DO INCREMENT-DECREMENT WORKLIFE MODELS REALLY WORK?*

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Increment-decrement models have enjoyed increasing popularity among demographers. Variants of these models have been used to predict state conditioned differences in future marriage, migration, and labor force rates. Because of their frequent use in court cases involving damages for economic loss, the most common application involves future expected worklives. Despite their dominant place in the demographic literature, these models predict actual labor force behavior quite poorly.

In this paper, we develop an alternative model to forecast women's expected remaining years of work. By incorporating population heterogenity, our approach allows the future work experiences of current workers and nonworkers to differ significantly. Our model is used to calculate both the past labor market experience of the female workforce and the female population and the future expected worklives of these samples. Our empirical simulations indicate that, despite their widespread use, increment-decrement models do not replicate women's observed labor market behavior. Using our alternative model, there exists no secular trend in accumulated experience of *working* women while the experience of all women, independent of their current work status, has been rising continuously. Similarly, our alternative model forecasts quite different expected worklives for women who are currently observed working and those women not now in the labor force.

INCREMENT-DECREMENT WORKLIFE MODELS: A SUMMARY

Increment-decrement models represented a significant advance in demographic research. Previously, conventional estimates of expected remaining years of worklife relied on differences in labor force participation rates of successive age groups.[1] For men, the fundamental assumption was that movement in and out of the labor force was undirectional. Prior to the age of peak labor-force involvement, men entered but did not leave the labor force. Subsequent to the peak

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[1]For an excellent discussion of these early models and their differences with multi-state models, see *Tables of Worklife: The Increment-Decrement Model*, 1982.

age of labor-force involvement, men only left the labor force. In this framework, there is no turnover of workers. A typical male can enter and leave the labor force only once.

While they shared a common underlying philosophy, conventional worklife models for women were more complicated. The assumption of continuous labor force attachment could simply not be carried over to women. Instead, the female population was divided into a number of demographic subgroups (e.g., marital status and age of children) with transitions allowed between the groups. Within groups, the assumption of unimodal participation in age patterns was maintained. A well known defect of these conventional models for both men and women was that they severely understated the extent of actual labor force turnover. One of the principal motivations for the use of increment-decrement models was to remedy this defect.

To forecast labor-force behavior, increment-decrement models are by now the demographic workhorse. The essential feature of the model is that it is a "two-state, one-period" Markov. People can occupy one of two mutually exclusive "states": (a) being a labor-force participant or (b) being out of the labor market. Although an individual can occupy only one of these states during a given period, he can move between them from period to period. The critical assumption is that the probability of working this year depends only on whether or not a person worked last year. The probability is not affected by labor-force history prior to that year. To illustrate, in the increment-decrement framework, two workers of the same age who worked last year are equally likely to work this year. This will be the case even though one of the workers may have worked for twenty consecutive years while the other may never have worked before last year.

Using a simple variant of an increment-decrement approach, the model is built up from four age-specific labor force transitions: P_{mm}, P_{mn}, P_{nm}, P_{nn} (where m is the labor force, and n indicates out of labor force).[2] Using these symbols, P_{mm} is the probability of a current

[2]For expository convenience the age-subscript is suppressed in the text. These labor force transitions are all age specific. More complicated increment-decrement models exist, especially in their

worker of a given age being in the labor force next period, while P_{nm} is the probability of a current non-worker transiting into the labor force in the next period.

The equation that links the labor force between periods[3] is

(1) $M_t = P_{mm} M_{t-1} + P_{nm} (1-M_{t-1})$

The labor force participation rate next year (M_t) will consist of two groups of workers. From the current workforce (M_{t-1}), a fraction P_{mm} will remain in the labor force for another year. From the current non-workforce ($1-M_{t-1}$), a fraction P_{nm} will transit into the workforce during this year.

These one-year transition probabilities between the workforce and non-workforce determine the amount of work experience accumulated during any given year. The increment to experience in any year is

(2) $exp_m = (P_{mm} + 1/2\ P_{mn})$ for labor force

(3) $exp_{nm} = 1/2\ P_{nm}$ for non labor force

(4) $exp = M_{t-1} (P_{mm} + 1/2\ P_{mn}) + (1-M_{t-1})\ 1/2\ P_{nm}$ for population.

exp_m is the yearly increment of experience for current period workers. During the year, the fraction P_{mm} of the current workforce will remain in the labor force and add one more year of work experience. The remaining fraction of the original labor force, P_{mn}, will leave the labor force uniformly over the year. On average, that subset of workers

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assumptions about the functional form of the within period transition. But the essential features of the model are captured with the simple version (linear variations within time period) used in the text.

[3]Throughout our exposition, we suppress the algebra for the incorporation of mortality. Our estimates in this paper include a standard mortality adjustment. The National Center for Health Statistics publishes lifetables from which one can derive age-conditional specific probabilities of living another year. These age-specific survivor rates can be linked to calculate the probability of living to any future age.

will add one-half year of an additional year of work experience. Similarly, the non-work force will accumulate exp_{nm} of a year of experience as the fraction P_{nm} transits uniformly into the workforce during the year. Finally, the experience accumulated for the population (exp) is a weighted average of the workforce and non-workforce accumulations, with the weights representing the current fraction of the population in the labor force.

Equation (4) can be translated into a future worklife discount by conditioning on an individual's current age and current labor force status. In doing so, the labor force participation rates in (4) are those future labor force participation rates conditioned on current work status. For example, for current workers, M_{t-1} in equation (1) is equal to one and M_t equals P_{mm}. By repeated use of equation (1), all future labor force participation rates for a group of original labor force members can be calculated.[4] Therefore, the amount of work experience in some future periods conditional on work status at period t can be written as

$$(5) \quad exp_s = (M_{s-1}|M_t = 1)\ (P_{mm} + 1/2\ P_{mn}) + ((1 - M_{s-1})|M_t=1)\ 1/2\ P_{nm}$$

$$(6) \quad exp_s = (M_{s-1}|M_t = 0)\ (P_{mm} + 1/2\ P_{mn}) + ((1 - M_{s-1})|M_t=0)\ 1/2\ P_{nm}$$

In each future period, equations (5) and (6) define the worklife discounts.

To calculate worklife discounts, we must know the four labor force transitions (P_{mm}, P_{mn}, P_{nm}, P_{nn}) and the labor force participation rates at each age. The Bureau of Labor Statistics (BLS) has periodically issued expected worklife tables based on increment-decrement models. The BLS series is by far the most widely cited and has been frequently used by economists and lawyers when calculating lost future earnings in lawsuits involving damages.

[4]Similarly for currently non-workers, M_{t-1} in equation (1) is equal to zero and M_t equals P_{nm}. Once again, all future labor force rates for non-workers flow from this initial value.

Their latest estimates are based on matched samples across the 1979 and 1980 Current Population Surveys.[5] These matched samples were used to estimate by age the four labor force transitions. While their estimates are available by race, sex, and years of schooling, we only summarize in Table 1 BLS expected worklives by sex.[6] Consistent with the multistate framework of these models, separate estimates are listed by current workforce status.

The salient patterns in Table 1 are typical of worklife tables derived from the increment-decrement approach. Expected worklives decline with age, reflecting both rising rates of mortality with age and labor-force retirement, a lifestyle change that looms closer for older people. Remaining years in the labor force are also considerable higher for men than for women. In spite of rapid secular increases in women's labor force participation rates, it remains the case that women will typically work fewer years over the course of their lives. The final--and for our purpose most important--pattern to note is that, for either sex, expected worklives are higher for those currently working than for non-workers. These differences are relatively small for young workers, but they are not trivial for mature workers. For example, a 40-year-old working male is predicted to work 3.5 more years than if he were not in the labor force at age 40 (20.4 years compared to 16.9). Similarly, if a 40-year-old woman was working, her expected worklife is 15.5 years; if she is not working, it is 12.1, a difference of 3.4 years.

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[5]These estimates were derived from a 12-month matched survey from the January, March, May, July, September and October CPS. For details see Smith-Horvath (1982).

[6]See "New Developments in Multistate Working Life Tables," by Shirley Smith and Francis Hovath, paper presented at the 1984 annual meeting of the Population Association of America.

Table 1

EXPECTED WORKLIVES USING THE INCREMENT-DECREMENT MODEL

	Men			Women		
Age	All Men	In Labor Force	Not In Labor Force	All Women	In Labor Force	Not In Labor Force
20	36.8	37.4	35.7	27.2	27.9	26.1
25	33.1	33.5	31.8	24.0	24.8	22.6
30	28.9	29.2	27.1	20.8	21.7	19.1
35	24.5	24.8	22.1	17.6	18.6	15.7
40	20.0	20.4	16.9	14.3	15.5	12.1
45	15.7	16.3	11.8	11.1	12.5	8.4
50	11.6	12.3	7.5	8.0	9.8	5.3
55	7.8	8.1	4.2	5.2	7.2	2.9
60	4.4	5.7	2.2	3.0	5.0	1.5

FEMALE WORKLIFE DISCOUNTS: AN ALTERNATIVE MODEL

In spite of their widespread use, increment-decrement models are poor predictors of women's future labor force behavior. They are simply incapable of replicating women's actual accumulation of labor force experience. Applying conventional increment-decrement models to women is problematic for two reasons: First, the labor-force transition rates are based on cross-sectional data for a single year or averages of groups of years. Basing the rates on such data implies that a woman who is 30 years old in 1979 can expect, twenty years later, to have the labor-force participation rate of a woman who is 50 years old in 1979. This implication is untenable--given the rapid, sustained secular increases in rates of women's labor force participation. As a result, the calculation of future worklife should accommodate the reality that a contemporary 30-year-old woman will work more when she is 50 than does today's 50-year old woman.

Second, and most important, conventional increment-decrement models do not distinguish sufficiently between the probable accumulated experience of current workers and non-workers. Female workers and non-workers are quite different. Women who are working tend to stay in the labor force for extended periods of time, while housewives persistently remain out of the labor force. The one-period assumption causes a great deal of labor force turnover in the increment-decrement model, making the expected worklives of workers and non-workers closer than they are likely to be in reality.

Because of these difficulties, we develop in this paper an alternative model of women's worklife discounts. Our estimates of the experience of the female workforce are derived from a mover-stayer model of labor force transition that is a combination of Markov and heterogeneity models. We consider two labor force states: working and nonworking. For individuals currently working, a fraction, sw, are "stayers" in the working state. This fraction has zero probability of leaving that state. Similarly, nonworkers have a stayer fraction sn, the fraction with zero probability of leaving the nonwork state. The remaining proportion of the population, $(1 - sw) M_{t-1} + (1 - M_{t-1}) (1 - sn)$, are "movers" who transit between the work and nonwork states according to the simple two-state Markov model. Movers who are currently working have a probability p_w of working in the succeeding period, and nonworkers have a probability q_n of remaining as nonworkers in the succeeding period.

Using the labelling conventions we adopted above, we can derive the four transition rates for women between the two labor force states.[7]

$$P_{mm} = sw + (1-sw)\ Pw$$

$$P_{mn} = (1-sw)\ (1-Pw)$$

[7]As was the as above, age-specific transition rates are used in the modelling. These are suppressed in the text for expository ease.

$$P_{nm} = (1-qn)\ (1-sn)$$

$$P_{nn} = sn + (1-sn)\ qn$$

$$\text{and } M_t = P_{mm}M_{t-1} + P_{nm}\ (1-M_{t-1})$$

$$\text{(1.b) or } M_t = sw\ M_{t-1} + (1-sw)\ Pw\ M_{t-1} + (1-sn)\ (1-qn)\ (1-M_{t-1})$$

$$\text{(4.b) } exp = \sum_{t=1}^{52} M_t/52$$

The probability of moving between the states is now a weighted average of the certain probability that a stayer remains in her current state and of the transition probability of movers. For example, the probability that workers will remain in the labor force (P_{mm}) is made up of two groups of workers. The fraction of workers who are stayers (sw) will all remain in the labor force and accumulate one year of experience. Of the workers who are not stayers (1-sw), a fraction Pw will remain in the labor force for another period.

Unlike the increment-decrement approach, our model permits current workers and nonworkers to distinguish themselves. If the fraction of stayers are constant over time, the accumulated work experiences of working and non-working women will differ significantly. In the extreme, a large fraction of women will always work accumulating many years of work experience, while a corresponding fraction of women will never work, accumulating zero years of work experience. It is this possibility that allows our model to distinguish between the workforce and non-workforce.

Our calculation of labor market experience uses the features of the mover- stayer model to accumulate time spent working over the career. Within a year, the estimated fraction of worker-stayers are assumed to accumulate 52 weeks of experience and nonworker-stayers accumulate zero experience. The fraction who are movers (1 - sw) M_{t-1} + (1 - M_{t-1}) (1 - sn) move according to the transition rates described above where, for purposes of calculation, the model is updated weekly and all transition probabilities are appropriately rescaled on a weekly basis. Repeated application of Equation (1.b) generates the participation rates during the year. Equation (4.b) shows that the average of these participation rates during the year indexes the amount of experience acquired during the year. The sum of these year specific experience amounts over all subsequent years equals remaining years of work by the female population.

Similar to the procedure in conventional increment-decrement models, future worklife discounts can be defined at all ages for current-period workers and non-workers respectively. In these calculations, the participation rates used in Eq. (1.b) are those conditional on initial workforce status. For example, in the first period for labor force members $M_{t-1} = 1$ and for non-workers $M_{t-1} = 0$. For both current period workers and non-workers, any age, the model implies the complete future series of participation rates.[8]

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[8]The population-wide averages of stayer fractions must be allocated in each period between current workers and non-workers. For example, if the fraction of the population who are worker-stayers rises, (i.e. $dsw = sw_t M_t - sw_{t-1} M_{t-1} > 0$), we assume that this population is augmented from the pool of worker-movers. Let ′index parameters for the initial group of workers and ′′index parameters for the initial group of non-workers. In the first period, all the worker- stayers (sw) are in the current worker group, so that sw′ = sw and sw′′ = 0. Similarly, the non-worker-stayers (sn) in the first period must come from the non-worker group so that sn′ = 0 and sn′′ = sn.

In all future periods, allocation into and out of the stayer groups are in proportion to the relative size of the relevant populations for the two groups. For example, if the population-wide stayer fraction rose (i.e., dsw > 0), that subpopulation was augmented from the pool of worker-movers. Our model generates worker-movers from each initial group. The total number of worker-movers in the population is the sum of those in these two subgroups. If additional worker-stayers are needed for the total population, they are taken from the two labor-force conditioned subpools of worker-movers in proportion to the relative sizes of worker-movers in the two groups. For example, the proportion of worker-movers from the original sample of workers assigned to the worker-stayer population can be written as $(1-sw_t)'M_t'E_o/((1-sw_t)'M_t'E_o + (1-sw_t)''M_t'' (1-E_o))$ where E_o is the original period employment rate. To illustrate, we can solve for the

Estimates of the parameters of this model can be had with measurements of duration in these states. We obtain these data from three sources: (1) the *Current Population Survey* estimates of employment and weeks worked during the year[9]; (2) tenure on current job, obtained from special CPS labor force questionnaires; and (3) continuous time out of the labor force estimated from the Social Security Administration's Longitudinal Employee-Employer Data file (LEED). Briefly, information on weeks worked during the year and the employment rate at the beginning of the year allow for estimation of the annual probability of continuous employment, $sw + (1 - sw)*p_w$, and continuous nonemployment, $sn + (1 - sn)*q_n$. These parameters are estimated from the fraction of the workforce that worked 50-52 weeks and the fraction of the nonworkforce who worked zero weeks. From data on the tenure distribution we can form estimates of the fraction continuously employed for one year and for two years. These two data estimate $sw + (1 - sw)*p_w$ and $sw + (1 - sw)p_w**2$ respectively, from which estimates of sw can be obtained. With this estimate, we return to CPS weeks distributions to calculate p_w. A similar set of observations on the fraction continuously out of work leads to estimates of sn.[10]

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new worker-stayer fraction (sw_t') using the following formula. $sw_t'M_t' E_o = sw_{t-1}' M_{t-1}' E_o + dsw ((1-sw_{t-1})' M'_{t-1} E_o)/((1-sw_{t-1})' M'_{t-1} E_o + (1-sw_{t-1})$ "$(1-M_{t-1})$" $(1-E_o))$. A similar algorithm is used to allocate the non-workforce-stayer fraction (sn) in all years between the initial group of workers and non-workers.

[9]For the subperiod 1967-1980, we used CPS public use files to calculate employment rates and weeks worked distributions for single years of age. Over the period 1950-1966, CPS published tables exist on the distribution of weeks worked and employment by age. However, these published tables are provided only in 5 year and 10 year age groups. We smoothed this series using cubic spline approximations to obtain values at single year of age.

Periodic yearly data was provided for these series during the 1940s. In addition, we used the 1900 and 1940 public use census data and the published data from 1910, 1920, 1930 census series to complete our series. Cubic spline approximations were also used to fill in these series for the years in which data were not available.

[10]In our exploratory empirical work, we rejected the two special cases of a pure heterogeneity model and a pure one period Markov. If both P_{mm} and P_{nn} were equal to one, this model of accumulation would reduce to a model of extreme heterogeneity. In the Markov model, unlike

The probability that a working woman remains employed for a year is P_{mm} (= sw + (1- sw)p_w). In order to depict lifecycle patterns in the parameters, Figure 1 shows with solid lines these probabilities for cohorts born in 1930, 1940, and 1950. The dotted lines in these figures illustrate the corresponding probability that a non-working woman remains out of the labor force for another year, P_{nn} (= sn + (1 - sn)) q_n). The lifecycle paths (Fig. 1) for these birth cohorts indicate that the transition probabilities from work to work decline initially from age 16 to 20 and rise gradually thereafter throughout the lifecycle. This U shape movement is due to the entry into the labor force of high school graduates and the subsequent exit of women during childbearing. Those women who remain in the labor force tend to have high probabilities of continuing to work, a tendency that rises with age.

A similar lifecycle path is shown for the probability of a non-worker remaining in the nonwork state. This shows the same early career decline and subsequent sharp rise, but the fraction reaches its asymptote around age 30. As women end their child rearing years and reenter the work force, those who remain out of the work force represent a subpopulation of women who have very low probabilities of ever working again. Combined, these probabilities in Figure 1 are a manifestation of the growing differentiation of workers from nonworkers as a cohort ages. As we move towards later stages of the lifecycle, current labor force status becomes an increasingly more accurate predictor of longer time labor force attachment.

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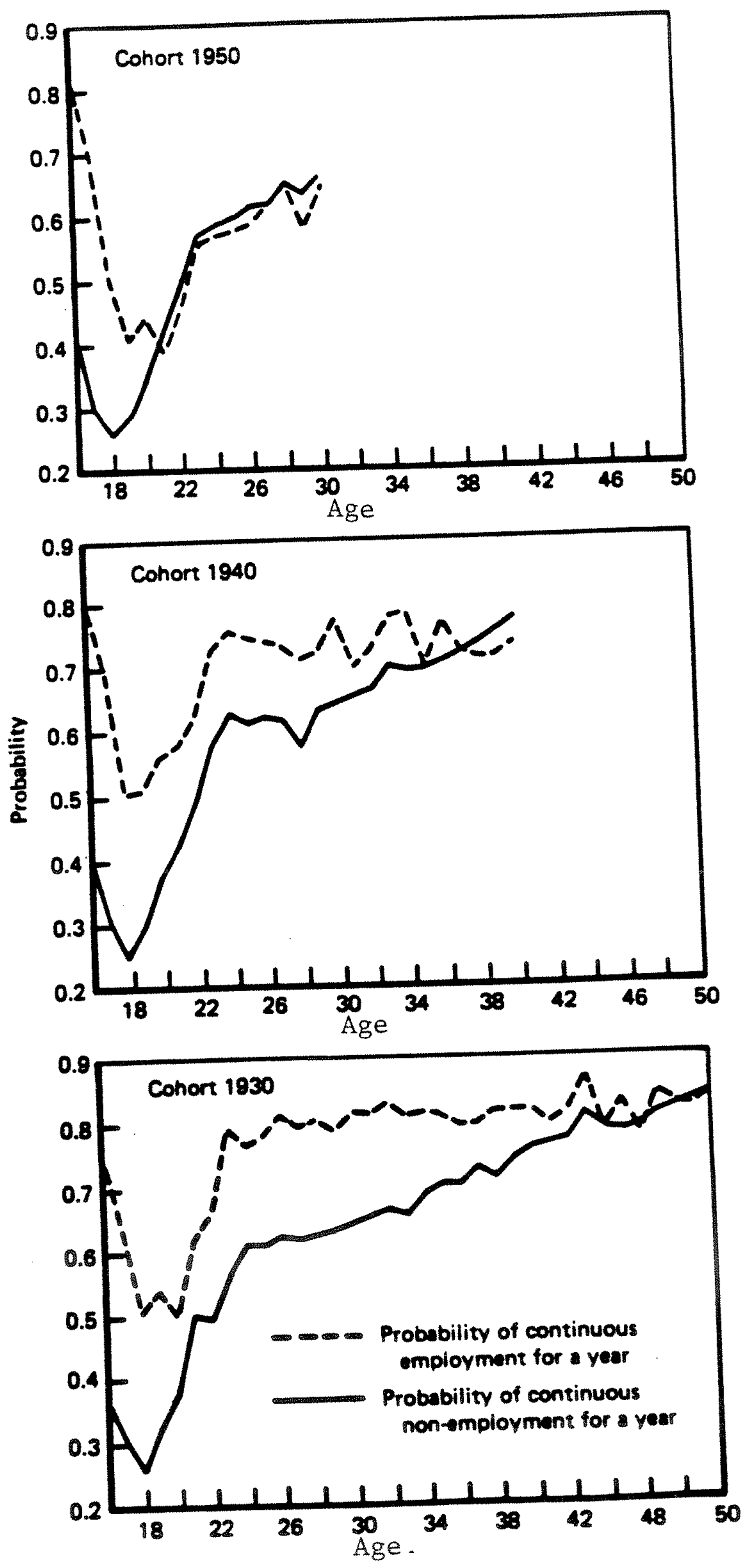
the pure heterogeneity model, the population members are homogeneous except for their current work status. Eventually, as the process evolves, workers and nonworkers will transit between these states so that the experience of the workforce and the experience of the population coverage toward one another regardless of their initial differences. Our investigation of the duration of "stays" in the work or the nonwork status showed that the Markov model did not describe these data accurately. For example, lengths of time out of the workforce violated the Markov structure--given that a women did not work last year, the probabilikty of her not working for the preceding two years was much higher than the geometric decline rate predicted by the Markov model. We did find that the simple Markov model worked better at ages less than 22 and older than 64. Within these age groups, therefore, the simple BLS Markov model was used.



Cohort 1950
Cohort 1940
Cohort 1930
Probability
Age
Probability of continuous employment for a year
Probability of continuous non-employment for a year

Figure 1

ACCUMULATED PRIOR LABOR FORCE EXPERIENCE

In practice, worklife models have a prospective orientation, forecasting a future that has not as yet taken place. But these models imply a past worklife as well as a future one. As a result, we can calculate the implications of alternative models for the retrospective years of work experience of current-period workers and current-period non-workers. Because we can simulate past realizations of prior cohorts of women, backcasting of these models is useful. By contrasting the actual realization with our model based predictions, the validity of our models can be assessed.

When backcasting these models, once again it is important to distinguish between the past work experience of the current period population of women and the accumulated experience of this period's working women and non-working women. Denote by ew_t the experience of current-period workers and by en_t the experience of current-period nonworkers. The accumulation of worker experience is described by

$$(7)\quad ew_t = \frac{P_{mm} * M_{t-1} * ew_{t-1} + P_{mn} * (1-M_{t-1}) * en_{t-1} + 1.}{P_{mm} * M_{t-1} + P_{mn} * (1-M_{t-1})}$$

The experience of the workforce is a weighted average of the experience of workers and nonworkers with weights proportional to the probability of being a worker in period t. To this average is added one period of experience accumulated during period t.[11] For nonworkers, experience accumulation is generated by

[11]At the end of the year, once again we must make some assumptions about the transition of stayers into other states. If the fraction of the population who are worker-stayers rises (i.e., $dsw = sw_t M_t - sw_{t-1} M_{t-1} > 0$), we again assume that this subpopulation is augmented from the pool of worker-movers. We further assume that the

$$(8) \quad en_t = \frac{P_{nm} * M_{t-1} * ew_{t-1} + P_{nn} * (1-M_{t-1}) * en_{t-1}}{P_{nm} * M_{t-1} + P_{nn} * (1-M_{t-1})}$$

The experience accumulation of the population is given (after some algebra) by

$$(9) \quad ep_t = M_t * ew_t + (1 - M_t) * en_t$$

$$= M_t + M_{t-1} * ew_{t-1} + (1 - M_{t-1}) * en_{t-1}$$

$$= M_t + ep_{t-1}$$

Note in Eq. (7) that an increase in P_{nm}, representing an increase in the probability of moving out of the nonworking state, will increase the weight attached to the experience of nonworkers in calculating next

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experience of workers switching from mover to stayer status is the mean of current worker-movers--a randomly chosen worker-mover becomes a worker-stayer. This implies that the average experience of worker-stayers will have declined, while that of worker-movers remains unchanged. This calculation appropriately constrains the experience of the aggregate of workers to remain unchanged when a worker-mover is designated as a worker-stayer.

Similar recalculations of average experience are made if the worker-stayer fraction should decline. In this case, we assume that a randomly chosen worker-stayer moves to worker-mover status. In general this move will increase the average experience of both groups while keeping the experience of workers unchanged. Changes in the fraction of stayer-nonworkers, $sn*(1 - M_{t-1})$, are treated similarly. We assume that stayer-nonworkers move only to mover-nonworkers and vice versa. The average experience of the origin group is assumed to be unchanged if one of its randomly chosen members leaves. The destination group's average experience will change so as to preserve the average experience of nonworkers.

period's experience for workers. In other words, if the fraction of the population working rises because of an increased movement of nonworkers to workers, the experience of the work force will initially decline as long as nonworkers have less initial experience than workers. If the fraction working rises because of workers "sticking" to the work force, then the experience of the workforce will rise.

Secular increases in participation rates can correspond to a greater attachment of workers to the labor force or a lower probability of current nonworkers staying out of the workforce. Which of the two factors dominate is crucial for understanding trends in labor market experience of female workers. Secular trends in these probabilities (P_{mm}, P_{nn}) are illustrated in Figure 2, evaluated at ages 25, 35, and 40. Figure 2 demonstrated that almost all of increase in the employment ratio for women was due to the decline in the probability of nonworkers remaining in the non-work state. The probability of exiting from the work state did not change over this 30 year period. Despite the enormous increase in employment, women workers exhibit the same attachment to the workforce in 1980 as in 1950. As a result, increasing levels of participation are associated primarily with large numbers of new female workers with little prior labor market experience.

The implications of such trends for our experience time series are illustrated in Figures 3 and 4. Figure 3 shows a typical lifecycle evolution of market experience of three groups for the cohort of women born in 1930. The experience of the population is simply the summation of all past employment ratios. The experience of the workers and nonworkers reflects the average experience for those groups at the date of measurement. Even though the identity of workers and nonworkers is changing constantly, our framework generates divergence between the experience accumulation of the population and the workforce. Because the stayer fractions for both workers and nonworkers rise throughout the lifecycle, there is a growing divergence between the experience accumulation of current workers and nonworkers. Toward the end of the career, the accumulation of experience for workers approaches the accumulation of age.

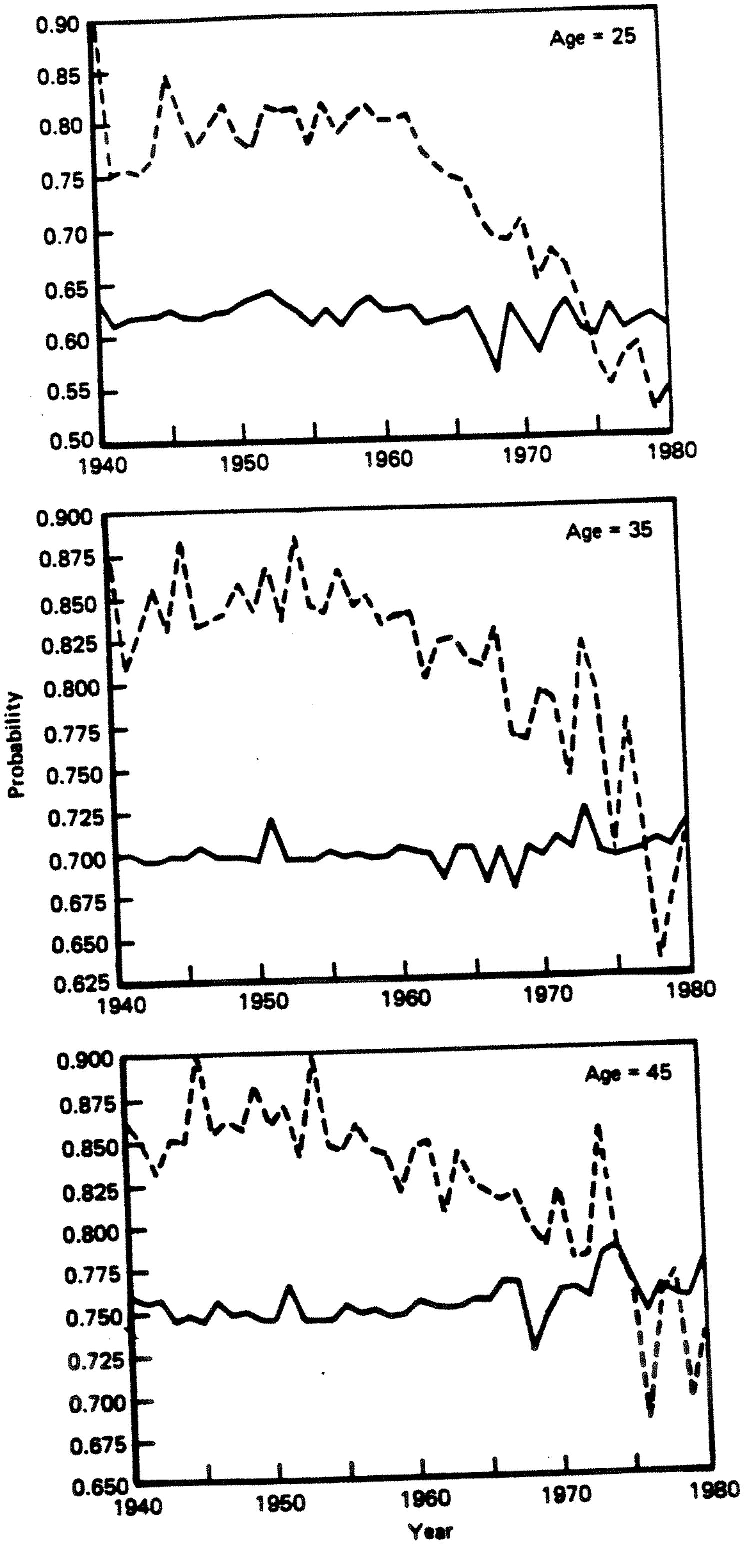
Age = 25
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
1940
1950
1960
1970
1980
Age = 35
0.900
0.875
0.850
0.825
0.800
0.775
0.750
0.725
0.700
0.675
0.650
0.625
Probability
Age = 45
Year

Figure 2

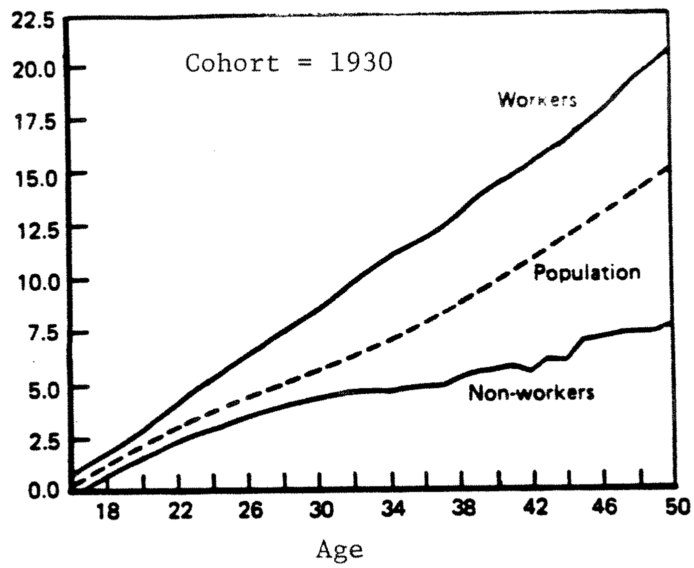
Cohort = 1930
Workers
Population
Non-workers
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
18
22
26
30
34
38
42
46
50
Age

Figure 3

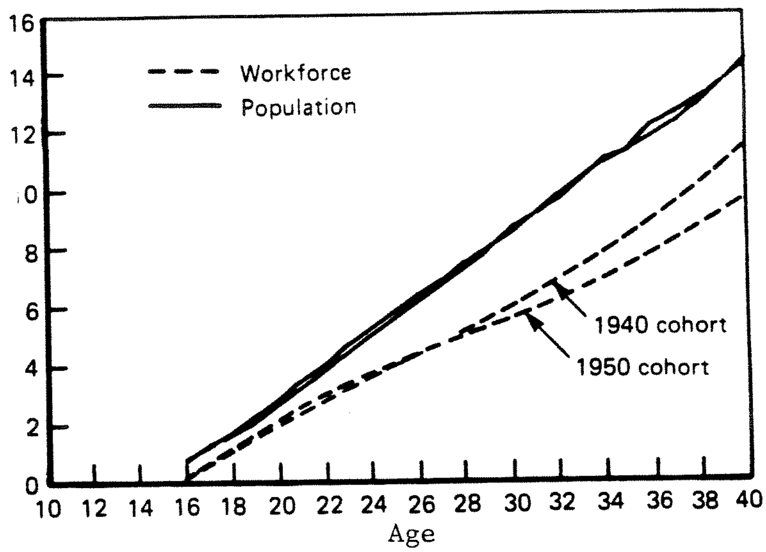
16
14
12
10
8
6
4
2
0
Workforce
Population
1940 cohort
1950 cohort
10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
Age

Figure 4

Figure 4 overlays the experience accumulations for workers and for the population for two cohorts. A comparison of the 1930 and 1940 cohorts shows the effect on the experience of the population of rising employment ratios. Especially as we move further out into the lifecycle, the average experience of the 1940 birth cohort diverges from that of the 1930 cohort. However, the experience of the workforce is the same at every age for these two birth cohorts. The entry of additional women into the workforce acted to hold down the average experience of workers for the 1940 birth cohort.

We conclude this section by examining in Table 2 the key issue of secular trends in women's experience. This Table lists out estimates of women's accumulated years of labor market experience for each end of decade year between 1920 and 1980. Our estimates are presented for the sample of working women and for all women. The contrast between these two samples are stark. For those over 30 years old, the experience of the female workforce has changed little over these last sixty years. For example, a forty-year old working women had 15.4 years of work experience in 1930; by 1980, a forty-year old working woman had worked 14.4 years. Essentially, the experience accumulation of workers was damped as low experience nonworkers entered the labor force. The accumulated experience of all women - workers and nonworkers alike - expanded continuously over the last half-century. Between 1930 and 1980, there was almost a 5 year incremental gain in the total number of years worked for the average forty-year old women (from 6.7 years in 1930 to 11.4 years in 1980).[12]

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[12]In other work, we have investigated the correspondence between the of weekly wages ratios by sex and the relatively stable for experience time series of the female workforce. See Smith and Ward (1988) for details.

Table 2

YEARS OF LABOR MARKET EXPERIENCE

Year	AGE 20	25	30	35	40	45
			Sample: Working Women			
20	2.62	5.57	3.74	11.80		
30	2.34	5.55	8.97	12.04	15.38	18.51
40	1.98	5.05	8.54	11.08	13.55	15.85
50	2.81	5.87	7.97	10.57	13.99	16.43
60	2.70	5.76	8.48	11.83	13.68	16.58
70	2.63	5.69	8.68	11.21	14.24	17.21
80	3.00	6.23	9.50	11.70	14.39	16.97
			Sample: All Women			
20	1.81	3.40	4.53	5.31		
30	1.55	3.57	4.90	5.82	6.65	7.39
40	1.25	3.08	4.63	6.11	7.19	7.94
50	2.14	4.08	5.04	6.29	8.13	9.87
60	1.96	3.92	5.61	7.38	8.71	10.43
70	2.13	4.29	5.98	7.68	9.66	11.91
80	2.47	5.27	7.85	9.46	11.40	13.35

COMPARISON OF WORKLIFE MODELS

In this final section, we return to the original intent of our paper - forecasting women's future worklife. The current workhorse for all such projections is the increment-decrement model, particularly the widely cited BLS worklife tables. We contrast in this section the different forecasts for women's remaining years in the labor market that emerge from the two models.

Table 3 compares the expected worklives obtained from our model with those derived from a conventional increment-decrement approach. Compared with our model, the increment-decrement model understates the remaining years of worklife for women under age 40. That understatement results from the latter's use of cross-sectional transition rates between labor-force states. As we suggested above in explaining the need for a new model, use of cross-sectional rates does not capture the reality of women's sustained, increasing rates of labor force participation. This argument is supported by the fact that the models exhibit little difference for the sample of all women after age 45, where this bias is small. Among younger women, however, the bias is not trivial. For example, we forecast that a 25 year old women will spend 2.9 more future years in the labor market than the BLS model predicts.

For calculating worklife discounts, the critical difference between the two models is not the disparity between their estimates for all women, but the difference between their estimates for women who are or are not currently in the labor force. As Table 3 shows, the BLS tables predict that at age 30, a currently working woman would work 21.7 more years while a currently non-working woman would work 19.1 years (a difference of only 2.6 years). In contrast, the numbers from Smith-Ward for 30-year-olds are 28.2 and 17.3 (a difference of 10.9 years). Both models predict increasing differentiation between workers and non-workers as women age, but the discrepancy is always much smaller with the increment-decrement approach. The Markov model that underlies the BLS work life tables simply does not allow for sufficient distinction between current workers and non-workers. By the time women are 45, the BLS tables indicate a 4.1 year difference in remaining years of work compared to our 12.8 year difference. At age 45, our model implies that non-labor force participants will work half as many years in the future than the BLS predicts (4 vs 8.4 years).

Because it forecasts a future we have not observed, Table 3 does not speak directly to the empirical validity of the two models. Since both models imply a past worklife as well as a future one however, we

Table 3

EXPECTED WORKLIVES USING THE DIFFERENT MODELS

	Increment-Decrement Model			Smith-Ward Model		
Age	All Women	In Labor Force	Not in Labor Force	All Women	In Labor Force	Not in Labor Force
20	27.2	27.9	26.1	30.7	32.2	29.1
25	24.0	24.8	22.6	26.9	30.4	22.5
30	20.8	21.7	19.1	22.4	28.2	17.3
35	17.6	18.6	15.7	18.6	25.3	12.5
40	14.3	15.5	12.1	14.9	19.9	9.0
45	11.1	12.5	8.4	11.1	16.8	4.0
50	8.0	9.8	5.3	8.2	13.1	2.7
55	5.2	7.2	2.9	5.2	8.9	1.9
60	3.0	5.0	1.5	2.8	5.5	1.0

can establish their relative merit by calculating women's retrospective accumulated experience. Table 4 calculates the past years of experience for current workers and non-workers for our model. These simulations are compared to the work experience actually accumulated by women in the the mature and younger women's panels of National Longitudinal Survey (NLS Parnes) data.[13] How do the models compare? Our approach is able to replicate the past work experience of current working women and current non-working women. As implied by our model, the actual labor force behavior of women also makes a sharp distinction between workers and non-workers. For example, among 45-49 year old women, we predict a mean prior work experience of 18.5 years for current women workers and 7.3 years for women who are currently out of the labor

[13]Our data is adopted from O'Neill (1985), Table 7. This table contains past experience for a single year, 1977, for women aged 40-49 and for 1972 for women, aged 35-39. Our model predictions are compared to her data for those years.

force. These model simulated predictions are quite close to the actual values of 17.9 years for the labor force and 8.7 years for the non-labor force.

Our predictions are even closer to the mark for younger women. Among women 35-39 years old, we actually match the actual non-labor force mean (4.8 years) and miss the labor force mean by only one-tenth of a year (12.1 compared to 12.2). Among those 35-39, the actual difference between past work experience of workers and non-workers is 7.3 compared to our prediction of 7.4 years.

CONCLUSIONS

While our application in this paper concerns the appropriateness of increment-decrement models for predicting future worklives, the arguments we advance hold more generally. Increment-decrement models have been applied to many other demographic behaviors, including marriage and divorce, (Krishnamoorthy 1979, and Schoen and Land 1979), and migration (Rogers, 1975). When we try to predict state specific durations, the assumptions inherent in increment-decrement models are even less likely to be appropriate in these applications. For example, there exists considerable heterogenity in divorce probabilities (see

Table 4

HOW WELL THE MODELS CALCULATE RETROSPECTIVE EXPERIENCE

	Actual[a]			Smith-Ward		
Age	Population	Labor Force	Non-Labor Force	Population	Labor Force	Non-Labor Force
35-39	8.9	12.1	4.8	8.7	12.2	4.8
40-44	11.7	14.9	6.6	11.5	14.8	6.2
45-49	13.9	17.9	8.7	13.6	18.5	7.3

[a]Source: O'Neill (1985).

Lillard-Waite 1988), a variation among people that will not be captured by simply conditioning on the current marital state. If our results for the labor market application generalize to these other behaviors, the widespread use by demographers of increment-decrement models may exceed their empirical validity. It may well be that other models are better able to replicate actual labor force dynamics than the simple one we propose here. What is clear is that in many respects increment-decrement model describe these dynamics quite poorly.

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