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COMPONENTS OF THE IN-MIGRATION STREAM IN CENTRAL CANADA

M. Woodyard

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PREFACE

As a component of growth, a response to changes in the labour market, and a determinant of future social change, in-migration has long been of interest to urban economists and geographers. This paper attempts to identify some of the characteristics of urban areas which may explain why some urban areas receive many in-migrants and others receive few. In addition the stream of in-migrants is broken down by origin, age, and sex to attempt to indicate what type of migrants urban areas receive. A discriminant analysis is used to identify characteristics which distinguish between urban areas with high and low migration rates. Inferring from the results of the discriminant analysis, a filtering mechanism of the location of migrants is hypothesized.

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I INTRODUCTION

In a look to the future of any urban system, one of the first things which must be determined is how many people there will be and how this total will be distributed throughout the system. Assuming that the total current population is known, then there are two inputs and two outputs required to predict the population of some future date. The inputs are births, and in-migration, and the outputs are deaths and out-migration. When dealing with the urban system as a whole, for provinces or nations, the total future population can be estimated fairly accurately using the cohort survival method. The above four variables are either held constant, or simple assumptions are made about how they change over time. With large aggregations of population, these assumptions are usually sufficient to achieve reliable estimates by repeating the necessary number of iterations of the cohort survival procedure until arriving at the future year in question.[1]

When attention is shifted from total growth to the distribution of population within the urban system, however, these simple assumptions no longer suffice. Unlike more aggregated units of observation, very little of the behaviour of the urban area may be explained by observing that area in isolation. Urban areas exist as units in urban systems, roughly defined by broad geographical regions. The behaviour of the individual urban area is determined by its interaction with the other urban areas in the system, and by the interaction of the system as a while with other urban systems. Insofar as the growth of an urban area is determined by characteristics of the urban system, any forecasting method, which does not recognize the role which an urban area performs in the system, will not produce reliable results.

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[1] See Bourne and Thackray (1972).

At the scale of the urban area, one can be reasonably confident of the assumptions regarding fertility and mortality rates, as they exhibit fairly continuous and predictable long range trends. There is some evidence to suggest that out-migration may be a constant proportion of the population of the sending urban area.[2] But when looking at the past behaviour of in-migration, rapid fluctuations are seen. Of all the variables necessary for population forecasting, in-migration is the most sensitive to structural changes in the urban system.

This paper considers the problem of identifying characteristics of urban areas which will help to anticipate the levels of future in-migration. There are two basic approaches one might take to study this problem. The first and more theoretical approach involves the postulation of a model of migration behaviour. According to the terms of the model, key variables which are believed to determine migration behaviour are chosen. By statistical procedures, one estimates parameters for these independent variables which in some specified combination will serve to best estimate in-migration rates.

The second, and more empirical approach begins with a larger set of variables which may affect migration behaviour. The urban areas are grouped according to their in-migration rates. Variables are then chosen from the data set whose linear combinations will best distinguish between high and low migration groups of urban areas. A discriminant analysis is used to identify the variables which provide maximum discrimination between the groups and minimum probability of misclassification. It is this second approach which has been used in this paper.

It is important when dealing with in-migration not only to be able to estimate the total number of in-migrants to an urban area but also to have some idea as to

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[2] See Lowry (1966).

what type of migrants the urban area can expect to receive. In order to anticipate future demographic changes in the receiving urban area, it is desirable to know from where the migrants originate, and to know the age and sex breakdown of the migration stream. This paper is therefore concerned not only with the total level of in-migration, but also with the components of the migration stream, as broken down by age, sex and origin.

II EMPIRICAL METHOD

For the purposes of the discriminant analysis the urban areas were ranked according to their migration ratios, and divided at the mean to provide two groups. A set of variables representing characteristics of the urban areas were provided, from which were selected those variables whose linear combinations discriminated best between the two groups.

1. Statistical Procedure

The particular form of discriminant analysis chosen computed an F-value for each variable, which was the likelihood ratio for testing the equality over both groups of the conditional distribution of that variable, given the variables which had been entered into the discriminant function. The variable with the largest F-value, called the F-to-enter, above a specified minimum F-value, was entered into the discriminant function. This criterion was equivalent to choosing that variable which gave the greatest decrease in the ratio of within to total generalized variance. The coefficients of the variables included in the discriminant function were estimated, and the urban areas were classified according to the value of the discriminant function. An F-statistic was computed for testing the equality of group means over all included variables. The F-to-enter for each variable was then revised given the new set of included variables. The whole procedure was repeated until no variable had an F-to-enter higher than the specified minimum.

The degrees of freedom of the F-to-enter changed as each new variable was added. They began at (1,61) and never dropped below (1,54). The specified minimum F-to-enter was 4.00 which was significant at the .05 level with (1,60) degrees of freedom. When the minimum F-to-enter was reached, the posterior probabilities of each observation coming from each group, and the square of the Mahalanobis distance of each observation from each group were computed. Each observation was assigned to the group for which it had the highest posterior probability, and a final classification matrix was presented.

The function produced by the discriminant analysis was a component y of the vector variable x of the following form

$$y = v_0 + v_1 x_1 + v_2 x_2 + \ldots + v_p x_p$$

where v is a vector of coefficients. Since the input variables did not have the same variances, the coefficients could not be compared. In order to be able to assess the relative contribution of the input variables in discriminating between the groups, the function had to be normalized, so that the variance of each variable was unity. For this purpose, the following form was required

$$y = c_0 + c_1 z_1 + c_2 z_2 + \ldots c_p z_p$$

where $$z_i = \frac{x_i - \bar{x}_i}{\sigma_{x_i}}$$

and $$c_i z_i = \frac{c_i x_i}{\sigma_{x_i}} - \frac{c_i \bar{x}_i}{\sigma_{x_i}}$$

The standardized form of y then becomes

$$y = c_0 - \frac{c_1 \bar{x}_1}{\sigma_{x_i}} - \frac{c_2 \bar{x}_2}{\sigma_{x_2}} - \ldots - \frac{c_p \bar{x}_p}{\sigma_{x_p}} + \frac{c_1 x_1}{\sigma_{x_1}} + \frac{c_2 x_2}{\sigma_{x_2}} + \ldots + \frac{c_p x_p}{\sigma_{x_p}}$$

In terms of the unstandardized function

$$v_0 = c_0 - \frac{c_1\bar{x}_1}{\sigma_{x_1}} - \frac{c_2x_2}{\sigma_{x_2}} - \ldots - \frac{c_p\bar{x}_p}{\sigma_{x_p}}$$

$$v_ix_i = \frac{c_ix_i}{\sigma_{x_i}}$$

and $c_i = v_i\ \sigma_{x_i}$

Multiplying each unstandardized coefficient v_i by the standard deviation of its corresponding element x_i produced the standardized coefficient c_i for each included variable. All the corrections for the means of each variable accumulated into the constant term c_o. Since the input data did not allow prediction in more than a qualitative manner, no attempt was made in this paper to compute the values of y for individual urban areas. The approach here was to examine the coefficients to identify the order of importance of the variables included in the function. For this purpose, the constant term had no importance, so the results were reported in the following form

$$y' = y - c_0 = c_1z_1 + c_2z_2 + \ldots + c_pz_p$$

The normalized coefficients, while identifying the order of importance of the included variables, did not indicate in which direction the variables were associated with the two groups. For this information, we look to the means of the included variables within the two groups.

2. Data, Variables, and Background Studies

Two types of data were used for the discriminant analysis: in-migration data, by which the observations were grouped, and characteristics of the urban area, which were the input variables for the discriminant analysis. The unit of observation for this analysis was the urban area of population 10,000 and over in Ontario and Quebec, of which there were 122 in 1961. All urban areas included in Census Metropolitan Areas (CMA's) and Major Urban Areas (MUA's)

were aggregated with their appropriate central cities. One urban area, St. Jerôme, was not included due to unavailability of data, leaving a total sample size of 63 observations.

Migration data:

Migration data for CMA's were obtained from a census bulletin based on the 1961 Census.[3] Migration data for MUA's and other urban areas over 10,000 population were obtained from an unpublished census tabulation from the same data base.[4] Both data sources were based on information obtained from a twenty percent household sample taken in conjunction with the 1961 Census and designed to represent all persons five years old and over, living in private households. The data were based on the responses given by people who were asked if they lived in the same dwelling unit five years ago on June 1, 1956, and if not, where did they live. The ideal form of the migration data would be a complete origin-destination matrix of all moves within the specified time period. The data were disaggregated along the destination axis of this matrix. Unfortunately the Dominion Bureau of Statistics aggregated the information on the origins of the migrants into three fairly broad categories of origins: migrants from the same province, migrants from a different province in Canada, and migrants from abroad. The number of migrants in each of these three categories was broken down by sex and by five age groups (5-14, 15-24, 25-44, 45-64, and 65 and over).

With three categories of origin, two sexes, and five age groups, the migration stream was broken down into thirty components. For each urban area, the total sample size and the total number of migrants in each category was reported. The migration ratios were obtained by subtracting from the total sample size the number of people in the sample who did not reply and dividing

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[3] Dominion Bureau of Statistics (1964).

[4] Dominion Bureau of Statistics (1963).

each component by the adjusted sample size for each urban area. If the sample were truly representative of the population in each urban area, then each variable represented the percentage of the total population living in each urban area in 1961 of a particular sex, of a particular age group, which had moved to the urban area from a particular origin group within the previous five years. When the ten categories of migrants from each origin group were added together, the sums were the ratios of total in-migrants from each of the three origin groups for each urban area. When all thirty components of the migration stream were added together, the sum was the total in-migration ratio for each urban area. The urban areas were ranked according to each of the thirty components of the migration strea, the totals for the three origin groups, and the total in-migration ratio. Each ranking was divided at its mean into high and low migration groups, and 34 separate discriminant functions were estimated, one for each grouping. The means and standard deviations for each component of the migration stream are shown in Table 1.

Input Data:

During the course of the Environment Study at the Centre for Urban and Community Studies, several research reports have been published which attempted to identify characteristics of urban areas which would influence the growth and distribution of the population of the urban system of Central Canada.[5] The results of these studies have included several qualitative indices of functional, structural, growth, demographic, and locational characteristics of the urban areas. It is the intent of this paper to test these characteristics against the in-migration data of the urban areas, to determine which if any have been associated with high and low in-migration rates. Nineteen variables were used as the data inputs to the discriminant

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[5] See studies by Barber (1971), Barber and Britton (1971), Bourne, (1971), Britton (1971), Bunting and Baker (1968), Golant and Bourne (1968), Hodge (1969), Lord and Miron (1971), Siegel (1971), Siegel and Woodyard (1971), Simmons (1970b).

TABLE 1: MIGRATION STRUCTURE OF THE CENTRAL CANADA URBAN SYSTEM
(Total number of migrants in each category as percentage of total population)

Components of the Migration Stream	Mean	Standard Deviation
Male migrants from same province aged 5-14 (SP05M)	0.0156	0.0100
Male migrants from same province aged 15-24 (SP15M)	0.0113	0.0068
Male migrants from same province aged 25-44 (SP25M)	0.0246	0.0160
Male migrants from same province aged 45-64 (SP45M)	0.0071	0.0034
Male migrants from same province aged 65 and over (SP65M)	0.0021	0.0013
Female migrants from same province aged 5-14 (SP05F)	0.0156	0.0095
Female migrants from same province aged 15-24 (SP15F)	0.0152	0.0083
Female migrants from same province aged 25-44 (SP25F)	0.0229	0.0142
Female migrants from same province aged 45-64 (SP45F)	0.0069	0.0034
Female migrants from same province aged 65 and over (SP65F)	0.0029	0.0022
Male migrants from different province aged 5-14 (DP05M)	0.0027	0.0028
Male migrants from different province aged 15-24 (DP15M)	0.0020	0.0020
Male migrants from different province aged 25-44 (DP25M)	0.0048	0.0050
Male migrants from different province aged 45-64 (DP45M)	0.0010	0.0010
Male migrants from different province aged 65 and over (DP65M)	0.0003	0.0004
Female migrants from different province aged 5-14 (DP05F)	0.0025	0.0024
Female migrants from different province aged 15-24 (DP15F)	0.0024	0.0027
Female migrants from different province aged 25-44 (DP25F)	0.0042	0.0042
Female migrants from different province aged 45-64 (DP45F)	0.0008	0.0007
Female migrants from different province aged 65 and over (DP65F)	0.0004	0.0004
Male migrants from abroad aged 5-14 (FA05M)	0.0026	0.0021
Male migrants from abroad aged 15-24 (FA15M)	0.0019	0.0019
Male migrants from abroad aged 25-44 (FA25M)	0.0059	0.0050
Male migrants from abroad aged 45-64 (FA45M)	0.0009	0.0009
Male migrants from abroad aged 65 and over (FA65M)	0.0001	0.0002
Female migrants from abroad aged 5-14 (FA05F)	0.0025	0.0021
Female migrants from abroad aged 15-24 (FA15F)	0.0022	0.0022
Female migrants from abroad aged 25-44 (FA25F)	0.0056	0.0046
Female migrants from abroad aged 45-64 (FA45F)	0.0011	0.0010
Female migrants from abroad aged 65 and over (FA65F)	0.0003	0.0003
Total migrants from same province (SPTOT)	0.1240	0.0674
Total migrants from different province (DPTOT)	0.0213	0.0198
Total migrants from abroad (FATOT)	0.0236	0.0190
Total in-migrants (IMTOT)	0.1689	0.0836

Note: Sample includes 63 urban areas of population 10,000 and over in 1961. See Britton (1971) for list of urban areas.

Source: Dominion Bureau of Statistics (1963, 1968).

analysis. Of the nineteen, fifteen were based on the results of previous research reports in the series, and four were based on data from the 1961 Census. The unit of observation of the input variables was the urban area of population 10,000 and over in Ontario and Quebec in 1961. There were some definitional and aggregation difficulties as pointed out in the following descriptions.

The first five variables were indices of the functions which the urban areas performed in the urban economy of Central Canada. These five indices were based on the results of Britton's analysis of the occupational structure of the Central Canada urban system.[6] In his analysis, the number of males employed in each of twenty-five occupation classes was expressed as a percentage of the total male labour force in each urban area. Using Q-mode factor analysis, these variables were reduced to five factors of economic function. Each urban area was assigned a factor loading on each of the five factors. Each factor can be interpreted as an index of a particular economic function, with the factor loadings being interpreted as the value of that index for each urban area. The range of these indices was from zero to one, with low loadings representing low employment, and high loadings representing high employment in a particular function. The factor scores for each factor indicated which of the twenty-five input variables correlated highly with each of the five factors.

In Britton's study all urban areas included in CMA's were aggregated with their appropriate central cities. St. Jerome was not included due to lack of data, so his study was based on a total of 72 urban areas. He did not aggregate the MUA's, so for the purposes of this study, the value of the index for the central city of the MUA was used to represent the whole MUA. The non-central cities which were included in MUA's were dropped. A brief description

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[6] Britton (1971).

of the five economic function variables follows.

1. An index of special manufacturing function in metal manufacturing engineering, and machinery. (MA) This factor explained 16.0 percent of the variance of the original 25 occupation variables. It had high factor scores ($\geq$ 1.0) on Machinists, Plumbers, Sheet Metal Workers, and Related Workers (3.7); Craftsmen, Production Process, and Related Workers (2.0); and Paper Makers, Still Operators, Chemical, and Related Workers (-1.6).

2. An index of special function in mining. (MI) This factor explained 13.6 percent of the original variance, and had high factor scores on Miners, Quarrymen, and Related Workers (4.3); and Craftsmen, Production Process, and Related Workers (1.4).

3. An index of special function in services. (SV) This factor explained 33.0 percent of the original variance, and had high factors scores on Service and Recreation Occupations (3.5); Managerial Occupations (1.7); Clerical Occupations (1.1); Miners, Quarrymen, and Related Workers (-1.1); and Paper Makers, Still Operators, Chemical and Related Workers (-1.0).

4. An index of special manufacturing function in textiles. (TX) This factor explained 8.5 percent of the original variance, and had high factor scores on Spinners, Weavers, Knitters, and Related Workers (4.2); and Craftsmen, Production Process, and Related Workers (1.4).

5. An index of special manufacturing function in paper and chemicals production. (PC) This factor explained 25.0 percent of the original variance, and had high factor scores on Craftsmen, Production Process, and Related Workers (2.8); Paper Makers, Still Operators, Chemical, and Related Workers (2.7); Labourers (1.7); and Service and Recreation Occupations (-1.1).

The next variable was an index of access to the urban hierarchy. The score which each urban area was given with respect to this indicator represented the potential which the urban area possessed for accesssing the major

transportation and communication networks of the urban system. The value of the index ranged from 0.0 to 2.0, with low values representing high accessibility and high values representing low accessibility. This index was based on the results of Siegel and Woodyard's analysis of the urban system hierarchy of Central Canada.[7] In their analysis, urban areas were grouped into one of four levels in the urban hierarchy: Level 1 - Dominant Central Cities, Level 2 - Secondary Central Cities, Level 3 - Satellite Cities, Level 4 - Independent Cities. A growth model, relating in-migration rates to growth in manufacturing employment, growth in municipal expenditures, and driving time accessibility, was tested by regression analysis over the four levels in the urban hierarchy.

The CMA's and MUA's were aggregated with their appropriate central cities. They considered Toronto and Hamilton as a single Level 1 urban area. Due to unavailability of data, their sample was reduced to 54 urban areas. For the purposes of this study Hamilton was considered as a separate Level 2 urban area with Brantford as its satellite. Using the methods described by Siegel and Woodyard, the remaining nine urban areas, not included in their samples, were assigned positions in the hierarchy. A brief description of the urban hierarchy variable follows.

6. An index of access to the urban hierarchy. (UH) Included in Siegel and Woodyard's data set was a variable (T) of driving time from each urban area to the nearest urban area which was higher in the urban hierarchy. This variable was converted to an accessibility index (T_1) ranging from zero to one, by setting all driving times greater than ten hours, equal to 9.999 hours, and dividing each item in the vector by 10. Based on their specifications of the hierarchy, a dummy variable (H) was created, such that H=0 for all Level 1 and Level 2 urban areas, and H=1 for all Level 3 and Level 4 urban areas. When

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[7] Siegel and Woodyard (1971).

this vector was added to the accessibility index (T_1 + H), a vector from 0.0 to 2.0 was produced, such that each level in the hierarchy was represented by the following ranges.

0.0	Level 1
0.001 - 0.999	Level 2
1.000 - 1.199	Level 3
1.200 - 1.999	Level 4

The remote peripheral urban areas had the largest values, and the two central metropolitan areas, Toronto and Montreal, had the smallest values.

The next two variables were indices of two aspects of urban growth in Central Canada. The first was based on total population as reported in the 1961 Census.[8] The second was based on the results of Barber's analysis of the growth determinants of the Central Canada urban system.[9]

7. An index of growth. (GR) The score which each urban area was given with respect to this indicator was the increase in population from 1956 to 1961 expressed as a percentage of the 1956 population. Most of the growth rates fell between 0.0 and 1.0 with one falling below, and a few falling above this range. MA's and MUA's were aggregated with their appropriate central cities.

8. An index of growth rate stability. (GS) The score which each urban area was given with respect to this indicator represented the direction and stability of the urban area's growth relative to the rest of the system. Barber grouped the urban areas into three groups: Growth Centres, Unstable Centres, and Declining Centres. An urban area was assigned to one of these three groups by comparing its growth rates in each of two successive five year time periods with the mean growth rates in each of two periods. In order to have a single index to represent this grouping method, a variable was created using deviations from the means in each time period. Though Barber's 10-year

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[8] Dominion Bureau of Statistics (1962).

[9] Barber (1971).

period was 1956-1966, for the purposes of constructing the index, the period 1951-1961 was used. The index thus reflected the growth stability prior to and including the migration period in order to point out the antecedents of migration. To construct the index, the deviations from the mean growth rate in 1951-61 and 1956-61 were calculated for each urban area. The deviations from the mean for both time periods were then added together. This provided an index ranging from low negative scores for declining centres to high positive scores for growth centres, with scores for unstable centres clustered around zero. With cut points at -0.05 and +0.05, this index correctly classified 86 percent of the 63 observations. This compared favourably with Barber's discriminant function, which correctly classified 76 percent of 49 observations. This index was not based directly on Barber's analysis, but was an independent attempt to replicate a grouping procedure described by him, and to devise a single index to represent the results of this procedure.

The next eight variables were indices of the structural characteristics of the Central Canada urban system. These eight indices were based on the results of Bunting and Baker's analysis of the structural characteristics of the Central Canada urban system.[10] In their analysis, 71 demographic, socio-cultural, economic, locational, and physical stock variables were transgenerated to adjust for the size of the urban area. Using R-mode factor analysis, these variables were reduced to eight dimensions of structural characteristics. Each input variable was assigned a factor loading on each of the eight factors, which showed the correlation between the original variable and the new factor. Each urban area was then assigned a factor socre on each of the factors. Each factor can be interpreted as an index of a particular structural characteristic, with the factor scores being interpreted as the value of that index for each

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[10] Bunting and Baker (1968).

urban area. The indices were all normalized variables, with most values falling between -3 and +3.

As in Britton's study, the CMA's were aggregated, but the MUA's were not. Again, in this study the central cities of the MUA's were used to represent the whole MUA. A brief description of the eight structural characteristic variables follows.

9. An index of obsolescence. (OB) This factor explained 19.5 percent of the original 71 variables. It had high positive correlations with an aging and middle aged population, a widowed and divorced population, a U.S. born population, labour participation rate, female labour participation rate, percentage of dwelling units built prior to 1920, and percentage of dwelling units owned by a single owner for ten years or more. It had high negative correlations with a young population, percentage of dwelling units built since 1945, proportion of males to females, average household size, and male labour participation rate. Positive values of this index were associated with obsolete, aging urban areas. Negative values were associated with dynamic young urban areas.

10. An index of cultural-linguistic characteristics. (CL) This factor explained 18.5 percent of the original variance. It had high positive correlations with a married, divorced, and widowed population, a Protestant population, a population of recent immigrants, an English speaking population, a U.K. born population, an international population, labour participation rate, percent of clerical occupations, percent of single family dwellings, percent of owned dwelling units, average family income, location relative to Highway 401, and average contract rent. It had high negative correlations with an unmarried population, a Catholic population, a French-speaking population, a native born population, percentage of families earning less than $3,000, percentage of persons with low educational attainment, percent-

age of apartment dwellers, percentage of rented dwelling units, and average household size. Positive values of this index were associated with English language and culture. Negative values were associated with French language and culture.

11. An index of metropolitan status. (MT) This factor explained 9.9 percent of the original variance. It had high positive correlations with a Jewish population, percentage of finance, insurance and real estate industry, population size in 1961, number of major provincial highways entering the urban boundary, and distance to the nearest city of same or larger size. Positive values of this index were associated with metropolitan areas. Negative values were associated with small towns and villages.

12. An index of trade and commerce. (CM) This factor explained 8.6 percent of the original variance. It had high positive correlations with percentage of managerial occupations, percentage of sales occupations, and percentage of trade industry. Positive values of this index were associated with an urban economy based on trade and commerce. Negative values were associated with non-commercial urban base.

13. An index of peripherality. (PR) This factor explained 7.7 percent of the original variance. It had high positive correlations with percentage of transportation industry and distance to Toronto or Montreal. It had high negative correlations with percentage of manufacturing industry, number of urban areas of population 5,000 or over within 50 miles, and total population of urban areas of population 5,000 or over within 50 miles. Positive values of this index were associated with a peripheral location. Negative values were associated with a central location.

14. An index of educational-occupational structure. (EO) This factor explained 5.6 percent of the original variance. It had high negative cor-

relations with a university educated population, percentage of population attending university, and percentage of professional occupations. Positive values of this index were associated with low levels of educational attainment and a lack of professional, degree-holding people. Negative values were associated with a high level of educational attainment and a high proportion of professional degree-holding people.

15. An index of growth characteristics. (GC) This factor explained 5.5 percent of the original variance. It had high positive correlations with value of industrial building permits, value of commercial building permits, and percentage of dwelling units built since 1945. Positive values of this index were associated with rapid growth. Negative values were associated with slow growth.

16. An index of public administration and defense industries. (AD) This factor explained 3.7 percent of the original variance. It had high negative correlations with percentage of service occupations and percentage of public administration and defense industries. Positive values of this index were associated with low employment in civil service and armed services. Negative values were associated with high employment in civil service and armed services.

The next two variables were indices of population size.

17. 1961 Population. (P2) The value of this index for each urban area was the population in millions of the urban area in 1961 as recorded in the 1961 Census.[11]

18. 1956 Population. (P1) The value of this index for each urban area was the population in millions of the urban area in 1956, as recorded in the

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[11] Dominion Bureau of Statistics (1962).

1961 Census.[12]

The final variable was an index of provincial location.

19. An index of Ontario-Quebec differences. (OQ) This was a dummy variable recognizing the fact that the urban system of Central Canada was divided into two politically distinct provinces. For an urban area in Ontario, it had a value of one. For an urban area in Quebec, it had a value of zero.

The means and standard deviations for the input variables are presented in Table 2.

TABLE 2: INPUT VARIABLES FOR DISCRIMINANT ANALYSIS

	Variable Name	Mean	Standard Deviation
1.	Economic function: Machinery (MA)	0.3662	0.1558
2.	Economic function: Mining (MI)	0.3134	0.2194
3.	Economic function: Service (SV)	0.5587	0.1889
4.	Economic function: Textiles (TX)	0.2572	0.1478
5.	Economic function: Paper and Chemicals (PC)	0.4475	0.1530
6.	Access to urban hierarchy (UH)	1.0880	0.5018
7.	Growth rate 1956-61 (GR)	0.2214	0.2871
8.	Growth rate stability (GS)	0.0016	0.4870
9.	Obsolescence (OB)	0.1719	0.8748
10.	Cultural-linguistic characteristics (CL)	0.0475	1.0109
11.	Metropolitan Status (MT)	0.0716	1.0521
12.	Commerciality (CM)	0.0232	0.9810
13.	Peripherality (PR)	0.0321	1.0277
14.	Educational occupational characteristics (EO)	0.0444	0.9223
15.	Growth characteristics (GC)	0.0424	1.0458
16.	Administration-defense industries (AD)	-0.0317	1.0309
17.	Population 1961 (P2)	0.1198	0.3488
18.	Population 1956 (P1)	0.1004	0.2882
19.	Ontario-Quebec differences (OQ)	0.6032	0.4932

Before proceeding to the results of the discriminant analysis, it is informative to examine a simple description of the input data. A matrix of correlation coefficients between the 19 input variables was produced. There were thirteen values of $r \geq \pm 0.50$, five of which were reflexive pairs, in

[12] Dominion Bureau of Statistics (1962).

which the correlation coefficient between two variables was the highest coefficient of both. These thirteen variables were grouped into four clusters, each with a core of reflexive pairs (see Figure 1). Within each cluster, the variables that were highly correlated, can be expected to be near substitutes in the discriminant function. For example Ontario-Quebec differences (OQ) represented essentially the same information as cultural-linguistic characteristics (CL). The same was true for Population 1956 (P1) and Population 1961 (P2). When the discriminant analysis program examined the F-to-enter of these highly correlated variables, it encountered essentially equal values, and its choice was almost an arbitrary one. However, as soon as one was chosen, the F-to-enter of the other dropped drastically, so that if both were chosen, this indicated a very strong effect in operation.

III RESULTS

The analysis presented some striking results, both in its failures and in its successes. Two criteria were selected for accepting the discriminant function chosen for each component of the migration stream. First, the F statistic for testing equality of group means over all included variables in both groups must have been significant at the .001 level. Second, the discriminant function must have correctly classified at least 80 percent of the urban areas in the sample. One function was rejected by the first criterion, and twelve were rejected by the second criterion. Table 3 shows the F values and percent misclassification for each component of the migration stream.

1. Overview

In looking at the overall performance of the input variables in discriminating between migration groups, some patterns may be seen. The input variables discriminated better for male migrants than for female, in that 10 functions for male components of the migration stream were acceptable while only 8 functions for female components were acceptable. The input

FIGURE 1: CLUSTERS OF CORRELATED INPUT VARIABLES
Numbers on lines are correlation coefficients.
All pairs of variables with r $\geq \pm$ 0.50 are shown.

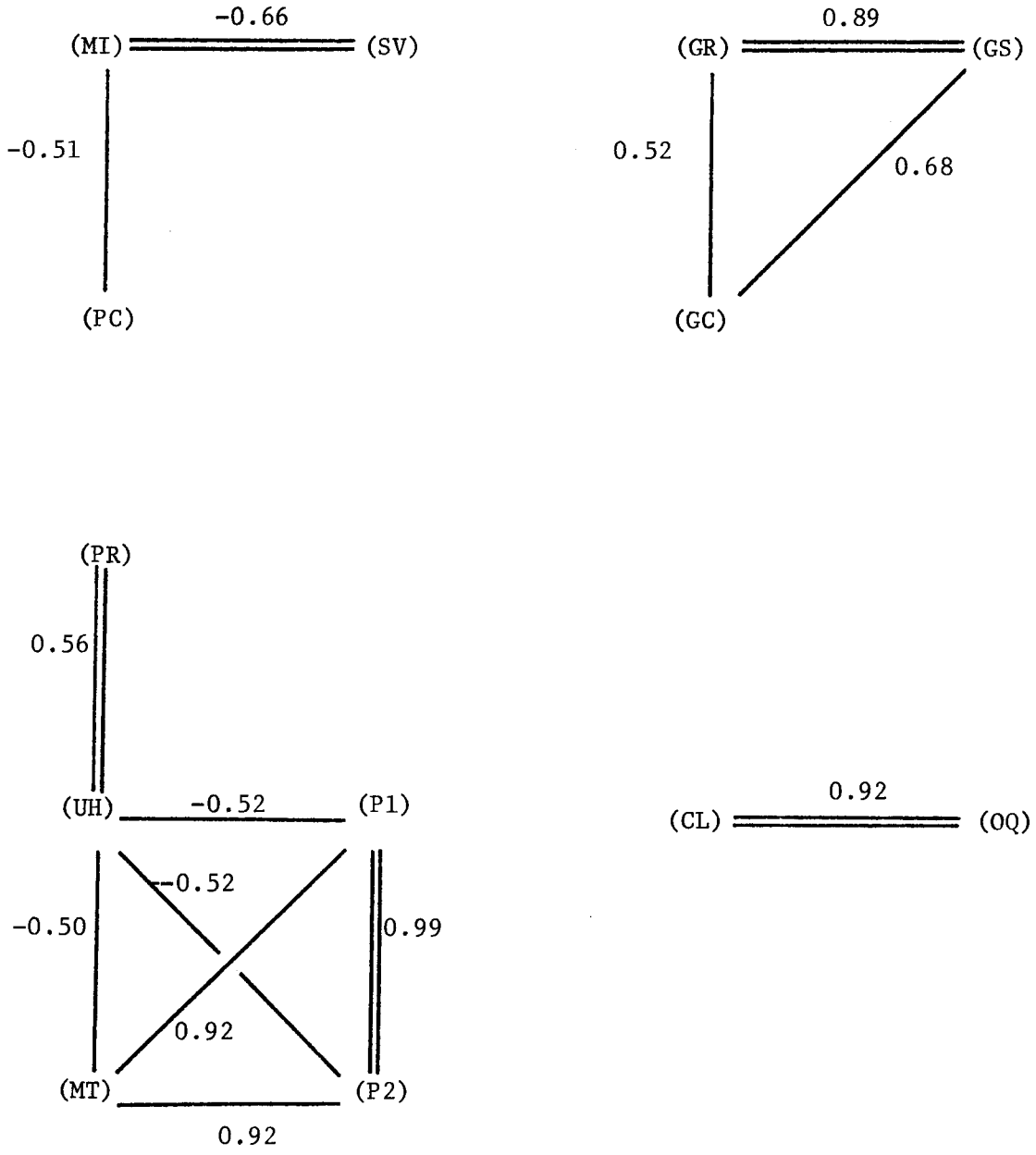

TABLE 3 : F VALUES AND PERCENT MISCLASSIFICATION FOR COMPONENTS OF THE MIGRATION STREAM

	F Value	Percent Misclassification		F Value	Percent Misclassification		F Value	Percent Misclassification
SP05M*	8.516 (2,60)	30.2	DP05M	11.571 (5,57)	15.9	FA05M	21.022 (4,58)	12.7
SP15M*	6.317 (1,61)	39.7	DP15M	15.856 (4,58)	11.1	FA15M	21.380 (4,58)	7.9
SP25M	9.184 (7,55)	12.7	DP25M	16.756 (7,55)	6.3	FA25M	24.581 (4,58)	11.1
SP45M	7.306 (4,58)	19.0	DP45M	7.844 (5,57)	19.0	FA45M	35.209 (2,60)	15.9
SP65M*	5.961 (6,56)	22.2	DP65M*	10.842 (3,59)	30.2	FA65M*	14.590 (3,59)	25.4
SP05F*	7.701 (3,59)	27.0	DP05F	10.885 (7,55)	7.9	FA05F	13.404 (4,58)	15.9
SP15F*	10.030 (2,60)	25.4	DP15F	13.093 (4,58)	14.3	FA15F	25.103 (3,59)	11.1
SP25F	8.343 (4,58)	19.0	DP25F	10.885 (7,55)	7.9	FA25F	23.198 (4,58)	12.7
SP45F*	6.317 (3,59)	23.8	DP45F*	13.894 (2,60)	25.4	FA45F	15.602 (3,59)	11.1
SP65F*	9.982 (3,59)	22.2	DP65F*	13.927 (2,60)	28.6	FA65F*	16.838 (2,60)	22.2
SPTOT*	8.215 (4,58)	23.8	DPTOT	10.885 (7,55)	7.9	FATOT	39.194 (3,59)	7.9
						IMTOT	12.050 (5,57)	14.3

*Rejected according to criteria discussed in text.

variables better explained the migration of the young and middle age groups than the very old. Four functions each were acceptable for the 5-14, 15-24, and 45-64 components of the migration stream. Six functions were acceptable for the 25-44 group and none for the 65 and over group. The input variables performed better in explaining the distribution of migrants who moved a long distance than migrants who moved a short distance. Eight functions were acceptable for migrants from abroad, seven for migrants from a different

province, and only three for migrants from the same province. In addition the functions for total migrants, total migrants from a different province, and total migrants from abroad were acceptable, while the function for total migrants from the same province was not.

Since the input data were characteristics of urban areas rather than of migrants, the results of the discriminant analysis did not in themselves indicate determinants of the behaviour of migrants. The variables chosen for the discriminant analysis showed what characteristics of urban areas had been associated with high and low in-migration rates. They did not directly prove that migrants preferred those urban areas, only that they moved to them. If the separation between groups was consistently large for a particular variable, then one may infer that perhaps the migrants preferred this characteristic, but this would be only an inference, not proven by the data. Since this research was empirical and based on variables several stages removed from raw data, any conclusions which may be drawn must necessarily be inferential and exploratory. When several variables were included in a discriminant function, this did not indicate that the characteristics associated with each of the variables must be present in order for an urban area to be included in the high migration group. The functions indicated that some weighted combination of the variables placed an urban area in one of the two groups. In an urban area had a low score on one variable, it could make up the difference with a high score on another variable. In fact, two included variables may be contradictory, indicating that a trade off must be considered between the two characteristics.

2. Discriminant Functions

The normalized discriminant function for male migrants from the same province aged 25-44 was

$$y' = 7.61UH + 6.58SV - 4.70PR + 1.870Q + 1.40PC - 1.12CL + 0.57GS$$

The means of these seven variables within each group are shown in Table 4.

TABLE 4: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from same province aged 25-44)

	Low Migration Group.	High Migration Group
Economic function: Service (SV)	0.509	0.645
Economic function: Paper and Chemicals (PC)	0.483	0.385
Access to urban hierarchy (UH)	1.015	1.215
Growth rate stability (GS)	-0.078	0.140
Cultural-linguistic characteristics (CL)	-0.214	0.501
Peripherality (PR)	0.028	0.040
Ontario-Quebec differences (OQ)	0.500	0.783
Number of urban areas in each group	40	23

The most important variable was UH, with the least accessible urban areas falling into the high migration group. This variable formed a reflexive pair ($r = 0.56$) with PR, which was third most important among the included variables, identifying a strong effect. The most peripheral urban areas fell into the high migration group. With respect to these two variables, it may be inferred that the aged 25-44, male residents of Ontario and Quebec were moving away from the central, metropolitan areas, and into the peripheral towns and villages. The second most important variable was SV, with high service employment associated with high in-migration rates. The fifth most important variable was PC with low employment in paper and chemicals associated with high in-migration rates. These two variables together suggest that urban areas which offered employment in the service industries received the aged 25-44 male migrants from Ontario and Quebec, and that a concentration of manufacturing industries may have served to repel these migrants. This reflects the well recognized shift from the manufacturing to the service industries.[13] The fourth most important variable was OQ, with Ontario urban areas falling into the high migration group. This variable formed a reflexive pair ($r = 0.92$) with CL, which was the sixth most important variable, identifying another strong effect. English speaking urban areas fell into the high migration group. With

[13] See Lithwick (1970).

respect to these two variables, one may infer that within their own province, the aged 25-44 male residents of Ontario were more mobile than were those of Quebec within their own province. The least important among the included variables was GS, and as would be expected, the urban areas with stable, high growth rates fell into the high migration group.

The normalized discriminant function for female migrants from the same province aged 25-44 was

$$y' = 2.91PC - 0.49GC + 0.16EO + 0.13CL$$

The means of these four variables within each group are shown in Table 5.

TABLE 5: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from same province aged 25-44)

	Low Migration Group	High Migration Group
Economic Function: Paper and Chemicals (PC)	0.478	0.395
Cultural-linguistic characteristics (CL)	-0.106	0.314
Educational-occupational characteristic (EO)	0.229	-0.276
Growth characteristics (GC)	-0.224	0.505
Number of urban areas in each group	40	23

The most important variable was PC with low employment in paper and chemicals associated with high in-migration rates. Second most important was GC with rapid growth associated with the high migration group. Third was EO with a high level of education and professional occupations associated with high in-migration rates. Fourth was CL, with English speaking areas falling into the high in-migration group. These results suggest that rapidly growing urban areas with a diversified urban base received the aged 25-44 female migrants and that the ontario residents of this group were more mobile than those in Quebec. In addition, urban areas with a high average level of educational attainment and with opportunities for professional employment received the 25-44 aged females.

The normalized discriminant function for male migrants from the same province aged 45-64 was

$$y' = 2.86PC + 0.24CL - 0.04GC + 0.020B$$

The means of these four variables within each group are shown in Table 6.

TABLE 6: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from same province aged 45-64

	Low Migration Group	High Migration Group
Economic function: Paper and Chemicals (PC)	0.469	0.418
Obsolescence (OB)	0.081	0.302
Cultural-linguistic characteristics (CL)	-0.169	0.355
Growth characteristics (GC)	-0.296	0.524
Number of urban areas in each group	37	26

The most important variable was PC, with low employment in paper and chemicals associated with high in-migration rates. Second most important was CL, with English speaking areas falling into the high migration groups. Third was GC, with rapid growth associated with high in-migration rates. Fourth, was OB with an aging population and structure associated with high in-migration rates. It appears that obsolescence may have had a positive attraction for 45-64 aged male residents, though the effect of this variable was very weak.

No other discriminant functions were acceptable with respect to their ability to classify migrants from the same province, nor was the function for total migrants from the same province acceptable. For the three functions which were accepted, three types of characteristics were common in each. First was the economic function of the urban areas. It appears that residents of Ontario and Quebec were attracted to urban areas with an urban economy based on services. Specialization manufacturing had a negative effect on migration. The second common characteristic was cultural, linguistic, and provincial. Residents of Ontario appeared to be more mobile than residents of

Quebec. The third common characteristic was growth. Growth tended to reinforce itself by attracting more migrants. In addition to these three common characteristics, the peripheral, smaller towns received the aged 25-44 male residents. The urban areas with high educational attainment and opportunities for professional employment received the aged 25-44 female residents. The urban areas with an aging population and an old physical stock received the aged 45-64 male residents.

As we look to the discriminant functions for the other origin groups, we find that the functions for many more age groups were acceptable. Since it was unlikely that the members of the 5-14 age groups were making decisions concerning their migration behaviour, the variables included in these functions should be viewed as those characteristics determining the migration decisions of families with children. The members of the 5-14 age group could have been the children of the members of either the 15-24, 25-44, or 45-64 age groups. If the members of these age groups were primarily members of families, then the discriminant functions would be essentially the same for all four groups, assuming that the families moved together. Unfortunately, it was impossible to determine directly whether this was true, since marital status and family size were not included in the migration data set. However, the extent to which the discriminant functions were similar over age groups gave some idea as to whether people moved together as families or singly as individuals.

The normalized discriminant function for male migrants from a different province aged 5-14 was

$$y' = 7.90SV - 4.83OB - 2.95CM + 2.11MA - 1.55CL$$

The means of these five variables within each group are shown in Table 7.

TABLE 7: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from different province aged 5-14)

	Low Migration Group	High Migration Group
Economic function: Machinery (MA)	0.399	0.317
Economic function: Service (SV)	0.496	0.654
Obsolescence (OB)	0.244	0.063
Cultural-linguistic characteristics (CL)	-0.162	0.366
Commerciality (CM)	0.138	-0.152
Number of urban areas in each group	38	25

The most important variable was SV, with high service employment associated with high in-migration rates. Second most important was OB, with dynamic, young urban areas falling into the high migration group. Third was CM, with a low level of trade and commerce associated with high in-migration rates. Fourth was MA, with a low level of machinery employment associated with high in-migration rates. Fifth was CL, with English speaking areas associated with high in-migration rates. It appears that dynamic, young urban areas with high employment in services in Ontario received the families with male children moving from a different province. Urban areas with a specialized urban base in machinery and trade and commerce were associated with low migration rates in this group.

The normalized discriminant function for female migrants from a different province aged 5-14 was

$$y' = 6.76UH + 6.19MA + 4.15P2 - 3.78AD - 1.48CL + 0.87GC - 0.83GS$$

The means of these seven variables within each group are shown in Table 8. The most important variable was UH, with the less accessible urban areas falling into the high migration group. This variable was associated with P2 ($r = -0.52$) which was third most important among the included variables, identifying a very strong effect. The large urban areas fell into the high

TABLE 8: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from different province aged 5-14)

	Low Migration Group	High Migration Group
Economic function: Machinery (MA)	0.405	0.299
Access to urban hierarchy (UH)	1.036	1.178
Growth rate stability (GS)	-0.104	0.186
Cultural-linguistic characteristics (CL)	-0.156	0.401
Growth characteristics (GC)	-0.176	0.423
Administration-defense industries (AD)	0.282	-0.577
1961 population (P2)	0.061	0.222
Number of urban areas in each group	40	23

migration group. The second most important variable was MA, with low employment in machinery associated with high migration rates. In contrast to this was the fourth most important variable AD, with high employment in administration and defense associated with high in-migration rates. Families in this group were moving to the armed service bases and the public administration cities. Fifth most important was CL, with English speaking areas associated with high in-migration rates. Sixth was GC and seventh was GS ($r = 0.68$), with high, stable growth rates associated with high in-migration rates. There appears to be a trade off with respect to the size and location of the destination of urban areas for families with female children moving from a different province. These families were likely to be moving from a rural area or a small to medium sized city since metropolitan areas like Montreal and Toronto did not exist in Canada outside Ontario and Quebec. They may have lacked the social skills and/or the inclination to attempt to survive in the metropolis, but they had to rely on the larger cities for employment opportunities. Apparently the desire to be away from the metropolitan areas dominated the necessity for proximity to employment, since the coefficient of the urban hierarchy variable was larger than the coefficient of the population size variable.

The normalized discriminant function for male migrants from a different province aged 15-24 was

$$y' = 3.65MA - 1.99AD - 1.32CL - 0.15GC$$

The means of these four variables within each group are shown in Table 9.

The most important variable was MA with low employment in machinery associated with high in-migration rates. Second most important was AD, with high employment in administration and defense associated with high in-migration rates. Third was CL with English speaking areas associated with high in-migration rates. Fourth was GC with rapid growth associated with high in-migration rates.

The normalized discriminant function for female migrants from a different province aged 15-24 was

$$y' = 1.950Q - 1.44AD + 0.99PR + 0.88GS$$

The means for these four variables within each group are shown in Table 10.

The most important variable was OQ, with Ontario urban areas falling into the high migration group. Second most important was AD, with high employment in administration and defense associated with high in-migration rates. Third was PR, with the more peripheral urban areas falling into the high migration group. Fourth was GS, with stable, high growth rates associated with high in-migration rates. In this function OQ replaced the CL variable ($r = 0.92$) of the previous function, representing essentially the same information.

TABLE 9: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from different province aged 15-24)

	Low Migration Group	High Migration Group
Economic function: Machinery (MA)	0.403	0.302
Cultural-linguistic characteristics (CL)	-0.207	0.490
Growth characteristics (GC)	-0.131	0.344
Administration-defense industries (AD)	0.339	-0.677
Number of urban areas in each group	40	23

TABLE 10: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from different province aged 15-24)

	Low Migration Group	High Migration Group
Growth rate stability (GS)	-0.090	0.185
Peripherality (PR)	-0.182	0.460
Administration-defense industries (AD)	0.318	-0.731
Ontario-Quebec differences (OQ)	0.500	0.810
Number of urban areas in each group	42	21

The normalized discriminant function for male migrants from a different province aged 25-44 was

$$y' = 5.14UH + 3.57MA + 2.71P1 + 2.05TX + 1.68PC - 0.92GC - 0.45CL$$

The means of these seven variables within each group are shown in Table 11.

TABLE 11: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from different province aged 25-44)

	Low Migration Group	High Migration Group
Economic function: Machinery (MA)	0.412	0.286
Economic function: Textiles (TX)	0.304	0.175
Economic function: Paper and Chemicals (PC)	0.490	0.373
Access to urban hierarchy (UH)	1.013	1.218
Cultural-linguistic characteristics (CL)	-0.176	0.436
Growth characteristics (GC)	-0.135	0.350
1956 population (P1)	0.052	0.185
Number of urban areas in each group	40	23

The most important variable was UH, with the less accessible urban areas falling into the high migration group. This variable was associated with P1 ($r = -0.52$) which was third most important among the included variables, identifying a very strong effect. The large urban areas fell into the high migration group. The second most important variable was MA, with low employment in machinery associated with high in-migration rates. Fourth most important was TX, with low employment in textiles associated with high in-migration rates. Fifth was PC, with low employment in paper and chemicals associated with high in-migration rates. These three variables indicate that migrants in this group preferred urban areas with a diversified economic base. Specialization in either machinery, textiles, or paper and chemicals had a detrimental effect on migration. Sixth most important was GC, with rapid growth associated with high in-migration rates. Seventh was CL, with English

speaking areas associated with high in-migration rates.

The normalized discriminant function for female migrants from a different province aged 25-44 was

$$y' = 6.76UH + 6.19MA + 4.15P2 - 3.78AD - 1.48CL + 0.87GC - 0.83GS$$

The means of these seven variables within each group are shown in Table 12.

TABLE 12: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from different province aged 25-44)

	Low Migration Group	High Migration Group
Economic function: Machinery (MA)	0.405	0.299
Access to urban hierarchy (UH)	1.036	1.178
Growth rate stability (GS)	-0.104	0.186
Cultural-linguistic characteristics (CL)	-0.156	0.401
Growth characteristics (GC)	-0.176	0.423
Administration-defense industries (AD)	0.282	-0.577
1961 population (P2)	0.061	0.222
Number of urban areas in each group	40	23

The coefficients and within group means for aged 25-44 females from a different province were exactly the same as for aged 5-14 females from a different province. One may infer from this that the 25-44 females were the mothers of the 5-14 females, and that they moved together as a family. It is also likely that part of the 5-14 and 25-44 males were involved in this family movement, since the included variables and the direction of their effect for those two groups were similar, but there apparently were a sufficient number of single males in both groups to cause some difference in the functions.

The normalized discriminant function for male migrants from a different province aged 45-64 was

$$y' = 3.48MA - 2.13AD - 1.14CL + 0.51P2 + 0.31GS$$

The means for these five variables are shown in Table 13.

TABLE 13: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from different province aged 45-64)

	Low Migration Group	High Migration Group
Economic function: Machinery (MA)	0.390	0.322
Growth rate stability (GS)	-0.083	0.160
Cultural-linguistic characteristics (CL)	-0.171	0.454
Administration-defense industries (AD)	0.230	-0.520
1961 population (P2)	0.062	0.227
Number of urban areas in each group	41	22

The most important variable was MA, with low employment in machinery associated with high in-migration rates. Second most important was AD, with high employment in administration and defense associated with high in-migration rates. Third was CL with English speaking areas associated with high in-migration rates. Fourth was P2, with the large urban areas falling in the high-migration group. Fifth was GS, with stable, high growth rates associated with high in-migration rates.

The normalized discriminant functions for total migrants from a different province was

$$y' = 6.76UH + 6.19MA + 4.15P2 - 3.78AD - 1.48CL + 0.87GC - 0.83GS$$

The means for these seven variables within each group are shown in Table 14.

TABLE 14: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Total migrants from a different province)

	Low Migration Group	High Migration Group
Economic function: Machinery (MA)	0.405	0.299
Access to the urban hierarchy (UH)	1.036	1.178
Growth rate stability (GS)	-0.104	0.186
Cultural-linguistic characteristics (CL)	-0.156	0.401
Growth characteristics (GC)	-0.176	0.423
Administration-defense industries (AD)	0.282	-0.577
Population 1961 (P2)	0.612	0.222
Number of urban areas in each group	40	23

The coefficients and within group means for total migrants from a different province were exactly the same as those for aged 5-14 and aged 25-44 females from a different province. This argues even more strongly that migration from a different province was family migration. The female migrants more accurately reflected or perhaps dominated the overall trend of people moving long distances from within Canada to Ontario and Quebec. Recall from the discussion of the 5-14 aged females that this trend was both toward the large urban areas and toward the peripheral urban areas. It was toward service, administration, and defense centres, but not toward manufacturing centres. And it was toward rapidly growing, English speaking urban areas. Similar variables were found, with different emphasis, throughout the other components of the migration stream moving from a different province.

Looking now at the functions for migrants from abroad, we find some striking contrast to the previous results. The number of included variables was much smaller than with the other migration groups, and they were almost monotonously consistent.

The normalized discriminant functions for male migrants from abroad aged 5-14 was

$$y' = 1.84CL + 0.68MT - 0.50AD - 0.49PR$$

The means for these four variables within each group are shown in Table 15.

TABLE 15: MEANS OF VARIABLES IN MIGRATION FUNCTION
(Male migrants from abroad aged 5-14)

	Low Migration Group	High Migration Group
Cultural-linguistic characteristics (CL)	-0.605	0.765
Metropolitan Status (MT)	-0.146	0.311
Peripherality (PR)	0.265	-0.225
Administration-defense industries (AD)	0.123	-0.202
Number of urban areas in each group	33	30

The most important variable was CL, with English speaking areas associated with high in-migration rates. The second most important variable was MT, with the large metropolitan areas falling into the high migration group. Third most important was AD, with high employment in administration and defense associated with high in-migration rates. Fourth was PR with the central (non-peripheral) urban areas falling into the high migration group. It appears the larger, central, English speaking metropolitan areas, with opportunities for employment in service, administration, and defense received the families with male children moving from abroad.

The normalized discriminant function for female migrants from abroad aged 5-14 was

$$y' = 3.200Q + 1.20P2 - 0.73CM - 0.64PR$$

The means for these four variables within each group are shown in Table 16.

TABLE 16: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from abroad aged 5-14)

	Low Migration Group	High Migration Group
Commerciality (CM)	0.180	-0.150
Peripherality (PR)	0.280	-0.241
1961 Population (P2)	0.043	0.204
Ontario-Quebec differences (OQ)	0.333	0.900
Number of urban areas in each group	33	30

The most important variable was OQ with Ontario urban areas falling into the high migration group. The second most important variable was P2, with the urban areas with large population falling into the high migration group. Third most important was CM, with low employment in trade and commerce associated with high in-migration rates. Fourth was PT, with the central urban areas falling into the high migration group. In this function OQ replaces

the CL variable (r = 0.92) of the previous function, representing essentially the same information. P2 replaces MT (r = 0.92) again with similar information. The appearance of CM in this function does suggest that commercial centres receive few families with female children moving from abroad.

The normalized discriminant function for male migrants from abroad aged 15-24 was

$$y' = 1.74CL + 0.80MT - 0.58PR - 0.53CM$$

The means for these four variables within each group are shown in Table 17.

TABLE 17: MEANS OF VARIABLES IN MIGRATION FUNCTION
(Male migrants from abroad aged 15-24)

	Low Migration Group	High Migration Group
Cultural-linguistic characteristics (CL)	-0.568	0.725
Metropolitan Status (MT)	-0.206	0.377
Commerciality (CM)	0.211	-0.183
Peripherality (PR)	0.288	-0.249
Number of urban areas in each group	33	30

The most important variable was CL, with English speaking areas associated with high in-migration rates. The second most important variable was MT with the large metropolitan areas falling into the high migration group. Third most important was PR, with the central cities falling into the high migration group. Fourth was CM, with low employment in trade and commerce associated with high in-migration rates.

The normalized discriminant function for female migrants from abroad aged 15-24 was

$$y' = 1.79CL + 0.96MT - 0.67CM$$

The means of these three variables within each group are shown in Table 18.

TABLE 18: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from abroad aged 15-24)

	Low Migration Group	High Migration Group
Cultural-linguistic characteristics (CL)	-0.475	0.791
Metropolitan Status (MT)	-0.211	0.474
Commerciality (CM)	0.227	-0.267
Number of urban areas in each group	37	26

The most important variable was CL, with English speaking areas associated with high in-migration rates. Second most important was MT, with the large metropolitan areas falling into the high migration group. Third was CM, with low employment in trade and commerce associated with high in-migration rates.

The normalized discriminant function for male migrants from abroad aged 25-44 was

$$y' = 2.09CL + 0.83MT - 0.72AD - 0.57PR$$

The means of these four variables within each group are shown in Table 19.

TABLE 19: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from abroad aged 25-44)

	Low Migration Group	High Migration Group
Cultural-linguistic characteristics (CL)	-0.587	0.791
Metropolitan Status (MT)	-0.159	0.342
Peripherality (PR)	0.265	-0.241
Administration-defense industries (AD)	0.165	-0.263
Number of urban areas in each group	34	29

The most important variable was CL, with English speaking areas associated with high in-migration rates. The second most important variable was MT, with the large metropolitan areas falling into the high migration

group. Third most important was AD, with high employment in administration and defense associated with high in-migration rates. Fourth was PR with the central cities falling into the high migration group.

The normalized discriminant function for female migrants from abroad ages 25-44 was

$$y' = 1.95CL - 0.86MT + 0.67GC - 0.49AD$$

The means for these four variables within each group are shown in Table 20.

TABLE 20: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from abroad aged 25-44)

	Low Migration Group	High Migration Group
Cultural-linguistic characteristics (CL)	-0.623	0.740
Metropolitan Status (MT)	-0.199	0.351
Growth characteristics (GC)	-0.169	0.261
Administration-defense industries (AD)	0.103	-0.171
Number of urban areas in each group	32	31

The most important variable was CL, with English speaking areas associated with high in-migration rates. The second most important variable was MT, with the large metropolitan urban areas falling into the high migration group. Third most important was GC with rapid growth associated with high in-migration rates. Fourth was AD with high employment in administration and defense associated with high in-migration rates. This is the only function for migrants from abroad in which a growth variable occurs. It suggests that rapidly growing centres will receive relatively large numbers of aged 25-44 women from abroad.

The normalized discriminant function for male migrants from abroad aged 45-64 was

$$y' = 1.65CL + 0.70MT$$

The means for these two variables within each group are shown in Table 21.

TABLE 21: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Male migrants from abroad aged 45-64)

	Low Migration Group	High Migration Group
Cultural-linguistic characteristics (CL)	-0.605	0.766
Metropolitan Status (MT)	-0.187	0.356
Number of urban areas in each group		

The most important variable was CL, with English speaking areas associated with high in-migration rates. Second most important was MT, with the large metropolitan areas falling in the high migration group.

The normalized discriminant function for female migrants from abroad aged 45-64 was

$$y' = 1.93UH + 0.60CL + 0.09CM$$

The means of these three variables within each group are shown in Table 22.

TABLE 22: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Female migrants from abroad aged 45-64)

	Low Migration Group	High Migration Group
Access to urban hierarchy (UH)	1.233	0.907
Cultural-linguistic characteristics (CL)	-0.453	0.673
Commerciality (CM)	0.168	-0.158
Number of urban areas in each group	35	28

The most important variable was UH, with the most accessible, metropolitan centres falling into the high migration group. In this function UH replaces both MT ($r = -0.50$) and P2 ($r = .0.52$), which appeared in the previous functions for migrants from abroad, representing essentially the same information. Second most important was CL, with English language and culture associated with high in-migration rates. Third was CM with low employment in trade and commerce associated with high in-migration rates.

The normalized discriminant function for total migrants from abroad was

$$y' = 2.33CL + 0.81MT - 0.45PR$$

The means for these three variables within each group are shown in Table 23.

TABLE 23: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Total migrants from abroad)

	Low Migration Group	High Migration Group
Cultural-linguistic characteristics (CL)	-0.728	0.799
Metropolitan Status (MT)	-0.177	0.312
Peripherality (PR)	0.238	-0.168
Number of urban areas in each group	31	32

The most important variable was CL, with English speaking areas associated with high in-migration rates. Second most important was MT, with the large metropolitan areas falling into the high migration group. Third was PR with the central cities falling into the high migration group. With regard to total migration from abroad, the growth and economic function variables drop out, with only the cultural, locational and city size variables appearing.

Looking over the set of functions for migrants from abroad, we find a very consistent group of variables included. All functions contained a variable relating to provincial location, culture, and language, either CL or OQ. In most of the functions, one of these two variables occupied the dominant position in order of importance. One may infer from these variables that migrants from abroad preferred the English speaking areas in Ontario to the French speaking areas in Quebec. All functions also contained a variable relating to population size, either MT, P2, or UH. In most of the functions one of these three variables occupied the secondary position in order of importance. One may infer from these variables that, in contrast to domestic migrants, migrants from abroad preferred the large metropolitan centres. Most

of the functions contained a variable relating to location, either PR or UH. It may be inferred from these variables that, also in contrast to domestic migrants, migrants from abroad preferred the easily accesible, central cities. Finally, most of the functions also contained a variable relating to economic function, either CM or AD. These variables indicated a possible preference for employment in service industries.

The normalized discriminant function for total in-migrants was

$$y' = 3.79PC - 2.17AD - 0.45GC + 0.40CL + 0.28EO$$

The means of these five variables within groups are shown in Table 24.

TABLE 24: MEANS OF VARIABLES IN DISCRIMINANT FUNCTION
(Total in-migrants)

	Low Migration Group	High Migration Group
Economic function: Paper and Chemicals (PC)	0.484	0.388
Cultural-linguistic characteristics (CL)	-0.223	0.488
Educational-occupational structure (EO)	0.204	-0.215
Growth characteristics (GC)	-0.242	0.504
Administration and defense industries (AD)	0.276	-0.531
Number of Urban areas in each group	39	24

The most important variable was PC, with low employment in paper and chemicals associated with high in-migration rates. The second most important variable was AD, with high employment in administration and defense industries associated with high in-migration rates. Third most important was GC with rapid growth associated with high in-migration rates. Fourth was CL, with English speaking areas associated with high in-migration rates. Fifth was EO, with a high level of educational attainment and professional employment associated with high in-migration rates. The two most important variables served to emphasize the importance of a diversified economic base with an emphasis on services and with manufacturing de-emphasized. The other general characteristics of urban areas receiving in-migrants, regardless of age, sex, or origin were those

of rapidly growing, highly educated, English speaking urban areas. The marked lack of locational and city size variables in this function suggests that these characteristics may be more related to the migration of persons of particular origins rather than to the total level of migration.

IV CONCLUSIONS

The variables relating to location and city size (UH, PR, MT, P1, P2) have been included in the functions for in-migrants from each of the three origin groups, but with different effect in each. Unlike migrants from within Canada, migrants from abroad appeared to have been attracted to the large central metropolitan areas. Inferring from the above results one may hypothesize a filtering mechanism of sorts operating with regard to the locational decisions of in-migrants. Migrants from abroad, when moving to the Central Canada urban system, gravitated toward the central cities with their international, cosmopolitan character, and their high employment opportunities. Here the international migrant found his fellow countrymen preserving the culture of the homeland, and his transition to Canadian society was made gradual, minimizing the effects of culture shock.

Migrants from a different province, moving fairly long distances within Canada, perhaps even the migrants from abroad of an earlier period, appeared to prefer both the large urban areas and the peripheral urban areas. They were forced to make a trade-off between these two preferences, so that urban areas of both types were included in the high migration groups. Migrants from the same province, moving short distances within the urban system, perhaps the migrants from abroad or from a different province of an earlier period, preferred the remote peripheral, small towns and villages, away from the centres of economic and cultural activity. Thus the distribution of migration within the urban system of Central Canada can be seen to have been directly related to the origins of the in-migrants. The longer the distance the migrants had to

travel, and the greater the cultural difference between their origin and their destination, the more they tended to gravitate toward the larger metropolitan centres and their satellites along the urban corridor. Of the two provincial, language, and cultural regions within the Central Canada urban system, in-migrants seemed to prefer Ontario.

With regard to the economic function of the destination urban areas, a preference may be seen over all components of the migration stream. Diversity of economic function was the key to attracting migrants. The only type of specialization for which the migrants indicated a preference was specialization in services. Specialization in manufacturing of any sort proved to have had a negative effect on in-migration.

When attempting to forecast the future growth of urban areas in the Central Canada urban system, in order to more accurately estimate the total in-migration component of growth, one should consider the following characteristics; the economic function, the provincial location, the past growth rates, and the level of educational attainment of the particular urban area. In attempting to estimate the origins, and age and sex breakdown of the migration stream, one should also consider the existing population size of the urban area and its location relative to the major concentrations of population along the urban corridor of the St. Lawrence River.

BIBLIOGRAPHY

Barber, G. Growth Determinants in the Central Canada Urban System, University of Toronto, Centre for Urban and Community Studies, Special Report No. 4, (1971).

Barber, G. and Britton, J.N.H. Occupational Structure of Population Growth in the Ontario-Quebec Urban System 1941-1966, University of Toronto, Centre for Urban and Community Studies, Research Report No. 49 (1971).

Bourne, L.S. Towards Urban Canada 2000: Growth Trends in Central Canada, University of Toronto, Centre for Urban and Community Studies, Special Report No. 5, (1971).

Bourne, L.S. and Maher, C.A. Comparative Extrapolations of City-Size Distributions: The Ontario-Quebec Urban System, University of Toronto, Centre for Urban and Community Studies, Research Report No. 27, (1970).

Bourne, L.S., Harper, P.D. and Thackray, D. Population Projections for Ontario and Quebec Cities 1971-2001, Appendix, September 1972.

Britton, J.N.H. An Occupational Grouping of Ontario-Quebec Cities, University of Toronto, Centre for Urban and Community Studies, Research Report No. 42 (1971).

Bunting, T. and Baker, A.M. Structural Characteristics of the Ontario-Quebec Urban System, University of Toronto, Centre for Urban and Community Studies, Research Report No. 3 (1968).

Davies, J.B. and Bourne, L.S. Behaviour of the Ontario-Quebec Urban System: City Size Regularities, University of Toronto, Centre for Urban and Community Studies, Research Report No. 2 (1968).

Dominion Bureau of Statistics, 1961 Census of Canada, Bulletin 1.1-6, "Population Incorporated Cities, Towns and Villages", Ottawa, Queen's Printer, (1962).

Dominion Bureau of Statistics, 1961 Census of Canada, Bulletin SX-15, "Population Sample, Characteristics of Migrant and Non-Migrant Population, Metropolitan Areas", Ottawa, Qu-en's Printer (1969).

Dominion Bureau of Statistics, Revised Analytical Tabulation Programme for the 1961 Census Data on Population Movement, Table 6, "Population 5 Years and Over by broad age group, sex, and type of movement for the major urban areas, the urbanized areas of 10,000 and over, and the incorporated and unincorporated municipalities of 10,000 and over", Ottawa, (1963).

Golant, S. and Bourne, L.S. Growth Characteristics of the Ontario-Quebec Urban System, University of Toronto, Centre for Urban and Community Studies, Research Report No. 4 (1968).

Hill, F.I. Migration in the Toronto-Centred Region, University of Toronto, Centre for Urban and Community Studies, Research Report No. 48, (1971).

Hodge, G. Comparisons of Structure and Growth of Urban Areas in Canada and the U.S.A., University of Toronto, Centre for Urban and Community Studies, Research Report No. 9 (1969).

Lithwick, N.H. Urban Canada: Problems and Prospects, Ottawa, Central Mortgage and Housing Corporation, (1970).

Lord, I.J. and Miron, J.R. Modelling the Impact of Proposed Transportation Networks on the Toronto-Centred Region, University of Toronto, Centre for Urban and Community Studies, Research Paper No. 45, (1971).

Lowry, Ira S. Migration and Metropolitan Growth: Two Analytical Models, San Francisco: Chandler Publishing Co., 1966.

Siegel, J. An Empirical Study of the Urban Hierarchy and Its Relation to Growth in Southern Ontario, University of Toronto, Research Paper No. 46 (1961).

Siegel, J., and Woodyard, M. Urban Growth and Its Relation to the Urban Hierarchy in Central Canada, University of Toronto, Centre for Urban and Community Studies, Research Paper No. 52, (1971).

Simmons, J.W. Interprovincial Interaction Patterns in Canada, University of Toronto, Centre for Urban and Community Studies, Research Paper No. 24, (1970a).

Simmons, J.W. Patterns of Interaction Within Ontario and Quebec, University of Toronto, Centre for Urban and Community Studies, Research Paper No. 41 (1971b).

Simmons, J.W. Net Migration Within Metropolitan Toronto, University of Toronto, Centre for Urban and Community Studies, Research Paper No. 44 (1971).

Simmons, J.W. and Baker, A.M. Household Movement Patterns, University of Toronto, Centre for Urban and Community Studies, Research Paper No. 54 (1972).