BOOK REVIEWS

NEW LIFE TABLES FOR LATIN AMERICAN POPULATIONS IN THE NINETEENTH AND TWENTIETH CENTURIES

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The book presents a set of life tables for 17 of 20 Latin American countries, usually by sex, and covering the 100 years from 1860 to 1960. Tables are included for some 70 populations. In this brief review, it seems natural that only a few selected points can be examined—those that are of special interest.

Before examining the particular aspects of the book, it is pertinent to emphasize that it represents a valuable effort to compile abundant, little-known (probably because of its difficult access) basic material. The author undertook a hard task and his effort will be useful for students of Latin American populations, not only for the results of its elaboration but also because the students will have access to little-known material. A good illustration of the value of the results obtained, when they are considered as estimates of general rather than age-specific mortality, is provided by a paper, "The Pattern of Mortality Change in Latin America," submitted by the author and Kingsley Davis to the Population Association of America meeting in 1968, on the pattern and significance of mortality change in Latin America.

Two procedures are employed to construct the life tables: one of them, designated method A by the author, is based on the ob-

served annual mortality rates by age derived from registered deaths and population enumerated in a census. The other, method B, uses only information on the population classified by age groups provided by a census—the structure within the age interval 10 to 59 years—and an estimate of the annual rate of growth. It is based on the assumption that the population considered can be assimilated to a stable one. Because the great majority of the life tables are constructed following method B (only some tables, most of them for recent years, in Chile, Costa Rica, Mexico and Venezuela, are elaborated by using method A) and also because method B is more controversial, these comments will be concerned, almost exclusively, with the discussion of the theory and application of the latter method. First we will consider theoretic aspects of it, followed by some comments on the application and on the results.

THEORY

The author mentions two conditions under which a population can be assimilated to a stable model: (1) fertility should be constant and (2) the population must be closed. He does not indicate that a stable population also has constant mortality and, consequently, a constant rate of growth. The populations he studies are typically accelerating their increase because of a declining mortality. In the theoretic description of method B it should have been proved that differences in the mortality variable—and consequently in the annual rate of growth—between the model and the real populations, are not important for the purpose of deriving the life tables functions.

It is true that the fertility level, rather than the level of mortality, plays the primary role in determining the age structure of a population. It is pertinent, however, to emphasize that this proposition has relative value: the effect of mortality on the age structure is minor as compared with the effect of fertility, but mortality has an effect. More specifically: a reduction in mortality, with the characteristics of the decline that has been observed in the past decades in Latin America, has a well-known consequence in the

age composition: it increases the proportion of the young and diminishes the percentage of the old. These are generally small, but significant, changes. As a result, a population with constant fertility and declining mortality will frequently show different rates of growth by ages: the population in young groups increasing faster than the people in old ages. Under these circumstances, which are typically those prevailing in the populations considered in the book, it is evident that it would be inadequate to employ a uniform rate of growth to transform the age composition of such a population, presumably stable, into that of the stationary population and derive therefrom the other life table functions. If this would have been done with the purpose of obtaining a total measure of mortality, the procedure might not be so inadequate, inasmuch as the uniform rate utilized would be lower than the real at some ages and greater at others. Compensations would be found. Because the purpose in the book was to derive age-specific death rates the objection seems valid.

The population of a country is frequently studied in the book at different years, those in which a census was taken, and is assimilated each time to a different stable population with its own rate of growth. A contradiction is implied in this procedure or, if not, an artificial assumption on the way mortality changes. Let us illustrate the point with an example. The population of Honduras in 1940 and 1950 is assimilated to a stable population with a rate of growth 22.0 per thousand in 1940. Ten years later, in 1950, it is again considered a stable population, now with an annual rate of 26.7 per thousand. In our opinion it is contradictorily assumed either that any two successive annual cohorts of births in Honduras were in the ratio 1 to 1.0220 and 1 to 1.0267 simultaneously, or, that between 1940 and 1950, a reduction in mortality occurred affecting, deeply and evenly, all ages in such a way that one stable age distribution was transformed into another—a very artificial change indeed.

It would have been of great interest to illustrate the effect on the resulting life tables of selecting different auxiliary mortality tables to derive the parameters of the stable population.

Equally interesting would have been to analyze the consequences or the results of adopting different assumptions regarding the annual rates of growth. The fact that the estimate of this rate is in most cases subject to a large margin of error is not, to our judgement, sufficiently emphasized.

It is also desirable to call the attention of the reader to the fact that the resulting life tables are frequently only estimates of the true level of morality and, consequenty, should be used with caution.

APPLICATIONS

With regard to the application of method B some observations are opportune. In some instances the two conditions mentioned above, constant fertility and absence of migration, are not satisfactorily met by real populations and this fact is overlooked by the author. Two examples, one related to each condition, will serve to illustrate the point—although other cases could also be presented.

Fertility was not constant in Chile between 1930 and 1940. It clearly declined. It is not possible to dismiss this fact simply by stating that (page 43) "a very slow decline over several decades does not significantly affect the proportional age distribution of the population." The effect of the decline in fertility might be important or not, but it certainly is significant and it would be necessary to prove that in such peculiar circumstances, with fertility and mortality declining, the estimate of the level of mortality through the assimilation of the population to a stable one is acceptable.

A conspicuous example of a population that has been open to migration is Paraguay. According to information derived from censuses taken in Argentina (1947, 1960) and Brazil (1950), over eight per cent of the population born in Paraguay was living in those two countries. This figure exceeded, nearly doubled, the foreign-born population enumerated in Paraguay in 1950. The author, however, in page 244 asserts that "the amount of emigration from Paraguay to Argentina and Brazil is approximately equal to the amount of immigration to Paraguay from these and other countries."

RESULTS

It is interesting to note the comparison between the life tables constructed for Chile in 1952 and 1960 following, in each case, both methods A and B, to show differences in the resulting values that can be attributed to the procedures employed. In the book, the function $1_{\tilde{x}}$ of the life table measuring the mortality level between ages 0 and x is utilized for purpose of comparison together with the expectation of life at birth. We consider it better to employ a function showing the mortality level for more specific age intervals, such as ${}_nq_{\tilde{x}}$ (the probability of dying between x and x + n corresponding to a person who attains age x).

It can be illustrated that for certain age intervals—primarily between 5 and 14 years—quite important differences appear in the values obtained using one or the other method.

Some results seem to be inaccurate if they are examined in the light of what is known about the way mortality has been declining. Take, for example, the values of the probability of dying in five-year intervals for Chile, between 1952 and 1960, male population, ages 40 and over. The level of mortality for those ages has apparently increased from 1952 to 1960. This trend is not supported by other statistics, including the life tables compared, which show a general mortality level higher in 1952 than in 1960, the expectation of life at birth rising from 50.80 to 54.18 between the two years (pages 56 and 63).

In the paper mentioned previously, submitted to the 1968 meeting of the Population Association of America, a very interesting comparison is made between some values of the life tables derived in the book, the "new life tables," and other mortality tables available for several Latin American populations. The latter tables were constructed using diverse procedures, by different authors, based on information of different quality. The main result of the comparison is that the new life tables show, in general, higher mortality than the other set of tables, pointing to the possibility that in many cases the life tables that have been commonly used in Latin America have probably failed to reflect the real level of mortality.

The book contains a complete analysis of the mortality in Mexico. The analysis made to estimate the importance of the omissions in the death registration as well as the effort to conciliate information of the last four censuses is remarkable. Estimates of the possible importance of omissions in death registration are worked out from 1920 to 1960. In the adjustment of the population figures, the fact is overlooked that the correction done is only relative of one census to another, not absolute. It could be questioned, therefore, if the correction of deaths—five per cent—is not excessive as compared with the slight adjustment of the population—only 0.8 per cent for the female population—when dealing with the information for 1960. A note, pointing out the conjectural nature of the corrections would be opportune.

The most outstanding merits of the study are, in our judgment, its completeness—it elaborates all the information available from censuses for Latin American countries with high fertility—and the clear and systematic description of the work done. It is easy and interesting to read. The results, the set of life tables, will most likely be the subject of lively discussions.

JORGE L. SOMOZA

REPLY TO MR. SOMOZA'S REVIEW

I thank Mr. Somoza for his positive comments on my book, but I must nevertheless show in what ways his criticisms are mistaken. He objects only to the life tables constructed by Method B, which are the tables made on the basis of stable population theory. These not only constitute most of the life tables in the volume, but they also represent the main contribution the study makes to a new understanding of the history of mortality in Latin America. They go back to dates when death registration did not exist or was so

incomplete that no conventional method of life-table construction could be used. The tables constructed by Method B require, as basic data, only the proportional age distribution from ages ten to 59, an estimate of the natural growth rate, and sets of the ${}_5L_x$ values from model life tables. Whenever possible, tables in the volume were constructed in the conventional way—that is, by use of the registered deaths by age and the population at risk in those ages.

In Method B the restriction to ages ten to 59 allows one to escape the great difficulty of a census enumeration at ages under ten and over 60. In other words, the same life table would be obtained no matter what errors occur in the reporting of persons under ten and over 60—even if none are reported at all. Somoza probably did not always have this point in mind and, as a result, he probably did not understand that the actual populations were not used directly in the construction of the life tables, but were used instead only for estimating a stable population.

One of Somoza's main arguments rests on a semantic confusion. He questions the validity of Method B by claiming that the populations in Latin America are not stable populations. He thus rests his objection on the seemingly plausible proposition that an application of stable population theory requires that one have a stable population. However, as he well knows and as everyone familiar with stable populations knows, and as the book specifically states on page 8, the technique—for purposes of estimating—does not require a stable population but only a quasi-stable one. A quasi-stable population is one in which fertility, normally the primary determinant of the age structure, has changed little, and in which the net international migration has been slight. In the book, page 10, it is specifically stated that the populations in the countries dealt with are not perfectly stable. To show how, despite this fact, the quasi-stable population model can be utilized, let me review briefly the steps in the construction of the life tables.

Only ages ten to 59 were used, because enumeration and age-reporting are most complete at these ages. In dealing with the structure within this range, we first smoothed the ten-year age groups, separated them into five-year age groups, and then divided

the five-year age groups by a particular set of ${}_5L_{\tilde{x}}$ values from the model life tables (details are explained in the book). The natural logarithms of these quotients were then *adjusted* to a straight line by least squares for all ages (the slope of the line should be close to the natural increase of the country), and then the antilogarithms of the *adjusted* values were multiplied by the same set of ${}_5L_{\tilde{x}}$ values. The results *are assumed to be the proportional five-year age distribution of the stable population* under the demographic characteristics of the same census year. It is not, by any means, the actual distribution. In no case was the actual population assumed to be stable.

Thus Somoza's contention (e.g., in the case of Honduras) that I considered the actual population to be stable and then applied different rates of growth to the same cohorts at different times is groundless. Of course, the estimated stable populations at different times—i.e., those that would result if the dynamics of the actual population at a given date held permanently—have different growth rates. He knows that this would be the case. All the age groups in each stable population will grow at the same rate, although the actual age groups of the actual population from where the stable population was obtained grow at different rates.

On the basis of this misinterpretation, Somoza says that the decline of mortality has affected the age distribution, and because the actual population is assumed to be stable (we have already shown that that was not true) it is not proper to apply Method B. I am glad the age structure was affected by the mortality decline (even though only slightly in the considered ages) because that change, together with the estimate of the growth rate, helped me estimate the proportional distribution of the stable population and then to calculate the life table. This was the purpose of the study. If I had made the assumption that mortality was constant, as he seems to suggest, the study would not have been necessary.

In regard to my life tables for Chile, Somoza objects to my handling of fertility (page 43). I refer to the slow decline in fertility during a long period (since the beginning of the century up to the present) as follows ". . . it would have been preferable [for the life-

table construction by Method B] to have had constant fertility in the past, but a very slow decline over several decades does not significantly affect the proportional distribution of the population . . ." My critic claims I should have supplied the evidence. Actually the evidence is supplied. The smoothed proportional age distributions ten to 59 are given for all the census years in Chile, as is done for the other countries, and they do not vary much from one decade to another.[1] In addition, although the results are not included in the volume, the procedure was tested by comparing tables constructed by Method B with tables constructed by other investigators for European countries. For instance, Method B was applied to Sweden's population in 1750, 1790 and 1830, years when fertility was declining in that country. The levels of mortality shown by our tables showed virtually no difference from those given by the Swedish life tables for the same years.

Even though the actual population was *not taken as stable,* but was merely used for estimating the stable population, Somoza could have checked how far it differed from the stable population. In the case of the male population of Chile in 1952, the intrinsic birth rate is close to 37 per thousand, the life expectancy close to 50, and the growth rate around 21–22 per thousand. Given these rates, the stable population generated by them can be compared to the actual:[2]

	Actual Population	*Estimate of the Stable Population for Chile 1952*
Age Groups		
10–19	21.85	21.82
20–29	16.78	16.81
30–39	12.71	12.77
40–49	9.59	9.51
50–59	6.68	6.76
Total: 10–59	67.61	67.61
Rates		
Birth	37.0	36.9
Death		15.5
Growth	21–22	21.4
e_0	50.8	50.8

This comparison should convince the reviewer that when fertility has declined for a long time, but slowly, the actual age distribution is still close to the stable form.[3] This being the case, no objection can be raised to using the essential features of the actual population to estimate the stable population.

Another of the reviewer's criticisms is that I underemphasized the fact that the application of Method B requires either no net migration or an insignificant amount of it. Actually, this requirement is stated on page 8. For most of the countries and dates considered, international migration has not been sufficient to bias the results. In certain cases where this is not true, such as Brazil and Panama, the native population was used to avoid the effect of immigrants on the age distribution. For the other countries I assumed that emigration balanced immigration.

In the case of Paraguay, a possibility exists that a net emigration of around five to six per cent of the Paraguayan population may have had some effects on the age structure. It is difficult to determine the effect of this net emigration, especially because the age reporting of the population is not very accurate in the censuses of Paraguay. However, smoothing the age distribution to correct the irregularities in age misreporting tends to minimize the effect, if any, of net emigration.

Another criticism is the reviewer's claim that the increases my tables show in the probability of dying for Chilean males at certain ages between 1952 and 1960 indicate errors in my method. Although the male life expectancy at birth increased from 50.8 to 54.2, some of the probabilities of death (${}_nq_x$) in the 1960 tables are greater than those of the 1952 tables. Somoza says: "Some results seem to be inaccurate if they are examined in the light of what is known about the way mortality has been declining." First, I think it is unfair to say "some results" when actually, among 130 life tables, only two cases show a rise in the probability of dying—the one under discussion and the Mexican life tables for years 1921 and 1930, which were not constructed by the discussed Method B but by using vital statistics. Second, I am surprised that Somoza has not noticed a similar development in many countries where life

tables have been constructed on the basis of accurate vital statistics. These show that the ${}_nq_{\dot{x}}$ in older ages, especially among males, does not necessarily decline when life expectancy at birth increases. The pattern of mortality change in the old ages is still not very well known, especially when the proportion of deaths from infectious and communicable diseases is small. Numerous European examples of rising male mortality at advanced ages can be cited.[4]

Finally, Somoza raises two more objections. One refers to the index to be used for comparison of the life tables, and the second relates to the estimation of the underregistration of deaths for Mexico. For comparison of mortality Somoza prefers to use the index ${}_nq_{\dot{x}}$ instead of 1_x. I would not be surprised if another person would prefer still another index. What I am certain of is that from the 1_x one can always easily calculate the ${}_nq_{\dot{x}}$, but not the other way around. To get 1_x from ${}_nq_{\dot{x}}$, one would need the sequence of ${}_nq_x$ and ${}_nq_0$. In addition, mortality differences measured in terms of relative changes of ${}_nq_x$, have the unfortunate quality that small differences in this index, when its absolute value is also small, could lead to highly questionable interpretations, a result that can hardly happen with the 1_x.[5]

In relation to the Mexican death omission, I would say that the discussion in the book is clear; it is also backed by a previous study.[6]

In sum, Somoza's objections seem to rest on a false interpretation of Method B and its applicability. I hope the discussion of this point helps to clarify the nature of the study.

EDUARDO E. ARRIAGA

REFERENCES

[1] For each country, the smoothed proportional age group distribution ten to 59 is given. The variations in each country are small, principally if the proportion ten to 59 is reduced to the same value for a better comparison. See reference 2.

[2] The same life table will be obtained, when Method B is used, for any value of the total proportion of populatoin between ages ten and 59. This will hold,

under the condition that the relative differences between age groups remains unchanged. In other words, if each age group is changed proportionally, the life table will be the same. Therefore, for a better comparison the distributions presented in the previous table were adjusted proportionally to the same total in ages ten to 59.

[3] Also, the actual population distribution can be compared with the male stable populations with similar demographic rates given by Leon Tabah *in* Poblaciones Modelos Estables, Cuasi-Estables y en Transicion Demografica, (Anexo a un Trabajo de Leon Tabah) CELADE, Santiago, Chile 1961, D. 4/5, Tables 13 and 23. The comparison can be made without any calculation.

[4] *See* the series of historical life tables for England and Wales *The Chester Beatty Research Institute Serial Abridged Life Tables, England and Wales, 1841–1960,* published by the Chester Beatty Research Institute, Institute of Cancer Research, Royal Cancer Hospital, London, 1962. Also, *see* United Nations, DEMOGRAPHIC YEARBOOK, 1966, Table 22, countries such as: Israel 1960 and 1965; Palestine 1936–38 and 1942–44; Czechoslovakia 1958 and 1964; Denmark 1956–60 and 1963–64; Malta 1946–48 and 1955–57; Netherlands 1956–60 and 1961–65; Norway 1951–55 and 1956–60; and many others.

[5] An example will illustrate how the use of mortality rates can distort the real meaning. The probability of dying between ages 15 to 29 ($_{15}q_{15}$) because of pregnancies is higher in Latin America than in Europe not only because of higher fertility but also because of higher maternal mortality. The probability for eight Latin American countries (Chile, Costa Rica, El Salvador, Guatemala, Mexico, Nicaragua, Panama and Venezuela) was .005118 for age 15 to 29 in the 1960's. For the same date and age the annual average for the United States and ten European countries (Belgium, Bulgaria, Czechoslovakia, England and Wales, France, Italy, Poland, Portugal, Sweden, Switzerland) the rate was .000594. In relative terms the maternal mortality in Latin America is 760 per cent higher than in Europe. Although this is true, assuming that *only* maternal mortality would affect the female population, European girls 15 years old would live an approximate average of 14.996 years during the next fifteen. In Latin America the same aged girls would live 14.962 years. Actually, the different maternal mortality of the two areas does not greatly affect the number of survivors. (Rates calculated from information given by WORLD HEALTH ORGANIZATION EPIDEMOLOGICAL YEARBOOK 1961 and by the United Nations DEMOGRAPHIC YEARBOOK).

[6] Arriaga, E., Rural-Urban Mortality in Developing Countries: an Index for Detecting Rural Underregistration, *Demography,* 4, 98–107.