THE RETAILING STRUCTURE OF CANADIAN METROPOLITAN AREAS: A COMPARISON OF CENTRAL PLACE STRUCTURE VERSUS SOCIO-ECONOMIC STRUCTURE AS PREDICTORS OF INTER-METROPOLITAN AREA VARIATIONS IN RETAILING PATTERNS

by

Peter Harrison
B.A., Hon., University of London, 1969

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in the Department

of

Geography

Accepted for the Faculty of Graduate Studies

[redacted]

Dean pro tem

27 October, 1970

We accept this thesis as conforming
to the required standard

[redacted]

University of Victoria

May 1970

Supervisor: Dr. D.R. Lycan

ABSTRACT

The retail sales of twenty-five types of establishment in the forty-five metropolitan areas defined by the 1961 Census are subjected to a principle components analysis to derive a set of independent factors representative of the retail structure of these areas. A similar components analysis is applied to twenty-eight socio-economic variables, chosen on the basis of previous studies, to produce a set of independent socio-economic factors for the same metro areas. On the basis of the factor scores resulting from these analyses, the distinctive regional variations in Canadian metro area retail structure and socio-economic structure are discussed.

In order to test the hypothesis that the retail structure of a metro area can be predicted more accurately by the socio-economic structure of the area than by its size and location as defined by central place theory, six variables traditionally used in the analysis of central place systems are chosen. A principle components analysis of these variables yields a set of independent factors and factor scores. By regressing the retail structure factor scores against the central place and socio-economic factor scores in turn, the hypothesis is shown to be substantiated. On the basis of this analysis the conclusion is drawn that the socio-economic structure of a metro area is a more effective predictor of retail structure than is its size or place in the national hierarchy.

Examiners: [redacted]

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

The author would like to express his appreciation and his thanks to the people who were instrumental in the preparation of this thesis. The help, criticism, and suggestions forwarded by my supervisor Dr. D.R. Lycan and the members of my committee, Dr. W.R.D. Sewell and Dr. G.R. Walter, provided the basis for the development of this study. Without the constant support and advice of these committee members little would have been achieved.

Special thanks are extended to Mr. J. Bryant for advice given concerning illustrative materials, to Mr. Ian Norie for his time spent in preparing the photographic work in the thesis, and to Mr. J. Heisterman who executed much of the cartographic work.

I am grateful to Miss Susan Langley for help in preparing tables, and to Mrs. Lynn Stewart for typing the text of the thesis.

Mention should also be made of the criticism and help given by fellow graduate students, and of their great longanimity.

CHAPTER ONE

INTRODUCTION

The role of the Western city has been centred in trade and commerce both between the residents of the city and between residents and outsiders. This activity is conceivably conditioned by the life-style of both. The activity of an individual person may to a large degree be random, but the activities of groups of individuals combine to create decipherable forms of activity.

This thesis is an attempt to analyse the 'super-ego' - the city, to find whether or not the retailing activity of the city is related to the life-style of its inhabitants. The use of Canadian metro areas as a case study reveals similarities in the city-organism across Canada; it also highlights the difficulties involved in comparing such vast and complex networks of activity on a nation-wide basis.

1. The Study of Urban Systems.

The way in which the economies of cities in a particular country are constituted, has been the subject of many 'ad hoc' studies by geographers. The work of Harris[1] and Nelson[2] on United States cities, and the study by Pownall[3] on the functions of New Zealand towns, represent an important early contribution to the methods of analysis used in urban geography: they impose taxonomies by means of which cities can be classified according to their industrial and retail formation.

The process of classification is a necessary step in the development of theory.[4] If a set of classifications results in a group of hypotheses forming a theory which is capable of being tested, then the end of a classificatory study justifies the means it uses. Work done on classifying city systems has so far yielded little of theoretical value[5]; but in the absence of a general equilibrium theory of urban functioning[6], such studies constitute one of the major contributions of urban geographers to the analysis of urban systems.

Another major thrust of geographic research has been the attempt to apply the classical 'central place theory' of Christaller[7] and Lösch[8] to the 'real world' situation[9], dropping some of the simplifying assumptions used by these two authors. The size, location, spacing, and function of centres is treated as a system of points ordered in a spatial hierarchy, and it is with the external relationships of these points (the centres) that the theory deals.[10] The postulates forwarded by central place theory relate size, function, and the hierarchical level of a centre to each other and to the same characteristics of all other centres within the hierarchical system. Central place theory therefore initially results in a taxonomy of centres. In an attempt to show the linkages within the system of central places, the number and variety of retail establishments have been the indices most used as surrogates, both for the external linkages of a centre as well as its internal 'composition'.[11]

2. The Behavioural Approach to Retail Marketing.

'Marketing theory' and, more specifically 'marketing geography' (which attempts to include a more explicit spatial element in its analysis than does marketing theory) represent an attempt to look at one aspect of the internal functioning of cities by examining the distributive process of the retailing sector.[12] Based on research findings in the fields of economics, psychology, sociology, and location theory[13], marketing theory attempts to relate the method and level of product distribution both to consumer behaviour and to the spatial positioning of retail establishments within the city.[14] However, the work of Applebaum and Cohen in attempting to develop a theory of store location and consumer activity[15] has been criticised by Hamill as unnecessary because he considers the market potential of different store locations to be entirely unique.[16] Necessary or not, the movement toward a theoretical base in this field has concentrated on the influence and importance of the individual store or individual shopping centre, and gives few guidelines as to the way in which entire city systems work. The theories on which marketing theory and marketing geography are based (i.e. psychological theory, economic theory, etc.) provide a general frame of reference for understanding commercial functions in the city. In a similar manner both marketing theory and marketing geography suggest the broad aspects of consumer behaviour involved in the analysis of a spatial system of central places.

The bridge between behavioural patterns (marketing theory) and city system structure (central place theory) has not yet been made.[17] The aim of this study, however, is to use the conclusions which marketing theorists derive from the observation of consumer behaviour in a cross-Canada analysis of metro areas.

3. The Retailing Structure of Urban Systems.

The modern city of the Western world functions as the major point of contact between consumer and producer. Central place theory suggests that the variety of goods offered to the consumer is related to the size of a particular city, and that the number of retail establishments providing these services is also related to the size of the city.[18] Some marketing theorists, however, reason that the way in which an individual spends his dollar is more a function of his own whim, desires, or needs, than of the size of the place in which he resides.[19]

Within a particular nation there is a great range in the size of metro areas, and between the various metro areas there are substantial differences in patterns of consumer expenditure. Assuming that in a given year the sales of all stores in all metro areas can be found, then spatially differing patterns of consumer activity are suggested by the varying composition of retail sales in the various metro areas.

In an attempt to combine this one aspect of aggregate consumer behaviour with city retail structure, the following definition of metro area retail structure (or composition) is proposed:

'the proportion of annual sales
which occurs in each category of
retail establishment'.

Thus, presuming that a set of retail categories (such as the Census categories) is decided upon, the retail structure of a place is taken as being the percentage distribution of sales between these categories. The way in which the term 'structure' is used throughout this study refers to the way in which centres are composed of different types of retail activity and is not meant to convey any idea of linkages between the activities in the form of the movement of persons, goods, or information.

The use of such a definition of retail structure instead of the gross number of establishments in a centre (central place theory) avoids the necessity of assuming that each outlet is the same as every other in size and importance, and that all are maximising profits. A level of store use is suggested by this index rather than a level of store provision in a centre.

The ideal would be to have a data set which expresses the 'value-added' or the value of the service performed by retail establishments. Such a value would take into account the costs of retailing in terms of inventory expenditure, store rent, employees salaries, profits, etc. ... and viewed from a different aspect would also reflect the level of mark-up which the particular type of store placed on its goods. The most available statistics which come anywhere near providing a value-added-like set of data are

the Census returns for the number of persons employed in retailing establishments. The employment statistics for retail establishments published by the Canadian Census are a sample taken during one month of the census year. No allowances can therefore be made for the great fluctuation in the numbers of sales-staff employed at different seasons. In addition, the data do not differentiate between stores which use self-service techniques and therefore minimise the number of sales-staff they employ.

4. Canadian Urban Systems.

The structure of the Canadian urban system, whether it be the industrial, retail, or social structure, has been studied only to a limited extent. The assumption that Canadian metro areas parallel those of the United States is easy to make, but such an asssumption discounts the differences between the two countries on both economic and social levels. Admittedly the industrial linkages of Southern Ontario, for example, may be more with the American Mid-West than the Prairie Provinces,[20] but the fact remains that there is a Canadian system of central places which may be similar to, but is disjunct from, the United States system of central places.

Maxwell[21] has studied the 'functioning' of Canadian cities based on the percentage distribution of employment between types of industry. By using 'indexes of specialisation' based on these employment patterns, he has also proposed a classificatory system of Canadian cities. The division of Canada he proposes differentiates

between the Western periphery, Northern periphery, Eastern periphery and Heartland of the nation.[22] Similar in kind to the work of Nelson and Pownall, Maxwell's study relates only incidentally to economic theory or central place theory.[23]

A study undertaken by King[24] attempts to outline basic 'dimensions' of the socio-economic structure of Canadian cities. By using 'principle components analysis' he isolates the underlying structure of a group of variables representative of inter-metropolitan city structure. These dimensions are then grouped into several classes, and the movement of cities between classes in the inter-censal period of 1951-1961 is compared. In his rationale for undertaking the study, King suggests that it will be a basis for future theoretical development, and will provide 'empirical findings on Canadian urban structure to this end.'[25] The developments of theory based on these findings have yet to be formulated: until such time, King's study remains a set of empirical findings. In terms of the present study the fact that King includes central place, socio-economic, and retail sales variables in the same components analysis precludes the use of his results in the cross-comparison of these three types of variables. It is for this reason that a separate socio-economic analysis (Chapter Four) is presented in this study.

In a paper using similar statistical methods (i.e. factor analysis, a form of principle components analysis) Ray[26] analyses the 'factorial ecology' of Canada in order to outline 'heartland-

hinterland' relationships between urban centres and their field of influence, and the way in which these vary with cultural and economic differences. 'Distance decay'[27] and its relation to such characteristics and dimensions is suggested as being one of the most important 'spatial patterns' at work in Canada. Although dealing with the two hundred and twenty-nine Census Counties of the whole Dominion, Ray's analysis concentrated on the metropolitan and major urban areas.

A previous study by Hodge[28] goes further than Ray's analysis and attempts to relate urban structure to regional development in selected areas of Saskatchewan, Eastern Ontario, Prince Edward Island, and Nova Scotia. His method of analysis is the same as that of Ray (factor analysis) in attempting to find 'patterns of structures and dimensions' underlying his data. Hodge concludes that there are still important elaborations of structural analyses which have yet to be made. He suggests that different types of regional and urban structure (such as economic and social structure) can profitably be compared in order to find any relationships which may exist between them.[29]

This study is an attempt to compare different aspects of urban structure in the manner suggested by Hodge: the retailing structure of the metro areas in Canada is compared in turn with the central place and socio-economic structure of these areas. The statistical methods used are the same as those employed by Ray, King and Hodge in the studies quoted in the above paragraphs. The choice of variables used and the manner of their use in this

study differ from the work of Ray, King, and Hodge as the following Chapters point out.

5. Purpose and Organisation of the Thesis.

This thesis isolates the retail sector of the forty-five metro areas defined in the 1961 Census[30] as one of the most important functions of these areas. The specific definition of retail structure as the proportion of a metro area's annual retail sales in a particular category of retail establishment (p. 5) is taken as the basis for all further discussion of retail structure. An attempt is then made to compare the variation of retail structure between the metro areas with the variation in selected central place factors. Following this analysis, the importance of central place factors is compared with the degree of relationships between retail structure, and socio-economic factors. As discussed previously (p. 5) the division of total dollar sales between a set of establishment categories in a particular metro area is probably not simply a function of gross size of the centre, but also of more complex social economic, and behavioural characteristics of the consumers. In order to test the significance of central place theory in this situation and assess how it compares with a more complex approach which includes additional socio-economic factors, the following hypothesis is used as a basis for later discussion, analysis, and testing:

> 'That the differing retail structure of the metropolitan areas and other major urban areas (over 30,000 population) of Canada, although greatly affected by the size of population of the centre and the position of this centre in the central place hierarchy, is substantially further affected by additional socio-economic, demographic, and employment conditions in the metro area'.

This hypothesis is substantive more than predictive.[31] It suggests relationships to be found at a particular point in time rather than the way in which and the extent to which variables in the relationships will develop and change.

A series of questions can be asked about retail structure, social structure, and implied relationships between the two, together with the usefulness of central place theory 'predictors' as surrogates for more complex relationships:

1. Retail structure.

What are the major similarities or dissimilarities in the retail structure of Canadian metro areas? Is there any regional pattern of retail structure?

2. Socio-Economic structure.

What are the major similarities or dissimilarities in the socio-economic structure of Canadian metro areas? Is there any regional pattern of socio-economic structure?

3. Central place structure.

What are the major similarities or dissimilarities in the central place functions of Canadian metro areas? Is there any regional pattern in central place structure?

4. Test of the Hypothesis.

Are Central place factors more effective predictors of retail structure than socio-economic factors?

It is the attempt to test the hypothesis and to answer the questions arising out of it which constitutes the following Chapters.

The construction of the study and the way in which Chapters relate to each other and to steps in the development of the argument testing the hypothesis are shown in Figure 1. The succeeding Chapters (Two through Seven) take the following form: Chapter Two discusses the statistical methods of principle components analysis and multiple regression analysis which are used in Chapters Three, Four, Five and Six, thus avoiding the necessity of involving technical discussion with the presentation of results, and providing a basis for the rationale behind Figure 1. Chapter Three presents the results of analysing the retail structure of the metro areas under consideration, and the way in which this structure varies between Provinces (A_1 - A_4 in Figure 1). Chapter Four makes a similar presentation of the socio-economic dimensions of the forty-five metro areas (B_1 - B_4 in Figure 1), and is followed in Chapter Five by another similar analysis of selected central place variables (C_1 - C_3 in Figure 1). Chapter Six (C_5; B_5; $C_{5/6}$ in Figure 1)

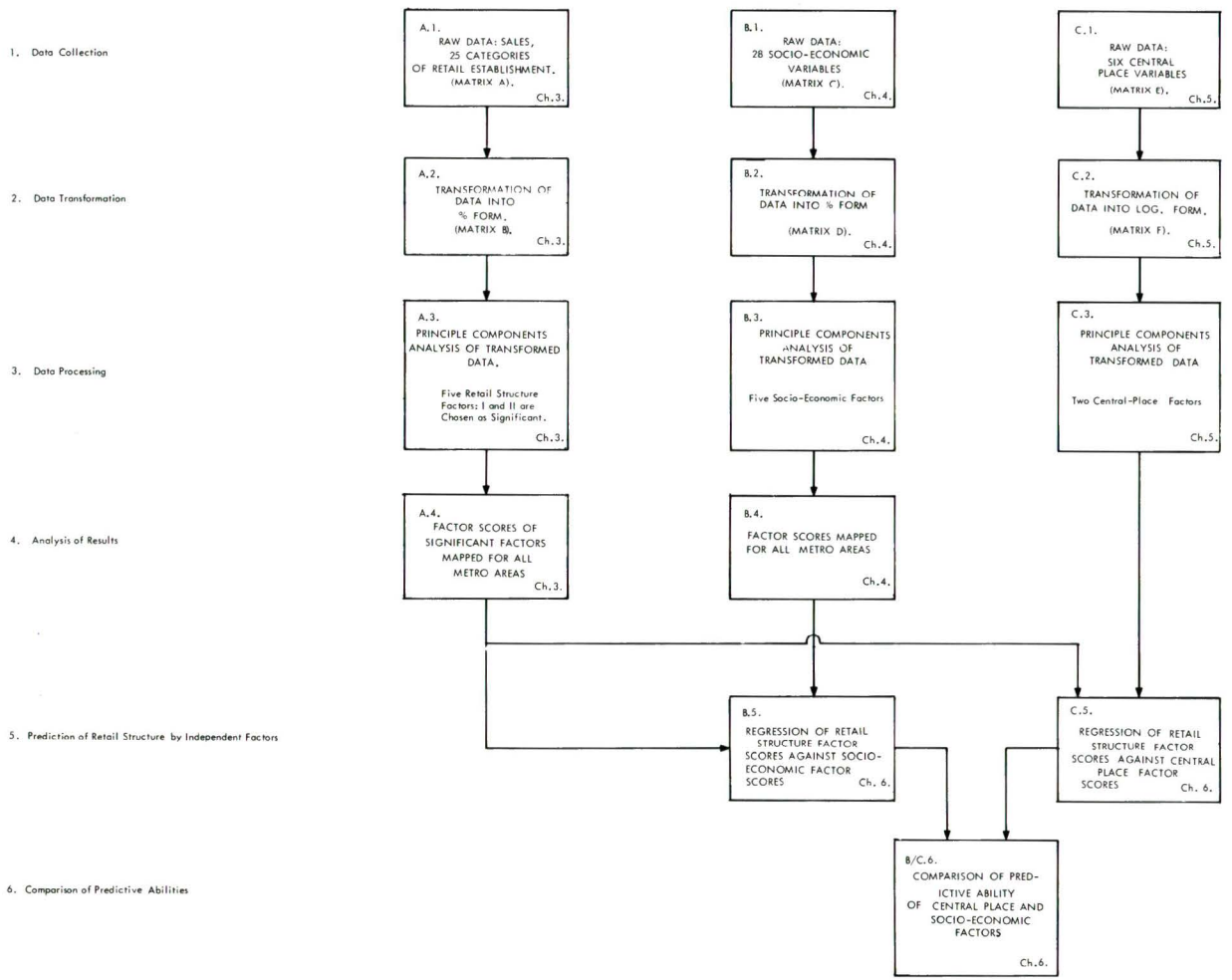


FIGURE I

STRUCTURE OF THE STUDY

synthesises the analyses of the study: comparison is made between the differing abilities of central place factors and socio-economic factors to predict the retail structure of Canadian metro areas. Although each individual Chapter contains its own conclusions, Chapter Seven summarises the findings of each Chapter, the specific conclusions arrived at, and presents the general conclusions concerning the study as a whole.

Footnotes.

1. C.D. Harris, "A Functional Classification of Cities in the United States," Geographical Review, Vol. 33 (1943), pp. 86-99.

2. H.J. Nelson, "A Service Classification of Cities in the United States," Economic Geography, Vol. 31 (1955), pp. 189-210.

3. L. Pownall, "The Functions of New Zealand Towns," Annals of the Association of American Geographers, Vol. 43 (1953), pp. 332-350.

4. A.D. Woozley, Theory of Knowledge: An Introduction (London, England: Hutchinson's University Press, 1949).

5. H.O. Nourse, Regional Economics (Toronto: McGraw Hill, 1968), especially Chapter 3, "Systems of Cities," pp. 33-63.

6. Ibid., p. 1.

7. W. Christaller (translated by C. Baskin), The Central Places of Southern Germany (Englewood Cliffs: Prentice Hall, 1966).

8. A. Lösch, The Economics of Location (New Haven: Yale University Press, 1968).

9. B.J.L. Berry, Shopping Centres and the Geography of Urban Areas: A Theoretical and Empirical Study of the Spatial Structure of Intraurban Retail and Service Business, Unpublished Ph.D. Thesis (Ann Arbor, Michigan: University Microfilms, 1958).

10. B.J.L. Berry, Geography of Market Centers and Retail Distribution (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967).

11. Ibid., pp.1-25.

12. T.N. Beckman, and W.R. Davidson, Marketing (New York: Ronald Press Co., 1967), pp. 1-25.

13. M.H. Halbert, "The Requirements for Theory in Marketing," R. Cox, W. Alderson, S.J. Shapiro, eds., Theory in Marketing (Homewood, Illinois: Irwin, Inc., 1964), pp. 22-45.

14. D. Huff, "Ecological Characteristics of Consumer Behaviour," Papers and Proceedings of the Regional Science Association, Vol. 7 (1961), pp. 19-28.

B.J.L. Berry, H.G. Barnum, and R.J. Tennant, "Retail Location and Consumer Behaviour," Papers and Proceedings of the Regional Science Association, Vol. 9 (1962), pp. 65-106.

15. W. Applebaum, and S. Cohen, "The Dynamics of Store Trading Area and Market Equilibrium," Annals of the Association of American Geographers, Vol. 51 (1961), pp. 73-101.

W. Applebaum, and S. Cohen, "Evaluating Store Sites and Determining Store Rents," Economic Geography, Vol. 36 (1960), pp. 48-60.

W. Applebaum, "Marketing Geography," P.E. James, and J.K. Wright, eds., American Geography: Inventory and Prospect (Syracuse, New York: Syracuse University Press, 1954), pp. 245-251.

S. Cohen, "Location Research Programming for Voluntary Food Chains," Economic Geography, Vol. 37 (1961), pp. 1-11.

W. Applebaum, "Teaching Marketing Geography by the Case Method," Economic Geography, Vol. 37 (1961), pp. 48-60.

16. L. Hamill, "Are Formal Theories Needed in Marketing Geography?" The Professional Geographer, Vol. XVII, 2 (1965), pp. 11-13.

17. See footnote 14.

18. B.J.L. Berry, Geography of Market Centers and Retail Distribution (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967), pp. 26-58.

B.J.L. Berry, "The Impact of Expanding Metropolitan Communities Upon the Central Place Hierarchy," Annals of the Association of American Geographers, Vol. 50 (1960), pp. 112-116.

C. Schlettler, "The Relation of City Size to Economic Services," American Sociological Review, Vol. 8 (1943), pp. 60-62.

19. J.A. Howard, and J.N. Sheth, The Theory of Buyer Behavior (New York: John Wiley and Sons,1969), pp. 24-29.

20. L. Mumford, The City in History, its Transformations and Prospects (First Edition) (New York: Harcourt, Brace, and World, 1961).

D.M. Ray, "Urban Growth and the Concept of Functional Region," N.H. Lithwick, G. Paquet, eds., Urban Studies: A Canadian Perspective (Toronto: Methuen and Co., 1968), especially p. 67.

21. J.W. Maxwell, "The Functional Structure of Canadian Cities: A Classification of Cities," Geographical Bulletin, Vol. 7, 2 (1965), pp. 79-104.

22. Ibid., pp. 96-104.

23. Ibid., p. 95.

24. L.J. King, "Cross-sectional Analysis of Canadian Urban Dimensions," Canadian Geographer, Vol. X, 4 (1966), pp. 205-222.

25. Ibid., pp. 210-211, 216-217.

26. D.M. Ray, "A Factorial Ecology of Canada," Papers and Proceedings of the Regional Science Association, Vol. XXIII (1969), pp. 7-23.

27. The principle of 'distance decay' is akin to the concept of the gravity model whereby the volume of interaction between two places is proportional to their size and inversely proportional to the distance between them. With increasing distance, the interaction grows less: hence the term 'distance decay'. For further discussion and references see W. Isard, Methods of Regional Analysis (Cambridge, Mass.: M.I.T. Press, 1960), Chapter 11, "Gravity, Potential, and Spatial Interaction Models," pp. 493-569.

28. G. Hodge, "Urban Structure and Regional Development," Papers and Proceedings of the Regional Science Association, Vol. XXI (1968), pp. 101-118.

29. Ibid., p. 118.

30. Dominion Bureau of Statistics, Census of Population, 1961, Vol. 6.1, Table 2.

31. L.C. Lockley, "An Approach to Marketing Theory," R. Cox, W. Alderson, S.J. Shapiro, eds., Theory in Marketing (Homewood, Illinois: Irwin and Co., 1964), pp. 46-55.

CHAPTER TWO

FACTOR ANALYSIS AND MULTIPLE REGRESSION ANALYSIS

Two statistical methods are used throughout this study in order to reduce the three data sets involved to a more compact form, and to compare the results of this reduction.[1] In the first instance each data matrix (A_2; B_2; C_2 in Figure 1) is subjected to a principle components analysis (A_3; B_3; C_3 in Figure 1). The groups of factor scores resulting from each components analysis are then used as the basis for a regression analysis (B_5; C_5 in Figure 1) which compares the abilities of central place and socio-economic factors in predicting the retail structure factors.[2]

1. Principle Components Analysis.[3]

Within each of the three data matrices used in the study, there are groups of variables which are similar to each other in the way they vary from metro area to metro area. A certain amount of redundancy thus exists because of these similarities, which can be reduced entirely by computing the principle components (factors) of each matrix.[4]

The standard method of principle components analysis is based on the patterns in which variables in a data matrix correlate with each other. From these patterns of inter-correlations a set of factors is derived, each factor being composed of groups

of the original variables. The importance of each variable to the composition of each factor is represented by the factor loading (a value much like a coefficient of correlation ranging between 0.0, no relation, +1.0 a perfect positive correlation, and -1.0 a perfect negative correlation). The factors resulting from the components analysis are rotated to their varimax position[5] in order to sharpen the contrast in loadings of the variables on each factor. Each factor is completely uncorrelated (orthogonal) with every other factor derived from the same data matrix, and each depicts a different pattern in the data matrix.

In order to govern the number of factors derived, however, the eigenvalue of the last factor is controlled to a pre-defined level.[6] In the case of the retail sales and socio-economic data matrices (A_3; B_3 in Figure 1) the eigenvalue was arbitrarily set at 2.0 in order to eliminate factors made up largely of a single variable, and in the case of the central place data matrix (C_3 in Figure 1) the eigenvalue was set at 0.9 in order to include all the relevant variables.

By applying such a principle components analysis to each data matrix used in the study (A_3; B_3 ; C_3 in Figure 1), the data sets are all reduced to a comparable form, and provide a common basis on which a comparison may be made between them. Once the factors have been derived from each matrix, their importance in all the metro areas is found by matrix multiplication of the loadings of variables which constitute each factor by the standardised

original data for each metro area. These factor scores are computed in a standardised form, and thus comparison can be made, for example, between a retail structure factor and a socio-economic factor for any given metro area.

Thus, in summary, the three data sets are each subjected to a principle components analysis to reduce the large number of variables in each matrix to a smaller number of factors, and secondly to provide a set of completely uncorrelated variables - the factor scores.

2. Multiple Regression Analysis.[7]

Multiple regression analysis is a method whereby a set of dependent variables (e.g. the retail structure factors) can be compared, in turn, with several sets of independent variables (e.g. the central place and socio-economic factors). The use of factor scores in a regression analysis as in Chapter Six, however, gives rise to several characteristics not encountered in the regression of raw data for individual variables. The factor scores for each data matrix are standardised scores and therefore have a mean value of (0): the regression equation resulting from using factor scores both as dependent and independent variables thus has no intercept value since it must, by definition, pass through the (0) value of each variable. Secondly, a more problematical characteristic occurs because each factor score represents a group of variables forming the factor, and it is therefore impossible to assess the number of degrees of freedom involved in the analysis.

Because of this, significance tests based on the number of degrees of freedom cannot be used indiscriminately: their exact meaning is obscure.

Although the use of factor scores gives rise to this latter problem, their main advantage is their orthogonality. The restriction found in the regression of non-components analysed data, whereby ostensibly independent variables are in fact correlated (multicollinearity), does not occur when factor scores are used as variables. Also, the smaller number of resultant variables facilitates a parsimonious explanation of the results.

The factor scores based on the principle components analysis of the retail sales data are used in Chapter Six as the dependent variables of a regression analysis (B_5; C_5 in Figure 1). Central place factor scores and socio-economic factor scores are then used, in turn, as independent variables to predict the dependent variable. In all cases the correlation values shown are the 'corrected correlation coefficients'. The use of corrected values reduces the bias in the relationships which they describe which is brought about because of the different numbers of variables or factors in the data sets used.

It is on the basis of the regression analysis of the three sets of factor scores that the conclusions about the predictive effectiveness of the two sets of independent variables are made.[8]

Footnotes.

1. Further and more elaborate discussion of these techniques can be found in texts such as:

   R.E. Frank, A.A. Kuehn, and W.F. Massey, Quantitative Techniques in Marketing (1st. Edition)(Homewood, Illinois: Irwin and Co., 1962).

   S. Gregory, Statistical Methods and the Geographer (1st. Edition), (London, England: Longman, Green and Co., 1964).

   P. Horst, Factor Analysis of Data Matrices (New York: Holt, Rinehart and Winston, Inc., 1965).

   L.J. King, Statistical Analysis in Geography (1st. Edition), (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1969).

   G. Tintner, Econometrics (1st. Edition) (New York: John Wiley and Sons, 1967).

2. The use of specific techniques in geographical research are incorporated in articles such as:

   R.R. Boyce, and W.A.V. Clark, "Selected Spatial Variables and Central Business District Sales," Papers and Proceedings of the Regional Science Association, Vol. 11 (1963), pp. 167-193.

   J. Goddard, "Multivariate Analysis of Office Location Patterns in the City Centre: A London Example," Regional Studies, Vol. 2 (1968), pp. 69-85.

   G. Hodge, "Urban Structure and Regional Development," Papers and Proceedings of the Regional Science Association, Vol. XXI (1968), pp. 101-118.

   D.M. Ray, "The Spatial Structure of Economic and Cultural Differences: A Factorial Ecology of Canada," Papers and Proceedings of the Regional Science Association, Vol. XXIII (1969), pp. 7-23.

   N. Spence, "A Multi-factor Uniform Regionalisation of British Counties on the Basis of Employment Data for 1961," Regional Studies, Vol. 2 (1968), pp. 87-104.

3. Factor analysis and principle components analysis were developed to be used as research instruments in experimental psychology. Spearman initially attempted to show that all forms of intellectual performance spring from a 'general mental capacity', and that a single underlying general ability factor can be found plus a factor which is specific to the performance of each individual (C. Spearman, "General Intelligence Objectively Determined and Measured," American Journal of Psychology, Vol. 15 (1904), pp. 201-293. See also C. Spearman, The Abilities of Man (London, England: Macmillan and Co., 1927)). This 'two factor' theory was later developed by Garnett (J.C.M. Garnett, "On Certain Independent Factors in Mental Measurement," Proceedings of the Royal Society, London, Vol. 46 (1919), pp. 91-111) and Thurstone (Thurstone, L.L. "Multiple Factor Analysis," Psychological Review, Vol. 38 (1931), pp. 406-427).

4. The factorial method used in this study is principle components analysis. Although this method results in a set of factors (components) in the same way as factor analysis, the major difference is that in the correlation matrix used to derive the factors, principle components analysis presumes that each variable is perfectly correlated with itself. Thus all the elements of the diagonal vector of the correlation matrix have a value (1.0). The method of factor analysis does not assume this perfect relationship, but rather works from the residual correlation matrix of variables (i.e. each cell is 1 - correlation coefficient) which produces values less than unity in the diagonal vector.

5. R.B. Cattell, "Factor Analysis: An Introduction to the Essentials, Part I," Biometrics, Vol. 21 (1965), pp. 190-215.

6. P.R. Gould, "On the Geographical Interpretation of Eigenvalues," Transactions of the Institute of British Geographers, Vol. 42 (1967), pp. 53-86.

7. For a more complete discussion of multiple regression analysis see N.R. Draper, and H. Smith, Applied Regression Analysis (New York: John Wiley and Sons, 1966).

8. The components analysis was performed on the University of Victoria's IBM System/360 Model computer using a modified version of the Scientific Subroutine Package FACTO, Source: System/360 Scientific Subroutine Package (360A - CM - 03X) Version III; Programmer's Manual (White Plains, New York: I.B.M., 1968), "FACTO - Sample Main Program," pp. 422-425. The multiple regression analysis was performed using the Scientific Sub-routine Package STEPR. Source: Ibid., pp. 413-418.

CHAPTER THREE

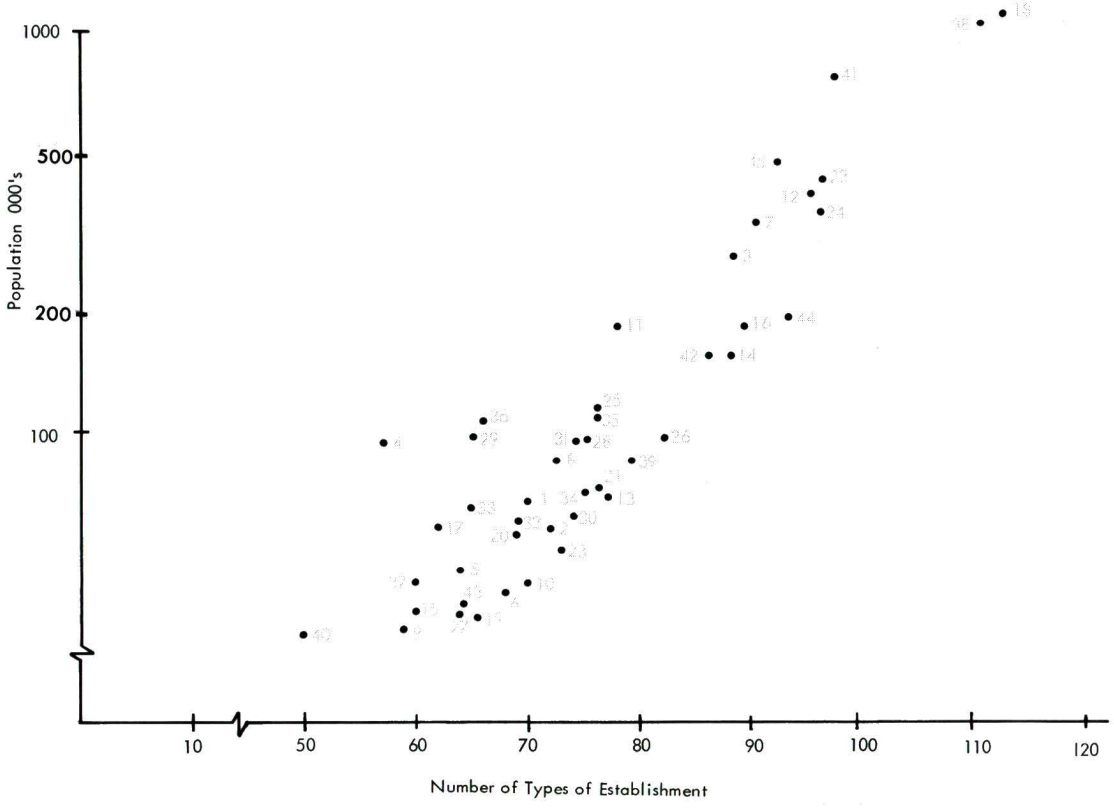
THE RETAILING STRUCTURE OF CANADIAN METROPOLITAN AREAS

Economic geographers and regional economists have attempted to describe and analyse the structure of regional economies by comparing the percentage distribution of employment among various industrial types.[1] Indexes of industrial localisation[2] and specialisation[3] have been derived which compare the 'industrial structure' of a series of regions with that of the nation as a whole. The use of employment as a measure of the importance of a particular industry has been debated on the grounds that the production functions of different industries are so varied as to avoid direct comparison.[4] Use of the 'value added' concept has been suggested[5] as a more effective index of relative industrial importance, because it represents a value of production which derives entirely from the region itself.

The definition of metro area retail structure presented in the Introduction (p. 5) is similar to the measures of industrial specialisation and concentration. A metro area is considered, in this study, to be a region, and the percentage distribution of sales between a pre-defined grouping of retail establishments can

be taken as an index of the retail structure of this region. In the study of metro area retailing the concept of 'value added' used in the analysis of industrial location patterns would be paralleled by the mark-up made by each retailing establishment. Variations of this figure would occur between different kinds of store (e.g. furniture stores and food stores) and would be indicative of the relative importance of each type of store in a centre. Such data are not available, and it is in default of having such values that the present study uses the distribution of dollar sales between store categories as indicators of metro area retail structure, as noted in Chapter One (p. 5).

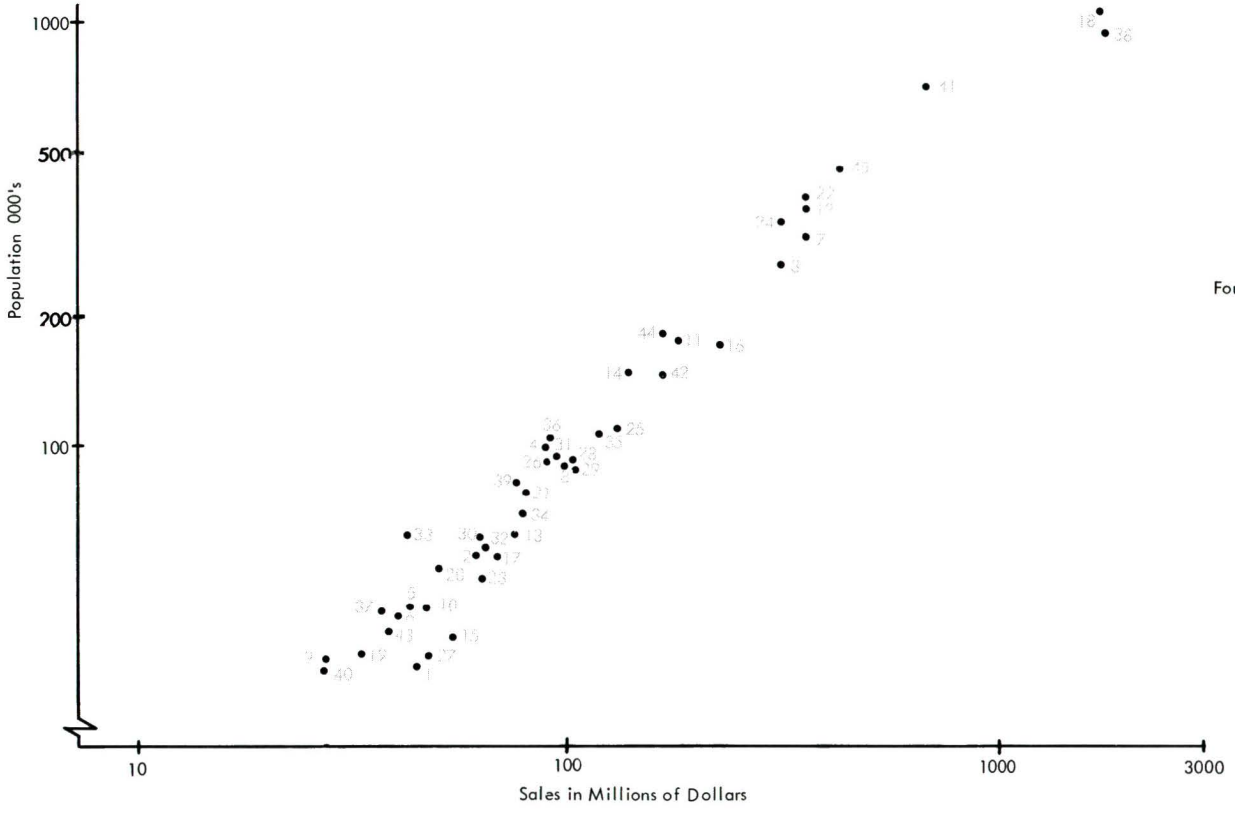
The 'number of business types' (or 'number of types of outlet') and the total number of establishments in a metro area are found to have a high degree of correlation with the size of the population of the area.[6] Figure 2 shows the extent of the relationship between the number of establishments and total population for the forty-five metro areas of Canada which have more than 30,000 population. The relationship between gross sales in a metro area and its population is even higher as shown in Figure 3. It is possible, however, that the percentage distribution of the total sales in a metro area between the types of establishment which it contains may not show such a close relationship with the size of the metro area population. Similarities between the gross retail sales of certain metro areas may, in fact, conceal important differences in the way in which this total is distributed between store types.



For key to Metropolitan Areas see Table 1.

FIGURE II

THE RELATIONSHIP BETWEEN POPULATION AND THE NUMBER OF TYPES OF ESTABLISHMENT IN THE FORTY-FIVE METROPOLITAN AREAS OF CANADA



For key to Metropolitan Areas see Table 1.

FIGURE III

THE RELATIONSHIP BETWEEN POPULATION AND TOTAL RETAIL SALES IN THE FORTY-FIVE METROPOLITAN AREAS OF CANADA

Direct application of industrial specialisation and concentration indexes to the percentage distribution of sales would yield a series of values for 'indexes of retail specialisation and concentration' based on the average retail structure of all Canadian metro areas. Such an average figure would represent an over-all structure of retailing in each metro area and would not show the way in which particular retail categories relate to each other. By applying a principle components analysis to the percentage distribution of sales between retail categories, the relationship between such categories can be found, and several indexes result (the factor scores) which represent underlying dimensions of the data. Thus, instead of one index of specialisation and concentration, the different sets of factor scores extract different patterns of variation and similarity from the original data.

1. Data Sources.

The 1961 Census of Canada published by the Dominion Bureau of Statistics[7] reports the trading figures from one hundred and two kinds of retail establishment within forty-five metro areas and other major urban areas with a population greater than 30,000[8] (see Table 1 for a list of the metro areas).[9] The Census definition of these metro areas includes the central metropolitan city plus contiguous urbanised areas, and therefore corresponds to the entire urban area agglomerated around the central city.[10]

TABLE 1

THE FORTY-FIVE METROPOLITAN AND MAJOR URBAN AREAS OF CANADA

1. Belleville
2. Brantford
3. Calgary
4. Chicoutimi-Jonquiere
5. Cornwall
6. Drummondville
7. Edmonton
8. Fort William/Port Arthur
9. Granby
10. Guelph
11. Halifax
12. Hamilton
13. Kingston
14. Kitchener
15. Lethbridge
16. London
17. Moncton
18. Montreal
19. Moose Jaw
20. Niagara Falls
21. Oshawa
22. Ottawa
23. Peterborough
24. Quebec
25. Regina
26. St. Catharines
27. St. Jean
28. St. John
29. St. John's
30. Sarnia
31. Saskatoon
32. Sault Ste. Marie
33. Shawinigan
34. Sherbrooke
35. Sudbury
36. Sydney-Glace Bay
37. Timmins
38. Toronto
39. Trois-Rivieres
40. Valleyfield
41. Vancouver
42. Victoria
43. Welland
44. Windsor
45. Winnipeg

The classification of stores made by the Census is based on a hierarchy of store types according to the major types of merchandise which they sell. No reference is made in such a classification to spatial differences in types of store (e.g. between Provinces) or in the different marketing methods which they use. Thus within a category such as 'grocery stores', no differentiation is made between discount grocery stores, street-corner delicatessens, or co-operative stores. Though all may sell basically the same type of merchandise, the methods by which they do this are quite different - and may in fact be more important in terms of varying retail patterns than the goods which the stores sell. In the event of such a result, the cultural and historical differences in the formation and growth of metro areas might give better explanations of retailing patterns than would the analysis of their socio-economic or central place structure.

Census rules stipulate that trading figures for a particular type of establishment in a particular centre will not be published if such publication might prejudice the position of a particular establishment.[11] This rule is enforced when one or two stores predominate in a centre and their individual trading figures might be revealed.

2. Data Processing.

Because of the above rule, the Census returns of retail trade are incomplete, and in order to derive a set of workable data,

two methods were used to estimate the unpublished values:

(i) the 102 Census categories of establishment were reduced to 25;

(ii) blank cells in the resulting data matrix (Matrix A, A.1 in Figure 1) were estimated on the basis of average per capita sales in centres for which values had been published.

The reduction of the hundred and two Census categories to a total of twenty-five is necessarily subjective. Some new groupings are suggested by the Census itself, which reports for certain groups of the hierarchy of establishments rather than an individual type, e.g.[12]

Automobile dealers
Automobile dealers with wholesale car departments
Automobile dealers with farm implements

Other groups of establishments can be found by amalgamating categories of similar type within the hierarchy, e.g.[13]

Hardware stores
Hardware and farm implements
Paint, glass, and wallpaper

The precise results of amalgamation are shown in Appendix A: a different set of grouping would obviously give different end results. Since the groups derived were used throughout the analysis and were applied to all metro areas, there is internal consistency and comparability within the study.

Following the above process, the hundred and four blank cells in the resulting matrix were estimated by taking all values

for the particular category and computing the average per capita sales for that category in all centres. This value, multiplied by the population of the centre for which a value was not reported, was inserted as an estimate in the blank cell. The intent here was not to create an actual data value, but simply to insert a value which would be largely neutral in its influence in the correlation analysis. The untransformed data matrix (Matrix A, A.1 in Figure 1) is shown in complete form in Appendix B.

3. Characteristics of Metro Area Retailing.

The completed data matrix of retail sales (Appendix B) shows that a few types of establishment dominate Canadian metro area marketing. Four types of establishment alone, combination stores (e.g. Safeway), department stores, automobile dealers, and second-hand automobile dealers account for over fifty per cent of retail sales in the metro areas. Although the importance of food stores has declined in the 1951-1961 inter-Censal period, the more comprehensive type of store such as Safeway or Super-Valu (combination stores) have grown rapidly in importance. Since the Census collects its data on the basis of goods sold rather than marketing methods used, as mentioned previously, it is not possible to trace the growing importance of combination stores and department stores and the varying marketing methods which they use. Comparative analyses of Canadian marketing[14] suggest that dramatic shifts in consumer habits have been witnessed since the Second World War, and that this is reflected in different methods of retail marketing. The type of data published by the Census does not allow the detailed analysis of such a

conclusion, and thus the percentage sales between the twenty-five categories of establishment is used in this study in an attempt to isolate underlying dimensions of Canadian retailing which depend not on the absolute size of the sales in a category but on variations in the importance of the category from metro area to metro area.

The average percentage of total sales in each category is shown in Table 2. Apart from the four predominant categories mentioned previously, the remaining categories each account for between 0.5% and 2.0% of metro area retail sales. Some categories appear to be unusually important in some centres, and thus there are many deviations from the percentage figures in Table 2, as is reflected in the high values of the standard deviations of variables such as combination stores (var. 3) and auto dealers (var. 8).

4. Principle Components Analysis: Results.

Before being subjected to a principle components analysis, the percentage values of retail sales were further transformed into arcsin percentage form in order to reduce the influence of extreme values (i.e. values much higher or lower than the average for that particular category).[15] The transformed data matrix (Matrix B, A_2 in Figure 1) was then subjected to a principle components analysis in order to summarise the information of the matrix by a smaller number of orthogonal factors. The factors resulting from this components analysis were rotated to their varimax position in order to enhance the contrast between loadings of variables on each factor. The following analysis is based on the rotated factors, and the factor scores discussed are likewise based on the rotated factors.

TABLE 2

PERCENTAGE DISTRIBUTION OF SALES BETWEEN
TWENTY-FIVE RETAIL SALES CATEGORIES

		Average % Total of Canadian Metro Areas Sales	Standard Deviation (%)
1.	Confectioners and bakers	0.8	0.55
2.	Grocery, fruit and vegetables	3.3	1.62
3.	Combination stores	21.1	4.00
4.	Meat, fish, and other food stores	2.1	1.10
5.	Department stores	10.5	6.01
6.	General stores	1.3	1.16
7.	Variety stores	2.8	1.09
8.	Automobile dealers	15.8	3.93
9.	Second-hand automobiles and accessories	8.2	1.29
10.	Service Stations and repairs	3.9	2.91
11.	Men's and boys' wear	1.7	0.60
12.	Women's and children's wear	2.8	0.96
13.	Shoe stores	1.5	0.45
14.	Bespoke clothing and special goods	2.5	1.69
15.	Hardware and paint	1.7	1.17
16.	Furniture	1.7	0.89
17.	Household appliances, television, radio	2.9	1.03
18.	Second-hand furniture and antiques	0.9	0.93
19.	Druggists	2.8	0.71
20.	Florists	0.3	0.14
21.	Tobacco stores and kiosks	0.6	0.33
22.	Cameras, books, and music	0.2	0.55
23.	Jewellery	1.2	0.17
24.	Sports goods, boats, and bicycles	0.5	0.31
25.	Miscellaneous stores, and non-classified stores	7.6	2.64

The correlation matrix of variables (Table 3) resulting from the components analysis shows a very low degree of inter-correlation between the twenty-five variables used. As can be seen in Table 3, only department sores had a high degree of correlation with another variable ($r = -0.7$ with combination stores), the next highest being the positive correlation between combination stores and men's and boys' wear ($r = 0.6$). The correlation matrix outlines 'patterns' of relationships: e.g. department stores are negatively correlated with men's and boys' wear which, in turn, is positively correlated with combination stores; department stores are thus negatively correlated with combination stores. The correlation between variety stores and hardware and paint stores ($r = -0.4$) is the only correlation which does not enter into a pattern with the other correlations shown.

Within the displayed matrix of correlations (Table 3) only correlations as large as(0.4)are shown. Few correlation values greater than (0.6) occur in the matrix, and since these values represent the way in which the variables co-vary for the forty-five metro areas,the conclusion derived is that many of the variables have a set of values the variation in which is completely unique. Thus, automobile dealers who, on the average, account for 15.8% of metro area retail sales, do not correlate with any other retail category. The way in which sales by automobile dealers vary between metro areas is therefore not related to the way in which sales by other establishments vary: it is essentially unique.

TABLE 3.

INTER-CORRELATION MATRIX:

SALES OF TWENTY-FIVE CATEGORIES

OF RETAIL ESTABLISHMENTS

1.	Confectioners and bakers	1.																						
2.	Grocery, fruit and vegetables		2.																					
3.	Combination stores			3.																				
4.	Meat, fish, and other food stores				4.																			
5.	Department stores		-0.7			5.																		
6.	General stores						6.																	
7.	Variety stores							7.																
8.	Automobile dealers								8.															
9.	Second-hand automobiles and accessories	-0.4								9.														
10.	Service stations and repair shops										10.													
11.	Men's and boys' wear		0.6			-0.5						11.												
12.	Women's and children's wear												12.											
13.	Shoe stores					-0.5						0.5		13.										
14.	Bespoke clothing and special goods														14.									
15.	Hardware and paint							-0.4								15.								
16.	Furniture					-0.5											16.							
17.	Household appliances, television, radio																	17.						
18.	Second-hand furniture and antiques																		18.					
19.	Druggists																			19.				
20.	Florists									-0.4				-0.5							20.			
21.	Tobacco stores and kiosks					-0.4																21.		
22.	Cameras, books, and music																						22.	
23.	Jewellery									0.4														23.
24.	Sports goods, boats, bicycles																				0.4			24.
25.	Miscellaneous stores, and non-classified stores																							25.

The factors or dimensions resulting from the components analysis are based on these patterns of inter-correlation. The loadings of each variable on each factor are an index of how each variable relates to the factors: the factors in turn are the significant correlation groupings found from Table 3.

Five factors are derived from the correlation matrix which account for 54.74% of the variance of the transformed data matrix (Matrix B, A_2 in Figure 1). The limiting eigenvalue was controlled to a value of 2.0 to cut off additional factors, which were found to be constituted largely of only a single important variable.

The five factors derived are shown in Table 4, and their individual composition is as follows:

Factor I (Central Functions) outlines the importance of department stores in metro area retail structure. Where department stores are important, combination stores, men's and boys' wear, shoe stores, and furniture stores are not predominant. The loadings of these variables represent the relative proportion of their importance, and thus this factor suggests that 16.5% (the summation of all the squared loadings divided by the number of variables) of the variance of the transformed data matrix (Matrix B) can be assessed in terms of department store dominance or non-dominance. The presence of tobacco stores and kiosks in this factor in contrast to department stores suggests that where the latter predominate they tend to cater for smokers' demands. In other metro areas where department store dominance is low, the incidence of specialist tobacco stores is high.

TABLE 4

ROTATED RETAIL STRUCTURE FACTORS (I - V)*

Variable		Factor					Communalities (Row Sum of Squares)
		I (Central Functions)	II (Specialist Functions)	III	IV	V	
Department stores	5	-0.88	-	-	-	-	0.82
Combination stores	3	0.81	-	-	-	-	0.69
Men's and boys' wear	11	0.72	-	-	-	-	0.65
Shoe stores	13	0.64	-	-	-	-	0.55
Furniture	16	0.64	-	-	-	-	0.54
Tobacco stores and kiosks	21	0.53	-	-	-	0.41	0.47
Florists	20	-	0.75	-	-	-	0.68
Second-hand automobiles and accessories	9	-	0.69	-0.30	-	-	0.70
Sports goods, boats, and bicycles	24	-	0.66	-	-	-	0.48
Grocery, fruit, and vegetables	2	-	-0.61	-	-	-	0.42
Druggists	19	-	0.55	-	0.45	-	0.54
Miscellaneous stores and non-classified stores	25	-	-	-0.69	-	-	0.54
Jewellery	23	-	-	-0.58	-	-	0.61
Cameras, books, and music	22	-	-	0.54	-	-	0.47
Automobile dealers	8	-	-	0.32	-0.68	-	0.70
Women's and children's wear	12	-	-	-	0.57	-	0.39
Hardware and paint	15	-	-	-	0.55	-	0.66
General stores	6	-	-	-	0.37	0.58	0.59
Service stations and repairs	10	-	-	-	-	-0.58	0.36
Household appliances, television, radio	17	-	-	-	0.37	0.54	0.49
Confectioners and bakers	1	-	0.33	-	-	-0.45	0.42
Meat, fish, and other food stores	4	-	-	-	0.46	-	0.24
Variety stores	7	-	-	-0.41	-	0.49	0.56
Bespoke clothing and special goods	14	0.42	0.40	-0.34	-	-	0.57
Second-hand furniture and antiques	18	0.46	-	-	-0.35	-	0.38
Column Sum of Squares		4.12	3.07	2.11	2.26	2.03	13.52
% Explained Variance		16.51	12.29	8.74	9.08	8.12	54.74
Cumulative Explained Variance		16.51	28.80	37.54	46.62	54.74	54.74

*Only loadings over 0.30 are shown

Factor II (Specialist Functions) isolates certain functions of metro areas which correlate together and which therefore have similar patterns of sales in the forty-five metro areas. Second-hand automobile dealers, florists, sports goods, and druggists load positively on this factor and compare in an inverse way with grocery stores, which have a negative loading. The composition of the factor suggests that where more specialised establishments such as florists or sports goods are together, then the incidence of grocery stores which deal in consumption goods of a more 'local' nature is low. The factor thus contrasts stores selling luxury and durable goods with stores selling goods which, in a sense, cater more for basic needs.

Factors I and II (Central Functions, and Specialist Functions) (Table 5) include nine of the eleven variables which have significant inter-correlation patterns in Figure 3, and it is interesting that the composition of these factors is based not primarily on the type of goods which the stores sell, but on whether or not the goods are consumer or luxury goods (factor II) and the method of marketing these goods (factor I).

The remaining three factors (factors III, IV, and V) although adding 26% to the explained variance of the transformed data, result from lower levels of inter-correlation of variables and are more difficult to name and analyse. Factors IV and V outline different types of central functions performed by the metro areas, and differentiate between hardware stores and automobile dealers (factor

TABLE 5

ROTATED RETAIL STRUCTURE FACTORS I AND II*

Variable		Factor		Communalities (Row Sum of Squares)
		I (Central Functions)	II (Specialist Functions)	
Department stores	5	-0.88	-	0.78
Combination stores	3	0.81	-	0.69
Men's and boys' wear	11	0.72	-	0.60
Shoe stores	13	0.64	-	0.42
Furniture	16	0.64	-	0.42
Tobacco stores and kiosks	21	0.53	-	0.30
Florists	20	-	0.75	0.59
Second-hand automobiles and accessories	9	-	0.69	0.53
Sports goods, boats, and bicycles	24	-	0.66	0.44
Grocery, fruit and vegetables	2	-	-0.61	0.42
Druggists	19	-	0.55	0.31
Miscellaneous stores and non-classified stores	25	-	-	0.05
Jewellery	23	-	-	0.22
Cameras, books, and music	22	-	-	0.15
Automobile dealers	8	-	-	0.06
Women's and children's wear	12	-	-	0.05
Hardware and paint	15	-	-	0.06
General stores	6	-	-	0.11
Service stations and repairs	10	-	-	0.01
Household appliances, television, radio	17	-	-	0.05
Confectioners and bakers	1	-	0.33	0.17
Meat, fish, and other food stores	4	-	-	0.01
Variety stores	7	-	-	0.09
Bespoke clothing and special goods	14	0.42	0.40	0.34
Second-hand furniture and antiques	18	0.46	-	0.23
	Column Sum of Squares	4.12	3.07	7.20
	% Explained Variance	16.51	12.29	28.80
	Cumulative % Explained Variance	16.51	28.80	28.80

*Only loadings over 0.30 are shown

IV) and variety stores and household goods (factor V). Factor III combines a specialist function (jewellery stores) with more local functions (news agents and miscellaneous stores) of a less specialised nature.

5. Clarity of the Retail Structure Factors.

Of the five factors extracted from the transformed retail sales data matrix, factors I and II are the only ones which can be analysed and named with any precision. Although the communalities of these two factors remain stable when a greater number of factors is used (Table 4), the values of these communalities are low. The variance which these variables do not explain is either explained by the three remaining factors (III, IV, V) or is of a random nature.

Given a great degree of systematic variability within the data one would expect high communalities. Figures IV and V show, however, that the communalities of all variables when two factors are used are in fact only slightly linearly related to the variability of the data (Figure IV) and the size of each data category (Figure V). If the data were completely regular then a variable with a high communality would also have a high coefficient of variability (standard deviation of the variable divided by its mean). Figure V shows that the communalities of the variables are also uncorrelated with the average size of the variable (expressed as a percentage of total retail sales). The relationships shown in Figures IV and V are thus too indistinct to enable a definite

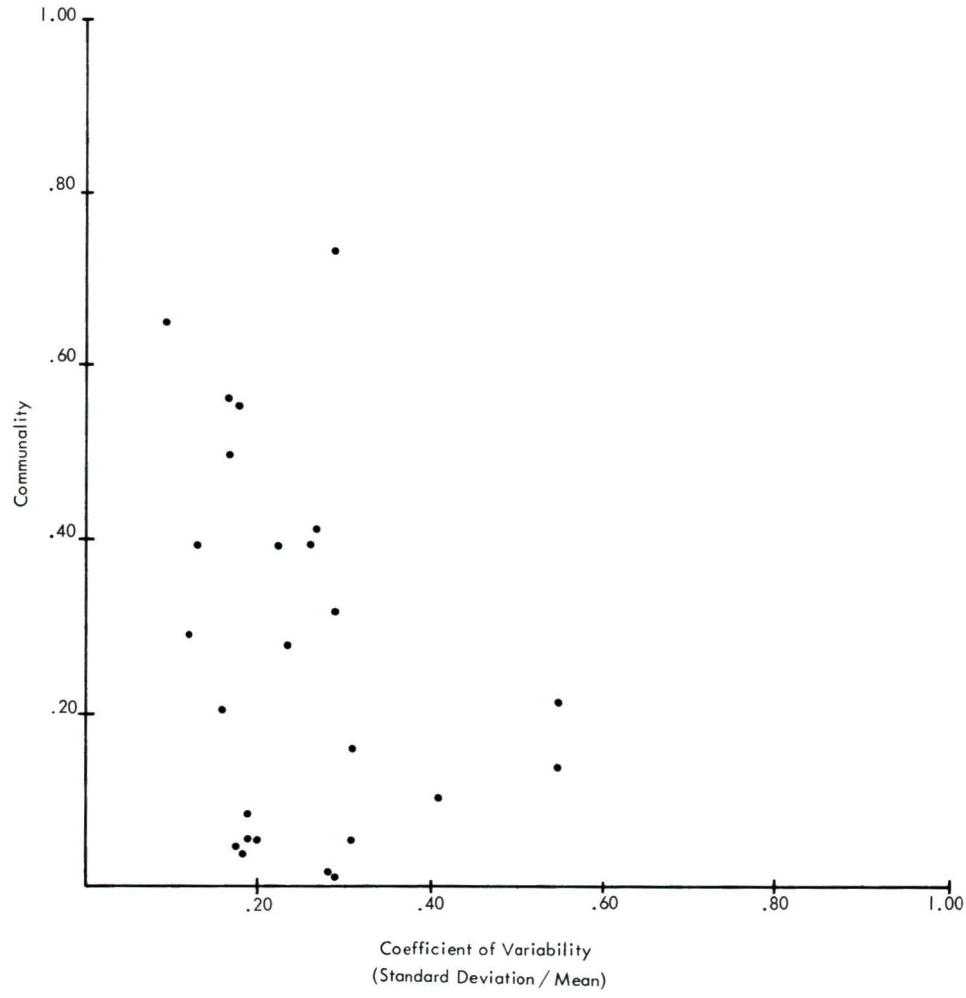


FIGURE IV

RETAIL STRUCTURE FACTORS I AND II: COMMUNALITIES
vs. COEFFICIENT OF VARIABILITY FOR 25
CATEGORIES OF RETAIL ESTABLISHMENT

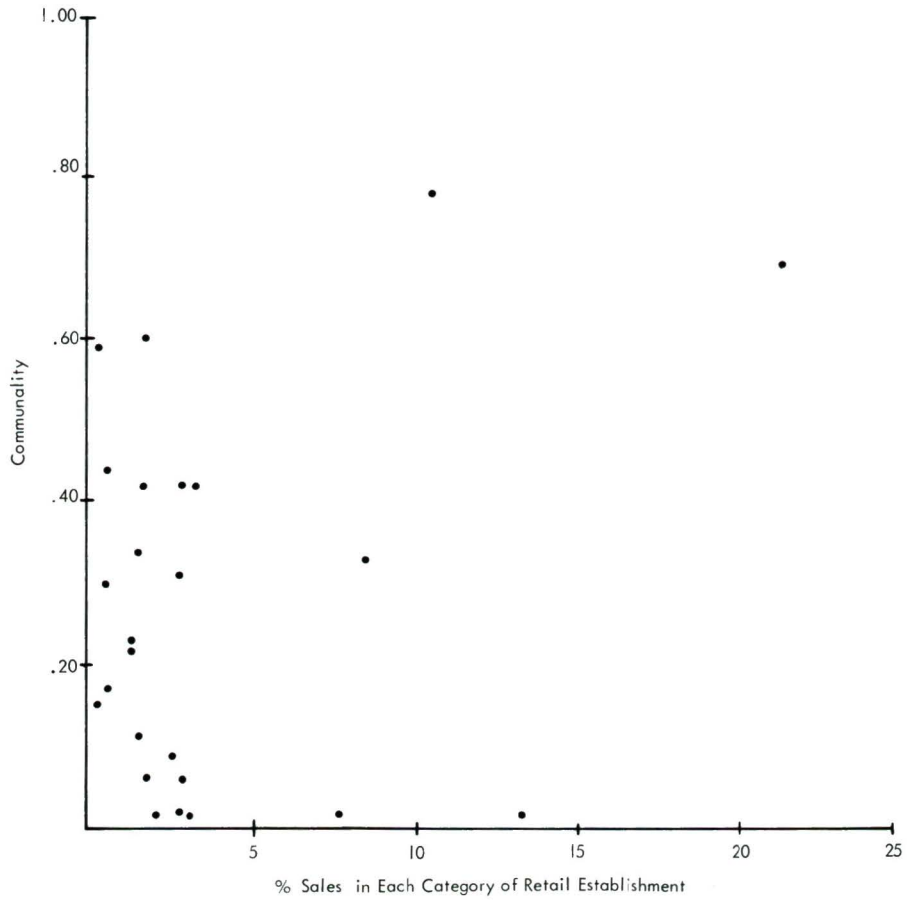


FIGURE V

RETAIL STRUCTURE FACTORS I AND II: COMMUNALITIES
vs. % TOTAL SALES IN 25 CATEGORIES OF
RETAIL ESTABLISHMENT

statement to be made regarding the causation of unclear factor composition. It is suggested that the lack of clarity does not derive from a regular and systematic variation in the data, because this would have been picked up by the above analysis, but rather from an irregular variation brought about by certain unique patterns of values in the original retail sales data.

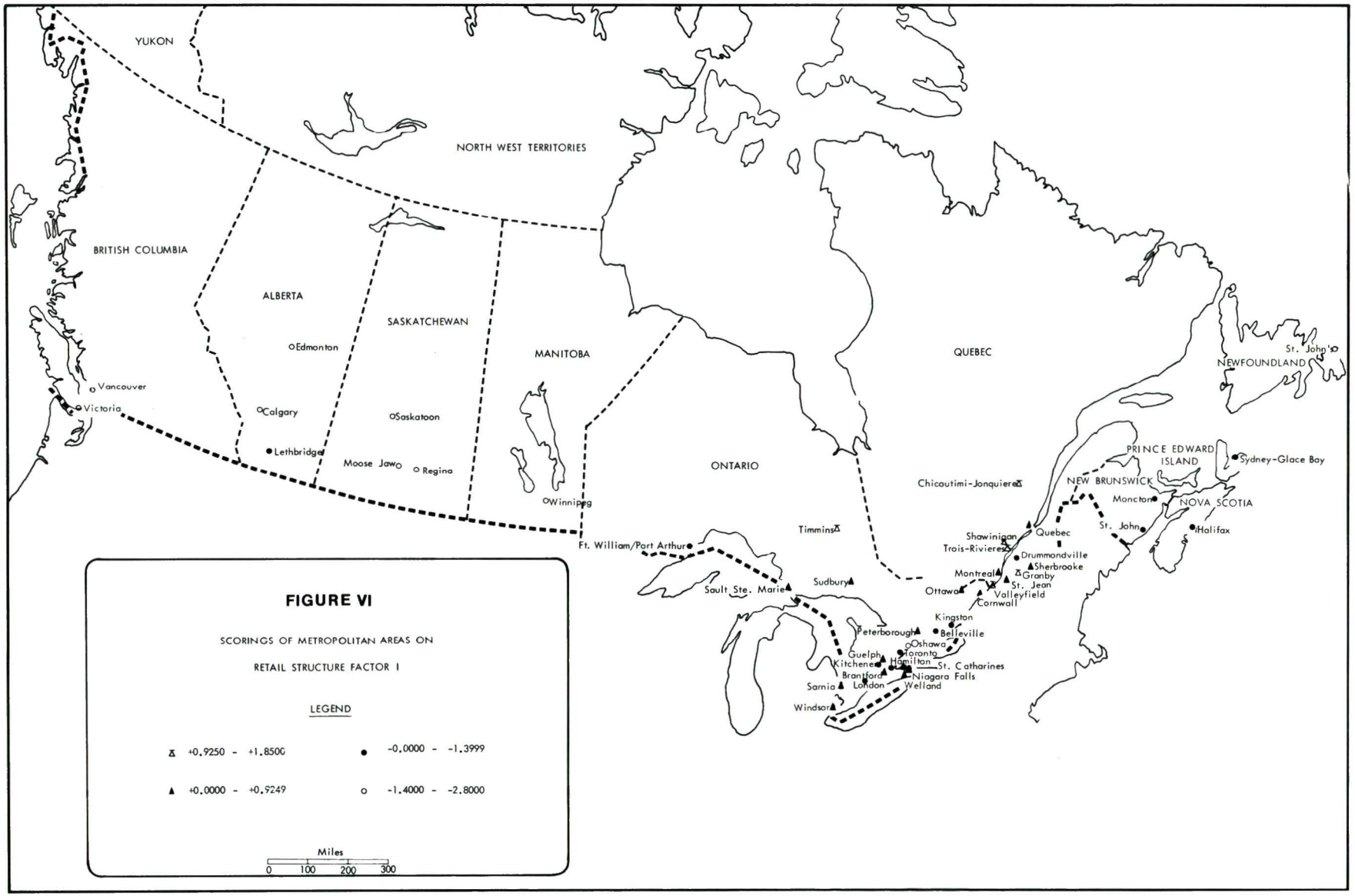
6. Spatial Variation in Metro Area Retail Structure.

The importance of each factor (I - V) in a particular centre is represented by the set of factor scores for that place. Since factor scores are orthogonal, they can be used as independent indexes of retail structure.

Factor I. (Central Functions).

The scores for factor I are plotted in Figure VI based on a quartile division of values. All metro areas west of Fort William/Port Arthur[16] show high negative scores, which suggests that department stores play a more important role in these centres relative to other central functions. The metro areas of the Atlantic Provinces show a similar characteristic.

The cities of Quebec have a high positive score on this factor, indicating that combination stores, mens' and boy's wear etc. .. predominate over department establishments. The metro areas of Ontario, apart from Timmins, all have low positive or negative scores and are equally distributed around (0) scores: the extreme values of other areas are not present in the more closely-knit complex of metro areas in Southern Ontario.


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Ft. William/Port Arthur
Timmins
Sudbury
Sault Ste. Marie
Chicoutimi-Jonquiere
Shawinigan
Trois-Rivieres
Quebec
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Valleyfield
Ottawa
Cornwall
Kingston
Peterborough
Belleville
Oshawa
Toronto
Guelph
Kitchener
Hamilton
St. Catharines
Brantford
Niagara Falls
Sarnia
London
Welland
Windsor
Moncton
St. John
Halifax
Sydney-Glace Bay
St. John's
FIGURE VI
SCORINGS OF METROPOLITAN AREAS ON
RETAIL STRUCTURE FACTOR I
LEGEND
+0.9250 - +1.8500
+0.0000 - +0.9249
-0.0000 - -1.3999
-1.4000 - -2.8000
Miles
0 100 200 300

Four distinct regions appear from this analysis which reflect differing importance of this retailing dimension:

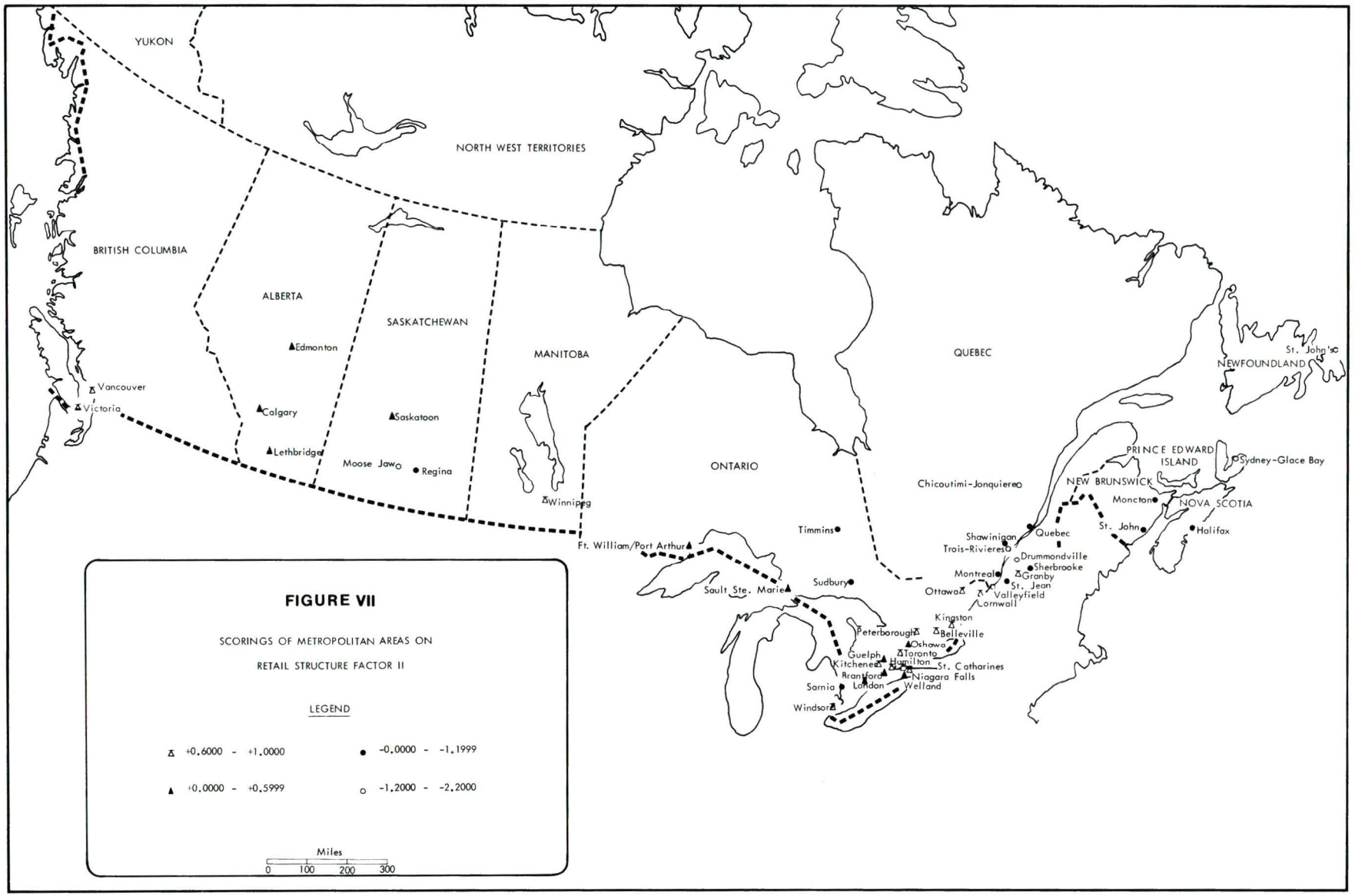
Department Stores
Predominate

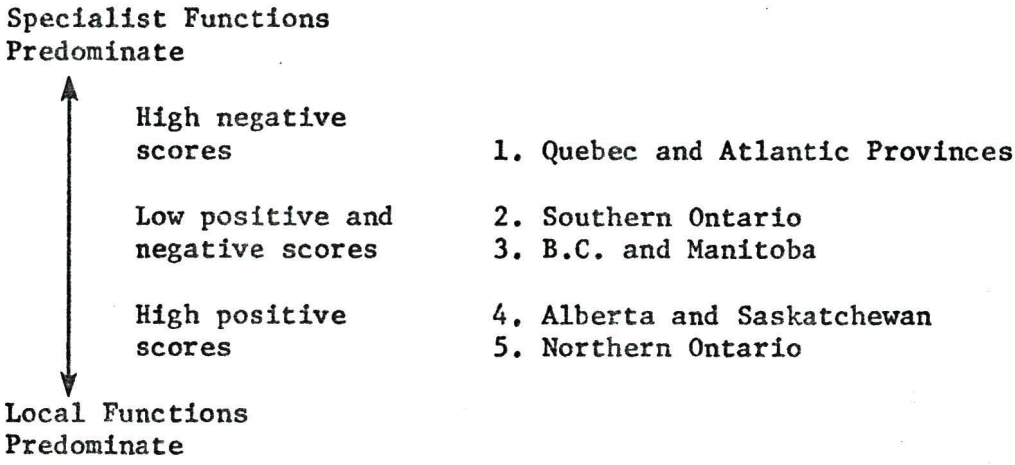
High negative Scores	1. Prairie and Western Provinces 2. Atlantic Provinces
Low positive and negative scores	3. Ontario
High positive scores	4. Quebec

Central functions
Predominate (combination scores)

Factor II. (Specialist Functions).

Plotting the factor scores on factor II by the same method (Figure VII) results in a different pattern of regions. The factor shows negative scores in Quebec and the Maritimes, suggesting that grocery, fruit, and vegetable stores play a more important role in the retailing structure of these metro areas than do the more specialised central functions. Southern Ontario, Manitoba and British Columbia, on the other hand, have high positive scores in comparison with the lower scores of Alberta, Saskatchewan, and Northern Ontario - which reflect the relative importance of specialist functions in these different areas. The regional grouping which result are as follows:


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Ft. William/Port Arthur
Sault Ste. Marie
Timmins
Sudbury
Chicoutimi-Jonquiere
Shawinigan
Trois-Rivieres
Quebec
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Valleyfield
Ottawa
Cornwall
Kingston
Belleville
Peterborough
Oshawa
Toronto
Guelph
Kitchener
Hamilton
St. Catharines
Brantford
Niagara Falls
London
Welland
Sarnia
Windsor
Moncton
St. John
Halifax
Sydney-Glace Bay
St. John's
FIGURE VII
SCORINGS OF METROPOLITAN AREAS ON
RETAIL STRUCTURE FACTOR II
LEGEND
+0.6000 - +1.0000
+0.0000 - +0.5999
-0.0000 - -1.1999
-1.2000 - -2.2000
Miles
0 100 200 300



Factors III, IV, and V do not show distinctive regional patterns in the same ways as factors I and II, and since they are not used for further analysis, the distribution of factor scores for factors II, IV, and V is shown in the maps of Appendix C.

7. Comparison of Factor I (Central Functions) and Factor II (Specialist Functions).

Although the two retail structure factors (Central Functions and Specialist Functions) are by definition uncorrelated, both may be important in a particular metro area. In other metro areas, however, one factor alone may be representative of the retail structure, and the remaining factor be completely insignificant. When the factor scores of factor I (Central Functions) and factor II (Specialist Functions) are plotted against each other along orthogonal axes (proportionate to the eigenvalue of the factors), distinct regional grouping patterns appear.

In the first instance the metro areas of the Atlantic Provinces, Quebec, and Ontario form a clock-wise continuum around the centre of the scatter of points (Figure VIII). None of the

metro areas is distinguished by a high score on either factor, but the conclusion arrived at in the previous section, that the retail structure of the metro areas of Southern Ontario are typified by specialist functions (factor II) is extended. As Figure VIII shows, an eastward movement to Quebec (anti-clockwise on the Figure) is reflected in a decline in the importance of specialist functions. The metro areas of the most easterly Provinces (which act more as central places than do the manufacturing centres of Southern Ontario) tend to have a greater department store dominance.

A second major region outlined in Figure VIII is constituted by the Western metro areas. These metro areas act as major foci of retailing activity and are characterised by department store dominance over the other specialist and central functions performed in the metro area. This region is more comparable with the metro areas of the Atlantic Provinces than it is with the metro areas of Quebec and Ontario.

A third region is the Quebec periphery which is made up of natural resource-based metro areas and metro areas with agricultural hinterlands. These areas differ from the administrative centres and retail centres of Quebec by having higher scores on each of the retail structure factors.

Six of the remaining seven centres which do not fall into distinct regional groupings have more exaggerated scores than the other metro areas of the Province in which they are situated. Moose Jaw, however, does not seem to be an exaggerated form of other Western cities, but is more like the metro areas of the Atlantic

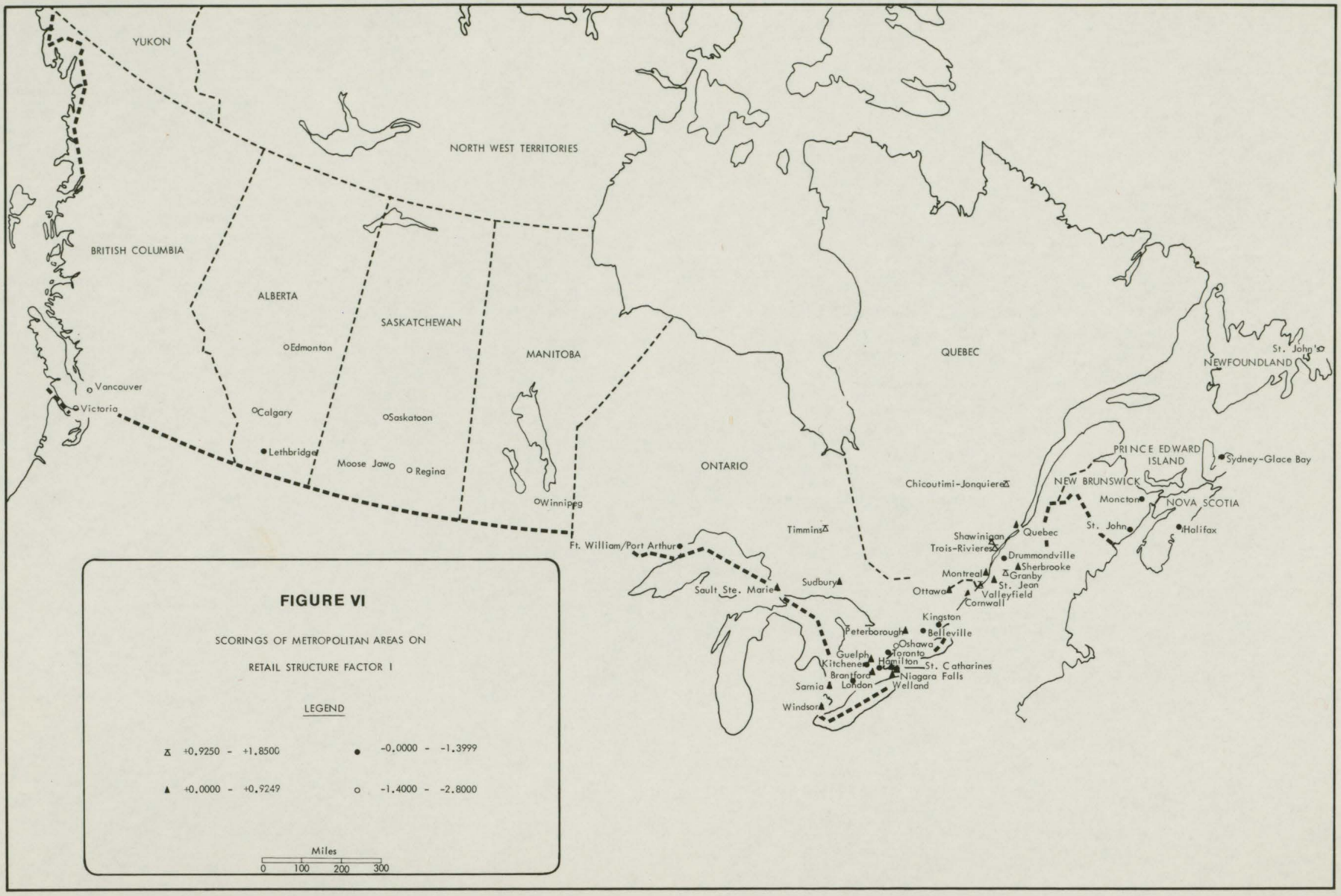


FIGURE VI

SCORINGS OF METROPOLITAN AREAS ON

RETAIL STRUCTURE FACTOR I

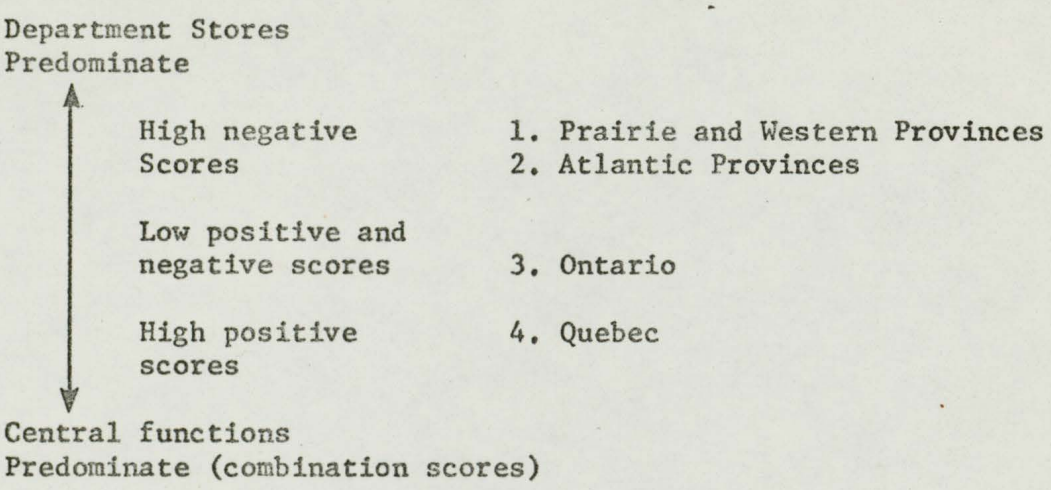
LEGEND

⧋	+0.9250 - +1.8500	●	-0.0000 - -1.3999
▲	+0.0000 - +0.9249	o	-1.4000 - -2.8000

Miles

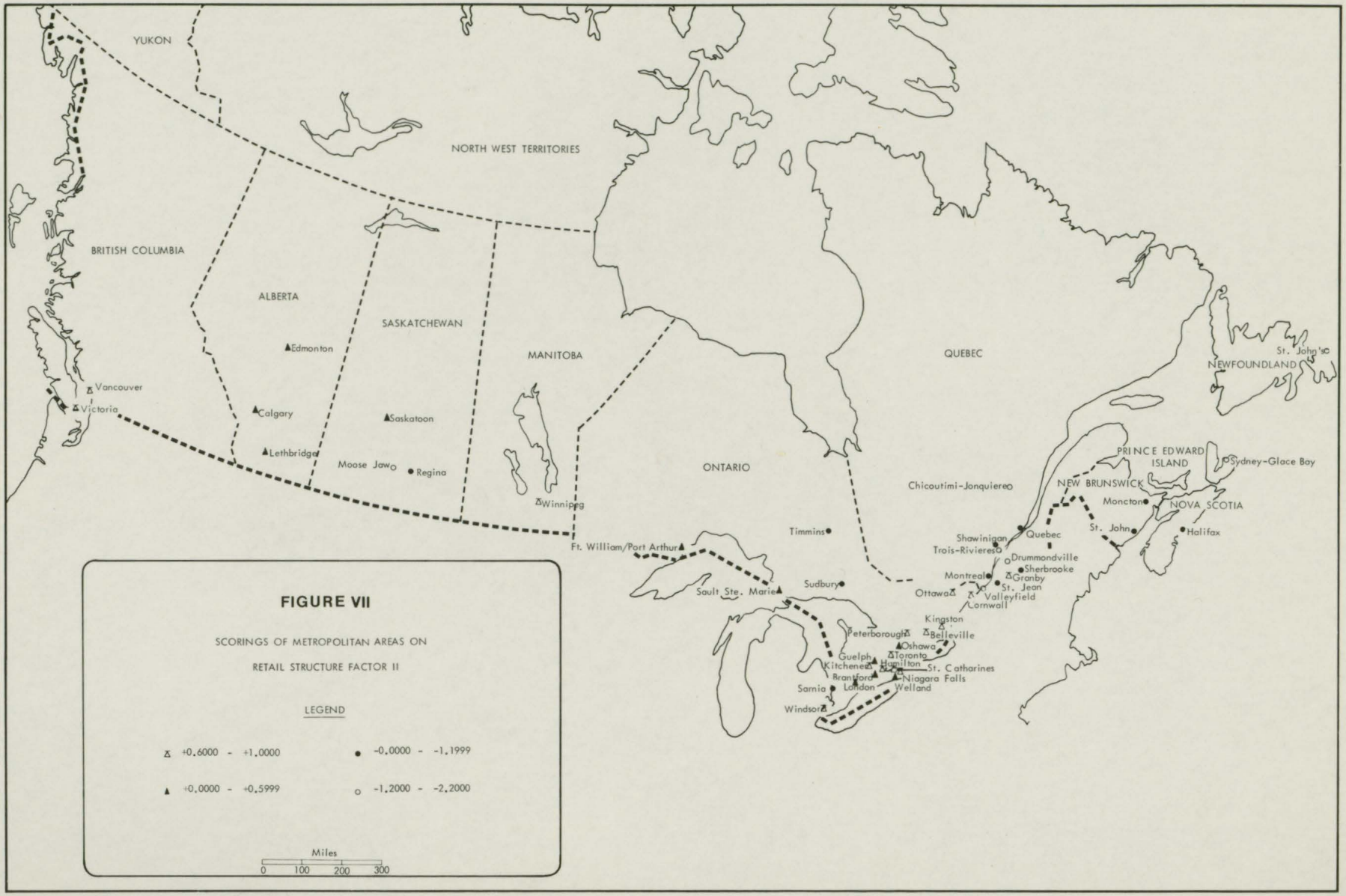
0 100 200 300

Four distinct regions appear from this analysis which reflect differing importance of this retailing dimension:



Factor II. (Specialist Functions).

Plotting the factor scores on factor II by the same method (Figure VII) results in a different pattern of regions. The factor shows negative scores in Quebec and the Maritimes, suggesting that grocery, fruit, and vegetable stores play a more important role in the retailing structure of these metro areas than do the more specialised central functions. Southern Ontario, Manitoba and British Columbia, on the other hand, have high positive scores in comparison with the lower scores of Alberta, Saskatchewan, and Northern Ontario - which reflect the relative importance of specialist functions in these different areas. The regional grouping which result are as follows:


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
St. John's
PRINCE EDWARD ISLAND
Sydney-Glace Bay
NEW BRUNSWICK
NOVA SCOTIA
Moncton
Halifax
St. John
Chicoutimi-Jonquiere
Quebec
Shawinigan
Trois-Rivieres
Drummondville
Sherbrooke
Granby
St. Jean
Valleyfield
Cornwall
Montreal
Ottawa
Timmins
Sudbury
Sault Ste. Marie
Ft. William/Port Arthur
Winnipeg
Kingston
Belleville
Peterborough
Oshawa
Toronto
Hamilton
St. Catharines
Niagara Falls
Welland
Guelph
Kitchener
Brantford
London
Sarnia
Windsor
Vancouver
Victoria
Calgary
Edmonton
Lethbridge
Saskatoon
Moose Jaw
Regina
FIGURE VII
SCORINGS OF METROPOLITAN AREAS ON
RETAIL STRUCTURE FACTOR II
LEGEND
+0.6000 - +1.0000
+0.0000 - +0.5999
-0.0000 - -1.1999
-1.2000 - -2.2000
Miles
0 100 200 300

Specialist Functions
Predominate

High negative scores	1. Quebec and Atlantic Provinces
Low positive and negative scores	2. Southern Ontario 3. B.C. and Manitoba
High positive scores	4. Alberta and Saskatchewan 5. Northern Ontario

Local Functions
Predominate

Factors III, IV, and V do not show distinctive regional patterns in the same ways as factors I and II, and since they are not used for further analysis, the distribution of factor scores for factors II, IV, and V is shown in the maps of Appendix C.

7. Comparison of Factor I (Central Functions) and Factor II (Specialist Functions).

Although the two retail structure factors (Central Functions and Specialist Functions) are by definition uncorrelated, both may be important in a particular metro area. In other metro areas, however, one factor alone may be representative of the retail structure, and the remaining factor be completely insignificant. When the factor scores of factor I (Central Functions) and factor II (Specialist Functions) are plotted against each other along orthogonal axes (proportionate to the eigenvalue of the factors), distinct regional grouping patterns appear.

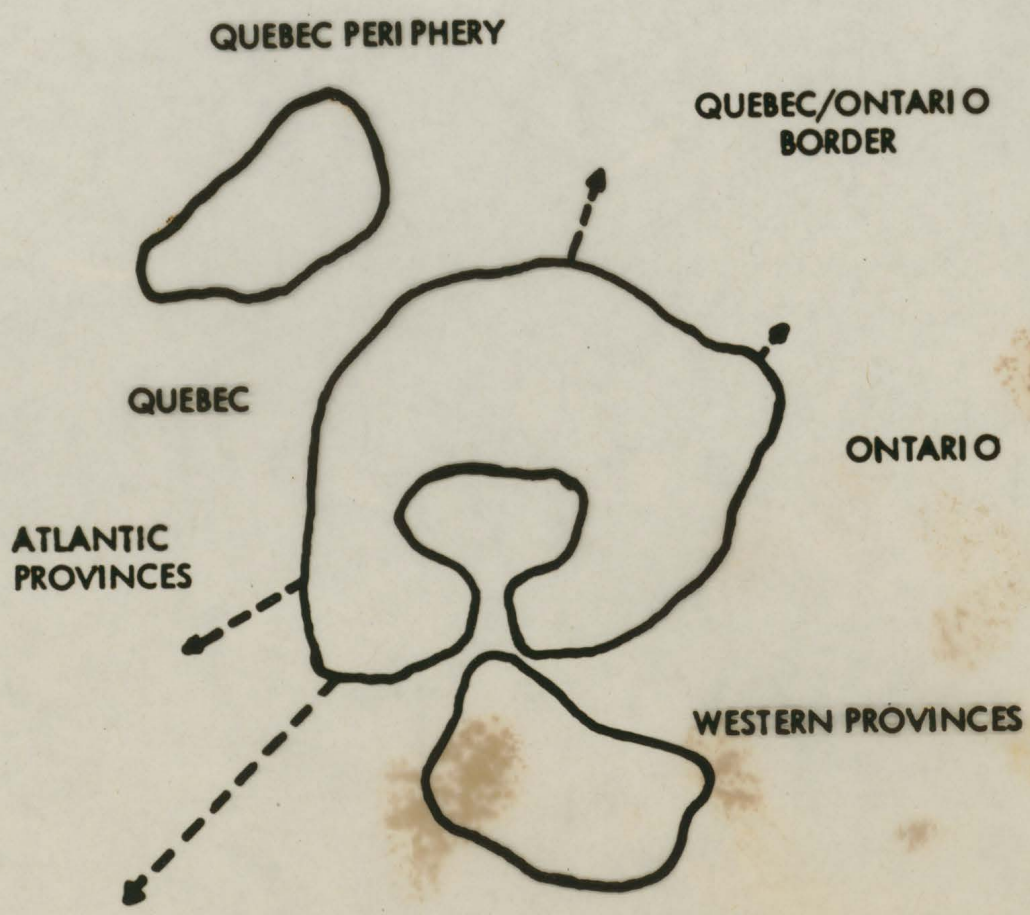
In the first instance the metro areas of the Atlantic Provinces, Quebec, and Ontario form a clock-wise continuum around the centre of the scatter of points (Figure VIII). None of the

metro areas is distinguished by a high score on either factor, but the conclusion arrived at in the previous section, that the retail structure of the metro areas of Southern Ontario are typified by specialist functions (factor II) is extended. As Figure VIII shows, an eastward movement to Quebec (anti-clockwise on the Figure) is reflected in a decline in the importance of specialist functions. The metro areas of the most easterly Provinces (which act more as central places than do the manufacturing centres of Southern Ontario) tend to have a greater department store dominance.

A second major region outlined in Figure VIII is constituted by the Western metro areas. These metro areas act as major foci of retailing activity and are characterised by department store dominance over the other specialist and central functions performed in the metro area. This region is more comparable with the metro areas of the Atlantic Provinces than it is with the metro areas of Quebec and Ontario.

A third region is the Quebec periphery which is made up of natural resource-based metro areas and metro areas with agricultural hinterlands. These areas differ from the administrative centres and retail centres of Quebec by having higher scores on each of the retail structure factors.

Six of the remaining seven centres which do not fall into distinct regional groupings have more exaggerated scores than the other metro areas of the Province in which they are situated. Moose Jaw, however, does not seem to be an exaggerated form of other Western cities, but is more like the metro areas of the Atlantic


QUEBEC PERI PHERY
QUEBEC/ONTARI O
BORDER
QUEBEC
ONTARI O
ATLANTIC
PROVINCES
WESTERN PROVINCES

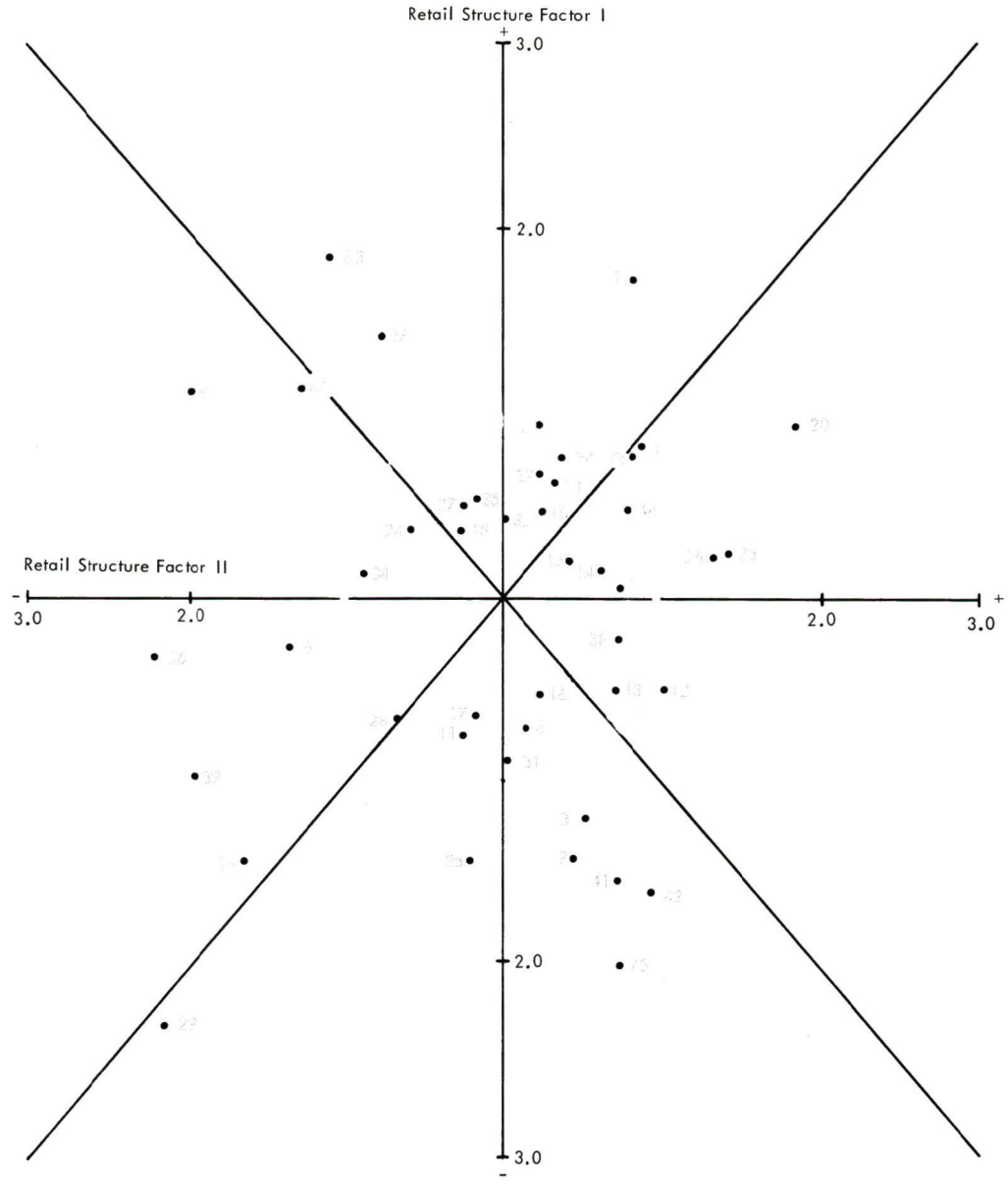


FIGURE VIII

SCORINGS OF METROPOLITAN AREAS

ON RETAIL STRUCTURE FACTORS I AND II

Axes are proportional to the square root of the eigenvalue of the factor

For key to Metropolitan Areas see Table 1.

Provinces. The proximity of Moose Jaw to Regina may effect this result because of the influence of Regina on the trade area of Moose Jaw.

The scoring of metro areas on both factors shown in Figure VIII is plotted in Figure IX. The direction of the arrows in Figure IX show how a particular metro area is placed in Figure VIII; the length of the arrow is proportional to the distance of the point in Figure VIII from the centre of the axes.

The major difference between the results of this comparative analysis and the individual analysis of each factor performed in the previous section is the emergence of the geographical continuum of centres from the Atlantic Provinces to the West coast. It is found that the retail structure of metro areas in the Atlantic Provinces is more like that of metro areas in the West than of the metro areas in Ontario or Quebec.

Another but different division of Canadian metro areas can be made on the basis of Figure VIII between the centres on the left of the vertical axis (retail structure factor I) and those on the right. This division in terms of the factor I axis seems, intuitively, to separate the more prosperous centres of Ontario and the West (right of the axis) which have a high standard of living, from those in the economically declining regions of Quebec and the Atlantic Provinces (left of the axis). On the basis of this reasoning it could further be postulated that the cross-Canada continuum shown in Figures VIII and IX is a function of different levels of standard

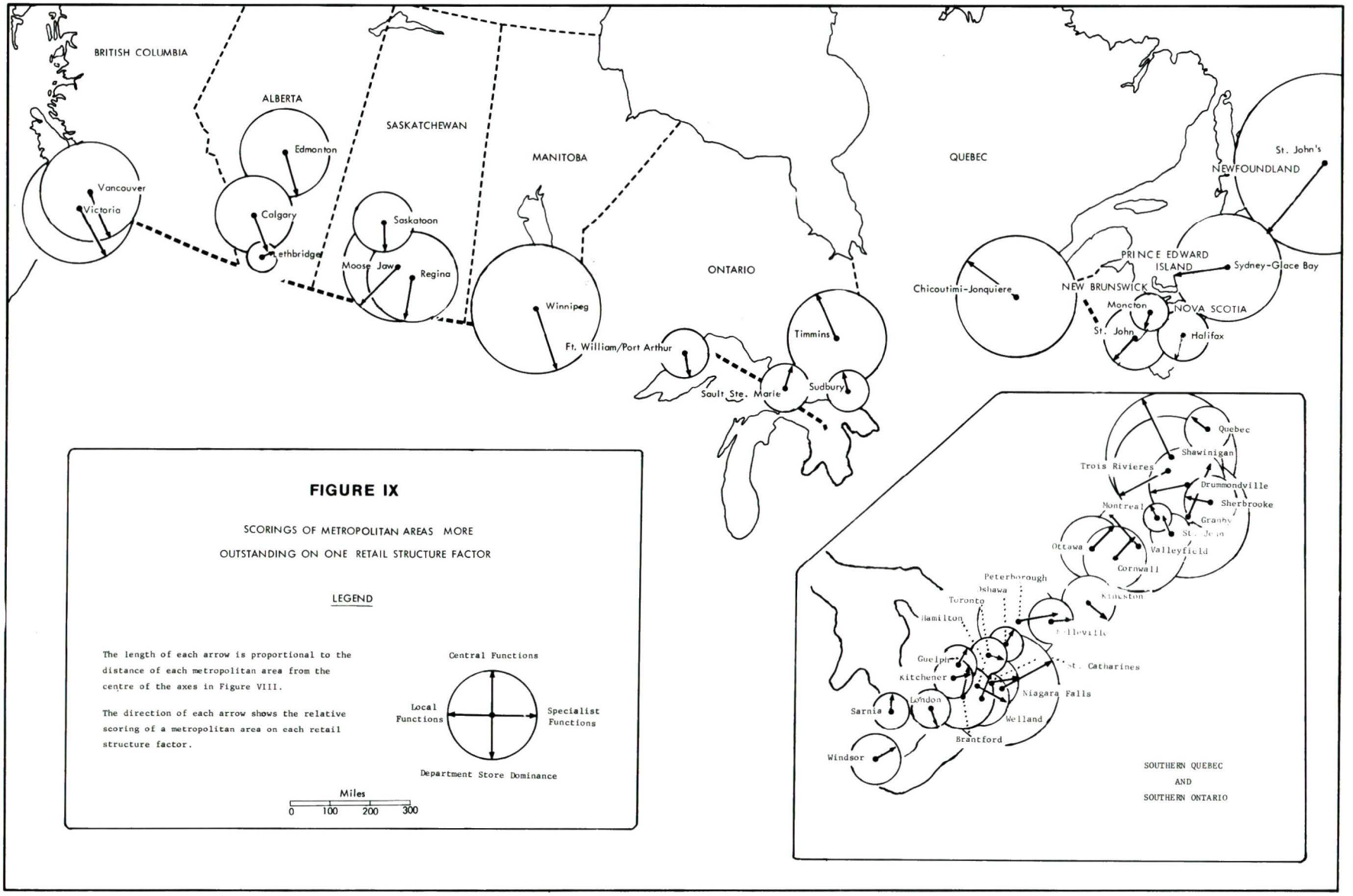


FIGURE IX

SCORINGS OF METROPOLITAN AREAS MORE
OUTSTANDING ON ONE RETAIL STRUCTURE FACTOR

LEGEND

The length of each arrow is proportional to the distance of each metropolitan area from the centre of the axes in Figure VIII.

The direction of each arrow shows the relative scoring of a metropolitan area on each retail structure factor.

Miles
0 100 200 300

of living. No ordering of centres in terms of size appears in either of the Figures, and thus the above reasoning could be extended to state that the retail structure of Canadian metro areas is more a function of the socio-economic structure of these areas than of their size. This fact was suggested by the hypothesis in Chapter One. The following Chapters attempt to substantiate the hypothesis, and also the intuitive conclusions of this Chapter, in more precise terms.

Footnotes.

1. W. Isard, Methods of Regional Analysis (Cambridge, Mass.: M.I.T. Press, 1967), Chapter 7, "Industrial Location Analysis and Related Measures," pp. 232-308.

2. P.S. Florence, Investment, Location, and Size of Plant (Cambridge, England: University Press, 1948).

   J.W. Alexander, "Location of Manufacturing: Methods of Measurement," Annals of the Association of American Geographers, Vol. 48 (1958), pp. 20-43.

3. E.M. Hoover, "The Measurement of Industrial Localisation," Review of Economics and Statistics, Vol. 18 (1936), pp. 162-171.

4. H.O. Nourse, Regional Economics (Toronto: McGraw Hill, 1968), pp. 66-68.

5. A. Pred, "The Concentration of High-Value-Added Manufacturing," Economic Geography, Vol. 41 (1965), pp. 108-132.

6. B.J.L. Berry, Geography of Market Centres and Retail Distribution (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1967), pp. 35-40.

7. Government of Canada; Dominion Bureau of Statistics, Census of Population, 1961 (Ottawa, Ontario: Queen's Printer, 1961).

8. Ibid., Vol. 6.1, Bulletin 6.1 - 1, Table 2.

9. Source: Ibid., Vol. 1.2, Bulletin 1.2 - 2, Tables 24 and 25. Because the data refer to 1961 Fort William/Port Arthur is not referred to as Thunder Bay, and therefore for reasons of consistency this study uses the name Fort William/Port Arthur.

10. Ibid., Vol. 6.1, Bulletin 6.1 - 1, Introduction.

11. Ibid., Table of Contents.

12. Ibid., Table 2.

13. Ibid.

14. M.S. Mayer and G. Snyder, Trends in Canadian Marketing (Ottawa: Queen's Printer, 1967), 1961 Census Monograph.

15. P. Haggett, Locational Analysis in Human Geography (London: Edward Arnold Ltd., 1965), p. 288.

CHAPTER FOUR

THE SOCIO-ECONOMIC STRUCTURE OF CANADIAN METROPOLITAN AREAS

The previous Chapter noted that there are several distinguishable dimensions underlying the structure of retailing in Canadian Metro areas, and that these dimensions have a distinctive grouping pattern across the country. To state that such regional differences occur because of variations in consumer composition may be to state the obvious. The way in which a metro area is composed of different socio-economic groups and age-groups, however, is considered by market researchers to be of great importance in the analysis of varying aggregate consumption patterns:

> " ... consumer demand for broad categories of expenditures (e.g. food, clothing, transport) as well as for specific classes of production (e.g. alcoholic beverages, sport-jackets, motor cycles, etc.) depends in some substantial measure upon population factors such as total population, sex distribution, age levels, geographic distribution, education level, and life style." (1)

Variations of demographic, social, and economic characteristics can occur both within and between metro areas, and the way in which retail sales vary in relation to such characteristics may indeed appear to be obvious. The extent and direction of this relationship, however, depends upon the initial assumption that some element of causation exists between socio-economic composition of the populace and retail sales: the determination of the level of relationship lies in direct measurement of the phenomena involved.

The studies by King, Ray, and Hodge discussed in Chapter One have already assessed the socio-economic structure of Canadian metro areas. In all three cases, however, no distinction was made between variables pertaining to central place structure and those representing socio-economic structure. All variables were treated together in the same data set. Because of this it is not possible to compare aspects within their studies with the retailing structure of Canadian metro areas outlined in the previous Chapter. Rather than repeating Ray's or King's analysis, the present Chapter selects those pertinent variables which can be considered primarily as socio-economic variables and attempts a division of the data into meaningful orthogonal factors.

The hypothesis on which this study is based (p. 10) proposes that demographic, social, and employment conditions within a metro area affect the relative importance of retailing dimensions (Chapter Three) within that metro area. In order to test this hypothetical statement and to provide a means of comparison with indicators used in expositions and application of central place theory (Chapter Five), five groups of variables are selected as being representative of metro area economic and social conditions.

(i) Population characteristics (5 variables)

(ii) Household characteristics (7 variables)

(iii) Income characteristics (5 variables)

(iv) Employment characteristics (11 variables)

1. Data Sources and Collection.

The 1961 Census of Canada published by the Dominion Bureau of Statistics, contains data on population,[2] household,[3] income,[4] and employment[5] characteristics for the forty-five metro areas of the Dominion. The definition of these areas is the same as the one used for data collection in Chapter Three,[6] and the data are subject to similar shortcomings resulting from the process of collection except that of disclosure. Discrepancies within the values published for these characteristics may arise because of sampling error. In addition, the possibility that many people understate their annual incomes, for example, is possibly high, since it is conceivable that there may be fear of income-tax assessment or re-assessment. The reasons for using Census results, however, are the same as those given in Chapter Three: the comprehensiveness and availability of the data.

2. Selection of Socio-Economic Variables.

Since many possible variables could be chosen to represent the characteristics outlined above, a selection of representative variables was made which, though subjective, was an attempt to include variables used in and suggested by other studies.

Population Characteristics

Besides the total population in a centre, Beckman and Davidson[7] suggest that the older and younger segments of the population (variables 5 and 2 respectively in Table 6) place different demands

TABLE 6

DEMOGRAPHIC, ECONOMIC, AND EMPLOYMENT VARIABLES USED IN MATRIX C

Population

1. % Women 15 - 44
2. % Population over 65
3. % Population under 14
4. Males per 100 females
5. Log. total population

Household

6. % Occupied dwellings single detached
7. % Occupied dwellings owner-occupied
8. % Occupied dwellings needing major repair
9. % Occupied dwellings with refrigerator
10. % Occupied dwellings with automobile
11. Log. total number of dwellings
12. Average number of persons per room

Income

13. % Wage-earners earning less than $2,000 per annum
14. % Wage-earners earning $2,000 - $4,000 per annum
15. % Wage-earners earning over $4,000 per annum
16. Log. average earnings of male workers
17. Log. average earnings of female workers

Labour Force

18. % Total labour force female
19. % Total labour force managerial
20. % Total labour force professional
21. % Total labour force clerical
22. % Total labour force sales
23. % Total labour force service and recreation
24. % Total labour force transport
25. % Total labour force primary production
26. % Total labour force manufacturing
27. % Total labour force labourers
28. Females as % of total employed in manufacturing

on the retailing system, since the expenditure by them, or on their behalf, is mainly of consumption rather than durable goods.[8] In studying the socio-economic dimensions of Canadian cities, King[9] found in addition that a dimension of importance in the structuring of Canadian society is the proportion of the population which is female and aged 15-44 (variable 1 in Table 6). Since differing types of demand are expected to result from variation in sex ratios as well as in age structure, the proportion of males to females (variable 4) is added to the above variables in order to isolate the possible importance of male (or female) predominance in metro areas.

Household Characteristics

The state of repair and disrepair of dwellings in a metro area, and the type of ownership involved is considered to be indicative of different levels of economic well-being of the occupiers.[10] The proportion of single-detached dwellings (variable 6) and owner-occupied dwellings (variable 7) in a metro area are used in conjunction with the proportion of dwellings which have a refrigerator (variable 9) and at least one automobile (variable 10) to represent variations in the standard of living. Dwellings needing major repair (variable 8) are included as a measure of the relative decay of the fabric of a metro area, and as a comparison with the assumed levels of affluence shown by variables 6, 7, 9, and 10. The total number of dwellings (variable 11) and the average number of persons

per room (variable 12) in a metro area are taken as a size index and a 'crowding' index respectively.

Income Characteristics

Levels of income are used based on increments of $2,000 (variables 13-15). The percentage distribution of wage-earners between these categories is taken to represent relative spending power in the metro area, and therefore the possibility of different types of demand for different types of store (e.g. consumer goods or luxury goods). The average earnings of male and female employees (variables 16 and 17) are used as indexes of the level of spending power originating in the two sex groups.

Employment Characteristics

Rather than using a single index of employment structure such as an industrial specialisation or industrial concentration index (see Chapter Three), the percentage distribution of the labour force in a metro area between nine types of employment reported in the Census (variables 19-27) is used to portray differing employment patterns. It is suggested that where managerial employees are relatively more predominant than, for example, labourers, a different pattern of retail demand will occur. Similarly, the importance of women in the labour force (variable 18) and in manufacturing industry (variable 29) will bring about differing spending capacities in household patterns of demand.

3. Data Processing.

The data matrix (matrix C in Figure 1) of the values of the above twenty-eight variables (see Appendix D for complete data matrix) was first transformed into percentage or logarithm form (matrix D in Figure 1) and then subjected to a principle components analysis in order to derive a set of factors which would 'summarise' the information of the matrix and provide a set of orthogonal factor scores to be used as independent variables. The resulting factors were then rotated to their varimax position in the same way as the retail structure factors derived in Chapter Three. The correlation matrix between all twenty-eight variables (Table 7) shows that high correlations exist between the variables, and that many patterns of inter-relationships are formed. Certain variables, such as variable 12, do not correlate with any variable, and variables such as variable 8 only correlated with one variable (variable 9).

High inter-correlations are in existence between household variables and income variables as well as between the income variables themselves. Labour force variables tend to correlate either with the number of males per hundred females or with each other.

4. Principle Components Analysis: Results.

From this pattern of inter-correlations five factors are derived which explain 71.3% of the variance of the transformed data matrix (matrix D, B_1 in Figure 1) and which outline underlying demographic-household-employment dimensions of the Canadian metro

TABLE 7.

INTER-CORRELATION MATRIX:
TWENTY-EIGHT SOCIO-ECONOMIC VARIABLES

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1.	% Women 15-44																												
2.	% Population 65+																												
3.	% Population less than 14	0.4	-0.5																										
4.	Males per 100 females																												
5.	Log. total Population																												
6.	% Occupied dwellings single detached		0.5																										
7.	% Occupied dwellings owner-occupied		0.4				0.8																						
8.	% Occupied dwellings needing major repair																												
9.	% Occupied dwellings with refrigerator									-0.4																			
10.	% Occupied dwellings with automobile						0.8	0.6		0.4																			
11.	Log. total number of dwellings					0.9																							
12.	Average no. of persons per room																												
13.	% Wage-earners earning less than $2,000 p.a.				-0.4	-0.4	-0.4			-0.4	-0.5	-0.4																	
14.	% Wage-earners earning $2,000 - $4,000 p.m.					-0.4					-0.5			0.4															
15.	% Wage-earners earning $4,000+				-0.4	0.5	0.4				0.6	0.4		-0.7	-0.7														
16.	Log. average earnings of male workers				0.4	0.6	0.4			0.4	0.7	0.4		-0.7	-0.7	0.9													
17.	Log. average earnings of female workers				0.5	0.4				0.4	0.5	0.5		-0.7		0.6	0.7												
18.	% total labour force female	0.4	-0.4	-0.6											0.4														
19.	% total labour force managerial	0.4																0.4	0.6										
20.	% total labour force professional																												
21.	% total labour force clerical					0.6						0.6					0.4	0.6	0.6	0.6									
22.	% total labour force sales			-0.4															0.5	0.6		0.4							
23.	% total labour force service & recreation																												
24.	% total labour force transport																						0.5						
25.	% total labour force primary production			0.5															-0.5	-0.4									
26.	% total labour force manufacturing																			-0.4	-0.4	-0.5	-0.4	-0.6					
27.	% total labour force labourers																		-0.4										
28.	Females as % total employment in manufacturing			-0.4		-0.4									0.5	-0.4	-0.4											0.6	

TABLE 8

ROTATED SOCIO-ECONOMIC FACTORS (1 - 5)*

Variable		Factor					Communalities (Row Sum of Squares)
		1 (Standard of Living)	2 (Basic vs. Non-Basic Employment)	3 (Relative Poverty)	4 (Size)	5 (Family Formation)	
% Occupied dwellings with automobile	10	0.90	-	-	-	-	0.89
% Occupied dwellings single detached	6	0.86	-	-	-	-	0.83
Log. average earnings of male workers	16	0.82	-	-	0.50	-	0.94
% Occupied dwellings owner-occupied	7	0.74	-	-	-	-	0.62
% Wage-earners $4,000 + per annum	15	0.74	-	0.56	-	-	0.88
% Wage-earners $2,000 - $4,000 per annum	14	-0.70	-	-	-	-0.30	0.68
% Wage-earners less than $2,000 per annum	13	-0.58	-	-	-0.61	-	0.79
% Total labour force managerial	19	-	0.83	-	-	-	0.80
% Total labour force sales	22	-	0.81	0.33	-	-	0.77
% Total labour force female	18	-	0.77	-	-	-	0.90
Males per 100 females	4	0.36	-0.70	0.32	-	-	0.74
% Total labour force clerical	21	-	0.60	-	0.62	-	0.81
% Total labour force manufacturing	26	-	-0.33	-0.68	-0.32	0.40	0.88
Females as % of total employed in manufacturing	28	-0.51	-	-0.74	-	-	0.86
% Occupied dwellings needing major repair	8	-	-	0.71	-	-	0.61
% Occupied dwellings with refrigerator	9	0.39	-	-0.67	-	-	0.64
% Total labour force primary production	25	-	0.56	0.58	-	-	0.68
Log. Total population	5	-	-	-	0.92	-	0.87
Log. Total number of dwellings	11	-	-	-	0.92	-	0.88
Log. average earnings of female workers	17	0.52	-	-	0.63	-	0.86
% Population less than 14	3	-	-	-	-	0.69	0.63
% Women 15 - 44	1	-	0.31	-	-	0.68	0.60
% Total labour force service and recreation	23	-	-	-	-	-0.65	0.52
% Population over 65	2	0.32	-0.49	-	-	-0.53	0.63
Average number of persons per room	12	-0.36	-	-	-	0.31	0.25
% Total labour force professional	20	-	-0.42	-	-	-	0.21
% Total labour force transport	24	-	-0.52	0.51	-	-	0.59
% Total labour force labourers	27	0.32	-	-	-	0.50	0.48
Column Sum of Squares		5.52	4.44	3.23	4.00	2.78	19.84
% Explained Variance		19.74	15.89	11.55	14.26	9.92	71.36
Cumulative % Explained Variance		19.74	35.63	47.18	61.44	71.36	71.36

*Only loadings over 0.30 are shown

areas (Table 8). Each of these factors is more easily distinguishable and more easily described than those derived from retail structure data (Chapter Three) and can be analysed as follows:

Factor 1 (Standard of Living).

This factor outlines areas which have a proportionately larger number of owner-occupied and single-detached households, and where the incidence of car ownership is high. Employees earning more than $4,000 per annum are more prominent than those earning less than $4,000 per annum.

Factor 2 (Basic vs. Non-Basic Employment Patterns).

This factor differentiates between metro areas where managerial, clerical, and sales employment (non-basic) predominates, and those where primary production (basic) employment and a large male population are relatively more important.

Factor 3 (Relative Poverty).

The number of dwellings in need of major repair and the incidence of employment in primary production is contrasted within the structure of Factor 3 with areas where manufacturing employment and the employment of females is more significant. The existence of refrigerators in households is found to be negatively related to the incidence of decayed housing which is in need of repair.

Factor 4 (Size Factor).

This factor extracts the log. of total population and the log. of total number of dwellings as major components, and can be

considered to be a factor reflecting the size of a metro area.

Factor 5 (Family Formation).

Metro areas with a younger population and with a greater preponderance of females of child-bearing age (15 - 44), are differentiated from metro areas which have older populations (where the number of persons over 65 is higher than average) and where employment in service industries is more important.

Factor 1 (Standard of Living) and factor 3 (Relative Poverty) express two aspects of a similar phenomenon which are not necessarily mutually exclusive in a particular place. The former is an absolute measure of affluence in terms of the earnings of employees and the incidence of car ownership: the latter factor, however, is an index of the way in which earned income is turned into the upkeep of the fabric of occupied dwellings. Thus in a peripheral metro area such as Timmins (Ont.) a high standard of living is in evidence (Factor 1), but the metro area is relatively poor judging by the upkeep of its occupied dwellings (Factor 3). Such a metro area has a preponderance of males and of employment in primary production: salaries are high, but the affluence is not used for the renovation of housing stock.

5. Spatial Variation of a Matro Area Socio-Economic Structure.

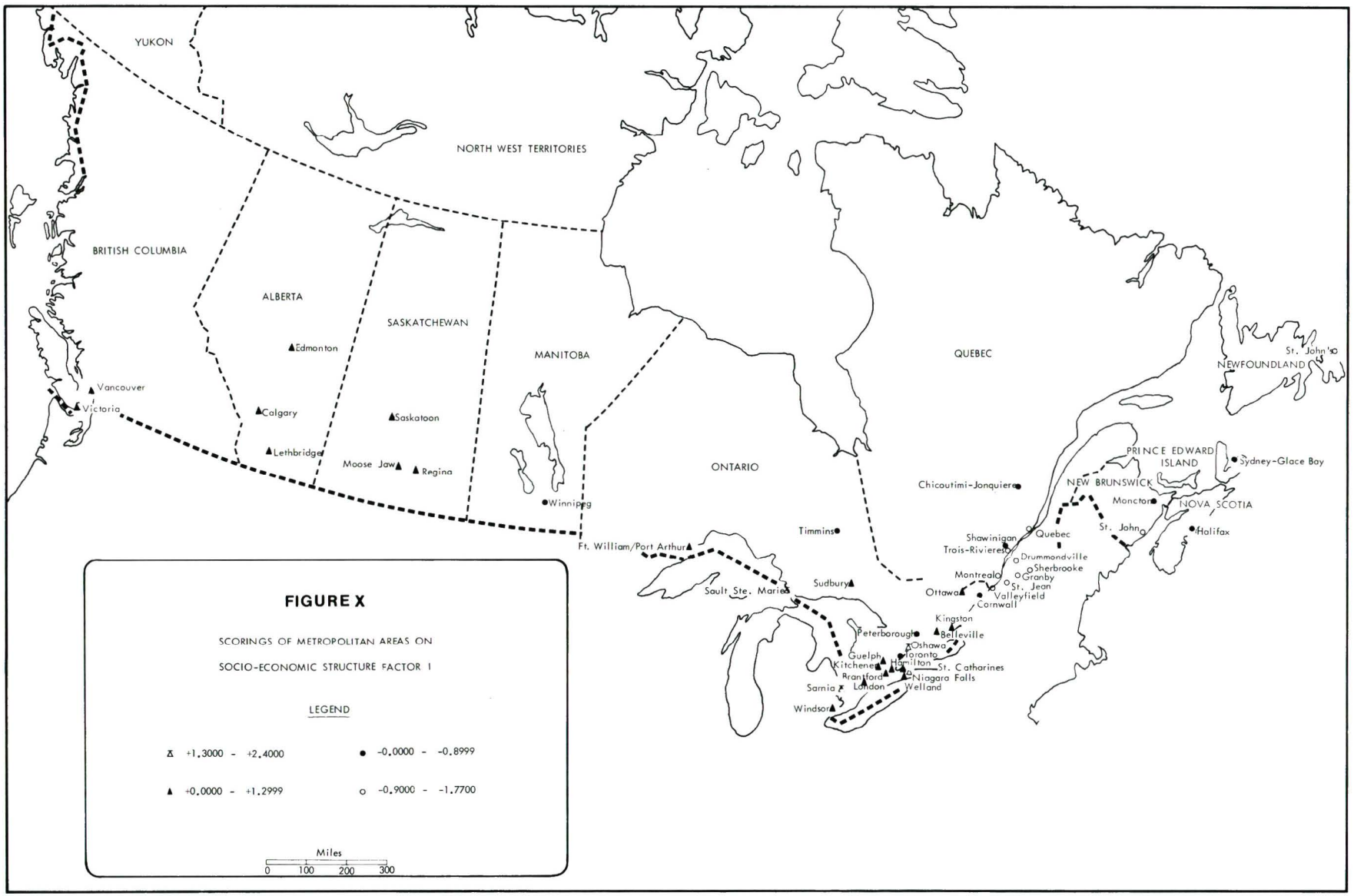
Of the above five factors, only factor 4 (Size) does not fall into distinct regional patterns (Figure XIII). Plotting of the factor scores for all five factors in quartile form yields

distinct spatial patterns for the other four factors.

Factor 1 (Standard of Living) (Figure X) reveals variations in the standard of living across Canada. The metro areas of Ontario score high positively on this factor, whereas those in Quebec and the Atlantic Provinces are consistently in a disadvantageous position (high negative scores). The metro areas of the Western Provinces score positively on Factor 1 (Standard of Living) but not highly: the standard of living in these areas is high, but not to the same extent as it is in Ontario.

Factor 2 (Basic vs. Non-Basic Employment Patterns) (Figure XI) shows that the Northern Ontario metro areas have a labour force which is mainly involved in primary production. The metro areas of the Western Provinces have a greater concentration of their labour force in managerial and sales occupation, which possibly reflect their service functions for the surrounding agricultural and primary industrial areas. Ontario and Quebec metro areas have both low positive and low negative scores, which may result from greater employment specialisation and diversification between metro areas. St. John's (Newfoundland) and Moncton (New Brunswick) have high positive scores, in a similar manner to the metro areas of the Western Provinces, which is a strong contrast with the negative scorings of the other metro areas of the Atlantic Provinces.

Factor 3 (Relative Poverty) (Figure XII) isolates the centres in the Atlantic Provinces, Western Provinces, and Northern Ontario as non-manufacturing areas, whereas in the metro areas of Southern Ontario and Southern Quebec, manufacturing employment is a very


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Timmins
Ft. William/Port Arthur
Sault Ste. Marie
Sudbury
Ottawa
Chicoutimi-Jonquiere
Shawinigan
Trois-Rivieres
Montreal
Drummondville
Sherbrooke
Granby
St. Jean
Valleyfield
Cornwall
Quebec
Monctor
St. John
Halifax
Sydney-Glace Bay
St. John's
Kingston
Belleville
Peterborough
Oshawa
Toronto
Hamilton
St. Catharines
Niagara Falls
Welland
Guelph
Kitchener
Brantford
London
Sarnia
Windsor
FIGURE X
SCORINGS OF METROPOLITAN AREAS ON
SOCIO-ECONOMIC STRUCTURE FACTOR 1
LEGEND
+1.3000 - +2.4000
+0.0000 - +1.2999
-0.0000 - -0.8999
-0.9000 - -1.7700
Miles
0 100 200 300

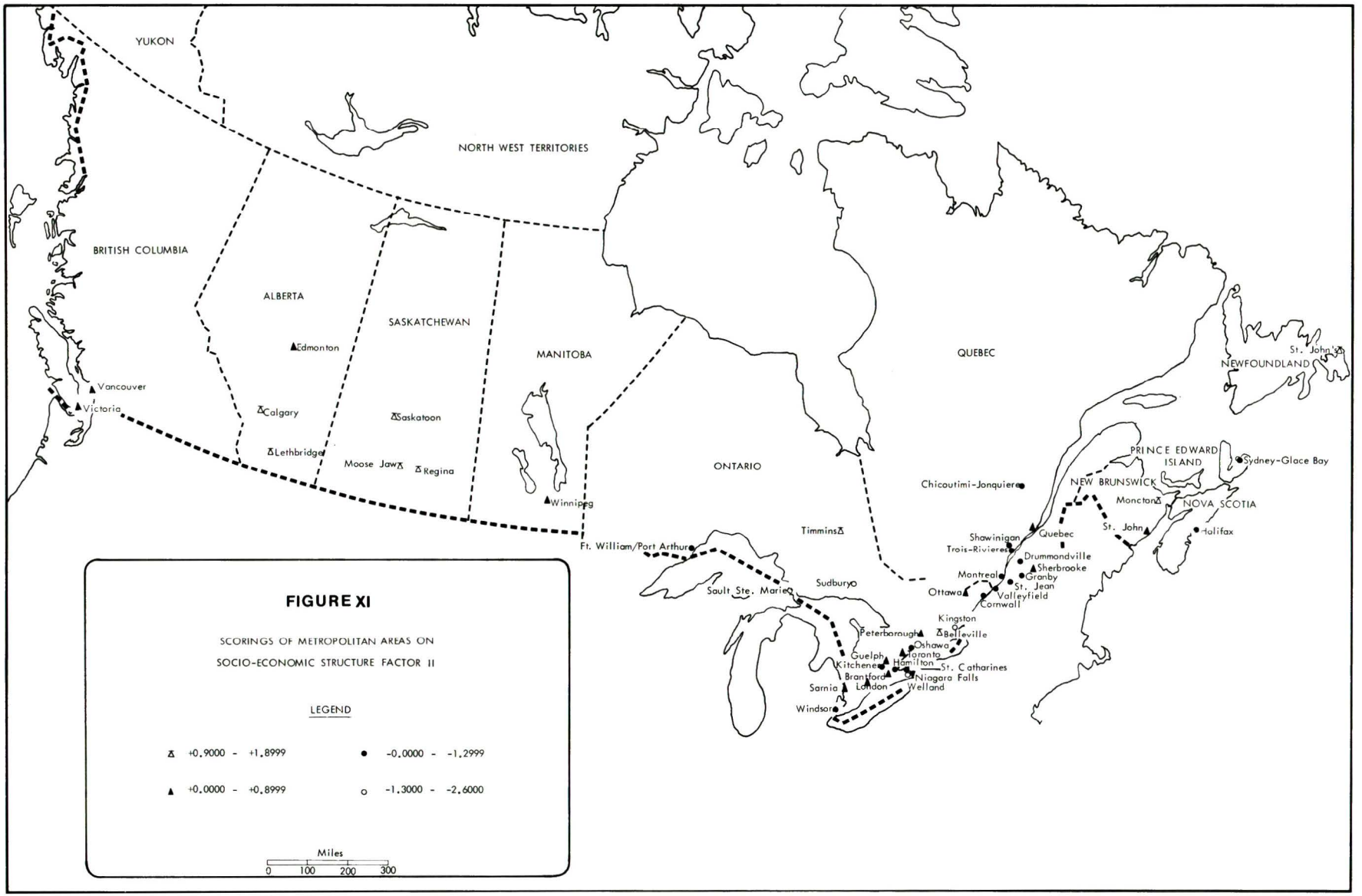


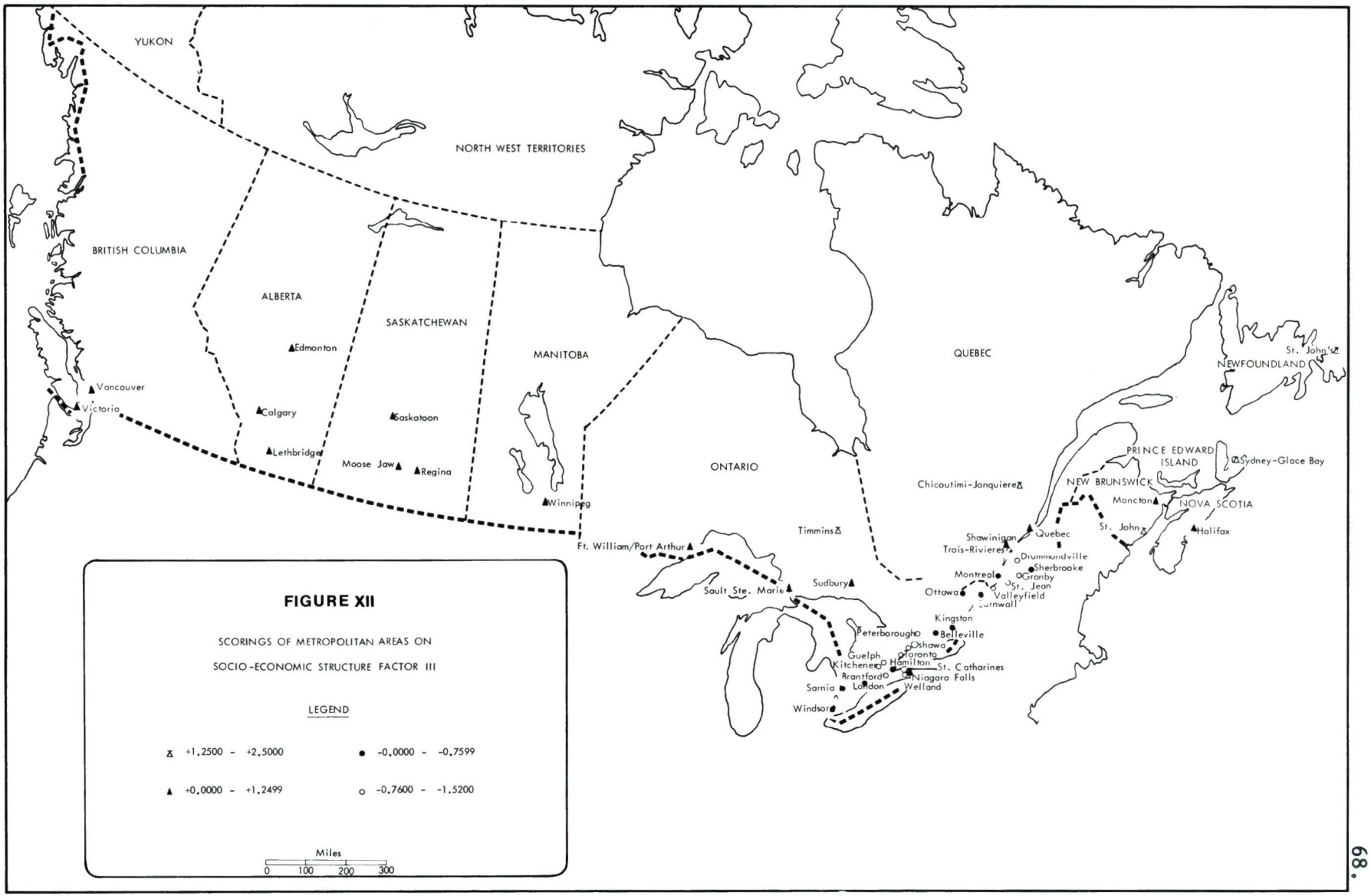
FIGURE XI

SCORINGS OF METROPOLITAN AREAS ON
SOCIO-ECONOMIC STRUCTURE FACTOR II

LEGEND

⧊ +0.9000 - +1.8999	● -0.0000 - -1.2999
▲ +0.0000 - +0.8999	o -1.3000 - -2.6000

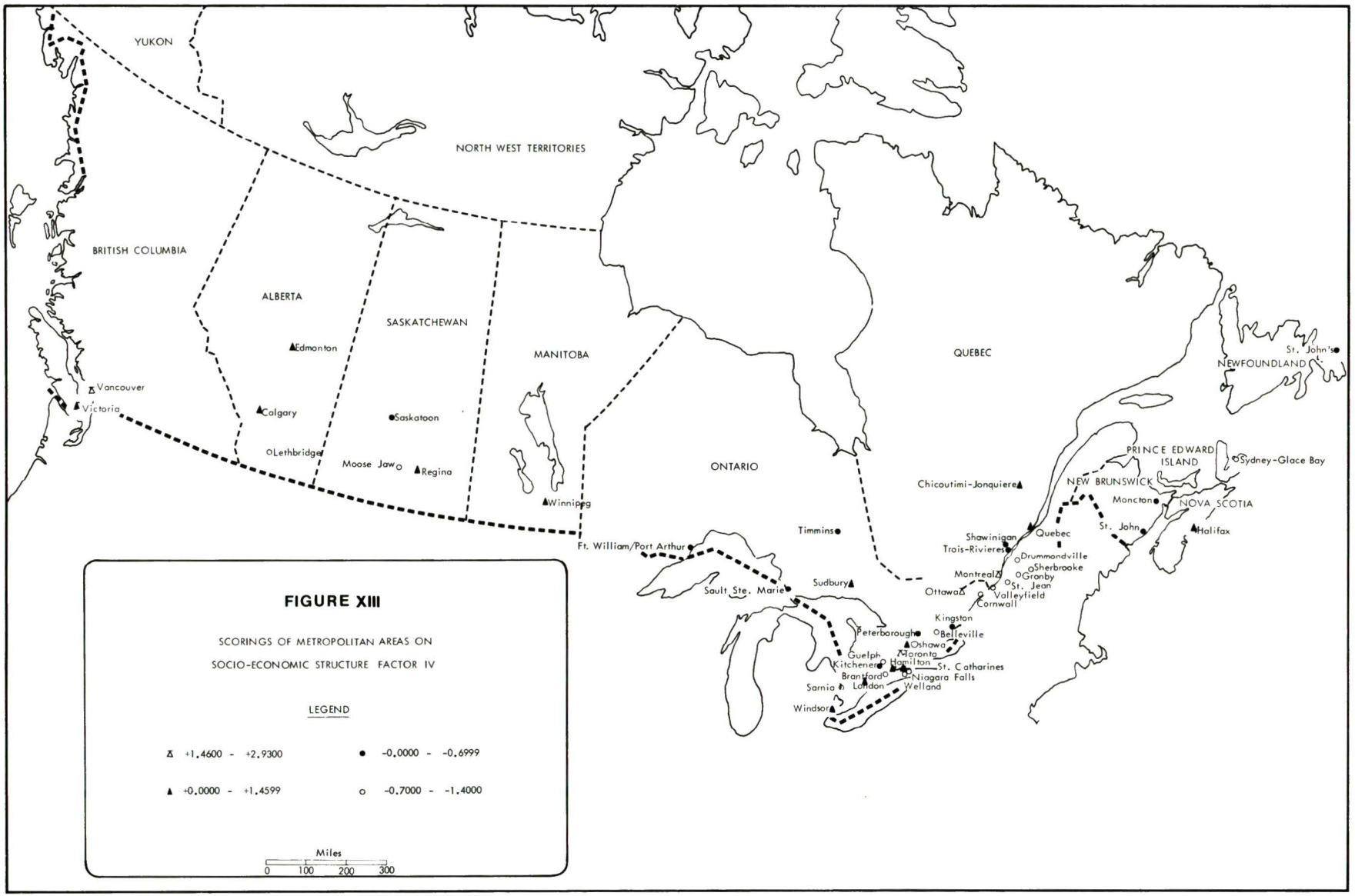
Miles
0 100 200 300

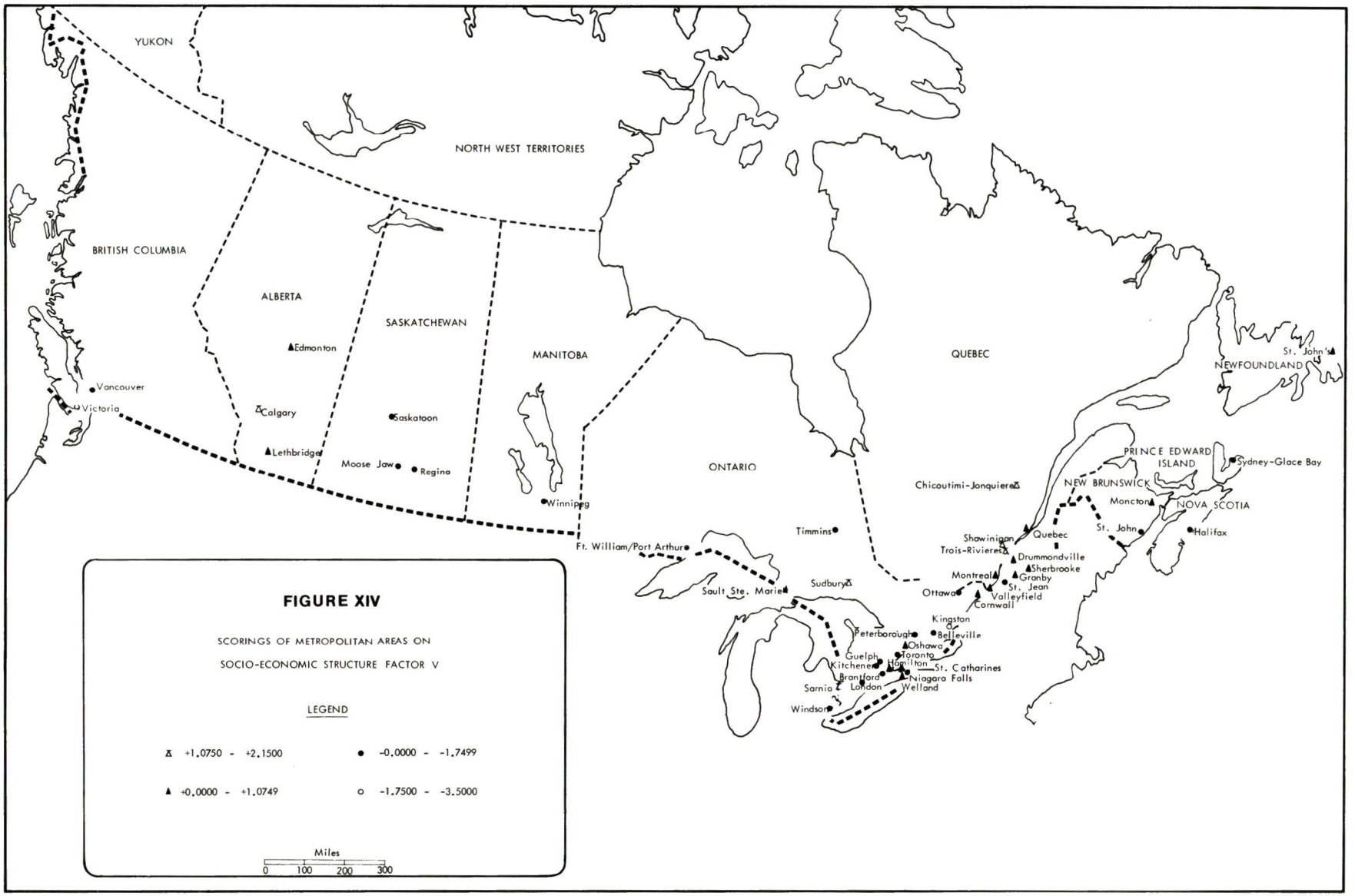

YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Ft. William/Port Arthur
Sault Ste. Marie
Timmins
Sudbury
Chicoutimi-Jonquiere
Shawinigan
Quebec
Trois-Rivieres
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Valleyfield
Cornwall
Ottawa
Kingston
Peterborough
Belleville
Oshawa
Toronto
Guelph
Hamilton
Kitchener
St. Catharines
Brantford
Niagara Falls
Sarnia
London
Welland
Windsor
Moncton
St. John
Halifax
Sydney-Glace Bay
St. John's
FIGURE XII
SCORINGS OF METROPOLITAN AREAS ON
SOCIO-ECONOMIC STRUCTURE FACTOR III
LEGEND
+1.2500 - +2.5000
+0.0000 - +1.2499
-0.0000 - -0.7599
-0.7600 - -1.5200
Miles
0 100 200 300

important employment dimension. Because of the formation of this factor, the incidence of declining housing property (households needing major repair and/or lacking a refrigerator) is higher in the former areas. Northern Ontario and the Atlantic Provinces are easier to fit into this description of decline than are the Western Provinces, since these latter tend to score higher on the standard of living factor (factor 1, Standard of Living). It is suggested that in these cases (especially the Prairie Provinces) standard of living of inhabitants is not necessarily related to the way in which they keep the exterior of the dwellings in which they live.

As has been mentioned previously, the formation of distinct regional groupings based on the size factor (factor 4) (Figure XIII) is not possible. Montreal, Toronto, Vancouver and Ottawa are isolated as having the highest scores on this factor, and thus the results represent a cross-Canada hierarchical system rather than a differentiation between sets of dissimilar or similar metro areas.

Regional groupings formed by factor 5 (Family Formation) are also tenuous (Figure XIV). Metro areas such as Victoria and Kingston (Ontario) are isolated as having older populations, whereas the towns of Alberta and Northern Quebec have significantly younger populations and a greater proportion of women of child-bearing age. Metro areas of Southern Ontario and Southern Quebec have low positive and low negative scores which are evenly distributed around (0) value.


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Ft. William/Port Arthur
Timmins
Sudbury
Sault Ste. Marie
Chicoutimi-Jonquiere
Shawinigan
Trois-Rivieres
Quebec
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Valleyfield
Ottawa
Cornwall
Kingston
Peterborough
Belleville
Oshawa
Toronto
Guelph
Kitchener
Hamilton
St. Catharines
Brantford
Niagara Falls
Sarnia
London
Welland
Windsor
Moncton
St. John
Halifax
Sydney-Glace Bay
St. John's
FIGURE XIII
SCORINGS OF METROPOLITAN AREAS ON
SOCIO-ECONOMIC STRUCTURE FACTOR IV
LEGEND
+1.4600 - +2.9300
+0.0000 - +1.4599
-0.0000 - -0.6999
-0.7000 - -1.4000
Miles
0 100 200 300


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Timmins
Ft. William/Port Arthur
Sault Ste. Marie
Sudbury
Chicoutimi-Jonquiere
Shawinigan
Trois-Rivieres
Quebec
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Ottawa
Valleyfield
Cornwall
Kingston
Peterborough
Belleville
Oshawa
Toronto
Guelph
Kitchener
Hamilton
St. Catharines
Brantford
Niagara Falls
Sarnia
London
Welland
Windsor
Moncton
St. John
Halifax
Sydney-Glace Bay
St. John's
FIGURE XIV
SCORINGS OF METROPOLITAN AREAS ON
SOCIO-ECONOMIC STRUCTURE FACTOR V
LEGEND
+1.0750 - +2.1500
+0.0000 - +1.0749
-0.0000 - -1.7499
-1.7500 - -3.5000
Miles
0 100 200 300

6. Toward Comparison.

Visual comparison of all the above spatial groupings with those found for the two most significant retail structure factors (Chapter Three) suggests that absolute size of a metro area may not be of importance to the way in which the retailing economy of that metro area is structured. This fact was suggested in the hypothesis (p. 10) , but in order to assess more precisely the relative importance of:

(i) the socio-economic factors discussed in this Chapter and

(ii) the factors derived from selected central place variables,

the following Chapter (Chapter Five) analyses selected Central place variables which are used in a principle components analysis. The results of this components analysis can then be compared with socio-economic factors to see which set of factors can more adequately predict the retail structure of Canadian metro areas.

Footnotes.

1. T.N. Beckman, W.R. Davidson, Marketing (New York: Ronald Press, Co., 1962), p. 118.

2. Government of Canada, Dominion Bureau of Statistics, Census of Population, 1961 (Ottawa, Ontario: Queen's Printer, 1961), Vol. 1.

3. Ibid., Vol. 2.2.

4. Ibid., Vol. 3.3, Tables 11, 12, 13.

5. Ibid., Vol. 3.3, Table 27.

6. Ibid., Vol. 6.1, Introduction.

7. T.N. Beckman, W.R. Davidson, op. cit., Chapter 5, "The Ultimate Consumer Market: Demographic Factors", pp. 118-130.

8. Ibid., pp. 123-124.

9. L.J. King, "Cross-sectional Analysis of Canadian Urban Dimensions," Canadian Geographer, Vol. X, 4 (1966), p. 210.

10. T.T. Semon, "Family Income and Spending Capacity," Journal of Marketing, Vol. 26, 2 (1962), pp. 26-30.

CHAPTER FIVE

THE CENTRAL PLACE STRUCTURE OF CANADIAN METROPOLITAN AREAS

The Metropolitan areas of a nation can be divided into a hierarchical system based on the number of facilities and services provided by each centre.[1] Each level of such a hierarchy contains all the facilities of every lower level, plus facilities specific to itself.[2] Thus centres such as Montreal or Toronto although providing specific national functions, also include all the facilities of smaller metro areas such as Kitchener. The manner in which one level of the hierarchy is related to the other in a 'nesting system' of central places is the main concern of classical central place theory.[3] The level of each centre is defined according to its provision of facilities,[4] and its level in the partly national, partly regional hierarchy is found by cross-national comparison of metro area retail facilities.[5]

In discussing 'systematic variations' of such a hierarchical system, Berry[6] deals with several indexes in order to construct a hierarchy of centres.[7] Population of a centre, trade area of a centre, number of functions and/or number of establishments within the centre, are all used in different combinations to distinguish between hamlets, villages, towns, and cities.[8] A hamlet, for example, has a very small population, few establishments, and even fewer different types of functions. Because each index deals with

absolute size of a centre, whether in terms of population or some aspect of retail trade, a close correlation between all such sets of numbers is to be expected: each data set has a similar degree and direction of variance. The number of establishments or business types in a centre have been used in an attempt both to form a hierarchical system of centres and to show the linkages and interactions between centres. The indexes themselves, however, only convey a notion of the size of individual centres rather than inter-linkage patterns between them: in a similar manner such an index of size does not necessarily compare with the structure of the retailing sector of a centre.

1. Selection of Central Place Variables.

The hypothesis (p. 10) suggested that gross indexes which are representative of the size of a central place, such as those discussed above, would be less effective than an analysis of the socio-economic structure of the metro areas in determining the structuring of the retail service sector of the same metro areas. In relating to central place principles, this study isolates six indexes which measure both the size, market potential, and trade area of each metro area (see Appendix F for complete data set):

(i) Population of the metro area

(ii) Gross retail sales in the metro area (based on derived total found in Chapter Three)

(iii) Total household income of the metro area

(iv) Number of central retail functions

(v) Market potential of the metro area

(vi) Index of the porportion of Provincial sales which take place in a particular metro area.

Indexes (i) - (iii) show the absolute size of a centre in three different ways. Population reflects the size of the consumer market, income the possible spending power of the population, and total sales the actual amount of transactions. The number of functions (iv) is one method of approximating the level of a centre within a hierarchy,[9] and the market potential index (v) relates probable expenditure patterns and income patterns to the relative isolation of a centre from its surrounding trade areas.[10] The market potential index, as used by Harris and Ray, is a form of 'gravity model' which expresses the probability of expenditure in any one centre by consumers from all other centres. Interaction between centres is taken as being directly proportional to the income of a centre where the consumers are located, and inversely proportional to the distance between this centre and all other centres. The index of market potential therefore reflects the spatial distribution of centres across Canada and differentiates between the closely-knit urban system of Southern Ontario and isolated metro areas such as Winnipeg (Man.), Edmonton (Alta.) or St. John's (Newfoundland).

The metro area does not necessarily correspond to the trade area of the centre of the built-up (urbanised) area, and although in terms of this study the metro area is the only available data base which is comparable across Canada, an index of Provincial sales

is used to simulate the Provincial importance of the retail sales of a centre. The proportion of retail sales per capita in the centre to retail sales per capita in the Province to which it belongs is used for this index. If a centre has an index (100), then its influence is not outstanding in the Province, but where the index is greater than (100) the centre is taken as having a greater proportional influence.

An alternative index expressing the sales in a metro area per unit of income in that metro area as a proportion of Provincial sales per unit of Provincial income, would relate the Provincial importance of a centre not to population, but to income patterns within the Province. Since the market potential index uses income as a weighting factor, sales per capita are used in the index of Provincial importance rather than sales per unit of income (See Appendix E).

2. Principle Components Analysis of Data: Results.

Comparison of the values of the above six indexes for all the forty-five metro areas of Canada shows that there is a high degree of inter-correlation between the variables denoting size (population, sales, income), as can be seen in Table 9. The remaining three variables (number of functions, market potential, and index of Provincial sales) show low correlations with the first three and, excepting the correlation between number of functions and Provincial sales index (r = 0.769) low inter-correlations with each other.

TABLE 9

CORRELATION MATRIX:
SELECTED CENTRAL PLACE
VARIABLES FOR 45 CANADIAN
METROPOLITAN AREAS

	Population	Sales	Income	No. of Retail Functions	Index of Market Potential	Index of Provincial Sales
Population	X					
Sales	0.994	X				
Income	0.994	0.998	X			
No. of Retail Functions	0.652	0.649	0.644	X		
Index of Market Potential	0.077	0.064	0.085	-0.194	X	
Index of Provincial Sales	-0.521	-0.519	-0.524	-0.760	-0.195	X

In order to reduce the six variables to a set of uncorrelated components, they were subjected to a principle components analysis in the same way as the data sets in Chapters Three and Four. After the critical value of the eigenvalue is controlled to 0.9, so that all the variables are included in the factors, two distinctive factors emerge (Table 10). The high correlations between population, sales, and income (Table 9) are represented in factor (a) by the high loadings of these variables on the factor, and the lower positive correlation between the market potential index and the size indexes is highlighted as a positive loading on factor (a). By itself factor (a) explains 72.3% of the variance of the six original variables, and factor (b) only 6.6% of the variance. This latter factor, however, focuses on the single variable Index of Provincial Sales. The only other variable to figure within factor (b) is the market potential index. Thus factor (a) (Size) and factor (b) (Provincial Importance) in combination suggest two different types of central place variable, the first representative of the absolute size of a centre and the second representative of the relative importance of a centre within its Province. Factor (a) (Size) parallels the conventional size variables used in classical central place theory as indicators of the position of a centre within the national hierarchy of centres. Factor (b) (Provincial Importance) introduces the effect of the distribution of centres in a Province and their trading influence on the rest of the Province.

TABLE 10

ROTATED CENTRAL PLACE FACTORS (a and b)*

Variable	Factor		Communalities (Row Sum of Squares)
	(a) (Size)	(b) (Provincial Importance)	
Population	0.97		0.94
Functions	0.93		0.88
Sales	0.98		0.96
Income	0.97		0.97
Index of Market Potential	0.98		0.97
Index of Provincial Sales	0.23	-0.74	0.60
Column Sum of Squares	4.34	0.98	5.31
% Explained Variance	72.30	16.60	88.90
Cumulative % Explained Variance	72.30	88.90	88.90

*Only loadings over 0.20 are shown.

The size factor (factor (a)) is similar in meaning to the 'Metropolitan Centers' factor derived by Ray in his analysis of the 'Factorial Ecology of Canada'. The Provincial Importance factor (factor (b)), however, does not relate to any of the findings of previous studies, and it is used in this study as an index of the different trade area patterns of Canadian metro areas.

The factor scores of these two orthogonal factors are used as two completely new variables (C_5 in Figure 1), which replace the transformed central place variables: they act as an input to the regression analysis used in the following Chapter (Chapter Six) to compare central place factors and socio-economic factor as predictors of metro area retail structure.

Footnotes.

1. B.J.L. Berry, and W.L. Garrison, "The Functional Bases of the Central Place Hierarchy," Economic Geography, Vol. 34 (1958), pp. 145-154.

2. H. Carol, "The Hierarchy of Central Place Functions within the City," Annals of the Association of American Geographers, Vol. L (1960), pp. 419-438.

3. B.J.L. Berry, Geography of Market Centers and Retail Distribution (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967), pp. 59-73.

4. Ibid., p. 37.

5. Ibid., pp. 89-105.

6. Ibid., pp. 26-58.

7. Ibid.

8. Ibid., p. 44.

9. Ibid., p. 39.

10. C.D. Harris, "The Market as a Factor in the Localization of Industry in the United States," Annals of the Association of American Geographers, Vol. 44 (1954), pp. 315-348.

    The source of values used in the study is:
    D.M. Ray, "The Spatial Structure of Economic and Cultural Differences: A Factorial Ecology of Canada," Papers and Proceedings of the Regional Science Association, Vol. XXIII (1969), Figure 2, p. 11.

CHAPTER SIX

CENTRAL PLACE FACTORS AND SOCIO-ECONOMIC FACTORS AS PREDICTORS OF METROPOLITAN AREA RETAIL STRUCTURE

The analysis of the three previous Chapters (Chapters Three, Four, and Five) has resulted in three different groups of factors and three sets of factor scores showing the importance of each factor in the forty-five metro areas of Canada. The principle components analysis used to derive these factor scores has for one of its controlling criteria the requirement that factors derived from the same data matrix be completely uncorrelated. Thus the retail structure factors are uncorrelated with each other, the socio-economic factors are uncorrelated with each other, and the central place factors are likewise uncorrelated. The following analysis, however, relates these three groups of factors to each other to assess the effectiveness of the two latter sets (socio-economic factors and central place factors) in predicting the former set (retail structure factors).

1. Simple Correlation Patterns.

Between the three sets of factor scores there are varying levels of correlation as is shown in Table 11. Three sections of this table are of interest:

(i) Section I shows the relationship between retail structure factors I (Central Functions) and II (Specialist Functions) and the five socio-economic factors;

TABLE 11

CORRELATION MATRIX:
RETAIL STRUCTURE, SOCIO-ECONOMIC,
AND CENTRAL PLACE FACTORS

Retail Structure Factor I (Central Functions)	1.000								
Retail Structure Factor II (Specialist Functions)	-	1.000							
Socio-economic Factor 1 (Standard of Living)	-0.121	0.544	1.000						
Socio-economic Factor 2 (Basic vs. Non-Basic Employment)	0.521	-0.134	-	1.000					
Socio-economic Factor 3 (Relative Poverty)	-0.405	-0.451	-	-	1.000				
Socio-economic Factor 4 (Size)	-0.211	0.224	-	-	-	1.000			
Socio-economic Factor 5 (Family Formation)	0.334	-0.308	-	-	-	-	1.000		
Central Place Factor (a) (Size)	-0.401	0.312	0.039	0.233	-0.071	0.907	-0.108	1.000	
Central Place Factor (b) (Provincial Importance)	-0.505	-0.313	-0.234	0.532	0.368	-0.085	-0.197	-	1.000

(ii) Section II shows the relationship between the two retail structure factors and the two central place factors;

(iii) Section III shows how the socio-economic and central place factors are inter-correlated.

The comparison of sections I and II of Table 11 constitutes the test of the hypothesis on which the study is based, and the individual values in these two sections show how individual socio-economic and central place factors predict the two retail structure factors I and II (Central Functions and Specialist Functions).

2. Central Place Factors as Predictors of Metro Area Retail Structure Factors.

From Table 11 it can be seen that the Provincial Importance factor (factor (b)) correlates more highly with retail structure factor I (Central Functions) ($r = -0.505$) than does the Size factor (factor (a)) ($r = -0.401$). This suggests that department store dominance is related more to the level of importance of the particular centre in the trading patterns of its Province than to the size of the centre in terms of population, income, sales, and the number of retail functions present. Thus a metro area such as Winnipeg is dominated by department stores (see Chapter Three), but this is found to be related not to the size of Winnipeg's population or income but more to the fact that Winnipeg dominates the trading of Manitoba as judged on a per capita sales basis (i.e. Winnipeg scores highly on central place factor (b) (Provincial Importance)). Department store dominance which, as Chapter Three

pointed out, is more prevalent in the Prairie and Western Provinces seems to stem from the relative isolation of the individual metro areas in the West. Edmonton, Calgary, Moose Jaw, Regina, etc. all cater for a widespread rural population and thus tend to dominate the trading patterns of their respective Provinces. The fact that department stores cater for this trade in a prominent way may arise either from the conscious decision of Eaton's, Hudson's Bay Company, Sears, etc. to locate in the metro areas or from the extensive use of department store mail order sections located in these metro areas by consumers from outlying areas.

3. Socio-Economic Factors as Predictors of Metro Area Retail Structure Factors.

The regression of the five sets of socio-economic factor scores (Chapter Four) against the two sets of retail structure factor scores (Chapter Three) yields the correlation results shown in section I of Table 11. The socio-economic factor representative of Size (factor 4) has very low correlations with retail structure factor I (Central Functions) ($r = 0.211$) and retail structure factor II (Specialist Functions) ($r = 0.224$). Since this size factor correlates highly with factor (b) (Size) of the central place factors ($r = 0.907$) it is not surprising that it has similar relationships with the two retail structure factors. Socio-economic factor 3 (Relative Poverty) correlates highly, but

negatively with the two retail structure factors (r = -0.405 and r = -0.451 respectively) suggesting that there is a positive statistical relationship between the level of affluence in a centre and the dominance of department stores (retail structure factor I) and an inverse relationship with Specialist Functions (retail structure factor II).

The absolute level of the standard of living in a metro area, however (socio-economic factor 1) is highly related to the provision of Specialist Functions (retail structure factor II, r = 0.544). This relationship is in direct contrast to the Relative Poverty factor (socio-economic factor 3) which is associated more with the provision of 'local' facilities.

Retail structure factor I (Central Functions) is more closely related to areas where primary employment predominates in the metro area (e.g. Sudbury, Ont.) than to metro areas (such as those in the Prairie Provinces) where managerial and clerical employment is more important.

When all the above relationships are taken in conjunction and the multiple correlation coefficient is computed based on the simple correlations (see Table 12), the two retail structure factors are found to have multiple correlations with all the socio-economic factors of (0.75) for Central Functions and (0.79) for Specialist Functions . Thus in the case of both retail factors the use of all socio-economic factors as predictors gives better results than the use of individual factors as predictors. This suggests that the aspects of retail structure summarised by retail

TABLE 12

CORRELATION MATRIX:
RETAIL STRUCTURE FACTORS (I and II)
vs. SOCIO-ECONOMIC FACTORS (1 - 5)
AND CENTRAL PLACE FACTORS (a and b)

Predictor Variable	Retail Structure Factor	
	I (Central Functions)	II (Specialist Functions)
1. Socio-Economic Factors		
1. (Standard of Living)	-0.121	0.544
2. (Basic vs. Non-Basic Employment)	-0.521	0.134
3. (Relative Poverty)	-0.405	-0.451
4. (Size)	-0.211	0.224
5. (Family Formation)	0.334	-0.308
Multiple R	0.755	0.794
2. Central Place Factors		
a. (Size)	-0.401	0.312
b. (Provincial Importance)	-0.505	-0.313
Multiple R	0.636	0.420
Multiple R, all Predictor Variables	0.792	0.801

structure factors I and II (Central Functions, and Specialist Functions) is best explained not simply by one aspect of the socio-economic structure of a metro area, but by the entire socio-economic structure.

4. Test of the Hypothesis.

The test of the hypothesis presented in the Introduction (Chapter One):

> 'That the differing retail structure of the metropolitan areas and major urban areas (over 30,000 population) of Canada, although greatly affected by the size of population of the centre and the position of this centre in the central place hierarchy, is substantially further affected by other socio-economic, demographic, and employment conditions in the metro area.'

lies in the comparison of sections I and II of Table 11 as noted previously (the values involved are synthesized in Table 12 in a more compact form).

Comparison of the results in Table 11 shows that in the case of both retail structure Factors I and II, the socio-economic factors give higher individual correlation coefficients than the central place factors. In neither instance is absolute size of centre (factor (a) and factor 4 in Table 11) more important than other factors. Those factors which are indicative of the function of a place rather than its size are more useful predictors of retail structure.

The difference between the multiple R's for retail structure factors I and II resulting from the regression of socio-economic

factors and central place factors is not great (Table 12). In the case of retail structure factor I, the multiple R with socio-economic factors (R = 0.755) is only slightly higher than the multiple R with central place factors (R = 0.636). In the case of retail structure factor II, the difference is greater: the multiple R using socio-economic factors is (R = 0.794) whereas using the central place factors it is (R = 0.420).

The statement contained in the hypothesis quoted above, 'that the differing stucture of metropolitan areas ... in Canada ... is further affected by other socio-economic, demographic, and employment conditions within that metropolitan area' is substantiated by the above results. Gross indexes of size are shown to be relatively unimportant in affecting the structure of retailing in a metro area: this structure is affected more by patterns of household and employment composition. When both central place factors and socio-economic factors are used together as predictors of retail structure, the multiple R's resulting are (R = 0.792) for retail structure factor I, and (R = 0.801) for retail structure factor II. Since these values are very little higher than the multiple R's using only socio-economic factors (0.755 and 0.794 respectively), the two sets of independent variables (socio-economic factors and central place factors) are dealing with similar amounts of variance in the dependent variable (retail structure factors). Little information is therefore added by using factors (a) and (b) in conjunction with factors (1 - 5).

An imbalance exists between the two data sets: in the case

of the central place factors five original variables were used to derive two factors, whereas in the case of the socio-economic factors twenty-eight original variables were used to derive a total of five factors. Although the variables traditionally included in central place studies were included in this analysis, the inclusion of more variables in the formation of the central place factors would possibly alter the levels of prediction found. In order to overcome this imbalance to a certain extent, all the correlation values presented in this Chapter are corrected correlation values.

5. Conclusion.

The hypothesis constructed in Chapter One outlined the specific relationships between metro area retail structure, socio-economic structure, and central place structure to be tested by this study. Later discussion (Chapter Three) of the regional patterns of retail structure in the metro areas suggested intuitively that the differences found were more a reflection of the socio-economic structure of these areas than of their central place structure. The findings portrayed in this Chapter confirm this intuitive reasoning by defining the exact levels of the relationships in existence. On the basis of the evidence given, the postulation of relationships forwarded in Chapter Three and the relationships suggested by the hypothesis in Chapter One have been shown to be correct.

CHAPTER SEVEN

SUMMARY AND CONCLUSIONS

Conclusions based on this study are of two kinds: specific conclusions derived from the analysis of retail sales, socio-economic, and central place data, and the test of the hypothesis, and general conclusions regarding the study as a whole. Although the concluding section of each of the preceding Chapters presents a synopsis of the findings and conclusions presented in the Chapter, the following discussion is an attempt to bring together and synthesise these conclusions. The first three of the following sections refer to the three major questions based on the hypothesis (p. 10), and the final section comments on the study as a whole.

1. Retail Structure (Chapter Three).

The retail structure of Canadian metro areas varies in a regular and predictable way from the east coast to the west coast: this is the major conclusion arrived at in Chapter Three. Beginning in the Atlantic Provinces and moving through Quebec and Ontario it is found that there are definite regional groupings of metro areas according to their retail structure. The centres in the Western Provinces are found to be more similar to those in the Atlantic Provinces than they are to centres in Ontario and Quebec. Thus the sprectrum of metro areas found in the analysis is a circular one: east meets west.

The following methods were used to arrive at this conclusion. A hundred and two Census categories of retail establishments were reduced to twenty-five and the blank cells in the resulting matrix of retail sales were predicted on a per capita basis. The completed data matrix was subjected to a principle components analysis which resulted in five retail structure factors. Only factor I (Central Functions) and factor II (Specialist Functions) proved to be decipherable.

Factor I (Central Functions) differentiates between metro areas where men's and boy's wear, shoe stores, and combination stores are dominant, and metro areas where department stores are dominant. Factor II (Specialist Functions) outlines metro areas where specialist functions such as jewellers and florists are more important in the retail structure, and contrasts them with metro areas where local stores (such as grocery stores) predominate.

Individually these two factors reflect differing common elements in the retail structure of Canadian metro areas: department store dominance (negative form of factor I) is more typical of the metro areas of the Prairie and Western Provinces (Figure VI), whereas factor II (Specialist Functions) shows a distinct regional concentration in Southern Ontario (Figure VII).

Both factors together explain only 28.8% of the variance of the original data, and as Chapter Three points out, this may result from the fact that there are only a few basic patterns in the retail sales statistics.

When both factors are analysed in conjunction (Figure VIII), it is found that there is a definite and regular cross-Canada variation in metro area retail structure. Department store dominance is prevalent in the western and eastern metro areas, whereas a predominance of central functions and specialist functions is typical of Ontario. Quebec and Western Ontario act as transition zones between these regions. It is postulated in Chapter Three that the regional variation in metro area retail structure reflects differences in socio-economic structure of the metro areas and is not clearly related to their size. This proposition is analysed in depth in later Chapters.

A different set of retail categories would have led to a different set of results from the principle components analysis. Thus, if the Census differentiated between stores on the basis of the method of marketing which they used, then more decipherable factors may have resulted, and more specific conclusions than those contained in Chapter Three could have been made.

The initial problems in analysing retail structure on a macro scale are therefore the way in which the data are categorized, and the basis on which this categorisation is made. The ideal would be to have a set of retail categories tailored to this particular study, but the application of these categories on a cross-Canada scale would be impossible. The Dominion Bureau of Statistics returns are the only source of data reported on the national level, but the form of the data reported in the Census constitutes one of the major problems encountered in this study. Fuller reporting

based on marketing method categories, instead of a hierarchy of stores defined by their type of merchandise, would have obviated the processes needed to clarify the results of Chapter Three.

2. Socio-Economic Structure (Chapter Four).

As the previous section pointed out, blank cells in the retail sales data matrix had to be projected in order to make the data compatible. This problem, however, does not occur in the case of socio-economic variables used in Chapter Four. The Census returns are complete and varied enough to make possible the extraction of relevant variables. The choice of many of the twenty-eight demographic, household, income, and employment variables used in Chapter Four was on the basis of previous micro studies in retailing and metro area social structure. The five factors resulting from the principle components analysis are more easily named and explained than those found in Chapter Three. Factor 1 (Standard of Living), factor 2 (Basic vs. Non-Basic Employment), factor 3 (Relative Poverty), factor 4 (Size), and factor 5 (Family Formation) together explain 71.36% of the variance of the original data.

Although this analysis parallels those of Hodge, King, and Ray discussed in Chapter One, the initial choice of variables is different, and thus the resulting factors are also different. Factors 1 (Standard of Living) and 3 (Relative Poverty) represent respectively the absolute standard of living of the metro areas and a poverty which is indicated by the life-style of the metro areas. This latter factor is relative in the sense that it only portrays an actual poverty of households if it is coupled with

factor 1. Although the standard of living factor (1) is comparable with those found by King, the relative standard of living factor (3) sheds a different light on the measurement of life-style: rather than being based on the level of income (as is factor 1), factor 3 is based more on the state of repair of the occupied houses of the metro area and the predominant occupations of the wage-earners in the area.

All factors except the Size factor (4) show distinct regional patterns: factor 1 (Standard of Living) is more representative of Southern Ontario, factor 2 (Basic vs. Non-Basic Employment) predominates in Northern Ontario, factor 3 (Relative Poverty) is concentrated in the Atlantic and Western Provinces, and factor 5 (Family Formation) predominates in Southern Ontario and Southern Quebec. The size factor (factor 4) is comparable to the size factor found in the analysis of central place variables ($r = 0.907$) and thus all five socio-economic factors in combination reflect not only the social structuring, similarities, and difference between metro areas, but also their relative importance in terms of size.

3. Central Place Structure (Chapter Five).

The size variables chosen to represent central place structure are those most frequently used in the analysis of systems of central places. The index of market potential indicates the accessibility of the centre to all other centres, the index of provincial sales shows the importance of a metro area in the retail trade of its Province. The remaining variables are measures of the absolute size of a centre based on the total population, gross retail sales,

and total household income. The result of a principle components analysis applied to this data is a set of two factors: factor (a) (Size) and factor (b) (Provincial Importance). The former factor combines all the size factors, as would be expected, together with the index of market potential. The latter factor, however, is more a relative index of the importance of a centre and is seldom considered to be of importance in the analysis of central place systems. In the case of Canada, however, there is obviously a great difference between metro areas such as Calgary (Alta.) and Edmonton (Alta.) which cater for wider areas of the Prairies, and centres such as London (Ontario) and Hamilton (Ontario) which form part of the closely-knit system of metro areas in Southern Ontario. Factor (b) (Provincial Importance) therefore reflects the relative influence of a centre in its Province and its isolation from surrounding market areas.

4. Test of the Hypothesis (Chapter Six).

The regression analysis used in Chapter Six tested the differing abilities of the two central place factors and the five socio-economic factors in predicting the retail structure of Canadian metro areas as represented by the two retail structure factors. This analysis showed that in all instances the socio-economic factors resulted in higher correlation coefficients with the retail structure factors than did those factors representative of central place characteristics. A certain amount of correlation exists between the central place and socio-economic factors. Thus in the

case of retail structure factor 1 (Central Functions) both socio-economic and central place factors are comparable in their predictive abilities and in their patterns of prediction.

In the case of the five socio-economic factors, the Standard of Living (factor 1) and the Relative Poverty (factor 3) of an area are the most effective single factors in predicting retail structure: in the case of central place factors, factor (b) (Provincial Importance) is found to be more effective than factor (a) Size in predicting the same retail structure patterns. Thus even in the case of central place factors alone, size is secondary to the regional influence of a metro area in terms of predicting metro area retail structure.

On the basis of this analysis the hypothesis has been substantiated both at the level of individual relationships between aspects of socio-economic structure and retail structure, and at the general level of the overall relationship between the two. The socio-economic structure of metro areas (as defined in this study) is thus more effective in predicting the aspects of retail structure represented by the two retail structure factors (Central Functions, and Specialist Functions) than is the central place structure of a metro area. As was pointed out in Chapter Six, however, a certain bias exists in the results because the socio-economic factors were derived from a much larger number of original variables (28) than were the central place factors (6). The use of corrected correlation values in the analysis makes allowances for this imbalance in the data used, and the conclusions are made on these corrected figures.

5. General Conclusions.

The aim of the study as outlined in the Introduction (Chapter One) was to attempt to bridge the gap between micro-level behavioural studies and macro-level studies of city systems. The variables used in the analysis of socio-economic structure (Chapter Four) were included at least in part, on the basis of micro-level behavioural studies. Apart from this aspect, the link between the micro- and macro-levels of retailing analysis has not been achieved by this study. Assumptions about behaviour at the micro-level, such as the individual metro area or shopping centre, cannot necessarily be extended to the level of inter-metro area comparison. Although the socio-economic factors found in Chapter Four are clear and understandable, to link individual consumer behaviour, via such factors, to the distribution of sales between a set of Census categories, would be to make a step not capable of sufficient justification.

A second problem in making such a jump between different scales of analysis lies not so much in the application of micro-level relationships at the macro-level, as in the eventual usefulness of such a large-scale study. The comment has been made in Chapter One that the study of "Canadian Urban Dimensions" by King was rationalised on the grounds that it would provide empirical findings for future theoretical developments. The same rationale could be applied to this study of retailing structure, but it is felt that such a rationale is not tenable: the findings of this study have been applied to aspects of theory within the study itself.

Although Hodge attempts to relate a similar kind of structural study to regional economic development in Canada (as noted in Chapter One), the findings of the present study would be difficult to apply to cross-Canada regional development. The aim of this study, however, was not to provide a case-study of the application of a planning tool (although the particular statistical methods could be used effectively in regional planning - especially at the micro-level) but to tackle an aspect of central place theory in the context of Canadian metro areas. Rather than leaving the results of the analysis for future developments of theory, the test of the hypothesis which was constructed suggests certain deficiencies in the use of Central Place Theory and the variables used as measures of centrality.

In the first instance, the size of a centre is found to be of little importance in determining the retail structure of Canadian metro areas as represented by the retail structure factors found in this study. More important is the relative importance of the centre in its Province, and this fact is being used as the basis of present developments of central place theory. Instead of gross indexes of size or of centrality being used as surrogates of activity, some form of system based on the movement of people, of goods, or of information within and between centres is being incorporated into studies of central place systems as the studies by Ray and Hodge show. In short, central place theory is incorporating a combination of indexes of observed behaviour on which to base its hypotheses concerning the spacing of centres and their position within the national hierarchy.

This study suggested and finally substantiated (see previous section) the fact that retail structure in Canada is more a function of the socio-economic structure of a centre than of its size or place in the national hierarchy as traditionally conceived. This study has failed to incorporate adequately a behavioural base into the aspect of central place theory under discussion. It has, however, pointed out the fact that although central place theory is a generalisation about, and an abstraction of a process in reality, there are perhaps more accurate levels of generalisation possible than the ones traditionally used in applications of the theory to the real world.

LITERATURE CITED

Alexander, J.W. "Location of Manufacturing: Methods of Measurement," Annals of the Association of American Geographers, Vol. 48 (1958), pp. 20-43.

Applebaum, W. "Marketing Geography," in P.E. James, and J.K. Wright, eds., American Geography: Inventory and Prospect (Syracuse, New York: Syracuse University Press, 1954), pp. 245-251.

Applebaum, W. "Teaching Marketing Geography by the Case Method," Economic Geography, Vol. 37 (1961), pp. 48-60.

Applebaum, W. and S. Cohen. "Evaluating Store Sites and Determining Store Rents," Economic Geography, Vol. 36 (1960), pp. 48-60.

Applebaum, W., and S. Cohen. "The Dynamics of Store Trading Area and Market Equilibrium," Annals of the Association of American Geographers, Vol. 51 (1961), pp. 73-101.

Beckman, T.N., and W.R. Davidson. Marketing (New York: Ronald Press, Co., 1962).

Berry, B.J.L. Shopping Centres and the Geography of Urban Areas: A Theoretical and Empirical Study of the Spatial Structure of Intraurban Retail and Service Business, Unpublished Ph.D. Thesis (Ann Arbor, Michigan: University Microfilms, 1958).

Berry, B.J.L. "The Impact of Expanding Metropolitan Communities Upon the Central Place Hierarchy," Annals of the Association of American Geographers, Vol. 50 (1960), pp. 112-116.

Berry, B.J.L. "Urbanisation and Economic Development," Chapter 7 in J. Friedman and W. Alonso, eds., Regional Development and Planning (Cambridge, Mass.: M.I.T. Press, 1964).

Berry, B.J.L. Geography of Market Centers and Retail Distribution (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967).

Berry, B.J.L., H. Barnum, and R. Tennant. "Retail Location and Consumer Behaviour," Papers and Proceedings of the Regional Science Association, Vol. 9 (1962), pp. 65-106.

Berry, B.J.L., and W.L. Garrison. "The Functional Bases of the Central Place Hierarchy," Economic Geography, Vol. 34 (1958), pp. 145-154.

Boyce, R.R., and W.A.V. Clark. "Selected Spatial Variables and Central Business District Sales," Papers and Proceedings of the Regional Science Association, Vol. 11 (1963), pp. 167-193.

Carol, H. "The Hierarchy of Central Place Functions within the City," Annals of the Association of American Geographers, Vol. L (1960), pp. 419-438.

Cattell, R.B. "Factor Analysis: An Introduction to the Essentials, Part I," Biometrics, Vol. 21 (1965), pp. 190-215.

Christaller, W. (translated by C. Baskin). The Central Places of Southern Germany (Englewood Cliffs: Prentice-Hall, 1966).

Cohen, S. "Location Research Programming for Voluntary Food Chains," Economic Geography, Vol. 37 (1961), pp. 1-11.

Draper, N.R., and H. Smith. Applied Regression Analysis (New York: John Wiley and Sons, 1966).

Florence, P.S. Investment, Location, and Size of Plant (Cambridge, England; University Press, 1948).

Frank, R.E., A.A. Kuehn, and W.F. Massey. Quantitative Techniques in Marketing (1st. Edition) (Homewood, Illinois: Irwin and Co., 1962).

Garnett, J.C.M. "On Certain Independent Factors in Mental Measurement," Proceedings of the Royal Society, London, Vol. 46 (1919), pp. 91-111.

Goddard, J. "Multivariate Analysis of Office Location Patterns in the City Centre: A London Example," Regional Studies, Vol. 2 (1968), pp. 69-85.

Gould, P.R. "On the Geographical Interpretation of Eigenvalues," Transactions of the Institute of British Geographers, Vol. 42 (1967), pp. 53-86.

Gregory, S. Statistical Methods and the Geographer (1st. Edition) (London, England: Longman, Green and Co., 1964).

Haggett, P. Locational Analysis in Human Geography (London: Edward Arnold Ltd., 1965).

Halbert, M.H. "The Requirements for Theory in Marketing," Chapter 1, pp. 22-45 in R. Cox, W. Alderson, S.J. Shapiro, eds., Theory in Marketing (Homewood, Illinois: Irwin, Inc., 1964).

Hamill, L. "Are Formal Theories Needed in Marketing Geography?" The Professional Geographer, Vol. XVII, 2 (1965), pp. 11-13.

Harris, C.D. "A Functional Classification of Cities in the United States," Geographical Review, Vol. 33 (1943), pp. 86-99.

Harris, C.D. "The Market as a Factor in the Localization of Industry in the United States," Annals of the Association of American Geographers, Vol. 44 (1954), pp. 315-348.

Hodge, G. "Urban Structure and Regional Development," Papers and Proceedings of the Regional Science Association, Vol. XXI (1968), pp. 101-118.

Hoover, E.M. "The Measurement of Industrial Localisation," Review of Economics and Statistics, Vol. 18 (1936), pp. 162-171.

Horst, P. Factor Analysis of Data Matrices (New York: Holt, Rinehart and Winston, Inc., 1965).

Howard, J.A., and J.N. Sheth. The Theory of Buyer Behavior (New York: John Wiley and Sons, 1969).

Huff, D. "Ecological Characteristics of Consumer Behaviour," Papers and Proceedings of the Regional Science Association, Vol. 7 (1961), pp. 19-28.

Isard, W. Methods of Regional Analysis (Cambridge, Mass.: M.I.T. Press, 1967).

King, L.J. "Cross-sectional Analysis of Canadian Urban Dimensions," Canadian Geographer, Vol. X, 4 (1966), pp. 205-222.

King, L.J. Statistical Analysis in Geography (1st. Edition) (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1969).

Lockley, L.C. "An Approach to Marketing Theory," in R. Cox, W. Alderson, S.J. Shapiro, eds., Theory in Marketing (Homewood, Illinois: Irwin and Co., 1964).

Lösch, A. The Economics of Location (New Haven: Yale University Press, 1968).

Maxwell, J.W. "The Functional Structure of Canadian Cities: A Classification of Cities," Geographical Bulletin, Vol. 7, 2 (1965), pp. 79-104.

Mumford, L. The City in History, its Transformations and Prospects (1st. Edition) (New York: Harcourt, Brace, and World, 1961).

Nelson, H.J. "A Service Classification of Cities in the United States," Economic Geography, Vol. 31 (1955), pp. 189-210.

Nourse, H.O. Regional Economics (Toronto: McGraw-Hill, 1968).

Pownall, L. "The Functions of New Zealand Towns," Annals of the Association of American Geographers, Vol. 43 (1953), pp. 332-350.

Pred, A. "The Concentration of High-Value-Added Manufacturing," Economic Geography, Vol. 41 (1965), pp. 108-132.

Ray, D.M. "Urban Growth and the Concept of Functional Region," in N.H. Lithwick, G. Paquet, eds., Urban Studies: A Canadian Perspective (Toronto: Methuen and Co., 1968).

Ray, D.M. "The Spatial Structure of Economic and Cultural Differences: A Factorial Ecology of Canada," Papers and Proceedings of the Regional Science Association, Vol. XXIII (1969), pp. 7-23.

Schlettler, C. "The Relation of City Size to Economic Services," American Sociological Review, Vol. 8 (1943), pp. 60-62.

Simmons, J.W. Toronto's Changing Retail Complex, Department of Geography Research Paper No. 104 (Chicago, Illinois: University of Chicago, 1965).

Spearman, C. "General Intelligence Objectively Determined and Measured," American Journal of Psychology, Vol. 15 (1904), pp. 201-293.

Spearman, C. The Abilities of Man (London, England: Macmillan and Co., 1927).

Spence, N. "A Multi-factor Uniform Regionalisation of British Counties on the Basis of Employment Data for 1961," Regional Studies, Vol. 2 (1968), pp. 87-104.

Tintner, G. Econometrics (1st. Edition) (New York: John Wiley and Sons, 1967).

Thurstone, L.L. "Multiple Factor Analysis," Psychological Review, Vol. 38 (1931), pp. 406-427.

Woozley, A.D. Theory of Knowledge: An Introduction (London, England: Hutchinson's University Press, 1949).

APPENDIX A

CATEGORIES OF RETAIL OUTLET USED IN THE ANALYSIS OF RETAIL STRUCTURE.

Consolidated Variables	Census Classification
	A. FOOD GROUP
1. Confectioners and bakers	1. Bakery products
	2. Candy, nuts
	3. Confectionery
	4. Dairy produce
2. Grocery, fruit, veg.	5. Eggs & poultry
	6. Fruit & veg.
	7. Grocery stores without fresh meat
3. Combination	8. Combination stores
	9. Meat markets
4. Meat, fish, other	10. Fish markets
	11. Delicatessen stores
	12. Other food
	B. GENERAL MERCHANDISE
5. Dept. stores	13. Department stores
	14. Mail order offices of 13
	15. Other stores operated by 13
6. General stores	16. General merchandise
	17. General stores
7. Variety stores	18. Variety stores
	C. AUTOMOTIVE GROUP
	19. Auto dealers
8. Auto dealers	20. Auto dealers with wholesale dept.
	21. Auto dealers with farm implements
	22. Used car dealers
9. 2nd. hand cars & accessories	23. Accessories, tyres, batteries
	24. Second-hand parts and accessories
	25. Service stations
	26. Garages
10. Service stations & repairs	27. Paint & body shops
	28. Other specialty repair shops
	29. Car wash
	30. Other
	D. APPAREL & ACCESSORIES
11. Mens and boys wear	31. Mens & boys clothing
	32. Mens & boys accessories
	33. Mens & boys hat stores
	34. Womens ready-to-wear
	35. Lingerie & hosiery
12. Women's & children's wear	36. Millinery
	37. Furriers
	38. Women's accessories
	39. Children's & infants
	40. Family clothing

		D. APPAREL & ACCESSORIES
		41. Men's shoes
13.	Shoe stores	42. Women's shoes
		43. Children's shoes
		44. Family shoes
		45. Custom tailors
14.	Bespoke clothing & special goods	46. Second-hand clothing
		47. Piece goods
		48. Miscellaneous apparel
		E. HARDWARE & HOME FURNISHINGS
15.	Hardware, paint	49. Hardware
		50. Hardware & farm implements
		51. Paint, glass, wallpaper
16.	Furniture	52. Furniture & undertakers
		53. Furniture
		54. Household appliances
		55. T.V. Sales & Service
		56. Furniture, T.V., Radio & Appliances
		57. T.V., Radio, Pianos, & Music
17.	Household appliances, T.V., Radio	58. T.V. & Radio Repairs
		59. Household Appliance repairs
		60. Electrical supplies repairs
		61. China, Glassware, Kitchenware
		62. Floor coverings, upholstery
		63. Linen stores
		64. Picture & Framing
18.	Second-hand & Antiques	65. Antiques
		66. Second-hand furniture
		67. Miscellaneous home furnishings
		F. OTHER RETAIL STORES
		68. Drug stores without meals
19.	Druggists	69. Drug stores with meals
		70. Medicine stores
		71. Fuel dealers
		72. Fuel oil dealers
		73. Ice
20.	Florists	74. Florists
		75. Luggage & leather goods
21.	Tobacco	76. Tobacco stores & stands
		77. Newsdealers
		78. Books & stationery
		79. Artists' supplies
22.	Cameras, books, news	80. Cameras & photography
		81. Music stores
		82. Gifts, novelties, souvenirs
23.	Jewellery	83. Jewellery stores
		84. Jewellery repairs

F. OTHER RETAIL STORES

24. Sports goods, boats, cycles	85. Sporting goods
	86. Bicycle shops
	87. Bicycle repairs
	88. Boats, outboards, accessories
	89. Motorcycles
	90. Pet shops
	91. Monuments & Tombstones
	92. Religious goods
	93. Opticians
	94. Health appliances
	95. Government liquor stores
	96. Brewers' retailers
25. Miscellaneous stores	97. Wine stores
	98. Hobby shops
	99. Toy shops
	100. Record bars
	101. Wool shops
	102. Miscellaneous

Source: Dominion Bureau of Statistics, Census of Canada, 1961. Vol. 6.1 'Retail Trade Locations: Provinces & Cities by Kind of Business'.
Table 2. 'Retail Trade by Kind of Business for Census Metropolitan Areas, Major Urban Areas, and other cities of over 30,000 population, 1961'.

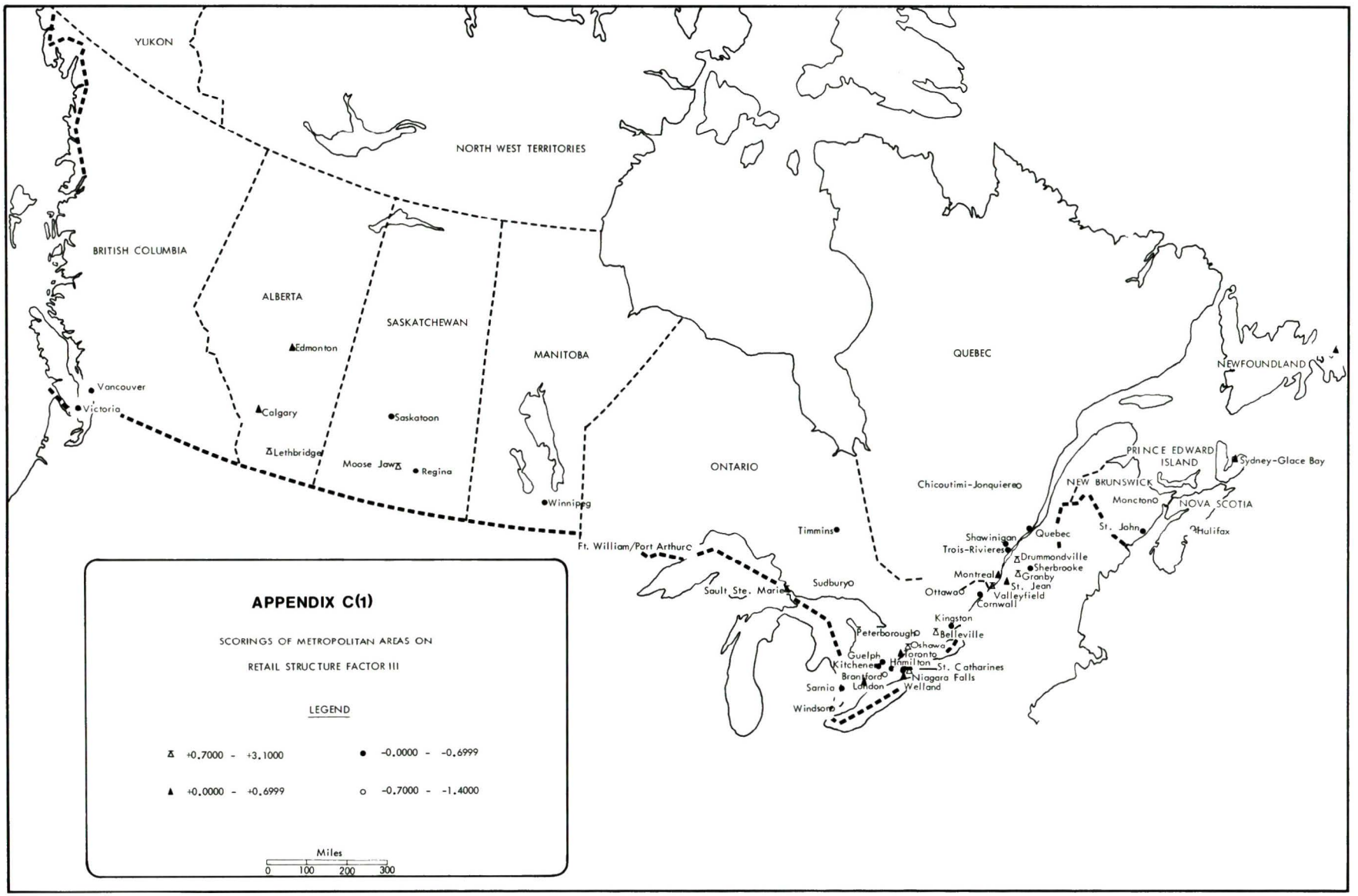
*APPENDIX B.

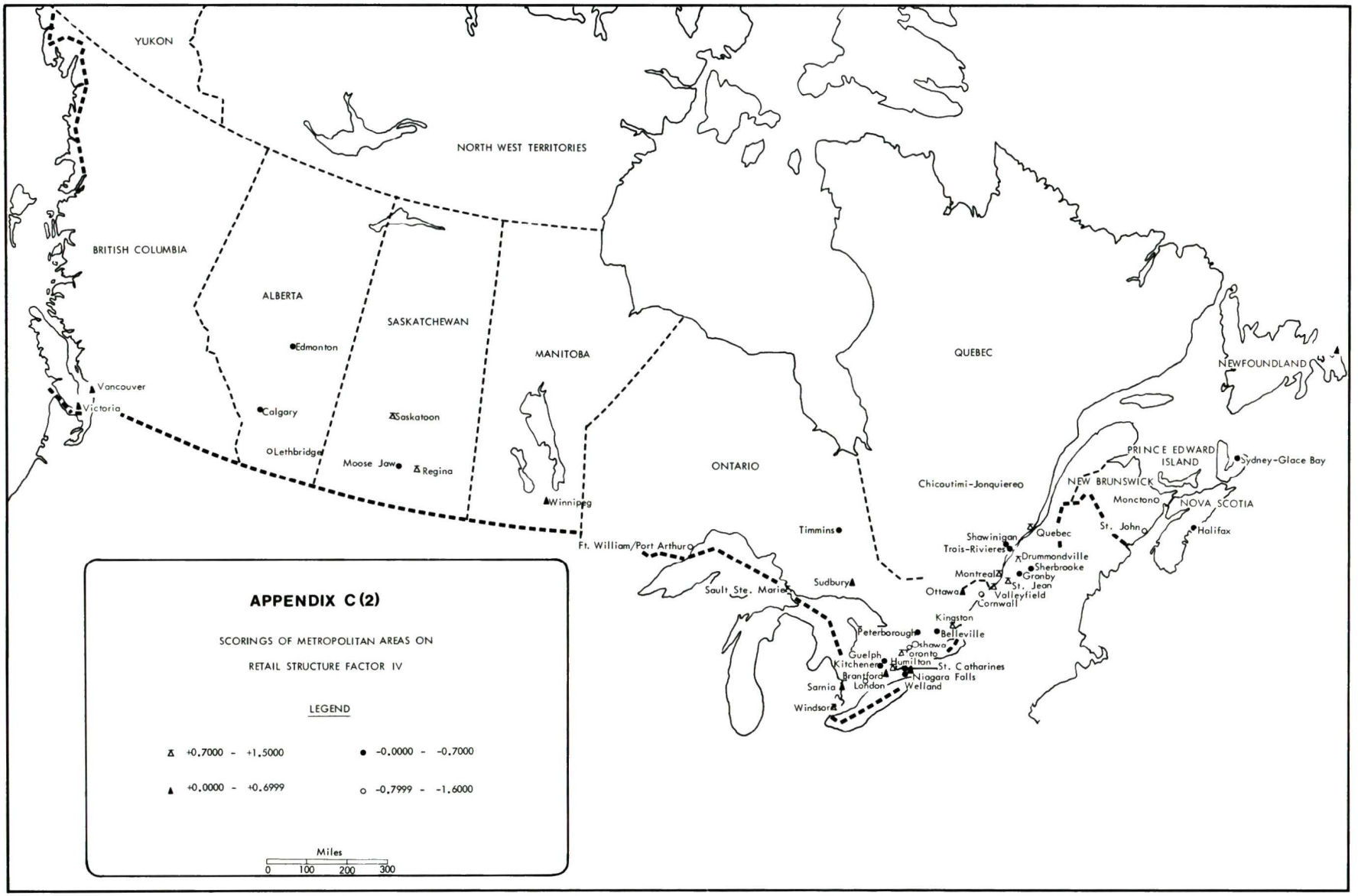
RETAIL SALES IN THOUSANDS OF DOLLARS:
TWENTY-FIVE CATEGORIES OF RETAIL ESTABLISHMENTS
IN FORTY-FIVE CANADIAN METROPOLITAN AREAS (1961).
(MATRIX A).

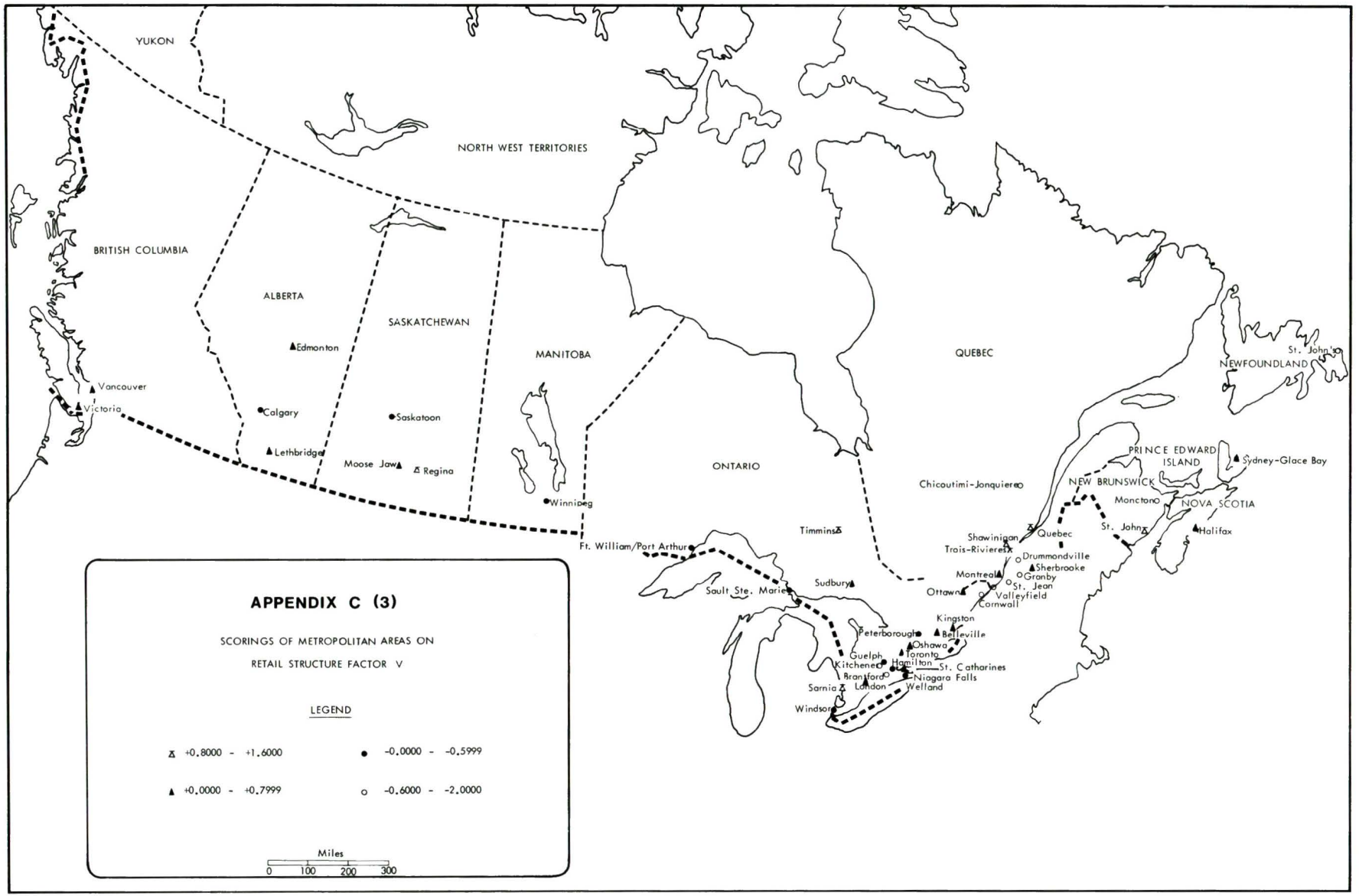
	1. Confectioners and bakers	2. Grocery, fruit and vegetables	3. Combination stores	4. Meat, fish, and other food stores	5. Department stores	6. General stores	7. Variety stores	8. Automobile dealers	9. Second-hand automobiles and accessories	10. Service stations and repair shops	11. Men's and boys' wear	12. Women's and children's wear	13. Shoe stores	14. Bespoke clothing and special goods	15. Hardware and paint	16. Furniture	17. Household appliances, television, radio	18. Second-hand furniture and antiques	19. Druggists	20. Florists	21. Tobacco stores and kiosks	22. Cameras, books, and music	23. Jewellery	24. Sports goods, books, bicycles	25. Miscellaneous stores, and non-classified stores	26. TOTAL RETAIL SALES (millions of dollars) Adjusted Figures	27. TOTAL RETAIL SALES (millions of dollars) Census Figures
1. Belleville	588	9647	96573	6731	35161	3607	13843	100067	33324	14974	7007	17208	7419	5082	10397	6351	13315	4371	13230	1886	3435	1142	5115	5220	37551	45323	44615
2. Brantford	15895	8973	149576	13265	29670	2810	20871	86428	60219	30593	14231	22897	8722	17373	8318	11935	22940	8676	16800	1722	4582	1008	6761	4705	65187	63416	63416
3. Calgary	21289	109130	633961	85974	686944	23376	72005	608432	299941	129032	44993	88088	39998	32573	42812	48164	98375	20930	89500	16444	9500	4295	36243	20085	197052	345913	342448
4. Chicoutimi-Jonquiere	5326	54966	211135	14397	23414	10106	44707	128686	72295	59316	8250	19666	9434	86498	1016	37035	8923	33999	20618	1445	6683	1171	7923	3032	53540	92338	92498
5. Cornwall	2990	18621	107885	1882	30449	0000	6172	65791	38197	30152	12204	4359	7106	20214	6130	11631	4612	5622	15897	1508	4490	1403	5210	3278	42403	44821	45301
6. Drummondville	5983	15159	65403	13617	55499	7268	7491	55067	30182	48563	7210	14599	7023	8434	17231	9032	11374	2573	9101	540	1865	1088	3123	1251	15555	41423	39412
7. Edmonton	5689	120025	635827	7999	769574	58828	80952	713667	353338	109582	40103	92323	33016	95833	53509	47903	118097	4424	119850	12855	16151	7491	37178	19187	256975	381037	388236
8. Ft. William/Port Arthur	16097	27165	235666	1224	126451	14260	32655	176522	86288	33924	18753	23923	10306	23923	10889	1314	20039	3744	26564	3635	4395	0000	13638	4638	126244	104225	103699
9. Granby	4102	3609	72329	1565	10853	0000	2200	42038	25229	8340	8258	8991	7447	15585	9140	7887	8790	6873	6412	798	1267	520	2018	4113	17106	27547	28904
10. Guelph	7101	11247	100643	16929	34738	3564	10851	75945	38474	14145	8677	14743	8593	13822	5408	10941	10661	5890	13347	2386	4494	961	4590	4217	48390	47076	47426
11. Halifax	9499	83983	405065	34761	272686	18990	55275	337358	149688	40354	27832	45343	20892	32641	16026	13059	59801	22662	54122	6755	7770	1573	30754	4696	219905	197149	199774
12. Hamilton	34935	97485	837174	138549	546809	19846	94867	517805	380939	113073	55032	100324	55200	55994	51804	58911	146443	3300	131703	20741	30452	8779	40003	23658	368406	393428	393428
13. Kingston	5621	18449	179549	22699	77241	2916	15668	95372	59793	31548	11095	24121	9366	11968	16349	10541	18960	5873	33222	3969	6018	991	9763	6587	88613	79253	76597
14. Kitchener	8648	36279	356109	37942	79824	4739	55459	239146	158389	312923	29347	52189	24679	25441	22989	33017	50188	12870	35153	8686	12326	4139	16287	9856	157512	178473	158018
15. Lethbridge	4513	8929	105164	9467	60300	6186	12223	141240	35288	14488	19004	16836	9100	6284	13776	10256	9680	11914	15260	3776	3248	965	5413	2765	31731	55786	55148
16. London	10286	40926	381147	62002	233298	28473	66832	649653	202987	100515	32729	18989	37111	90819	33171	32365	93689	4239	65039	11554	16895	5915	25494	6421	210547	246109	243099
17. Moncton	8718	25459	122541	4953	116749	2560	28959	147723	58713	12801	7063	9051	7099	31537	2119	19877	9886	2507	16763	2146	2591	1079	8654	5258	60339	71514	72630
18. Montreal	209808	869459	4748952	662722	2062206	247013	454653	2576907	1525899	361898	355805	833033	380895	418657	499571	418883	720652	29695	683528	66082	197609	40870	235124	122733	1562920	2028559	2028552
19. Moose Jaw	4910	19062	67809	9952	115736	11874	11995	92878	26656	10652	5821	8748	6549	8369	9281	4795	12854	3945	10514	1779	3106	923	278	1429	30343	48024	50507
20. Niagara Falls	2147	12251	151749	6887	36763	3771	10889	78337	44507	19347	12618	15221	7676	7029	9095	13667	20116	735	26660	4061	3910	20124	4283	3330	44945	51967	55668
21. Oshawa	5167	22131	205317	15177	89156	6788	32611	170678	75567	25959	18436	28377	14022	8745	13686	11127	12315	17710	25649	3437	7404	1115	10449	5243	8989	83525	91615
22. Ottawa	44607	196537	855415	12388	76507	35856	122767	585780	360750	151629	78864	134473	61172	65451	49585	80936	153669	5432	116731	24022	41330	1634	59665	32541	461294	380903	437727
23. Peterborough	4139	3656	135784	18347	69077	7087	26806	82743	71913	26149	10895	19295	10046	12777	7591	8067	13198	17801	20679	2872	3718	2023	9841	5615	66497	65862	65492
24. Quebec	4913	232409	635590	121353	276297	78017	124887	487435	305567	47905	50342	137974	75420	106509	80446	39446	150461	2076	111521	11691	62246	8366	34051	20219	256706	345990	346460
25. Regina	6036	33575	199803	19147	77591	88293	56156	218214	95541	34309	22971	47004	12741	16940	15246	16255	51490	1597	50520	5070	6180	1131	16988	8213	94265	139335	132184
26. St. Catharines	6774	18126	239894	27355	37282	18753	36159	144295	96042	48247	16306	6537	18261	19123	22963	4397	27861	1253	31181	5111	5466	5317	10500	7200	82626	93702	94658
27. St. Jean	2704	14093	80420	10922	22747	2333	4611	48265	33337	10544	8206	7463	9291	9265	9865	7398	13618	0000	9148	647	808	665	3611	739	24401	33490	34227
28. St. John	2263	53611	191192	19959	133203	2441	33281	212264	56973	17088	11712	13445	11458	15004	1427	4841	29871	11187	6465	3915	7451	2242	11265	8865	110090	97151	97608
29. St. John's	25093	93495	128528	28619	182881	2955	22019	157575	54749	109591	4404	38197	15136	21508	9017	7083	10958	0000	27423	2916	952	670	2848	2326	75653	102459	102460
30. Sarnia	4505	9939	147250	12918	55332	16431	23548	88655	54224	27649	9536	19907	10222	7803	7901	14999	27252	8618	20387	3313	6935	1821	5785	882	58706	64452	64451
31. Saskatoon	7025	35996	187350	1802	205891	29796	21035	173064	103376	27691	18828	36791	14091	29105	16114	19119	28736	877	41711	3200	2785	1183	14846	2427	72694	109553	111175
32. Sault Ste. Marie	9457	22528	171582	9709	52378	5373	18332	100867	58718	34521	16062	22349	11336	1431	33744	16533	26114	4711	18755	2275	3825	569	5852	4988	8977	66095	73928
33. Shawinigan	3706	21691	109834	5908	17913	1837	15713	57292	29196	11630	9111	16811	9943	28091	2569	10392	20063	9337	10933	1034	3427	1920	6898	2211	29343	43678	42490
34. Sherbrooke	5900	23173	160995	14512	108342	11117	35212	139702	63472	33284	10802	22310	16151	36944	6330	14990	35164	7309	20426	2444	3454	1142	9543	2587	44236	82965	81840
35. Sudbury	19380	34341	288024	20593	67201	20682	70851	193047	109359	38833	29031	34957	16983	21703	20140	29138	33352	351	36018	4828	8863	0000	19378	3449	129331	124983	124279
36. Sydney-Glace Bay	16070	54950	216156	16667	104505	35529	21184	171125	56458	17620	12684	16534	10556	28344	17752	12509	27024	3963	14201	1429	4063	2095	7015	1716	73922	94405	91424
37. Timmins	2685	13207	113925	3965	17056	4514	15735	50501	25349	11606	9859	6045	6554	17423	7998	6140	15764	1749	9064	692	3544	817	3568	2082	23894	37174	36952
38. Toronto	112589	517272	4029040	729277	2582116	238236	404826	3294220	1756894	698584	372989	759778	290906	211520	313960	359105	733667	26412	738400	88244	319076	79118	219806	145039	2128240	2114931	2114931
39. Trois-Rivieres	10496	30906	183161	23332	35151	12083	33265	152610	55497	18934	15857	32419	16837	30007	3144	8520	24890	28153	23853	1195	4643	1260	7213	1060	50003	80448	80447
40. Valleyfield	2793	9794	73489	9291	13492	1384	2735	33463	20903	10564	4812	14390	5277	6744	17162	12320	3026	5849	6519	403	1712	833	2476	126	16733	27629	27595
41. Vancouver	16420	427208	1406402	285483	1275914	100814	96625	1264892	705711	131009	89567	235262	84507	120268	86751	27876	270934	71331	291142	30633	32687	14853	85705	86363	667499	790585	835585
42. Victoria	4228	33927	224970	64119	285349	19783	23159	218706	123378	30834	14367	37094	15853	21177	24672	10996	57283	9465	49348	5293	3540	3053	18748	17110	156634	147308	157299
43. Welland	5624	11545	96580	6715	17770	7877	11041	66713	36496	11603	8820	7574	7370	6886	9132	9331	8358	2448	11092	1895	3156	978	2430	2802	32157	38639	39033
44. Windsor	21836	51072	395906	67099	55450	26372	51441	226000	183142	86041	28499	39543	23513	62949	31478	46863	90056	16520	60135	8252	6229	3553	25068	14708	133890	175561	175562
45. Winnipeg	15814	207742	949398	98612	1186505	35269	72178	733380	428979	91268	35363	102967	37346	64510	63993	44341	120184	9848	178540	23555	13899	4748	52617	27414	382940	498138	493134

*For data sources, see Appendix F.

Adjusted Figures are underlined


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Timmins
Ft. William/Port Arthur
Sudbury
Sault Ste. Marie
Chicoutimi-Jonquiere
Shawinigan
Trois-Rivieres
Quebec
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Valleyfield
Cornwall
Ottawa
Kingston
Belleville
Peterborough
Oshawa
Toronto
Hamilton
St. Catharines
Niagara Falls
Welland
Guelph
Kitchener
Brantford
London
Sarnia
Windsor
Moncton
St. John
Halifax
Sydney-Glace Bay
APPENDIX C(1)
SCORINGS OF METROPOLITAN AREAS ON
RETAIL STRUCTURE FACTOR III
LEGEND
+0.7000 - +3.1000
+0.0000 - +0.6999
-0.0000 - -0.6999
-0.7000 - -1.4000
Miles
0 100 200 300


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
Vancouver
Victoria
Edmonton
Calgary
Lethbridge
Saskatoon
Moose Jaw
Regina
Winnipeg
Timmins
Ft. William/Port Arthur
Sudbury
Sault Ste. Marie
Chicoutimi-Jonquiere
Shawinigan
Trois-Rivieres
Quebec
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Valleyfield
Ottawa
Cornwall
Kingston
Belleville
Peterborough
Oshawa
Toronto
Guelph
Kitchener
Hamilton
St. Catharines
Brantford
Niagara Falls
London
Welland
Sarnia
Windsor
Monctono
St. John
Halifax
Sydney-Glace Bay
APPENDIX C(2)
SCORINGS OF METROPOLITAN AREAS ON
RETAIL STRUCTURE FACTOR IV
LEGEND
+0.7000 - +1.5000
+0.0000 - +0.6999
-0.0000 - -0.7000
-0.7999 - -1.6000
Miles
0 100 200 300


YUKON
NORTH WEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
St. John's
PRINCE EDWARD ISLAND
Sydney-Glace Bay
NEW BRUNSWICK
Moncton
NOVA SCOTIA
Halifax
St. John
Chicoutimi-Jonquiere
Shawinigan
Quebec
Trois-Rivieres
Drummondville
Sherbrooke
Granby
Montreal
St. Jean
Valleyfield
Ottawa
Cornwall
Kingston
Belleville
Peterborough
Oshawa
Toronto
Hamilton
St. Catharines
Niagara Falls
Welland
Guelph
Kitchener
Brantford
London
Sarnia
Windsor
Sudbury
Timmins
Sault Ste. Marie
Ft. William/Port Arthur
Winnipeg
Vancouver
Victoria
Calgary
Edmonton
Lethbridge
Saskatoon
Moose Jaw
Regina
APPENDIX C (3)
SCORINGS OF METROPOLITAN AREAS ON
RETAIL STRUCTURE FACTOR V
LEGEND
+0.8000 - +1.6000
+0.0000 - +0.7999
-0.0000 - -0.5999
-0.6000 - -2.0000
Miles
0 100 200 300

*APPENDIX D.

TWENTY-EIGHT SOCIO-ECONOMIC VARIABLES
FOR FORTY-FIVE CANADIAN METROPOLITAN AREAS.
(MATRIX C).

	1. Number of Women 15-44	2. Population [illegible] 65	3. Population less than 14 years of age	4. Males per thousand females	5. Total population	6. Occupied dwellings single detached	7. Occupied dwellings owner-occupied	8. Occupied dwellings needing major repair	9. Occupied dwellings with refrigerator	10. Occupied dwellings with automobile	11. Total number of dwellings
1. Belleville	6637	2444	10085	941	30655	5697	5423	572	8518	6559	8563
2. Brantford	11574	5631	17322	957	56741	11807	11852	752	16202	12258	16319
3. Calgary	62381	19319	94075	1013	201022	50802	49623	2774	75419	60731	78396
4. Chicoutimi-Jonquiere	23562	2965	43508	1012	105009	7548	10705	601	17595	12354	19193
5. Cornwall	8994	2741	15769	972	43639	5452	5479	450	10636	7194	10751
6. Drummondville	8488	1893	15205	962	39307	2243	3621	446	8424	5404	8619
7. Edmonton	68035	19542	117641	1017	337568	61800	57916	4000	85008	68058	89009
8. Fort William/Port Arthur	19132	7351	29867	1050	93251	19200	18035	1286	22894	17603	24000
9. Granby	6988	1669	11368	978	31463	2613	3405	315	7001	4599	7478
10. Guelph	8379	3856	13240	943	41767	8106	8077	318	11254	8460	11330
11. Halifax	42339	10559	60570	1010	183946	23450	23234	2661	40393	28396	42366
12. **Hamilton**	83616	30964	124935	992	395189	76869	77367	3305	103763	81045	105240
13. Kingston	2250	4961	19003	1020	63419	8231	7855	707	15566	12222	15864
14. Kitchener	33013	11849	49520	983	154864	29688	30479	1807	41700	33132	42174
15. Lethbridge	7332	3211	11665	998	35454	7153	6844	479	9737	7669	10016
16. London	39457	15869	55420	959	181263	33824	33695	1559	49776	38588	50564
17. Moncton	12271	4047	19098	917	55768	7474	8016	1057	12611	9457	13258
18. Montreal	481631	29201	649672	968	2109509	106969	179083	15401	531432	297666	549731
19. Moose Jaw	6834	3938	10547	978	33206	6665	6227	654	9160	7057	9562
20. Niagara Falls	11502	4376	17423	979	54649	11513	11221	453	14807	12088	14884
21. Oshawa	17219	5626	26369	999	80918	16825	16486	704	21169	17543	21396
22. Ottawa	94199	27770	144274	962	429750	51914	55569	3892	105761	78460	107572
23. Peterborough	10420	4536	16257	939	49902	10387	9579	446	13303	10542	13474
24. Quebec	83999	23023	113655	929	357568	23127	33458	2475	74413	43705	79139
25. Regina	25850	8355	35332	978	112141	21544	20048	1446	28895	22902	30125
26. St. Catharines	20254	7468	30836	988	95577	20387	9579	855	25745	20766	26148
27. St. Jean	7741	1859	11755	978	34576	2743	3590	211	7873	4710	8025
28. St. John	19420	8380	31430	967	95563	8854	10682	2884	21386	15596	24143
29. St. John's	19786	5515	32933	952	90838	9537	12454	1152	14397	11153	17917
30. Sarnia	13133	3635	21979	998	61293	13330	12370	599	16219	13918	16393
31. Saskatoon	21634	8684	39519	961	95526	19193	18363	1160	24830	19140	25912
32. Sault St. Marie	12532	3317	20407	1046	58460	10658	10803	906	14222	11464	14507
33. Shawinigan	14275	2674	23948	984	63518	4075	5941	406	13601	8579	13892
34. Sherbrooke	15713	4855	23824	928	70253	4361	6072	580	16273	10385	16795
35. Sudbury	24190	3729	41371	1072	110694	15182	14807	1371	25656	11929	26255
36. Sydney-Glace Bay	21035	7446	39842	999	106114	16415	17861	2485	20438	12741	22734
37. Timmins	8046	2329	13821	1079	40121	6055	5931	1087	9661	6251	10088
38. Toronto	403475	142623	527722	980	1824481	268984	325435	10747	475543	351970	482540
39. Trois-Rivieres	19190	4505	28646	963	83659	4822	7341	572	18242	10341	18838
40. Valleyfield	6554	1617	10492	989	29849	2286	3088	122	6651	4178	6947
41. Vancouver	162166	87804	226596	991	790165	171620	159414	8510	218488	163073	228598
42. Victoria	28266	24541	42880	967	154152	35747	33893	1372	44838	34052	47485
43. Welland	7693	2482	12006	1016	36079	7029	6901	301	9286	7274	9428
44. Windsor	38998	16125	63657	987	193365	40102	38620	2379	52603	39239	53315
45. Winnipeg	102828	42902	143361	972	475989	90412	85831	6421	124502	87207	128532

	12. Average number of persons per room	13. Wage-earners earning less than $2 000 per annum	14. Wage-earners earning $2,000 - $4,000 per annum	15. Wage-earners earning more than $4,000 per annum	16. Average earnings of male workers	17. Average earnings of female workers	18. Total labour force female	19. Total labour force in managerial positions
1. Belleville	0.6	2625	3780	3922	4068	2035	3727	1041
2. Brantford	0 6	5518	8327	5985	3733	1921	7189	1954
3. Calgary	0.7	21749	36413	48920	4256	2137	32605	11985
4. Chicoutimi-Jonquiere	0.9	7230	7423	9452	3831	1705	7052	1837
5. Cornwall	0.7	3585	4362	4157	3646	1849	3953	1201
6. Drummondville	0.8	3556	5440	1667	3035	1608	3766	964
7. Edmonton	0.7	29157	44812	54248	4059	2055	40761	12786
8. Fort William/Port Arthur	0.7	7927	11195	11362	3880	1877	9604	2827
9. Granby	0.8	2601	5428	730	3157	1911	3440	907
10. Guelph	0.6	3967	6489	4393	3822	1997	5748	1396
11. Halifax	0.7	18398	27286	20433	3724	1928	21482	5769
12. **Hamilton**	0.7	30818	43909	73750	4251	2075	42995	12100
13. Kingston	0.7	5429	8203	9949	3978	2075	7739	1650
14. Kitchener	0.7	14309	24429	22764	3884	1937	20830	5503
15. Lethbridge	0.6	3456	4493	3394	3666	1817	4290	1527
16. London	0.6	16001	27040	27215	4000	2098	25108	6543
17. Moncton	0.7	4909	7383	5278	3713	1849	6721	1936
18. Montreal	0.8	158594	310183	299754	3972	2213	241006	73396
19. Moose Jaw	0.7	2778	4275	3287	3688	1958	3852	1028
20. Niagara Falls	0.6	5003	5324	7928	4111	1926	6076	1837
21. Oshawa	0.7	5317	8792	16154	4252	2123	7971	2147
22. Ottawa	0.7	31479	56784	81678	4407	2451	55178	15787
23. Peterborough	0.6	4052	5365	6800	4166	2109	5600	1617
24. Quebec	0.8	31424	47033	34195	3559	1782	40158	9993
25. Regina	0.8	9921	17593	17938	4012	2153	15912	4501
26. St. Catharines	0.6	7271	10013	13746	4135	1955	9569	2909
27. St. Jean	0.8	3516	4980	2304	3217	1777	3536	945
28. St. John	0.7	9310	13657	8438	3357	1790	10386	3081
29. St. John's	0.9	8775	10843	7307	3361	1635	9151	2906
30. Sarnia	0.7	4703	4813	10001	4668	1929	5194	1792
31. Saskatoon	0.7	7597	12654	12877	3896	2082	11560	3419
32. Sault St. Marie	0.7	4184	4974	10080	4531	1979	5194	1560
33. Shawinigan	0.8	4688	4959	6102	3716	1641	4265	1239
34. Sherbrooke	0.8	6950	9401	4898	3222	1631	7783	1890
35. Sudbury	0.9	6460	8695	23264	4402	2007	8803	2438
36. Sydney-Glace Bay	0.8	8185	12294	7179	3272	1586	7475	1961
37. Timmins	0.8	2908	5926	3210	3449	1673	2883	912
38. Toronto	0.7	146703	279334	348989	4330	2338	260633	79689
39. Trois-Rivieres	3.8	7546	9419	7946	3449	1618	7849	1963
40. Valleyfield	0.8	2395	3915	1920	3146	1735	2456	678
41. Vancouver	0.7	59733	85836	134462	4219	2219	90497	30903
42. Victoria	0.6	12654	16270	23006	3976	2013	16743	4619
43. Welland	0.7	2723	3861	4696	3925	1932	3244	937
44. Windsor	0.7	14692	19525	30979	4002	2182	19493	6249
45. Winnipeg	0.7	46185	70870	69121	3907	1961	65199	16818

	20. Total labour force professional	21. Total labour force clerical	22. Total labour force sales staff	23. Total labour force service and recreation	24. Total labour force transport	25. Total labour force primary production	26. Total labour force manufacturing	27. Total labour force labourers	28. Females employed in manufacturing
1. Belleville	1513	1660	940	1878	987	62	2829	511	592
2. Brantford	2110	3170	1705	2778	1087	366	7518	1002	1374
3. Calgary	13179	20003	9755	16129	7154	1761	21788	4704	1473
4. Chicoutimi-Jonquiere	4147	3025	2191	3500	1840	7950	9239	1932	253
5. Cornwall	1631	1528	985	1820	854	98	4432	1114	417
6. Drummondville	1244	1270	866	1181	601	78	5281	689	1110
7. Edmonton	16189	22806	11153	19255	9341	2546	28272	5927	2729
8. Fort William/Port Arthur	3275	4626	2429	4862	2796	1361	9211	2349	334
9. Granby	1022	1171	741	912	608	95	4753	756	1356
10. Guelph	2189	2237	1129	2361	[illegible]	235	5422	804	1217
11. Halifax	8290	12209	4736	21079	3978	446	12662	2387	1128
12. **Hamilton**	14823	21853	11431	16807	8468	4461	50447	8235	5960
13. Kingston	3785	3186	1543	6374	1105	161	4996	863	424
14. Kitchener	5328	9414	4695	6098	2789	1522	25476	2818	6138
15. Lethbridge	1658	1759	1470	1831	1078	500	2685	627	231
16. London	8588	12633	6510	11528	4104	1768	17600	2894	3287
17. Moncton	2315	4152	1964	2688	1733	134	3733	858	323
18. Montreal	91659	139896	55715	92953	54442	5492	234544	35889	50346
19. Moose Jaw	1482	1494	1041	2249	1193	347	2339	556	202
20. Niagara Falls	2202	2586	1373	2975	1219	319	6375	1205	706
21. Oshawa	2593	4711	1982	3122	1476	270	12034	1305	987
22. Ottawa	24369	39861	10125	28994	8496	1926	26854	6486	2221
23. Peterborough	2669	2726	1623	2153	837	130	5348	676	711
24. Quebec	17195	21252	10155	18715	8683	1476	30439	5039	5441
25. Regina	5855	10364	4064	6885	2850	703	8575	1721	585
26. St. Catharines	3572	4446	2546	3844	1967	535	12580	1840	1134
27. St. Jean	1152	1294	722	2405	683	67	4158	657	905
28. St. John	3380	5551	2737	4696	2527	451	8478	1763	701
29. St. John's	3670	5044	2578	4572	2166	464	5961	1177	463
30. Sarnia	3386	2751	1535	2741	1333	194	7593	5052	235
31. Saskatoon	5274	5690	3247	5375	2581	748	6678	1450	488
32. Sault St. Marie	2026	2563	1354	2371	1318	221	7204	2117	182
33. Shawinigan	2172	1730	1215	1665	1168	326	7252	935	897
34. Sherbrooke	3289	2973	2000	3177	1544	225	7183	1376	1390
35. Sudbury	3610	3825	2447	4016	1986	8276	8759	2426	198
36. Sydney-Glace Bay	2935	3008	2317	3769	2130	5456	7109	1728	241
37. Timmins	1137	1253	861	1405	674	3907	2621	533	70
38. Toronto	87698	163330	60570	91139	43121	8414	206049	32065	37996
39. Trois-Rivieres	3132	2986	2008	2920	1746	174	11885	1800	1986
40. Valleyfield	878	882	620	956	601	94	4114	720	616
41. Vancouver	32331	48072	25863	38976	19037	9095	69863	11951	6846
42. Victoria	6403	8018	4421	13523	3012	1827	9981	1970	579
43. Welland	1057	1142	674	1349	599	127	5176	1009	532
44. Windsor	7225	10692	4909	8830	4426	1087	20832	2719	1788
45. Winnipeg	19841	38325	15220	28950	13033	2313	46046	9215	7518

*For data sources, see Appendix F.

*APPENDIX E.

SIX SELECTED CENTRAL PLACE VARIABLES.

(MATRIX E).

		1. Total population	2. Total retail sales ($000's)**	3. Total income ($000,000's)	4. Number of retail functions	5. Index of market potential	6. Index of provincial sales
1.	Belleville	60655	45323	361	70	3	148
2.	Brantford	56741	63416	635	72	3	112
3.	Calgary	279062	345913	3581	88	2	90
4.	Chicoutimi-Jonquiere	105009	92338	902	57	4	112
5.	Cornwall	43639	44821	407	64	3	103
6.	Drummondville	39307	41423	291	68	3	134
7.	Edmonton	337568	381037	4125	90	2	118
8.	Ft. William/Port Arthur	93251	104225	1067	72	3	112
9.	Granby	31463	27547	280	59	3	112
10.	Guelph	41767	47076	494	70	3	113
11.	Halifax	183946	197149	2189	78	4	136
12.	Hamilton	395189	393428	4962	95	1	100
13.	Kingston	63419	79253	767	77	2	125
14.	Kitchener	154864	178473	1899	88	1	115
15.	Lethbridge	35454	55786	361	60	3	164
16.	London	181283	246109	2226	89	2	136
17.	Moncton	55786	71514	569	62	3	175
18.	Montreal	2109509	2028549	25323	102	1	123
19.	Moose Jaw	33206	48024	341	63	3	182
20.	Niagara Falls	54649	51967	653	69	2	95
21.	Oshawa	80918	83525	1033	76	2	103
22.	Ottawa	429750	380903	5887	96	1	89
23.	Peterborough	49902	65642	587	73	3	132
24.	Quebec	357568	345990	3453	96	1	146
25.	Regina	112141	139335	1444	76	3	156
26.	St. Catharines	95577	93702	1125	82	2	98
27.	St. Jean	34576	33490	317	64	3	124
28.	St. John	95563	97151	879	75	2	139
29.	St. John's	90838	102459	754	65	4	180
30.	Sarnia	61293	64452	788	74	3	67
31.	Saskatoon	95526	109553	1064	75	3	225
32.	Sault Ste. Marie	58460	66095	776	69	2	113
33.	Shawinigan	63518	43678	536	65	4	88
34.	Sherbrooke	70253	82945	594	75	3	151
35.	Sudbury	110694	124983	1407	76	3	113
36.	Sydney-Glace Bay	106114	94405	821	66	4	112
37.	Timmins	40121	37174	393	60	4	93
38.	Toronto	1824481	2114923	26149	101	1	116
39.	Trois-Rivieres	83659	80448	736	79	3	96
40.	Valleyfield	29849	27629	245	50	3	118
41.	Vancouver	790165	790585	9362	97	2	103
42.	Victoria	154152	147308	1676	86	2	98
43.	Welland	36079	38639	396	64	3	107
44.	Windsor	193365	175561	2162	93	2	91
45.	Winnipeg	475989	498138	5766	92	3	125

*For data sources, see Appendix F.

** Adjusted Figures

APPENDIX F

SOURCES OF APPENDIX B, APPENDIX D, AND APPENDIX E.

1. Appendix B. Retail Sales.

Figures for the sales in 102 categories of retail establishment are published in: Government of Canada, Dominion Bureau of Statistics, Census of Population, 1961 (Ottawa, Ontario: Queen's Printer, 1961), Vol. 6.1, Bulletin 6.1-1, Table 2. The twenty-five categories used in the study are shown in Appendix A. Blank cells in the data matrix were estimated according to the process outlined in Chapter Three (p. 30). The last two columns of Appendix B show the different total figures arrived at: the last column presents the figures published by the Census, and the penultimate column those derived by adding all the figures (including derived and adjusted figures) in each row of the matrix.

2. Appendix D. Socio-Economic Variables.

a. Population variables (1-5): Government of Canada, Dominion Bureau of Statistics, op. cit., Vol. 1.2, Bulletin 1.2-2, Tables 24 and 25.

b. Household variables (6-12). Ibid., Vol. 2.2., Bulletin 2.2-5. Tables 57, 58, 59; Bulletins CT-1 through CT-24.

c. Income variables (13-17). Ibid., Vol. 3.3, Bulletin 3.3-2, Tables 11, 12, 13.

d. Labour force variables (18-28). Ibid., Vol. 3.3, Bulletin 3.3-9, Table 27.

3. Appendix E. Central Place Variables.

a. Population. Government of Canada, Dominion Bureau of Statistics, op. cit., Vol. 12., Bulletin 1.2-2, Table 24.

b. Total sales. The derived figures in the penultimate column of Appendix B. were used instead of the Census published totals.

c. Income. Government of Canada, Dominion Bureau of Statistics, op. cit., Vol. 3.3, Table 11.

d. Number of Retail Functions. Ibid., Vol. 6.1, Bulletin 6.1-1, Table 2.

e. Index of Market Potential. D.M. Ray, "The Spatial Structure of Economic and Cultural Differences: A Factorial Ecology of Canada," Papers and Proceedings of the Regional Science Association, Vol. XXIII (1969), Figure 2 . Also, D.M. Ray, Market Potential and Economic Shadow, Department of Geography Research Paper No. 101 (Chicago, Illinois: University of Chicago, 1965).

f. Index of Provincial Sales. The method used to derive this index is given in Chapter Five , p.77 .

CURRICULUM VITAE

Name: HARRISON Given Names: PETER

Place of Birth: Manchester, England Date of Birth: March 23, 1947

Educational Institutions Attended, with Dates of Entering and Leaving:

Catholic University of America, Washington, D.C.	1964	to	1965
London School of Economics and Political Science (London University), England	1966	to	1969
University of Victoria, British Columbia	1969	to	1970

Degrees, Diplomas, etc.,, Awarded, with Dates and Names of Institutions:

B.A. (Hon.)	1969	London University

Honors and Awards:

United Kingdom Government Scholarship, 1966/69

The Director's Prize for Geography (London School of Economics), 1967

Hilda Ormsby Essay Prize, 1969

University of Victoria Graduate Fellowship, 1969/70

Publications:

'Demographic Change and Commercial Change: A Case Study in Metz, Eastern France', Horizon, Vol. 6, pp. 47-60. Publication of the London School of Economics and King's College (London) Geographical Association, 1969.

THE UNIVERSITY OF VICTORIA LIBRARY

MANUSCRIPT THESIS

AUTHORITY TO DISTRIBUTE

AUTHOR: This dissertation may be lent or microfilm copies made available:

(a) Without restriction [redacted]..

(b) With the restriction that, for a period of five years (until .....) the written approval of the following is required:

(1) The Chairman, School of Graduate Studies .....

(2) The Author .....

(3) Both the Chairman, School of Graduate Studies, and the Author .....

BORROWERS: The borrower undertakes, by signing below, to give proper credit for any use made of the thesis, and to obtain the consent of the author if it is proposed to make extensive quotations, or to reproduce in whole or in part.

Signature of Borrower	Address	Date
[redacted]	#208 514 23rd St E. Saskatoon Sask	July 19/71
[redacted]	432 Patricia Ave Winnipeg 19	Jan 4/72
[redacted]	Analyse et Indexation Université Laval, Québec	23 nov. 73