CHARACTERIZATION AND EXPLANATION OF THE DESTINATION CHOICE PATTERNS OF CANADIAN MALE LABOUR FORCE ENTRANTS 1971-76

By

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A Research Paper
Submitted to the Department of Geography
in Fulfilment of the Requirements
of Geography 4C6

McMaster University

April 1984

ABSTRACT

Since the classic study of migration and metropolitan growth by Lowry (1966), migration researchers have assumed a two-stage process wherein the decision to migrate is followed by the destination choice decision. Such an approach is employed here, to provide a characterization and explanation of the destination choice patterns of the male labour force entrants.

Specifically, a nonlinear migration model, developed by Liaw and Bartels (1982), is applied to Canadian migration data for the 1971-76 period. The inter-metropolitan migration patterns of the male labour force entrants is found to be well explained by six explanatory variables: population size, logarithmic distance, housing growth, employment increase, cultural barriers and "strong ties". The last two variables are dummy variables derived from the characterization of the destination choice patterns through the application of entropies. The study examines factors involved in the destination choice decision and concludes with suggestions for future investigation.

ACKNOWLEDGEMENTS

The completion of this thesis gives me an opportunity to thank those who have contributed their time and effort freely over the course of this research, as well as my years at McMaster in general. I extend my greatest appreciation to Dr. Kao-Lee Liaw for his continuous patience and guidance extended throughout the duration of this undertaking, as well as his insights into topics other than inter-metropolitan migration. Mr. Ric Hamilton deserves due acknowledgement for his diligent effort on the maps and diagrams contained within. I would also like to express my appreciation to the Department of Geography in general, for their most important role in providing both knowledge and insights which will remain with me (hopefully) for the rest of my days, as well as the relaxed 'open door' policy extended to the students. Lastly, but of no less importance, I would like to express my appreciation to my parents and other family members, for their support, financial and otherwise, over the course of the last four years.

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CHAPTER 1: INTRODUCTION

The growth of population within an urban area is the result of either natural increase, net in-migration or the enlargement of the political boundaries of the urban area (Greenwood, 1981). In modern nations, the role of net migration is magnified due to the declining rates of natural increase. The impacts of migration include not only an affect on the magnitude of a population, but also affects the age structure and hence the fertility of that population (Liaw, 1979). Therefore, a fundamental understanding of the processes of migration are necessary to understand the urban system in Canada. If demography is defined as "the systematic analysis of population phenomenon" (Schnell and Monmonier, 1983, pg. 5), then the study of migration becomes a key component of this knowledge.

This research analyzes the subject of Canadian inter-metropolitan migration in the 1971-76 period. If regional differentiation is mainly a product of internal migration, then it is possible to capture the character of regions through the characterization of migration amongst the largest urban centers of the nation, the Census Metropolitan Areas (CMA's, see Figure 1). It is possible to utilize an explanation of inter-metropolitan migration to provide an explanation of the regional differentiation that occurs within the nation. These two ideas, the characterization and explanation of inter-metropolitan migration, will form the basis of the statistical analyses contained within the paper. For this research, Canada is first divided into a metropolitan part and a nonmetropolitan part. The former is then further divided into the twenty-three CMA's shown in Figure 1 and Table 1. The divisions reflect our emphasis on the metropolitan areas.

The research hypotheses can be outlined as follows. First, it is hypothesized that it is possible to utilize a characterization of inter-metropolitan migration to develop a regional differentiation of migration patterns. Secondly, the inclusion of housing and employment variables is necessary to develop a comprehensive explanation of migration. Within the limits of this course, it is not possible to test these hypotheses for the entire Canadian population. The research to be carried out here will be limited to an indepth study of one cohort, the male labour force entrants, aged fifteen through nineteen in 1971.

This research does not deal with the question "why do people migrate?" Rather, it focuses on the destination choice patterns of migrants. The patterns are characterized by entropy measures and explained by a set of geographical and socioeconomical variables through a multinomial logit model adopted from Liaw and Bartels (1982). The migration data pertain to the 1971-76 intercensus period and were obtained in an unpublished form from Statistics Canada by

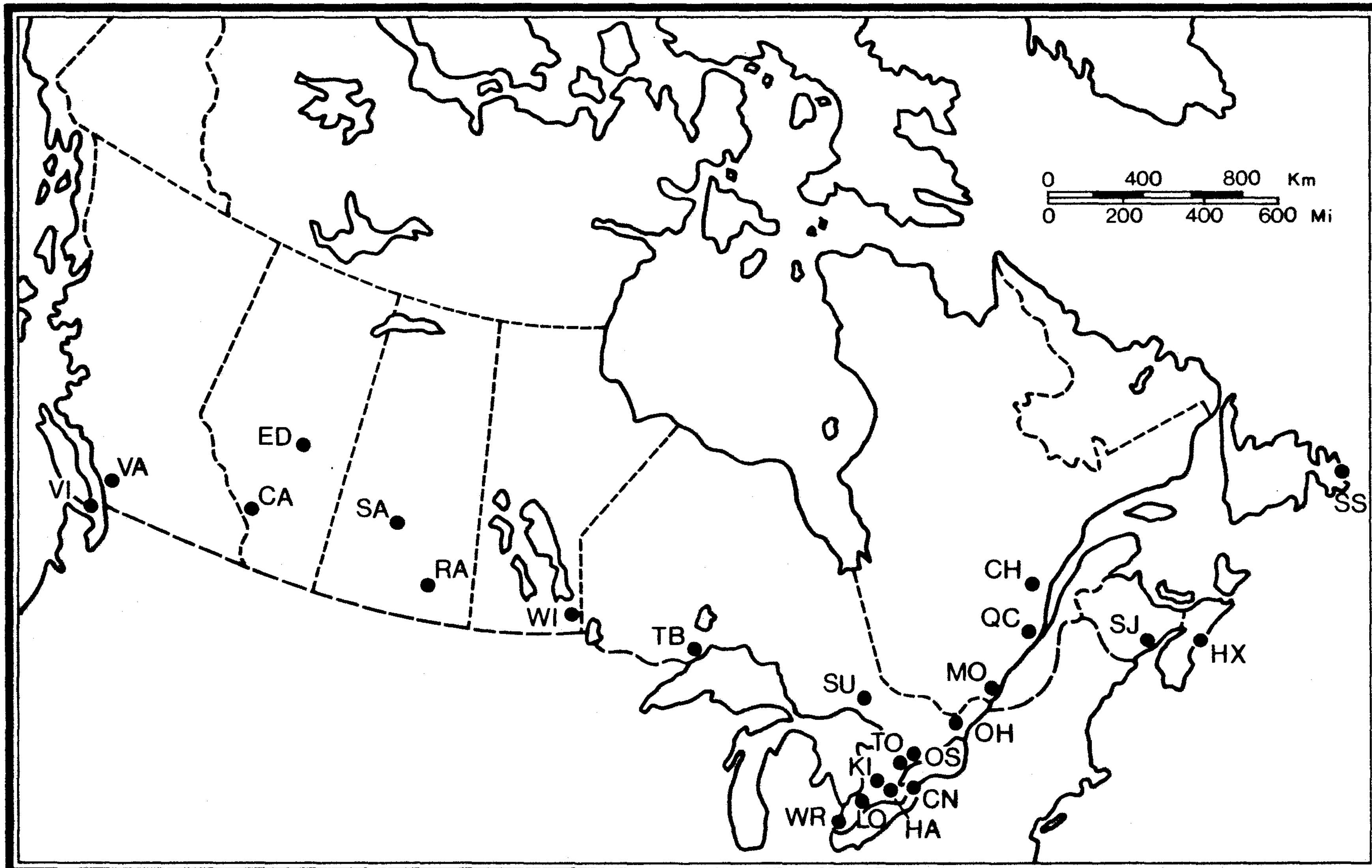
K. L. Liaw (1983).

The paper will be broken down as follows. Chapter Two presents a summary of the major migration theories. A synthesis of the development of two level allocation models is also included. The reader should pay particular attention to section 2.3, which summarizes the work of Liaw and Bartels. It is necessary to emphasize that this section outlines the techniques to be applied in the empirical study at hand.

Chapter Three describes the application of entropies to the origin by destination migration matrix for the labour force entrants group. Three types of entropies have been applied, following the approach of Theil (1972). The chapter developes a characterization of the migration patterns of the study group.

Chapter Four, entitled the Explanation of the Destination Choice Patterns, involves the empirical application of Liaw and Bartels (1982) destination choice model. Maximum likelihood method is used to estimate the unknown parameters. The explanatory variables include housing, labour market, cultural and geographical variables.

Chapter Five completes the paper, including conclusions about the research carried out here as well as suggestions for future undertakings.



THE LOCATION OF CANADIAN CENSUS METROPOLITAN AREAS.

Figure 1

CHAPTER 2: THEORETICAL AND EMPIRICAL BACKGROUNDS

2.1 Major Theoretical Approaches

A review of migration literature lends itself to a definite historic development of the theoretical approaches within the discipline. In 1885, Ravenstein developed his push-pull hypothesis to capture the phenomenon of rural-urban migration occurring in England at that time. He identifies that the existing social and economic conditions in the rural areas presented a disadvantageous state which pushed the inhabitants of these areas to search for better conditions. The rural inhabitants saw the developing urban areas as the solution to their predicament. The existence of educational and employment opportunities, as well as the developing urban social networks, pulled the rural inhabitants to the cities and towns (Ravenstein, 1885). Historic accounts of life in nineteenth century England have highlighted that life for the working class was far from glamorous. Unemployment was common, and the working conditions of the employed were dismal and often dangerous. But these realities could not overcome the powerful excitement of urban life and the attraction that held to the desolate rural inhabitants.

As the economies of nations became modernized, the phenomenon of urbanization became less important. The economy of a nation, as well as its society became more and more complex. Ravenstein's basic push-pull hypothesis became too simplistic to capture the process of migration. An approach identified as selectivity developed, which is based on the assumption that certain demographic, social and economic characteristics of the population identify mobile and immobile groups (Tice, 1980).

Voluminous literature has produced several consistent conclusions. Young adults are much more likely to move than the old. As an individual's level of education increases, his propensity to move also increases (Courchene, 1970). Specific to the Canadian setting, it has been repeatedly confirmed that the French language acts as a strong deterrent to the out-migration of the province of Quebec. Average income earners are less likely to move than the high and low income groups. White collar workers are identified as consistently moving greater distances than the Canadian blue collar worker (Courchene, 1970 and 1974).

This selectivity approach is used primarily as a tool to describe the migrant population, and to distinguish that population from those who are characteristically immobile. The final discernable approach is known as Human Capital Theory. The principles of the push-pull hypothesis and selectivity are evident in human capital theory, but the emphasis is switched to the determinants of migration, rather than maintaining the descriptive nature of the other two approaches.

Human capital theory is rooted in the general theory of investment and is therefore econometrically framed. The basic underlying notion of human capital theory is that an individual invests into his future well-being through the alteration of his present situation by raising the quality of his labour and therefore his earning capacity (Bodenhofer, 1967). The role of formal education and the upgrading of skills are key components in human capital theory. Mobility comes into play when an individual moves to an area in which his skills are in higher demand. A migrant is assumed to carry out a rational cost-benefit analysis, and the decision to move is a direct result of the expected benefits outweighing the incurred costs.

Both monetary and non-monetary aspects are taken into consideration. Paralleling cost-benefit analysis, the monetary aspects associated with a decision to relocate are quite readily quantified. These include such considerations as moving costs, transportation, lost wages and time. The non-monetary aspects are much more difficult to pin a dollar value on. How do you value such considerations as the emotional turmoil associated with leaving family and friends behind, or the anxiety of settling in unfamiliar surroundings?

These major theoretical approaches can all utilize the same data bases, and each approach has selected certain elements from the preceding ones. The next section will outline the development of the specific type of migration model that is applied in this research.

2.2 The Development of a Two-Level Model of Migration

The earliest migration models fell under two broad categories. The first borrowed laws from the physical sciences and applied these laws in a social science context. The gravity model developed in this manner, using population size and intervening distance to predict migration flows on an aggregate scale (Meuller, 1982). The second category is labelled as neoclassical. The basic underlying theory is that "differences in net economic advantages, chiefly differences in wages, are the main causes of migration" (Meuller, 1982, pg. 8). Migration is seen as a tool which will eventually eliminate any regional differentiation in wages and employment.

Lowry (1966), in his classic study on the links between migration and metropolitan growth, combined these two early schools of thought into one migration model.

$$M_{ij} = k(U_i/U_j \cdot W_j/W_i \cdot L_iL_j/d_{ij}) \qquad (4)$$

where, M_{ij} is the number of migrants from i to j, U_i and U_j are unemployment rates at i and j, W_i and W_j are the wage rates, L_i and L_j are the labour forces, d_{ij} is the intervening distance and k is a constant.

Lowry expected that the economic conditions at both the origin and destination would have equivalent effects on the resulting migration. His empirical testing of the model disproved this hypothesis. Instead, Lowry found that the origin economic conditions were not important in determining migration, but the economic conditions of the destination had a significant impact (Lowry, 1966).

This result has affected profoundly all migration research which has followed. Many researches now assume that the migration decision is a two-stage process wherein the decision to migrate is followed by the destination choice decision. The nonlinear model to be introduced in the next section is based on such an assumption.

2.3 A Nonlinear Migration Model

This section will summarize the nonlinear migration model developed by Liaw and Bartels (1982). This is the model to be applied, in part, to develop an explanation of the destination choice patterns of the labour force entrants group. The development of the model was motivated to capture the dynamics of both the spatial and temporal characteristics of the processes of inter-metropolitan migration. It is attractive because it incorporates well developed statistical theory while maintaining a simple methodology.

It is assumed within the model that the decision to move is made before a particular destination choice is identified. Thus, the general model has two components. It is developed as follows:

$$M_{tij} = p_{ti}p_{tij} \qquad (5)$$

where, p_{ti} is the individual's probability of moving out of place i during time period t and p_{tij} is the conditional probability of determining place j as the destination choice. M_{tij} becomes the probability that an individual from place i will migrate to place j during the time period t. p_{ti} and p_{tij} are subject to the following constraints, by definition,

$$0 \leq p_{ti} \leq 1, \quad 0 \leq p_{tij} \leq 1, \quad \sum_{j=1}^{D} p_{tij} = 1 \tag{6}$$

where D is the total number of possible destinations.

The departure model and destination choice model have been developed to satisfy these constraints. Logistic formulations were found to be the most convenient.

$$p_{ti} = \frac{e^{\alpha_0 + \alpha_1 x_{ti1} + \ldots + \alpha_k x_{tik}}}{1 + e^{\alpha_0 + \alpha_1 x_{ti1} + \ldots + \alpha_k x_{tik}}} \qquad \text{Departure Model} \tag{7}$$

$$p_{tij} = \frac{e^{\beta_1 x_{tij1} + \beta_2 x_{tij2} + \ldots + \beta_k x_{tijk}}}{\sum_{l=1}^{D} e^{\beta_k x_{til1} + \beta_2 x_{til2} + \ldots + \beta_k x_{tilk}}} \qquad \text{Destination Choice Model} \tag{8}$$

where, $x_{ti1} \ldots x_{tik}$ are the identified variables controlling the departure probabilities p_{ti}; $x_{tij1} \ldots x_{tijk}$ are the determinants of the destination choice probabilities. Both models are nonlinear.

Bartels and Liaw (1983) applied their departure and destination choice models to study the internal labour migration of the Netherlands. The models were utilized to discover the influence of housing supply, inter-regional distance, general living and labour market conditions. A measurement of housing supply was found by calculating the percentage increase in the total housing stock. The inverse of the unemployment rates were used to indicate the condition of the labour market. Environmental quality was employed to indicate the general living conditions appearing in each destination. Distance was represented by the inter-provincial physical distance.

They found that these few variables could account for a large part of the variations in the destination choice proportions (R^2 = 0.79) and the variations in the departure rates (R^2 = 0.49). Inter-regional distance and labour market size provided the greatest degree of explanatory power in the destination choice model, as reflected in the calculated t-ratios. Dummy variables were added to represent unusually strong flows which the economic and housing variables could not capture. The housing, job opportunity and environmental quality variables proved to be insignificant in explaining the destination choice proportions, although the positive effect of national housing growth on the departure rates turned out to be highly significant.

The theoretical and empirical backgrounds of the research at hand are now complete. It is now possible to use these frameworks to develop a characterization and explanation of the destination choice patterns of the young labour force inter-metropolitan migrants in Canada in the period 1971-76.

CHAPTER 3: CHARACTERIZATION OF THE DESTINATION CHOICE PATTERNS

3.1 Introduction

The purpose of this chapter is to develop a quantitative characterization of the destination choice patterns of Canadian male labour force entrants during the 1971-76 period. These entrants include all male Canadians who were fifteen through nineteen years of age in 1971 and were found to have migrated from one region to another, within Canada, in the five year period. We are asking two questions about the migrants from each place of origin:

1. How are the migrants distributed into metropolitan-ward (MW) and nonmetropolitan-ward (NMW) migration streams?
2. How is each MW migration stream further divided into the twenty-three metropolitan-specific (MS) migration streams?

These questions lend themselves to developing a hierarchical structure for the pattern of destination choice. The first question is interested only in the choice between a metropolitan or nonmetropolitan destination. The second question is interested in the description of the specific choice of a particular CMA.

Entropies will be used to measure the distribution of migrants among the different streams. The results of these entropy analyses will provide a quantitative characterization of the destination choice patterns within the Canadian setting. The specification of the relevant entropies and the methodologies employed will be outlined in the following section.

3.2 Specification of Entropies

Entropies are the computed values of "the expected information content" (Theil, 1972, pg. 4) of a statement before its message is known. Suppose we want to find out whether a migrant belongs to the MW of NMW stream. Let p be the probability that the migrant belongs to the MW stream. Then the entropy of a statement about the migrant's choice of destination streams is defined as:

$$H_1 = p\log(1/p) + (1 - p)\log(1/1 - p) \qquad (1)$$

This formula can be broken into two components. The first component, log(1/p), represents the information of a statement which indicates that an individual has chosen the metropolitan-ward destination. The second component, log(1/1 - p), represents the information of a statement indicating that an individual has chosen the nonmetropolitan-ward destination.

The expected information content is calculated as the weighted sums of the individual informations, with the corresponding probabilities as the weights. The value of the entropy will be highest when p = 0.5, as illustrated in Appendix A. This represents the most uncertain situation, as there is an equal chance of the individual choosing a metropolitan or a nonmetropolitan destination. Since 1 - p is dependent on the value of p, if p is very large or very small, a small amount of average information will be conveyed to the observer. In other words, the value of the entropy lowers as p and 1 - p become increasingly dissimilar. By interpreting p as the proportion of migrants belonging to the MW stream, H_1 becomes a measure of the evenness of the distribution of migrants between the two alternatives. Since we are not interested in intra-regional migration, H_1 is not computed for the migrants moving out of the 'rest of Canada' (the nonmetropolitan part of Canada).

The theoretical maximum of H_1 can be found by setting $p = 1 - p = 0.5$. That is, the maximum entropy is:

$$H_1 = 0.5\log_2(1/0.5) + 0.5\log_2(1/0.5) = 1.0$$

Information is measured in units of bits and the base of the logarithm is therefore two.

Let q_i be the probability that a MW migrant chooses the ith CMA as the destination. Then the entropy of a message about this migrant's choice of destination is:

$$H_2 = \sum_{i=1}^{R} q_i \log(1/q_i) \qquad (2)$$

where R = 23 if the migrant is from the rest of Canada; otherwise, R = 22. By interpreting q_i as the proportion of the MW migrants who have chosen the ith CMA as the destination, we can use H_2 as a measure of the evenness of the distribution of the MW migrants among the alternative CMA's.

The theoretical maximum of H_2 can be found in the following fashion:

$$H_2 = \log_2 22 = (\log 22/\log 2) = 4.46$$

Again, the unit of information is bits and the logarithmic base is two.

For each CMA, we can define the total entropy as:

$$H = H_1 + pH_2 \qquad (3)$$

which measures the evenness of the CMA's migrants among all twenty-three possible destinations. Following Theil's convention, we may call H_1 and H_2 as <u>between-group</u> and <u>within-group</u> entropy, respectively.

The characterization of the destination choice patterns of male Canadian labour force entrants has been developed by computing the three entropies specified here using the software Minitab package. The following three sections of this chapter will involve a description of the results of each of the entropy analyses. A complete summary of the computed entropy values is contained in Table 1.

3.3 Between-Group Entropies

The initial stage in the characterization of the male labour force entrants is the compilation of between-group entropies. This allows us to develop a quantitative description of the distribution of migrants into metropolitan-ward (MW) and nonmetropolitan-ward (NMW) migration streams. For each CMA, the values for p and 1-p were first computed from the migration data and then entered into equation (1) to

Table 1: Summary of the Entropy Analyses

CMA Origin	Value of p (MW)	Value of 1-p (NMW)	Between Group Entropy	Within Group Entropy	Total Entropy
1 St. John's	.414352	.585648	.978729	3.12712	2.27446
2 Halifax	.423996	.576004	.983268	3.69374	2.54940
3 Saint John	.398648	.601316	.970176	2.99672	2.16492
4 Chicoutimi	.540121	.459879	.995350	1.65191	1.88758
5 Quebec City	.534784	.465216	.996506	1.79023	1.95389
6 Montreal	.454536	.545464	.994028	3.39047	2.25351
7 Ottawa-Hull	.514045	.485955	.999431	3.50594	2.80164
8 Oshawa	.536193	.463807	.996217	2.47768	2.32473
9 Toronto	.465925	.534075	.996647	3.89772	2.81269
10 Hamilton	.567847	.432153	.986677	3.16816	2.78571
11 St. Cath-Niagara	.622931	.377069	.955945	3.03119	2.84417
12 Kit-Wat.	.532273	.467727	.996993	3.05786	2.62461
13 London	.505189	.494811	.999920	3.21832	2.62578
14 Windsor	.553256	.446744	.991801	3.22248	2.77465
15 Sudbury	.525333	.474667	.998147	3.24994	2.70545
16 Thunder Bay	.565860	.434140	.987448	3.28739	2.84765
17 Winnipeg	.488895	.511105	.999644	3.35067	2.63777
18 Regina	.531823	.468177	.997076	3.05663	2.62266
19 Saskatoon	.491257	.508743	.999780	2.76183	2.35655
20 Calgary	.450050	.549950	.992789	2.88047	2.28915
21 Edmonton	.400757	.599243	.971391	2.65045	2.03358
22 Vancouver	.331076	.668924	.916022	3.24057	1.98890
23 Victoria	.467068	.532932	.996869	2.52963	2.17838
24 Rest of Canada	1.00000	.000000		4.01761	4.01761
Maximum Entropy			1.0bit	4.46bits	

yield the between-group entropy.

The theoretical maximum of the between-group entropy has been calculated as 1.0 bits. A quick scan of the between-group values for the twenty-three CMA's leads one to believe that the allocation of the out-migrants is very similar between the MW and NMW migration streams, as all of the values are greater than 0.9 bits. The following discussion will illustrate that this speculation does not hold.

The between-group entropy values convey the closeness to an even distribution between the MW and NMW streams. A few CMA's reflect a well-balanced distribution between the two possible streams. London, for example, has a between-group entropy of 0.9999. A migrant from London has an almost perfect fifty-fifty chance of choosing a metropolitan or non-metropolitan destination. Saskatoon and Winnipeg, with values of 0.9998 and 0.9996 respectively, are also centers of well-balanced migrant distributions. Ottawa-Hull also has a fairly even distribution among the MW and NMW streams as reflected by the entropy of 0.9994.

It has been previously stated that as p and 1-p become increasingly dissimilar, the value of the entropy decreases. Without checking the values of p and 1-p, it is not possible to interpret in which direction the bias is lying. In other words, the between-group entropy value is blind to the direction of the imbalance in distribution between the MW and NMW streams. For example, although Ottawa-

Hull and Winnipeg have almost identical between-group entropies, the odds for the MW stream are 51:49 for Ottawa-Hull and 49:51 for Winnipeg. The biases are in opposite directions.

For the CMA's with relatively low between-group entropies, it is essential to know the direction of strong preference. Vancouver has the lowest between-group entropy at 0.9160. The values of p and 1-p are more dissimilar than in any of the other CMA's. The value of p is 0.33 and 1-p is 0.67. This indicates that two out of every three migrants from Vancouver choose nonmetropolitan destinations. St. Catharines-Niagara has the second smallest between-group entropy (0.9559) and is biased in the opposite direction, with p having a value of 0.62 and 1-p of 0.38. However, the CMA's with the third and fourth smallest between-group entropies, Saint John and Edmonton, are both strongly biased toward nonmetropolitan destinations.

It is an interest of this study to develop a knowledge of regional patterns as reflected by the largest urban centers. The p and 1-p values allow for some regional characterization. The Maritime CMA's, St. John's, Halifax and Saint John, all show strong NMW biases. The western seaboard CMA's of Vancouver and Victoria indicate the same tendency. One could speculate that peripheral centers have a stronger tie to NMW destinations.

The provinces of Quebec and Ontario also share similar destination choice patterns. Chicoutimi and Quebec City are biased towards the MW stream. Montreal, the largest urban center within the province, is biased towards nonmetropolitan-ward streams. All of the Ontario CMA's are metropolitan-ward biased except for Toronto, which again is the largest urban center. Toronto, like Montreal, is biased towards NMW destinations.

The West is more difficult to classify. Generally, the bias tends to favour NMW destinations, with the exception of Regina. The magnitude of this bias varies more than in any of the other regions. The next stage in the analysis, the calculation of within-group entropies, will further develop the characterization of the destination choice pattern. It will then be possible to provide some speculations on the developing patterns of the labour force migration streams.

3.4 Within-Group Entropies

The second stage of the entropy analysis consisted of the computation of within-group entropies H_2, computed according to equation (2). For migrants from each CMA, there are twenty-two possible alternative destinations. Recall that the theoretical maximum of H_2 has been determined as 4.46 bits. If the value of the within-group entropy is small, then a concentrated pattern of destination choice is reflected. Conversely, a large within-group entropy value indicates a dispersed pattern of destination choice.

Toronto has the largest within-group entropy, with a value of 3.8977. This highly dispersed pattern conveys that a migrant has similar probabilities of choosing several alternative destinations. Ottawa-Hull, with a within-group entropy of 3.5059, also has a dispersed pattern of migration. Intuitively, this seems to be reasonable, as one would expect the nation's capital to feed migrants to all areas of Canada.

Chicoutimi and Quebec City have the lowest within-group entropies of 1.6519 and 1.7902 respectively. This conveys to the observer that the pattern of destination choice for these two cities is very concentrated. Again this seems to be intuitively understandable, as we would expect these migrants to remain within the boundaries of the French language. Montreal, with the largest within-group entropy among all CMA's in Quebec (3.3905), seems to act as the province's leaping point to the CMA's of 'English' Canada.

In the Maritime and western regions, the CMA's at the highest level in the urban hierarchy also have the highest within-group entropies: 3.6937 for Halifax and 3.2406 for Vancouver. In general, within each urban system, the within-group entropy is a reflection of a metropolitan area's importance.

Table 2 is an origin by destination proportion matrix. The information contained in this table can be utilized in conjunction with the within-group entropies to further develop the characterization of the choice pattern. Each column in the table contains the percentage distribution of metropolitan-ward out-migrants among the alternative CMA's.

The concentration of the destination choice pattern of the MW migrants from Chicoutimi is clearly indicated in Table 2. Only three CMA's receive more than one per cent of these migrants. Montreal is the destination choice of 49.5%, Quebec City of 37.7% and Ottawa-Hull of 8.4%. This pattern is quite different from the dispersed pattern of Toronto. Toronto is the only CMA which sends migrants to each of the other twenty-two CMA's. Kitchener-Waterloo and Vancouver are the only two destination choices which receive more than ten per cent of the MW migration from Toronto.

The table makes it possible to speculate further on the regional aspects of labour force entrants migration. The Maritimers tend to 'skip' over Quebec and choose Southern Ontario and Western destinations. The total percentages of migrants to these two alternative regions is almost equivalent, with Southern Ontario having a small upper hand.

The internal cohesion of the province of Quebec is extremely strong. Out-migration to the other regions of Canada is not significant in comparison to the migration within the provincial boundaries. Quebec as a destination choice of migrants originating from Southern Ontario, the Maritimes and the West is also insignificant. The provincial boundaries of Quebec seem to act as a repellent against both in and out migration in the destination choice pattern of

Origin CMA

Destination CMA

	St.J	Hal	Sa.J	Chi	Q.C	Mon	Ot-H	Osh	Tor	Ham	Ca-N	K-W	Lon	Wind	Sud	T.B.	Winn	Reg	Sask	Cal	Edm	Van	Vic	RofC
St.J	--	3.7	3.3	0	0	0.5	0.5	0	0.9	0	0.3	0.4	0	0	0.5	0	0.8	0.5	0	0.6	0	0.2	0	1.5
Hal	15.8	--	3.8	0.6	1.5	3.4	4.6	0	3.0	2.8	1.5	1.4	1.5	1.6	0.6	0	2.5	1.2	0.6	1.9	0.3	1.4	6.2	4.6
Sa.J	5.0	4.7	--	0	0	0.6	0.3	0	0.5	0	0	0.4	0.4	0.8	0.4	0.6	0	0	0	0.3	0	0	0	1.2
Chi	0	0.6	0	--	4.2	1.9	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7
Q.C.	0	1.1	0	37.7	--	12.3	3.2	0	0.5	0	0	0	0.4	0	0	0	0	0	0	0.3	0.3	0.6	0.9	6.0
Mon	5.6	11.1	3.3	49.5	67.5	--	18.9	2.5	5.8	1.4	1.3	3.5	2.5	1.3	5.8	2.3	3.8	0.5	1.7	2.0	1.4	4.4	1.8	14.6
Ot-H	10.4	12.2	5.0	8.4	13.0	17.7	--	4.3	9.6	5.7	4.2	7.9	6.9	8.0	11.7	1.2	4.0	4.2	1.7	2.9	4.6	4.6	5.0	6.7
Osh	0	1.1	0	0	0	0.9	0.9	--	8.2	1.2	0.9	0.9	2.5	0.9	2.0	1.2	0	0	0	0	0	0	0	1.0
Tor	29.8	19.7	16.8	0.6	6.3	25.2	25.2	58.0	--	36.1	39.3	41.5	39.1	34.0	35.7	24.7	11.5	7.4	3.3	6.2	6.7	13.0	6.7	11.7
Ham	0	1.1	8.2	0	0	2.6	1.6	5.0	9.4	--	15.7	10.1	7.6	5.1	9.3	1.2	2.2	2.0	1.1	2.0	0.8	0.6	0.5	2.2
Ca-N	0	2.1	0	0	0.3	0.5	0.9	2.5	4.2	12.0	--	3.2	2.6	3.8	3.2	0	0.3	0	0	0	0.2	0.2	0	0.8
K-W	5.6	2.7	1.7	0	0	1.3	3.7	5.0	11.9	9.3	11.0	--	7.6	6.9	8.7	4.8	0.8	0	1.1	0.6	0.6	2.2	0.9	3.2
Lon	1.9	1.6	3.3	0	0	2.0	3.8	5.2	8.9	8.4	7.3	10.8	--	15.8	6.9	5.9	1.7	1.0	0.6	0.3	0.8	1.6	0	2.9
Wind	0	0	0	0.6	0.3	0.6	1.0	0	1.4	1.4	3.0	1.4	4.4	--	0.5	2.4	0.6	0	0	0	0.3	0.9	0	0.8
Sud	0	1.1	0	0	0	0.4	1.1	0	1.6	0.3	1.6	0.4	0.8	0.5	--	3.8	0.6	0.5	0.5	0.3	0	0.4	0	1.2
T.B.	0	0	1.7	0	0	0.4	1.0	0.8	1.8	1.8	1.0	0.4	1.2	1.5	1.1	--	1.4	1.0	0	0.3	0.6	0.2	0	0.9
Winn	3.7	2.7	3.3	0.6	1.1	2.5	3.8	0.8	3.4	1.2	1.6	1.3	0.8	0.9	2.1	19.0	--	6.4	9.5	5.9	3.8	7.6	3.4	6.0
Reg	0	2.1	0	0	1.0	0.5	0.9	0.8	0.7	0	0	1.7	0.4	0.5	1.0	4.8	5.8	--	10.7	4.5	3.6	2.0	1.4	3.1
Sask	0	0.5	0	0	0	0.3	1.2	0.8	0.6	0.3	0	0.4	0	0	0.5	2.4	4.7	21.7	--	3.8	2.0	3.1	1.4	3.6
Cal	3.9	9.3	5.0	0	1.0	5.8	5.6	5.0	6.4	5.2	2.6	4.0	5.1	5.3	1.5	6.2	20.6	23.3	28.5	--	41.5	18.6	10.1	8.1
Edm	4.7	5.5	1.7	0.6	1.7	6.2	6.7	3.3	5.6	3.8	3.3	3.6	5.6	4.8	2.0	2.4	13.9	13.8	29.1	37.9	--	21.0	12.2	10.6
Van	10.8	10.6	6.9	0.6	1.3	12.1	10.8	3.3	12.8	6.4	2.7	5.9	8.3	5.8	4.9	16.6	21.1	13.9	10.0	21.0	23.2	--	49.8	6.7
Vic	2.8	6.4	1.7	0.6	0.7	2.1	4.1	2.5	2.6	2.8	2.3	0.9	1.6	2.7	1.0	1.2	3.7	2.5	1.7	9.2	9.4	17.3	--	2.1

Table 2: The Percentage Distribution of Metropolitan-Ward Outmigrants Among the CMA's

the labour force entrants.

Migrants who originate in Southern Ontario tend to choose alternative CMA's within the same region. Western destinations are, however, important alternatives. The West portrays this same type of pattern, with Western destinations as the most prominant, but a significant proportion migrating to Southern Ontario CMA's.

3.5 Total Entropies

The third and final stage of the entropy analysis consisted of the computation of the total entropies for each of the twenty-four regions. These total entropies are the weighted sums of the between-group and within-group entropies. Since the variation in within-group entropies is much larger than the variation in between-group entropies, it is clear that the variation in the total entropies is mainly due to the variation in the within-group entropies. For example, the two CMA's with the lowest total entropies are Chicoutimi and Quebec City which have been shown to have the lowest within-group entropies. Similarly, the CMA's with high within-group entropies such as Toronto and Ottawa, turn out to have high total entropies. However, the CMA's with the lowest proportion of migrants choosing the NMW stream also have large total entropies (eg. St. Catharines-Niagara, Hamilton and Thunder Bay). Since the greater proportion of the choices areNMW, then the distribution amongst all the CMA's appears to be more even when the NMW share is reduced.

3.6 Summary

The computation of entropies allows the observer to follow an individual through a hierarchy of destination choices. The first choice an individual must make is between metropolitan-ward (MW) and nonmetropolitan-ward (NMW) destinations. The computation of between-group entropies conveyed a level of expected information. After this initial choice, we are interested only in those migrants who have chosen a metropolitan destination. These individuals must make a specific choice about a CMA destination. Within-group entropies were calculated to describe this stage of the destination choice process. The total entropies calculated represent a choice made between all possible destinations.

The speculations developed in this chapter, based on the characterization of the choice pattern through the application of entropies, will become important implements in the next section of analysis. The patterns uncovered here will play an important role in the determination of dummy variables to be utilized in the next chapter. The following chapter, through the inclusion of housing and labour market variables will place some rationality behind this characterization of the destination choice pattern.

CHAPTER 4: EXPLANATION OF THE DESTINATION CHOICE PATTERNS

4.1 Introduction

Chapter Three has provided a basic description of the inter-metropolitan migration destination choice patterns of the labour force entrants. The purpose of the analysis outlined here is to develop an explanation of these patterns. An attempt is made to uncover the dynamic properties of labour force migration, with a focus on the influences of the destination labour market and housing supply properties. As outlined earlier, this analysis is a direct application of the destination choice model developed by Liaw and Bartels (1982). This chapter will (i) specify potentially useful explanatory variables; (ii) describe the estimation procedure; (iii) report the statistical results; and (iv) summarize the empirical findings.

4.2 Specification of the Variables

The following thirteen explanatory variables were carefully chosen, in hope that each would offer some degree of explanation to the destination choice patterns.

1. Distance: The intervening road mileage distance between the origin and the destination measured in kilometers was included. Increasing distance is expected to have a negative effect on migration. (Source: Ontario Motor League)

2. 1971 Population at Destination: These figures were adjusted to conform to the 1976 area composition of each CMA, but no attempt was made to adjust for census underenumeration. Population size is expected to have a positive effect on migration. (Source: 1976 Census of Canada, Population: Geographic Distributions, Table 2).

3. Average Annual Percentage Housing Growth Rate at Destination: This was determined using the following formula:

$$\frac{\frac{HB71}{OD71} + \frac{HB76}{OD76}}{2} \times 100$$

where, HB71 = Homes Built in 1971 (Source: The Financial Post Survey of Markets 1973/74)

OD71 = Total Occupied Dwellings in 1971 (Source: The Financial Post Survey of Markets 1973/74)

HB76, OD76 (Source: The Financial Post Survey of Markets 1979)

Housing growth is expected to have a positive effect on migration.

4. Percentage Increase in Employment at Destination: Levels of employment were gathered for each CMA for the years 1971 and 1976. These were converted into percentage figures by dividing the employment increase from 1971 to 1976 by the 1971 employment level and multiplying by one hundred. Increasing levels of employment are expected to have a positive effect of migration. (Source: 1971 data - The Financial Post Survey of Markets 1973/74; 1976 data - The Financial Post Survey of Markets 1979)

5. 1971 Unemployment Rate at Destination: The percentage of unemployed males in the 1971 male labour force population in each CMA. Higher unemployment rates are expected to have a negative effect on migration. (Sourse: 1971 Census of Canada, catalogue 94-703, table 5)

6. 1971 Average Weekly Earnings of Destination: Chosen as an indicator of the income level associated with each alternative destination. Average Weekly Earnings are expected to have a positive effect on migration. (Source: The Financial Post Survey of Markets 1973/74)

7. Percentage Increase in Average Weekly Earnings at Destination: The percentage figure was derived from the actual increase in average weekly earnings between the years 1971 and 1976. Expected to have a positive effect on migration. (Source: 1971 data - The Financial Post Survey of Markets 1973/74; 1976 data - The Financial Post Survey of Markets 1979)

8. 1971 Average Income at Destination: Average Income is defined to include all forms of wages and salaries net of income from bonds, dividends or investment, or government transfer payments. Expected to have a positive effect on migration. (Source: 1971 data - The Financial Post Survey of Markets 1973/74; 1976 data - The Financial Post Survey of Markets 1979)

9. The Percentage Increase in Average Income: This variable has been calculated to act as an indicator of any changes in income opportunities at each destination between 1971 and 1976. Expected to have a positive effect on migrat-

tion. (Source: 1971 data - the Financial Post Survey of Markets 1973/74; 1976 data - The Financial Post Survey of Markets 1979)

10. 1971 Gross Rent: This variable gives an indication of the cost of physical accommodation at each destination. Gross rent is the total monthly amount paid by a tenant, including cash rent, water, electricity, and gas or fuel. (Source: 1971 Census of Canada, Housing, Table 47). Increasing gross rent is expected to have a negative impact on migration.

11. Cultural Barrier: A dummy variable included to represent the cultural barrier existing between Quebec and the rest of Canada. A value of one was used to represent a barrier. For example, if Montreal was the origin, all other CMA's would have a value of one, except for Chicoutimi and Quebec City. Ottawa-Hull was considered to be outside of Quebec.

12. Special Position of Ottawa-Hull: A dummy variable included to capture the special role of Ottawa-Hull as 'the Nation's capital'. A value of one was given to Ottawa-Hull as the destination.

13. Strong Ties: The initial entropy analysis uncovered a few migration flows between centers which are not explainable by any of the other variables. Especially strong ties were found from Halifax to Victoria as well as from Victoria to Halifax. Also, flows from Chicoutimi to Quebec City and from Quebec City to Montreal were found to be very strong.

Flows from Oshawa to Toronto and from Victoria to Vancouver were also included in this dummy variable. Lastly, the dummy variable was used to capture the strong migration ties from Calgary to Edmonton, as well as the reverse flow from Edmonton to Calgary.

4.3 Estimation Procedure

The model, as presented in equation (2) in section 2.3, is nonlinear in parameters. A BMDP program named BMDP3R is employed together with a subroutine adopted from Liaw and Bartels (1982), to perform an iterative procedure searching for the maximum likelihood estimates of the unknown parameters. The program accepts as input all possible pairs of CMA's, representing a total of 506 possible migration flows.

A residual is calculated by subtracting the observed migration proportion from i to j from the migration proportion which is predicted by the model. The weighted residual mean square is computed from the residuals. For each explanatory variable entered, a tolerance level is calculated to provide an indication of the level of colinearity with other explanatory variables. The mean and standard deviation are also provided for each of the input variables.

The output of BMDP3R is then edited to create two smaller subfiles. The first subfile contains the mean and standard deviation of the variables, as well as the parameter estimate, asymptotic standard error and tolerance level. The first subfile is entered into a Minitab program which, after a series of mechanical manipulations, determines the measures of relative importance of the explanatory variables within a logit model. The output includes the adjusted t-ratio[1] associated with each variable as well as the beta weight and elasticity measures, which indicate the strength of each variable as an explanatory component (Liaw and Bartels, 1982).

The second subfile is entered into a multiple linear regression routine named BMDP1R. The data subfile contains the 506 origin-destination possibilities and the corresponding predicted, observed and residual migration flow levels. The program BMDP1R computes a value of the model's multiple r-square. This is indicative of the model's overall ability to explain the destination choice patterns of the labour force entrants. The output also includes a series of graphical portrayals of the relationships between the observed, predicted and residual values.

The above procedures was carried out in seven separate tests. The variables were changed from one run to the next, according to the results of each run as a whole, as well as the performance of each particular variable.

4.4 Results of the Destination Choice Model

The following section will outline the results of the seven runs of the computer programs described in section 4.3.

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[1] The t-ratio is determined by dividing the estimated variable parameter by the standard error. The adjusted t-ratio is determined by dividing the t-ratio by the weighted error mean square. This avoids the possibility of variables which contribute little having a significant t-ratio.

Table 3 summarizes the coefficients from the estimation results for the allocation model and includes the associated adjusted t-values. The multiple r-square value for each specification is also presented. The beta weights and elasticity measures for each of the seven specifications are provided in Appendix B.

The overall explanation of specification 1 is quite good, as indicated by the R^2 value of 0.7486. As shown in Table 3, three variables were excluded in this first test. In order to avoid creating colinearity problems among variables, only two of the four income related variables were included, in this case average weekly earnings and the percentage increase in average weekly earnings. The dummy variable created to capture unusually strong ties between specific CMA pairings was also excluded. It is of greater interest to exclude this variable and test the performance of the other variables. Some of these 'strong ties' may be well predicted by other variables.

The distance and population variables come out quite strongly as explanatory variables.[2] The dummy variable representing the cultural barrier separating the province of Quebec from the rest of Canada is useful in explaining a high degree of the labour force entrants migration patterns. The specification does hold a few initial disappointments. Both

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[2] At the 0.05 significance level, a value of $\pm$ 1.95 is significant. At the 0.01 significance level, a value of $\pm$2.326 is significant. Section 4.2 has outlined the expected 'direction' or the sign.

Table 3. Coefficients From Estimation Results For The Allocation Model (adjusted t-values given in brackets)

Independent Variable	Specification 1	2	3	4	5	6	7
Distance	- 0.41*	- 0.40*	- 0.55	- 0.55	- 0.54	- 0.54	- 0.51
	(-14.6)	(-14.7)	(-20.7)	(-20.3)	(-20.8)	(-19.7)	(-18.5)
1971 Population	0.09	0.09	0.09	0.09	0.09	0.09	0.09
	(16.1)	(16.6)	(18.7)	(19.1)	(19.2)	(23.4)	(23.1)
% Housing Growth	0.30	0.29	0.24	0.28	0.28	0.24	0.24
	(4.6)	(4.6)	(4.3)	(5.0)	(5.0)	(4.4)	(4.5)
% Increase In Employment	0.04	0.04	0.05	0.05	0.05	0.04	0.04
	(6.1)	(6.3)	(8.6)	(7.7)	(7.9)	(10.3)	(10.1)
1971 Unemployment Rate	0.16	0.15	0.18	0.17	0.16		
	(4.3)	(4.2)	(5.4)	(4.9)	(5.1)		
1971 Average Weekly Earnings	0.06	0.08	- 0.36				
	(0.1)	(0.2)	(- 1.1)				
% Increase In Av. Weekly Earnings	- 1.40	- 1.36	- 2.01				
	(- 1.5)	(- 1.5)	(- 2.5)				
1971 Average Income				- 0.05			
				(- 0.3)			
% Increase In Average Income				-11.92	-10.6		
				(- 1.8)	(- 1.9)		
1971 Gross Rent	0.93	0.94	0.54	0.69	0.63		
	(1.8)	(1.8)	(1.2)	(1.8)	(1.9)		
Cultural Barrier	- 1.43**	- 1.64	- 1.37	- 1.44	- 1.44	- 1.49	- 1.42
	(-11.2)	(-12.2)	(-11.6)	(-12.0)	(-12.1)	(-12.0)	(-11.4)
Special Position of Ottawa-Hull	0.12	- 0.06	0.04	0.03	0.00		
	(0.8)	(- 0.4)	(0.4)	(0.2)	(0.0)		
Strong Ties							0.60
							(3.5)
R^2	0.7486	0.7581	0.8124	0.8139	0.8140	0.8046	0.8217

*, ** Indicates a variable transformation or alteration. See text.

the unemployment rate and gross rent variables are incorrectly signed. It appears that the study group tends to choose destinations with high unemployment rates and costly housing opportunities. The percentage increase in average weekly earnings is also incorrectly signed.

The model predicts a number of flows poorly. For the eastern CMA's, Halifax is consistently underestimated as a destination choice. A number of the badly estimated flows include the CMA pairings identified as having especially strong ties. Vancouver is often highly underestimated as a destination from origin CMA's located in all areas of the country. Especially evident was the underestimation of the migration flows from the Quebec CMA's to Ottawa-Hull. There was also an underestimation of the return pattern of Ottawa-Hull as the origin and one of the Quebec CMA's as a destination choice.

Specification 2 attempted to improve on the estimation of the flows between the Quebec CMA's and Ottawa-Hull. The dummy variable (Cultural Barrier) was altered in the data base. Originally, Ottawa-Hull was considered to be in Ontario, and hence the flow between each of the three Quebec CMA's and Ottawa-Hull was considered to be across the cultural barrier so that the dummy variable assumed the value of one. Specification 2 recognized the borderline position of Ottawa-Hull; for any flows between Quebec CMA's and Ottawa-Hull, the dummy variable assumed the intermediate value of 0.5.

This reduced the cultural barrier between these centers, as the city of Hull is located within the Quebec provincial boundaries.

The degree of explanation provided by the cultural barrier did increase in specification 2, and the destination choices of these centers were better predicted by the model. The unemployment rate, percentage increase in average weekly earnings and gross rent variables all maintained the incorrect sign that we would expect these variables to hold, although two of them were statistically insignificant. The dummy variable representing the special attraction of Ottawa-Hull as the nation's capital was also incorrectly signed in this specification. This is unusual, as it did not appear negatively in any of the other specifications.

Although the distance variable accounted for a high degree of explanation, it was evident that for destinations that are far from an origin, the linear road mileage distance was creating a stronger impedement to increasing distance than was observed. If a migrant is willing to move 2000 kilometers from his place of origin, an alternative destination which happens to be 2100 kilometers away should not be very discriminated against, purely because of the additional 100 kilometers. The distance variable was thus subjected to a logarithmic transformation within the BMDP3R program.

Specification 3 includes this distance transformation, and the overall level of explanation of the model improved substantially ($r^2 = 0.8124$). The level of explanation of the distance variable, as reflected by the adjusted t-values, increased from -14.7 in specification 2 to -20.7 in specification 3. The prominent problem evident with the model's performance to this stage has been the incorrect sign of the three previously identified variables.

Specification 4 attempts to correct this by including the 1971 average income and the percentage increase in average income as alternative variables to represent the income levels of each destination. These two variables are both incorrectly signed, as was found in the previous testing for the average weekly earning variables. It was then hypothesized that the inclusion of two income variables was creating colinearity between the variables. The occurrence of colinearity causes any explanatory power of the variables involved to be lost.

Specification 5 tested this hypothesis. The weaker of the two variables, 1971 average income, was dropped from the model. The sign of the percentage increase in income remained to be in the wrong direction. The overall explanation of the model improved slightly, but many of the variables were still incorrectly signed and insignificant.

Specification 6 is perhaps the most important run performed in the entire series of analyses. Included as variables were logarithmic distance, 1971 population size, the percentage housing growth, the percentage increase in employment, and the dummy variable representing the cultural barrier separating Quebec and the rest of Canada. All of these variables have had adjusted t-ratios of large magnitudes (greater than 3.0), as well as the correct sign. The R^2 value of the test is 0.8046, indicating a relatively good level of explanation provided by these five variables.

Population and distance, as in the gravity model tradition, have the highest adjusted t-ratios. The cultural barrier dummy variable, with an adjusted t-value of -12.0 is also very significant. The percentage increase in employment has a t-value of 10.3. The percentage housing growth is the least important of these variables, but is still significant with an adjusted t-value of 4.4.

Specification 7 added the dummy variable created to capture especially strong ties existing between certain CMA pairs. The R^2 of the model was increased to 0.8217. The level of explanation obtained in these analyses was consistently raised from one specification to the next. The next section will outline the conclusions drawn from this explanation of the labour force entrants destination choices.

4.5 Explanation and Summary

The empirical specifications obtained through the destination choice model allow for the evaluation of the extent to which the model has explained the destination choice patterns of the labour force entrants. Although only a few variables have been included, most of the variability in the data matrix has been accounted for. This suggests two conclusions. First, the model developed by Liaw and Bartels provides a good empirical tool which, when applied, renders an accurate formulation of the destination choice patterns. Second, the simplicity of the input variables and the statistics involved make the model attractive and could easily be transformed into a regional or national scale predictive model.

The performance of the variables imply certain elements underlying the destination choice decision of the labour force entrants group. Distance has created the negative impedement as expected. It was found that a logarithmic transformation of distance captured the role if distance better than simple linear distance. The 1971 population was an important attractive force. The percentage increase in employment was also an attractive factor. Labour force entrants chose as their destinations, CMA's with high employment growth. The importance of growth was also reflected by the percentage housing growth variable. The cultural barrier of Quebec again, as in past studies, acts as a strong impedement to the out-migration of labour force entrants from Quebec as well as to the in-migration of labour force entrants from the other provinces of Canada.

The final chapter of this paper will draw general conclusions about the research performed here and will include suggestions for future undertakings.

CHAPTER 5: CONCLUSIONS

The analyses contained in this paper have clearly provided answers to the questions raised in this research. The major focus has been on the destination choice patterns of the male labour force entrants. The analyses have provided both a characterization and an explanation of these patterns.

The entropy analyses discussed in Chapter Three developed a characterization of the destination choice patterns. Regional differentiation was captured through migration amongst the largest urban centers, the CMA's. Halifax, Montreal, Toronto and Vancouver were found to be the leading regional centers of the nation.

In Chapter Four, six out of the thirteen variables were found to be significant in the destination choice model adopted from Liaw and Bartels (1982). The 1971 population at the destination and the logarithm of the intervening distance between the origin and destination provided the greatest degree of explanation, with adjusted t-ratios of 23.1 and -18.5 respectively. This result does not hold much surprise, as these two variables have historically been found to have an impact on migration flows.

The percentage increase in housing growth and the percentage increase in employment, with adjusted t-values of 4.5 and 10.1 respectively, also contributed to the overall explanation level of the model. The labour force entrants are found to migrate to CMA's with employment sectors which are expanding at a faster pace than the other CMA's. Housing growth is often used as an indicator of economic well-being, and thus it is not surprising that the housing variable contributes significantly to the performance of the model.

The last two significant variables were dummy variables, created to explain flows which occur, or conversely do not occur, as a result of intangible factors. The cultural barrier variable, representing the barrier of the French language had an adjusted t-value of -11.4. The cultural barrier variable provided a significant amount of explanation for the large internal flows within the province of Quebec, as well as the weak in-migration flows from the rest of Canada. The 'strong ties' variable, representing especially strong flows (for example from Oshawa to Toronto) had an adjusted t-ratio of 3.5. The overall R^2 of the model is 0.82.

These six significant variables can therefore account for, or explain, a high degree of the variation in the destination choice patterns of the male labour force entrants. The major disappointment associated with this research has been the concistently poor (nonsignificant and incorrectly signed) performance of the four income variables. Intuitively, one would believe that the income opportunities associated with a CMA would have an influence on choosing that location as a destination. According to the empirical results in each of the seven specifications, income measures do not appear to have any significance in the destination choice decision.

This research has revealed some insight into the motivations behind the labour force entrants intermetropolitan migration patterns. It has been shown that this motivation is derived not only from the classical explanatory variables of population size and intervening distance, but also by variables which are economic and cultural in nature.

Future research may take the direction of attempting to apply the first level of the Liaw-Bartels model (1982), the departure model, in order to uncover the motivations underlying the decision to move. A clear conception of the factors affecting the decision to move, as well as the choice of a particular destination, could possibly lead to a fairly accurate model of forecasting the migration flows. It would also be of great interest to perform these same analyses on different cohorts, to uncover any discrepancies in migration motivation which could be associated with changes in the life cycle. A clear understanding of the processes of migration become crucial as the rates of natural increase decline and the role of migration, as a determinent of population size and fertility, becomes more and more important. Mankind has a propensity to migrate, and the knowledge of the motivations behind this action has become a key component of our understanding of the urban system, and man's world in general.

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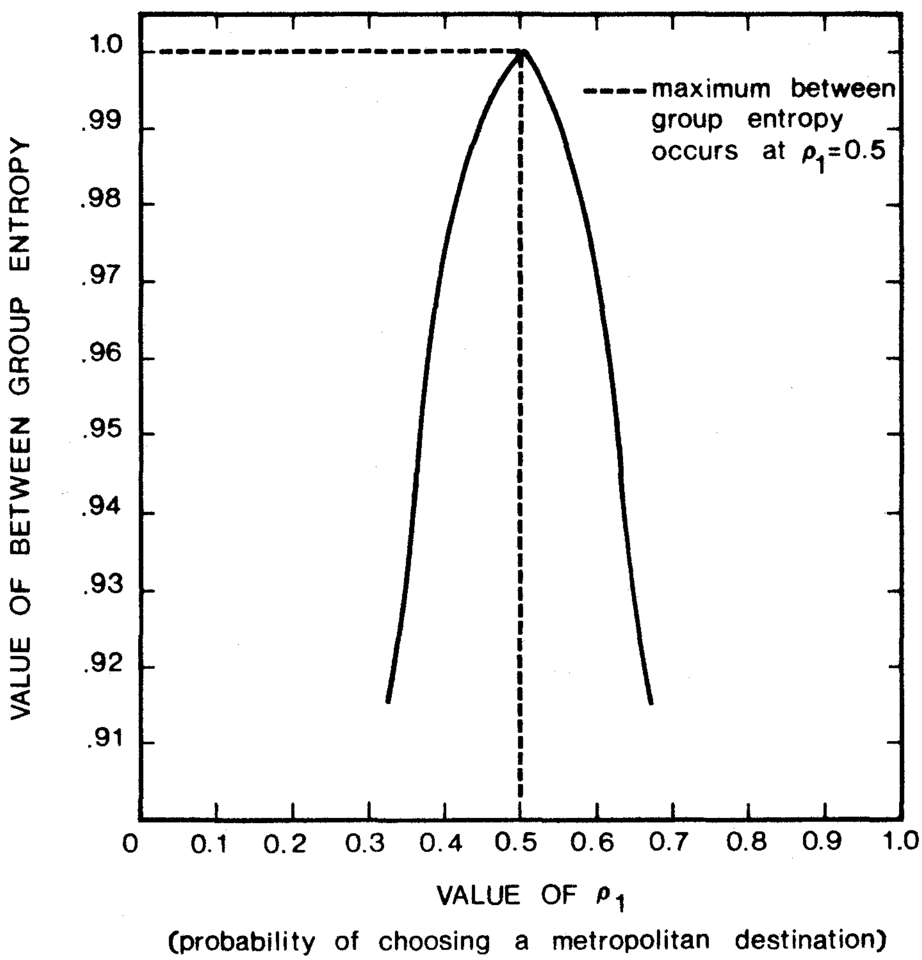
APPENDICES



THE RELATIONSHIP BETWEEN ρ_1 AND ENTROPY

APPENDIX A

APPENDIX B

The Computed Elasticity and (Beta Weights)

Independent Variable	Specification 1	2	3	4	5	6	7
Distance	-0.90* (-8.11)	-0.88* (-7.91)	-0.23 (-6.93)	-0.23 (-6.86)	-0.23 (-6.80)	-0.22 (-6.73)	-0.22 (-6.40)
1971 Population	0.44 (7.27)	0.44 (7.34)	0.43 (7.22)	0.43 (7.13)	0.43 (7.12)	0.46 (7.66)	0.45 (7.54)
% Housing Growth	1.09 (3.21)	1.06 (3.13)	0.87 (2.57)	1.04 (3.07)	1.03 (3.04)	0.88 (2.60)	0.88 (2.59)
% Increase In Employment	0.50 (5.77)	0.50 (5.76)	0.61 (6.98)	0.66 (7.52)	0.65 (7.44)	0.56 (6.43)	0.54 (6.18)
1971 Unemployment Rate	1.13 (3.80)	1.08 (3.64)	1.26 (4.25)	1.18 (3.97)	1.15 (3.87)		
1971 Average Weekly Earnings	0.07 (0.12)	0.10 (0.16)	-0.47 (-0.73)				
% Increase In Av. Weekly Earnings	-0.90 (-1.56)	-0.86 (-1.49)	-1.29 (-2.23)				
1971 Average Income				-0.32 (-0.33)			
% Increase In Average Income				0.83 (2.03)	0.74 (1.82)		
1971 Gross Rent	1.11 (1.76)	1.11 (1.76)	0.64 (1.02)	0.82 (1.30)	0.74 (1.17)		
Cultural Barrier	-0.33** (-7.26)	-0.36 (-8.12)	-0.30 (-6.82)	-0.32 (-7.13)	-0.32 (-7.14)	-0.33 (-7.40)	-0.31 (-7.03)
Special Position of Ottawa-Hull	0.01 (0.30)	-0.00 (-0.14)	0.00 (0.11)	0.00 (0.07)	0.00 (0.01)		
Strong Ties							0.00 (0.83)

*,** Indicates a variable transformation or alteration, See text.

APPENDIX C

LIST OF THE CANADIAN CENSUS METROPOLITAN AREAS (CMA'S)

		1971 Population*
1.	St. John's (SS)	131,814
2.	Halifax (HX)	250,851
3.	Saint John (SJ)	106,744
4.	Chicoutimi-Jonquiere (CH)	126,401
5.	Quebec City (QC)	501,365
6.	Montreal (MO)	2,729,211
7.	Ottawa-Hull (OH)	619,861
8.	Oshawa (OS)	120,318
9.	Toronto (TO)	2,602,098
10.	Hamilton (HA)	503,122
11.	St. Catharines-Niagara (CN)	285,802
12.	Kitchener-Waterloo (KI)	238,574
13.	London (LO)	252,981
14.	Windsor (WR)	248,718
15.	Sudbury (SU)	157,721
16.	Thunder Bay (TB)	144,708
17.	Winnipeg (WI)	549,808
18.	Regina (RA)	140,734
19.	Saskatoon (SA)	126,449
20.	Calgary (CA)	403,343
21.	Edmonton (ED)	496,014
22.	Vancouver (VA)	1,082,352
23.	Victoria (VI)	195,800

* These figures are adjusted to conform to the 1976 area composition, but have not been adjusted for census underenumeration.

Source: 1976 Census of Canada, Population: Geographic Distributions, Table 11.