where A_t is the number of active persons at age t, I_t is the number of inactive persons, (AA) is the fraction of active persons who remain active until the next age $(t+1)$, and (IA) is the fraction of inactives who become active; and, given that all those alive, N_t, are either active or inactive:

$$N_t = A_t + I_t; \quad (2)$$

given that the participation rate, W_t, is the fraction of those alive who are active:

$$W_t = \frac{A_t}{N_t}; \quad (3)$$

and, given that the probability of remaining alive for one year, P_t, is:

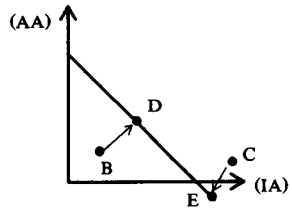
$$P_t = \frac{N_{t+1}}{N_t}; \quad (4)$$

then it follows that:

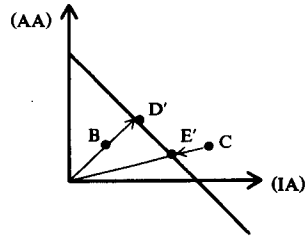
$$(AA) = P_x \frac{W_{t+1}}{W_t} - \left(\frac{1}{W_t} - 1\right) (IA). \quad (5)$$

That is, if mortality and participation rates are known (that is, P and W are given), then the transition probabilities, (AA) and (IA) cannot equal just any values which happen to appear in a sample. If those values do not lie along the line segment defined by equation 5, then either they or the underlying mortality and participation rates must be incorrect.

In fact, the transition probabilities used in the BLS estimates for males lie mainly below this locus (like B):



A first attempt to adjust the BLS transition probabilities minimally by moving to the locus perpendicularly (B to D) led to some negative figures (C to E). Therefore, it was decided to adjust all figures proportionately (B to D' and C to E'):



□

FOOTNOTES

[1] Shirley J. Smith, "New worklife estimates reflect changing profile of labor force," *Monthly Labor Review*, March 1982, pp. 15–20.

[2] *Handbook of Labor Statistics*, Bulletin 2070 (Bureau of Labor Statistics, 1980), pp. 8–9.

[3] See Smith, "New worklife estimates," table 3, p. 17.

[4] See Shirley J. Smith, *New Worklife Estimates*, Bulletin 2157 (Bureau of Labor Statistics, 1982), table 4A, p. 10. An example of an implicit participation rate for 20-year-old men would be 63,850/96,892 = 75.1 percent, well below the 86.7 percent actually observed for such persons.

Labor force participation rates are not the relevant factor

SHIRLEY J. SMITH

The new BLS worklife estimates presented in my article in the March 1982 issue of the Review are the result of a computer simulation spelling out the lifetime implications of age-specific mortality, labor force entry, and exit rates which prevailed in this country during 1977. They were derived using a new model, known as the increment-decrement working life table. This model was tested against its predecessor, the conventional worklife model, and judged superior because of its explicit allowance for movement into and out of the job market at midlife. (The earlier technique had estimated worklife expectancies and entry and exit rates from a cross-sectional profile of labor force activity rates. This entailed assuming continuous labor force involvement from age of first entry to age of final retirement.)

The preceding critique by John L. Finch maintains that, because the labor force participation rates implicit in the new 1977 working life tables do not match annual average rates for the year published elsewhere by BLS, the worklife expectancies displayed in these tables are wrong. To paraphrase his argument, the implicit rates for men are too low and those for women are somewhat high. As a result, "incorrect 'transition probabilities' . . . are obtained." He states that, through biased entry and exit rates, errors are passed on to the worklife expectancy figures. According to Finch, the 1977 tables understate the length of working life for men and overstate that of younger women.

Finch makes a number of valid observations which, on first reading, seem to substantiate his claim. He is correct in noting that, if the participation rates and

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mortality rates were the same in the old and new models, their population-based expectancies would also be identical. In reality, when the two models are applied to data for the same year they yield quite different estimates. Furthermore, he is correct in observing that the two contain different schedules of implicit participation rates. He may even be correct in asserting that the increment-decrement activity rates for men are somewhat low, due to understatement of labor force retention.

However, I would take issue with Finch's quick solution, which implies knowledge of the precise magnitude and character of this understatement. He maintains that the link between annual average participation rates and transition probabilities is tautological, such that the "correct" probabilities would explain age-to-age differences (as between cells a and b or b and c) in the activity rates described in exhibit 1. Building on this supposed relationship he forces BLS figures through an additional iteration to bring them into line with the cross-sectional profile of labor force activity for 1977. This is accomplished by:

1. Reestimating the size of the model labor force at each age (that is, multiplying the number of life table survivors to that age by the annual average participation rates published for that age group).[1]
2. Using conventional formulae to revise the person-years of activity estimates accordingly.
3. Recomputing worklife expectancies on the basis of these values.
4. Determining discrepancies between the size of the labor force in his revised estimates and that embodied in the 1977 increment-decrement tables from BLS. (Differences are taken to indicate the magnitude of misstatement in transition probabilities.)
5. Adjusting the probabilities of labor force entry and exit accordingly, to take account of the apparent "error."

A closer look at this revision process shows that Finch has actually reestimated worklife durations using the conventional model. Steps 1 through 3 exactly replicate worklife derivation in that model. His "revised increment-decrement figures" no longer rest on observed transition probabilities, but instead are drawn from cross-sectional activity rates.[2] (The increment-decrement technique actually derives participation levels from transition probabilities, and not vice versa.)

Exhibit 1. Hypothetical labor force activity rates underlying the Finch and BLS worklife tables

Age	*1977 annual averages (Finch)*	*1977 January (BLS)*	*1978 January (BLS)*
x − 1	a	d	g
x	b	e	h
x + 1	c	f	i

Furthermore, steps 4 and 5 rework the model input (observed rates of labor force entry and exit), then present the same data in an adjusted form as model output. But because the figures have been significantly altered, they are no longer really observed values. The observed values are lost.

Such adjustments might be warranted in a stable population, where age-specific activity rates never changed—for example, if a=d=g; b=e=h; and c=f=i in exhibit 1. But with rates changing over time, the activity level of persons aged x (cell h) is a function of the same group's activity level 1 year earlier (cell d), and not that of persons aged x−1 at the same point in time (cell g). The more rapidly activity rates change, the more Finch's cross-sectional approach introduces its own bias.

To elaborate a little further, the real-world activity rate of persons aged x is a function of three things: (1) their present age (the "age effect"), (2) the current economic and social climate (the "period effect"), and (3) the group's unique work experience accumulated over previous ages (the "cohort effect"). The last set of factors is very important. The share of a birth cohort active at age x is the cumulative result of net labor force entries and exits made by group members during *each* previous year of life. To use an obvious example, the share of all 38-year-old women active in 1978 was determined by labor force entry and exit rates of 37-year-olds in 1977, 27-year-olds in 1967, 17-year-olds in 1957, and so on. It had nothing to do with entry and exit rates of 16- to 36-year-old women in 1977.

The new working life table is an artificial construct which attempts to eliminate cohort effects. It focuses directly on age and period factors. Working with a hypothetical "stable population" (that is, one in which age-specific rates never change), it spells out the lifetime implications of labor force entry and exit rates observed in the reference year—in this case, 1977.

If those rates have been constant over the lifetime of a real cohort, model and observed labor force activity rates will necessarily match. But this is never the case. Any marked trend upward or downward in entry or exit rates will cause real and model activity rates to diverge. One would expect this result in a model based on labor force mobility rates. For instance, in the case of 38-year-old women, the worklife model for 1977 implies a higher activity rate than was observed in the real cohort during that year. This is because the labor force entry and retention rates of 1977, used to define the model's active population, were much higher than those experienced by the real cohort between 1956 and 1976. Because we wish to look at the implications of work

patterns in 1977, it is to our advantage to weed out those earlier cohort factors. The trends are less obvious for men, but the same factors pertain.

There may be merit in Finch's observation that the activity rates of men in the 1977 tables are somewhat low. However, the character of biases in the transition matrix cannot be identified solely from a cross-sectional profile of activity rates, nor can the biases be eliminated by a simple prorating procedure. There are several key problems yet to confront in the area of worklife, such as how best to quantify person-years of work, and how to move from a period to a longitudinal model. Fine-tuning the activity rates will not bring us any closer to a solution of these problems. Nonetheless, we will certainly give further thought to the question of implicit participation rates as we continue to refine BLS worklife estimates. □

FOOTNOTES

[1] His activity rates are not actually the official BLS estimates. At least some of the difference in estimates may be attributed to this fact. For men 62 to 68, Finch's values are as much as 10 to 15 percentage points higher than BLS figures.

[2] For a discussion of the conventional model and the reasons it is no longer used at BLS, see Shirley J. Smith, *Tables of Working Life: The Increment-Decrement Model,* Bulletin 2135 (Bureau of Labor Statistics, 1982).

A note on communications

The *Monthly Labor Review* welcomes communications that supplement, challenge, or expand on research published in its pages. To be considered for publication, communications should be factual and analytical, not polemical in tone. Communications should be addressed to the Editor-in-Chief, *Monthly Labor Review,* Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212.