Migration Through the Rural-Urban Hierarchy: Canadian Patterns

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Introduction

Extensive as the literature on migration has become, substantial gaps have remained in our knowledge of the spatial dimensions of the process. In the analysis of flow patterns, primary attention has been given to the broader interregional movement of population between provinces or other major areal units. Data constraints have impeded the measurement of migration transfers between the rural and urban sectors or any comprehensive investigation of the population exchanges of towns and cities in the middle and lower orders of the urban hierarchy, including the impact of the migration process on the growth dynamics and demographic structure of these centres. A general trend towards demetropolitanization in North America in the 1960s and 1970s received widespread attention in the literature, but the types of data available were not adequate to trace, in any precise fashion, the spatial pattern of dispersion or to pinpoint the levels of the rural-urban system that were gaining from this outflow. In Canada, many of these gaps in our knowledge can now be filled. Improvements in the data base have opened the way for the analysis of the migration process at a scale that is still beyond the reach of researchers in most other countries.

The present study involves an investigation of migration linkages between the various levels of the Canadian rural-urban hierarchy during the 5-year intercensal period 1971-76, employing a unique data set from the 1976 Census. In addition to providing fresh insight into some of the basic features of the migration process, it is hoped that it will serve as an initial frame of reference for comparative studies of subsequent time periods.

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Progressive innovations have been made over the past two decades in the release of Canadian census migration data on magnetic tape at finer levels of areal disaggregation. Research opportunities have expanded greatly in response to these developments. For the last several censuses, tapes have been produced detailing changes in place of residence over the preceding 5-year periods between the 265 census divisions (counties and equivalent units) of the nation.[1] Information has also been available, in the published census reports as well as on tape, on the migration exchanges between the census-defined metropolitan areas (CMAs). For the 1981 Census, this matrix was expanded in the User Summary Tape series to include the set of eighty-eight CAs (urban census agglomerations consisting of more than one municipality) as well as the twenty-four 1981 CMAs. It was only for the 1976 Census, however, that the migration data were eventually disaggregated on tape into movements between the system of approximately 5500 census subdivisions that represent individual municipalities and equivalent-type areas. It is this special compilation of census subdivision migration data that has been used in the present study.

The objective in this study has been to produce, for the first time, a comprehensive inventory and analysis of the transfer of Canada's population between the rural and urban sectors and of the pattern of population exchange between the various levels of the urban hierarchy. The hierarchical exchanges have been investigated both for Canada's rural-urban system in the aggregate and for the regional subsystems operating within each of the five major geographic divisions of the nation: the Atlantic Region, Quebec, Ontario, the Prairies, and British Columbia. Differences in the pattern of movement through the hierarchy have also been explored for age-specific groups of the population, including young adults, the middle-aged, and the elderly.

The first stage in the analysis has been to determine the overall net gain or loss for each level of the hierarchy for total migrants, as well as individual age groups, and the extent to which regional subsystems conform to the national pattern. The internal structure of the individual matrices of net exchange has then been assessed by converting each one into a dominance matrix. Particular attention has been given to the geographic pattern of the gains that were recorded by the rural sector. Migration rates per unit of population for inflows, outflows, and net balances are used to evaluate the impact of migration on the relative growth and age structure of towns in each level of the hierarchy and the stability of their resident population. Considerable insight into the comparative role of push versus pull factors in the net migration patterns is provided by these rates. Other components of

[1] J. Simmons (1978) has used the census division migration data to produce flow matrices for a system of urban-centred regions.

the analysis consider the contribution of interregional versus intraregional transfers in the system of hierarchical movements and the relative strength of the migration ties that bind together different levels of the hierarchy. Little more than an overview of the research findings can be incorporated in this paper. Major components that are referred to only tangentially include the mapping and evaluation of the geographic pattern of gains and losses by the rural sector and the patterns of variance between individual centres within each urban population size group. The paper also focuses on domestic migration exchanges and excludes all but a brief concluding reference to the international migration component and how it relates to the domestic patterns.

The Data Base

It is appropriate to begin with a short commentary on the data base and on the conceptual issues relating to the migration systems that are to be analysed.

The 1976 Census migration tabulations encompass changes in place of residence over the 5-year period 1971-76 for population age 5 years and over in the terminal year. The 1971 place of residence, or origin of the migrants, was recorded at the level of the individual municipality. The data were collected on the basis of a one-third sampling of the nation's households and subsequently weighted to provide estimates of movement for the total population. On the tapes used in this study, final digits were rounded to multiples of three to ensure confidentiality of information relating to any identifiable individual. Sampling, random rounding, and other types of error reduce the reliability of the data for individual small towns or rural municipalities, even more so when the figures are disaggregated by age or when total in- and outmigrants are broken down into origin-destination linkages with other individual municipalities. The more aggregative the measures employed, the more reliable will be the results of the analysis.

Viewed as a flow matrix, a system of over 5,500 areal units allows for approximately 30 million origin-destination linkages in terms of unidirectional movements between pairs of census subdivisions. Actual population transfers between 1971 and 1976 were recorded for just over 200,000, or about 1 percent, of these potential spatial linkages. Each of these municipality origin-destination links over which migration was actually recorded is represented by a single record on the computer tape, with the total migrants age 5 years and over broken down into ten age groups, and by sex. The task is to aggregate data in the form of flow matrices and other types of tabulations employing a system of spatial or structural units appropriate to the process being investigated—in this case, population exchange between levels of the

rural-urban hierarchy, both nationally and for individual geographic divisions.[2]

In order to derive rates of in-, out-, and net migration per unit of population and to assess the impact of migration on demographic structure, other census files in the Summary Tape series were used to produce parallel aggregations, or counts, of the base population for the same set of rural-urban categories, regional divisions, and age groupings used in the tabulation of migrants.[3]

Definition of the Rural-Urban Hierarchy and Migration Systems

The migration systems analysed in this study pertain to internal or domestic migration and exclude the external or international population movement. Also excluded are all changes in place of residence within the same municipality, whether it be an urban or a rural one, as well as movements between municipalities that are defined in the census as belonging to the same CMA or CA. Migration flows for municipalities belonging to either a CMA or CA have been assigned to the urban size category of the larger agglomeration into which they fit.[4] Also excluded are migrants who failed to state their municipality of residence in 1971. In the 1976 Census approximately 10.3 million persons, or half of Canada's population age 5 years and over, were

[2]The data are available in the form of two special tapes that were not part of the regular Census Summary Tape series: an Inmigration tape, entitled RES7671.INMIG, in which all of the records are grouped for each destination (1976 Place of Residence) and arranged sequentially by municipality of origin (1971 Place of Residence), and an Outmigration tape, entitled RES7176.OUTMIG, in which the grouping is based on the 1971 place of residence. The flow matrices compiled in this study were derived from data on the Inmigration tape. Inmigrants to each municipality who did not report their 1971 place of residence in terms of a specific municipality have been excluded from the tabulations produced in this study. In total, they accounted for about 6 percent of the respondents who indicated that they had resided in a different municipality in 1971. Some of these moves involving unstated origins would have been between municipalities within the same CMA or CA and would fall into the intraurban category. The special INMIG and OUTMIG tapes do not include records for moves that took place within individual census subdivisions or for inmigrants from abroad. Data for these two components were compiled from 1976 Census Summary Tape SDDEMB20.

[3]1976 Census Summary Tape SDDEMA10.

[4]The 23 CMAs collectively encompassed 350 census subdivisions and the 87 CAs an additional 267. Aggregating data for municipalities belonging to CAs was a more cumbersome programming task than for the CMAs because CA municipalities were not identified by a special code on the census tapes. Some 400,000 origin and destination municipality codes on the migration tape had to be checked individually against an array of the 267 CA municipality codes and, where a match was found, data assigned to the appropriate CA size class.

reported to have changed place of residence over the preceding 5 years. Only 3.3 million entered into the migration systems being considered in this study. The overwhelming majority of those excluded were intraurban movers.[5]

CMAs and CAs, as defined in the census, include adjacent rural municipalities that are undergoing appreciable urban sprawl or that contain a substantial number of commuters who work in the urbanized core. Out-movements into these areas may be directed to suburban-type housing subdivisions or to more rural-type settings. Some of these moves into relatively open country are essentially similar to the outward dispersion of extra long-distance commuters to rural areas beyond the defined boundaries of the CMAs. The net gain of the rural sector would be even greater than the one derived in this study if net inflows to rural municipalities located within the census-defined boundaries of the CMAs and CAs were included.

In defining the urban hierarchy, the urban centres of the nation have been divided into seven population size categories using the standard set of break-points employed by Statistics Canada in its coding of areal units. The highest order consists of the CMAs with populations exceeding 100,000, while the lowest order contains the incorporated small towns and villages of less than 1,000 population.[6] Unincorporated settlements are included in the rural category. In the census, incorporated urban settlements of less than 1,000 population are also counted as part of the nation's rural population, whereas in this study they have been treated as a component of the urban population. Table 1 lists the eight levels into which the rural-urban system has been divided, each level's share of the nation's population, the number of centres in each urban size category, and selected measures of age structure differences throughout the hierarchy.

The national urban hierarchy as defined in this study, with each CMA and CA counted as a single urban unit, contains just over 1,800 centres, with the very small towns and villages below the 1,000 population size threshold accounting for a little over half the total number. Over 600, or a disproportionate share, of the lowest order urban settlements are located in the Prairie region, with a particularly high concentration in Saskatchewan. The rural sector, which has been defined

[5]Of the approximate 7 million movers excluded in this study, inmigrants from abroad accounted for just over 700,000; those who failed to state their place of residence in 1971, about 200,000; movers within the same municipality, approximately 5 million; and movers between municipalities within the same CMA or CA, just over 1 million.

[6]The terms city, town, and village used in the nomenclature for urban centres are not a reliable guide to their ranking in population size. Urban municipalities, as opposed to rural, were defined as those with census subdivision *type codes* of 01 to 07.

to exclude rural municipalities within CMAs and CAs as well as the very small towns, contains about 18 percent of the nation's population. In comparison, the broader census definition placed about 24 percent of the Canadian population in the rural category in 1976.

Table 1

LEVELS OF THE HIERARCHY, RURAL-URBAN POPULATION GROUPS

	Number of Urban Centres	1976 Population (Age 5 years +)*		Group Age Structures (% of Pop.)*	
		('000)	% of Total	Age 20-29	Age 60+
Urban Centres (Pop. Size):					
≥ 100,000 (CMAs)	23	11,893	55.9	19	12
30,000-99,999	41	1,967	9.2	18	13
10,000-29,999	92	1,469	6.9	18	13
5,000-9,999	88	558	2.6	18	14
2,500-4,999	191	626	2.9	17	15
1,000-2,499	373	520	2.4	16	17
1-999	1014	381	1.8	14	22
Rural		3,848	18.1	15	12
Canada Total	1822	21,261	100%	18%	13%

* Share of the nation's population has been based on those age 5 years and over, since these values are used in the subsequent calculation of migration rates. The percentage of each category's population that falls into the 20-29 and 60+ age groups is based on total population, including the 0-4 age group.

The last two columns of Table 1 show a progressive increase in the weighting of the population towards the older age groups as one moves down the urban hierarchy. On average, 22 percent of the residents of the small towns and villages of less than 1,000 population fall into the age bracket 60 years and older, in contrast to only 12 percent for the CMAs. The reverse pattern can be observed for young adults age 20-29. One of the issues to be investigated in the analysis is the extent to which the concentration of elderly population in the nation's smaller towns is simply a residual effect of the out-migration of their younger inhabitants or a reflection of net inflows of population of retirement age.

The total of 3.3 million migrants included in the exchange system being analyzed represented 16 percent of Canada's population age 5 years and over. Participation rates declined progressively with age from a peak of about one-quarter of the nation's population age 20-29 to a low of 8 percent for those age 60 and over. The 20-29 age group

accounted for approximately one-third of all the migrants in the system.

The National Flow Matrix

The matrix of absolute flows between the eight levels of the national rural-urban hierarchy is shown in Table 2,[7] which serves as the starting point in the analysis. Similar 8 x 8 origin-destination matrices were produced for each age group for the national system and a parallel set for the intraregional flows within each of the major geographic regions. In analyzing interregional versus intraregional moves within the system, the table was expanded to 48 origins and destinations based on six regions (including the Yukon-NWT) and the eight rural-urban categories within each. Main diagonal cells in the matrices represent moves between different centres falling within the same level of the hierarchy.

Table 2

1971-76 MIGRANTS, AGE 5 YEARS AND OVER, CANADA TOTALS
(thousands)

	Urban Size Groups ('000 Population)							Rural	Total Inmigrants	Net Migrants
	≥100	30-99.9	10-29.9	5-9.9	2.5-4.9	1-2.4	<1			
Urban										
≥100 (CMAs)	554	147	124	50	55	46	51	201	1229	-101
30-99.9	162	34	38	14	20	18	14	78	378	35
10-29.9	126	28	32	15	17	18	13	71	320	-12
5-9.9	47	10	13	5	8	7	8	32	130	-8
2.5-4.9	46	12	14	7	9	10	11	43	152	-19
1-2.4	38	10	13	5	8	9	10	38	132	-31
<1	27	5	7	3	5	6	11	26	90	-74
Rural	331	96	91	38	49	50	46	172	872	210
Total Outmigrants	1330	343	332	138	172	163	164	662	3304	0

Rows = Inmigrants (1976 Place of Residence); Columns = Outmigrants (1971 Place of Residence).

The final column in Table 2 represents the net migration balance for each level of the national hierarchy and is derived by subtracting

[7] Values in Table 2 have been rounded to thousands for simplicity of presentation. Migration rates in subsequent tables are based on the original unrounded figures.

the column sums (total outmigrants) from the corresponding row sums (total inmigrants). For the nation as a whole, only two levels registered a net gain in the domestic system of hierarchical exchange. The largest gain, totalling just over 200,000, was recorded by the rural sector. Within the urban sector, only the medium-size cities in the 30,000-99,999 population size category experienced a net inflow. The losers included both the metropolitan centres at the top of the size hierarchy and all urban categories below the 30,000 population threshold.

The structure of the system of net exchanges between individual levels of the hierarchy can be explored with the aid of a dominance matrix (Table 3). Levels are arranged in rank order, with the ranking based on the number of other levels from which a gain has been effected, rather than on the absolute magnitude of the aggregate net gain or loss. In a perfectly ordered system of net exchanges, with no internal inconsistencies, all of the net flows in the dominance matrix will appear on one side of the diagonal. Such a matrix can be described as perfectly transitive. Each unit or category in the ranking will gain from all those below it and lose to all those above it. The national matrix of net population transfers between levels of the rural-urban hierarchy displays such properties and, as such, can be described as a highly ordered system. The coefficient of consistency is equal to 1.00.[8]

Although the system of net exchanges in the dominance matrix is highly structured, the ranking deviates markedly from the position occupied by each level in the rural-urban hierarchy. The rural sector occupies the top position in the dominance matrix, having gained from all seven of the urban population size categories. The largest single gain for the rural was effected at the expense of the metropolitan

[8]A dominance matrix is also known as a tournament, since it can be likened to a sports tournament in which each team plays one game against each other team in the league and ranking is based on the number of games won rather than on the sum of the scores for and against recorded in all of the games. The coefficient of consistency is based on subtournaments or triples representing the pattern of wins or gains between each possible set of three competitors (in this case, levels of the hierarchy) that are engaged in the tournament. In a transitive, or consistent, triple the top competitor wins from each of the other two, the second wins from the third, and the third ranking competitor loses both games. In a cyclic, or inconsistent, triple each competitor wins one game and loses one and all three are tied in rank. Mathematically, it is impossible for all triples to be cyclic in a matrix of more than three units. The maximum possible number of cyclic triples as a proportion of total triples declines as the size of the matrix increases, stabilizing at about 25 percent for larger matrices of 100 or more rows or columns. For the 8 x 8 matrix employed in this study, the total number of triples is 56 and the maximum possible number of cyclic triples is 20, or 36 percent. The coefficient of consistency = 1 - (c/c_{max}), where c is the observed number of cyclic triples and c_{max} is the maximum possible number of cyclic triples for a matrix of that size.

centres. Second ranking goes to the medium-size cities (30,000-99,999), which, although losing to the rural, gained from each of the other six urban categories. The third position is occupied by the urban size group (10,000-29,999) immediately below the medium-size cities in the hierarchy. They also gained from both the CMAs and lower order urban size groups. The metropolitan centres are relegated to a notch midway in the ranking, losing to the rural sector as well as to the two urban categories between 10,000 and 100,000 population, but showing a consistent pattern of net inflow from all four of the lowest levels of the urban hierarchy that encompass the towns and villages of less than 10,000 inhabitants. Ranking of the four bottom levels of the urban hierarchy in the dominance matrix corresponds perfectly with their hierarchical order based on population size. "Small-town Canada", manifested in its most extreme form in the scattered network of some one thousand village-type settlements with fewer than 1,000 residents, suffered a population loss in its exchange with every other level of the rural-urban hierarchy. Within the urban sector, the net movements were funneling population into the middle levels of the system, transferring people downwards from the metropolitan centres at the top and upwards from the smaller centres at the bottom.

Table 3

DOMINANCE MATRIX, CANADIAN RURAL-URBAN SYSTEM (1971-76), NET MIGRANTS AGE 5 YEARS AND OVER
(thousands)

	Urban Size Groups ('000 Population)							Number	Total Net
	Rural	30-99.9	10-29.9	100+	5-9.9	2.5-4.9	1-2.4	<1	of Gains	Migrants
Rural	18	20	130	6	5	11	20	7	210
Urban									
30-99.9	-	9	14	5	8	8	9	6	35
10-29.9		-	1	1	3	4	7	5	-12
100+ (CMAs)			-	3	10	8	24	4	-101
5-9.9				-	1	2	5	3	-8
2.5-4.9					-	2	5	2	-19
1-2.4						-	4	1	-31
<1							-	0	-74

Rows = Net Gains; Columns = Net Losses. Coefficient of consistency (ζ) = 1.0.

Not all centres within each urban population size group could be expected to conform to the pattern of the group as a whole. Almost half of the CMAs, for example, recorded a net gain. The gain, however, was in many cases at the expense of other CMAs rather than

other levels of the hierarchy. Most noteworthy was the inclusion of the nation's three largest metropolitan centres, Toronto, Montreal, and Vancouver, among those that lost. Of the three, Toronto recorded by far the largest net outflow during the 1971-76 period, both in absolute number and as a rate per unit of population, since it was losing heavily both to other levels of the hierarchy within Ontario and to Western Canada. Montreal's losses to other provinces were partially cushioned by gains from within Quebec. Vancouver fared the best of the three, since its substantial losses within its own province, like those of Toronto, were almost counterbalanced by the traditional inflows from other parts of the nation. Viewed in terms of individual centres, one of the most pervasive features of the metropolitan migration patterns was the loss to the rural sector, with 19 of the 23 CMAs contributing to the net outflow. The only exceptions were Quebec City and Chicoutimi-Jonquière in the Province of Quebec, St. John's in Newfoundland, and Thunder Bay in Northwestern Ontario. At the bottom end of the urban hierarchy, over 80 percent of the centres of less than 1,000 population shared in the loss experienced by the group as a whole.

Of obvious interest is the extent to which "the flight to the country" from the CMAs, reflected in the gains of the rural sector, represented more than just the outflow of extra-long-distance commuters who had not severed their employment ties with the city and, in this sense, had not rejected completely the lifestyle and values of the metropolitan milieu. The CMAs and CAs are themselves broadly defined territorial units, with outer limits delineated to encompass most of the commuting hinterland.[9] Mapping of the net gains of the rural sector did reveal some clustering in census divisions surrounding the outer boundaries of the metropolitan areas, but the pattern also had spatial dimensions of a much broader sort. Large rural gains in the southern interior of British Columbia were clearly divorced from the labourshed of the Vancouver CMA and similar features could be seen in the rural gains throughout the nation.

[9]The net gain of about 210,000 by the rural sector during the 1971-76 period would be substantially greater if movements to rural municipalities within the census-defined territorial boundaries of the CMAs and CAs were included. For the CAs alone, this would add an extra 65,000 to the national rural net migration gain. Within the territorial limits of the CMAs it is difficult to distinguish suburbanization moves to essentially rural settings from those to new housing subdivisions on or near the fringe of the continuously built-up area on the basis of figures for individual municipalities. Some of the suburban municipalities of CMAs with urban status have resulted from the amalgamation of one or more towns with a surrounding rural township and still encompass extensive tracts of open country.

Dominance matrices, comparable in design to Table 3, were produced for the system of net exchanges of individual age groups. The matrix for the 20-29 age group also displayed perfect internal consistency or transitivity. It differed only in the rank order of the urban levels, with the metropolitan centres rising to first place in the urban system immediately below the rural sector. Thus, for young adults, the rural sector gained from all levels of the urban hierarchy, but within the urban hierarchy itself each size category had a net inflow from all levels of lesser population size and a net outflow to all levels of greater population size. The dominance matrix for the retirement age group differed from the others in that the rural sector occupied the bottom rather than the top rung in the ranking. The rural areas lost to all urban levels except the CMAs. In absolute magnitude, however, the net inflow of retirement-age population from the metropolitan areas to the rural was sufficient to slightly more than counterbalance the rural losses to the remainder of the urban hierarchy. In this case, with the entry from the CMAs to the rural appearing to the left of the diagonal, transitivity in the system was less than perfect and the coefficient of consistency dropped to 0.9. The medium-size cities ranked first among the urban levels in the exchange of elderly population and were followed once more by the next size class of town (10,000-29,999). The metropolitan centres, however, slipped to fifth place, gaining elderly residents only from the two lowest order urban categories below the 2,500 size threshold. The small urban settlements of less than 1,000 population did experience some net gain of retirement-age population from their rural environs, but it was more than offset by their losses of population in the same age category to all levels of the urban hierarchy of greater population size.

The net migration rates in Table 4, expressed per 1,000 population for each level of the hierarchy and age group, can be used to assess the impact of domestic migration exchanges on the growth dynamics and age structure of the population of each level. For the top four urban size categories, the 5-year internal net migration gain or loss was equivalent to only one or two percent of their 1976 population. Below the 5,000 size threshold it increased progressively, jumping to almost 20 percent for the lowest order towns and villages. Particularly marked were the increasing rates of net outflow for the young adult 20-29 age group, which attained in the smallest towns a level equivalent to 50 percent of their 1976 population of corresponding age. We must conclude that it is this pronounced exodus of the young, and not a gain of retirement population, that accounts for the exceptionally high proportion of the elderly among the residents of the lowest order urban centres (noted previously in Table 1). Moving down the hierarchy from the third urban level (10,000-29,999) to the sixth (1,000-

2,499), the increased weighting of the elderly in their population can be attributed to a combination of the residual effects of progressively increasing rates of loss for the younger age groups plus positive net inflows in the 60 years and over age bracket. The highest rate of net gain for the retirement age group was in fact recorded by the medium-size cities, but the effect on age structure was negligible, since net gains were also being made by these centres throughout the rest of the age spectrum.

Table 4

1971-76 NET MIGRATION RATES, CANADA TOTALS BY AGE GROUP

	Net Migrants per 1000 Population (1976) of Age Group					
	5 yrs.+	5-19	20-29	30-39	40-59	60+
Urban Centres (Pop. Size)						
≥ 100,000 (CMAs)	-8	-10	15	-30	-11	-11
30,000-99,999	18	24	11	14	13	44
10,000-29,999	-8	-10	-29	-6	-9	18
5,000-9,999	-14	-10	-49	-0.3	-11	16
2,500-4,999	-31	-44	-94	-19	-15	34
1,000-2,499	-59	-79	-171	-21	-36	19
1-999	-194	-227	-496	-144	-130	-44
Rural	55	53	45	119	55	2

The patterns for individual age groups in Table 4 share many common features, but differ in two significant respects. Consistent features worth noting are the gains registered by both the rural sector and medium-size cities for all age groups and the across-the-board losses for all age groups from the lowest order urban centres of less than 1,000 population. The two inconsistent features include, first, the net gain of young adults age 20-29 by the metropolitan centres, in contrast to the losses of the CMAs for all other age groups. Secondly, net gains for the elderly (60 years and over) were experienced by urban centres throughout all of the middle range of the hierarchy and not just by the medium-size cities. The only net losers for the elderly were the CMAs at the top and the smallest settlements with fewer than 1,000 inhabitants at the bottom of the urban system.

Regional Systems

To what extent do the hierarchical systems of migration exchange for individual regions parallel or diverge from the pattern examined for the nation in the aggregate? For any given geographic division of the

nation, the performance of each level of its hierarchy can be assessed solely on the basis of intraregional movements that originate and terminate within its own territory or on the basis of exchanges with other levels that encompass both intraregional and interregional movements. Patterns based on the two approaches can be expected to differ the greatest for the CMAs. It will subsequently be demonstrated that the metropolitan centres have a much higher propensity to participate in the interregional transfers.

Table 5 shows the net migration balance by level of the hierarchy for each of the major geographic divisions of Canada. The figures in this table incorporate both the interregional and intraregional exchanges. The column totals reflect the overall net gains of the Western and Atlantic systems during the 1971-76 period at the expense of Quebec and Ontario in Central Canada. Several features of the table warrant emphasis. Firstly, the losses from the small towns were a universal phenomenon characterizing all regions. Secondly, the gains of the rural sector were also a broadly-based feature, Quebec being the only region to diverge from the national pattern. Also worth noting are the positive values for the medium-size cities in four of the five regional divisions. Quebec was again the exception, having experienced a loss to all eight levels of its rural-urban system when interregional transfers are included; still, in absolute magnitude, the medium-size cities of Quebec suffered less than the other levels from the provincial outdrain. Within the Prairies, centres in the 5,000-10,000 population range recorded a gain, in contrast to the pattern across the nation. However, the gain for this category was confined to the growth province of Alberta, which had attracted net inflows from other parts of the Prairies as well as from Eastern Canada. Within the Prairie Region, Alberta had a total net migration gain of over 60,000, but most of this was counterbalanced by the negative balances of Saskatchewan and Manitoba.

The greatest difference between regions in Table 5 is exhibited by the metropolitan centres. In part, this can be attributed to interregional transfers from the metropolitan centres of Central Canada to the metropolitan centres of other geographic divisions rather than to differences in their pattern of exchange with other levels of the rural-urban hierarchy. Nevertheless, significant regional differences do occur in the degree to which the metropolitan areas gain or lose population in their interaction with the lower order levels. This is clearly evident in an examination of the intraregional systems of exchange within each of the geographic divisions.

The intraregional systems of Ontario and British Columbia both conformed strongly to the pattern for the national rural-urban hierarchy that was portrayed in the dominance matrix in Table 3. The

modest gain for B.C.'s metropolitan population that appeared in Table 5 was due entirely to the inflow from other regions. Within British Columbia the metropolitan order had suffered a net loss of 44,000. Ontario's CMAs had a net outward drain to Ontario destinations roughly double this magnitude. Demetropolitanization, then, had become a major force in the intraregional population movements of two of the most urbanized provinces of the nation during the 1971-76 period. In both cases, the metropolitan areas gained only from the bottom levels of the urban hierarchy, and these modest gains were dwarfed by the net outflow of their residents to the rural sector and middle rungs of the urban system. Quebec has attained a level of urbanization comparable to that of Ontario and British Columbia, but the structure of its internal population transfers was quite different. Quebec's intraprovincial system corresponded to what could be hypothesized as the classic pattern of hierarchical exchange intrinsic to the urbanization process. At the top of the dominance matrix in Quebec were the CMAs, drawing on population from all other levels of the urban hierarchy as well as from the rural sector. Next in line were the medium-size cities, losing only to the metropolitan areas above. The rural sector was relegated to a position close to the bottom of the order, with its residents being siphoned off to all levels of the urban system with the sole exception of the lowest order settlements below the 1,000 population threshold. Patterns of hierarchical transfer in the other two major divisions, the Prairies and the Atlantic Region, exhibited features transitional between the classic conurbation model of Quebec and the new wave model of demetropolitanization that had gained the ascendency in Ontario and British Columbia.

In the Prairies the forces of deglomeration, so evident in Ontario and British Columbia, were still waging a struggle with the traditional processes of agglomeration during the 1971-76 period. This is reflected in the standing of the rural sector midway in the ranking of the Prairies intraregional dominance matrix in contrast to its position at the top in Ontario and B.C. and close to the bottom in Quebec. The rural sector in the Prairies recorded a substantial gain from the metropolitan centres, but was experiencing, simultaneously, minor net losses to several of the intermediate urban size categories. As in Quebec, net gains were continuing to be effected by the metropolitan centres from other levels of the urban hierarchy, including the medium-size cities. Throughout the urban hierarchy in general, progressive transfers were taking place in an upward direction. Examination of the more localized hierarchical transfers within the three individual provinces of the Prairie Region demonstrates that some of the transitional attributes of the regional system of the Prairies can be traced to differences between Alberta and the other two provinces. Alberta's two metropolitan centres, Edmonton and Calgary, both experienced a net loss to other levels of the hierarchy within their own province, emulating the pattern observed in Ontario and British Columbia. In contrast, the three CMAs of Manitoba and Saskatchewan (Winnipeg, Regina, and Saskatoon) all gained from the remainder of the hierarchy within their own province as had their counterparts in Quebec.

Table 5

1971-76 REGIONAL NET MIGRATION BALANCES, MIGRANTS AGE 5 YEARS AND OVER
(thousands)

	Canada	Atlantic	Quebec	Ontario	Prairies	B.C.
Urban Centres (Pop. Size)						
≥ 100,000 (CMAs)	-101	2	-8	-110	10	6
30,000-99,999	35	2	-1	4	7	22
10,000-29,999	-12	-3	-11	-7	-1	10
5,000-9,999	-8	-0.3	-5	-6	9	-6
2,500-4,999	-19	-2	-6	-9	0.3	-4
1,000-2,499	-31	-2	-4	-12	-9	-4
1-999	-74	-4	-14	-9	-45	-2
Rural	210	19	-16	98	36	73
Total*	0	12	-66	-50	8	95

*The total net migration balances for the geographic regions (column totals) differ, in the case of the Atlantic Region, Quebec, and the Prairies, by several thousand from those based on the interprovincial flow matrix published in *1976 Census of Canada Bulletin 2.9*. The difference is due partly to the exclusion in this study of those who reported their 1971 place of residence in terms of a province, but omitted the municipality, and partly to the aggregation of randomly rounded figures for the movements between pairs of census subdivisions.

The major losses recorded by the network of small towns and villages that dot the Prairies can be attributed, at least in part, to the exceptional number of these centres within the region, although the forces of depopulation acting on them do appear to be even more extreme than those experienced by the small towns of other regions. Expressed as a rate per unit of population, the net outflow from the lowest order settlements in the Prairies exceeded that of any other region. The Prairie settlements in the lowest order urban size group had a mean size of only 300 inhabitants, in contrast to averages of 500-600 in the other four regions. The smaller size of the Prairie settlements and associated paucity of services, their relative isolation from larger towns with higher order goods, the declining farm popula-

tion which they serve, and the harsh winters of the region, could all be factors that might contribute to their higher rates of population loss.

The intraregional exchanges of the Atlantic Region also exhibited the classic structure of progressive upward transfer of population through the urban hierarchy. Each size category of urban centre gained from all those of lesser size and lost to all those of greater size. However, unlike Quebec or the Prairies, the rural sector had risen to the top and outranked even the CMAs, siphoning off population from all levels of the urban system. Only Newfoundland diverged from this pattern and was still experiencing losses from its rural areas. That population was not yet shifting downwards from the metropolitan order to the middle rungs of the urban system in the Atlantic Region may reflect the lesser size of the Halifax, St. John, and St. John's CMAs. The economic and social stresses associated with advanced metropolitanization may not yet have been felt with sufficient intensity.

Rates of Inmigration and Outmigration

When the net migration rates previously discussed are partitioned into their inflow and outflow components a number of interesting features of the process of population exchange are uncovered. Particularly significant are differences in participation rates, or the degree to which members of large versus small urban centres enter into the system of migration transfers. This in turn affects the stability of the resident population of towns in different levels of the hierarchy.The relative contribution of push, as opposed to pull, forces in the pattern of net losses or gains for various levels of the hierarchy can also be assessed and the intensity of these forces measured. These issues will be discussed under separate subheadings. The IN, OUT, and NET migration rates for each level of the hierarchy, expressed as a percentage of the 1976 population, are presented in Table 6. The final column, in which outmigrants are expressed as a percentage of the population "at risk," represents a more refined measure of the strength of the push forces contributing to the outward movements from each level.

Participation Rates

One of the most striking features of both the in- and outmigration rate patterns is the very low value of the rate for the metropolitan centres in comparison to other levels of the hierarchy. Although less extreme, a tendency towards lower participation rates can also be observed for the medium-size cities immediately below the CMAs in the size ranking. The low rates for the CMAs does not mean that metropolitan populations are less prone to change their place of residence than the inhabitants of lower-order centres. It stems, rather, from the much higher propensity for moves involving the residents of large cities to be of the intraurban type, representing residential relocation within the boundaries of the same centre. Such moves are excluded from the migration systems under analysis in this study. When all types of moves recorded in the 1976 Census are considered, individuals who had been resident in one of the 23 CMAs in 1971 accounted for 59 percent of the respondents who reported a change in place of residence over the preceding 5 years, a proportion slightly exceeding their 56 percent share of the nation's population. The low rates of in- and outmigration for the largest urban centres are very much in line with what one might predict on the basis of general interaction theory.[10]

Table 6

1971-76 IN- AND OUTMIGRATION RATES: MIGRANTS AGE 5 YEARS AND OVER, CANADA TOTALS

	Migrants: % of 1976 Pop. Age 5 Yrs.+			Outmigrants: % of Population at Risk*
	Inmigrants	Outmigrants	Net Migrants	
Urban Centres (Pop. Size)				
≥ 100.000 (CMAs)	10	11	-1	11
30,000-99,999	19	17	2	18
10,000-29,999	22	23	-1	22
5,000-9,999	23	25	-1	24
2,500-4,999	24	27	-3	27
1,000-2,499	25	31	-6	30
1-999	24	43	-19	36
Rural	23	17	6	18
Total	16	16	0	16

* Population at risk = 1976 Population of Age Group + Outmigrants - Inmigrants.

[10]That the metropolitan areas had internal rates of residential relocation far above average, in conjunction with rates of population exchange with other centres or areas far below average, corroborates the assumptions implicit in the numerator of the gravity model. In the gravity model, when the distance factor is held constant, interaction between each pair of origins and destinations is expected to be proportional to P_iP_j; that is, to the product of their respective populations. In effect, each areal unit in the system is expected to have a share of both the outmovers and in-movers (the row and column totals in a matrix) exactly equal to its percentage share of the total population. Quite essential to generating such a distribution using the P_iP_j function is the recognition that each areal unit can itself serve as one of the potential destinations for the moves that originate within it. These internal moves, contained in the main diagonal cells of the matrix of expected flows, will constitute a variable *proportion* of the total originating or ter-

Stability of the Resident Population

The inmigration rates in Table 6 provide an index of the average stability of the resident population of the centres in any given level of the hierarchy. They indicate the extent to which the population of an urban centre is relatively permanent and has its roots deeply embedded in the community. If each CMA is viewed as a single urban entity, then the towns in the lower orders of the hierarchy with their higher inmigration rates have populations that are substantially less stable or permanent than those of the larger cities. About one-quarter of the population of the lower-order centres had roots in their town extending back less than 5 years. For the CMAs the corresponding proportion of the population, based on domestic inmigrants, was only 10 percent. Even when the substantial influx of migrants from abroad is included, residents of less than 5 years' duration make up only 15 percent of the population of the metropolitan areas.

Push Versus Pull Force

Below the level of the medium-size cities, rates of net migration loss per unit of population increased progressively through the lower orders of the urban hierarchy, attaining a peak equivalent to 19 percent of the 1976 population for the small centres with fewer than 1,000 inhabitants. At the same time the average inmigration rates, reflecting the strength of the *pull* forces of attraction, displayed little variance between these levels. It was the outmigration rates, representing the *push* forces of expulsion, that increased markedly with each additional step down the hierarchy. Thus, *within the lower orders* of the urban hierarchy rising rates of net population outflow associated with diminishing size of centre appear to be due essentially to the increasing intensity of the push mechanism and not, on the average, to any

minating moves for each areal unit whenever the areas are of unequal population size. Based on the P_iP_j function, the *proportion* of any row or column total that falls into the diagonal cell will increase progressively with the size of the areal unit. The larger the population of the unit relative to the average size of all areal units in the system, the lower will be its expected propensity to participate in interregional, or interurban, movements and the greater will be the expected intensity of movements confined within its own boundaries. In logical terms, the explanation differs somewhat depending on whether the process is being viewed from the standpoint of the outmigrants or inmigrants for any given areal unit. Viewed from the standpoint of the moves that originate in each area, the greater its population size the higher will be the probability that the mover will find a potential destination within the same unit that satisfies his or her requirements in terms of such variables as employment opportunities, lifestyle factors, or environmental conditions. From the standpoint of moves that terminate in each areal unit, the greater its share of the total population in the system the smaller will be the pool of potential inmigrants originating outside its boundaries on which it can draw.

change in the rate at which different size towns draw in new residents per unit of their population. Particularly noteworthy is the observation that the net migration gain experienced by the rural sector in the national system of population exchange was not due to a higher rate of inmigration compared to that of the lower orders of the urban hierarchy. It was again a change in the outmigration rate that controlled the direction and magnitude of the net migration balance. The gains of the rural areas could be attributed more to their ability to retain their existing population, reflected in a lower outmigration rate, than to stronger forces of attraction pulling in new residents at an abnormally high rate.

A more refined measure of the strength of the push forces is obtained when outmigrants are expressed as a percentage of the population exposed to the risk of migrating—that is, the base population from which the outmigrants originated. The population *at risk* for migrants in any given age group can be defined as the terminal population in that age group plus the outmigrants minus the inmigrants. Put another way, the population *at risk* is equivalent to the terminal population minus the net migrants. When the net migration rate is low, the difference will be insignificant between outmigration rates calculated as a percentage of the terminal population or as a percentage of the population at risk. When the net migration rate is high, as it was for the small settlements with less than 1,000 inhabitants, the difference will be more substantial. For the lowest order urban centres the outmigrants were equivalent to 43 percent of their 1976 population or 36 percent of the population at risk. The pattern of rising rates of outmigration with decreasing size of urban centre, as well as a reduced rate for the rural sector, is pervasive for all age groups. For the highly mobile 20-29 age group, 18 percent of the population at risk departed from their CMA of residence during the 5-year period. For the medium-size cities, the proportion rose to 31 percent. The exodus among the young adults exposed to the risk of leaving reached the rather astounding levels of 51 percent and 62 percent respectively for the smallest two categories of urban centre.

Interregional versus Intraregional Movements

Interregional migration between any two of the major geographic divisions of the country, as opposed to intraregional migration within any single division, generally involves longer distances and a more complete disruption of family ties and other established relationships. Stronger motivation in terms of unique opportunities not found in the home region would normally be required to counterbalance the greater friction of distance. How much does the probability of participating in

the longer distance interregional exchanges vary among the different levels of the hierarchy?

To assess this issue the national flow matrix (Table 2) was converted into a matrix in which the migrants for each origin-destination linkage in the body of the matrix, as well as the row sums, column sums, and grand total, represented the percent of the cell total that consisted of interregional migrants. For the entire system of exchanges 78 percent of the movements were intraregional and only 22 percent interregional, reflecting as expected the constraints exerted on the choice of destination by the distance factor. For the metropolitan centres the proportion of interregional transfers was much higher, involving approximately one-third of both their inmigrants and outmigrants. The proportion dropped to about 20 percent for the next two levels of the urban hierarchy. The decline continued with diminishing size of centre to a low of approximately 10 percent for the row and column totals of the smallest category of towns. For individual cells in the body of the matrix, the interregional share reached a peak of 50 percent for the movements between pairs of CMAs, a value roughly double that of the next highest cell in the matrix. The next highest proportions generally involved linkages between the CMAs and centres in the following two urban size categories. At the other end of the spectrum, for the diagonal cell representing migration between settlements of less than 1,000 population, the interregional share was only 1 percent. In most of the cells representing linkages between urban centres in the lowest four categories, as well as in the cells in the row and column of the rural sector, interregional migrants accounted for less than 15 percent of the total movements.

It was previously noted that metropolitan residents are much more likely than the residents of smaller cities and towns to satisfy their impulses for a move through residential relocation within their own centre. Opportunities and environmental attractions, unmatched by the varied assortment available within their own CMA, are more likely to be found in other regions of the country than elsewhere within their home region. It may be this factor, as much as some intrinsic conditioning of big city residents to cope with the stresses of long distance separation from family and friends, that accounts for their much higher propensity to enter into the interregional migration streams.

Transition Matrix Analysis

Differences in average migration rates for levels of the hierarchy, based on their total inflows and outflows, have already been examined. To what extent, however, does each class of centre exhibit stronger linkages with some levels of the hierarchy than with others?

Table 7 represents a transaction matrix of flow ratios in which the actual number of migrants in each cell has been divided by the expected number. The expected flows, or denominators of the flow ratios, have the same conceptual basis and mode of derivation as the theoretical frequencies in a Chi Square table. The expected value for any given cell is derived by taking the product of the intersecting row and column totals in the matrix of actual flows and dividing by the grand total of migrants in the system. In other words, the total number of outmigrants (column sums) recorded for each origin in the matrix of actual flows is accepted as given. This sum is redistributed among destinations in proportion to the row totals that represent the average force of attraction exerted by each destination. If the actual flow exceeds the expected for any given cell, the flow ratio will be greater than 1.0 and will reveal a linkage of above-normal intensity after allowing for the average rates of outflow and inflow for that particular origin and destination respectively.

Table 7

TRANSACTION MATRIX (FLOW RATIOS), 1971-76 MIGRANTS AGE 5 YEARS AND OVER, CANADA TOTALS

	Urban Size Groups ('000 Population)							Rural	Total Inmigrants
	≥100	30-99.9	10-29.9	5-9.9	2.5-4.9	1-2.4	<1		
Urban:									
≥100(CMAs)	1.12	1.16	1.01	.97	.87	.76	.83	.82	1.0
30-99.9	1.06	.87	.99	.90	1.03	.95	.76	1.03	1.0
19-29.9	.98	.85	1.00	1.09	1.02	1.12	.85	1.11	1.0
5-9.9	.90	.71	1.00	.93	1.17	1.10	1.28	1.23	1.0
2.5-4.9	.75	.79	.89	1.16	1.19	1.32	1.42	1.41	1.0
1-2.4	.72	.73	1.00	.98	1.15	1.35	1.48	1.45	1.0
<1	.74	.59	.77	.91	1.14	1.27	2.39	1.44	1.0
Rural	.94	1.06	1.03	1.05	1.07	1.16	1.07	.98	1.0
Total Outmigrants	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Rows = Inmigrants; Columns = Outmigrants; Flow ratios = Actual Migrants/Expected Migrants; Expected = Row Total x Column Total/Grand Total.

The highest flow ratios in the matrix occur in a block in the lower right-hand quarter of the table and represent migration linkages between all of the lower orders of the hierarchy. The greater propensity of rural outmigrants to move to smaller urban centres can be seen

in the rural column, where flow ratios increase progressively in magnitude with decreasing size of urban centre. Flow ratios are also above-average for the diagonal cell representing moves between pairs of metropolitan centres as well as in the contiguous cells for movements between the CMAs and medium-size cities. The propensity of the CMAs to interact with other levels in terms of both inflows and outflows declines with decreasing size of urban centre. Clearly, the residents of each level display a tendency to move to centres of similar size. It could be hypothesized that we are creatures of habit and exhibit a preference for the type of lifestyle environment with which we are most familiar. Another possible explanation could be a greater similarity of employment opportunities in centres of similar size, with migrants selecting destinations within the hierarchy where their training and work experience may be most readily accommodated.

Movement into the Hierarchy from Abroad

In Canada, far more than in most countries, the relative growth dynamics of each level of the rural-urban system is affected by international as well as domestic migration. For both practical and theoretical reasons, the internal or domestic migration transfers are commonly analysed independently from the international migration patterns. However, to fail to relate them in any way sacrifices much perspective.

The 1976 Census recorded just over 700,000 migrants who had come from abroad during the preceding five years, a number less than one-quarter as great as the 3.3 million internal migrants that made up the domestic matrix in Table 2. However, the *net* immigration of almost one-half million, derived as the residual difference between intercensal population growth and recorded reproductive growth, was roughly double the sum of the net domestic transfers between levels of the rural-urban system shown in Table 3. Of greatest significance is the fact that 80 percent of the migrants from abroad had selected one of the metropolitan centres as their destination, with the Toronto CMA alone receiving about 30 percent of the national total. Aggregation of the inmigrants from abroad for the same system of hierarchical levels used in the analysis of the domestic migration exchanges revealed a progressive decline in the rate of inflow per unit of population with decreasing size of urban centre. The most precipitous change was recorded between the CMAs, where almost 5 percent of the 1976 residents age 5 years and over had been living outside the country 5 years previously, and the next urban size class, the medium-size cities, where the proportion dropped to 2 percent. Still lower values, ranging down to 0.9 percent for the urban centres of less than 1,000 population, were recorded by all other levels of the rural-urban system. At

the top of the urban hierarchy, domestic migration losses for the metropolitan centres were being far more than offset by international migration gains. In contrast, in the lowest rungs of the urban system, the minor gains of population from abroad were completely dwarfed by their domestic migration losses. The centres of less than 1,000 population were the most extreme example. For this size group the domestic migration loss, equivalent to almost 20 percent of its 1976 population (Table 6), was associated with a net international migration gain that would have been even lower than the 0.9 percent rate of inmigration from abroad.

Summary

During the 1971-76 period domestic migration patterns in Canada revealed a substantial net ransfer of population from all levels of the urban hierarchy to the rural sector. Rural gains tended to be of greatest intensity in the general hinterlands of the CMAs, but the net rural inflows were by no means restricted to these areas. They suggested an outward movement from the metropolitan centres that involved more than just long distance commuters. The rural gains encompassed all age groups, but were quite minor for the elderly, who displayed a preference for the amenities of an urban environment. The net losers in the exchange of elderly population were the metropolitan areas and the urban centres with fewer than 1,000 inhabitants. Within the urban system, only the medium-size cities registered, in the aggregate, a net domestic migration gain, but it was effected at the expense of the larger metropolitan centres and smaller towns rather than being drawn from the rural sector. The substantial domestic migration losses of the CMAs were more than offset by the influx of immigrants from abroad, since international migration gains in Canada are both substantial and heavily concentrated in the larger cities. Per unit of population the biggest losers were the smaller towns at the bottom of the urban hierarchy, particularly those with fewer than several thousand inhabitants. For towns and villages of less than 1,000 population, the 5-year period saw a net domestic migration loss equivalent to almost 20 percent of their 1976 population and to about 50 percent of their young adult residents in the 20-29 age range. It was this heavy net migration loss from the younger age categories, rather than inmigration of retirement population, that accounted for the exceptionally high proportion of elderly people in the population of the smallest urban centres of the nation. Analysis also revealed that, in the lower levels of the urban hierarchy, increasing rates of net migration loss associated with declining size of centre could be traced to the

changing impact of "push" rather than "pull" forces. Inmigration rates remained relatively constant, while outmigration rates moved upwards. In line with general interaction theory, both in- and outmigration rates were markedly lower for the largest cities, contributing to a reduced level of population turnover for the CMAs.

Viewed as a dominance matrix, the national system of net migration exchanges between levels of the rural-urban hierarchy was a highly ordered one, with each category in the ranking gaining from those below it and losing to those of higher rank. The CMAs had net inflows only from the urban size classes of less than 10,000 population. Some deviations from the national pattern were observed in the intraregional systems of population movement. Particularly noteworthy was the adherence of Quebec to a more classic model of urbanization, with the CMAs continuing to gain from all urban classes of lesser population size as well as from the rural sector.

Decomposition of the migration flows into interregional versus intraregional movements revealed a much higher propensity for the residents of the larger urban centres to participate in the longer distance interregional moves. Transaction matrix analysis demonstrated that, after eliminating the average attraction of each level of the hierarchy as a variable, migrants exhibited a definite preference for centres of similar size to the one from which they were departing. This was reflected also in the stronger attraction that smaller towns exerted on the outmigrants from the rural sector.

Many of the process features of the Canadian migration system evaluated in this study could be interpreted as durable attributes, while others, such as the pronounced rural gains and downward movement from metropolitan areas to medium-size centres, could prove to be more transitory in intensity if not direction. Clearly, there is a need for an on-going monitoring of domestic migration exchanges between the various rungs of the rural-urban system at both the national and intraregional levels. It is hoped that this study will encourage further work along these lines.

Reference

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