Mortality and its Measurement: Extension of Life Tables

Demography Camp

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1 Life table as a Stationary Population

1.1 Characteristics of a stationary population

- Constant size
- Fixed age distribution
- Constant annual number births = constant annual number deaths

1.2 Life table Formula Interpretations

- l_0: constant annual number of births (assumed to be evenly distributed throughout the year
- l_1: number reaching their first birthday each year
- l_x: number reaching their xth birthday each year
  - The l_x curve gives the age distribution of the stationary population
- ${}_nL_x$: number of persons in the stationary population between exact ages x and x+n
- T_x: total size of the stationary population

Note: It takes ω years for a stationary population to be generated.
For $t > \omega, \sum {}_nd_x = l_0 \rightarrow$ total annual number of deaths = total annual number of births

1.3 Key Stationary Population Equation

$$CBR = CDR = \frac{1}{\mathring{e}_0}$$

Why? need to consider 2 views of life tables

- CBR = CDR in a stationary population = $\frac{l_0}{T_0}$
- $\mathring{e}_0 = \frac{T_0}{l_0}$

1.4 Implications

The long-run average rate of population growth must be zero. Implies a stationary population with birth rate = death rate, or we get absurd results. Therefore, if we want to continue to enjoy $\mathring{e}_0$ of $\sim$ 75 (U.S.1985), we need CBR = 13.3 per 1,000 and age distribution of a stationary population.

2 Other Examples of Life Tables

2.1 UN Model Life Tables

- First published in the 1950s and subsequently revised.
- Based on a collection of 158 observed life tables for each sex.
- Basic idea? Although the level of mortality differs widely from population to another, there is a characteristic age pattern of mortality. High mortality at one age is generally indicative of high mortality at all ages.
- U.N. tables are a "one-parameter" system; ${}_1q_0$ is chosen arbitrarily to set the level of mortality ${}_1q_0$ and ${}_4q_0$ then combined to generate ${}_5q_0$, etc.
- Problems:
  - Errors in the estimation of the coefficients are compounded at each step by "chaining" method.
  - The 158 life tables used as the data base were of varying quality.

2.2 Coale-Demeny Regional Model Life Tables

- First published in 1966; revised in 1983
- Main discovery analysis of a more extensive set of life tables revealed existence of four characteristic age patterns of mortality. Patterns comprised of geographically contiguous countries or major regions.
- Raw data 326 male and 326 female life tables
- Based mainly on recent European experience

- 4 separate families detected
  - "North: Scandinavian countries
  - "East": Eastern Europe
  - "South": Southern Europe
  - "West": Western Europe, US, Canada, Oceania, Japan, Taiwan
- These patterns of deviations were the basis for assigning each original national life table to one of the four families. Model life tables were made separately for each family (i.e., region).
- Model life tables now being revised to capture recent experience with low mortality.

2.3 Cause-of-Death Life Tables

- An example of multiple-decrement table
- Other examples; marriages can end in divorce, widowhood, death of either spouse; students can leave school through graduating, voluntary withdrawal, involuntary expulsion
- There are multiple paths of exit.
- Independence of causes usually assumed
- In cause of death tables: $\mu(x) = \mu_1(x) + \mu_2(x) + \cdots + \mu_n(x)$ where $\mu_i(x)$ is the age-specific death rate from cause i

2.4 Multiple Increment-Decrement Life Tables

- Also called multistate and/or multiregional life tables.
- Are of different character because focus is less on mortality than on the transitions individuals make among alive statuses.
- Persons can revisit states they previously occupied.
- Can't leave "absorbing" sate of death.

Ex. Marital status life tables, U.S. females

- State space (see diagram).
- Data requirements.
- Assumptions: no duration dependence; population homogeneity (are characteristic of pure Markov models).
- Outputs (e.g. decomposition of into time spent in alternative statuses).

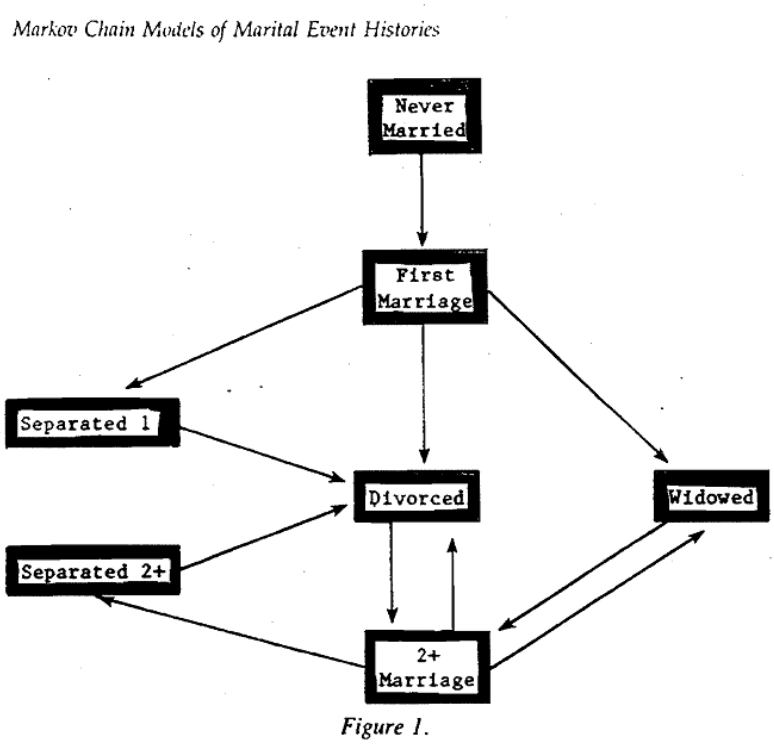

Figure 1: Marital Status