments to producers, the data is necessarily quite accurate.

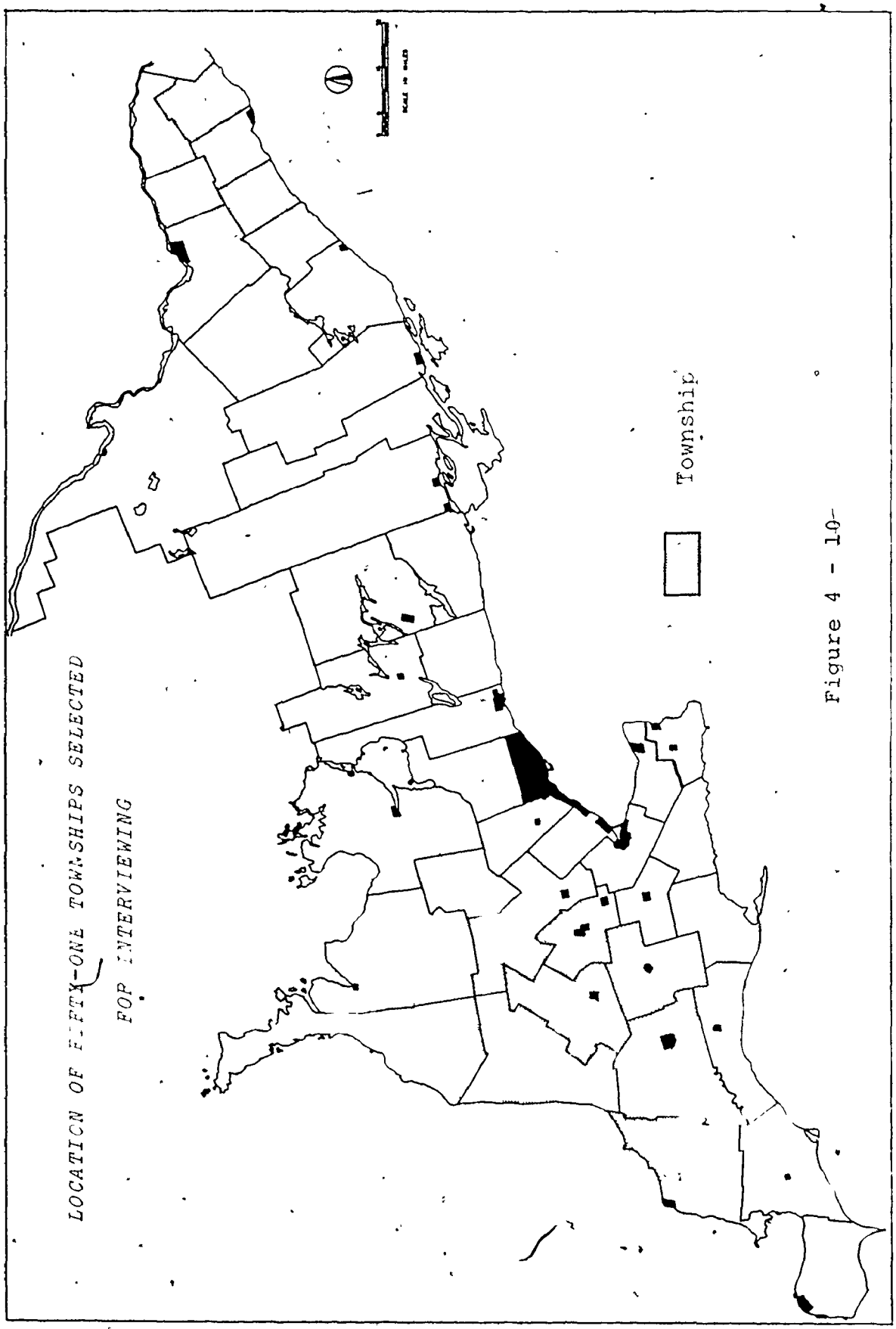
LOCATION OF FIFTY-ONE TOWNSHIPS SELECTED
FOR INTERVIEWING
Township

Figure 4 - 10

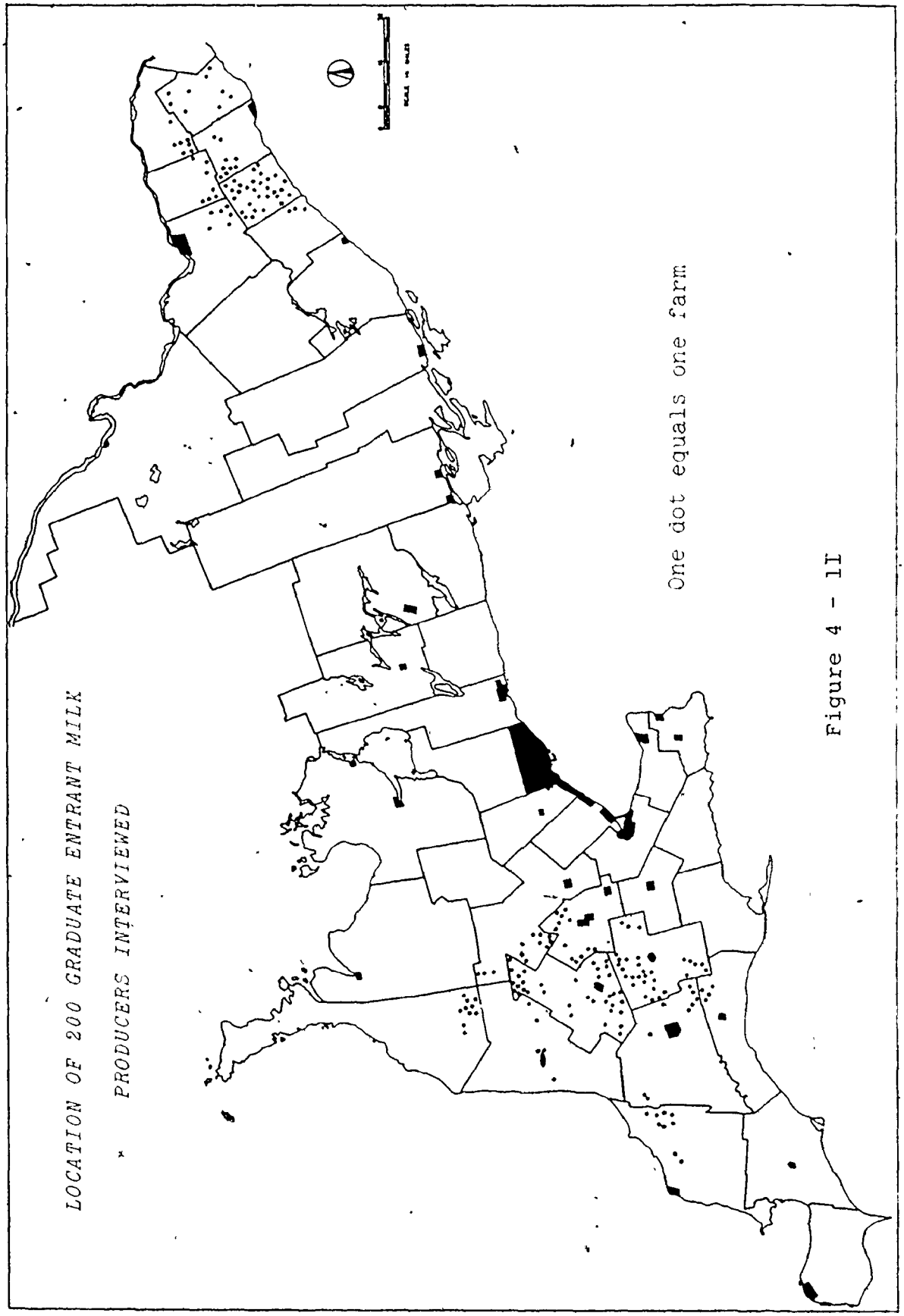
LOCATION OF 200 GRADUATE ENTRANT MILK
PRODUCERS INTERVIEWED
One dot equals one farm

Figure 4 - 11

Milk Marketing Board. By linking the data from these two sources, it was possible to develop a more complete data file and to cross check some of the answers on the questionnaire. In addition, the availability of the producer status reports made it possible to avoid asking questions in such sensitive areas as income and milk quality.

Before finalizing the questionnaire (Appendix I), the questions were pretested in August and September of 1973 in both Eastern and Western Ontario. A number of changes were made in the questionnaire following pretesting: (1) the format was altered in order to facilitate recording of the answers; (2) the sequence of the questions was changed; (3) the length was reduced in an attempt to get the time of the interview down to 30 to 40 minutes; and (4) some of the questions were rephrased in order to improve clarity.

Techniques of Analysis

Mapping Regional Data. In order to map the pattern of fluid and industrial milk producers for June, 1968, the number of producers was determined for each county. Each county's percentage of the total number of producers was calculated along with the mean and the standard deviation. The average and standard deviation was then used as a basis for establishing mapping categories, resulting in five categories in all cases. This same procedure was applied to

the June, 1974, statistics on producer numbers; the number of graduate entrants over the 1968 to 1973 period; and the attrition rate among regular fluid milk producers.

Testing for Differences and Association. A variety of standard statistical techniques were used for determining the relationship between variables. These consisted of the "t" test for determining significant differences in averages between Eastern and Western Ontario, and simple correlation and regression analysis for assessing statistical association between selected variables. The 95 per cent level of significance was generally used, although where a 99 per cent significance level occurred this was indicated.

The Multiple Regression Model. The multiple regression model provides a useful technique for dealing with the problem of a complex set of interrelationships. Once the dependent variable has been selected, it is possible to relate changes in this variable to a number of independent variables which may have some bearing on the response or dependent variable. This technique has become standard for dealing with problems of a complex series of interrelationships and numerous examples were noted in the review of literature where the multiple regression model had been used.

One of the basic assumptions involved in the use of the model is that the effect of including additional independent variables is additive. This is reflected in the form of the model itself:

$Y = a + b_1x_1 + b_2x_2 + \ldots\ldots b_nx_n + u$ where

Y = dependent or response variable

X_1 = first order independent variable

X_2 = second order independent variable

u = an error term measuring the unexplained variance in the dependent variable

a & b = parameters of the equation representing the Y intercept and the slope of the independent variable respectively

The model in this study has been developed for predictive purposes with the stepwise procedure being employed. With this procedure, the first independent variable to enter the equation accounts for the greatest variance in the dependent variable. The effect of this variable is then held constant and the independent variable which accounts for the greatest remaining variance enters the equation. This selection procedure continues until some established cutoff point is reached.[1]

Procedures for Handling the Data. After the interviews were completed, the data was coded, linked with producer status data, and keypunched on I.B.M. cards. A series

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[1]For discussion of the problems associated with the use of the technique see: D.P. Hauser, "Some Problems in the Use of Stepwise Regression Techniques in Geographical Research", The Canadian Geographer, Vol. 18, No. 2 (1974) pp. 148 - 58; and Leslie J. King, Statistical Analysis in Geography, Englewood Cliffs, N.J. : Prentice-Hall, 1969, pp. 135 - 52.

of simple descriptive statistics were run and the data was then edited for errors. The programmes for data analysis have been selected from the B.M.D. package of canned programmes.

Summary of Chapters One to Four

Attention in chapter one focused on developing the research problem, indicating the contributions of the study, and providing an outline of the thesis organization. Emphasis in this research is on recent adjustments at both the regional and farm levels. The problem at the county level is one of describing and accounting for changes in the pattern of milk producers in Southern Ontario since 1968. At the farm level attention is on identifying factors influencing herd enlargement behaviour among a random sample of new fluid milk producers in Eastern and Western Ontario.

The work of sociologists, economists and geographers was considered in the review of literature on agricultural adjustment. This literature review served two important functions: (1) it indicated that a wide range of variables should be considered in any attempt to predict farm level change; and (2) it suggested an appropriate technique of analysis for dealing with the problem of a complex of interrelated variables. Among the factors influencing farm level

adjustment were: management ability, social and economic characteristics, level of technology, resource base, communication network, the institutional setting, and the attitudes and aspirations of the farmers. Multiple regression analysis was widely used in the previous studies where the authors were dealing with a series of interrelated factors in a predictive model.

In chapter three, attention is given to the problem of providing an explanation of the complex institutional setting which has evolved in the dairy industry since the mid-1960's. Division within the industry, inequity among milk producers, and surplus production in the late 1950's and early 1960's led to a major change in institutional setting. At the provincial level the producer controlled Ontario Milk Marketing Board has played a key role in promoting change. Through such policies as the pooling of milk prices and transportation rates, and the introduction of quota transfer programmes, the basis was laid for major regional adjustments in the supply pattern of fluid milk. At the same time the federal involvement in the industrial milk sector of the dairy industry has been exerted through the Canadian Dairy Commission. Examination of the institutional framework within which the dairy industry operates provided some insight into the many policies and programmes that the milk producer may be responding to at any time.

Attention in chapter four is on the measurement of variables, data collection, and techniques of analysis. Herd enlargement has been selected as the dependent variable as it reflected structural changes that have been occurring for some time. In the predictive model, herd enlargement has been measured in both absolute and percentage terms. The independent variables will be measured on an interval or ratio scale with the exception of the bulk tank variable and the ethnic variable. Both of these variables have been included as dummy variables.

From the distribution pattern of graduate entrant milk producers a total of fifty-one townships in Eastern and Western Ontario were selected for sampling and interviewing. A random sample of two hundred milk producers was picked for farm interviews. This represented about fifteen per cent of the graduate entrant milk producers in each region.

The techniques of analysis to be used are standard and include simple correlation and regression and multiple regression. The mapping of regional data will utilize the mean and standard deviation for establishing mapping categories. A number of models will be developed for the farm data, using the stepwise multiple regression procedure.

Material covered in chapters one to four defined the research problem and provided background information on the study and research procedure. In chapter five the regional

data on producer number changes over the 1968 to 1974 period is mapped and analyzed. A series of predictive models, based on herd size changes, are developed in chapter six. Finally, results are summarized and presented along with the conclusions in chapter seven.

CHAPTER 5

REGIONAL ADJUSTMENTS IN THE DAIRY INDUSTRY OF SOUTHERN ONTARIO

Introduction

The purpose of this chapter is to describe and account for the regional pattern of adjustment in the number and pattern of fluid and industrial milk producers in Ontario since June, 1968. Prior to dealing with the Ontario situation, special attention is given to the role of the Ontario dairy industry in the broader Canadian context. This is accomplished by comparing three dairy statistics for the census years 1961, 1966, and 1971. These statistics consisted of: (1) the number of commercial dairy farms; (2) the number of milking cows on census farms; and (3) the number of pounds of milk produced one day prior to the census.

In section two, the pattern of fluid and industrial milk producers has been mapped on a county basis for June, 1968 and June, 1974. Section three examines the change in number and pattern of fluid and industrial milk producers over the six year period. The changes in milk production during the June, 1970 to June, 1974 period are discussed in section four. The factors contributing to the changes in

number and pattern of producers are considered in section five. Special attention is given to: (1) the role of the graduate entrant programme as it affects the transfer from the industrial to the fluid milk market; (2) the role of land values as it influences attrition rates among regular fluid milk producers; and (3) the role of the cost-price squeeze as it affects the industrial milk producers.

Finally, the Eastern-Western Ontario contrast is the subject of section six. Focus is on the differences in land capability and degree-growing days. These two factors were selected for more detailed attention with the belief that they would have an influence on the farm characteristics in the two regions.

The Role of Ontario in the Canadian Dairy Industry

Since the establishment of a national marketing scheme in 1970, the future role of any province is dependent upon its ability to maintain its share of the national allotment of butterfat. Because Quebec is the major competitor for Ontario's share of industrial milk, trends in the dairy industry in these two provinces take on an added importance.

In order to assess the changing role of the Ontario dairy industry in the Canadian setting, three census variables are examined over the ten year period 1961 to 1971.

The number of commercial dairy farms[1] provides one-measure of the relative importance of the dairy industry,[2] (table 5 - 1). The provinces of Quebec and Ontario dominated in terms of number of commercial dairy farms with 83.19 per cent of the Canadian total in 1961. This figure was virtually unchanged in 1971 when the corresponding statistic was 83.77 per cent. However, over the 1961 to 1971 period, the number of commercial dairy farms in Ontario had declined by 8,528 or 32.49 per cent, (table 5 - 4). During this same period, the loss for the entire country was 23,877 or 30.14 per cent, of which Ontario's contribution represented 35.71 per cent. As indicated by table 4 - 1, many of the producers dropping out of the industry were in the smaller herd categories. During the 1961 to 1971 period, Quebec lost 11,011 commercial dairy farms. This represented a reduction of 27.76 per cent in the number of commercial dairy farms and contributed 46.11 per cent of the national decline.

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[1]To be designated as a dairy farm required that 51.0 per cent or more of the total sales of agricultural products were obtained from dairy products or 40.0 to 50.9 per cent of total sales of agricultural products were obtained from dairy products, provided that the sale of dairy products together with the sale of cattle and calves amount to 51.0 per cent or more of total sales of agricultural products.

[2]For more details the reader is referred to a two part series by I.F. Furniss, "Basic Parameters of the Primary Dairy Industry in Ontario and Quebec," Canadian Farm Economics, Vol. 5 (October, 1970) pp. 11 - 24; and Vol. 6 (June, 1971) pp. 29 - 47.

TABLE 5 - 1

NUMBER OF COMMERCIAL DAIRY FARMS BY PROVINCE
1961, 1966, AND 1971 *

Province	1961 No.	1961 %	1966 No.	1966 %	1971 No.	1971 %
B.C.	2,898	3.66	2,061	3.65	1,633	2.95
Alta.	2,646	3.34	2,089	3.70	2,490	4.50
Sask.	1,032	1.30	592	1.05	701	1.27
Man.	2,348	2.96	1,240	2.20	1,614	2.92
Ont.	26,246	33.13	21,159	37.48	17,718	32.02
Que.	39,657	50.06	26,609	47.12	28,646	51.75
N.S.	2,017	2.55	1,290	2.28	1,019	1.84
N.B.	1,740	2.20	957	1.70	821	1.48
P.E.I.	554	0.70	388	0.69	629	1.14
Nfld.	80	0.10	75	0.13	70	0.13
Canada	79,218	100.00	56,460	100.00	55,341	100.00

* In order to qualify as a commercial farm sales of agricultural products over the twelve month period prior to the census had to exceed $2,500.00 in 1966 and 1971 and $1,200.00 in 1961.

Source: Dominion Bureau of Statistics, 1961, Cat. No. 96 - 531 - 40; 1966, Cat. No. 96 - 602 - 11; and Statistics Canada, 1971, Cat. No. 96 - 702 - 11.

TABLE 5 - 2

NUMBER OF MILKING COWS BY PROVINCE
1961, 1966, AND 1971 *

Province	1961 No.	1961 %	1966 No.	1966 %	1971 No.	1971 %
B.C.	91,889	3.07	81,135	3.03	80,485	3.57
Alta.	287,932	9.64	242,971	9.08	185,557	8.22
Sask.	241,113	8.06	153,819	5.75	111,714	4.95
Man.	195,869	6.55	150,062	5.61	109,774	4.86
Ont.	992,396	33.20	908,699	33.94	755,311	33.45
Que.	1,006,744	33.68	995,295	37.18	906,347	40.14
N.S.	64,047	2.14	52,360	1.96	41,208	1.83
N.B.	67,306	2.25	52,201	1.95	36,473	1.62
P.E.I.	39,589	1.32	37,326	1.39	28,124	1.25
Nfld.	2,760	0.09	2,922	0.11	2,402	0.11
Canada	2,989,645	100.00	2,676,790	100.00	2,257,395	100.00

* Includes census farms in all cases. While the acreage involved in defining a census farm changed from three acres to one acre in 1966, the minimum sales value of $50.00 has been maintained throughout the three census periods. The definition of animals includes cows and heifers, two years and over, milking or to be milked.

Source: Dominion Bureau of Statistics, 1961, Cat. No. 96 - 531 - 40; 1966, Cat. No. 96 - 602 - 11; and Statistics Canada, 1971, Cat. No. 96 - 702 - 11.

TABLE 5 - 3

POUNDS OF MILK PRODUCED ONE DAY PRIOR TO THE CENSUS
1961, 1966, AND 1971 *

Province	1961 lbs.	1961 %	1966 lbs.	1966 %	1971 lbs.	1971 %
B.C.	2,394,410	3.39	2,430,845	3.54	2,626,940	4.39
Alta.	6,846,569	9.69	5,940,645	8.64	4,790,128	8.01
Sask.	5,127,397	7.26	3,331,593	4.85	2,529,575	4.23
Man.	4,068,947	5.76	3,249,147	4.73	2,536,397	4.24
Ont.	24,246,273	34.34	24,346,461	35.41	19,614,260	32.82
Que.	24,314,273	34.44	26,079,348	37.93	24,993,707	41.82
N.S.	1,188,886	1.68	1,094,465	1.59	986,831	1.65
N.B.	1,422,760	2.01	1,192,172	1.73	844,791	1.41
P.E.I.	955,742	1.35	1,024,803	1.49	793,273	1.33
Nfld.	53,895	0.08	61,254	0.09	57,857	0.10
Canada	70,619,790	100.00	68,750,733	100.00	59,773,759	100.00

* Refers to all census farms.

Source: Dominion Bureau of Statistics, 1961, Cat. No. 96 - 531 - 40; 1966, Cat. No. 96 - 602 - 11; and Statistics Canada, Cat. No. 96 - 702 - 11.

TABLE 5 - 4

ABSOLUTE AND PERCENTAGE CHANGES IN SELECTED DAIRY STATISTICS 1961 TO 1971 *

Province	Number of Commercial Dairy Farms		Number of Milking Cows		Pounds of Milk Produced. May 31, 1961 and 1971	
	No.	% Change	No.	% Change	lbs.	% Change
B.C.	1,265	- 43.65	11,404	- 12.41	+ 232,530	+ 9.71
Alta.	156	- 5.89	102,375	- 35.55	- 2,056,441	- 30.03
Sask.	331	- 32.07	129,399	- 53.66	- 2,597,822	- 50.66
Man.	734	- 31.26	86,095	- 43.95	- 1,532,550	- 37.66
Ont.	8,528	- 32.49	237,085	- 23.89	- 4,632,013	- 19.10
Que.	11,011	- 27.76	100,397	- 9.97	+ 678,796	+ 2.79
N.S.	998	- 49.47	22,839	- 35.65	- 202,055	- 16.99
N.B.	919	- 52.81	30,833	- 45.81	- 577,969	- 40.62
P.E.I.	+ 75	+ 13.53	11,465	- 28.96	- 162,469	- 17.00
Nfld.	10	- 12.50	358	- 12.97	+ 3,962	+ 7.35
Canada	23,877	- 30.14	732,250	- 24.49	-10,846,031	- 15.35

* Calculations based on data in figures 5 - 1 to 5 - 3.

When the number of milking cows on all census farms[1] are considered, Quebec and Ontario once again rank one-two and accounted for 66.88 per cent of the Canadian total in 1961, (table 5 - 2). This figure had increased to 73.59 per cent in 1971 as a result of lower rates of decline in cow numbers in these two provinces, (table 5 - 4). The loss in number of milking cows in Ontario from 1961 to 1971 was much greater than in Quebec. Consequently, Ontario's percentage of the national total remained virtually unchanged, while Quebec increased its share from 33.68 per cent to 40.14 per cent. Thus, the relative importance of Quebec, in terms of number of milking cows, had increased greatly while Ontario was just maintaining its position.

Finally, a comparison of the number of pounds of milk produced one day prior to the census indicates a marked difference between Ontario and Quebec. While Ontario showed a decline in milk production of some 4,632,000 pounds or 19.10 per cent over the 1961 to 1971 period, Quebec increased its production by 678,000 pounds or 2.79 per cent, (table 5 - 4).

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[1]Statistics were not available for commercial dairy farms over the three census years, necessitating the use of census farms. This term is defined in the 1966 Census as an agricultural holding of one acre or more with sales of agricultural products, during the twelve month period prior to the census, of $50 or more. Thus, the total number of milking cows is somewhat larger than if commercial dairy farms had been used.

As a result, Quebec's share of the national total increased to 41.82 per cent while Ontario's percentage declined to 32.82 per cent, (table 5 - 3).

In summary, it was noted that Quebec and Ontario completely dominated in the Canadian dairy industry ranking one-two in the three census variables examined. However, the trends over the ten year period 1961 to 1971 suggest that Quebec may play a more important role in the future. Nevertheless, the Ontario dairy industry will continue to be a major competitor for the role as Canada's number one dairy province.

The Pattern of Milk Producers in 1968 and 1974

Although the Ontario Milk Marketing Board was established in 1965, programmes leading to adjustments in the dairy industry were not implemented until 1968. One of the programmes contributing to this adjustment was the graduate entrant programme which became operational in September, 1968, and permitted industrial milk producers to transfer to the more remunerative fluid milk market. Consequently, 1968 has been selected as the base year for assessing regional and farm level adjustment.

Fluid Milk Producers : June, 1968. Figure 5 - 1 shows the distribution of fluid milk producers for June, 1968. As this predates the entry of the first group of

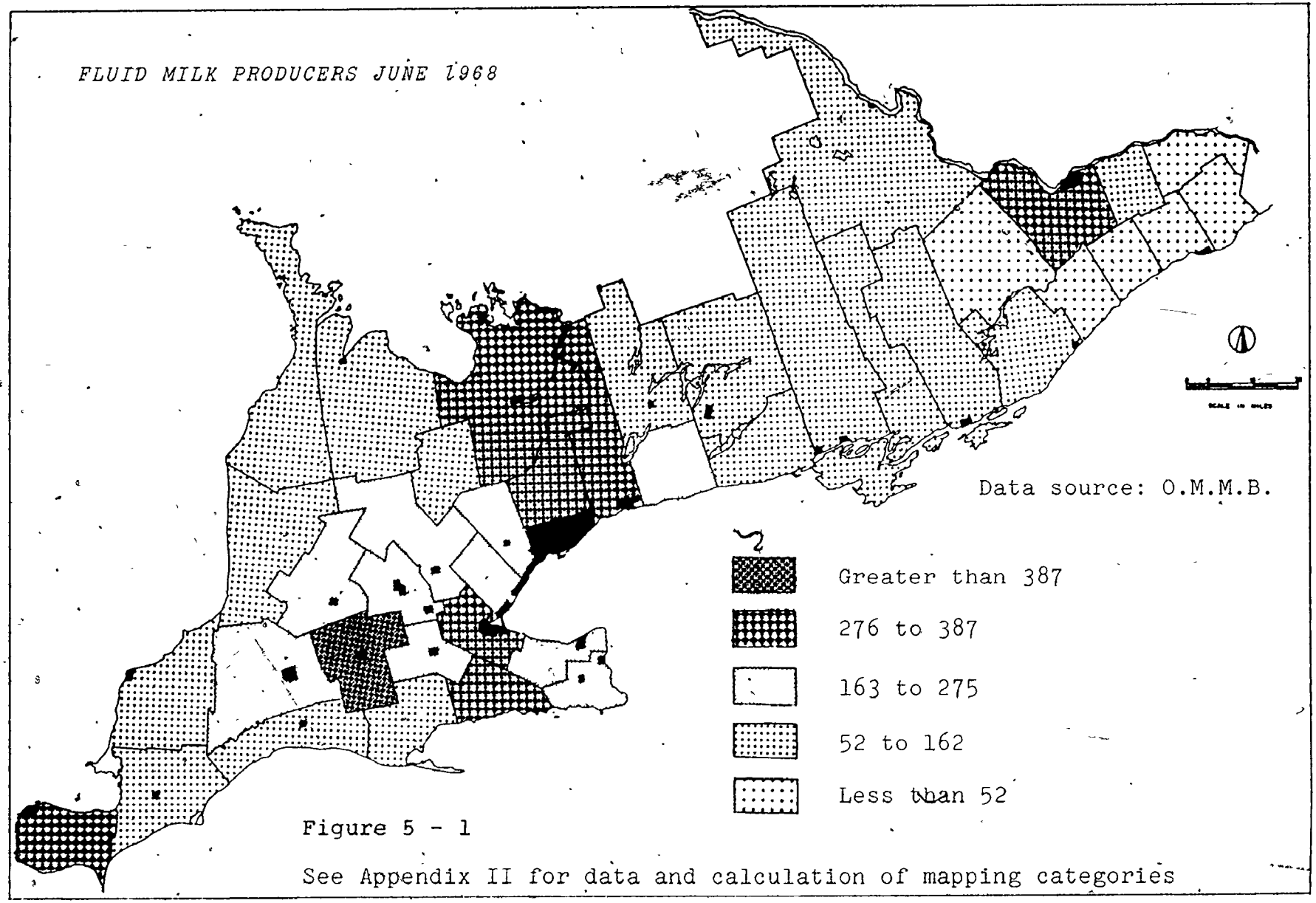


Figure 5 - 1

See Appendix II for data and calculation of mapping categories

graduate entrant milk producers into the fluid milk market, the map reflects the supply pattern before the impact of the graduate entrant programme.

The most outstanding feature of this distribution is the market-oriented nature of the fluid milk supply. As shown in table 5 - 5 the five largest cities accounted for some 59.02 per cent of all fluid milk consumption for Southern Ontario in June, 1968. The Toronto market area completely dominated during this period, consuming some 36.51 per cent of the Southern Ontario total. Many of the

TABLE 5 - 5

FLUID MILK CONSUMPTION BY AREA: JUNE, 1968 *

Area	Quarts	Percentage
Ontario	57,566,671	100.00
Northern	4,715,027	8.19
Southern	52,851,644	91.81
Major Urban Centres	31,194,065	59.02
Toronto	19,294,767	36.51
Ottawa	3,761,408	7.12
Hamilton	3,682,684	6.97
Windsor	2,571,566	4.87
London	1,883,640	3.56
Other Areas in Southern Ontario	21,657,579	40.98
Total for Southern Ontario	52,851,644	100.00

* Monthly Dairy Report, Ontario Department of Agriculture and Food, Farm Economics, Co-operatives and Statistics Branch, August, 1968, No. 366, pp. 2 - 7.

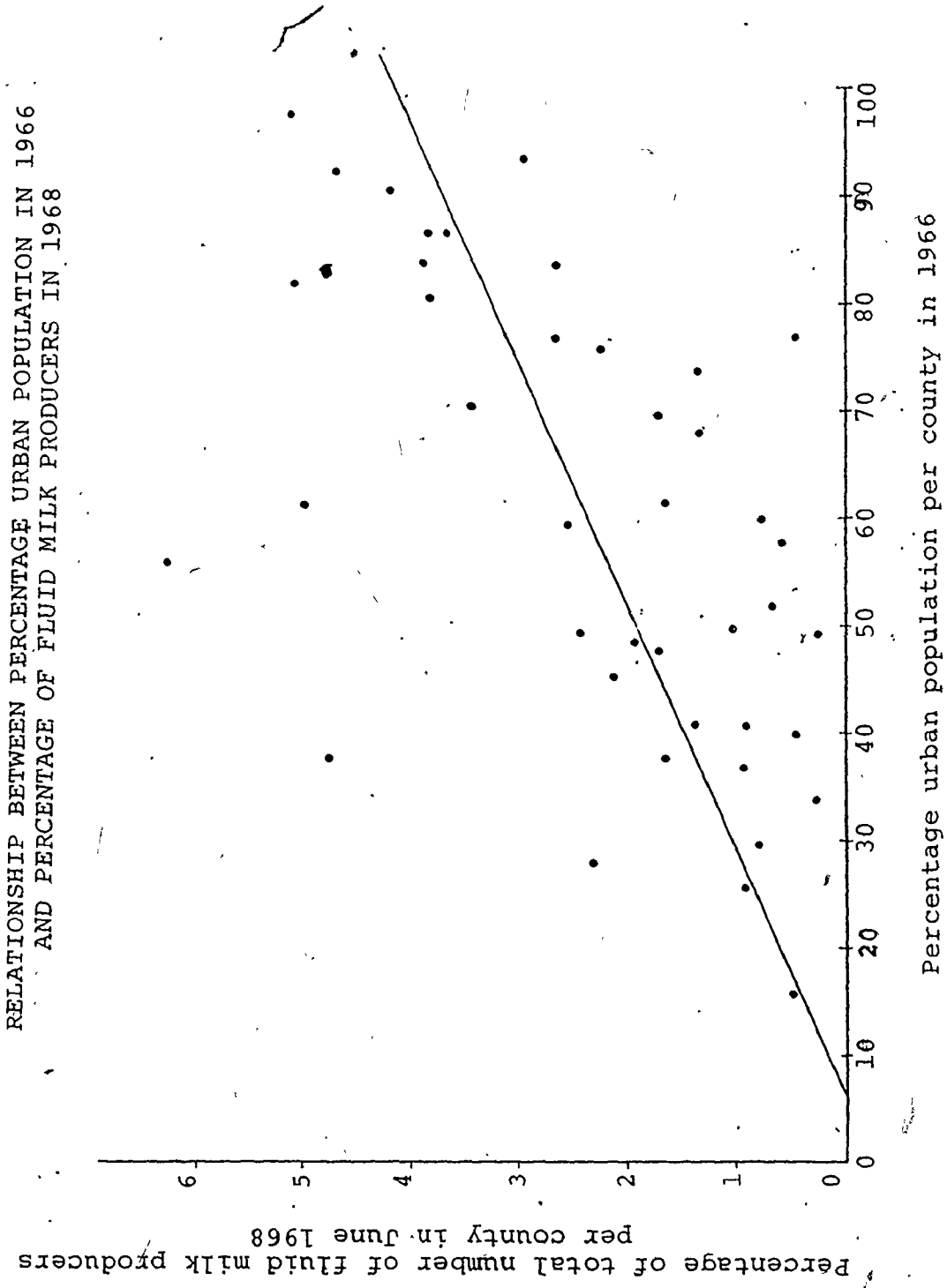
producers in counties to the north and west of Toronto were supplying this large and growing market. As a result of the arrangements between dairies and producers this pattern of supply, which evolved in response to market considerations at an earlier period, was maintained.

If Toronto is considered the single dominant market, one can note the dropoff in number of fluid milk producers with increased distance from that market. It is therefore appropriate to inquire into the changing relationship between percentage urban population and percentage of fluid milk producers on a county basis from 1968 to 1974.

The relationship between the percentage urban population in 1966 and the percentage of fluid milk producers in June, 1968 was examined through the use of simple regression analysis, (figure 5 - 2). In this case, the response variable, percentage fluid producers per county, was regressed against the percentage urban population. The correlation value of 0.58 was highly significant, supporting the contention that the pattern of fluid milk producers in June, 1968 was market oriented.

Industrial milk Producers : June, 1968. Figure 5 - 3 presents the pattern of industrial milk producers in June, 1968. A visual comparison of figures 5 - 1 and 5 - 3 indicates that the pattern of industrial milk producers is the

Figure 5 - 2


RELATIONSHIP BETWEEN PERCENTAGE URBAN POPULATION IN 1966
AND PERCENTAGE OF FLUID MILK PRODUCERS IN 1968
Percentage of total number of fluid milk producers
per county in June 1968
0
1
2
3
4
5
6
0
10
20
30
40
50
60
70
80
90
100
Percentage urban population per county in 1966

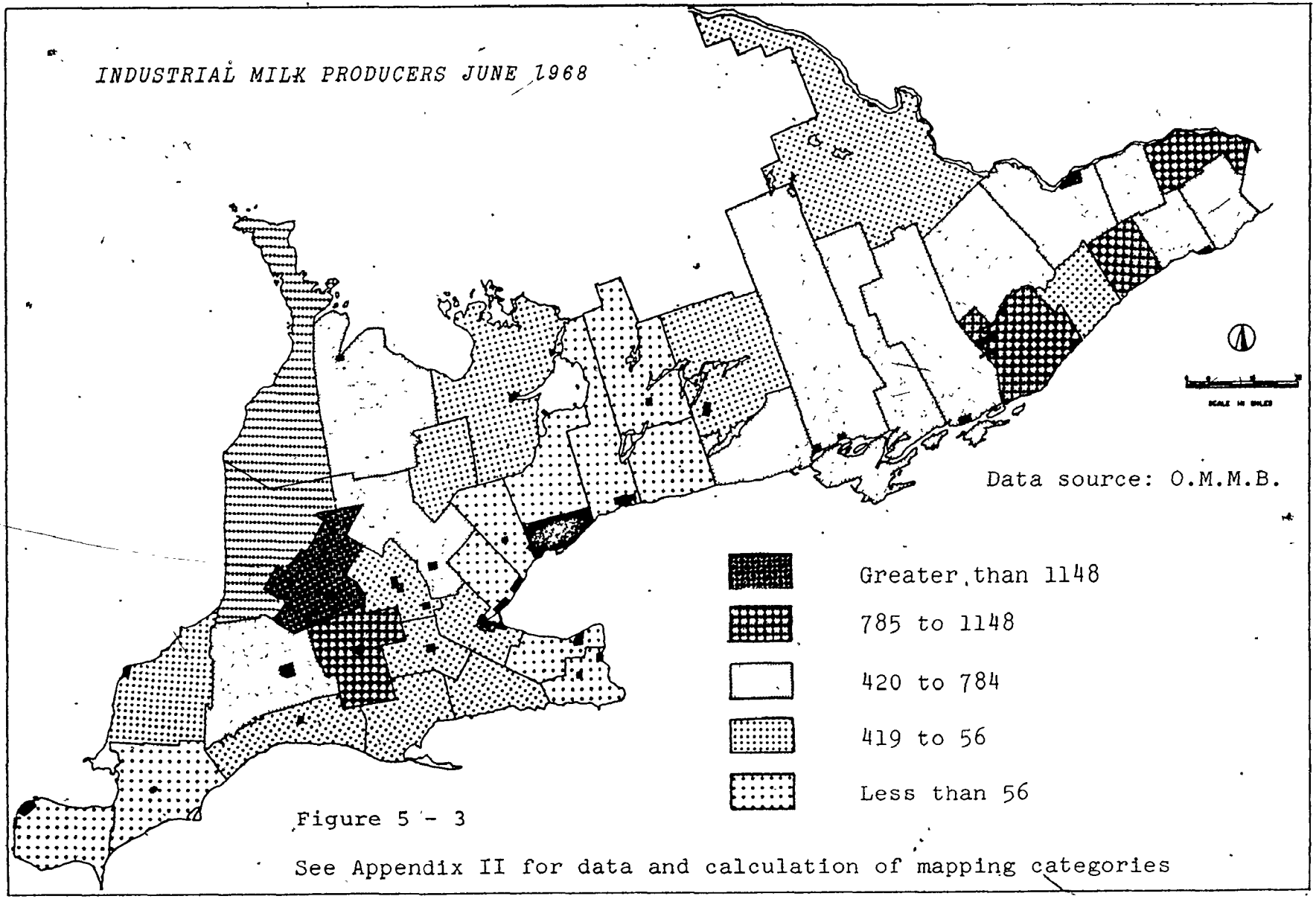


Figure 5 - 3

See Appendix II for data and calculation of mapping categories

inverse of that for fluid milk producers. Assuming Toronto is the single most important market, the pattern of industrial milk producers is characterized by location at the margins. Given the nature of the final product this location is in keeping with prior expectations.

The Pattern of Producers in June, 1974. In order to examine the adjustments occurring in the dairy industry of Southern Ontario, the pattern of fluid and industrial milk producers was mapped for June, 1974 (figures 5 - 4 and 5 - 5). Through the use of the same mapping technique, it is possible to visually compare the changes which have occurred over the six year period.

Change in Number and Pattern of Producers

When the change in the number of producers is examined over the six year period, June, 1968 to June, 1974 (table 5 - 6), some appreciation of the recent adjustments in the dairy industry of Southern Ontario can be gained. The total number of milk producers has declined by approximately one third from 23,639 to 15,766. At the same time, the number of industrial milk producers dropped from 16,797 to 8,056 representing a loss of 8,741 producers or 52.03 per cent.

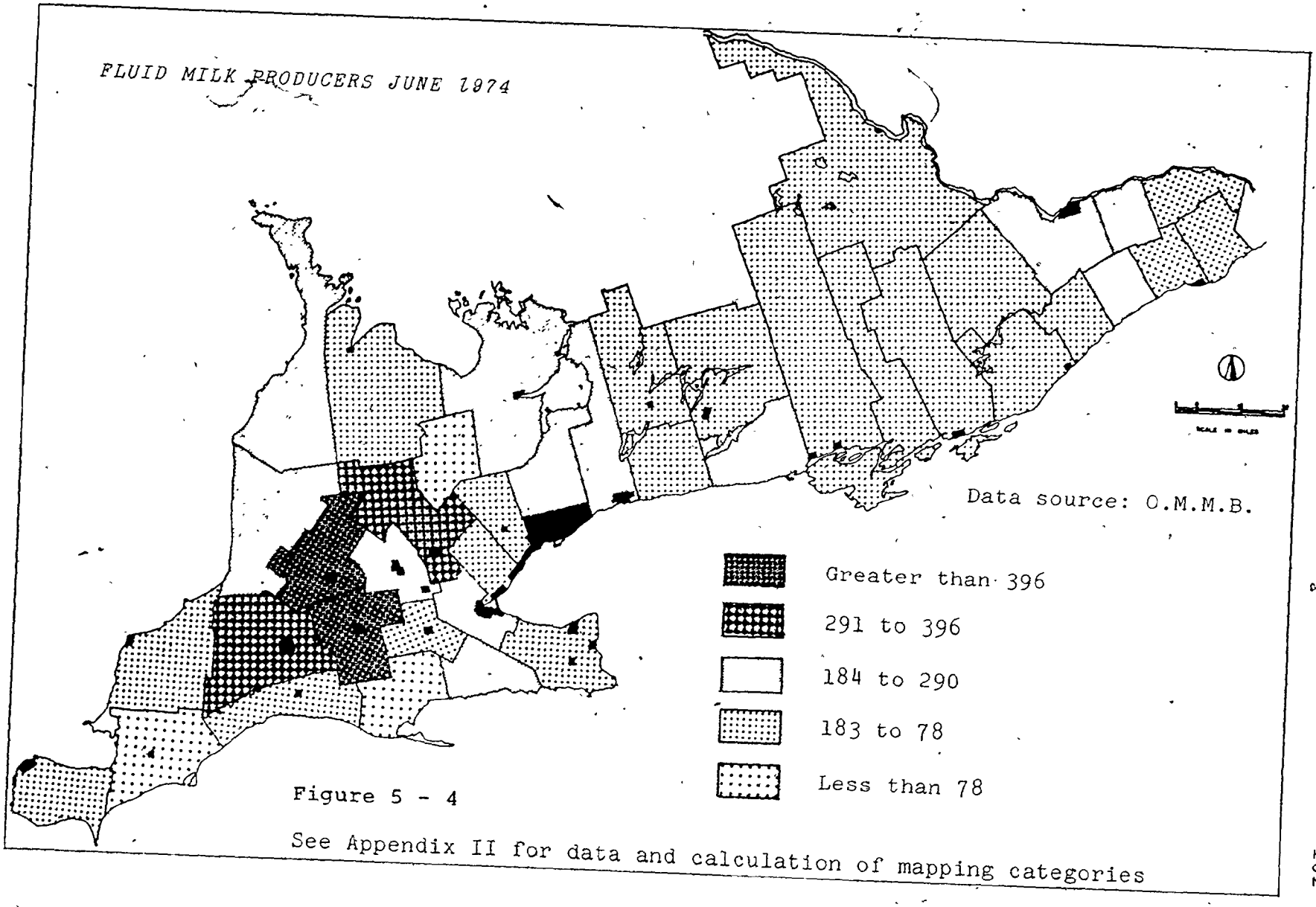


Figure 5 - 4

See Appendix II for data and calculation of mapping categories

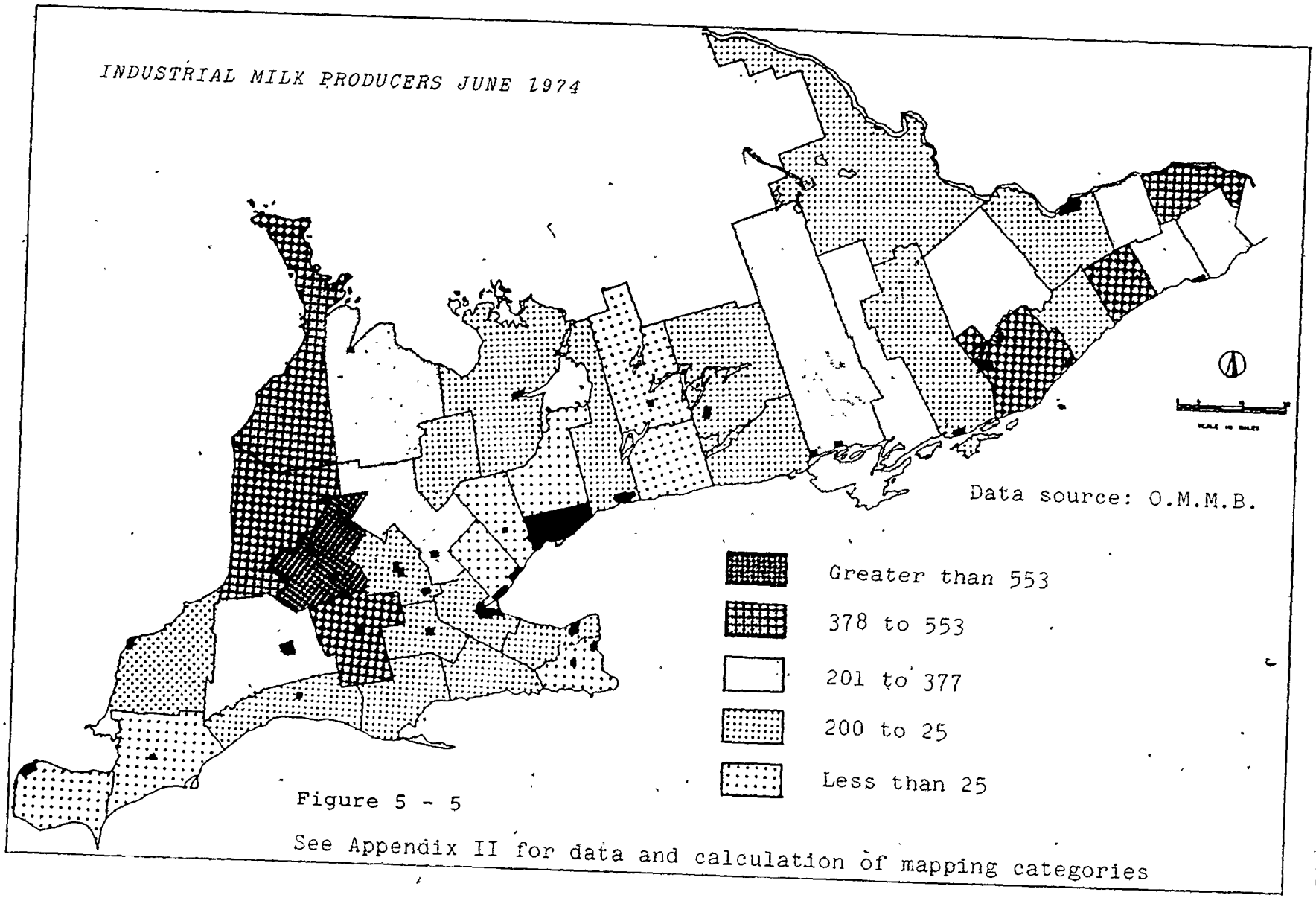


Figure 5 - 5

See Appendix II for data and calculation of mapping categories

TABLE 5 - 6

CHANGE IN NUMBER OF MILK PRODUCERS
JUNE 1968 TO JUNE 1974

Type of Producer	No. June 1968	% of Total	No. June 1974	% of Total	Absolute Change	% Change
Fluid	6,842	28.94	7,712	48.92	+ 870	+12.72
Industrial	16,797	71.06	8,056	51.08	-8,741	-52.03
Total	23,639	100.00	15,768	100.00	-7,871	-33.31

During this same period, there was an increase in the number of fluid milk producers of 870 which represented an increase of 12.72 per cent. With these changes in producer numbers, the fluid milk producers accounted for 48.92 per cent of the total in 1974 as compared to 28.94 per cent in 1968.

A visual comparison of the pattern of fluid milk producers in 1968 and 1974 (figures 5 - 1 and 5 - 3) indicates that a number of major changes have taken place in that sector of the dairy industry. These changes can be summarized as follows: (1) a decrease in importance of a number of highly urbanized counties, e.g. Essex, Carleton, York, Wentworth, and Ontario; (2) an increase in importance of a number of counties in Eastern Ontario, e.g. Lanark, Dundas, Stormont, Glengarry, Prescott, and Russell; and (3) the increase in importance of counties in Western Ontario, e.g. Perth, Middlesex, Wellington, Huron, and Bruce.

When the relationship between the percentage of urban population in 1971 and the percentage of fluid producers in June 1974 was examined, a correlation of 0.11 was obtained, (figure 5 - 6). This correlation value reflects the lack of a significant association between the two variables. In light of the analysis of these two variables at the beginning of the period of adjustment, (figure 5 - 2), one can conclude that the fluid milk supply is coming from farms located at a greater distance from the urban centres.

The visual comparison of the pattern of industrial milk producers in 1968 and 1974 indicates only minor changes have occurred. Table 5 - 6 shows that the number of industrial milk producers has declined substantially over the intervening period.

Changes in Ontario Milk Production June 1970 to June 1974[1]

The adjustment in number of milk producers has resulted in changes in milk production although these changes have not been as dramatic as the dropout rates would suggest. There are two major reasons for this: (1) producers who are

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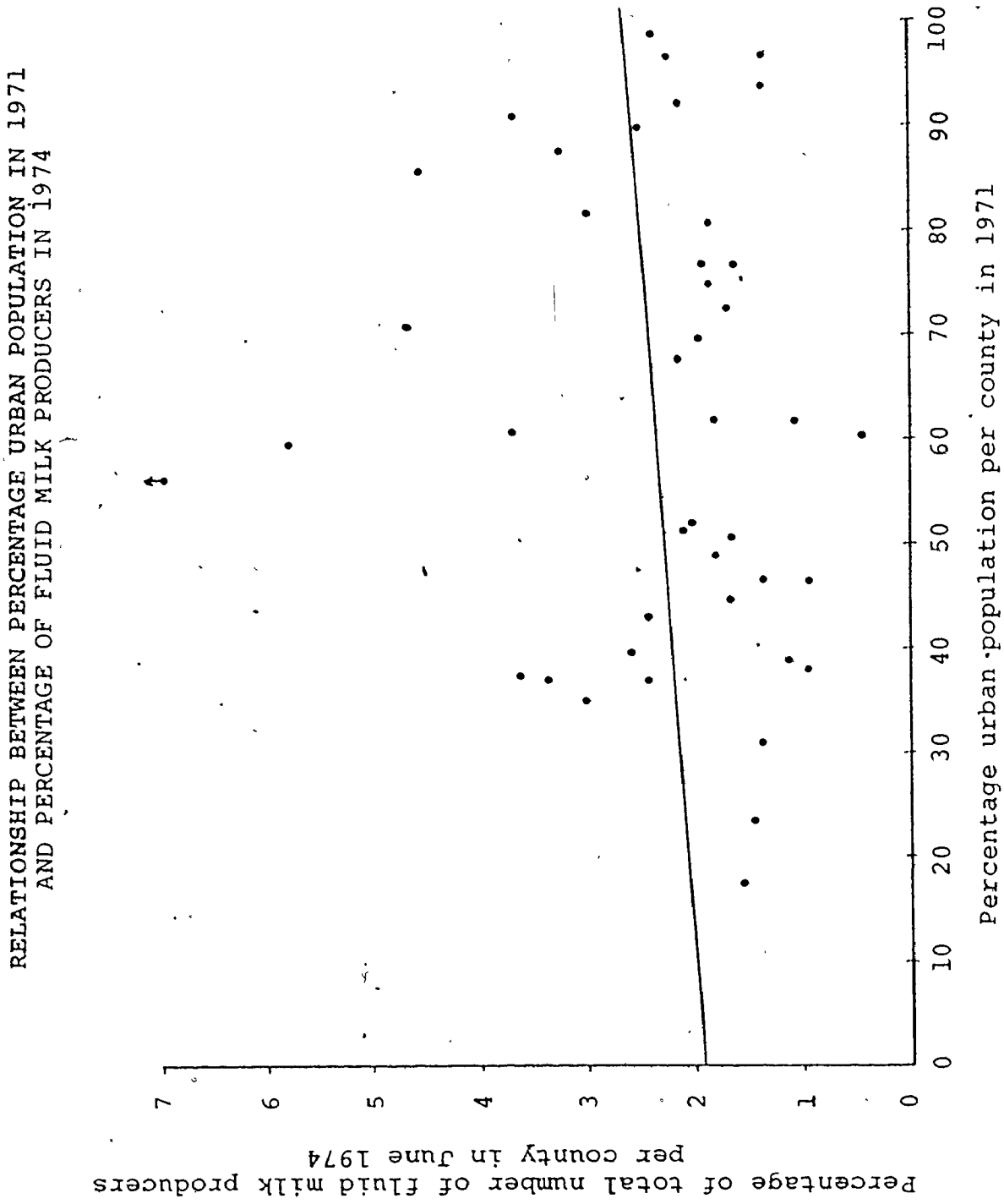
[1]June, 1970 represents the first month that Ontario Milk Marketing Board statistics were available on industrial milk production in Ontario. The June to June period has been used for consistency in the comparisons over this four year period.

Figure 5 - 6


RELATIONSHIP BETWEEN PERCENTAGE URBAN POPULATION IN 1971
AND PERCENTAGE OF FLUID MILK PRODUCERS IN 1974
Percentage of total number of fluid milk producers
per county in June 1974
0
1
2
3
4
5
6
7
0
10
20
30
40
50
60
70
80
90
100
Percentage urban population per county in 1971

remaining in the industry are increasing the size of their dairy operations, (table 4 - 1); and (2) there has been a substantial increase in the productivity of dairy herds, (table 5 - 7).

The changes in milk production over the period June 1970 to June 1974, (table 5 - 8), give some indication of the magnitude of these changes. During this four year period, total milk production declined by 42,619,000 pounds or by 7.73 per cent. This was comprised of a decrease of 112,818,000 pounds or 38.74 per cent in industrial milk production, and an increase of 70,199,000 pounds or 27.00 per cent in fluid milk production.

This change in emphasis in milk production could come from two sources: (1) a differential in herd enlargement, attrition rates, and productivity gains between fluid and industrial milk producers; and (2) the result of the graduate entrant programme. Although the first factor undoubtedly plays a role, the shift in emphasis in milk production can be largely attributed to the transfer of producers from the industrial to the fluid milk market. Table 5 - 9 provides a breakdown of the number and percentage of graduate entrant milk producers by year of entry.

The largest decreases in industrial milk production occurred the June following the largest intake of graduate entrant milk producers. Thus, the evidence would suggest that fluid milk production changes from June, 1970 to June,

TABLE 5 - 7

CHANGES IN MILK PRODUCTION PER COW IN ONTARIO
1961 TO 1972

Year	Milk Production[1] (000)	Cows for[2] Milking Purposes	Average	Absolute Change	% Change
1972	6,379,080	736,000	8,667	+ 526	+ 6.46
1971	6,147,051	755,000	8,141	+ 798	+ 10.87
1970	6,388,678	870,000	7,343	- 59	- .79
1969	6,625,276	895,000	7,402	+ 64	+ .87
1968	6,641,173	905,000	7,338	+ 154	+ 2.14
1967	6,645,988	925,000	7,184	- 298	- 3.98
1966	6,801,485	909,000	7,482	+ 169	+ 2.31
1965	6,896,717	943,000	7,313	+ 190	+ 2.67
1964	6,795,248	954,000	7,123	- 20	- .27
1963	6,786,308	950,000	7,143	+ 280	+ 4.08
1962	6,657,112	970,000	6,863	+ 304	+ 4.63
1961	6,506,246	992,000	6,559		

[1]These are annual figures for total milk production and were obtained from various issues of Dairy Review. The total figure includes fluid milk, milk equivalents of factory products, farm butter, farm-home consumption, and milk feed to livestock.

[2]The number of milking cows was obtained from various issues of Agricultural Statistics for Ontario and represents June 1st. figures in each case.

TABLE 5 - 8

CHANGES IN ONTARIO MILK PRODUCTION
JUNE 1970 TO JUNE 1974 *

Time Period	Weight (000) lbs.	% of Total	% Change from Previous Year
June 1974			
Fluid	330,186	64.92	+ 9.34
Industrial	178,398	35.08	- 14.88
Total	508,584	100.00	- 0.59
June 1973			
Fluid	301,991	59.03	- 2.27
Industrial	209,592	40.97	- 8.89
Total	511,583	100.00	- 5.09
June 1972			
Fluid	308,995	57.32	+ 10.81
Industrial	230,041	42.68	- 4.81
Total	539,036	100.00	+ 3.56
June 1971			
Fluid	278,849	53.57	+ 7.25
Industrial	241,659	46.43	- 17.01
Total	520,508	100.00	- 5.57
June 1970			
Fluid	259,987	47.17	_____
Industrial	291,216	52.83	_____
Total	551,203	100.00	_____

* Data Source : Ontario Milk Marketing Board

TABLE 5 - 9

NUMBER OF GRADUATE ENTRANT PRODUCERS BY YEAR OF ENTRY.

Time of Entry*	Number of Producers	Percentage of Total
1968	412	12.40
1969	651	19.59
1970	812	24.44
1971	533	16.04
1972	153	4.60
1973	762	22.93
Total	3,323	100.00

* September in all cases

Data Source: Ontario Milk Marketing Board

1974 is largely the result of the Marketing Board's graduate entrant programme. At the same time, this market transfer contributed to an additional decline in industrial milk production beyond that resulting from producers dropping out of milk production altogether.

Factors Contributing to Adjustment in Number and Pattern of Producers

Although this section examines some of the reasons accounting for the exit of milk producers, major emphasis is on the regional patterns of attrition and the factors

associated with this regional variation. While there are common factors affecting the decision of both fluid and industrial milk producers to leave the dairy industry, there also appear to be some unique factors operating in each case.

Reasons for Exit from Milk Production. One of the factors contributing to the decision to leave the dairy industry has been the cost-price squeeze. In a review of dairy farm production costs during the 1970 to 1972 period, the Monthly Dairy Report noted that: "Specialized dairy farm costs increased more during the 1970 to 1972 period than for any other similar period in the 20-year history of the D.H.I. cost study program."[1] However, it can be pointed out that this is just one of a number of considerations affecting the decision to drop out of dairying. In a recent survey by the Ontario Milk Marketing Board,[2] the results indicated that the major reasons for leaving the dairy industry related to the age and health of the operator with costs of production being a secondary factor. These factors apply to both industrial and fluid milk producers and have been cited in

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[1] Monthly Dairy Report, Ontario Ministry of Agriculture and Food, Economics Branch, July, 1973, No. 425, p.1.

[2] O.M.M.B. General Manager's Report, April, 1974, p.32. Out of 395 producers who dropped out of dairying from November 1973 to February 1974, 45 returned a questionnaire which indicated that: 15 left for health reasons, 14 because of age, 6 listed cost of production, 5 due to labour difficulties and 5 found other agricultural activities more attractive.

previous surveys of producers leaving the industry.[1]

The Role of the Graduate Entrant Programme. Out of the 8,741 industrial milk producers dropping out of that sector of the dairy industry between June, 1968 and June, 1974, some 3,343 have transferred to the fluid milk market through the graduate entrant programme. As a result, the policies of the Marketing Board have played an important role in the decrease in number of industrial milk producers. When the pattern of graduate entrant producers (figure 5 - 7) is compared with the pattern of industrial milk producers in 1968, (figure 5 - 3), a high degree of correlation is evident. This is not unexpected for the graduate entrant milk producers have all been drawn from the pool of industrial milk producers.

The individual motives contributing to the decision to take advantage of the graduate entrant programme are varied:[2] (1) the higher price for fluid milk; (2) the limited number of changes necessary to qualify as a graduate entrant; (3) the possibility that a son might be interested in dairy farming in the future; (4) a desire to remain in dairying along with the feeling that it was necessary to be

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[1] T. Ross Graham, "Trends in Changes in the Dairy Business of Eastern Ontario," Paper presented to the 1973 Annual Conference at Kemptville College of Agricultural Technology, January 18, 1973, p. 12.

[2] Based on farm interviews with 200 graduate entrant milk producers in Eastern and Western Ontario during the period October, 1973 to February, 1974.

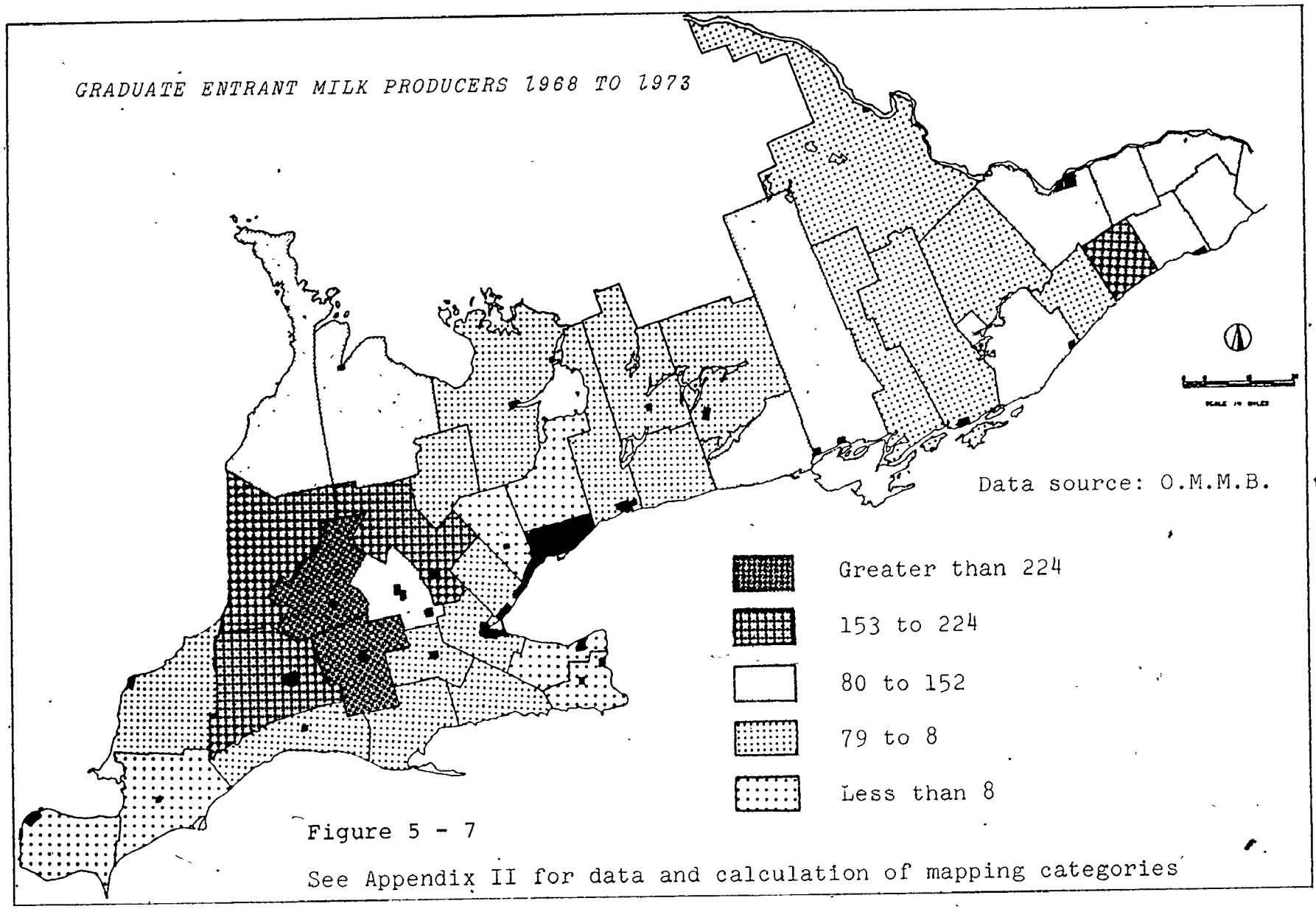

Figure 5 - 7

See Appendix II for data and calculation of mapping categories

a fluid milk shipper in order to do so; (5) a speculative factor manifested in the feeling that property values would be improved and in the long run the producer could not lose on the free quota allotment; and (6) the desire to have the income and prestige associated with being a fluid milk producer. In a number of cases, more than one consideration entered into the decision. However, the higher returns from the fluid milk market over the longer run was invariably mentioned.

The Role of Land Values. With the large addition of new industrial milk producers to the fluid milk market, one might expect a substantial increase in the number of fluid milk producers. Table 5 - 6 shows that during the six year period from 1968 to 1974, the increase was only 12.72 per cent or 2.12 per cent per year. This indicates that there has been a marked decline in the number of regular fluid milk producers since June, 1968. By assuming that all dropouts over the 1968 to 1974 period were regular fluid milk producers, it is possible to arrive at a county value for dropouts from the fluid milk market.[1] Figure 5 - 8 presents the

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[1]The number of graduate entrant milk producers dropping out of the dairy business is quite small, making this a realistic assumption. By adding the number of graduate entrant producers to the number of regular fluid milk producers in June, 1968 and subtracting the number present in June, 1974 it was possible to arrive at a dropout value for each county.

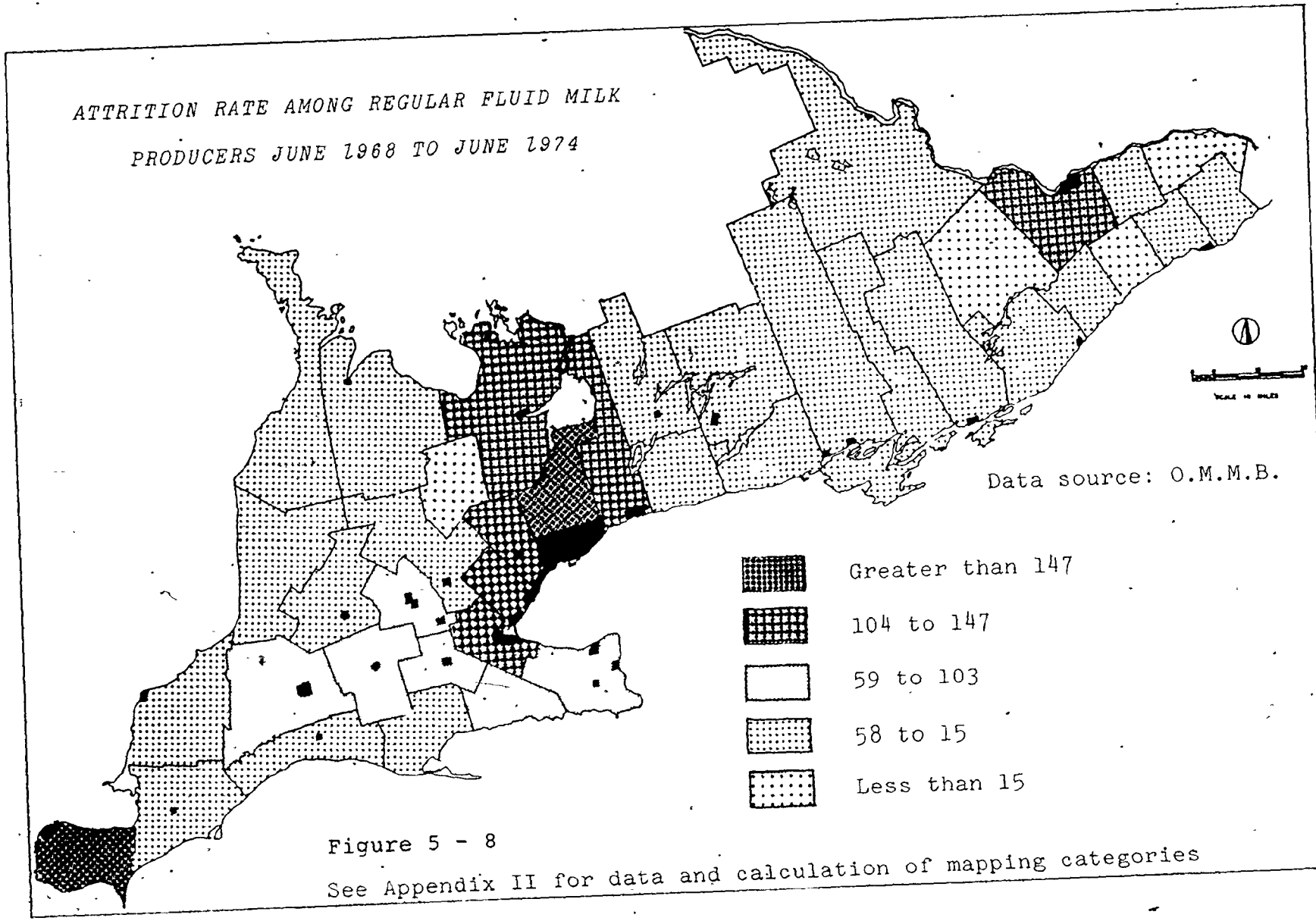

Figure 5 - 8

See Appendix II for data and calculation of mapping categories

dropout or attrition rate for Southern Ontario during the six year period in question.

The pattern evident in the map suggests that the assessment by Marshall and Lane with respect to changes in milk production also applies to the adjustment in number of fluid milk producers. These authors noted that: "... fluid milk production is rapidly moving away from those areas where opportunity costs for land and labour are high."[1] As a result, one might hypothesize a positive association between attrition in number of regular fluid milk producers and land values. In order to test this relationship, the Spearman rank correlation[2] was run on the attrition rates among fluid milk producers during the June, 1968 to June, 1974 period and the average county land values in 1971. The correlation of 0.71 was highly significant, (Appendix III), supporting the hypothesis that land values are positively associated with attrition rates among fluid milk producers.

From these findings, one can conclude that unless there is a major change in the type of dairy operations in

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[1]Marshall and Lane, Fluid Milk Pricing, p. 69.

[2]Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences, Toronto : McGraw-Hill, 1956, pp. 205 - 212.

the areas of high land values,[1] one can expect that the "Golden Horseshoe"[2] area will become a minor region in terms of fluid milk production in the future. This adjustment is being accelerated by two processes: (1) the high attrition rate among regular fluid milk producers in these areas; and (2) the graduate entrant programme which is bringing in new fluid milk producers in the outlying counties.

The Contrast Between Eastern and Western Ontario

The concentration of graduate entrant milk producers in Eastern and Western Ontario (figure 4 - 9) raises the prospect of comparing two areas that are vastly different in terms of agricultural land capability. Some indication of the differences can be gained by comparing the percentage of classes 1 and 2 land in the sample of townships selected for interviewing purposes (table 5 - 10). This table shows that there is a pronounced difference in high capability agricultural land in the two regions.

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[1] One alternative would be to shift to the California-type dairy operation which utilizes small acreages run essentially as milk factories. For an account of this system see: H.F. Gregor, "Industrial Drylot Dairying : An Overview," Economic Geography, Vol. 39 (1963) pp. 299 - 318.

[2] This term refers to a group of highly urbanized counties extending from the Niagara Peninsula on the south through to Ontario county on the east.

TABLE 5 - 10

PERCENTAGE OF CLASS 1 & 2 LAND FOR SELECTED TOWNSHIPS IN EASTERN AND WESTERN ONTARIO

Eastern Ontario	%	Western Ontario	%
Glengarry County		Elgin County	
Charlottenburgh	32.0	Dorchester S.	70.4
Kenyon	16.8	Oxford County	
Lancaster	56.8	Blenheim	80.7
Lochiel	17.2	Dereham	78.5
Prescott County		Nissouri E.	87.0
Caledonia	12.2	Zorra East	85.4
Plantagenet S.	20.0	Zorra West	80.6
Russell County		Lambton County	
Cambridge	43.1	Bosanquet	54.8
Russell	67.8	Plympton	92.8
Stormont County		Warwick	84.7
Finch	52.6	Middlesex County	
Roxborough	19.5	Dorchester N.	71.9
Dundas County		London	83.9
Matilda	53.6	Nissouri W.	79.8
Mountain	32.5	Williams W.	74.6
Williamsburgh	25.6	Perth County	
Winchester	50.5	Blanshard	69.9
Grenville County		Downie	85.8
Edwardsburgh	48.2	Easthope N.	64.0
Carleton County		Easthope S.	79.8
Osgoode	41.0	Ellice	84.3
		Elma	88.9
Average percentage		Fullarton	79.1
Class 1 & 2 land	35.8	Logan	90.3
		Wallace	84.1
		Waterloo County	
		Wellesley	50.6
		Wilmot	57.8
		Woolwich	55.9
		Wellington County	
		Maryborough	78.9
		Minto	61.6
		Peel	74.9
		Bruce County	
		Carrick	58.5
		Culross	48.9
		Huron County	
		Goderich	81.1
		Grey	77.9
		Hullett	83.6
		Average percentage	
		Class 1 & 2 land	75.2

Source: Calculations made from data in D.W. Hoffman's Land Use Capability for Agriculture, Toronto: Ontario Department of Agriculture and Food, 1970.

With the exception of six townships in the Western Ontario sample area, uniformly high land capability is characteristic. Culross township stands out as having the lowest land capability with 48.9 per cent of classes 1 and 2 land. The other five townships in Western Ontario that appeared at the lower end of the scale all had values in the 50 to 60 per cent range. On the other hand, only one township in the Eastern Ontario sample had a value in excess of 60 per cent of high capability agricultural land. In the case of Caledonia township only some 12 per cent of the land is of high capability. In addition to the lower values of land capability in Eastern Ontario, the range in values is greater. Given these differences in agricultural land capability, one might anticipate significant differences in farm size between graduate entrant milk producers in Eastern and Western Ontario.

Attention was also given to the question of differences in degree-days above 42°F between the sample townships in Eastern and Western Ontario in the belief that this might have an effect upon the corn acreages[1] in the two areas. This index provides a useful cumulative measure of the growing period.[2] When the pattern was compared for the two study

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[1]Includes both grain corn and silage corn.

[2]The Canada Land Inventory, The Climates of Canada for Agriculture, Department of Forestry and Rural Development, Ottawa, Report No. 3, pp. 6 - 8. Also see figure 9.

areas, it was noted that there was practically no difference in the areas with the heaviest concentration of graduate entrant milk producers. In both areas, the values ranged between 3000 and 3500 degree-days above 42°F. As a result, no significant differences in corn acreage in the two areas were expected on the basis of degree-day differences.

The general hypothesis, that there is a significant difference between the two regions, is tested in terms of nine selected variables. For statistical purposes, the null hypothesis, i.e. there is no difference in variable averages for the two groups, was assumed for each of the nine variables. In order to reject the hypothesis, a 95 per cent level of significance was required. The results of the analysis are presented in table 5 - 11.[1]

For three of the nine variables, the null hypothesis was accepted. Although the gel test averages were higher in Eastern Ontario, the difference was not significant at the 95 per cent level. Thus, on the basis of the survey sample there does not appear to be any significant difference in herd management levels in Eastern and Western Ontario. The same conclusions were reached with respect to fluid milk quota holdings and acreage in corn in 1973.

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[1]Leslie J. King, Statistical Analysis in Geography, Englewood Cliffs, N.J. : Prentice-Hall Inc., 1969, pp. 76-77.

COMPARISON OF AVERAGES FOR SELECTED FARM VARIABLES IN EASTERN AND WESTERN ONTARIO

Variable	Eastern[5] Ontario	Western[6] Ontario	Significance
Pool I quota in pounds per day[1]	721	749	Not significant
Market share quota pounds per annum	336,000	279,000	99% level
Income from milk sales per annum[2]	$20,819	23,801	95% level
Percentage farm income from milk sales	83.4	72.3	99% level
Herd average per annum	10,843	12,315	99% level
Average gel test over 12 month period	11.72	9.42	Not significant
Milking herd size	40	35	95% level
Farm size in acres[3]	254	193	95% level
Acres in corn during 1973 crop year[4]	38.1	42.8	Not significant

Data Source: Farm Interviews

[1]This figure is comprised of the five year graduate entrant quota allotment plus quota purchases at the time of the interview. A 400 pound minimum value was used.

[2]Includes all income received through the Ontario Milk Marketing Board but excludes Canadian Dairy Commission subsidy payments.

[3]Includes both owned and rented acreage.

[4]Includes both silage and grain corn.

[5]Sample size of 68.

[6]Sample size of 125.

Graduate entrant milk producers in Eastern Ontario had a significantly larger market sharing or industrial milk quota than their counterparts in Western Ontario. This is quite in keeping with expectations for Eastern Ontario has long been known as the major source of industrial milk production. In addition, it can be noted that producers in Eastern Ontario were more dependent on milk sales for their farm income than producers in Western Ontario. This suggests that Eastern Ontario lacked the alternative agricultural activities that are available to the graduate entrant producers in Western Ontario.

Producers in Eastern Ontario were characterized by significantly larger milking herds. This may be anticipated in an area where there is a greater dependence on dairying as a source of farm income. However, it must be noted that herd averages were significantly higher in Western Ontario. In light of this difference, it is not surprising that income from milk sales was significantly higher in Western Ontario. Farm size was significantly larger in Eastern Ontario. Considering the lower quality of the land resources in this area, the larger farm size was anticipated.

Summary

Emphasis in chapter five has been on the regional adjustments that have been taking place in the number of milk

producers in Ontario over the period from June, 1968 to June, 1974. In order to place these provincial changes in a broader context, trends in Ontario and Quebec were compared over the 1961 to 1971 period. Although Quebec overtook Ontario as the top dairy province during this ten year period, the two provinces remain highly competitive for the title as Canada's number one dairy province.

Examination of the pattern of fluid and industrial milk producers in June, 1968 indicated that there was a concentration of fluid milk producers in proximity to the major Ontario market, Toronto. At the same time, the industrial milk producers were located at some distance from the Toronto market. During the six year period from June, 1968 to June, 1974, high dropout rates occurred among both fluid and industrial milk producers. The fluid milk sector has been able to replenish its supply of producers through the graduate entrant programme. This has not been the case with the industrial milk sector. However, because the new fluid milk producers were formerly in the industrial milk market, there has been a shift in the pattern of fluid milk producers to locations that were more distant from the important urban markets. One can anticipate that this trend will continue in the future given the present institutional setting and current economic situation.

On the one hand, the graduate entrant programme combined with quota negotiability and the pooling of milk prices and transportation rates provided incentive for industrial milk producers to switch to the fluid milk market. On the other hand, high land values in the "Golden Horseshoe" area and high prices for Pool I quota encouraged regular milk producers to discontinue milk production. The net effect of these two sets of forces was to accelerate regional adjustments in the supply pattern of fluid milk in Southern Ontario.

Finally, the regional differences between Eastern and Western Ontario were tested for nine selected variables. In the case of herd management, acreage in corn, and fluid milk quota size, there was no significant difference between graduate entrant milk producers in Eastern and Western Ontario. Producers in Eastern Ontario occupied larger farms, carried larger milking herds and industrial milk quota, and were more dependent on milk sales for their farm income. On the other hand, the producers in Western Ontario were characterized by significantly higher milking herd averages and income from milk sales.

Having thus established the importance of the graduate entrant programme to recent changes in the dairy industry of Southern Ontario, it is appropriate to examine farm level adjustments among these producers.

CHAPTER 6

MULTIPLE REGRESSION ANALYSIS OF FARM DATA

Introduction

Multiple regression analysis has been widely used in the study of adjustment in the dairy industry. Through the use of this technique of analysis it is possible to identify quantitatively the relationship that exists between a dependent variable and a series of independent variables.

The objective of this chapter is to investigate the variables associated with changes in milking herd size since 1968 and to predict such changes. Section two discusses the selection of variables for the model with emphasis on the rationale for their selection. A series of hypotheses have been developed for the expected relationship between the dependent and independent variables.

A series of models are developed in section three, using absolute change in herd size as the dependent variable. The several models are developed on the basis of various combinations of independent variables. In addition, data are grouped by region and in accordance with an ethnic factor. The material in this section is organized into three parts: (1) presentation of a correlation matrix; (2) presentation

of the models used and results obtained; and (3) discussion and interpretation of the findings.

Section four is organized in a similar manner with the dependent variable in this case being the percentage change in herd size since 1968. In the regression models, the order of entry of the variables, the F level at entry, the degree of relationship between the dependent and independent variables, the sign and statistical significance of the regression coefficients, and the overall level of explanation provided by the models are all considered.

Selection of Variables

The Dependent Variable. Changes in milking herd size since 1968, measured in both absolute and percentage terms, is the dependent variable used in this study. This variable has been selected for several reasons: (1) it provides a measure of changing farm structure; (2) it reflects an industry-wide adjustment that has been taking place since at least 1951; and (3) changes in herd size can be directly related to changes in milk supply.

The Independent Variables. A total of eleven independent variables have been included in the model covering seven factors believed to have a bearing on herd enlargement behaviour. Following is a brief statement of rationale for the factors included in the models.

The method of storing and delivering milk in 1968 was used as an index of the level of mechanization and capitalization. Since one of the requirements of the graduate entrant programme is the presence of a bulk tank, farms with such facilities in 1968 were in a position to take advantage of the programme at an earlier date and direct future improvements to other areas. Furthermore, the use of a bulk tank reduces the farm labour input and results in higher returns from milk sales because of a differential in transportation rates. Thus the presence of a bulk tank in 1968 may be a factor inducing a higher level of milk production and expansion in the size of the milking herd. This variable entered the equation as a dummy variable, i.e. assigned a one for presence and a zero for absence.

A second factor included in the model was a measurement of the herd management level of the farm operator. Because the measurement used was directly related to milk production, an operator with a high level of management would receive greater returns from milk sales. As a result, one could anticipate that such an individual would be more likely to enlarge the size of his milking herd and be capable of managing a larger herd than a poorer manager.

The third factor included in the model related to the social characteristics of the farm operator. Three variables fall into this category: the age of the operator in 1968, the educational background, and the ethnic group. Age was

included because of its significance in the adoption of innovations and the anticipation that it could also have an influence on a farmer's decision with respect to herd expansion.[1] The educational level might exert an influence in several ways: (1) higher levels could reflect better overall managerial ability and efficiency; and (2) higher educational levels may be associated with greater life style expectations. In both cases, herd expansion behaviour might be expected to be more probable. The anticipation with respect to the ethnic factor was generated as a result of the attention it received in the literature and because of the high proportion of immigrant Dutch Canadians in the sample. Thus, it was expected that herd expansion would be more characteristic of immigrant Dutch Canadians than other groups. This variable was included in the model as a dummy variable.

The fourth factor represented the economic characteristics of the farm in 1968 and were measured in terms of farm size and milking herd size. Larger farms were expected to have greater potential for expansion. As a result, a positive relationship between farm size and herd enlargement was anticipated. On the other hand, it is logical to expect that farms with smaller herds would be facing the greatest cost-price

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[1] G.J. Conneman, A Methodological Study of Representative Farm Groups and Alternative Methods of Analyzing and Projecting Changes in Milk Production, Unpublished Ph.D. thesis, Pennsylvania State University, 1967, p. 114.

squeeze and consequently to exhibit the greatest herd enlargement.

The fifth factor measured the quality of the land resource base and was expressed in terms of percentage of classes 1 and 2 land in the township. In this case, the lower quality land was expected to be associated with the greatest herd enlargement. The reasoning behind this was that better quality land would provide the farmer with alternative agricultural opportunities such as cash cropping.

A sixth factor related to changes in the land resource base brought about by: (1) additions to the farm through purchase or rental; and (2) upgrading of the land resource through the installation of tile drainage. Both of these changes increase the herd carrying capacity of the farm. Consequently, greater herd enlargement was expected to be associated with these changes. In order to hold the effect of these changes constant, both of these variables were measured as a percentage of the farm size in 1968.

Finally, an institutional factor was included, expressed as the amount of fluid milk quota purchased since 1968. Because the purchase of fluid milk quota results in the shift of a larger portion of the producer's milk into the top price category, the farmer receives additional income from milk sales. The anticipation with respect to this factor was that herd expansion and quota purchasing behaviour would be occurring concurrently. Thus, the inclusion of this

factor provides some indication of the role that the institutional setting may be playing in the decision to increase herd size.

Variables and Simple Hypotheses. Table 6 - 1 presents a summary of the variables included in the model along with a statement of the expected relationship between the dependent and independent variables. The abbreviations used indicate the manner in which the variables have been labelled in the computer printouts.

Models with Absolute Change in Herd Size as the Dependent Variable

Matrix of Simple Correlation Coefficients. The simple correlation matrix for the farm variables (table 6 - 2) gives some insights into the problem of correlation among the independent variables.[1] The highest correlation in this case is a positive association of 0.393 between farm size in 1968 and milking herd size for the same year. Since both of these variables are included in the model as an economic factor, it would be possible to eliminate one of these independent variables. Because the correlation between enlargement of milking herd and herd size in 1968 is the stronger of the two, the farm size variable will be deleted in one of the models.

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[1] Referred to as the problem of multicollinearity in the literature.

TABLE 6 - 1

VARIABLES AND SIMPLE HYPOTHESES

Variable		Abbreviation	Simple Hypotheses
Dependent			
Y_1	Absolute change in herd size 1968 - 73	EMILKH	
Z_1	Percentage change in herd size 1968 - 73	EMILKH	
Independent			
X_1	Method of milk delivery in 1968	BULKT	Greater expansion of milking herd size is associated with presence of a bulk tank in 1968
X_2	Level of herd management	GELTET	Herd enlargement increases with management level
X_3	Age of operator in 1968	AGE	Herd expansion increases as age decreases
X_4	Immigrant Dutch Canadian	DUTCH	Greater expansion of milking herd size is associated with immigrant Dutch Canadians
X_5	Level of education	EDUCAT	Expansion in milking herd size increases with education level
X_6	Size of milking herd in 1968	MILKH	Milking herd enlargement increases as herd size decreases
X_7	Size of farm in 1968	FARMSZ	Enlargement of milking herd size increases with farm size
X_8	Land resource base	PER12	Expansion in milking herd size increases as land quality decreases
X_9	Increases in land base since 1968	LAND	Milking herd enlargement increases with additions to the land resource base
X_{10}	Tile drainage since 1968	DRAIN	Milking herd expansion increases with tile drainage
X_{11}	Fluid milk quota purchases since 1968	POOLIP	Milking herd enlargement increases with quota purchases

TABLE 6 - 2

CORRELATION MATRIX FOR FARM VARIABLES

	EMILKH	BULKT	GELTET	AGE	DUTCH	EDUCAT	MILKH	FARMSZ	PER12	LAND	DRAIN	POOLIP
EMILKH	1.000	.085	.032	-.059	.130	.155	-.344	.067	.017	.227	.031	.313
BULKT		1.000	-.042	-.028	.121	-.004	.225	.232	-.050	.060	.045	.163
GELTET			1.000	.035	.101	.076	.076	.125	-.060	.008	-.119	-.038
AGE				1.000	-.021	-.115	.096	.133	-.026	-.044	-.140	-.036
DUTCH					1.000	.252	.210	.092	.077	.048	.057	.158
EDUCAT						1.000	.020	.003	.061	.083	.106	.152
MILKH							1.000	.393	-.146	.023	-.036	.251
FARMSZ								1.000	-.221	-.269	-.101	.146
PER12									1.000	-.047	.126	.046
LAND										1.000	.023	.056
DRAIN											1.000	.175
POOLIP												1.000

With a sample size of 200 a correlation coefficient of 0.138 is significant at the 5 per cent level, while a correlation coefficient of 0.181 is significant at the 1 per cent level. This matrix results from measuring milk herd expansion and Pool I purchases in absolute terms.

Examination of the correlation between herd enlargement and each of the independent variables indicates that, with the exception of age and milking herd size in 1968, all of the variables were positively related to herd expansion. The strength of the relationship shows that milking herd size, Pool I purchases, and land additions are quite significant, while education level and the Dutch variables are only marginal in terms of significance. The land quality variable (#9) was characterized by a number of negative correlations, the most significant being farm size and milking herd size in 1968. However, this is quite consistent with expectations.

Model 1. The dependent variable was run against eleven independent variables using total sample size and two regional groupings. Results from the three runs for this model are presented in tables 6 - 3, 6 - 4, and 6 - 5. The shorthand designations used in table 6 - 1 to refer to variables is used throughout. In addition to presenting the equation for each model, the "t" values and level of significance of the regression are indicated. An F level for entry and deletion of 1.5 was used in all the runs. Although the high F requirements for entry means that a number of variables are not in the equation, the order of entry of the independent variables not in the equation can be determined by the magnitude of the partial correlation coefficients.

Model 2. In the second model, the two dummy variables, BULKT and DUTCH along with the FARMSZ variable have been

deleted, leaving a total of eight independent variables. This model was run using the total sample size and four groupings based on the ethnic variable and region. The results are presented in tables 6 - 7, 6 - 8, 6 - 9, 6 - 10, and 6 - 11.

Variables Associated With Herd Enlargement: Model 1. In this model, eleven independent or predictor variables were run against the dependent or response variable. Three different groupings of cases, consisting of the total sample size, an Eastern Ontario group, and a Western Ontario group, were run for the model. The sample sizes were 193 cases, 68 cases, and 125 cases respectively. The results from each of the runs will be discussed separately, followed by a summary of the model results.

When the 193 observations were used in the first model, five independent variables entered the equation. All were highly significant. With the exception of milking herd size in 1968, all of the independent variables in the model were positively associated with the dependent variable. This was consistent with the relationships hypothesized in table 6 - 1. The multiple r and R^2 values were highly significant as well.

The size of the milking herd in 1968 was the first independent variable to enter the model, and with a negative sign indicates that the smallest milking herds in 1968 experienced the greatest absolute herd enlargement over the 1968 to 1973 period. Although this is contrary to Conneman's

findings with respect to herd size, it can be readily interpreted in the Ontario setting. Logically one would expect that the smaller dairy operations would be experiencing the greatest cost-price pressures. Faced with this situation, the milk producer has four possible options: (1) expand the size of his milking herd; (2) increase herd production by upgrading management; (3) purchase fluid milk quota in order to obtain higher returns from milk sales; or (4) use some combination of the above strategies. Given the predominance of the family farm organization of the dairy industry of Southern Ontario, labour and land restraints established an effective upper limit on expansion among the larger milking herds in 1968. Consequently, the inverse relationship between herd enlargement and milking herd size in 1968.

Fluid milk quota purchase was the second independent variable to enter the model. The positive sign indicates that the milk producers were purchasing quota in conjunction with herd enlargement. Thus, it would appear that the milk producers were using at least two strategies in attempting to deal with the cost-price squeeze. It also reflects the importance of the institutional factor, because the market in fluid milk quota has come about directly as a result of a Marketing Board policy.

The third significant variable to enter the model was additions to the land resource base since 1968, coming as a result of either land purchase or rental. This independent

variable was positively associated with herd enlargement, indicating that herd enlargement was occurring in conjunction with additions to the land resource base. The implication arising from this result is that the lack of land resources serves as a restraint on herd expansion.

Farm size in 1968 was the fourth independent variable to enter the model. The positive association between herd expansion and farm size once again emphasizes the importance of the availability of land resources. Finally, the Dutch ethnic variable was positively associated with herd expansion at a significant level. This provides support for the contention that Dutch Canadians have played an important role in the dairy industry of Southern Ontario.

Examination of the sign of the partial correlation coefficients provides information on the relationship of the dependent variable and the independent variables not in the equation. A positive relationship was evident between herd expansion and the presence of a bulk tank in 1968, the gel test averages, and the level of education. A negative relationship existed between herd enlargement and the remaining three independent variables: age of the farm operator in 1968, percentage class 1 and 2 land, and additions of tile drainage since 1968, (table 6 - 3). With the exception of the last independent variable, these relationships were consistent with expectations.

Employing the same set of independent variables,

TABLE 6 - 3

RESULTS FROM MODEL 1: TOTAL SAMPLE (193 CASES) RUN 1

Variables in Equation.

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	7	.3401	.1157	.1157	24.9875
2	POOLIP	12	.5344	.2856	.1699	45.1933
3	LAND	10	.5757	.3314	.0458	12.9395
4	FARMSZ	8	.6393	.4088	.0774	24.6014
5	DUTCH	5	.6568**	.4314	.0226	7.4458

Equation: $Y = 11.65 + 2.55X_5 - .49X_7 + .04X_8 + .05X_{10} + .01X_{12} + u$

t Value : (2.728)** (9.574)** (4.990)** (5.108)** (6.540)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
BULKT	2	.07027	.9230
GELTET	3	.05003	.4668
AGE	4	- .02373	.1048
EDUCAT	6	.06174	.9143
PER12	9	- .02110	.0828
DRAIN	11	- .05357	.5353

** Significant at the 99 per cent level of confidence.

the model was run a second time using only the observations from Eastern Ontario, (table 6 - 4). A number of changes occurred when this grouping of cases was used. In this instance, seven independent variables entered the model, consisting of three new variables and four of the five variables present in the first run. The Dutch ethnic variable did not enter the model in this run. However, the presence of a bulk tank in 1968, the gel test average, and the level of education were added. Although their level of significance was not as high as the first four variables in run one, a case has been made for their inclusion.[1] The net effect of these three additional independent variables is to produce a marked increase in the multiple r and R^2 values.

The size of milking herd in 1968 and quota purchases entered in the same order as in the first run. The farm size variable and the land variable entered the model as number five and six. However, the level of significance and the sign remained the same as in the first run. In the case of the three new independent variables, the nature of the relationship between the dependent variable and these independent variables was the same as indicated from the examination of partial correlation coefficients in run one.

In the final grouping of data for model one, the 125

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[1] D.P. Hauser, "Some Problems in the Use of Stepwise Regression Techniques in Geographical Research," The Canadian Geographer, Vol. XVIII, No. 2, 1974, pp. 155 - 56.

TABLE 6 - 4

RESULTS FROM MODEL 1: EASTERN ONTARIO (68 CASES) RUN 2

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to enter
1	MILKH	7	.4059	.1648	.1648	13.0184
2	POOLIP	12	.6467	.4182	.2534	28.3120
3	BULKT	2	.6812	.4641	.0459	5.4833
4	GELTET	3	.7086	.5021	.0380	4.8098
5	FARMSZ	8	.7281	.5301	.0280	3.6904
6	LAND	10	.7674	.5889	.0588	8.7240
7	EDUCAT	6	.7803**	.6088	.0199	3.0571

Equation: $Y = 1.58 + 3.75X_2 + .18X_3 + .81X_6 - .60X_7 + .04X_8 + .05X_{10} + .02X_{12} + u$

t Value : $(1.968)^{oo}$ $(1.859)^{oo}$ $(1.748)^{oo}$ $(7.504)^{**}$ $(3.342)^{**}$ $(3.039)^{**}$ $(5.834)^{**}$

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
AGE	4	- .01480	.0129
DUTCH	5	- .09804	.5726
PER12	9	.09500	.5374
DRAIN	11	.0644	.2163

** Significant at the 99 per cent level of confidence.
oo Significant at the 90 per cent level of confidence.

observations from Western Ontario were used, (table 6 - 5). Six independent variables entered the equation in this case, with five of the variables being highly significant. These were the same five variables that were significant in the first run. The drainage variable also entered the equation in run three, but was only significant at the .80 per cent level. However, the drainage variable is positively associated with the dependent variable in this instance. Although this is in contrast to the sign in run one, it is in keeping with the type of relationship initially hypothesized between herd expansion and additions of tile drainage. Even with six independent variables in the equation, the multiple r and R^2 values are very similar to those of run one.

Results from the three runs of model one have been summarized in table 6 - 6. Examination of the summary table shows that the results from run one and run three are quite similar. This is not unexpected as the observations from Western Ontario comprise approximately 65 per cent of the total sample. It can be noted that four of the eleven independent variables are highly significant in all three data groupings for model one. These four variables are milking herd size and farm size in 1968, land additions since 1968, and the purchase of fluid milk quota since 1968. The Dutch ethnic variable is highly significant in runs one and three, but does not enter the equation in run two. In the Eastern Ontario group, education level, gel test average, and the

TABLE 6 - 15

RESULTS FROM MODEL 1: WESTERN ONTARIO (125 CASES) RUN 3

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	POOLIP	12	.3281	.1076	.1076	14.8371
2	MILKH	7	.4884	.2385	.1309	20.9667
3	DUTCH	5	.5588	.3123	.0738	12.9829
4	LAND	10	.5965	.3558	.0435	8.1054
5	FARMSZ	8	.6462	.4175	.0617	12.6083
6	DRAIN	11	.6559**	.4303	.0127	2.6368

Equation: $Y = 12.20 + 3.93X_5 - .46X_7 + .03X_8 + .05X_{10} + .04X_{11} + .008X_{12} + u$

t Value : (3.524)** (6.906)** (3.310)** (3.382)** (1.623)° (4.790)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
BULKT	2	- .00802	.0075
GELTET	3	- .09873	1.1516
AGE	4	.04941	.2863
EDUCAT	6	- .03380	.1338
PER12	9	- .06690	.5259

** Significant at the 99 per cent level of confidence.
o Significant at the 80 per cent level of confidence.

TABLE 6 - 6

SUMMARY OF MODEL 1 RESULTS

Variable	Order of Entry*			Significance of Values			Sign		
	T	E	W	T	E	W	T	E	W
1. EMILKH**									
2. BULKT	NIE	3	NIE		90%		+	+	-
3. GELTET	NIE	4	NIE		90%		+	+	-
4. AGE	NIE	NIE	NIE				-	-	+
5. DUTCH	5	NIE	3	99%		99%	+	-	+
6. EDUCAT	NIE	7	NIE		90%		+	+	-
7. MILKH	1	1	2	99%	99%	99%	-	-	-
8. FARMSZ	4	5	5	99%	99%	99%	+	+	+
9. PER12	NIE	NIE	NIE				-	+	-
10. LAND	3	6	4	99%	99%	99%	+	+	+
11. DRAIN	NIE	NIE	6			80%	-	+	+
12. POOLIP	2	2	1	99%	99%	99%	+	+	+
Multiple r	.6568	.7803	.6559	99%	99%	99%			
Multiple R^2	.4314	.6088	.4303						

* Using an F value cutoff point of 1.5.
** Dependent Variable.
NIE Not in Equation.
T Total Sample.
E Eastern Ontario.
W Western Ontario

presence of a bulk tank in 1968 are all included in the model. Thus, Eastern and Western Ontario groupings show some important differences. This is quite in keeping with the generally held belief that there are some major differences in the dairy industry in these two regions.

Two such differences should be considered when interpreting the results from the multiple regression models. On the one hand, developments in dairying such as herd testing, improvements in herd quality, acceptance of modern technology, and capital improvements tend to lag in Eastern Ontario. Support for this contention is provided by the appearance of the bulk tank variable when the Eastern Ontario observations were grouped. Consequently, it was a good predictor variable for the Eastern Ontario data set.

On the other hand, Eastern Ontario does not have the agricultural alternatives that Western Ontario has, resulting in a greater dependence on dairying as a viable agricultural activity. Evidence for the limited alternatives in Eastern Ontario is provided by the land capability variations between the two areas, (table 5 - 10). This factor may account for the significance of the Dutch ethnic variable in runs one and three and its absence in run two. Although the percentage of Dutch Canadians was almost identical in the Eastern and Western Ontario regional samples, their lack of significance

in Eastern Ontario may reflect the lack of alternative agricultural opportunities. As a result, there was no prediction value for this variable in Eastern Ontario because other ethnic groups were also undertaking herd expansion programmes in an attempt to increase farm income. Where alternatives were available, the Dutch showed a greater inclination for dairying, which was reflected in herd enlargement.

Variables Associated With Herd Enlargement: Model 2. This model includes eight independent variables from model one, with the two dummy variables BULKT and DUTCH deleted along with the FARMSZ variable. The dependent variable is once again measured in absolute terms, and the stepwise procedure is used. Five runs, using somewhat different groupings of variables, were employed. In addition to the total sample and the Eastern and Western Ontario groupings, the observations were also classified on the basis of the ethnic variable. This resulted in one group of 70 cases consisting of Dutch Canadians, and a second group of 123 cases consisting of non-Dutch fluid milk producers. As the Dutch element was found in both regions in approximately the same percentage, this grouping is quite different from the regional classification of observations.

When the total sample was included, five independent variables entered the equation, (table 6 - 7). Three were highly significant. These three variables were the size of the milking herd in 1968, fluid milk quota purchases, and land

TABLE 6 - 7

RESULTS FROM MODEL 2: TOTAL SAMPLE (193 CASES) RUN 1

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.3401	.1157	.1157	24.9875
2	POOLIP	9	.5344	.2856	.1699	45.1933
3	LAND	7	.5757	.3314	.0458	12.9395
4	EDUCAT	4	.5819	.3386	.0072	2.0368
5	GELTET	2	.5867**	.3442	.0057	1.6138

Equation: $Y = 11.66 + .07X_2 + .33X_4 - .37X_5 + .03X_7 + .01X_9 + u$

t Value : (1.270) (1.311)^{o} (7.442)** (3.486)** (6.582)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
AGE	3	.01626	.0492
PER12	6	- .07375	1.0173
DRAIN	8	- .07658	1.0973

** Significant at the 99 per cent level of confidence.
o Significant at the 80 per cent level of confidence.

additions since 1968. Their order of entry and relationship to the dependent variable was the same as in the first run of model one. The fourth and fifth variables to enter the model were education and gel test average. However, only the education variable was significant at the 80 per cent level. The multiple r and R^2 values were somewhat lower than in the first run of model one.

The 70 Dutch Canadians were grouped for the second run of model two, (table 6 - 8). In this case, four independent variables entered the equation: milking herd size in 1968, fluid milk quota purchases, age, and land additions. Milking herd size and quota purchases were both highly significant. The age variable was significant at the 95 per cent level, while the land variable was significant at the 90 per cent level. It should be noted that the age variable was positively associated with herd expansion which is in contrast to prior expectations. However, there may be an explanation for this anomaly. All of the milk producers in this group are recent immigrants, who have established themselves in the dairy industry since coming to Canada. It may be that initial efforts in such a situation are directed towards building up other aspects of the farm. Consequently, herd enlargement is coming at a later stage, thus accounting for the inverse relationship between herd expansion and age.

In the third run of model two, the 123 non-Dutch observations were grouped. A total of six independent variables

TABLE 6 - 8

RESULTS FROM MODEL 2: DUTCH (70 CASES) RUN 2

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.3907	.1526	.1526	12.2465
2	POOLIP	9	.5382	.2897	.1371	12.9311
3	AGE	3	.5866	.3441	.0544	5.4698
4	LAND	7	.6031**	.3637	.0196	2.0072

Equation: $Y = 12.19 + .24X_3 - .49X_5 + .02X_7 + .009X_9 + u$

t Value : (2.345)* (4.989)** (1.416)° (3.475)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
GELTET	2	- .05092	.1664
EDUCAT	4	- .00987	.0062
PER12	6	.02194	.0308
DRAIN	8	.08452	.4604

* Significant at the 95 per cent level of confidence.
** Significant at the 99 per cent level of confidence.
o Significant at the 80 per cent level of confidence.

entered the equation, (table 6 - 9). Milking herd size in 1968, fluid milk quota purchases, land additions, and tile drainage were all significant at the 99 per cent level. The age variable was significant at the 80 per cent level. Although the land capability variable entered the equation, it was not significant at the 80 per cent level. Only quota purchases and land additions were positively associated with the dependent variable.

When the Eastern Ontario observations were grouped in run four, five independent variables entered the equation, (table 6 - 10). Only milking herd size and quota purchases were highly significant. The education variable was significant at the 90 per cent level, while land additions and gel test averages were significant at the 80 per cent level. The same series of independent variables present in the comparable grouping of observations in model one were evident in model two. In addition, the nature of the relationship between the dependent and independent variables are similar. However, the multiple r and R^2 values are slightly lower.

Finally, the cases for Western Ontario were grouped for run five of the model. Four independent variables entered, with three being highly significant, (table 6 - 11). The drainage variable was significant at the 90 per cent level. All four independent variables were present in the comparable grouping for model one. With the exception of the drainage variable, the nature of the relationship between the dependent

TABLE 6 - 9

RESULTS FROM MODEL 2: NON DUTCH (123 CASES) RUN 3

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.3775	.1425	.1425	20.1107
2	POOLIP	9	.5643	.3184	.1759	30.9723
3	LAND	7	.6218	.3866	.0682	13.2220
4	DRAIN	8	.6525	.4257	.0391	8.0390
5	AGE	3	.6605	.4363	.0106	2.1905
6	PER12	6	.6666**	.4443	.0081	1.6840

Equation: $Y = 21.55 - .083X_3 - .42X_5 - .04X_6 + .04X_7 - .08X_8 + .02X_9 + u$

t Value : $(1.388)^{o}$ $(7.183)^{**}$ (1.297) $(3.512)^{**}$ $(2.765)^{**}$ $(6.541)^{**}$

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
GELTET	2	.11082	1.4300
EDUCAT	4	.09168	.9747

** Significant at the 99 per cent level of confidence.
o Significant at the 80 per cent level of confidence.

TABLE 6 - 10

RESULTS FROM MODEL 2: EASTERN ONTARIO (68 CASES) RUN 4

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.4059	.1648	.1648	13.0184
2	POOLIP	9	.6467	.4182	.2534	28.3120
3	GELTET	2	.6719	.4515	.0333	3.8888
4	LAND	7	.6904	.4767	.0252	3.0291
5	EDUCAT	4	.7046**	.4964	.0197	2.4315

Equation: $Y = 8.68 + .20X_2 + .79X_4 - .48X_5 + .03X_7 + .02X_9 + u$

t Value : $(1.812)^{oo}$ $(1.559)^{o}$ $(5.828)^{**}$ $(1.694)^{oo}$ $(5.511)^{**}$

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
AGE	3	.06224	.2372
PER12	6	.01887	.0217
DRAIN	8	.05216	.1664

** Significant at the 99 per cent level of confidence.
oo Significant at the 90 per cent level of confidence.
o Significant at the 80 per cent level of confidence.

TABLE 6 - 11

RESULTS FROM MODEL 2: WESTERN ONTARIO (125 CASES) RUN 5

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.3281	.1076	.1076	14.8371
2	LAND	7	.4884	.2385	.1309	20.9667
3	DRAIN	8	.5401	.2918	.0532	9.0962
4	POOLIP	9	.5597**	.3133	.0215	3.7595

Equation: $Y = 14.81 - .33X_5 + .04X_7 - .05X_8 + .01X_9 + u$

t Value : (4.953)** (3.107)** (1.939)oo (5.312)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
PER12	6	- .01641	.0321
EDUCAT	4	.04290	.2195
AGE	3	.05770	.3975
GELTET	2	.06851	.5611

** Significant at the 99 per cent level of confidence.
oo Significant at the 90 per cent level of confidence.

and independent variables was the same as in model one.

Examination of table 6 - 12 provides a summary of the results from the five groupings of observations used in model two. Although the number of independent variables was reduced to eight in model two, some comparisons are in order. Runs one, four, and five of model two have comparable groupings in model one. Consequently, comparison will be limited to similar data groupings. Thus, comparison with table 6 - 6 indicates that: (1) the multiple r and R^2 values were slightly lower in comparable groupings in model two, but were still highly significant; (2) the best level of explanation in the dependent variable was obtained from the Eastern Ontario grouping; (3) with the exception of run one in model two, all of the independent variables in model one were present in model two:[1] (4) with the exception of the drainage variable in run five of model two, the relationship between the dependent variable and independent variables in the equation was the same; and (5) milking herd size and quota purchases were highly significant in all runs of both models.

Models With Percentage Change in Herd Size as the Dependent Variable

Matrix of Simple Correlation Coefficients. The correlation matrix in table 6 - 13 is similar to table 6 - 2

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[1]The variable in question was the herd management variable, (GELTET).

TABLE 6 - 12

SUMMARY OF MODEL 2 RESULTS

Variable	Order of Entry*					Significance of Values					Sign				
	T	D	ND	E	W	T	D	ND	E	W	T	D	ND	E	W
1. EMILKH**															
2. GELTET	5	NIE	NIE	3		NS			90%		+	-	+	+	+
3. AGE	NIE	3	5	NIE			95%	80%			+	+	-	+	+
4. EDUCAT	4	NIE	NIE	5		80%			80%		+	-	+	+	+
5. MILKH	1	1	1	1	1	99%	99%	99%	99%	99%	-	-	-	-	-
6. PER12	NIE	NIE	6	NIE				NS			-	+	-	+	-
7. LAND	3	4	3	4	2	99%	80%	99%	90%	99%	+	+	+	+	+
8. DRAIN	NIE	NIE	4	NIE	3			NS		90%	-	+	-	+	-
9. POOLIP	2	2	2	2	4	99%	99%	99%	99%	99%	+	+	+	+	+
Multiple r	.5867	.6031	.6666	.7046	.5597	99%	99%	99%	99%	99%					
Multiple R^2	.3442	.3637	.4443	.4964	.3133										

* Using an F value cutoff point of 1.5.
** Dependent Variable.
NIE Not in Equation.
NS Not significant at the 80 per cent level.
T Total sample.

D Dutch
ND Non-Dutch
E Eastern Ontario
W Western Ontario

TABLE 6 - 13

CORRELATION MATRIX FOR FARM VARIABLES

	EMILKH	BULKT	GELTET	AGE	DUTCH	EDUCAT	MILKH	FARMSZ	PER12	LAND	DRAIN	POOLIP
EMILKH	1.000	.009	-.002	-.125	.067	.013	-.493	-.024	.017	.146	.070	.095
BULKT		1.000	-.047	-.020	.118	-.001	.222	.231	-.054	.062	.043	.171
GELTET			1.000	.059	.092	.082	.068	.122	-.068	.013	-.127	-.078
AGE				1.000	-.002	-.128	.116	.143	-.011	-.055	-.130	-.118
DUTCH					1.000	.259	.204	.090	.071	.052	.051	.134
EDUCAT						1.000	.025	.005	.066	.081	.110	.095
MILKH							1.000	.392	-.153	.027	-.041	.120
FARMSZ								1.000	-.224	-.268	-.103	.085
PER12									1.000	-.044	.122	-.003
LAND										1.000	.026	.038
DRAIN											1.000	.154
POOLIP												1.000

With a sample size of 200 a correlation coefficient of 0.138 is significant at the 5 per cent level, while a correlation coefficient of 0.181 is significant at the 1 per cent level. This matrix results from measuring milk herd expansion and Pool I purchases in percentage terms.

except that both herd enlargement and quota purchases (variables 1 and 12) are measured in percentage terms rather than absolute terms. Comparison of the two tables reveals two changes have occurred: (1) a change in the nature of the relationship (sign) between the dependent and independent variables; and (2) a change in the strength of the relationship between the dependent and independent variables.

Several examples of the first type of change can be noted. The gel test average, which was positively associated with absolute herd enlargement, becomes negative when the percentage value is employed. The same type of change can be noted in the case of the farm size variable. However, in both cases, the negative correlation is far from being significant. This lack of significance was also the case when the absolute change in herd size was used. In all other cases, the nature of the relationship remained the same.

A number of changes have occurred in the strength of relationship between the dependent and independent variables. Variable four, five, six, ten, and twelve all showed a decline in the strength of their relationship with herd enlargement when the dependent variable was measured in percentage terms. This was particularly evident in the case of variable twelve, where it dropped from being highly significant when herd enlargement was expressed in percentage terms. On the other hand, the relationship between herd expansion and milking herd size in 1968 was much stronger when herd enlargement

was measured in percentage terms. Finally, it can be noted that the intercorrelation between farm size in 1968 and milking herd size remained almost the same in the two correlation matrices.

Model 3. The dependent variable was run against eleven independent variables using total sample size, and an Eastern and Western Ontario grouping. Results from these three runs of model three are presented in tables 6 - 14, 6 - 15, and 6 - 16, with the findings being summarized in table 6 - 17. Once again an F level to enter of 1.5 was used throughout.

Model 4. The fourth model is similar to model two in that the two dummy variables and the farm size variable have been deleted. Five groupings, involving the total sample, the Dutch and non-Dutch classification, and the Eastern and Western Ontario groupings, have been used. Individual results are presented in tables 6 - 18 through 6 - 22, with the overall results being summarized in table 6 - 23.

Variables Associated With Herd Enlargement: Model 3. When the 193 observations were used, five independent variables entered the model. Milking herd size in 1968 was inversely related to the dependent variable, while the four remaining independent variables were all positively associated with percentage herd enlargement. Milking herd size and farm size in 1968 along with land additions were all significant at the 99 per cent level using the t test. The

Dutch ethnic variable and quota purchases were significant at the 95 per cent level.

The size of the milking herd in 1968 was the first independent variable to enter the model, (table 6 - 14). Once again the negative sign indicates that the smallest milking herds in 1968 showed the greatest percentage change in herd size over the 1968 to 1973 period. This is consistent with the results of model one and suggests that the introduction of labour-saving technology has enabled these operations to increase in size without affecting major changes in the organization of the dairy farm.

Farm size in 1968 and land additions since 1968 were the second and third independent variables to enter, once again emphasizing the importance of available land resources if herd enlargement is to occur. The fourth and fifth variables to enter were the Dutch ethnic variable and purchases of fluid milk quota.

Examination of the partial correlation coefficients for the independent variables not in the equation shows that herd enlargement is positively associated with the presence of a bulk tank in 1968, the gel test average, and drainage improvements. This is in accord with prior expectations, (table 6 - 1). Age, education level and land quality were inversely related to herd enlargement. With the exception of education level, this was consistent with expectations.

Using the same set of independent variables, the data

TABLE 6 - 14

RESULTS FROM MODEL 3: TOTAL SAMPLE (193 CASES) RUN 1

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	7	.4932	.2432	.2432	61.3872
2	FARMSZ	8	.5261	.2768	.0336	8.8298
3	LAND	10	.5727	.3280	.0512	14.3945
4	DUTCH	5	.5938	.3526	.0246	7.1456
5	POOLIP	12	.6059**	.3671	.0145	4.2907

Equation: $Y = 79.13 + 14.81X_5 - 3.26X_7 + .18X_8 + .23X_{10} + .29X_{12} + u$

t Value : (2.452)* (9.955)** (3.996)** (3.643)** (2.071)*

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
BULKT	2	.05292	.5223
GELTET	3	.00309	.0018
AGE	4	- .07857	1.1554
EDUCAT	6	- .05186	.5015
PER12	9	- .03045	.1727
DRAIN	11	.04890	.4458

* Significant at the 95 per cent level of confidence.
** Significant at the 99 per cent level of confidence.

were grouped by region and the 68 observations from Eastern Ontario made up the first run, (table 6 - 15). A total of six variables entered the model in this case. Only herd size in 1968 and quota purchases since 1968 were highly significant. The bulk tank variable was significant at the 90 per cent level. Education level was significant at the 80 per cent level, while gel test averages were not significant at this level. Although the multiple r and R^2 values are higher than in run one, they are still slightly lower than in the comparable run of model one.

In the final run of model three, the 125 cases from Western Ontario were grouped, resulting in four independent variables in the equation, (table 6 - 16). Milking herd size and farm size in 1968 along with land additions were highly significant. The Dutch ethnic variable was significant at the 90 per cent level.

The findings from model three have been summarized in table 6 - 17. Only one independent variable, size of milking herd in 1968, was significant in all three runs of model three. Once again the total sample and the Western Ontario runs were quite similar in terms of the independent variables in the model and the multiple r and R^2 values. Pool I variable was present in the total sample and significant at the 95 per cent level, but was not included in the Western Ontario run. The Eastern Ontario case stood out in terms of number of independent variables in the equation and the level of

TABLE 6 - 15

RESULTS FROM MODEL 3: EASTERN ONTARIO (68 CASES) RUN 2

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter.
1	MILKH	7	.5418	.2935	.2935	27.4181
2	POOLIP	12	.6286	.3951	.1016	10.9217
3	BULKT	2	.6476	.4194	.0243	2.6777
4	DRAIN	11	.6582	.4333	.0139	1.5419
5	EDUCAT	6	.6685	.4469	.0136	1.5221
6	GELTET	3	.6785**	.4604	.0135	1.5252

Equation: $Y = 117.29 + 23.23X_2 + .80X_3 - 4.15X_6 - 2.84X_7 + .44X_{11} + .75X_{12} + u$

t Value : $(1.902)^{oo}$ (1.235) $(1.344)^{o}$ $(6.299)^{**}$ $(1.668)^{oo}$ $(2.880)^{**}$

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
AGE	4	.11161	.7568
DUTCH	5	.10749	.7013
FARMSZ	8	.13015	1.0339
PER12	9	.00659	.0026
LAND	10	.03502	.0737

** Significant at the 99 per cent level of confidence.
oo Significant at the 90 per cent level of confidence.
o Significant at the 80 per cent level of confidence.

TABLE 6 - 16

RESULTS FROM MODEL 3: WESTERN ONTARIO (125 CASES) RUN 3

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	7	.4651	.2163	.2163	33.9480
2	LAND	10	.5134	.2635	.0472	7.8272
3	FARMSZ	8	.5816	.3383	.0747	13.6636
4	DUTCH	5	.5956**	.3547	.0164	3.0525

Equation: $Y = 79.68 + 13.56X_5 - 3.44X_7 + .23X_8 + .30X_{10} + u$

t Value : $(1.747)^{oo}$ $(7.426)^{**}$ $(3.638)^{**}$ $(3.610)^{**}$

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
BULKT	2	.00839	.0014
GELTET	3	- .05072	.3069
AGE	4	- .11077	1.4782
EDUCAT	6	- .02233	.0594
PER12	9	- .02088	.0519
DRAIN	11	.01005	.0120
POOLIP	12	- .06393	.4884

** Significant at the 99 per cent level of confidence.
oo Significant at the 90 per cent level of confidence.

TABLE 6 - 17

SUMMARY OF MODEL 3 RESULTS

	Variable	Order of Entry*			Significance of Values			Sign		
		T	E	W	T	E	W	T	E	W
1.	EMILKH**									
2.	BULKT	NIE	3	NIE		90%		+	+	+
3.	GELTET	NIE	6	NIE		NS		+	+	-
4.	AGE	NIE	NIE	NIE				-	+	-
5.	DUTCH	4	NIE	4	95%		90%	+	+	+
6.	EDUCAT	NIE	5	NIE		80%		-	-	-
7.	MILKH	1	1	1	99%	99%	99%	-	-	-
8.	FARMSZ	2	NIE	3	99%		99%	+	+	+
9.	PER12	NIE	NIE	NIE				-	+	-
10.	LAND	3	NIE	2	99%		99%	+	+	+
11.	DRAIN	NIE	4	NIE		90%		+	+	+
12.	POOLIP	5	2	NIE	95%	99%		+	+	+
Multiple r		.6059	.6785	.5956	99%	99%	99%			
Multiple R^2		.3671	.4604	.3547						

* Using an F value cutoff point of 1.5.
** Dependent Variable.
NIE Not in Equation.
NS Not significant at the 80 per cent level of confidence.
T Total Sample.
E Eastern Ontario.
W Western Ontario.

explanation provided by the model.

Variables Associated With Herd Enlargement: Model 4. In this model, the same set of eight independent variables used in model two have been employed. The difference between this model and model two is that the dependent variable is now expressed in percentage terms. Five runs, using the total sample size, the Dutch and non-Dutch groupings, and the two regional classifications, have been employed.

In the total sample run, only three independent variables entered the model, (table 6 - 18). Land additions and quota purchases were significant at the 95 per cent level, with milking herd size being significant at the 99 per cent level. One independent variable, milking herd size in 1968, dominates and accounts for much of the explanation in the model. The multiple r and R^2 values are somewhat lower than in previous models.

When the Dutch observations were grouped, four independent variables entered with milking herd size dominating to an even greater extent than in the first run, (table 6-19). Each of the four independent variables had a different level of significance in this case. Milking herd size was significant at the 99 per cent level and negatively related to the dependent variable. The age variable was significant at the 95 per cent level and was positively associated with the dependent variable. The land quality variable entered the model at a 90 per cent significance level and was inversely

TABLE 6 - 18

RESULTS FROM MODEL 4: TOTAL SAMPLF (193 CASES) RUN 1

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.4932	.2432	.2432	61.3872
2	LAND	7	.5185	.2688	.0256	6.6495
3	POOLIP	9	.5398	.2913	.0225	6.0053

Equation: $Y = 97.67 - 2.59X_5 + .16X_7 + .36X_9 + u$

t Value : $(8.357)^{**}$ $(2.525)^{*}$ $(2.451)^{*}$

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
GELTET	2	.05071	.4847
AGE	3	- .04718	.4193
EDUCAT	4	- .00099	.0002
PER12	6	- .06627	.8294
DRAIN	8	.02545	.1218

** Significant at the 99 per cent level of confidence.
* Significant at the 95 per cent level of confidence.

TABLE 6 - 19

RESULTS FROM MODEL 4: DUTCH (70 CASES) RUN 2

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1.	MILKH	5	.6236	.3889	.3889	43.2709
2	POOLIP	9	.6503	.4229	.0340	3.9477
3	AGE	3	.6767	.4580	.0351	4.2719
4	PER12	6	.6884**	.4739	.0159	1.9680

Equation: $Y = 131.56 + 1.17X_3 - 4.14X_5 - .31X_6 + .40X_9 + u$

t Value : (1.999)* (7.251)** (1.403)^{oo} (1.871)^{o}

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
GELTET	2	.04198	.1130
EDUCAT	4	- .11417	.8453
LAND	7	.07971	.4093
DRAIN	8	.08816	.5013

** Significant at the 99 per cent level of confidence.
* Significant at the 95 per cent level of confidence.
oo Significant at the 90 per cent level of confidence.
o Significant at the 80 per cent level of confidence.

related to the dependent variable. Finally, quota purchases were significant at the 80 per cent level and were positively related to the dependent variable. The multiple r and R^2 values have increased considerably from the previous run, largely because of the greater significance of the herd size variable. It can be noted that the relationship between herd expansion and age is positive. Although this is contrary to other runs, it is consistent with the results from the previous grouping using the Dutch element.

The third run consisted of the 123 observations of non-Dutch milk producers. Table 6 - 20 presents the results. Only three independent variables entered the equation in this case. Milking herd size and land additions were both significant at the 99 per cent level, while age was significant at the 95 per cent level. Although the milking herd size variable was not as dominant as in the previous run, it is still the single most important independent variable in the model. The multiple r and R^2 values were somewhat lower than in run two, but were quite similar to the results from the total sample run.

When the Eastern Ontario cases were grouped, three independent variables were present in the equation, (table 6 - 21). Milking herd size and quota purchases were highly significant, but the drainage variable was not significant at the 80 per cent level.

In the final grouping of data for model four, only milking herd size in 1968 and land additions were in the

TABLE 6 - 20

RESULTS FROM MODEL 4: NON-DUTCH (123 CASES) RUN 3

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.4700	.2209	.2209	34.3014
2	LAND	7	.5172	.2675	.0466	7.6345
3	AGE	3	.5413**	.2930	.0255	4.2978

Equation: $Y = 117.47 - .81X_3 - 2.13X_5 + .20X_7 + u$

t Value : (2.073)* (5.935)** (2.577)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
GELTET	2	- .03409	.1373
EDUCAT	4	- .02815	.0936
PER12	6	.02703	.0862
DRAIN	8	.00141	.0002
POOLIP	9	.07907	.7424

** Significant at the 99 per cent level of confidence.
* Significant at the 95 per cent level of confidence.

TABLE 6 - 21

RESULTS FROM MODEL 4: EASTERN ONTARIO (68 CASES) RUN 4

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.5418	.2935	.2935	27.4181
2	POOLIP	9	.6286	.3951	.1016	10.9217
3	DRAIN	8	.6398**	.4093	.0142	1.5356

Equation: $Y = 101.13 - 2.71X_5 + .32X_8 + .80X_9 + u$

t Value : (6.057)** (1.239) (3.054)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
GELTET	2	.12539	1.0064
AGE	3	.12176	.9481
EDUCAT	4	- .11817	.8922
PER12	6	- .06856	.2975
LAND	7	.04531	.1296

** Significant at the 99 per cent level of confidence.

equation, (table 6 - 22). Both were highly significant. The multiple r and R^2 values, although still highly significant, were the lowest of the five runs for this model. The results from this run are similar to the Eastern Ontario run in terms of the number of independent variables to enter at a significant level. However, in this case, the land variable was the second independent variable, whereas in run four quota purchases entered as the second variable.

Results from the five runs of model four have been summarized in table 6 - 23. The only variable to stand out consistently was the milking herd size in 1968. It dominated in varying degrees in all of the runs, but was always highly significant and inversely related to the dependent variable. Land additions and Pool I quota purchases entered the model in three cases. However, they were both present only in the total sample grouping. The age variable was present in the Dutch and non-Dutch grouping. The relationship with the dependent variable was negative in the former case and positive in the latter. Finally, although the drainage variable was present in the Eastern Ontario case, it was not significant at the 80 per cent level.

Summary

The farm level data were analyzed in a series of multiple regression models in chapter six. Four models were

TABLE 6 - 22

RESULTS FROM MODEL 4: WESTERN ONTARIO (125 CASES) RUN 5

Variables in Equation

Step Number	Variable Entered	#	Multiple R	RSQ	Increase in RSQ	F to Enter
1	MILKH	5	.4651	.2163	.2163	33.9480
2	LAND	7	.5134**	.2635	.0472	7.8272

Equation: $Y = 100.52 - 2.63X_5 + .24X_7 + u$

t Value : (5.986)** (2.798)**

Variables Not in Equation

Variable	#	Partial Correlation Coefficients	F to Enter
GELTET	2	.00919	.0102
AGE	3	- .09088	1.0076
EDUCAT	4	.04224	.2163
PER12	6	.05042	.3084
DRAIN	8	- .02411	.0704
POOLIP	9	.08670	.9165

** Significant at the 99 per cent level of confidence.

TABLE 6 - 23

SUMMARY OF MODEL 4 RESULTS

Variable	Order of Entry*					Significance of Values					Sign				
	T	D	ND	E	W	T	D	ND	E	W	T	D	ND	E	W
1. EMILKH**															
2. GELTET	NIE	NIE	NIE	NIE	NIE						+	+	-	+	+
3. AGE	NIE	3	3	NIE	NIE		95%	95%			-	+	-	+	-
4. EDUCAT	NIE	NIE	NIE	NIE	NIE						-	-	-	-	+
5. MILKH	1	1	1	1	1	99%	99%	99%	99%	99%	-	-	-	-	-
6. PER12	NIE	4	NIE	NIE	NIE		90%				-	-	+	-	+
7. LAND	2	NIE	2	NIE	2	95%		99%		99%	+	+	+	+	+
8. DRAIN	NIE	NIE	NIE	3	NIE				NS		+	+	+	+	-
9. POOLIP	3	2	NIE	2	NIE	99%	80%		99%		+	+	+	+	+
Multiple r	.5398	.6884	.5413	.6398	.5134	99%	99%	99%	99%	99%					
Multiple R^2	.2913	.4739	.2930	.4093	.2635										

* Using an F value cutoff point of 1.5.
** Dependent Variable.
NIE Not in Equation.
NS Not significant at the 80 per cent level.
T Total sample.

D Dutch
ND Non-Dutch
E Eastern Ontario
W Western Ontario

developed, based on the number of independent variables included and the manner in which the dependent variable was measured. Models one and three were similar in terms of the number of independent variables considered as were models two and four. In the first and third model, eleven independent variables were considered, while in the second and fourth model, eight were used. Several regional and ethnic groups were run for each of the four models. Herd enlargement was measured in absolute terms in models one and two, while a percentage measurement was used in models three and four:

When a correlation matrix was run for the farm data the results indicated that there were no problems of collinearity among the independent variables. A series of simple hypotheses were developed outlining the expected relationship between the dependent and independent variables. These were then tested using a series of multiple regression models.

The dependent variable was measured in both absolute and percentage terms and different combinations of independent variables were used. In addition the data were grouped by region and by an ethnic factor. The multiple r and R^2 values were highly significant in all cases. Generally the models, in which the dependent variable was measured in absolute terms, explained the greatest amount of variance. The highest level of explanation was achieved in the case of the Eastern Ontario data grouping. Results from the farm

and regional analysis are summarized in chapter seven and presented along with the major findings from the research.

CHAPTER 7

SUMMARY AND CONCLUSION

This chapter presents a summary of the findings with respect to regional and farm level adjustments occurring in the dairy industry of Southern Ontario since 1968. Subsequently, some general conclusions arising from this work along with suggestions regarding future research activities are made. In order to facilitate the summary, tables 7 - 1, 7 - 2, and 7 - 3 have been developed to outline the discussion of farm level variables and to summarize the results from the analysis.

The analysis of regional data shows that over the six year period from June, 1968 to June, 1974, the location of fluid milk producers shifted away from the market orientation evident at the beginning of the period. This adjustment can be attributed to institutional and economic forces operating over this time period. The policies and programmes implemented by the Ontario Milk Marketing Board provided the incentive and opportunity for industrial milk producers to transfer to the fluid milk market. Motive for the upgrading was essentially economic, the attraction of a more remunerative market. At the same time that former industrial milk producers were transferring to the fluid milk market,

TABLE 7 - 1

FACTORS AND VARIABLES USED IN FARM LEVEL ANALYSIS

Factor	Variable Number	Variable	
I	Mechanization and Capitalization in 1968		
	1	BULKT	Presence of a bulk tank in 1968 (Dummy)
II	Herd Management		
	2	GELTET	Gel Test average
III	Social Characteristics		
	3	AGE	Age of farm operator in 1968
	4	DUTCH	Immigrant Dutch Canadian (Dummy)
	5	EDUCAT	Level of education
IV	Economic Characteristics		
	6	MILKH	Size of milking herd in 1968
	7	FARMSZ	Size of farm in 1968
V	Land Resource Base		
	8	PER12	Percentage class 1 and 2 land
VI	Changes in Land Resource Base		
	9	LAND	Purchase or rental of land since 1968
	10	DRAIN	Tile drainage since 1968
VII	Institutional Factor		
	11	POOLIP	Purchases of fluid milk quota since 1968

TABLE 7 - 2

SUMMARY OF MODELS ONE AND THREE *

Total Sample	Eastern Ontario	Western Ontario	Variable
			EMILKH (Dependent Variable)
	+ 3 + 3		BULKT (Dummy Variable)
	+ 4 + 6 **		GELTET
			AGE
+ 5 + 4		+ 3 + 4	DUTCH (Dummy Variable)
	+ 7 - 5		EDUCAT
- 1 - 1	- 1 - 1	- 2 - 1	MILKH
+ 4 + 2	+ 5	+ 5 + 3	FARMSZ
			PER12
+ 3 + 3	+ 6	+ 4 + 2	LAND
	+ 4	+ 6	DRAIN
+ 2 + 5	+ 2 + 2	+ 1	POOLIP
.6568 .6059	.7803 .6785	.6559 .5956	Multiple r
.4314 .3671	.6008 .4604	.4303 .3547	Multiple R^2

* In this summary table the numbers represent the order of entry while the sign indicates the nature of the relationship with the dependent variable. In each cell the upper number applies to model one where the dependent variable was measured in absolute terms while the lower number applies to model three where the dependent variable was measured in percentage terms.

** Not significant at the 80 per cent level.

TABLE 7 - 3

SUMMARY OF MODELS TWO AND FOUR *

Total Sample	Dutch	Non-Dutch	Eastern Ontario	Western Ontario	Variable
					EMILKH (Dependent Variable)
+ 5			+ 3		GELTET
	+ 3	- 5			AGE
	+ 3	- 3			
+ 4			+ 5		EDUCAT
- 1	- 1	- 1	- 1	- 1	MILKP
- 1	- 1	- 1	- 1	- 1	
		- 6 **			PER12
	- 4				
+ 3	+ 4	+ 3	+ 4	+ 2	LAND
+ 2		+ 2		+ 2	
		- 4 **		- 3	DRAIN
			+ 3 **		
+ 2	+ 2	+ 2	+ 2	+ 4	POOLIP
+ 3	+ 2		+ 2		
.5867	.6031	.6666	.7046	.5597	Multiple r
.5398	.6884	.5413	.6398	.5134	
.3442	.3637	.4443	.4964	.3133	Multiple R^2
.2913	.4739	.2930	.4093	.2635	

* In this summary table the numbers represent the order of entry while the sign indicates the nature of the relationship with the dependent variable. In each cell the upper number applies to model two where the dependent variable was measured in absolute terms while the lower number applies to model four where the dependent variable was measured in percentage terms.

** Not significant at the 80 per cent level.

considerable attrition was occurring among the regular fluid milk producers. When the relationship between the attrition rate and county land values were examined, a significant positive association was evident. This serves to emphasize the importance of alternative opportunities in areas of high land values. In addition to the high land values, the high price of Pool I quota in 1970 and 1971 provided an opportunity for regular fluid milk producers to take advantage of windfall capital gains.

The net effect of these economic and institutional factors was to accelerate an adjustment that had been retarded by previous arrangements between milk producers and dairies. This shift in the pattern of fluid milk producers provides an example of accelerated agricultural adjustment brought about by a combination of institutional and economic factors. Land values appear to have played an important role in causing the shift of an intensive agricultural activity to locations more distant from the primary market.

Analysis of the farm level data resulted in a number of conclusions and interpretations relating to each of the independent variables. Discussion of these results will be undertaken within the framework presented in table 7 - 1. Assessment of the first factor involved using a variable that provided an index of the level of mechanization and capitalization in 1968. As noted in table 7 - 2, this

variable entered the model only in the Eastern Ontario data grouping. It was noted that the incidence of bulk tanks was somewhat higher in 1968 among the graduate entrant milk producers in Eastern Ontario. Thus the idea that Eastern Ontario was lagging behind the Western region in acceptance of modern technology may be rejected with respect to the new fluid milk producers. The conclusion drawn from these results is that those graduate entrant milk producers in Eastern Ontario who had bulk tanks in 1968 were undertaking larger herd expansion programmes than their counterparts in Western Ontario. This would be in keeping with the conventional wisdom which maintains that Eastern Ontario has more limited agriculture alternatives.

The second factor evaluated in the models dealt with herd management using gel test averages as an index of herd management. From tables 7 - 2 and 7 - 3 one can note that this variable entered the models in only four of the sixteen runs. In three of the four cases where this variable entered the equation, Eastern Ontario data groupings were involved. Although the overall average gel test was slightly higher in Eastern Ontario, the difference was not significant at the 95 per cent level. The results from the analysis indicate that the herd management variable used in these models served as a useful predictor variable for the Eastern Ontario region. A positive association between dependent and independent variable prevailed in all four cases where the independent

variable entered the equation. The author had expected that this variable would be present in more of the runs. However, the management aspect has traditionally presented other researchers with problems. Thus the presence of this variable at a significant level in the Eastern Ontario runs indicates some measure of success in dealing with the problem.

Social characteristics of the farm operators comprised the third factor considered in the models. Three variables were included under this factor: age of the farm operator in 1968, an ethnic classification, and the educational level of the graduate entrant milk producer.

The age variable was considered in all four models, but appeared to have statistical significance at the 80 per cent level only when the ethnic groupings were run. As indicated in table 7 - 2, the relationship with the dependent variable was not consistent. The author had expected a negative association in all cases. The anticipated relationship was only evident with the non-Dutch grouping and appeared when both an absolute and percentage measurement of the dependent variable was employed. One possible explanation for the unexpected relationship may be suggested. Since the immigrant Dutch milk producers have had to establish themselves in the dairy business, it may be that the efforts of the younger producers were directed towards land acquisition and building improvements. Consequently, herd expansion might be expected to occur at a later age. Thus, the positive

association between herd enlargement and age among the Dutch Canadians may result. These results are contrary to the findings of previous studies where age was used as an independent variable. However, none of these studies used an ethnic factor.

The Dutch variable was assessed in models one and three as a dummy variable. It was positively associated with herd enlargement as might be expected from the review of literature. As noted in table 7 - 2, this variable entered the models when the total sample and the Western Ontario groupings were used. One possible interpretation for this may be that in Western Ontario where alternative opportunities are available the Dutch showed their preference for dairying through herd expansion behaviour. On the other hand, in Eastern Ontario, where alternative opportunities are limited, herd expansion was not associated with any particular ethnic group. The appearance of the Dutch variable in the total sample runs may have resulted from the fact that approximately 65 per cent of that sample consisted of producers from Western Ontario.

The educational variable was assessed in all four models, but entered the equation in only four cases. In three of these cases, the association with the dependent variable was positive as expected. The difference in relationship indicated by the sign difference in the Eastern Ontario runs of models one and three does suggest some instability of sign.

However, this was the only case in the various data groupings for the four models where there was such a difference.

Assessment of the importance of the economic factor was made through the use of two variables: milking herd size in 1968 and farm size in 1968. Milking herd size in 1968 was evaluated in all four models and entered the equation as the first independent variable in every case but one. From the review of previous literature where this variable was used, it was found to be a significant independent variable. In this study, the sign was quite stable throughout and negative in all cases. This in effect means that the smallest herds in 1968 were showing the greatest herd enlargement. This is in contrast to the findings of Conneman where a positive relationship was noted between increases in milk production and herd size. This would indicate that the smaller herds in 1968 were experiencing the greatest cost-price pressures. Under these conditions, it is not surprising that these producers increased the size of their operation. At the same time, there appeared to be an upper size limit beyond which producers would not readily exceed due to resource limitations. The resource restraints might include such factors as labour, land, capital, and managerial ability. One of the key resource limitations appeared to be that of the lack of reliable full time labour.

The second economic variable, farm size in 1968, was assessed in models one and three. This particular variable

entered the model in five out of a possible six cases and was positively associated with herd enlargement. This is quite in line with prior expectations and is supported from the results of previous studies.

Land quality comprised the fifth factor with one variable being used to provide a measure of land quality. The percentage of classes 1 and 2 land for the township in which the farm was located was used in this study. As previously indicated considerable reservation was expressed in the use of this measurement of land quality. These reservations arise from the fact that there could be considerable variation between the values for individual farms and the township average. This is particularly true in Eastern Ontario where areas of high land capability appear in pockets. Nevertheless, it was felt that this factor should still be assessed using the available data. The land quality factor was assessed in all four models, but entered the equation in only two cases. In one of these cases, the variable was not statistically significant at the 80 per cent level. The relationship with the dependent variable was negative in the two cases where the variable entered the equation, which was in line with the relationship hypothesized. This in turn gives rise to the suggestion that perhaps dairying has greater future potential on a lower quality land base.

Changes in the land resource base constituted the sixth factor. Two variables were employed: one measuring

additions to the land resource base since 1968, and a second one providing a measurement of intensification. Inclusion of these two variables was made with a view to assessing whether herd expansion was occurring in conjunction with expansion of the land base or through intensification or upgrading of the acreage occupied in 1968.

When additions to the land resource base were evaluated, it entered the equation in thirteen out of sixteen possible cases. It was positively associated with herd enlargement in all cases. The conclusion drawn from these results is that a causal relationship may exist between herd expansion and acquisition of additional land. Thus lack of available land resources could serve as a constraint to future herd enlargement plans.

The drainage variable was assessed in all four models. It entered the equation in five out of a possible sixteen cases, but was not significant in two of these cases. The results with respect to sign were inconclusive for in three cases a positive relationship was indicated with a negative association occurring in the remaining two cases.

The conclusion reached with respect to this variable was that upgrading of land resources through tile drainage does not play as important a role in herd enlargement as does additions to the land resource base. While the incidence of tile drainage improvement was much higher in Western Ontario, it does not appear to be translated into herd enlargement.

It may well be that these improved land resources were being used to increase production of cash crops in Western Ontario.

The final factor examined in the farm level analysis was an institutional variable, the purchase of fluid milk quota since 1968. When the purchase of Pool I quota was evaluated it was positively related to herd expansion and evident in thirteen of the sixteen possible cases. This was not entirely unexpected for quota purchases provide milk producers with another means of increasing income from the dairy operation. The conclusion arising from these results is that the institutional factor, as represented by Marketing Board, had a major impact on herd enlargement behaviour over the 1968 to 1973 period.

At this point more general conclusions, based on the regional and farm level adjustments, will be discussed. In addition the direction of future research efforts will be indicated. Based on differentials in attrition rates and Ontario Milk Marketing Board policy, fluid milk production will become a more important component of the dairy industry in Ontario in the future. However, the new fluid milk producers will not display the market orientation in location that was so evident in the past. Rather, the newly emerging concentration of producers will be located at some distance from the market, thereby adding to the total transportation costs facing the industry. Structural changes in the producing segment of the industry will continue, resulting in

ever larger milking herds in the future. In the current climate of competing land-use pressures, research attention should be directed into the type and location of land resources needed to sustain a viable dairy industry in the years ahead.

From the farm level analysis of graduate entrant milk producers, it would appear that there is no marked or sudden shift to the large factory-type dairy operations found in Southern California. Several factors may account for this. Limitation of resources, whether it be land, labour, capital or managerial ability, provides part of the answer. Two additional factors also deserve mention. The first is a cultural factor represented by the "family farm" concept which is very much a part of the dairy industry in Southern Ontario. Some major modifications would be necessary in this system should such operations be viewed as a desirable alternative to the family farm. The second factor is the adverse climatic conditions which would mean considerable additional capital costs.

Nevertheless, as new technology is adopted and efficiency improves, there will be a gradual move towards larger milking herds. This was evident among the graduate entrant milk producers interviewed with some 72.5 per cent of these producers undertaking herd expansion since 1968. This trend can be expected to be most evident among the graduate entrant milk producers for this group of producers has already made

a future commitment to the dairy industry. Future research on structural adjustments in the dairy industry should focus on the problem of rate of structural adjustment among various categories of milk producers. Results from such work would have direct application in determining future resource requirements for dairy farms and in making projections on herd size and structure.

Throughout the analysis the economic variables consistently accounted for the greatest variation in the dependent variable. This was not unexpected for previous work had indicated that milking herd size was an important predictor variable in the models. Thus the importance of this factor can be taken as given. However, in the Eastern Ontario case, it was the inclusion of variables measuring such aspects as management, mechanization, education, land quality, drainage improvement, and quota purchasing behaviour, which provided the high level of prediction. The general conclusion reached from this study is that these other factors are of considerable significance and must be taken into account in future work along these lines.

The variation in results based on regional data groupings suggests that this regional dimension is of considerable importance in the dairy industry of Southern Ontario. Furthermore, it may be that a somewhat different set of independent variables should be used for Western Ontario. In the Western Ontario case emphasis should probably be on the role of the

alternative cash cropping opportunities that dairy producers in this region have open to them. By including such variables, the competitive position of the dairy enterprise and the relationship between prices of grain corn and dairy herd expansion may be gained. One of the conclusions reached from this study is that the models developed are probably most appropriately applied to regions where the dairy enterprise does not have any major agricultural alternatives.

Improvements in the results from this study could probably be attained by further refinement in the measurement of some of the variables. This is particularly true with respect to the land quality variable. Some improvement in the results may be expected if individual farm ratings of land capability were used rather than the current township averages.[1] In the future it may also be possible to work with detailed records of annual milk production, making for very accurate measurement of changes in milk production. This would raise the possibility of changing the dependent variable from herd expansion to changes in milk production.

In addition to refinement in measurement of variable, future research should consider the possibility of expanding the number of independent variables. Among the additions

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[1] Attempts were made to obtain individual farm data on land quality from the Agricultural Assessment Branch. While this data is currently being collected, it will not be readily accessible for another six to twelve months.

that might be considered are such variables as: son over 14 interested in farming, enjoyment of dairying, attitudes towards credit, life style aspirations, and availability of farm labour, (both family and non-family). These additions along with a refinement in measurement of the variables currently used could contribute significantly to reducing the error term.

Among the independent variables evaluated in this study one is deserving of special comment. This is the important role that immigrant Dutch Canadians have played among the graduate entrant milk producers over the 1968 to 1973 period. These findings are consistent with observations in the literature with respect to this group in the dairy industry in other areas. The positive association found between herd enlargement and immigrant Dutch Canadians indicates that these producers could be playing an even more important role in the dairy industry of Ontario in the future.[1] A number of considerations appear to be playing a role in this case: (1) these milk producers have an unusually strong commitment to the dairy industry and are very much dependent on milk sales for their farm income; (2) in many cases they have considerable family labour available

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[1]This depends to some extent on whether the first generation has the same commitment to the dairy industry as their parents had.

which is especially important in the expansion of the dairy enterprise; (3) there is a willingness to work hard and undertake the risks involved in expanding the dairy operation; (4) in a number of cases these dairymen have had several years of agricultural schooling in the Netherlands which has given them a good background for decision-making with respect to the dairy business; and (5) there is a cohesiveness among the immigrant Dutch Canadians which facilitates dissemination of information about problems and new developments in the industry.

This study has been typical of many research efforts in that it has raised more questions than it has answered. However, it has laid the basis for additional work on the recent spatial and structural adjustments in the dairy industry of Southern Ontario. Through further research in this area, it should be possible to improve the predictive aspect of the models and to move towards a more general theory of agricultural adjustment.

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APPENDIX I

QUESTIONNAIRE

CONFIDENTIAL QUESTIONNAIRE NO. _____

SURVEY OF GRADUATE ENTRANT
POOL I MILK PRODUCERS

Name:
Mailing Address:
County: Township:
Lot: Concession:

1. FARM SIZE AND LAND USE
   How many acres do you farm? _____ Owned _____ Rented _____
   How many acres did you have in crop this year? _____
   Pasture _____ Woodlot _____ Corn _____ Other _____

2. HERD SIZE AND PRODUCTION
   How many milking cows are you keeping? _____ Breed _____
   How many cattle do you keep? _____
   How many cattle did you sell last year? _____
   What was your average herd production last year? _____

3. YEARS OF FARMING
   How many years have you been operating a dairy farm on your own? _____

4. SOURCES OF INCOME
   What percentage of your total farm income is received from the sale of milk (Pool I and Pool II)? _____
   What other farm enterprises contribute to your farm income? _____

5. AGE AND EDUCATION
   What is your present age? _____
   What was the last grade you completed? _____
   How many years of further education in technical or agricultural college or university did you take? _____
   Have you taken any short courses or extension courses?
   Yes No

6. NATIONAL ORIGIN AND FAMILY SIZE
   What is your national origin? (Grandfather) _____
   How many children do you have? __ Boy(s) __ Girl(s) ___
   Are the boys interested in farming? Yes No

7. MEMBERSHIP IN FARM ORGANIZATIONS
   Do you have membership in the following organizations?
   _____ Ontario Federation of Agriculture
   _____ Ontario Soil and Crop Improvement Association
   _____ Breed Association (Holstein, Jersey, Guernsey, Ayrshire)
   _____ Milk Committee
   _____ Others (Specify) _____

8. FARM ORGANIZATION
   Are you presently in partnership? Yes No.
   Do you plan to enter into partnership in the near future? (Two years) Yes No

9. YEAR OF POOL I ENTRY
   When did you become a Pool I (fluid) milk producer?
   _____

10. YEAR OE BULK TANK PURCHASE
    When did you purchase your bulk tank? _____ Size _____
    Why did you purchase a bulk tank? _____
    _____

11. FARM PRACTICES AND EQUIPMENT
    Which of the following practices or equipment do you presently use on your farm?

D.H.I.A. or R.O.P.	Yes	No	Pipeline milker	Yes	No
Farm account books	Yes	No	Soil testing	Yes	No
Teat Dipping	Yes	No	Protein testing of feed	Yes	No
Free stall barn	Yes	No	Both A.I.	Yes	No
Does the A.I. Technician do the mating for you?				Yes	No
Dry cow mastitis treatment				Yes	No

12. RECENT FARM CHANGES
    Which of the following changes have you made in the last five years?

a) Land purchase	Yes	No	Acres _____
b) Land rental	Yes	No	Acres _____
c) Tile drainage	Yes	No	Acres _____
d) Herd increase	Yes	No	Number _____
e) Building additions	Yes	No	Type _____
f) Crop changes	Yes	No	Type _____
g) Feeding changes	Yes	No	Type _____

    Were these changes made in preparation for Pool I entry? Yes No If YES indicate which ones, i.e. a) b) c) d) e) f) g)

13. FUTURE CHANGES
    What changes are you planning over the next two years?
    _____
    How far ahead do you plan a major farm change such as building a silo, tile drainage, etc? _____

14. CONSIDERATIONS FOR BECOMING A POOL I PRODUCER
    What considerations influenced your decision to become a Pool I milk producer? _____
    Why did you become a Pool I producer WHEN you did? _____
    _____
    Who influenced you most in making the decision to become a Pool I producer? _____

15. MAJOR PROBLEM AS A POOL I PRODUCER
What is the major problem you have encountered as a result of becoming a Pool I milk producer? _____

16. BREEDING CYCLE CHANGES
Has your calving cycle changed since becoming a Pool I producer? Yes No If YES how has it changed? _____

17. SOURCES OF DAIRY FARM INFORMATION
Who do you consult when you are planning a major farm change such as quota purchase, herd expansion, etc.?

What reading material do you depend on to keep you informed on the dairy business? _____

18. POOL I PRODUCTION GOALS
What is your current Pool I quota? _____
Have you purchased Pool I quota? Yes No
If YES how much? _____
Why did you purchase Pool I quota? _____

Do you plan to purchase Pool I quota in the future?
Yes No
What Pool I quota size are you planning for? _____

How did you arrive at this goal? _____

19. POOL II PRODUCTION GOALS
What is your current M.S.Q.? _____ S.E.Q.? _____
Have you acquired any M.S.Q. in the last two years?
Yes No If YES how much? _____
Have you purchased any S.E.Q. in the last two years?
Yes No If YES how much? _____ Why did you purchase S.E.Q.? _____

What Pool II quota size are you planning for? _____

How did you arrive at this goal? _____

COMMENTS:

APPENDIX II

REGIONAL DATA

Number of Fluid Milk Producers June, 1968.

Number of Fluid Milk Producers June, 1974.

Number of Graduate Entrants 1968 to 1973.

Attrition Among Regular Fluid Milk Producers June 1968 - June 1974.

Estimated Number of Industrial Milk Producers June, 1968.

Number of Industrial Milk Producers June, 1974.

Percentage Urban Population 1966 and 1971.

REGIONAL DATA

NUMBER OF FLUID MILK PRODUCERS JUNE, 1968

	Absolute Number	Percentage of Total
Brant	182	2.66
Bruce	67	.98
Carleton	320	4.68
Dufferin	62	.91
Dundas	20	.29
Durham	167	2.44
Elgin	135	1.97
Essex	324	4.74
Frontenac	94	1.37
Glengarry	31	.45
Grenville	30	.44
Grey	72	1.05
Haldimand	323	4.72
Halton	204	2.98
Hastings	92	1.34
Huron	95	1.39
Kent	54	.79
Lambton	117	1.71
Lanark	41	.60
Leeds	54	.79
Lennox-Addington	62	.91
Middlesex	264	3.86
Niagara North	261	3.81
Niagara South	183	2.67
Norfolk	114	1.67
Northumberland	146	2.13
Ontario	346	5.06
Oxford	429	6.27
Peel	263	3.84
Perth	177	2.59
Peterborough	155	2.26
Prescott	19	.28
Prince Edward	56	.82
Renfrew	114	1.67
Russell	158	2.31
Simcoe	340	4.97
Stormont	32	.47
Victoria	117	1.71
Waterloo	250	3.65
Wellington	237	3.46
Wentworth	287	4.19
York	348	5.09
Total:	6842	
Average:	162.90	2.38
Standard Deviation:	111.85	1.63
Variance:	12510.33	2.67

REGIONAL DATA

NUMBER OF FLUID MILK PRODUCERS JUNE, 1974

	Absolute Number	Percentage of Total
Brant	148	1.92
Bruce	188	2.44
Carleton	283	3.67
Dufferin	73	.95
Dundas	231	3.00
Durham	129	1.67
Elgin	162	2.10
Essex	145	1.88
Frontenac	129	1.67
Glengarry	119	1.54
Grenville	86	1.12
Grey	128	1.66
Haldimand	280	3.63
Halton	106	1.37
Hastings	164	2.13
Huron	260	3.37
Kent	35	.45
Lambton	153	1.98
Lanark	83	1.08
Leeds	156	2.02
Lennox-Addington	105	1.36
Middlesex	351	4.55
Niagara North	173	2.24
Niagara South	105	1.36
Norfolk	75	.97
Northumberland	186	2.41
Ontario	229	2.97
Oxford	596	7.73
Peel	164	2.13
Perth	443	5.74
Peterborough	144	1.87
Prescott	139	1.80
Prince Edward	110	1.43
Renfrew	139	1.80
Russell	199	2.58
Simcoe	283	3.67
Stormont	124	1.61
Victoria	103	1.34
Waterloo	250	3.24
Wellington	357	4.63
Wentworth	194	2.52
York	185	2.40
Total:	7712	
Average:	183.62	2.38
Standard Deviation:	106.34	1.38
Variance	11307.46	1.90

REGIONAL DATA

NUMBER OF GRADUATE ENTRANTS 1968 TO 1973

	Absolute Number	Percentage of Total
Brant	26	.78
Bruce	148	4.43
Carleton	88	2.63
Dufferin	25	.75
Dundas	224	6.70
Durham	12	.36
Elgin	60	1.79
Essex	00	0.00
Frontenac	63	1.88
Glengarry	104	3.11
Grenville	73	2.18
Grey	84	2.51
Haldimand	55	1.65
Halton	8	.24
Hastings	116	3.47
Huron	206	6.16
Kent	1	.03
Lambton	74	2.21
Lanark	56	1.68
Leeds	121	3.62
Lennox-Addington	70	2.09
Middlesex	164	4.91
Niagara North	7	.21
Niagara South	3	.09
Norfolk	10	.30
Northumberland	87	2.60
Ontario	25	.75
Oxford	252	7.54
Peel	5	.15
Perth	296	8.85
Peterborough	41	1.23
Prescott	124	3.71
Prince Edward	80	2.39
Renfrew	58	1.73
Russell	99	2.96
Simcoe	66	1.97
Stormont	113	3.38
Victoria	11	.33
Waterloo	87	2.60
Wellington	178	5.32
Wentworth	18	.54
York	5	.15
Total:	3343	
Average:	79.60	2.38
Standard Deviation:	72.07	2.16
Variance:	5193.91	4.65

REGIONAL DATA

ATTRITION AMONG REGULAR* FLUID MILK PRODUCERS
JUNE 1968 - JUNE 1974

	Absolute Number	Percentage of Total
Brant	60	2.43
Bruce	27	1.09
Carleton	125	5.06
Dufferin	13	.53
Dundas	13	.53
Durham	50	2.03
Elgin	33	1.34
Essex	179	7.25
Frontenac	24	.97
Glengarry	16	.65
Grenville	17	.69
Grey	28	1.13
Haldimand	98	3.97
Halton	106	4.29
Hastings	44	1.78
Huron	41	1.66
Kent	20	.81
Lambton	38	1.54
Lanark	14	.57
Leeds	19	.77
Lennox-Addington	27	1.09
Middlesex	77	3.12
Niagara North	95	3.85
Niagara South	81	3.28
Norfolk	49	1.99
Northumberland	47	1.90
Ontario	142	5.75
Oxford	85	3.44
Peel	104	4.21
Perth	30	1.22
Peterborough	52	2.11
Prescott	4	.16
Prince Edward	26	1.05
Renfrew	33	1.34
Russell	58	2.35
Simcoe	123	4.98
Stormont	21	.85
Victoria	25	1.01
Waterloo	87	3.53
Wellington	58	2.35
Wentworth	111	4.50
York	168	6.81
Total:	2468	
Average:	58.76	2.38
Standard Deviation:	44.49	1.80
Variance:	1979.06	3.25

* Excludes Graduate Entrant Producers

REGIONAL DATA

ESTIMATED NUMBER OF INDUSTRIAL MILK PRODUCERS JUNE, 1968

	Absolute Number	Percentage of Total
Brant	167	.99
Bruce	789	4.70
Carleton	469	2.79
Dufferin	90	.54
Dundas	944	5.62
Durham	17	.10
Elgin	265	1.58
Essex	00	0.00
Frontenac	429	2.55
Glengarry	719	4.28
Grenville	377	2.24
Grey	541	3.22
Haldimand	282	1.68
Halton	26	.15
Hastings	643	3.83
Huron	1098	6.54
Kent	00	0.00
Lambton	167	.99
Lanark	422	2.51
Leeds	902	5.37
Lennox-Addington	533	3.17
Middlesex	556	3.31
Niagara North	33	.20
Niagara South	14	.08
Norfolk	111	.66
Northumberland	437	2.60
Ontario	14	.08
Oxford	1048	6.24
Peel	7	.04
Perth	1385	8.25
Peterborough	58	.35
Prescott	967	5.76
Prince Edward	475	2.83
Renfrew	252	1.50
Russell	766	4.56
Simcoe	91	.54
Stormont	699	4.16
Victoria	3	.02
Waterloo	363	2.16
Wellington	513	3.05
Wentworth	117	.70
York	8	.05
Total:	16797	
Average	419.93	2.50
Standard Deviation:	364.30	2.17
Variance:	132712.23	4.71

NUMBER OF INDUSTRIAL MILK PRODUCERS JUNE, 1974

	Absolute Number	Percentage of Total
Brant	74	.92
Bruce	432	5.36
Carleton	193	2.40
Dufferin	60	.74
Dundas	401	4.98
Durham	8	.10
Elgin	122	1.51
Essex	00	0.00
Frontenac	189	2.35
Glengarry	336	4.17
Grenville	156	1.94
Grey	338	4.20
Haldimand	114	1.42
Halton	9	.11
Hastings	323	4.01
Huron	556	6.90
Kent	00	0.00
Lambton	78	.97
Lanark	230	2.86
Leeds	446	5.54
Lennox-Addington	206	2.56
Middlesex	251	3.12
Niagara North	30	.37
Niagara South	15	.19
Norfolk	64	.79
Northumberland	195	2.42
Ontario	30	.37
Oxford	511	6.34
Peel	5	.06
Perth	695	8.63
Peterborough	29	.36
Prescott	451	5.60
Prince Edward	206	2.56
Renfrew	129	1.60
Russell	308	3.82
Simcoe	59	.73
Stormont	318	3.95
Victoria	19	.24
Waterloo	166	2.06
Wellington	258	3.20
Wentworth	36	.45
York	10	.12
Total:	8056	
Average:	201.40	2.50
Standard Deviation:	176.16	2.19
Variance:	31032.76	4.78

REGIONAL DATA

PERCENTAGE URBAN POPULATION 1966 AND 1971

	1966	1971
Brant	76.45	76.89
Bruce	36.76	37.09
Carleton	92.27	90.89
Dufferin	40.58	46.53
Dundas	33.83	34.97
Durham	49.31	44.31
Elgin	48.56	51.25
Essex	82.68	80.47
Frontenac	73.65	72.38
Glengarry	15.75	17.53
Grenville	39.72	38.84
Grey	49.48	50.46
Haldimand	37.73	37.14
Halton	93.37	93.83
Hastings	67.89	67.54
Huron	41.08	37.00
Kent	59.59	60.16
Lambton	69.40	69.76
Lanark	57.77	62.70
Leeds	51.91	52.00
Lennox-Addington	26.38	30.99
Middlesex	83.92	85.22
Niagara North	80.27	96.41
Niagara South	83.75	96.41
Norfolk	37.63	37.89
Northumberland	45.02	42.83
Ontario	81.75	81.46
Oxford	55.56	55.85
Peel	86.77	92.00
Perth	59.31	59.67
Peterborough	75.51	74.47
Prescott	49.03	48.88
Prince Edward	29.63	23.62
Renfrew	61.21	61.89
Russell	27.91	39.53
Simcoe	61.07	60.88
Stormont	76.85	76.86
Victoria	47.69	46.38
Waterloo	86.25	87.70
Wellington	70.16	70.88
Wentworth	90.50	89.65
York	97.79	98.61

APPENDIX III

RANKING OF ATTRITION RATES AND LAND VALUES

RANKING OF ATTRITION RATES AND LAND VALUES

	Attrition Rank *	Land Value Rank **
Brant	15	5
Bruce	29	31
Carleton	4	22
Dufferin	40.5	21
Dundas	40.5	29
Durham	19	14
Elgin	25	20
Essex	1	8
Frontenac	33	32
Glengarry	38	36
Grenville	37	38
Grey	28	27
Haldimand	9	16
Halton	7	4
Hastings	22	41
Huron	23	28
Kent	35	11
Lambton	24	23
Lanark	39	40
Leeds	36	34
Lennox-Addington	29	33
Middlesex	14	19
Niagara North	10	3
Niagara South	13	7
Norfolk	20	6
Northumberland	21	18
Ontario	3	15
Oxford	12	12
Peel	8	1
Perth	27	24
Peterborough	18	30
Prescott	42	37
Prince Edward	26	31
Renfrew	25	42
Russell	16	35
Simcoe	5	13
Stormont	34	39
Victoria	32	25
Waterloo	11	9
Wellington	16	17
Wentworth	6	10
York	2	2

* Based on period June 1968 to June 1974.

** Data Source: Rural Real Estate Values in Southern Ontario, 1971. Ontario Ministry of Agriculture and Food, 1974.