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DEMOGRAPHIC PROJECTIONS FOR LATIN AMERICAN COUNTRIES*

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I. INTRODUCTION

CELADE is responsible for the preparation of the demographic projections of 20 Latin American countries. This is a task that cannot be performed uniformly in all countries because, as a matter of policy, CELADE tries to work with local demographers in the preparation of the country projections which means that their opinions should be taken into account when estimating the current demographic situation, when adjusting basic data and when formulating hypotheses on future trends of the demographic variables.

In spite of that diversity, in what follows, a brief description is given on how the current demographic estimates, as well as the population projections are prepared in what might be termed a typical case, representing the situation of the majority of the countries in the region with respect to the basic information. This can be defined as follows:

- there is no reliable information available from registers on annual births, deaths, and international migration;
- there is information available from two or more population censuses and maybe also from a national demographic survey.

When the situation regarding the basic information available is as mentioned above, it is particularly important to clearly distinguish two parts in the computation of a demographic projection. The first part is the estimation of what has happened in the past and the current demographic situation at the starting point of the projection. The second part includes the formulation of the hypotheses on the future trend of the demographic variables and, subsequently, the actual computation of the projection.

In the typical situation of a Latin American country, it is the first part the one that is more difficult to accomplish, the most important one, the part demanding more time and the one that may produce only rough results, as opposed to the situation of countries in other regions where the past and present demographic situation is well documented.

A first conclusion that can be drawn from what has just been said is the following: if the first part, i.e. the derivation of past and present demographic estimates, is carried out with difficulties and yields results that are merely rough approximations to the true values, it seems illusory to perform refined elaborations on the future trends of the demographic variables. This second part, to our judgement, must be done through procedures that are consistent with the quality of the estimates of the current demographic situation.

The following two sections of this paper deal with the two parts mentioned above. In the first, the current status of demographic estimates in a typical Latin American country is examined, in the second, a description is given on the way hypotheses on future trends of the demographic variables are formulated and elaborated by CELADE.

II. CURRENT STATUS OF DEMOGRAPHIC ESTIMATES IN LATIN AMERICA.

It seems appropriate to consider how we in CELADE are presently estimating each of the demographic variables, i.e. fertility, mortality and international migration, in a typical Latin American country.

Fertility estimates.

Fertility is measured by means of the annual fertility rates by quinquennial age groups in the female population. They are derived from the following censal information:

a) number of children ever born to women up to the time of the census. This information is broken down by quinquennial age groups of mothers.

b) number of births occurring during the year previous to the census. They are also classified by age of mothers;

c) number of enumerated children by single years of age up to 10 or 15 years, according to age of their mothers.

With the above data the fertility of the population in the 10 or 15 years previous to the census is calculated. The analysis of this information may show that changes in fertility have occurred in the past, this being a useful finding to formulate hypotheses on its future trend.

The same information permits to establish if there are or not differences in the level of fertility among sub-groups of the population, for example, between urban and rural areas, among categories of the population defined according to level of instruction of mothers, etc.

The methods that are used in order to derive these estimates are the ones proposed by professor William Brass (Brass, 1973) and the own-children method (Cho, 1974).

As stated above, the fertility estimates obtained are rough and subject to a margin of error much larger than the one affecting those of countries with complete and accurate registration of births. However, estimates based on information from censuses taken after 1970 are more reliable than those derived from previous censuses. By that time, there was no information available on recent fertility that is available now, and the methods of analysis that are now employed were not widely known then.

In order to continue improving the reliability of fertility estimates in the future all countries taking a census around 1980 should include the appropriate questions, try to raise the quality of the information collected, and prepare the tabulations that are necessary in order to apply the methods of analysis.

CELADE's activity in this field is aimed at achieving these goals, mainly through the diffusion of those methods of analysis that have proved to be the most efficient ones in estimating fertility. At present, for instance, a project "Investigación de la Fecundidad a Través del Método de los Hijos Propios en América Latina" (IFHIPAL) is being carried out, in order to diffuse the application in Latin America of the own-children method to estimate fertility, using census information from the 1970 round of population censuses, in some 15 countries of the region.

Mortality estimates.

Mortality is measured by means of the annual death rates by quinquennial age groups and sex. In order to derive the life tables reflecting these death rates, starting exclusively from census information, methods of analysis should be utilized, some

of which have been developed only recently, that produce results which are not completely satisfactory. The present situation however is much better than the one existing a few years ago when such methods had not yet been devised.

In almost all countries there are now at least two population censuses available, instead of only one as was the case in some instances some years ago, thus allowing the computation of intercensal survivorship ratios which constitute a basis for constructing a life table. The use of these methods, requiring either that the population be closed or that the migration be known, is limited however due to the increasing importance of international emigration, which is not accurately determined, or due to the lack of comparability of the two censuses that are used in establishing the survivorship ratios.

A procedure that utilizes mainly the age distribution of annual deaths, either registered or reported at a census (Brass, 1977) has been recently developed to estimate mortality. Although the results that can be derived by its use are often very rough, they are also in some instances, the only ones that can be obtained.

The most significant advance has taken place in the development of techniques that aim at estimating mortality starting from indicators such as the incidence of dead among all children ever born, of maternal orphanhood, or of widowhood of the first husband. Simple questions included in censuses or survey forms provide these indicators from which the estimates are derived (Brass 1973, Feeney 1977, Brass-Hill 1974, Hill 1976). It is important to promote the inclusion of these questions in the forms of the next round of population censuses, to start in 1980, in order to improve the quality of the mortality estimates in the countries of the region. Although a large number of countries have already utilized some of these questions (the one

dealing with the proportion of children dead among all children ever born) only a few have taken advantage of the use of the other questions.

When mortality is estimated by using the procedures mentioned above it is difficult that the estimates allow for determining whether or not changes in mortality have occurred in the past. With regard to changes in mortality through time, only some indicators are available. Variations can be observed, for example, in the age distribution of registered deaths, reflecting a decline in mortality (even if the registration of deaths is incomplete and, consequently, inappropriate to establish the level of mortality, it may be useful to reflect trends).

Mortality differentials among sub-groups of the population are even less known than fertility differentials. Only recently, starting in 1974, CELADE has initiated a research project assessing very significant differences in the childhood mortality according to place of residence, urban or rural, to level of instruction of mothers whose children are considered when estimating mortality, or to other social variables (the project "Investigación de la Mortalidad Infantil en América Latina" (IMIAL) has already been completed for 13 countries, namely, Argentina, Bolivia, Colombia, Costa Rica, Chile, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay, Perú and República Dominicana).

International migration estimates.

The knowledge of international migration is very unsatisfactory. The situation is even worse than the one existing with relation to fertility or mortality. Reliable registers on annual international migration do not exist for any country in Latin America.

Migration is measured in terms of the absolute number of persons classified by quinquennial age groups and sex who arrive or leave the country in a five year period. The estimate on international migration is made in terms of net balance of migrants i.e, the difference between immigrants and emigrants; the balance taking a positive sign, when immigration prevails over emigration, and a negative sign in the opposite case.

The estimate of immigration can be worked out starting from census information on country of birth and year of arrival at the country being studied. The question on year of arrival, which is not usually included in the census forms, is useful to estimate variations in the number of arrivals through time. It would be very convenient to all countries in the region to include these two questions (country of birth, year of arrival) in their 1980 census forms.

To estimate immigration is easier than to do so with emigration. What is usually done to estimate the latter is to collect census information available from countries of destination of migrants from the country under study. The same census information that is useful to study immigration would permit to estimate the emigration of a given country if it were possible to assemble that information from censuses of all countries of destination and if, in addition, the information were available tabulated by sex and age, for persons born in the country of origin being studied. This is the idea on which the project "Investigación de la Migración Internacional en Latino America" (IMILA) is based. CELADE initiated the IMILA project around 1970, collecting unpublished census information and making it available to countries in the region (B.D., 1977).

The practical limitations of the procedure suggested above are as follows:

a) there is no information available from all countries of destination of emigrants of a given country of origin,

b) when such information is available it is not referred to the same year in which the census of the country under study is taken,

c) the information from censuses of countries of destination is seldom tabulated by sex and age by country of origin (the IMILA project has meant an important advancement in this respect providing such tabulations when the basic information is available) and, finally,

d) what is more important, the information that can be eventually collected is frequently affected by omissions due to illegal migration. Persons who have entered illegally to a country most likely do not state their true country of birth in a census enumeration. Clandestine migration is supposed to be very important. Estimates on the number of emigrated Colombians, for example, amount to 600 000 during the decennial period 1963-1973 out of which only one fourth i.e., 150 000 are legal, and three quarters, i.e. 450 000 illegal (Bayona 1977).

Estimates on net migratory balances, based on the census information of the kind mentioned above, are very unreliable. Emigration has become so important in the recent past for the majority of the countries in the region that, in spite of the limitations related to the basic information, making some kind of estimate is considered appropriate no matter how conjectural this might be, rather than not take migration into account when preparing population projections. The need to take measures aiming at improving the present knowledge of international

migration is urgent and this is the right time to start action in this respect, so that the tremendous effort that will be undertaken in connection with the 1980 censuses program would produce the badly needed information. CELADE intends to promote the inclusion of questions in the census schedules (on country of birth, that has already been included in international recommendations, and on year of arrival); it will continue supporting the IMILA project and will explore new census questions that might permit the derivation of estimates on emigration.

The inclusion of two new questions providing information to estimate emigration has already been proposed. They would complement two others that are already included in census forms (survivorship of children, and the incidence of maternal orphanhood). The proposed questions would request information about presence of surviving children (to be put to the female population) and on presence of mothers, when investigating maternal orphanhood (to be put to the whole population). They are simply intended to find out whether the persons reported about are presently in the country or abroad. These questions have still to be tested in an experimental census in order to find out whether or not they provide useful information for the purpose in mind. Trials like this, we believe, should be encouraged, their results critically examined, and the findings circulated among interested demographers in order to arrive at some conclusion, before the next round of population censuses.

III. FORMULATION OF HYPOTHESES ON FUTURE TRENDS OF THE DEMOGRAPHIC VARIABLES.

This chapter is formed by two parts. The first part deals with the adoption of projected global levels of demographic variables in a distant future, say 1995-2000; the second, with the procedures that are currently used in CELADE in order to project each variable.

Adoption of projected global levels of demographic variables.

As a result of the analysis described in the previous chapter we have now estimates of fertility, mortality and international migration referred to a time period close to the starting point of the projection. In some instances, just a few, the same kind of estimates is also available for past periods. When this is the situation, i.e. when it is possible to establish the past trend of the variables, a careful examination of that trend is the first exercise that should be undertaken in order to guess what the future global levels of fertility, mortality and migration in the future might be.

Studies on differentials in fertility and mortality among sub-groups of the population also provide valuable indications allowing to speculate about what may happen in the future. Studies on differentials, as the ones mentioned above related to childhood mortality (IMIAL-Project) or fertility (IFHIPAL-Project) are of great value since they provide not only information on differences within a country but, due to their comparative nature, also show differences among countries.

Finally, in order to establish consistent future demographic assumptions among countries, the demographic situation of the country being studied is usually compared with that corresponding

to other countries in the region, mainly those to which the country concerned is more closely related. When working with local demographers, a frequent situation as mentioned in the Introduction, it is sometimes difficult to achieve this consistency among projected values in different countries, since when adopting assumptions on demographic variables in the future, national development plans must be taken into account and, in some instances, the demographic goals in those plans are rather unrealistic.

In summary, past trends, when they are known, differences in the level of the variables among sub-groups of the population and the examination of the country's situation in comparison with others, for which the projected values are known, are the elements that are taken into account in the exercise of adopting future global estimates for a distant future. Global assumptions are expressed in terms of the gross reproduction rate, in the case of fertility, in terms of expectation of life at birth by sex, in the case of mortality, and in actual numbers of migrants by sex and age, i.e. balance between immigrants and emigrants, in the case of international migration.

The first step in preparing population projections consists in the adoption of values representing those projected global levels of the variables. In what follows we will assume that this has been accomplished and will examine which procedures are employed to determine specific rates by age along the projection.

Procedures utilized for projecting the demographic variables.

We will consider successively the methods used in order to project fertility, mortality and international migration.

Fertility.

The projection of fertility is based on four values of the gross reproduction rate (GRR) each of them referred to a given moment. To each GRR an age structure of rates is assigned.

- The first, usually the most reliable, is the one that has been derived for a recent period, say for the period 1970-1975. For this period fertility rates by ages and, consequently, the GRR have been estimated. This GRR will be represented R'(72.5), indicating that it refers to the period 1970-1975.

- The second is a hypothetical limit that fertility could have had in the remote past. This value is adopted examining past trends in fertility, in the few cases when this is possible, or rather by simply guessing a possible value. We represent it $R'(-\infty)$.

- The third is another hypothetic limit, the one that might be attained by fertility in the distant future, for example, a level for the gross reproduction rate equal to 1. We represent this value by $R'(\infty)$.

- The fourth is the projected global level that has been adopted as plausible resulting from the exercise mentioned in the section above. Let us assume that this limit is adopted for a period 1995-2000. It is represented by R'(97.5).

These four values define a logistic function in time that reproduces them. By means of an interpolation, intermediate values for the five year periods between 1970-1975 and 1995-2000 are determined. The interpolation is performed for the gross reproduction rate as well as for the age specific fertility rates that we have assumed, as stated above, associated with each level of GRR. The computations are carried out expeditiously using a mini-computer.

As the future trend in fertility is very uncertain in addition to the projected values of what might be considered the most plausible alternative, other alternatives are also prepared. Among these there are two that are the most interesting to analyze. One of them illustrates what future fertility might be if there would be a deviation from the most plausible alternative towards higher values, while the other illustrates an opposite deviation. The differences in the numbers of births between these two alternatives provide an indication of the margin within which the actual number of births will most likely fall, although of course the possibility cannot be discarded that the real number of births could get off this margin.

Mortality.

As in the case of fertility, we start from an estimate of the level of mortality i.e., with a life table by sex for a recent period, say for 1970-1975. We compute the logits of the function ℓ_x that we represent Y_x. The definition is

$$Y_x = 1/2 \ln((1-\ell_x)/\ell_x)$$

Since the life table refers to the period 1970-1975 we indicate Y(72.5).

A projected global level of mortality, expressed in terms of the expectation of life at birth, has already been adopted for a distant future, say for 1995-2000. This limit has resulted from the analysis as explained above. We emphasize the conjectural value of such an exercise.

We accept that some time in the future mortality will approach the biological limits, by sex, set by Bourgeois-Pichat (B.P., 1952). The life tables representing such limits are also expressed in the logit scale. We represent them $Y(\infty)$.

This is all the information we need to prepare the mortality projection. By linear interpolation between values of $Y(72.5)$ and $Y(\infty)$, for each age group, values are determined, that we write $Y(97.5)$, corresponding to a life table with the assumed expectation of life at birth for the period 1995-2000.

The life tables for the intermediate five year periods between 1970-1975 and 1995-2000 are calculated by linear interpolation between the logits of the life tables for those periods, i.e. $Y(72.5)$ and $Y(97.5)$.

The resulting values in terms of the expectation of life at birth show reasonable levels. They vary more when the level of mortality is low -high mortality- and vary less when it is high -low mortality-.

We usually do not prepare alternative hypotheses on the future trend of mortality, although this might perhaps be justified in countries where quite wide possibilities for variation are still open.

The necessity of improving the present estimates on mortality and, if possible, its past trends is evident. In many countries the estimates that are in use are still very uncertain.

International migration.

It has already been stated that migration is measured, for the purpose of population projections, by means of the absolute number of net migrants classified by sex and age, that move in a five year period.

The projection of the international migration has a purely conjectural value. It is based on the estimates about what has happened in the past as well as on governmental plans about their future policy regarding migration.

The way in which the actual projection is computed consists simply in adding to the results of the population projected after a five year period, according to the assumptions on fertility and mortality, the assumed net balance of migrants by sex and age.

It is evident that be they estimates on what has happened in the past, or estimates of what might happen in the future, the knowledge of international migration is clearly not satisfactory.

IV. FINAL COMMENTS

Summarizing what has been discussed above we can say that the most important task in relation to demographic projections for Latin America, to our judgement, is the improvement of the knowledge that we presently have on the demographic situation.

The round of population censuses, that is going to start in 1980, offers a very good opportunity to act in order to improve that knowledge. Different activities should be undertaken by the United Nations in order to persuade governments to collect the appropriate information, to prepare useful tabulations for analysis, employ suitable methods for analyzing the results, and publish the findings.

With regard to fertility the questions that have already been used -number of children ever born, date of the last birth- and the adequate tabulations for using the own-children method,

should be adopted in the census programs of all countries in the region.

In so far questions regarding mortality have not been so widely used as those dealing with fertility, it will demand a greater effort to convince governments of the usefulness of their inclusion. The questions that have proved efficient and are, consequently, recommended for estimating mortality are:

- those dealing with surviving and ever born children, to measure childhood mortality,
- those dealing with maternal orphanhood and widowhood of first husband, to measure female and male adult mortality, respectively.

Finally, it is necessary to promote investigation about how to estimate emigration on the basis of information collected in a census. As stated elsewhere in this paper CELADE has already advanced some ideas dealing with this problem.

Regarding methods of projecting fertility and mortality, to our judgement, those that are presently used by CELADE are in agreement with the quality of the existing estimates of those variables. We believe that it is not worthwhile to utilize more elaborated methods of projections before improving the basic knowledge of the present demographic situation.

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