

ship, 1929–1931 White Life Table—of relatively higher survivorship, and Hypothetical Life Table—of high survivorship.

Following down the data given in the table, column by column, one readily notices the expected increases in these age groups due to declining fertility, since the same life table has been used within each column. Increases in these age groups may be noted in following these data across, row by row, reflecting mainly changes due to declining mortality. Greater increases may be expected under analogous conditions from simultaneous changes in both fertility and mortality, provided these changes are in the same direction. Thus, if a population, reproducing itself, say, at $r = .0050$ and having a survivorship equivalent to the Negro life table, should change to $r = .000$ and a life table equivalent to that of white population, its per cent of 65 years of age and over would change under stabilized conditions from 5.85 to 11.48.

Of course, these are ideal percentages; the trend, however, toward such distributions may be considered as real.

As stated above, only partial data have been presented in the table. In the mentioned study, a wider range of r 's has been used and complete age distributions have been presented in quinquennial age groups. It seems that these age distributions, though theoretical, can be advantageously utilized in general discussions on the expected effects of mortality and fertility on age structures.

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LIFE TABLES FROM LIMITED DATA¹

THE purpose of this monograph is “to develop a way of constructing life tables when conventional methods cannot be applied and primary reliance has to be placed on the information found in a single enumeration.” It is assumed “that data on deaths by age are not available and that substitute measures cannot be deduced from successive censuses.” Influenced by his training in actuarial methods, the reviewer frankly

¹ Stolnitz, George J.: *LIFE TABLES FROM LIMITED DATA: A DEMOGRAPHIC APPROACH*. Princeton, Office of Population Research, Princeton University, 1956. Pp. xii + 164. \$4.00.

admits that he approached the reading of this book with serious doubts as to the feasibility of such an approach. Dr. Stolnitz has overcome these doubts and proved to the reviewer's satisfaction his case that life tables adequate for most purposes can be constructed from the data of a single census together with such meager supplementary data as may be available in some instances. This achievement probably has required extensive experimentation and entailed a great deal more work than is apparent merely from reading the final product. The fact that a demographer of Dr. Stolnitz' standing has devoted so much effort to this undertaking is in itself an eloquent testimonial to the usefulness of the life table in demographic research.

He prudently warns that "the errors to be expected from single-census methods will often be rather large. Indeed, no more is claimed for the approach than that it is only potentially useful. Whether it should be applied or rejected in any concrete problem will depend on circumstances."

Even at the risk of making this review appear too technical, it seems necessary for an adequate discussion of the proposed method to refer to the basic equation which underlies it. This is

$$\frac{{}_5N_{i+5}}{{}_5N_i} = \frac{{}_5B_{i+5}}{{}_5B_i} \frac{S^{T-5}_{i+2.5}}{S^{T}_{i+2.5}} {}_5p_{i+2.5}, \quad i = 0, 5, \dots$$

where ${}_5N_i$ denotes the enumerated population at time T between exact ages i and $i + 5$, ${}_5B_i$ denotes the number of births between i and $i + 5$ years before the census, $S^{T}_{i+2.5}$ denotes the proportion of these births still surviving at time T : in other words, the quotient of ${}_5N_i$ divided by ${}_5B_i$, and ${}_5p_{i+2.5}$ denotes the 5-year life table survival rate at age $i + 2.5$. Except for the quite reasonable assumption that the survival rate for a 5-year age group can be taken as applying to the central age of the group, this equation is a mere tautology. However, as a practical matter it provides a basis for a satisfactory method of constructing life tables from inadequate data.

For convenience, the three ratios which appear in the basic equation are referred to as the "population ratio," the "birth ratio," and the "survival ratio," respectively. The population ratio is, of course, available from the data of a single census. If the other two ratios can be estimated with sufficient accu-

racy, the equation can be solved for the life table survival rate. This is Dr. Stolnitz' procedure. If birth data are available, they can be used to compute or estimate the needed birth ratios. In this case, however, the effect of migration between the birth of the cohort and the date of the census may be a troublesome problem, and a whole chapter is devoted to possible methods of dealing with this problem. However, the author recognizes that there will be many situations in which adequate birth data will not be available, and proposes estimating the birth ratio in such cases by the formula:

$$\frac{1}{2} \left(\frac{\text{Population Ratio}}{\text{Survival Ratio}} + 1 \right).$$

The adequacy of this approximation has been thoroughly tested by application to a number of actual cases for which the correct results are known, and the error involved is less than might be supposed. In particular cases, there may be a basis for selecting weights other than $\frac{1}{2}$ and $\frac{1}{2}$ for the two terms in the formula. In general, the survival ratios will have to be estimated on the basis of data for other populations thought to have similar characteristics (e.g., data for neighboring countries).

This abbreviated and oversimplified presentation does not do justice to the careful attention that has been given to numerous details and practical problems that will arise in applying the procedure under a variety of conditions, and to extensive practical tests in which the suggested methods were applied to populations with known survival rates in order to appraise the limits of error involved. This publication is a most important contribution to demographic analysis of underdeveloped areas.

As examples of the technique, the author has developed two original life tables which are important contributions in themselves: one for the native white population of the United States, 1885-1889, and the other for the native-born population of Brazil, 1936-1940. The latter is of particular interest, inasmuch as Brazilian mortality on a national level has always been an unknown quantity. The conclusion that "the level of Brazilian mortality about 1940 was among the highest recorded

in any part of the world" is plausible to the reviewer on the basis of limited personal observation in certain rural sections of that country.

The material is well organized and presented. The inclusion of summary paragraphs at the end of the more important chapters is extremely helpful. Discussion of the most difficult technical aspects has been relegated to appendixes following certain of the chapters. Notwithstanding this excellent organization, there were paragraphs here and there that the reviewer found it necessary to read several times in order to grasp the intended meaning. This may be due as much to the inherent difficulty of the subject as to the quality of the exposition (generally excellent).

The reviewer finds himself somewhat out of sympathy with the author's severe strictures (p. 19) against the "usual argument" that terminal age estimates introduced for the purpose of deriving measures of expectation of life have only small effect on the accuracy of the summary measure, even when wide of the mark as age-specific indexes. The point he attempts to make does not seem essential to his general argument and is somewhat weakened by his finding two pages later that "even large terminal errors beyond age 77.5 will have only insignificant effects on $e_{2.5}$." On the other hand, there can be little argument with his suggestion that ${}_{65}e_{2.5}$ possesses substantial advantages as a measure of longevity, especially in the case of populations for which demographic data are meager.

The concluding paragraph of the report is worth quoting in full:

"In conclusion, it should be re-emphasized that the use of single-census methods for any of these purposes will involve results whose accuracy is somewhat uncertain. There can be no doubt the state of demographic knowledge will be far richer when such methods can be discarded. On the other hand, they should provide much valuable information for many years to come."

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