ANALYSIS OF METROPOLITAN OUTMIGRATION OF ELDERLY FEMALES IN CANADA: 1971-76

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ABSTRACT

This paper analyzes the 1971-1976 outmigration pattern of the Canadian female elderly from the 23 Census Metropolitan Area's (CMA's). The migration is conceptualized as a three-level choice process and is represented by the logit model. The major findings are as follows:

(1) Elderly females are substantially less migratory than young females but are slightly more mobile than elderly males. In addition,. the elderly females in the Western region tend to be more mobile than those in other regions.

(2) Elderly females show less preference for the metro politan destinations than the young population; however, among the elderly, females have a stronger preference for metro-politan areas than males.

(3) In general, the metropolitanward outmigrants' destination choice pattern is less dispersed for the elderly than for the young. Among the older persons, female migrants have a larger dispersion than male migrants in most CMA's.

(4) With respect to metropolitanward elderly migrants from the CMA's, the probability of choosing a particular destination is positively related to population size, brightness, and housing growth, and negatively related to the logarithm of distance, cultural dissimilarity, coldness, and gross rent.

(5) Environmental variables are more important than the housing variables in determining the destination choice pattern of the elderly migrants.

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I. INTRODUCTION

The elderly population (aged over 64) in Canada has been increasing in terms of both number and percentage from 1961 to 1976 (Statistics Canada,1981). During that period of time, the elderly population has increased by 43.9% while the whole population increased by 26.1% (Statistics Canada, 1981). In the five years from 1971 to 1976, the corresponding growth rates were 14.8% and 6.6%, respectively (Statistics Canada, 1981). This trend continued in the late 1970's; the share of elderly population in the total population increased from 8.1% in 1971 to 9.7% in 1981 (Liaw and Kanaroglou, 1986). The trend of aging in population is neither accidental nor unique in Canada.

With the improvement in the standard of living and medical advances in the past few decades, the life expectancy in many developed countries has increased. The decrease in mortality, together with a decline in fertility, has created a trend of aging in population. Furthermore, this trend in North America will be accelerated when the baby boom population enters the retirement age in the early part of the next century.

Foot (1982) projects that by the year 2031 the share of older persons in Canada would be over 20% of the total population. "As the elderly have assumed more importance nummerically

and proportionately, their visibility has risen" (Bowles, 1980). As a result, attention has been drawn to the issues related to the elderly population.

The Canadian population has become increasingly female dominant. "In 1976, for the first time in the history of Canadian census-taking, the number of females exceed that of males" (Statistics Canada, 1981, p.115). The sex ratio by that year is 99.2 males for every 100 women (Statistics Canada, 1981). There are at least two factors on the trend toward an increasing female dominance: (i) "life expectancy at birth has increasingly favoured women" (Statistics Canada, 1981, p.115), and (ii) "the change in the sex pattern of migration shows increasing female immigrants in recent periods"(Statistics Canada, 1981, p.115). Since the gap between the male and female mortality schedules widens with age, the female dominance of the elderly population is particular strong. Hence, it would be important to focus attention on female elderly population instead of the general population.

When the population is aging, the provision of the faciliti-es and services in the society should be increasingly diverted to older persons. The location of the facilities and services for the elderly has to be consistent with the geographical distribut-ion of the elderly population. This distribution is undergoing

a continual change. Since the interregional variations in birth and death processes have declined in recent decades, the spatial variation in the burden of the elderly depends increasingly on the imbalance in the migration of both young and old Canadians (Liaw and Kanaroglou, 1986).

"Traditionally, demographers, geographers, and others have concentrated their migration research on labour force movement whereas aged migration has received relatively little attention" (Wiseman, 1978). Barsby and Cox(1975) have also indicated that there is lack of mobility studies of the elderly. Since the older persons have distinct characteristics and needs which result in a different mobility and spatial redistribution pattern, it is essential to study the migration process of the elderly population, in particular the eldery females.

Canada is one of the countries with the highest mobility level in the world, partly because Canada is a country of immigrants. Generally speaking, the elderly population is less mobile than the young population. Nevertheless, the elderly migration is expected to become more important, because increase in living standard allows more older people to migrate to a more satisfactory environment, and because " the growing number of older persons results in even larger numbers of elderly persons changing residence" (Wiseman,1978).

The focus of this study is on the migration behaviour of elderly females among the metropolitan areas in Canada during the 1971-76 period. More than half of the Canadian population (55.7%) is located in the 23 Census Metropolitan Areas (CMA's) for the 1976 census (Statistics Canada, 1981) and ~~that~~ the major migration flows are interurban. Furthermore, data on the socioeconomic factors on migration are relatively rich at the metropolitan level. Therefore, the choice of the CMA's as the basic geographical units for studying elderly migration seems to be meaningful.

The outline of the paper is as follows. A review of migration literature is presented in section 2. The characterization of elderly female outmigration is discussed in section 3. A formal statistical explanation will be applied in section 4 to the destination choice pattern of elderly female migrants. The paper ends with a brief summary and concluding remarks in section 5.

2. LITERATURE REVIEW

After extensive research has been done for the elderly population, geographers and demographers are beginning to gain a better understanding of the socio-economic characteristics of

this age cohort in the society (Wiseman,1978 ; Golant,1980). Having their own characteristics, the motivation and the spatial pattern of elderly migration would be different from those of the general population. Wiseman suggests that older persons now tend to be "more affluent, better educated, healthier, longer-lived, and earlier to retire"(Wiseman,1978). He further suggests the likely implications of these changes on elderly migration.

In general, elderly migration is associated with retirement migration. Retirement migration usually refers to the migration of persons who are aged 65 and over. In his migration studies in United States of America, Wiseman points out that there is "a modest increase in mobility rates during the years of peak retirement activity followed by very low mobility until the latest stage of life has been reached" (Wiseman,1978). However, in Canada the "retirement oriented migration takes place long before the offical retirement age [of 65]" (Liaw and Kanaroglou,-1985). This increase in mobility in the old age group creates a migration peak which occurs a few years before the offical retirement age. In addition, it is shown by Liaw and Nagnur (1985) that the retirement migration peak is relatively small in comparis on with the migration peak of the young adults.

The spatial pattern of elderly migration can be identified through their salient migration streams. Flynn (1980) indicates

that salient streams of aged interstate migration in the United States of America are more obvious and concentrated than those of the general population. These salient streams flow toward the warm retirement states (Flynn, 1980). Wiseman also predicts that "elderly migration will continue to produce high concentrations of older persons in specific localities" based upon the development of local retirement communities and publicly subsidized housing projects for the elderly(Wiseman, 1978). In Canada, Liaw and Kanaroglou(1986) show that among the males, elderly migrants have a more concentrated destination choice pattern and are less likely to be metropolitanward than the young migrants. It will be determined in this research if female elderly migration in Canada also has these salient features.

The elderly migration level and their destination choice pattern are the result of factors that motivate the elderly to move. Some of these factors would be different from those affecting the migration pattern of the young. Even the factors that affect both the young and the old may have differential effects. The more important variables identified in the literature are as follows.

Distance is widely accepted as a factor on migration, since the friction of distance is generally considered to have a negative effect upon mobility. Some reasons for this effect

are: (i) that monetary cost of migration tends to increase with distance; (ii) that the flow of information from potential destinations tends to decrease with distance (However, it should be noted that information flows between two points in space tend to be stronger at the higher level of urban hierarchy); and (iii) that the psychic cost of migration tends to increase with distance not only because of the increased difficulties in adapting to the new social life and in seeking opportunities in a distant place, but also because of the difficulty in maintaining the ties with old acquaintance in the place of origin. Therefore, it has been suggested that shorter distance would make a stronger interprovincial migration flows (Economic Council of Canada,1977). Historically, female migrants were usually found to dominate in shorter distance migration (Lee,1966). It would be interesting to find if this is true for the elderly female migration in Canada.

In addition to the distance effect, there may be some other factors that affect elderly migration. Wiseman(1978) suggests that interpersonal relations are a factor on the elderly migration. It is quite possible that older migrants would tend to select the destinations where the ethnic background and the languages used are similar to their own. A potential destination is the state of migrants' birth; Serow (1978) finds that older people are more likely to return to their states of

birth. It has been recognized that "language facility appears to make for greater mobility" (Economic Council of Canada,1977, p.176). The linguistic factor could be particularly important for the elderly, as they might have greater difficulties in learning new languages. In Canada, there is a great variety of enthic groups, ranging from groups with European origins to groups from Asian countries. It is then not surprising to find the great diversity of languages used in Canada. In general, the people with French origin are less likely to migrate than those of other ethnic origins (Economic Council of Canada, 1977). This is supported by the finding that migration " from one province to another is least likely for those who speak only French" (Economic Council of Canada, 1977, p176). Therefore, cultural dissimilarity (difference in enthic origin or mother tongue) is likely to be an important factor on elderly migration.

Many studies of elderly migration in the United States of America indicate that older people are very sensitive to environmental variables, e.g. a salient stream of elderly migrants flowing towards Florida (Flynn, 1980). Cebula(1974) points out that temperature differential is very important in affecting the mobility level of elderly. Warm winter is pleasant for living and also leads to a lower cost of living. Hence, climate is a factor on elderly migration. In addition, there are other variables representing the envirnomental quality such as polluti-

on level, amenities and avaliability of recreational facilities.

Economic considerations may also be essential for understanding elderly migration. Since the elderly depend more on pension funds and social security, areas with lower cost of living (rather than higher wages) would be attractive to them. When the older persons reach a critical point of their life cycle, their housing needs and preferences would change (Wiseman, 1978). If more housing units of differnt kinds were available in the market, there would be more migration. Hence, it is reasonable to consider change in housing stock as an factor on elderly migration.

In the old age group, some people need medical care and special services. Better facilities and services are usually found in large urban places (Wiseman, 1980) where the support of a large tax base is available. Therefore, the large urban places would appeal to the elderly. Population size can then be included as one of the factors on the eldery migration.

Based upon the findings of past research, we have so far identified several potentially influential factors: distance, cultural dissimilarity, climate, cost of living, housing growth and population size. However, none of the works we have reviewed has focused on the migration of elderly females. Therefore, this

research is expected to fill in an important gap in migration research.

3. CHARACTERIZATION OF ELDERLY OUTMIGRATION

A. The geographical system and migration data

This study uses a 24-region geographical system which is composed of 23 Census Metropolitan Areas (CMA's) and the remaining non-metropolitan area as one unit, according to the 1976 boundaries(Figure 1). CMA represents " the main labour market of a contineous built-up area having a population of 100,000 or more" (Statistics Canada, 1981, p.114). Such system is selected mainly because of the availibility of the data on migration and socioeconomic attributes at the level of metropolitan areas.

The origin-by-destination migration data, purchased by Dr. Liaw from Statistics Canada, are based on the 1976 population census. The data contain sex-specific migration tables for 85 single-year age groups (0,1,.....,84) and an open ended age group (85+), with the ages being defined as the completed age on June 1, 1971. The tables for single-year age groups will be aggregated into five-year age groups (0-4, 5-9, ... ,80-84) in

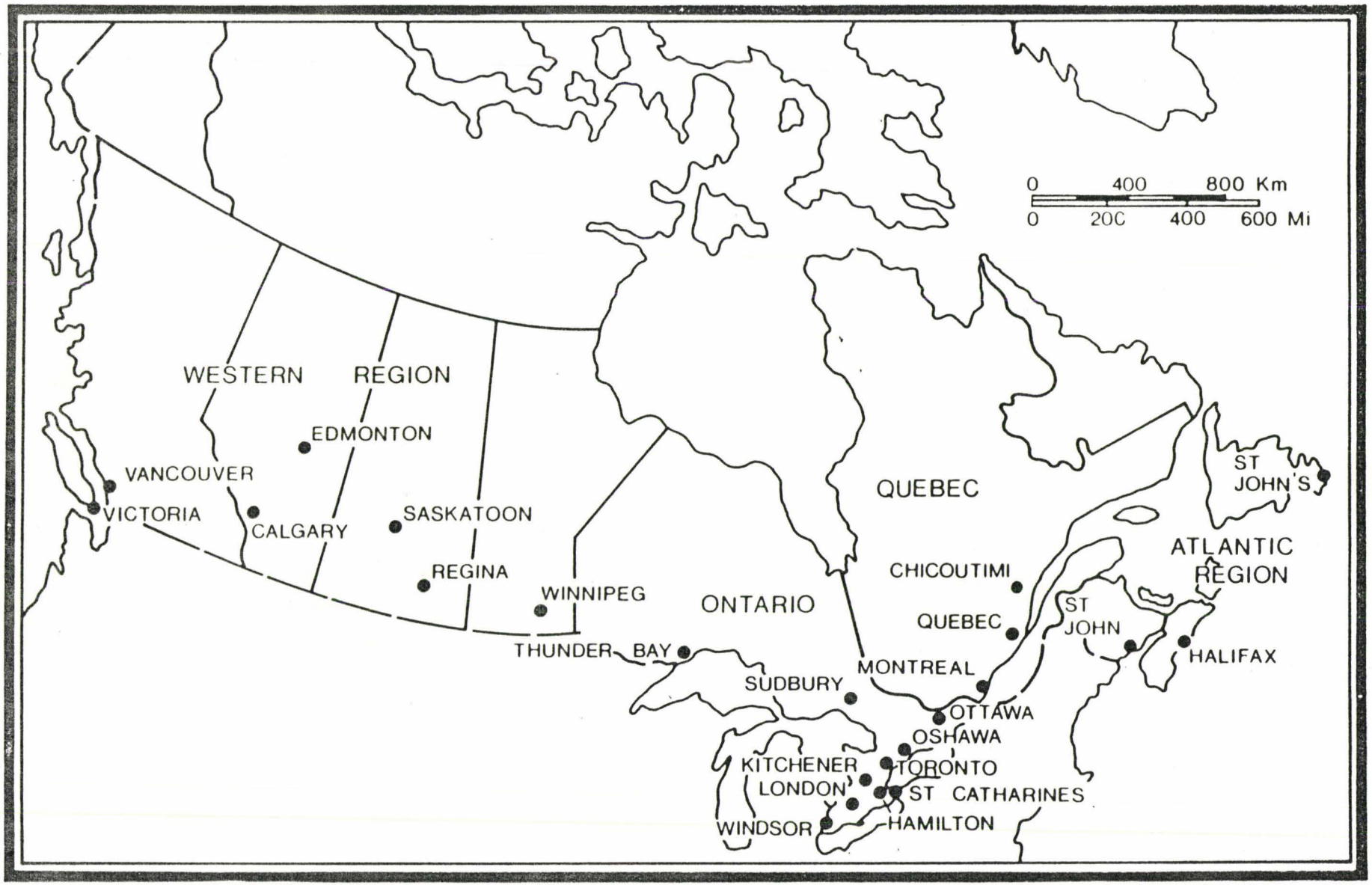

FIGURE 1: The location of Canadian census metropolitan areas.

order to avoid too many empty cells in the migration tables. The resulting tables are used together with 1971 at-risk population from the census to generate 18 matrices of origin- and destination-specfic outmigration rates, which then become the basis of future analysis.

The definition of "elderly" is very vague, usually it refers to people at the official retirement age and older. However, since the retirement migration peak occurs before the official retirement age of 65, the elderly age interval must be redefined. In this study, a conformity index (defined in Liaw, 1985) is computed for each pair of the 18 matrices of migration rate so that clusters of the age groups can be formed according to the nearest neighbor criterion. There are two clusters for the elderly population: the young elderly (50-74) and the old elderly (75+). Since the migration matrix of the old elderly contains too many zeros to permit a reliable description of the migration pattern, this study will only focus on the migration pattern of the females in age group (50-74). The young elderly will be termed simply as elderly in the rest of this paper.

The migration of elderly females is conceptualized as a three-level choice process and is represented by the logit model(detail description of the model is in section 4). In the logit model, the probability of choosing a destination will be

related to the explanatory variables. There will be three kinds of probabilities to estimate: (i) the probabilities of an elderly female to outmigrate from a metropolitan area k, $P(O_k)$; (ii) the conditional probability of her choosing some metropolitan area as a destination, $P(M|O_k)$; and (iii) the conditional probability that an elderly female metropolitanward outmigrant chooses metropolitan i as a destination $P(i|M,O_k)$. To estimate these probabilities the migration data and population data are separately aggregated for the 50-74 age interval. Let F_{ki} be the 1971-76 observed number of elderly female migrants from region k to region i, and let F_k be the corresponding at-risk population in 1971. Then the estimated values of choice probabilities are as follows.

$$\hat{P}(O_k) = \sum_{\substack{i=1 \\ i\neq k}}^{24} F_{ki}/F_k$$

$$\hat{P}(M|O_k) = \sum_{\substack{i=1 \\ i\neq k}}^{23} F_{ki} \Big/ \sum_{\substack{i=1 \\ i\neq k}}^{24} F_{ki}$$

$$\hat{P}(i|M,O_k) = F_{ki} \Big/ \sum_{\substack{i=1 \\ i\neq k}}^{23} F_{ki}$$

In addition, the entropies of the choice probabilities (E_k) would be computed to characterize concisely the allocation of metropolitanward female migrants among the 22 destination CMA's.

$$E_k = -\sum_{\substack{i=1 \\ i\neq k}}^{23} \dot{P}(i|M,O_k) \log_2 [\dot{P}(i|M,O_k)] \quad \text{for } k = 1, 2, \ldots, 23$$

E_k ranges from zero (when all migrants go to only one destination) to 4.46 (when the migrants are evenly distributed).

B. Characteristics of the elderly female outmigration pattern

To characterize female elderly migration pattern in a meaningful way, comparsions of their pattern would be made to those of young female migrants (15-19) and male elderly migrants (55-79). To identify broad geographical patterns, the CMA's are grouped into four regions: (1) Atlantic; (2) Quebec; (3) Ontario; and (4) Western.

B.1 The propensity to outmigrate

From the estimated outmigration probabilities $\dot{P}(O_k)$ shown in Table 1, we observe the following properties.

First, the elderly females (as well as the young females and the elderly males) in Western Region tend to be more mobile than those in other regions. This pattern supports the earlier finding about elderly males by Liaw and Kanaroglou(1986) that a long settlement history tends to depress geographical mobility.

TABLE 1: THE ESTIMATED OUTMIGRATION PROBABILITIES P(Ok) OF THE 23 CMA'S IN CANADA FOR 3 COHORTS, 1971-76

	FEMALE 15-19 (%)	FEMALE 50-74 (%)	MALE 55-79 (%)	1971 POPULATION (1000 PERSONS)
ATLANTIC REGION				
1. ST. JOHN'S	24.5	5.3	5.3	132
2. HALIFAX	22.6	7.6	7.4	251
3. ST. JOHN	18.1	5.7	5.3	107
PROVINCE OF QUEBEC				
4. CHICOUTIMI	24.7	5.4	5.4	126
5. QUEBEC CITY	15.2	4.0	3.7	501
6. MONTREAL	9.6	4.2	4.0	2729
PROVINCE OF ONTARIO				
7. OTTAWA	17.2	5.9	5.1	620
8. OSHAWA	28.1	8.2	7.8	120
9. TORONTO	15.8	6.1	6.2	2602
10. HAMILTON	17.3	5.0	4.3	503
11. ST. CATHARINES	22.4	4.0	3.4	289
12. KITCHENER	24.8	5.2	4.8	239
13. LONDON	27.6	5.9	4.7	253
14. WINDSOR	20.1	4.6	4.5	249
15. SUDBURY	28.0	9.1	8.3	158
16. THUNDER BAY	19.8	4.7	4.7	115
WESTERN REGION				
17. WINNIPEG	20.3	5.3	4.7	550
18. REGINA	37.1	9.7	8.7	141
19. SASKATOON	48.2	9.8	8.7	126
20. CALGARY	27.2	8.3	7.7	403
21. EDMONTON	26.1	9.0	8.8	496
22. VANCOUVER	18.3	6.3	6.1	1082
23. VICTORIA	28.3	7.4	6.4	196
MINIMUM	9.6	4.0	3.4	107
MEDIAN	22.6	5.8	5.3	251
MAXIMUM	48.2	9.8	8.8	2729

Secondly, in every CMA, the elderly females are substantially less migratory than the young females. The median probability of outmigration from the CMA's is 5.8% for the elderly females, compared with 22.6% for the young females. The large difference between elderly and young females indicates a "stronger relunctance on the part of older people to move" (Wiseman,1978). Among the four regions, the highest elderly/young mobility ratio is found in the Western Region (the regional median of 0.31 versus the national median of 0.26). The lowest ratio is found in the Atlantic region(0.25).

Thirdly, there is a strong negative relationship between the population size of the origin and mobility level of young females, whereas the negative relationship is not significant for the elderly males and females(Table 2). For both female and male elderly, Toronto and Vancouver have outmigration rates that are higher than the median of all CMA's. This result suggests that the largest metropolitan areas may have a large pool of affluent elderly who have a relatively high propensities of migrating out of congested urban centers.

Fourthly, the older females are slightly more mobile than the older males(5.8% versus 5.3%). This confirms the findings of Wiseman and Roseman(1979) in their study of interstate elderly migration in the United States of America during the 70's. The

TABLE 2: THE RESULT OF LINEARIZED REGRESSION OF OUTMIGRATION RATE ON POPULATION SIZE AT THE ORIGIN

	R SQUARE	T RATIO	DEGREE OF FREEDOM
)UNG FEMALE	48.0%	-4.40	21
.D FEMALE	8.3%	-1.38	21
.D MALE	7.0%	-1.26	21

:: The following model is used to run the linear regression (the equation is log-linearized before using the ordinary least-squares method):

$$P(O_k) = \alpha N_k^{\beta} \varepsilon_k$$

where P(Ok) is the probability of migrants moving out from k;

Nk is the population at the origin k;

α and β are unknown coefficients and ε_k is a error term.

difference of oumigration rate between elderly females and males is probably due to the lower labor force participation rate among the elderly females. Among the four regions, the highest elderly females/elderly males mobility ratio is found in Ontario (the regional median of 1.17 versus the national median of 1.09), while the lowest is found in Province of Quebec(1.05). It seems that the French speaking elderly females are also least mobile, which is consistent with the trend of the general population.

Fifthly, the historical arguement that females dominate the short distance migration does not hold true for the elderly female migration in Canada. Comparison is made between elderly females and elderly males for pairs of CMA's having shorter distance, the dominance of elderly females holds true between CMA's such as Oshawa and Toronto, but not true between CMA's such as Vancouver and Victoria.

B.2 The Choice between Metropolitan and Nonmetropolitan Destination

In every CMA, the elderly females as well as males show less preference for the metropolitan destinations than the young population. We see in Table 3 that the elderly outmigrants' median probabilities of being a metropolitanward migrant are 38% for females and 34% for males. The corresponding figures for the

TABLE 3: THE METROPOLITAN SHARES OF THE OUTMIGRANTS FROM THE 23 CMA'S IN CANADA FOR 4 COHORTS ,1971-76

	FEMALE 15-19 (%)	FEMALE 50-74 (%)	MALE 55-79 (%)	MALE 15-19 (%)
ATLANTIC REGION				
1. ST. JOHN'S	35	35	22	41
2. HALIFAX	38	24	18	42
3. ST. JOHN	36	17	10	40
QUEBEC PROVINCE				
4. CHICOUTIMI	57	46	47	54
5. QUEBEC	51	48	45	53
6. MONTREAL	43	34	30	45
ONTARIO PROVINCE				
7. OTTAWA	48	42	34	51
8. OSHAWA	56	37	33	54
9. TORONTO	47	30	25	47
10. HAMILTON	63	42	38	57
11. ST. CATHARINES	68	46	41	62
12. KITCHENER	52	35	36	53
13. LONDON	49	34	34	51
14. WINDSOR	57	39	38	55
15. SUDBURY	52	38	30	53
16. THUNDER BAY	58	45	38	57
WESTERN REGION				
17. WINNIPEG	45	48	43	49
18. REGINA	49	45	43	53
19. SASKATOON	45	44	37	49
20. CALGARY	42	36	29	45
21. EDMONTON	36	38	35	40
22. VANCOUVER	32	23	17	33
23. VICTORIA	44	42	34	47
MINIMUM	32	17	10	33
MEDIAN	48	38	34	51
MAXIMUM	68	48	47	62

young are 48% and 51%. The stronger preference for non-metropolitan area among the elderly migrants of both sexes is consistent with the findings of Fuguitt and Tordella (1980) that the elderly tend to move to areas rich in environmental and recreational amenities. Golant also finds that "elderly movers showed a greater interest in moving to non-metropolitan areas; they were less likely to move to the suburbs and particularly reluctant to choose central cities"(Golant, 1979).

The following two observations are true for all four cohorts shown in Table 3. First, all three CMA's in the Atlantic region send less than the median proportions of their outmigrants to other metropolitan areas. This is perhaps due to the fact that they are far away from the majority of English-speaking metropolitan areas in Canada. Second, the nation's three largest CMA's (Montreal, Toronto and Vancouver) also send less than the median proportions of their outmigrants to other CMA's, suggesting the importance of "exurbanization".

In terms of the metropolitan shares of outmigrants, the elderly/young ratio is 0.79 for the females and 0.67 for males. It seems that older females have a stronger preference for metropolitan areas than the older males (the ratio of older females/older males is 1.12). Nevertheless, young males in general seem to have a slightly greater tendency to move to

metropolitan areas than the young females (51% versus 48%). The difference in preference between the two sexes changes from one age group to another.

With respect to regional differences in the elderly females/ young females ratio, the Western region has the highest value (the regional median of 0.96 versus the national median of 0.79), while the Atlantic region has the lowest value(0.67). In terms of the elderly female/ elderly male ratio, the highest value is found in the Atlantic, while the lowest value is found in Quebec.

B.3 The Destination Choice Pattern of Metropolitanward Outmigrants

For 14 out of 23 CMA's, the metropolitanward outmigrants' destination choice pattern is less dispersed for the elderly than for the young, whereas five CMAs diaplay the same degree of dispersion for both groups. As shown in Table 4, the median entropy is 3.0 for the elderly females and 2.7 for the elderly males, whereas the corresponding figures are 3.1 and 3.2 for the young females and males, respectively. The elderly migrants' destination choice pattern in the American interstate migration is also highly concentrated (Flynn, 1980). This concentrated distribution pattern suggests "that the places perceived to be

TABLE 4: THE ENTROPIES OF THE DESTINATION CHOICE PATTERNS OF THE METROPOLITANWARD OUTMIGRANTS FROM THE 23 CMA'S FOR FOUR COHORTS, 1971-76 : UNIT = BITS

	FEMALE 15-19	FEMALE 50-74	MALE 55-79	MALE 15-19
		ATLANTIC REGION		
1. ST. JOHN'S	3.1	3.1	3.1	3.1
2. HALIFAX	3.4	3.9	3.1	3.7
3. ST. JOHN	3.0	2.8	2.2	3.0
		QUEBEC PROVINCE		
4. CHICOUTIMI	1.8	1.7	1.8	1.7
5. QUEBEC CITY	1.8	1.4	1.2	1.8
6. MONTREAL	3.2	3.4	3.4	3.4
		ONTARIO PROVINCE		
7. OTTAWA	3.5	3.3	3.2	3.5
8. OSHAWA	2.0	1.7	2.0	2.5
9. TORONTO	3.8	3.8	3.8	3.9
10. HAMILTON	3.0	3.0	3.1	3.2
11. ST.CATHAINES	2.8	3.0	2.9	3.0
12. KITCHENER	3.1	2.8	3.1	3.1
13. LONDON	3.2	3.2	3.3	3.2
14. WINDSOR	3.0	3.0	2.8	3.2
15. SUDBURY	3.1	2.9	2.7	3.2
16. THUNDER BAY	3.4	3.2	2.9	3.3
		WESTERN REGION		
17. WINNIPEG	3.3	3.1	2.7	3.4
18. REGINA	3.1	2.7	2.7	3.1
19. SASKATOON	3.0	2.9	2.3	2.8
20. CALGARY	2.8	2.6	2.6	2.9
21. EDMONTON	2.8	2.5	2.5	2.7
22. VANCOUVER	3.2	3.1	2.7	3.2
23. VICTORIA	2.3	2.4	1.9	2.5
MINIMUM	1.8	1.4	1.2	1.7
MEDIAN	3.1	3.0	2.7	3.2
MAXIMUM	3.8	3.9	3.8	3.9

environmentally attractive are less numerous than the places perceived to be economically attractive" (Liaw and Kanaroglou, 1986). Among the older persons, the female migrants have a larger dispersion for most CMAs.

In addition, the entropy of elderly female migration is positively related to the level of urban hierarchy, the population size, the centrality, and the political status of the destination CMA. In each region, the CMA on the top of urban hierarchy has largest dispersion; Halifax (3.9) in the Atlantic Region, Montreal (3.4) in the Province of Quebec, Toronto (3.8) in the Province of Ontario, and Vancouver(3.1) as well as Winnipeg(3.1) in the Western region. All the above CMAs (except Winnipeg) have the largest population in their own regions. This implies that dispersion of the destination choice pattern is positively related to population. Due to its more central location, Winnipeg has same level of dispersion as Vancouver, even though its population is much smaller (550000 versus 1082000). Ottawa has a relatively small population (620000) when compared to Montreal (2729000). However, as Ottawa is the capital city of Canada, its entropy (3.3) is similar to that of Montreal (3.4) (Table 4). On the other hand, small CMAs at lower levels in the urban hierarchy and those under the shadow of a big CMA tend to have smaller dispersion. Secondary CMA's in the Province of Quebec (Chicoutimi and Quebec City) also have a

small dispersion. The other three cohorts have similar spatial patterns of dispersion. However, it should be noted that Halifax has the highest dispersion (3.9) for old female cohort while Toronto (3.8) has highest dispersion for the other three cohorts.

Moreover, for both the old and young female migrants, there is an apparent east-west division of the migration field, with Thunder Bay being the "migration shed". In the eastern part of the migration field, Toronto is the main receiver of migrants of both cohorts from all CMAs (except Chicoutimi and Quebec City). Toronto is attractive to older females perhaps because of the mild climate, provision of facilities and services , and concentration of different ethnic communities(Liaw and Kanaroglou, 1986). The appeal of Toronto to the young female is probable due to the large job market in the service sector. In the area west of Thunder Bay, Vancouver and Victoria with an attractive environment are the most attractive places to older females. Their attractive power also extends to the eastern part of Canada. For example, Halifax sends 10.5% of metropolitanward elderly female migrants to Vancouver, 6.8% to Victoria, but only 10.8% to Montreal.

The above characterization of the elderly female destination choice pattern is impressoinistic and subjective. In order to provide a more objective explanation to the destination choice

pattern, we adopt the formal statistical approach in the following section.

4. STATISTICAL EXPLANATION OF THE DESTINATION CHOICE PATTERN OF THE ELDERLY FEMALE METROPOLITANWARD MIGRANTS

A. The Logit Model

The common practise of using gravity model to describe the migration flows between origin and destination is not satisfactory, because the model is not derived from the basic principles of individual behaviour. The use of the linear regression model to explain migraion pattern is not statisfactory either; as it is possible to generate negative outmigration rates. As a result, migration researchers have advocated the use of choice theory and the application of logit model (Moore, 1972, and Liaw and Kanaroglou, 1986). In this paper, we will use a multinomial logit model to explain the destination choice pattern of the elderly females who were metropolitanward outmigrants during the 1971-76 period. Let $X_{k1}, \ldots\ldots, X_{kq}$ be the explanatory variables. The multinominal logit model is of the form:

$$P(i|M,O_k) = \exp\left(\underset{\sim}{\beta}'\underset{\sim}{X}_{ki}\right) \Big/ \sum_{j\neq k}^{23} \exp\left(\underset{\sim}{\beta}'\underset{\sim}{X}_{kj}\right)$$

where $\underset{\sim}{\beta}'$ is a 1 x q vector of unknown coefficients, and $\underset{\sim}{X}_{ki}$ is a q x 1 vector of explanatory variables. An advantage of

using the logit model is that the predicted probabilities are nonnegative and sum to one for each origin. The explanatory variables will be discussed in the next section and the estimation method for the unknown parameters will be covered in a later section.

B. The Explanatory Variables and the Hypothesis

As mentioned in the section 2 of the paper, the findings in the migration literature guide the selection of several potential explanatory variables for the destination choice pattern of female elderly migration. These variables are the proxies of a set of spatial, cultural, environmental and economic factors, which would affect the perceived utilities of the elderly female migrant on potential destinations. They are identical to those used to explain the destination choice pattern of elderly male migrants by Liaw and Kanaroglou (1986).

Highway distance is used to measure the spatial separation between the origin and destination. Based upon the well-known tendency that the marginal friction of distance decreases sharply with an increase in distance, the highway distance is transformed into a logarithmic form. Thus the log of highway distance is chosen as an explanatory variable. It is hypo-

thesized to have negative effect on the probability of choosing destination.

In Canada, there are close to four million Canadians who are bilingual(Statistics Canada, 1985). English is the most common mother tongue for most of the province with a clear exception -- Quebec; about 61% of Canadians in 1976 have English as their mother tongue (Statistics Canada, 1981). French is the second most important mother tongue; 26% of Canadian in 1976 were Francophones(Statistics Canada, 1981) and 85% of them were living in Quebec(Statistics Canada, 1985). However, in the Prairie provinces and British Columbia, German, not French, is the second most common mother tongue(Statistics Canada, 1985). Other than the two official languages, Chinese, Portuguese, Ukrainain and other languages are also found as the mother tongue for the remaining 13% of Canadian population(Statistics Canada,1981). The biliualism and multiculturalism form the distinct cultural landscape across Canada and would play an influential role in determining the destination choice pattern. The choice probability is hypothesized to be negatively affected by cultural dissimilarity. The index of cultural dissimilarity between metropolitan areas i and k is computed according to

$$1/2 \sum_{l=1}^{19} \mid T_{il} - T_{kl} \mid$$

where T_{il} is the percentage of the 1971 population of metro-

politan area i who had the lth language as the mother tongue. The index shows the percentage of individuals in one metropolitan area that must be re-allocated among the 19 language types in order to make the two metropolitan areas to have idential linguistic composition.[1]

Environmental variables are very important on elderly migration (Cebula, 1974). Coldness and brightness are chosen to represent the environmental variables. The former is the annual number of degree days below 18°C (Environment Canada, 1982b), and the latter is the annual number of bright sunshine hours (Environment Canada, 1982a). Both are averaged over the period from 1951 to 1980. It is hypothesised that coldness has negative effect while brightness has positive effect on the destination choice pattern. Other environmental variables (e.g. pollution level) are not included in the model because the data are not available.

Large urban places are usually equipped with various facilities for the elderly and special services for people with foreign background. Hence, it is hypothesized that the destination choice probability is positively related to the 1971 population size of origins.

The attractiveness of the destination i, in terms of

economic advantage, would spell out in the cost of living. Since it is difficult to find a single index that is computed on a common basis in all CMA's, our choice narrows down to the average gross rent. The 1971 average gross rent at destination i, is the total monthly amount paid by an average tenant, including cash rent, water, electricity, and fuel costs(Financial Post, 1973-79). It is hypothesized that gross rent is negatively related to destination choice probability.

The availability of housing units of various types in the market would be enhanced by the construction of new housing units. The growth in housing stock would stimulate a stronger consideration for migration. Hence, the last hypothesis is that the 1971-1976 housing growth has a positive effect on the destination choice probability. The housing growth index is defined as

$$\frac{1}{2}\left(\frac{HB71}{OD71}+\frac{HB76}{OD76}\right)$$

where HB71 and OD71 are the number of housing units built and the number of occupied dwellings in 1971, and HB76 and OD76 are the corresponding quantities in 1976 (Financial Post, 1973-1979).

In brief, log of distance, cultural dissimilarity, coldness, gross rent are hypothesized to have negative impact upon the destination choice probability, whereas brightness, population

size and housing growth are hypothesized to be positively related to the destination choice probability.

C. The Estimation Method and the Definitions of Statistical Indices

The observed values of the explanatory variables are to be subsituted into the X_{ki}'s in the logit model. The maximum likelihood method is then used to estimate the vector of unknown parameters. The estimated values of the parameters are computed by the program BMDP3R through the Newton-Raphson algorithm (Dixon and Brown, 1977).

To evaluate the relative importance of the explanatory variables, t-ratio and beta weight are computed . The t-ratio (i.e. the estimated coefficient divided by its standard error) measures the likelihood that the associated explanatory variable is related to the dependent variable. Since the explanatory variables are measured in different units, it is then better to use beta-weight (i.e. the average change in standard units of dependent variable divided by an increase in one standard unit in an independent variable) as a measure of the average strength of relationship.

The model's overall goodness-of-fit is measured by

$\dot{R}^2 = 1 - \dot{S}^2/\dot{S}^2_0$, where $\dot{S}^2$ is the weighted residual mean square of the maximum-likelihood solution, and $\dot{S}^2_0$ is the weighted mean square computed under the null hypothesis that $\underset{\sim}{\beta} = \underset{\sim}{0}$. In addition, R^2 ,the square of the simple correlation coefficient between the observed and predicted destination choice probabilities, will be presented in Table 5 for reference. Both $\dot{R}^2$ and R^2 are bounded between 0 and 1. Since the maximum-likelihood solution minimizes the weighted (rather than the unweighted) residual sum of squares, $\dot{R}^2$ is better than R^2 in reflecting the overall goodness-of-fit. The estimation procedure and the basic statistical ideas are discussed in greater detail in Liaw and Bartels(1982).

D. Interpretation of the Statistical Results

In order to get some idea about the robustness of the statistical indices, we have tried six specifications of the model using various combinations of the explanatory variables. The results are summarized in Table 5.

The full model(specification 1) shows that all seven explanatory variables are significantly related to the destination choice probability according to the hypothesized manner. The overall explanatory power is moderately high ($\dot{R}^2 = 0.86$). According to the t-ratios, population size is the most powerful

TABLE 5. THE STATISTICAL RESULT OF FITTING VARIOUS SPECIFICATIONS OF THE DESTINATION CHOICE MODEL OF METROPOLITANWARD MIGRANTS AMONG THE CANADIAN FEMALES, AGED 50-74*.

EXPLANATORY VARIABLE	SPECIFICATION 1	2	3	4	5	6
LOG OF DISTANCE	-5.0 (-16.3)	-5.0 (-16.1)	-5.0 (-15.9)	- 5.0 (-15.7)	-5.1 (-13.4)	-5.5 (-12.0)
CULTURAL DISSIMILARITY	-9.2 (-12.1)	-8.8 (-11.5)	-8.8 (-12.1)	-8.6 (-11.6)	-9.2 (-10.2)	-8.3 (-8.6)
COLDNESS	-8.0 (-14.9)	-7.1 (-14.4)	-6.5 (-14.3)	-6.0 (-14.1)	-7.0 (-11.9)	
BRIGHTNESS	3.9 (5.1)	3.2 (4.3)			5.2 (6.1)	
POPULATION SIZE	8.0 (22.1)	7.2 (23.6)	8.0 (21.9)	7.4 (24.0)	5.8 (19.9)	6.9 (14.8)
GROSS RENT	-1.9 (-4.1)		-1.3 (-3.0)			1.3 (2.4)
HOUSING GROWTH	5.7 (11.2)	5.0 (10.4)	6.2 (11.8)	5.6 (11.5)		3.5 (5.6)
$\dot{R}^2$	0.86	0.85	0.85	0.85	0.81	0.74
R^2	0.78	0.78	0.78	0.77	0.74	0.70
DEGREE OF FREEDOM	476	477	477	478	478	478

* The t-ratios are in parentheses and the beta weights are above them. A variable with a t-ratio greater than 3.0 in magnitude is said to be a significant explanatory variable. The higher the magnitude of the t-ratio the higher the significance level. Since the values of R are computed outside of BMDP3R from the rounded values of the predicted and observed choice proportions, a slight change in R need not have any real meaning.

positive factor (22.1) and log of distance is the strongest negative factor (-16.3). Cultural dissimilarity and housing growth are highly significant too. Between the two environmental variables, coldness has much greater strength (-14.9) than brightness (5.1). However, gross rent is least powerful (-4.1) in explaining the destination choice pattern. As a result, gross rent is deleted in specification 2. This results in a very small reduction in the significance levels of the most remaining variables and in the overall goodness of fit ($\dot{R}^2$ = 0.85).

Specification 3 shows that the deletion of the second least significant variable (brightness) from the model results in a same level of $\dot{R}^2$ as specification 2 and a very small reduction in the significance levels of most remaining variables.

Specification 4 reveals that the deletion of both variables (gross rent and brightness) results in the same level of overall goodness-of-fit (.85) as the preceeding two specifications. However, some minor downward and upward changes are found in the significance level of remaining five explanatory variables. Housing growth becomes the least significant variables in this run.

Two related variables, gross rent and housing growth are excluded in specification 5. In comparing specification 1

and specification 5, we find that there is a moderate drop in the model's overall goodness-of-fits; the value of $\bar{R}^2$ is reduced from 0.86 to 0.81. A comparison of specification 1 and 6, however, shows that the deletion of all environmental variables severely weakens the model's overall explanatory power; the value of $\bar{R}^2$ is reduced to only 0.74, and gross rent becomes insignificant explanatory variable. These comparsions show clearly that in the context of population size, distance, cultural dissimilarity, the set of environmental variables are more important than the set of housing variables in determining the destination pattern.

A similar set of specifications is done for elderly males by Liaw and Kanaroglou (1986) which is shown in Appendix Table 3. In general, a higher level of explanation is found for the elderly females in terms of both the overall goodness-of-fit and the t-ratios. We may suspect that the higher level of explanation for elderly females is caused by less zeros in the female outmigration rate matrix (the female age bound is five years lower than the one for males). Hence, a test run is computed in which the lower female age bound is modified to be identical to that of the males. The result shows that a higher level of explanation is still found in the female model. Thus, we are confident that the explanatory variables are more significant in affecting the destination choice pattern of the elderly females than that of the elderly males.

5. CONCLUSION

We have learned from the study that compared with young females, the elderly females are substantially less migratory and their migration pattern is less metropolitanward and less dispersed. However, compared with elderly males, the elderly females are more mobile and have a stronger preference for metropolitan areas and a more dispersed destination choice pattern.

Referring to the median values, about 6 % of the elderly females outmigrate from a CMA, among whom about 40 % are metropolitanward migrants. With Thunder Bay being the migration shed, the migration field of the elderly females is divided into two parts. Except for the two secondary CMA's in Quebec, the eastern part is dominated by Toronto, whereas the western part is unequivacally dominated by Vancoucer. With its attractive environment, Vancouver's appeal is very extensive, attracting more than 10 % of the metropolitanward elderly female migrants from the four eastern CMA's at the highest levels of the urban hierarchy (Hailfax, Montreal, Ottawa, and Toronto).

For metropolitanward elderly migrants from the CMA's, the probability of choosing a particular destination is positively related to population size, brightness, and housing growth, and

negatively related to the logarithm of distance, cultural dissimilarity, coldness, and gross rent. In addition, the environmental variables are more important than the housing variables in determining the destination pattern of elderly migrants.

Our findings on the migration behaviour of elderly females in Canada have been largely based on a macro perspective. Further progress in research could be facilitated by combining the theory of individual decision-making and the analysis of micro data on elderly females.

FOOTNOTES

1. The 19 mother tongues are (1) English, (2) French, (3) Chinese and Japanese, (4) Yugoslavian, (5) Czech and Slovak, (6) Finish, (7) Gaelic and Welsh, (8) German, (9) Greek, (10) Indian and Eskimo, (11) Italian, (12) Hungarian, (13) Dutch, (14) Polish, (15) Russian, (16) Scandinavian, (17) Ukranian, (18) Yiddish, and (19) "Other". Source: Statistics Canada (1973).

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PPENDIX TABLE 1. THE 1971-1976 PERCENTAGE DISTRIBUTION OF METROPOLITANWARD FEMALE MIGRANTS IN THE 15-19 AGE GROUP

ESTINATION CMA	ORIGIN CMA																						
	ST. J	HAL	SA.J	CHI	Q.C	MON	OTT	OSH	TOR	HAM	CATH	KIT	LON	WIND	SUD	T.B.	WINN	REG	SASK	CAL	EDM	VAN	VIC
1 ST. J	--	2.9	4.3	0	0	0.4	0.2	0	1.1	0.2	0.7	0.4	0.6	0	0.4	0	0.6	0	0	0.2	0.2	0.2	0
2 HAL	13.9	--	33.2	0	0.8	2.8	5.0	0	2.6	1.1	0.5	1.4	2.0	1.1	0.4	0	1.3	0.4	1.0	0.7	1.1	1.9	3.7
3 SA. J	4.2	5.1	--	0.5	0.5	0.8	0	0.6	0.7	0.4	0.5	0.7	0	0.4	0	0	0.5	0	0	0.2	0	0	0
4 CHI	0	0	0	--	5.3	1.3	0.2	0	0.1	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0
5 Q.C.	0	1.0	1.4	43.5	--	12.3	3.2	0	0.4	0	0.2	0.4	0.3	0.7	0	0	0.2	0.8	0	0.5	0.9	0.6	0
6 MON	5.5	9.6	2.9	40.1	66.3	--	15.0	0.6	6.1	2.6	0.7	1.8	2.6	1.5	4.7	1.5	3.7	0.8	1.7	0.9	2.7	3.9	1.4
7 OTT	10.5	16.5	10.1	8.9	13.6	19.8	--	4.7	8.3	5.1	5.3	4.3	6.0	5.7	14.0	4.8	4.7	4.5	2.1	3.9	3.3	4.0	2.7
8 OSH	0	0.5	0	0	0.5	0.5	0.8	--	11.1	1.0	1.2	1.5	1.0	0.7	0.4	3.1	0	0.4	0.3	0.2	0.2	0.6	0
9 TOR	31.5	25.5	20.5	3.3	7.5	30.6	30.1	67.4	--	42.8	41.7	41.0	36.6	37.6	39.3	25.5	12.5	4.9	5.4	5.8	7.6	16.1	3.7
0 HAM	2.3	2.9	2.9	0	0.3	2.2	3.2	3.5	13.1	--	21.5	11.3	6.0	4.5	8.2	2.3	1.3	1.2	1.0	1.7	0.6	1.1	0.9
1 CATH	0	1.0	1.4	0	0.3	0.6	1.4	1.8	4.6	12.3	--	2.2	3.7	3.8	3.4	0.8	0.2	0.8	0	0	0	0.6	0
2 KIT	8.0	1.0	2.9	0.5	0	2.0	2.9	3.5	10.8	8.8	7.9	--	12.2	6.0	7.1	3.1	0.8	0	0.7	0.7	0	0.9	1.4
3 LON	0.8	2.4	0	0	0	2.0	4.6	4.3	8.3	8.5	7.9	13.7	--	21.4	7.3	5.6	1.1	1.3	0.3	0.9	0.2	1.0	0.5
4 WIND	0	0	1.4	0	0	0.6	0.8	1.2	2.2	0.6	0.7	2.6	5.1	--	2.2	1.5	0.4	0.4	0.7	0.2	0.4	0.2	0
5 SUD	0	0	0	0	0.3	0.8	2.7	1.8	1.9	0.9	1.2	1.4	1.0	0.7	--	1.5	0.4	0.4	0.7	0	0.2	0	0
6 T.B.	0	0	0	0	0	0.2	1.2	0	1.4	1.3	0.7	1.4	1.4	0.7	1.2	--	3.7	0	0.3	0.2	0.4	0.8	0
7 WINN	1.6	3.1	1.4	0.5	0	1.9	3.0	0	2.8	1.5	0.7	1.1	1.0	1.5	0.8	18.7	--	13.2	7.7	4.9	4.5	7.3	5.2
8 REG	0	0.5	0	0.5	0.8	0.6	0.8	0	0.4	0.6	0.2	0.4	0.6	0.4	0.8	2.3	4.5	--	14.9	3.8	3.5	2.0	2.3
9 SASK	0	0.5	0	0	0	0.1	0.2	0	0.3	0	0	0.4	0.3	0	0.4	1.5	4.5	18.4	--	5.1	3.5	2.8	0
0 CAL	3.9	6.0	8.7	0	0.5	5.2	5.2	2.3	6.2	3.6	2.2	2.9	4.3	3.4	1.2	5.4	17.5	21.4	26.2	--	38.9	18.0	10.4
1 EDM	0.3	6.1	2.9	0	0.8	3.1	5.2	0.6	3.8	1.9	1.5	2.9	3.0	4.6	2.2	5.6	15.1	14.5	20.0	39.7	--	15.9	10.4
2 VAN	10.6	10.2	5.8	1.4	1.7	11.3	10.7	6.0	12.2	5.7	3.9	6.7	11.1	4.3	5.1	13.7	23.6	14.0	14.2	23.7	22.8	--	57.4
3 VIC	3.9	5.4	0	0.9	0.8	1.0	3.6	1.8	1.4	1.2	0.7	1.8	1.3	1.1	0.4	3.1	3.2	2.8	2.4	6.6	8.7	22.3	--

PPENDIX TABLE 2. THE 1971-76 PERCENTAGE DISTRIBUTION OF METROPOLITAN WARD FEMALE MIGRANTS IN THE 50-74 AGE GROUP

ESTINATION CMA	ORIGIN CMA ST. J	HAL	SA. J	CHI	Q.C	MON	OTT	OSH	TOR	HAM	CATH	KIT	LON	WIND	SUD	T.B.	WINN	REG	SASK	CAL	EDM	VAN	VIC
1 ST. J	--	4.5	0	0	0	0.3	1.2	0	1.3	0.5	1.1	0	1.2	0	0	0	0	0	0	0.7	0	0	0.6
2 HAL	17.1	--	14.2	0	0	2.5	4.6	3.4	2.2	1.7	0	0	3.0	2.5	0	0	0.7	0	0	1.1	0.8	0.6	0.6
3 SA. J	0	5.8	--	0	0.6	1.3	0	1.7	1.0	0	0	1.8	1.2	0	0	0	0.4	0	0	0	0	1.2	0.6
4 CHI	0	0	0	--	5.5	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Q.C.	0	1.3	0	32.9	--	9.3	1.2	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0
6 MON	12.2	10.8	4.4	45.4	77.1	--	22.7	0	6.7	2.0	5.7	2.6	4.0	3.4	4.3	0	3.3	0	0	1.7	1.2	4.9	2.4
7 OTT	14.6	13.4	14.2	17.1	6.6	16.9	--	1.7	7.5	4.6	4.7	2.6	5.2	8.5	18.2	2.1	4.6	1.8	3.0	3.5	1.7	4.6	1.2
8 OSH	2.4	0	0	0	0	1.1	0.4	--	9.1	1.1	2.1	0	0	3.0	0	0	0.7	0	0	0	0	0.3	0
9 TOR	31.2	14.2	35.4	4.6	4.4	30.0	23.0	70.6	--	36.2	37.5	39.5	35.2	36.8	35.8	23.3	11.5	3.6	2.0	5.2	4.1	12.1	9.0
0 HAM	2.4	3.9	0	0	1.7	3.6	1.5	6.8	16.3	--	19.7	17.4	7.4	9.6	4.3	2.1	1.3	0	0	1.1	0.8	0.6	3.0
1 CATH	2.4	1.3	0	0	1.2	2.9	4.2	7.2	10.1	19.8	--	1.3	5.2	2.3	12.4	6.4	1.0	0	0	0	0.8	1.2	0
2 KIT	2.4	1.3	0	0	0	1.9	3.2	1.7	5.4	9.8	7.6	--	15.0	7.1	1.4	2.1	0	0	1.0	0	0.4	0.6	1.3
3 LON	2.4	1.3	9.7	0	0	2.9	5.8	0	7.5	3.3	5.9	11.2	--	16.0	7.5	2.5	0.7	0.9	1.0	0	0	1.8	0
4 WIND	2.4	6.8	4.4	0	0	0.8	1.5	0	1.8	2.7	3.0	10.6	8.2	--	1.4	0	0.7	2.0	1.0	0	0.4	1.0	0.6
5 SUD	0	2.9	4.4	0	1.3	0.1	0.4	0	1.7	0.5	2.1	1.3	0	1.1	--	2.1	0.7	0	0	0	0	0	0
6 T.B.	0	1.8	0	0	0	0.1	0.4	0	0.6	0.7	0	0	1.2	0	1.4	--	1.1	0	0	0	0	0.9	0.6
7 WINN	2.4	1.3	0	0	0.6	2.8	2.9	0	3.5	2.3	0.9	1.3	1.0	2.3	5.8	19.5	--	8.5	16.7	4.8	4.1	7.7	6.6
8 REG	0	1.3	0	0	0	0.3	0.4	0	0.8	1.0	0	0	0	0	0	2.1	3.1	--	8.8	2.5	1.6	1.2	1.5
9 SASK	2.9	1.3	0	0	0	0.3	0	1.7	0.7	0	0	0	1.0	0	0	0	1.8	6.7	--	3.1	1.2	2.3	1.2
0 CAL	0	5.2	4.4	0	0	3.4	2.4	3.4	3.6	1.5	0.9	1.3	2.0	1.1	1.4	6.8	11.8	14.5	12.0	--	25.7	10.6	10.0
1 EDM	0	4.2	8.8	0	0	1.5	1.5	0	2.3	0.5	2.8	1.3	1.0	1.1	2.9	4.7	5.6	13.0	10.0	21.0	--	10.8	4.9
2 VAN	2.4	10.5	0	0	1.1	11.6	11.7	1.7	11.8	6.7	0.9	5.2	6.2	5.0	1.4	15.7	34.0	34.4	26.5	37.0	33.9	--	55.7
3 VIC	2.4	6.8	0	0	0	4.9	11.1	0	6.0	4.9	4.9	2.6	2.0	0	1.4	10.6	16.9	14.6	17.9	18.3	23.2	36.6	--

Appendix

Table 3. The statistical result of fitting various specifications of the destination choice model of metropolitanward migrants among the Canadian elderly males, aged 55-79*.

Explanatory Variable	Specification				
	1	2	3	4	5
Log of Distance	-4.5 (-12.8)	-4.3 (-12.2)	-4.3 (-11.8)	-4.2 (-10.4)	-4.7 (-8.9)
Cultural Dissimilarity	-9.4 (-10.3)	-8.8 (-9.4)	-8.6 (-9.4)	-9.2 (-8.7)	-8.4 (-7.4)
Coldness	-9.9 (-15.7)	-8.5 (-14.4)	-7.0 (-14.0)	-8.6 (-12.7)	
Brightness	5.4 (5.8)	4.3 (4.6)		6.4 (6.3)	
Population Size	7.6 (17.8)	6.4 (17.6)	6.7 (17.8)	5.1 (15.0)	6.3 (11.4)
Gross Rent	-3.1 (-5.6)				1.0 (1.5)
Housing Growth	5.8 (9.9)	4.8 (8.5)	5.5 (9.7)		3.3 (4.7)
$\bar{R}^2$	0.80	0.79	0.78	0.75	0.62
R^2	0.71	0.70	0.71	0.64	0.58
D. of Freedom	476	477	478	478	479

*The t-ratios are in parentheses and the beta weights are above them. A variable with a t-ratio greater than 3.0 in magnitude is said to be a significant explanatory variable. The higher the magnitude of the t-ratio the higher the significance level. Since the values of R^2 are computed outside of BMDP3R from the rounded values of the predicted and observed choice proportions, a slight change in R^2 need not have any real meaning.

Source: Liaw and Kanaroglou, 1986.