Canadian Studies in Population, Vol. 10, 1983, pp. 85-97

RESEARCH NOTES

TOWARD ACHIEVING NUMERICAL AND METHODOLOGICAL CONSISTENCY IN DEVELOPING NATIONAL AND PROVINCIAL PROJECTIONS: CANADA'S EXPERIENCE

M.V. George
Statistics Canada, Ottawa, Ontario, Canada

Résumé — Les agences gouvernementales et non-gouvernementales ont utilisé des projections de population nationales et sous-nationales comme base afin de planifier et de développer d'autres projections dérivées. Lorsque ces projections sont préparées par différentes agences, un des principaux problèmes du point de vue des usagers est le manque de consistance numérique et méthodologique entre les projections nationales et sous-nationales. Cette étude discute les problèmes qui découlent du manque de coordination dans la production et l'usage des projections et présente l'expérience de Statistique Canada dans l'accomplissement de la consistance numérique et méthodologique en développant des projections nationales et provinciales. Avant que Statistique Canada ait commencé à développer des projections de population nationales et provinciales officielles, un nombre de départements du gouvernement fédéral avaient l'habitude de préparer de telles projections ou utilisaient des projections produites par les gouvernements provinciaux pour leurs propres usages spéciaux et qui variaient en sophistication technique, méthodes appliquées, périodes de temps considérées et en présomptions de base. C'étaient des projections rarement comparables. La méthodologie et les procédures utilisées par Statistique Canada pour développer les projections de population de 1974 et de 1979 pour le Canada et les provinces sont aussi décrites pour illustrer le processus de consistance et de comparaison entre les projections nationales et provinciales.

Abstract — National and subnational population projections are used by government and nongovernment agencies as a base for planning purposes and for developing other derived projections. When these projections are prepared by different agencies, one of the main problems from the point of view of the user is the lack of numerical and methodological consistency between national and subnational projections. This paper discusses the problems consequent to lack of co-ordination in the production and use of projections and presents Statistics Canada's experience in achieving numerical and methodologial consistency in developing national and provincial projections. Before Statistics Canada started developing official national and provincial projections of population, a number of federal government departments used to prepare such projections or make use of projections produced by the provincial governments for their own special purposes which varied in technical sophistication, methods applied, time periods considered and underlying assumptions; these were seldom comparable. The methodology and procedures employed for developing Statistics Canada's 1974 and 1979 population projections for Canada and the provinces are also described to illustrate the process of consistency and comparability between national and provincial projections.

Key Words — **projections, consistency, integration, components**

Introduction

In countries with a federal system of government, there is a growing realization of the need for standardization of national and subnational projections which are generally used by the federal agencies to distribute federal funds and for regional development planning. As an in-

itial effort to achieve some degree of standardization and to provide population projections for a variety of purposes relating to social and economic planning, the federal statistical agencies of such countries have started to prepare and publish national and subnational projections on a continuing basis at regular intervals. The use of population projections from different sources for the same geographic areas can lead to substantial amounts of "overfunding." A specific example of such overfunding is provided in a recent study based on the experience of the United States Environmental Protection Agency, which collected state-generated population projections for use in allocating sewage treatment construction grants. These projections summed to a population far in excess of the projected American population for 1990, even under the highest fertility model. The building of sewage facilities based on such a nonuniform set of projections would lead to excess capacity in many areas and the waste of billions of dollars (Griffith, 1980).

This paper discusses problems consequent to lack of co-ordination in the production and use of projections and presents Statistics Canada's experience in achieving numerical and methodological consistency in developing national and provincial projections. The methodology and procedures adopted for preparing the 1974 and 1979 population projections for Canada and the provinces (Statistics Canada, 1974, 1979) are described to illustrate the process of consistency.

Judging from the considerations of geographic units, three broad groups of users of population projections can be identified in Canada: those who need (1) national projections only; (2) both the national projections and their breakdown by region, province and county; and (3) projections for specific geographic areas only. It is relatively easy to satisfy the first group because the demographic growth components to be taken into account are fewer in number, and the most problematic component — internal migration — does not appear in the growth equation. The population projections developed for Canada by Statistics Canada in 1969 and its programme to develop and publish, on a continuing basis, demographic projections at the national level marked the beginning of meeting the requirements of the first type of user.

Statistics Canada's projection programme was subsequently expanded to include provincial projections. The first sets of official population projections for Canada and the provinces were published in 1974. They were revised in 1979, based on 1976 census results. These projections and the household and family projections which followed for Canada and the provinces could meet the basic needs of the second type of user. They were also an important step in reaching the goal of numerical and methodological consistency in the development of national and provincial projections.

Before Statistics Canada started preparing official national and provincial projections of population, a number of federal government departments used to prepare such projections or used projections which were produced by the provincial governments for their own special purposes. Those projections varied in technical sophistication, methods applied, time periods considered and underlying assumptions, and they were seldom comparable. Subnational projections prepared by provincial or local agencies are generally done in isolation, without taking into consideration the aggregate consistency for the geographic areas together in terms of component assumptions and results.

Basic Approaches in Meeting User Needs for National and Subnational Projections

It is more difficult to satisfy the user needs for both the national and subnational projections than for national projections only. This is because the work and procedures involved in developing standardized sets of national and subnational projections are quite complex. Two

commonly used basic methods can be identified for making regional population projections by age and sex. They are (1) the ratio method applied on a period or cohort basis and (2) the cohort-component method.

Ratio Method

The ratio method essentially involves projecting the proportion or ratio which a given geographic area constitutes of some large area — usually the nation as a whole — and applying this projected proportion to an independently derived projected population for the larger area. The projection of ratios by age and sex and their application may be made either on a period basis or on a cohort basis. For the projection of the ratios, the proportions for the past years may be held constant at the last observed level or extrapolated by graphical or suitable mathematical curves. The sums of the regional projections by age and sex prepared by a ratio method would not normally correspond with the projected totals for the larger area or for the country as a whole. The consistency between the total regional figures and the national totals is achieved by proportionate adjustments of the figures for all areas — at each age and sex — to the corresponding national totals. In Canada, a cohort ratio method was used by Statistics Canada to prepare provincial projections by age and sex on the basis of the 1969 national population projections. This procedure was replaced by a component method for the subsequent projections.

Although the ratio method is rather simple to apply when preparing subnational projections and permits rapid revisions as revised national projections become available, it is a mechanical procedure depending heavily on past trends. It also fails to take explicit and detailed account of the differentials and prospective trends in each of the components of population growth and distribution. This is especially true of changes in internal migration — the chief component contributing to the redistribution of population — which are heavily influenced by current and prospective economic developments. There is no direct or practical way in the ratio method of projection to take into consideration the prospective economic developments which are likely to affect the internal mobility of the population (Shryock and Siegel, 1971:794).

Because of these limitations, the ratio method does not satisfy the users of subnational projections who prefer projections developed on a component method, taking into consideration specific regional variations in the socio-economic and geographic factors which are likely to influence future growth of population of the area concerned. However, the ratio method is a practical and simple procedure to easily achieve consistency between national and subnational projections.

Cohort-Component Method

The cohort-component method is the most preferred analytical method for preparing subnational projections, since it attempts to take explicit account of the components of change based on the knowledge of factors that influence them in each area and provide more realistic and detailed projection results. The component method is, however, not superior to ratio method in producing regional projections that correspond with national projections. This is because different agencies generally prepare either national or subnational projections without any attempt to acheive consistency between the two levels of projections.

In Canada before Statistics Canada started preparing and publishing national and provincial projections simultaneously, the component method provincial projections developed by provincial governments and private agencies for their own particular needs did not correspond with existing national projections. The aggregate totals of the provincial projections prepared

by independent agencies did not tally with the national totals of Statistics Canada, and they varied in the base year, methodology and time periods used. They also presented some theoretical inconsistencies, particularly in the projection of interprovincial migration. For example, unless the same agency prepares national and provincial projections, the assumed levels of interprovincial net migration under different provincial series may not balance to zero for the country as a whole. This is because each provincial authority is concerned only about its respective resident population and has the tendency to inflate the population by assuming a migration gain for the future. In order to ensure that net interprovincial migration for the country as a whole balances to zero, one has to consider the in- and out-flows for all the provinces and not each province in isolation.

A Regional Component Approach for Achieving Integration, Consistency and Comparability

In view of the problems in achieving consistency and comparability between national and provincial projections when they are prepared by different agencies and for serving the users of both national and provincial projections more satisfactorily, Statistics Canada adopted a regional component approach with the 1971 census-based projections. (The term "region" is used here in a generic sense to refer to a province or a group of provinces, such as the Atlantic Region, or to economic/geographic subdivisions of the country.) There are two basic steps in this approach. First, separate analysis and projection of each component of population growth — fertility, mortality and migration (interprovincial and international) — are made by using appropriate demographic parameters. These parameters, generally in the form of rates and ratios, are then applied to the population of a base year to obtain separately the future population by age and sex for each province and territory. Second, the national projections are derived by aggregating the projections for provinces and territories.

Thus, $$P_{t+\Delta t} = \sum_{i=1}^{12} (P_{i,t} + B_{i,\Delta t} - D_{i,\Delta t} + I_{i,\Delta t} - E_{i,\Delta t} + I_{i,\Delta t} - 0_{i,\Delta t})$$

where $P_{t+\Delta t}$ = national population at the end of the time interval Δt;
$P_{i,t}$ = the population of province i at time t;
$B_{i,\Delta t}$ = the number of births in i during the time interval Δt;
$D_{i,\Delta t}$ = the number of deaths in i during the time interval Δt;
$I_{i,\Delta t}$ = the number of immigrants in i during the time interval Δt;
$E_{i,\Delta t}$ = the number of emigrants in i during the time interval Δt;
$I_{i,\Delta t}$ = the number of in-migrants in i during the time interval Δt;
and $0_{i,\Delta t}$ = the number of out-migrants in i during the time interval Δt.

It should be noted that the above formula is applied on a cohort basis for each sex by single years of age. Thus, the procedure yields future population by single years of age and sex for Canada and each province and territory. Since the projections are developed for each single year of age, the results are available for each year of the projection period.

From the point of view of methodology and for meeting users' requirements for national and provincial projections more satisfactorily, the regional component approach adopted by

Statistics Canada has a number of advantages over other methods used for developing both national and subnational projections.[1]

First, the use of this approach in preparing national and provincial population projections at regular intervals has been a major step for achieving integration, consistency and comparability in the development and use of national and provincial projections for Canada. Second, since the same agency prepares provincial and national projections using this procedure, it ensures a unified methodological approach in terms of data used and methods employed. Third, it contributes to the quality of projection results, since the regional approach attempts to take into account the socio-economic and demographic factors influencing the prospective changes in each component of population growth for each province.

The user's degree of faith in the projection results generally depends upon their agreement with the underlying assumptions, methodology and consistency between projections at different geographical levels. In order to improve the quality of projections and to make them more acceptable to the users, Statistics Canada also consults with the federal and provincial government departments and academic experts on the methods, assumptions and inputs on each component in the projection model. An important outcome of these consultations is greater integration in projection work and consequent reduction in the proliferation of projections by the main users, especially federal government agencies.

Projections of Demographic Components and Integration of Results

Development of national and provincial projections by the regional component method as outlined above involves five basic steps: (1) development of suitable algorithms as an integral part of the projection model; (2) analytical and methodological studies relating to the trends and patterns in each of the population components — fertility, mortality, international migration (immigration and emigration) and interprovincial migration (in- and out-migration); (3) establishment of a base population and setting up of the assumptions on each components; (4) integration of the assumptions into a computer programme for projections by age and sex up to the time span stipulated for each province and territory; and (5) evaluation of projection results to judge their quality in terms of consistency, possible errors and acceptability by users and selection of a reasonable number of projection scenarios. Of these basic steps, the most difficult is the setting up of assumptions on future trends in the components of growth and then to effect their integration within the framework of the overall methodology adopted. The more distant the future, the more difficult is the task of determining realistic assumptions on the future course of the components of growth. The method(s) used for this purpose should have the properties of operational simplicity and analytical advantage for meaningful interpretation of the results.

Mortality Projections

The prerequisite of population projections is a schedule of survivorship probabilities at different ages (S_x values). Projected survival ratios by single year of age and sex for provinces and territories were applied in preparing the 1971 census-based and 1976 census-based national and provincial projections. However, the analyses of mortality trends and differentials for Canada and the provinces, which formed the basis of mortality projections, were made using the age-specific death rates (m_x).

Two steps are involved in developing the mortality projections. First, based on the results of a detailed analysis of disease-specific death rates for Canada and paying special attention to accident mortality, age-sex specific death rates were projected for Canada as a whole. These were then used for constructing life tables for Canada for future years. In the second step, a

ratio method was adopted to obtain projected mortality values for the provinces. The ratio method was considered practical for taking into account the differential mortality among the provinces. After a detailed analysis of provincial life tables for the past several years, ratios of life expectancy for each province to that of Canada in the most recent period were calculated. The projected expectation of life at birth for provinces were obtained by applying these ratios for each province to the projected expectation of life at birth for Canada. S_x values for the provinces, which are required for projection of population, were estimated on the basis of the correspondence between projected values of provincial life expectancy at birth and national life table values. Using the latest life tables of the provinces and the projected national life tables, the S_x values pertaining to projected e_0^o values of the provinces were estimated by linear interpolation (for details see Gnanasekaran, 1975:121).

Fertility Projections

As noted earlier, for the regional component method the annual number of births for each province and territory must be projected for each year of the projection period. The projection of births consists basically of applying age-specific fertility rates to the female population of childbearing age.

For the 1976 census-based projections, Statistics Canada used the fertility index of period age-specific fertility schedule. To simplify the projection of each age-specific fertility rate, a parametric model was used to derive projected age-specific fertility rates. Thus, the projected single-year age-specific fertility rates were obtained using three indices: the total fertility rate, which measures the level of fertility, and the mean and modal ages of fertility, which measure the timing of births (for details, see Romaniuc, 1975a).

Two basic approaches can be considered practicable for projection of fertility at the provincial level. In the first approach, projections are made at the national level, and indices of fertility for the provinces are derived based on a ratio method (e.g., province/Canada ratio). In the second approach, fertility indices are projected for each province, and the indices at the national level are derived by aggregating the provincial results. Since the latter approach is more meaningful and efficient at taking into account the factors affecting fertility variations and differentials at the regional level, this was adopted for the 1976 census-based Statistics Canada projections.

For the purpose of taking into consideration provincial variations, four groups of provinces were identified based on similarities in the observed trends and levels of fertility. These were those (1) with fertility levels below or almost equal to the national average, (2) with fertility close to replacement level (2.1 children per woman), (3) with high fertility but with relatively quick declines and (4) the two territories which alone have very high fertility level compared with the provinces, but show a fast rate of decline. In general, it was observed that the fertility levels in the provinces were converging. On the basis of the trends and patterns of fertility in the four groups of provinces/territories, two assumptions were made: a high assumption in which fertility will be increasing and reaching the replacement level, and a low assumption in which fertility will be declining and reaching 1.7 children per woman by 1991 (for details, see Lavoie, 1978).

Projections of International Migration

An analytical method is suitable in many situations for projection of international migration. This method rests upon the examination of trends and patterns of migration in a historical perspective and their extrapolation into the future. Such a procedure was adopted for Statistics Canada projections.

Within the general framework of an analytical approach, several strategies can be adopted, depending upon the data available. Based on the level of average immigration and emigration for several periods in the past, four assumptions on the volume of annual immigration and one assumption on emigration were made for Canada as a whole in the 1976 census-based Statistics Canada projections. The assumptions were based on absolute numbers of annual immigration and emigration and not rates, as in the case of interprovincial migration.

For the purpose of distributing the total immigrants by province, only one assumption was made. In the absence of clear-cut trends in the share of immigrants by province, the average provincial share of total immigrants for the most recent period 1975-78 was used to distribute the assumed national totals by the provinces and territories. The projected numbers of immigrants thus obtained for each province were then distributed by age and sex on the basis of the national average age-sex distributions of immigrants for the most recent three years (for details, see Norris and Perreault, 1979).

One single assumption was made for the projection of total emigration. The projected total number of emigrants for Canada was distributed by province of origin, age and sex mainly on the basis of the corresponding average distributions of emigrants from Canada to the United States for the most recent three years (for details see Norris and Perrault, 1979).

Projections of Interprovincial Migration

Although fertility is the most important component of population growth for Canada and for most of the provinces, interprovincial migration is the dominant factor of growth for some of the provinces and is the most problematic component in developing provincial projections.[2] There have been considerable fluctuations in the past trends of interprovincial migration, and the complexities involved in explaining these trends make it difficult to formulate assumptions for the future. One widely adopted strategy in such situations is to make a range of alternative assumptions based on average levels over various periods of time. For the 1976 census-based projections, the strategy adopted was to generate a series of four assumptions which take into account both "favourable" and "unfavourable" patterns of migration for each province (for details, see Norris and Perrault, 1979).

Unlike the projections of international migration, the assumptions on the levels of interprovincial migration were made in the form of rates, as opposed to the absolute number of migrants. The use of rates makes it possible to explicitly relate migration to the population at risk of migrating. A similar procedure was adopted by the American Bureau of the Census for making state population projections (U.S.A. Bureau of the Census, 1979). The method uses age-sex specific out-migration rates for each province, and by applying these to the base population, one derives the total number of out-migrants in each age-sex group for the projection period. The out-migrants from each province are then pooled into national age-sex specific groups. These are then allocated back to the provinces as in-migrants by using an assumed proportional distribution (Norris and Perrault, 1979).

The age-sex specific in- and out-migration rates were developed in two stages. First, on the basis of the annual estimates of total in- and out-migration, assumptions for the total out-migration rates and in-migration proportions were developed. Second, using the age data of interprovincial migrants from the census, the age-sex specific rates and proportions corresponding to the specified migration totals were then derived.

Integration and Evaluation of Provincial Projections

The demographic projections of each of the components of growth for each province (as discussed in the preceding sections) and their integration to generate the provincial and na-

tional population projections are made using a sophisticated projection model which has considerable flexibility.[3] The flow chart presented below illustrates, in a systematic manner, the various projection blocks and stages which lead to the final product.

The combination of the various assumptions on components of population growth leads to several series of projections at the provincial and national levels. For example, the latest Statistics Canada projections (based on the 1976 Census results) had one mortality, two fertility, four international and four interprovincial migration assumptions. Combination of these assumptions leads to numerous population projection scenarios for the provinces and Canada, which can be quite confusing from the user's point of view. There is no simple rule or principle for the selection and integration of the appropriate projection series. (The term "integration" here refers to both the combination of various assumptions to yield a reasonable number of projection series and the aggregation of the provincial/regional projections to obtain a national series.) The projection results from various combinations of assumptions have to be evaluated for numerical consistency and feasibility in terms of past and expected trends before integration. Statistics Canada's projection programme includes a number of selected evaluation tests on the basis of several indicies such as projected growth rates, birth rates, death rates, sex ratios and percentage distributions of crucial age groups. On the basis of the evaluation tests, five projection series have been selected.

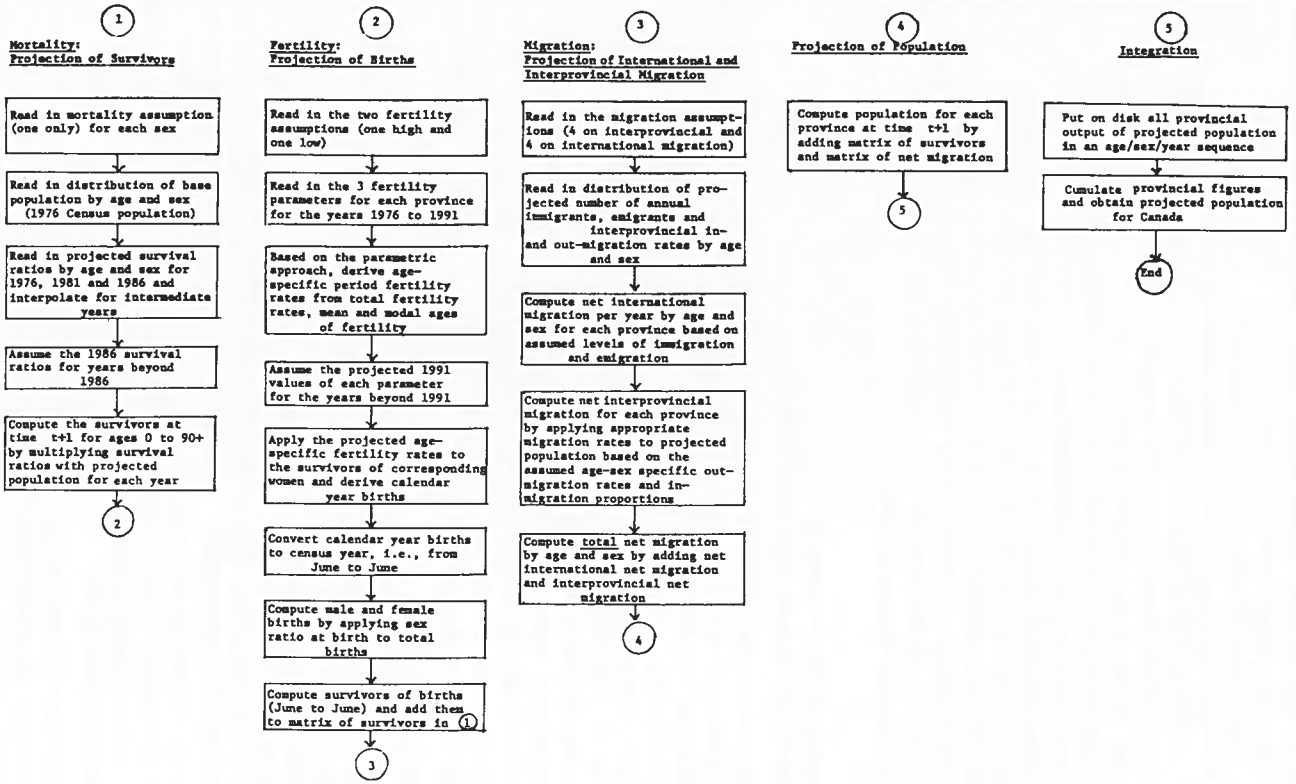
Although the analyst's judgment of the likely course of future change plays an important role in the selection of appropriate projection series, the main consideration is the possibility of offering the user a fairly wide choice of assumptions regarding the future course of population changes. The selected series are intended to encompass the upper and lower bounds of future populations during the projection period. In view of the high uncertainties in predicting the crucial components of fertility and migration, Statistics Canada does not recommend any one series as the "best" or "preferred" series. It should be noted that since a reasonable number of projection series are offered without designating a "preferred" series, the "accuracy of projections," in the statistical sense, is less meaningful in the selection and integration of national and provincial projections. However, as pointed out by Shryock and Siegel (1971:806), the projection "error" rate, whatever the index of measurement used, tends to vary directly with the rate of population growth and with the length of the projection period. Similarly, the "error" rate is likely to be greater for subnational areas than for the country as a whole. These considerations have influenced Statistics Canada's policy of revising population projections for Canada and the provinces at periodic intervals.

Achieving Consistency in the Development of Various Derived Projections

There are several types of projections relating to selected socio-economic characteristics of the population which are generally derived from the projected populations at the national and subnational levels. Examples of such "derived" projections include projections of households and families, labour force and school enrolment. These projections are generally derived from already existing sets of population projections by age and sex. The methods generally applied to obtain the derived projections of households or labour force, for example, involve projection of specific headship rates or participation rates and applying them to the corresponding projected populations. If such projections are prepared using the existing most recent national and regional population projections and employing a uniform approach and methodology, consistency of results can be easily achieved.

In an effort to widen the projection work activity in response to user requests and to provide consistent and comparable projection results at the national and provincial levels, Statistics Canada prepares selected "derived" projections. The development of household and family

FIGURE 1. STATISTICS CANADA POPULATION PROJECTIONS MODEL, CANADA AND PROVINCES



* The projection model illustrated is for the 1976 Census-based population projections for Canada and the provinces. The computation process is carried out for one province and one set of assumptions at a time. The computation of various demographic indices and other related features of the model are not shown here.

projections, following the preparation of the population projections at regular intervals, is intended to achieve this objective. Two generations of household and family projections for Canada and the provinces have already been prepared, based on 1971 and 1976 census results and the corresponding population projections, respectively (Statistics Canada, 1975, 1981). As in the case of projecting the population of Canada and the provinces, a regional component approach is adopted for household and family projections. Four basic steps are followed to develop the projections for Canada and the provinces: (1) projection of population 15 years of age and over by marital status based on the age-sex distribution of the latest population projection; (2) projection of age-sex specific headship rates by type (primary family, secondary family and non-family); (3) derivation of projected households and families by applying the headship rates in step 2 to the corresponding projected population by marital status in step 1; and (4) aggregation of the projections of the provinces and territories to obtain the national totals. The projections thus obtained can provide consistent and comparable series of projections for the provinces and the country as a whole. The regional component approach, based on specific headship rates for each province and territory, implicitly takes into account the influence of regional differentials in socio-economic factors on the future formation and dissolution of households and families.

The Emergence of the Computer in the Projection Field and the Feasibility for an Integrated Model

The emergence of the electronic computer in projection work has facilitated achieving numerical consistency in national and subnational projections and in meeting diverse types of user requirements. The increased use of computer technology in data analysis in recent years has considerably increased the scope of projection work in terms of data input and results. The population projection model used by Statistics Canada, for example, is quite elaborate in scope, with the capability of incorporating new time series in the various projection parameters and of generating population by single years of age and sex for each year of the projection period, as well as a number of demographic indices for Canada and the provinces. Computations of this magnitude using clerical manpower and desk calculators would have been a Herculian task. The projection model is also capable of applying various demographic simulations consisting of a wide range of mortality, fertility and migration assumptions.

Furthermore, the model, in its present form, can meet a variety of user requests for "customized" or "tailor made" projections at the national/provincial levels. The requests for customized projections are mainly of two types: first, to provide alternative projections under a different combination of existing assumptions or under new assumptions of the parameters of population growth, and secondly, to prepare "special purpose" projections for either a particular province or for a particular component (for example, births, migration) or for a subgroup of the population, such as marital status projections, projections of the school population and older population. All such user requests can be effectively satisfied with moderate costs because of the increased use of computer in the projection field. Because the provincial and national projections are prepared using an elaborate computer model, it is relatively easier to integrate the results under various combinations of assumptions and to achieve numerical consistency.

Statistics Canada's projection programme aims to expand and redesign the present model so as to develop an integrated projection model for generating a wide variety of projections. Such a model is considered feasible because of the mutual interrelations between demographic factors and the changes occurring in the socio-economic factors affecting the same population. Already using the existing model, it is possible to integrate and balance the projections of

the total population for Canada and the provinces under a combination of assumptions and to generate household and family projections using the same data base. With the development of projections (which are in progress) of other socio-economic characteristics of the population, such as labour force and the rural-urban population, it would be possible to incorporate the various programmes for "derived" projections into the main projection model. Use of the computer renders feasible the development of such an integrated projection model with considerable flexibility. Another advantage of the use of the computer is the flexibility it provides in the presentation of the output – printouts and/or magnetic tapes – and the building of data banks which can serve as input for the development of an integrated comprehensive demographic projection model.

Concluding Remarks

Projections of population and its selected characteristics at the national and subnational levels are required by various types of users for planning purposes. These projections are generally prepared by different government and non-government agencies without coordination. As a result, there is no consistency between projections prepared by different agencies for the same area and projections between national and subnational areas. When projections for various geographic areas are prepared by different agencies without coordination, the sum of the subnational totals often results in totals far in excess of that projected for the nation under any reasonable assumptions of demographic growth.[4] From a user's point of view, it is far more advantageous to draw on one source for projections rather than relying on projections prepared by each provincial/state government agency by different methods, in varying degrees of detail and at different points in time.

This paper discusses Statistics Canada's projection programmes and experience in achieving consistency and integration in the development of projections of population, households and families for Canada and the provinces, using a highly sophisticated regional component model. At regular intervals, Statistics Canada prepares standardized sets of official projections for the country as a whole as well as for the provinces. Because the population, household and family projections for Canada and the provinces are developed by the same agency employing a unified methodological approach in terms of data, methods and time periods, the projection series for Canada and the provinces is consistent and comparable. Thus, Canada has made significant progress in achieving numerical and methodological consistency in the development of national and provincial projections. The projection model used is also capable of generating customized special purpose demographic projections to satisfy a variety of user requests.

Acknowledgments

The author would like to thank M. Britton, J.A. Harrington and J. Perreault for their comments on an earlier draft of this paper and S. Inoue, the organizer of the I.U.S.S.P. Meeting Session (F-27) for his encouragement in preparing it.

Disclaimer

Paper prepared for the session F.27 of the 1981 General Conference of the International Union for the Scientific Study of Population, held in Manila, the Philippines, December 9-16, 1981. The responsibility for the views expressed in this paper is that of the author and not of Statistics Canada.

Footnotes

1. The prevailing policy of Statistics Canada is to prepare and publish revised projections at regular intervals (currently every five years) based on the latest census and other demographic data.
2. The migration phenomenon has certain special problems: (*a*) Unlike fertility, all ages are affected by migration with considerable age selectivity. (*b*) Migratory movements are easily susceptible to socio-economic and political changes. (*c*) Increased migration gain in an area means corresponding migration losses in one or more other areas. (*d*) Migration is often affected by government policies.
3. The Statistics Canada Projection Model is an elaborate demographic model of Canada and the provinces with built-in provisions for incorporating time series changes and new assumptions of the parameters of population growth. The model is flexible enough to rearrange its subroutines easily so as to generate additional data or to input the data in a different form and to change the format of the presentation of output.
4. One possible explanation of higher projections comes from the fact that local authorities put forward a series of policies for their areas and for the projections to assume the success of these policies (see Campbell, 1979:21; see also Griffith, 1980:57, which shows the American experience).

References

Benediksen, B. 1967. Schematized local projections in connection with a population census. In Proceedings of the World Population Conference at Belgrade, 1965, vol. III. New York, New York: United Nations.

Campbell, R. 1979. Population projections: English regions and countries. Population Trends, Office of Population Censuses and Surveys, London. Also, Autumn 1976.

Canada. Statistics Canada. 1974. Population projections for Canada and the provinces, 1972-2001. Catalogue 91-514. Ottawa, Ontario.

_____. 1975. Household and family projections for Canada and the provinces to 2001. Catalogue 91-517. Ottawa, Ontario.

_____. 1979. Population projections for Canada and the provinces, 1976-2001. Catalogue 91-520. Ottawa, Ontario.

_____. 1981. Household and family projections for Canada and the provinces, 1976-2001. Catalogue 91-522. Ottawa, Ontario. (forthcoming).

Gnanasekaran, K.S. 1975. Mortality trends and projections for Canada and the provinces, 1950-1986. Technical Report on Population Projections for Canada and the Provinces, 1972 -2001. Catalogue 91-516. Ottawa, Ontario: Statistics Canada.

_____ and J. Perreault. 1975. International and interprovincial migration projections: Canada and provinces, 1972 to 1986. Technical Report on Population Projections for Canada and the Provinces, 1972-2001. Catalogue 91-516. Ottawa, Ontario: Statistics Canada.

_____ and A. Romaniuc. 1971. DBS population projections for Canada based on 1971 census data: a regional approach. Ottawa, Ontario: Census Division, Statistics Canada (mimeographed).

Griffith, J.E. 1980. Standardizing population projections required in federal fund allocations. Statistical Reporter. Washington, D.C.: U.S.A. Department of Commerce.

Lavoie, Y. 1978. Fertility projections for Canada and the provinces, 1976-1991. Background paper prepared for the 1976 Statistics Canada population projections. Ottawa, Ontario: Demography Division, Statistics Canada (mimeographed).

Norris, D.A. and J. Perreault. 1979. Migration projections for Canada and the provinces, 1976-1991. Background paper prepared for the 1976 Statistics Canada population projections. Ottawa, Ontario: Demography Division, Statistics Canada (mimeographed).

Perreault, J. 1975. Population projections algorithm and model. Technical Report on Population Projections for Canada and the Provinces, 1972-2001. Catalogue 91-516. Ottawa, Ontario: Statistics Canada.

Romaniuc, A. 1975a. A three parameter model for birth projections. Technical Report on Population Projections for Canada and the Provinces, 1972-2001. Catalogue 91-516. Ottawa, Ontario: Statistics Canada.

_____. 1975b. Fertility projections for Canada, 1971-1986. Technical Report on Population Projections for Canada and the Provinces, 1972-2001. Catalogue 91-516. Ottawa, Ontario: Statistics Canada.

Shryock, H.S. and J.S. Siegel. 1971. The Methods and Materials of Demography. Vol. 2. U.S. Bureau of the Census. Washington, D.C.: U.S. Government Printing Office.

U.S.A. Bureau of the Census. 1979. Illustrative projections of state populations by age, rate, and sex, 1975 to 2000. Current Population Reports, series P-25, no. 796.

Vanasse-Duhamel, D. 1975. Provincial fertility projections. Technical Report on Population Projections for Canada and the Provinces, 1972-2001. Catalogue 91-516. Ottawa, Ontario: Statistics Canada.

Received August, 1982.