THE USE OF ADMINISTRATIVE RECORDS FOR ESTIMATING MIGRATION AND POPULATION*

Douglas A. Norris, Malcolm Britton** and Ravi Verma, Statistics Canada

Abstract

This paper reviews the work currently underway within Statistics Canada to develop more timely and accurate population estimates at the sub-national level. The emphasis is on the attempts to improve the accuracy of the migration component within the post-censal population estimation methodology by the use of family allowance and income tax records. The results of recent evaluation studies using 1981 Census population counts are outlined, and some of the emerging issues discussed. Future developments are also identified.

INTRODUCTION

In Canada the population counts resulting from the 1981 Census have led to an evaluation of the accuracy and appropriateness of the post-censal, population estimation methodology (See Basavarajappa et al., 1982). The evaluation is largely concerned with the fact that, at the sub-national level, the disparities between the census counts and the post-censal estimates of population - often referred to as "closure errors" - are larger than anticipated for June 1981. For example, while the percentage disparity for Canada as a whole is negative at about one half of one percentage point (that is, the estimate is slightly lower than the final census count), the corresponding figures for the provinces range from three percentage points (posi - tive)for Newfoundland to three percentage points (negative) for Alberta. Considered in terms of the estimated and actual intercensal growth in population size (rather than the population figures themselves) the "errors" for the provinces are even more striking. That these discrepancies need to be investigated in earnest is indicated by the important role given to the post-censal population estimates in determining the levels of federal-provincial fiscal transfers.

Except for the population base, which is currently determined every five years in Canada by a census, intercensal changes in population have been determined for some time from administrative data sources made available to Statistics Canada. Estimates of the numbers of births, deaths, immigrants, emigrants and internal migrants are all produced in part, if not in total, from data sources designed primarily for administrative purposes. In recent years existing administrative data sources have been further developed, and of particular note here is the substantive progress made in the development of migration data from taxation records. Attempts are now being made to evaluate these enhanced data sources and, where practical to do so, integrate them into the ongoing population estimates program.

The purpose of this paper is to give an overview of the current methods and data sources used to prepare the Canadian sub-national population estimates, with particular emphasis on the migration components. The differences between the June 1981 post-censal population estimates and the 1981 Census Population counts are presented,

with similar comparisons for 1976 and 1971. Then the results of the examination of some possible refinements to the current methodology are outlined, followed by a discussion of some of the issues involved and future work planned.

CURRENT METHODOLOGY

Statistics Canada produces annual estimates of total population for Canada, the provinces and territories, census divisions (counties) and census metropolitan areas (CMA's). (Similar estimates for Canada and the provinces are also produced on a quarterly basis.) The estimates for Canada are obtained by an aggregation of the provincial and territorial estimates, while the estimates for census divisions and CMA's are consistent with the appropriate provincial totals. Other parts of the population estimates program covering the national and provincial estimates of population by age, sex and marital status, and the estimates of families will not be discussed in this paper.

Provincial Population Estimates

The current method of making provincial population estimates is a component technique in which vital statistics are employed to measure natural increase (that is, births minus deaths). Migration, the most problematic component, is broken down into three parts: interprovincial migration is estimated using data from family allowance records; international immigration is derived directly from immigration records; and international emigration is estimated from fragmentary data on emigration from Canada to the United States (U.S.) and to the United Kingdom (U.K.). (For a complete description of the methodology see Statistics Canada 1980b .)

The estimates of interprovincial migration are derived from the administrative records of the Family Allowance Program. This program provides a monthly payment for virtually all children under the age of 18 years. The program is a federal program but is administered on a provincial basis and therefore movement between provinces is carefully recorded. It has been in existence since 1947 and monthly data on interprovincial movements are available since that time. Originally, data were only available on the number of families that moved between provinces. In 1974 data became available on the actual number of children that moved. Since 1978, data by single years of age have become available on the movement of children into and out of Canada. Kasahara (1963) developed a method of using the family allowance data to produce estimates of interprovincial migration flows for the total population. The original methodology has undergone a number of revisions and refinements and is currently being used by Statistics Canada to produce quarterly and annual estimates of migration flows between provinces (Statistics Canada 1980a). The basic method uses the migration data on children in the form of an out-migration rate; a corresponding rate for adults is derived by means of a multiplier estimated from an independent source. By multiplying the estimated adult rate by the adult population

one obtains an estimate of adult migration; this estimate when added to that for child migration provides an estimate of total migration.

The key to this method is the specification of the multipliers to derive adult migration rates from those for children. Currently the multiplier is derived using the most recent census data and it is assumed to remain constant for the subsequent intercensal period[1]. A separate multiplier is derived for each province and the same multiplier is used regardless of the province of destination. (As discussed below, recent attempts to improve the methodology have focussed on the improved specification of these multipliers.)

International immigration data are obtained from the Canada Employment and Immigration Commission (CEIC) from administrative records of immigrant arrivals in Canada. The recorded province of destination is the province in which the immigrant intends to settle on arrival. These data are thought to be of high quality although they exclude Canadian citizens who are returning to Canada after living abroad.

Estimates of international emigration are obtained by first estimating emigration at the national level, and then allocating the emigrants by province on the basis of immigrant visas issued to Canadian residents by each of seven U.S. consular offices located in Canada. Although there is not a consular office in each province, the regional data are used to make provincial estimates. The national emigration estimate is obtained by adding estimates of emigration to the U.S., to the U.K. and to all other countries collectively. Data on emigration to the U.S. and U.K. are obtained from the U.S. Department of Justice, Immigration and Naturalization Service and the U.K. International Passenger Survey respectively; the estimate of "other" emigrants is a residual estimate based on census data, and on vital statistics and immigration figures for the previous intercensal period. The latter estimate is assumed to remain constant for the subsequent intercensal period. The above methodology has been used with minor modifications since 1966.

An assessment of the quality of the provincial population estimates is obtained by comparing the estimates for census years with the actual census counts[2]. The results of comparisons for 1971, 1976 and 1981 are shown in Table 1. The average absolute relative difference between the post-censal estimates and the census counts for the ten provinces is 0.67 percent in 1971, 0.77 percent in 1976 and 1.54 percent in 1981. Most of the apparent error is known to be due to problems in estimating interprovincial migration and, to a lesser extent, international emigration. The apparent deterioration in the estimates for 1981 is almost certainly due to the fact that the existing methodology was not adequately sensitized to the changes in migration trends which were taking place during the 1970's.

Census Division Population Estimates

In addition to producing provincial population estimates Statistics Canada currently produces annual sub-provincial estimates of population for census divisions (or counties) and census metropolitan areas[3]. The current method of making

TABLE 1: Relative Differences between the Post-censal Population Estimates and Census Population Counts by Province, 1971, 1976 and 1981
(Percentages)

Province	1971	1976	1981
Newfoundland	0.38	-0.19	3.08
Prince Edward Island	-0.89	1.58	1.47
Nova Scotia	-2.41	0.93	1.13
New Brunswick	-0.47	1.51	2.04
Québec	0.03	0.10	-1.51
Ontario	1.45	1.07	0.01
Manitoba	0.00	1.21	0.46
Saskatchewan	0.22	0.91	1.24
Alberta	0.37	-0.09	-3.34
British Columbia	0.50	0.07	-1.11
Average Absolute Relative Difference	0.67	0.77	1.54

NOTE: See Table 2.

annual estimates of total population by census division varies by province. A ratio correlation method is used for Newfoundland and Quebec; a component method for Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Alberta and British Columbia; and a ratio method for Ontario and Saskatchewan. Birth, death, school enrolment, medicare and tax data are currently used as symptomatic indicators depending upon the method and the province concerned. (For a complete description of the methodology see Statistics Canada, 1969.) A significant shortcoming of these methods is that they involve a time lag of nearly two years due to delays in obtaining the required input data.

A comparison of the census division estimates to the census population counts for 1971 and 1976 is shown in Table 2. Data for 1981 are not yet available, but since there has been no change in methodology the results are expected to be similar to earlier years. The average absolute difference between the post-censal estimates and the census counts is around 4 percentage points in 1971 and in 1976. Deviations vary widely across the provinces, the lowest being observed for Ontario and Saskatchewan. For these two provinces, the estimates are produced using a ratio method based on independent population counts (medicare data in Saskatchewan and tax assessment data in Ontario). As is commonly the case, the accuracy of the estimates generally increases with population size.

Census Metropolitan Area Population Estimates

Post-censal population estimates for CMA's are derived by a component method. Data on births and deaths are obtained from vital statistics. The migration component is subdivided into international immigration and emigration, and into interprovincial and intraprovincial migration. The number of immigrants is estimated directly from immigration records and, as with the provincial estimates, the data refer to the intended destination at the time of immigration. Data on emigration are derived by allocating provincial emigration on the basis of recent population size. Data on interprovincial migration to and from the CMA are obtained by allocating total interprovincial moves on the basis of the proportion of inter-

TABLE 2: Relative Differences between the Post-censal Population Estimates and Census Population Counts for Census Divisions by Province and Size, 1971 and 1976

Province	1971		1976	
	Number of census divisions	Average absolute relative difference (Percentage)	Number of census divisions	Average absolute relative difference (Percentage)
Newfoundland	10	8.55	10	4.62
Prince Edward Island	3	6.79	3	2.61
Nova Scotia	18	5.97	18	4.16
New Brunswick	15	5.04	15	5.66
Québec	63	3.53	74	4.63
Ontario	52	2.30	53	2.09
Manitoba	20	7.08	20	5.07
Saskatchewan	18	2.61	18	2.16
Alberta	15	4.05	15	3.19
British Columbia	10	5.35	29	5.14
All Census Divisions	224	4.17	255	3.93
Population Size of Census Division				
0 - 4,999	0	–	2	8.32
5,000 - 19,999	36	5.92	42	4.49
20,000 - 49,999	93	4.39	108	3.81
50,000 - 99,999	52	3.64	60	4.05
100,000 +	43	2.87	43	3.35

NOTE: The relative difference was calculated as ((Estimate-Census)/Census) X 100.

TABLE 3: Relative Differences between the Post-censal Population Estimates and Census Population Counts for Census Metropolitan Areas, 1971, 1976 and 1981

CMA	1971	1976	1981
Calgary	-1.2	3.6	-3.8
Chicoutimi-Jonquière	3.7	-0.4	-2.9
Edmonton	-2.0	1.9	-4.0
Halifax	-2.7	-3.0	-0.9
Hamilton	-0.2	1.2	0.5
Kitchener	-6.2	-4.8	1.4
London	-1.4	0.0	-2.1
Montréal	-0.7	0.1	0.3
Oshawa	not available	-2.7	-5.7
Ottawa-Hull	-3.3	-2.4	6.5
Québec	-2.5	-3.0	-0.7
Regina	2.1	0.3	4.2
St. Catharines-Niagara	1.7	0.3	2.2
St. John's	-1.5	-4.8	-2.1
Saint John	0.0	2.6	6.6
Saskatoon	1.6	-2.0	-5.0
Sudbury	-4.5	3.0	-0.2
Thunder Bay	-1.8	-1.1	0.5
Toronto	-3.0	1.9	-3.4
Vancouver	-0.3	-3.2	-3.4
Victoria	0.0	-5.2	2.2
Windsor	-0.8	2.9	-1.1
Winnipeg	3.0	0.8	1.6
Average Absolute Relative Difference	2.0	2.2	2.7

NOTE: See Table 2.

provincial moves involving the CMA as estimated from the most recent census. Finally, intraprovincial moves are estimated by assuming a constant rate of migration derived from the most recent census. (For a complete description of the estimation methodology see Statistics Canada, 1979.) The methodology described above was used for the 1976 to 1981 estimates. For earlier years internal migration was estimated on the basis of manual counts of family allowance change of address notifications. However, these counts were not used after 1976 because of the lack of timeliness and completeness of the data.

A comparison of the CMA post-censal population estimates with the census population counts for 1971, 1976, and 1981 is shown in Table 3. For the CMA's, the average deviation between the post-censal estimates and the census counts increases from 2.0 to 2.7 percentage points between 1971 and 1981. But between CMA's, and over time, there does not appear to be any consistent pattern to the deviations. The increase in the average deviation likely reflects the corresponding disparities at the provincial level of estimation described earlier, although the significance of the change in methodology between 1976 and 1981 and of the necessary reliance on recent census data should not be forgotten.

POSSIBLE MODIFICATIONS TO THE METHODOLOGY: SOME PRELIMINARY RESULTS

New Sources of Migration Data

The release of the 1981 census counts provides an opportunity to evaluate the ongoing population estimates program. While the estimation of natural increase is being evaluated simultaneously, it is considered that the migration components are subject to the most error. Consequently work is being directed at the assessment and improvement of the migration estimates. During the past few years substantial progress has been made in developing new sources of migration data from administrative records. A description of this work is given in Norris (1982). Currently a major effort is being made to assess these new data sources and investigate the feasibility of incorporating these into the ongoing population estimates program. Although final decisions on modifications to the methodology will not be made until early 1983, some preliminary work has been done to indicate areas where improvements may be possible.

Efforts to improve the estimation of migration have focussed on the development of individual income tax records and family allowance records. The tax records have been used to produce estimates of migration flows by major age and sex groupings between all census divisions in Canada. These data have been produced on an annual basis for the period 1966-67 to 1979-80, but, because of changes in the derivative methodology and geographic boundaries, a consistent series is not available for all census divisions. Attempts to evaluate the tax migration estimates are hampered by the dearth of comparable data. However, limited comparisons of net migration indicate the tax estimates compare favourably with existing estimates at the provincial and census division levels (see Norris, 1982).

While the accuracy of the tax migration estimates is promising, the data can only be produced with a time lag of 18-24 months and this limits their usefulness in producing timely population figures. Therefore, work is ongoing to modify existing methods or develop new methods to produce more timely migration estimates. One possibility is that a separate method be used to produce timely preliminary migration estimates and then the tax data used as final migration estimates. This approach can be justified if the tax migration estimates are at least as good as those derived from the preliminary method. The tax data have the additional advantage of providing a rich and consistent source of provincial and census division migration data.

The other enhanced source of migration data has been family allowance records. Although interprovincial migration data from family allowance records have been available for some time, recent work has resulted in more detailed data by single years of age as well as data on the international movement of children. Work is also underway to produce subprovincial data on the population and migration of children. Although the family allowance data are restricted to the subpopulation of children, they are available with only a short time delay and therefore could serve as indicators of total migration. The key to using the family allowance data in this manner, whether at the provincial or sub-provincial level, is to develop a method of estimating total migration from child migration and monitor its performance. Some preliminary results of work in this direction are outlined below.

Provincial Population Estimates

The evaluation of the provincial population estimates has identified possible weaknesses in the estimation of interprovincial migration and the estimation of international emigration. (See Basavarajappa et al., 1982 and Britton, 1981 for further details.)

In an attempt to produce timely estimates of interprovincial migration, the evaluation has focussed on modifying the existing methodology of using the family allowance migration of children to estimate total migration. The main weakness of the current method is considered to be the specification of the multiplier used to estimate the numbers of adult migrants from those of child migrants. Currently the multipliers are allowed to vary only by the province of origin. But it has been recently demonstrated that the multipliers also vary markedly by province of destination, and that if such a modification were made improvements to the closure errors would ensue. Similarly, improvements are thought likely if a more up-to-date source for deriving the multipliers could be found. The multipliers are now estimated from census data, reflecting moves that occurred on average five years in the past. Other more current sources of estimating the multipliers are the tax migration data discussed above and possibly the monthly Labour Force Survey.

To investigate the impact of alternative specifications of the multipliers, estimates of interprovincial migration have been simulated for the period 1976-81. These estimates have then been used to derive alternative estimates of the provincial populations for June 1981. By com-

paring these alternative estimates to the 1981 census counts one obtains some indication of the sensitivity of the estimates to the specification of the multipliers.

Table 4 shows the results for a number of comparisons using alternative estimates of interprovincial migration. The variant estimates are:

(1) the actual post-censal estimates incorporating estimates of interprovincial migration produced as outlined in section 2;

(2) estimates where the interprovincial migration component is produced using multipliers that vary by origin and destination and that are derived from the most recent census data - in this case the 1976 census;

(3) estimates produced by using origin - destination - specific multipliers derived from tax migration data, but with the multipliers lagged by two years, (e.g., the multipliers for 1978-79 are used to produce estimates for 1980-81). Note that both variants (2) and (3) could be operationalized to produce timely preliminary estimates. In addition, two other variants were considered that could be used as revised estimates involving a time lag of 18-24 months. These are:

(4) estimates derived directly from tax data; and

(5) estimates produced by using origin - destination - specific multipliers derived from tax migration data but without any time lag. For the latter two alternatives, final taxation data are only available for four years 1976-80 and figures for the year 1980-81 have been indirectly estimated.

The results shown in Table 4 suggest that the estimates of interprovincial migration could be improved by using a multiplier specific for both province of origin and destination. The average deviation with the 1981 census population counts is reduced from 1.5 percent to 0.9 percent using census factors by origin and destination (comparison of variants 1 and 2). An attempt to use more current multipliers from the tax migration data shows a further improvement (average deviation reduced from 0.9 to 0.8 percent), especially for Newfoundland and Alberta where deviations from the census are large (Variant 3).

Variants (4) and (5) show no dramatic improvements over variant (3) although there is some indication that variant (4), the direct use of the tax migration estimates, may minimize extreme errors. Furthermore, for both of these alternatives final data for the entire intercensal period are not yet available and any final conclusions on the merits of using one approach or another must await further analysis. A particular issue here will be the necessity for provisional estimates of interprovincial migration to be revised using alternative methods like those outlined by variants (4) and (5).

Recent work on the development of administrative records has also yielded new data on emigration from Canada. It is now possible to obtain data on the emigration of children from the family allowance records. Tax records also provide limited data on emigration. Preliminary evaluations indicate that direct estimates from tax data are probably too low; however, it may be possible to combine data on 'family allowance' children with multipliers from tax data to produce improved estimates of emigration. At a minimum the new data sources should allow for some improvements in the distribution of emigrants by province.

A first attempt to use the family allowance data to distribute emigrants by province was inconclusive. Data on emigrants by province from the family allowance records are available for two years 1978-80, and these were used to distribute the emigrants for the period 1976-81. These estimates of emigration were then used together with the variants of interprovincial migration (presented in Table 4, and described above) to produce estimates of population for 1981. The comparison of these estimates to the 1981 Census population counts is given in Table 5.

Contrasting the relative differences in Table 5 to those in Table 4 indicate mixed results. Overall, there appears to be no clear evidence that the distribution of emigrants from family allowance records leads to better population estimates. However at this point the possible use of family allowance data for emigration has not been abandoned since data for the entire 1976-81 period were not available, and further work and compari-

TABLE 4: Relative Differences between the 1981 Census Population Counts and the Simulated Population Estimates for June 1981 Based on Varying Assumptions of Net Interprovincial Migration

(Percentages)

Province	Variant (see text)				
	1	2	3	4	5.
Newfoundland	3.08	2.50	1.46	1.03	1.67
Prince Edward Island	1.47	-0.39	0.88	-0.79	0.17
Nova Scotia	1.13	-0.07	0.09	0.29	0.13
New Brunswick	2.04	0.39	0.29	-0.07	0.09
Québec	-1.51	-1.37	-1.50	-1.51	-1.30
Ontario	0.01	0.05	-0.19	0.00	-0.30
Manitoba	0.46	-0.31	0.75	1.05	0.51
Saskatchewan	1.24	0.51	-0.74	-0.68	-0.34
Alberta	-3.34	-3.60	-1.94	-1.54	-1.54
British Columbia	-1.11	0.01	-0.18	-0.78	-0.65
Average Absolute Relative Difference	1.54	0.92	0.80	0.77	0.67

TABLE 5: Relative Differences between the 1981 Census Population
Counts and the Simulated Population Estimates for June 1981
Based on Varying Assumptions of Net Interprovincial
Migration and Alternative Assumptions for Emigration

(Percentage)

Province	Variant (see text)				
	1	2	3	4	5
Newfoundland	3.22	2.64	1.60	1.17	1.81
Prince Edward Island	1.42	-0.44	0.84	-0.84	0.12
Nova Scotia	0.96	-0.24	0.08	0.12	-0.03
New Brunswick	1.57	-0.08	0.28	-0.54	-0.39
Québec	-0.81	-0.67	-0.80	-0.81	-0.60
Ontario	-0.21	-0.17	-0.41	-0.22	-0.51
Manitoba	-0.30	-1.07	0.01	0.29	-0.25
Saskatchewan	1.22	0.49	-0.72	-0.70	-0.32
Alberta	-4.47	-4.73	-3.07	-2.67	-2.68
British Columbia	-0.72	0.40	0.21	-0.39	-0.26
Average Absolute Relative Difference	1.49	1.09	0.80	0.78	0.70

NOTE: See Table 2.

sons are required. Actually the situation is far more complex than the above anlysis implies. The existing errors in the interprovincial migration estimates may be distorting any actual improvements to the distribution of emigrants when assessed in terms of "closure errors." This issue will be discussed later.

Census Division Estimates

Much of the recent work on the development of administrative records for statistical purposes has been directed at the production of sub-provincial data. As mentioned above, tax records have been used to estimate migration flows by origin and destination at the census division level. Annual migration estimates have been produced and these data have in turn been used to derive post-censal population estimates via a component method for each of the intercensal periods 1966-71, 1971-76 and 1976-81 (in the latter case the estimates for 1980 were extrapolated to 1981). To assess the quality of these estimates the data for 1971, 1976 and 1981 were compared to the corresponding census population counts. The results are summarized in Table 6.

The average deviation between the tax estimates and the census was 2.7 percent in 1971, 2.3 percent in 1976 and 2.0 percent in 1981. This improvement probably reflects refinements that have been made to the methodology over time. The tax estimates also compare favourably with the existing post-censal estimates (see Table 2). The average deviations of the existing post-censal estimates were 4.2 percent in 1971 and 3.9 percent in 1976, compared to 2.7 and 2.3 for the tax estimates respectively. Comparisons show the tax estimates are generally superior for most provinces and census divisions of all sizes.

Although the tax migration data are promising from an accuracy point of view, there still remains the two year time lag. More timely estimates are needed at least on a preliminary basis. To address this, a number of new methods are being tested (see Verma, 1982). These include ratio correlation, difference correlation and proportional allocation methods. These methods

are attempting to estimate population based on indicators of change such as births, deaths, counts of children from the family allowance file and migration data from tax records. At this time no test results from these methods are available. If the test results are satisfactory these new procedures could also be developed to produce estimates for other sub-provincial area systems such as CMAs, census subdivisions, etc.

DISCUSSION

With respect to the post-censal population estimation program, the established practice within Statistics Canada is to conduct an evaluation once the population counts from the latest census are known. The recent availability of the 1981 Census population counts represents no exception. Early indications, as outlined above, are that changes will be made to the provincial and sub-provincial estimation procedures, and that these changes will be significant in relation to those adopted on previous occasions. Although further analyses are still being conducted, taxation records seem likely to play an important role in providing an internally consistent series of migration data for standard (and to some extent non-standard) geostatistical areas. The integration of the tax-based information into the ongoing population estimation program - either directly, in the form of multipliers, or in some other fashion - will depend on attempts to overcome its tardiness, a demonstration of its compatibility with other "recognized" datasets, and on decisions taken regarding the necessity for revisions to be made to preliminary migration estimates not involving this source. It is true to say that the current evaluation is less superficial than five years ago with far more attention being paid to the consequences of the assumptions inherent in the methodology, and to the nature of the migration flows being measured. Sensitivity analyses, in particular, are the order of the day.

Statistics Canada is also faced with an apparent abundance of migration datasets - for example, those derived from family allowance, taxa-

TABLE 6: Relative Differences between the 1981 Census Population Counts and the Population Estimates
Based on Migration Estimates from Tax Records by Size of Census Divisions, 1971, 1976, 1981

Population size of census division	1971		1976		1981 (Provisional)	
	Number of census divisions #	Average absolute relative difference (percentage)	Number of census divisions #	Average absolute relative difference (percentage)	Number of census divisions #	Average absolute relative difference (percentage)
0 - 19,999	35	3.51	31	2.37	43	3.37
20,000 - 49,999	102	3.04	90	2.64	103	2.04
50,000 - 99,999	51	2.46	50	2.27	63	1.58
100,000 or higher	42	1.69	40	1.41	51	1.45
All	231	2.73	211	2.28	260	2.03

NOTE: See Table 2.
It was not possible to make comparisons for all census divisions because of boundary changes [3].

tion and census records. On the one hand multiple datasets provide the analyst with increased flexibility to validate individual datasets and decide which one is the most appropriate for the work at hand. On the other hand users may become confused with so many estimates of migration flows. Resolution of this apparent dilemma would seem to rest with providing thorough descriptions of the concepts, sources, methodology, limitations of each of the series, i.e., a 'route-map' linking the various data series. While considerable success has been achieved in developing the potential of the above-mentioned administrative systems, the necessary relational framework has yet to be established. Such a framework would provide the expected relationships between five-year moves (census-based), one-year moves (taxation-based) and quasi-monthly moves (family allowance-based); and some indication of the importance of 'return' and 'chain' migration. Sample linkages between the various datasets remain a means by which the framework could be established, but they are known to be time-consuming and costly; and record linkage remains a sensitive issue. Rather an attempt is being made to use the August 1982 supplement to the monthly Canadian Labour Force Survey to obtain representative provincial information on the nature of migration within Canada. This is to be an extended follow-on to an earlier supplement, carried out in conjunction with other sponsors from various arms of government, to obtain further information on the economic and social characteristics of recent migrants[4]. The August supplement will also provide a migration history (covering all interprovincial moves of at least one month's duration) spanning the period since the 1976 census for all adults aged 15 and over normally interviewed in the survey, and for any associated children. From the history, for example, grossed-up estimates of the number of interprovincial five-year migrants - that is, those living in a different province in June 1981 to that stated for June 1976 - will be derived, thereby facilitating a comparison with 1981 Census mobility data and hopefully a secure basis for the development of the relational framework.

Because of the lack of a relational framework, and hence the means of independently assessing the validity/accuracy/biases of the available datasets, and the high number of possible revisions to the existing methodologies, it is proving difficult to articulate the various practical options. At the present time, the likelihood of any particular revisions being adopted for the 1981-86 period is based on their simulated performance over the previous intercensal period within the total population estimation procedure. This performance is being measured in terms of the resultant levels of 'closure errors' (that is, the differences between the final 1981 Census population counts and the June 1981 population estimates). It is possible, though not necessarily probable, that with this approach some revisions to the international and sub-national migration components might lead to low, acceptable closure errors but at the expense of the accuracy of the component estimates. Without due care, an overriding concern with closure error levels could detract from an equally important need to strive for accurate components. Put another way, low closure errors are a necessary but not sufficient consequence of accurate components of population change. In contrast, the endeavour to obtain the 'best' component estimates in the prevailing circumstances could lead to higher closure errors, as the example of the revisions to the emigration component illustrates in Table 5.

The assessment of what is regarded as an acceptable pattern and level of closure errors is further complicated by the relative extent of under-enumeration between the 1976 and 1981 Censuses. For the Canadian provinces as a whole the estimated rate of census undercoverage decreased from 2.6 percent in 1966 to about 2 percent in 1971, this latter level being maintained in 1976. Provincial trends have varied: some provinces have shown a steady decline in the rate while others have fluctuated or stayed relatively contant at a high level. The expectations for the 1981 census are that the undercoverage estimates, due in the fall of 1982, will be generally lower than in 1976, but that the changes will not be significant enough to delay or influence significantly the evaluation work discussed above.

ACKNOWLEDGMENTS

Statistics Canada, who were of invaluable assistance in the development of the simulation work outlined in this paper. Thanks are also due to Marcelle Forrest who patiently interpreted the hieroglyphics and typed the paper.

FOOTNOTES

[1] The standard census question on five-year mobility (place of residence five years ago) is the source for the derivation of the child to adult multiplier. Since the data are based on age at the census and not age at time of migration a number of assumptions are made. Adjustments are also required for the population aged 0-4 for whom the census question does not apply. Note that while the census question relates to five-year mobility prior to the census the derived multiplier is used in practice to estimate annual migration during the following intercensal period. The significance of this practice is currently under investigation.

[2] The differences between the post-censal estimates and the census counts (errors of closure) are only an approximate measure of the quality of the estimates. In addition to reflecting errors in the estimates, the error of closure reflects any change in the level of underenumeration from one census to the next. In Canada, census undercoverage has been decreasing over time although the changes have not been dramatic from one census to the next. Therefore, in most cases the error of closure is thought to be a reasonable indication of the error in the estimates. An exception to this may be the Yukon and Northwest Territories where the extent of underenumeration is unknown but probably more variable. Because of the potential impact of changing underenumeration and possible inadequacies with the component data sources the population estimates for the territories are not considered in this paper.

[3] There were 260 census divisions in 1981 that covered the provinces within Canada. The corresponding figures for 1971 and 1976 were 224 and 255 respectively. In some provinces these correspond to counties while in others they are artifically created statistical entities. There are 23 census metropolitan areas (1976 boundaries) each having a population of at least 100,000.

[4] In December 1980 a Labour Force Survey supplement was undertaken for the provinces of Alberta and British Columbia. It related solely to those provinces and sought information on the characteristics of migrants but only in relation to their most recent move. The results of the study are given in Statistics Canada (1982).

REFERENCES

Basavarajappa, K.G., Britton, M., Verma, R., Raby, R. and Romaniuc, A., 1981. "A Comparison of Preliminary Census Counts and Preliminary Post-censal Estimates, 1981, Canada, Provinces and Territories." Unpublished Working Paper, Demography Division, Statistics Canada.

Britton, M., 1981. "An Investigation into the Methodology for Deriving Post-censal Interprovincial Migration Estimates." Unpublished Working Paper, Demography Division, Statistics Canada.

Kasahara, Y., 1963. "The Flow of Migration Among the Provinces in Canada, 1951-1961." In Canadian Political Science Association, Conferences on Statistics, 1961, Toronto, Ontario: University of Toronto Press, pp. 20-48.

Norris, D., 1982. "New Sources of Canadian Small Area Migration Data." Paper presented at the International Conference on Forecasting Regional Population Change and its Economic Determinants and Consequences, Airlie House, Virigina, May 1982.

Statistics Canada, 1969. Population Estimates for Census Divisions. Catalogue 91-206. Ottawa: The Queen's Printer.

Statistics Canada, 1979. Estimates of Population for the Census Metropolitan Areas of Canada as of June 1, 1978. Catalogue 91-207. Ottawa: Supply and Services Canada.

Statistics Canada, 1980a. International and Interprovincial Migration in Canada, 1978-79. Catalogue 91-208. Ottawa: Supply and Services Canada.

Statistics Canada, 1980b. Estimates of Population for Canada and the Provinces. Catalogue 91-201. Ottawa: Supply and Services Canada.

Statistics Canada, 1982. "Characteristics of Migrants to Alberta and British Columbia: 1976-1980." In The Labour Force Catalogue 71-001 (February) pp.81-114. Ottawa: Supply and Services Canada.

Verma, R. and Basavarajappa, K.G., 1982. "Subprovincial Estimation of the Population in Canada: A Review of Estimation Methods and Prospects for Development". To be presented at the Population and Family Planning Session, American Public Health Association Meeting to be held in Montreal, November 1982.