Lifetime Earnings Patterns, the Distribution of Future Social Security Benefits, and the Impact of Pension Reform

*by Barry Bosworth, Gary Burtless, and Eugene Steuerle**

Policymakers have long been interested in understand,, ing the adequacy and distribution of Social Security benefits and in predicting the effects of reform on representa,, tive workers. This article describes two new methods for estimating the career profile of earnings for representative workers. It then compares the results of those new methods with earnings profiles as,, sumed in traditional distribu,, tional analysis of Social Security and shows the impli,, cations of the new results for evaluating Social Security reform.

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Summary

In order to assess the effect of Social Security reform on current and future workers, it is essential to accurately characterize the initial situations of representative workers affected by reform. For the purpose of analyzing typical reforms, the most important characteristic of a worker is the level and pattern of his or her preretirement earnings. Under the current system, pensions are determined largely by the level of the workers' earnings averaged over their work life. However, several reform proposals would create individual retirement accounts for which the pension would depend on the investment accumulation within the account. Thus, the pension would also depend on the timing of the contributions into the account and hence on the exact shape of the worker's lifetime earnings profile. Most analysis of the distributional impact of reform has focused, however, on calculating benefit changes among a handful of hypothetical workers whose relative earnings are constant over their work life. The earnings levels are not necessarily chosen to represent the situations of workers who have typical or truly representative earnings patterns. Consequently, the results of such analysis can be misleading, especially if reform involves introducing a fundamentally new kind of pension formula.

This article presents two broad approaches to creating representative earnings profiles for policy evaluation. First, we use standard econometric methods to predict future earnings for a representative sample of workers drawn from the Survey of Income and Program Participation (SIPP). Our statistical estimates are based on a simple repre,, sentation of typical career earnings paths and a fixed-effect statistical specification. Because our estimation file contains information on each worker's annual earnings from 1951 through 1996 as reported in the Social Security Administration's earnings files, we have a record (though an incomplete one) of the actual earnings that will be used to determine future benefit payments. Our estimates of the earnings function permit us to make highly differentiated predictions of future earnings for each member of our sample. By combining the histori,, cal information on individual earnings with our prediction of future earnings up through the normal retirement age, our first approach produces tens of thousands of predicted career earnings paths that can be used in microsimulation policy analysis.

Our second approach to creating lifetime earnings profiles is similar in

some ways to the traditional method. For example, it is based on the creation of only a handful of "stylized" career earnings patterns. An important difference with the traditional method, however, is that we define the career earnings patterns so that they are truly representa,, tive of patterns observed in the workforce. We use simple mathematical formulas to characterize each stylized earnings pattern, and we then produce estimates of the average path of annual earnings for workers whose career earnings path falls within each of the stylized patterns we have defined. Finally, we calculate the percentage of workers in successive birth-year cohorts who have earnings profiles that match each of the stylized earnings patterns. Although this method may seem simple, it allows the analyst to create stylized earnings patterns that are widely varied but still represen,, tative of earnings patterns observed among sizable groups of U.S. workers. The effects of policy reforms can then be calculated for workers with each of the stylized earnings patterns.

Our analysis of U.S. lifetime earnings patterns and of the impact of selected policy reforms produces a number of findings about past trends in earnings, typical earnings patterns in the population, and the potential impact of reform. The analysis focuses on men and women born between 1931 and 1960. Along with earlier analysts, we find that men earn substantially higher lifetime wages than women and typically attain their peak career earn,, ings at a somewhat earlier age. However, the difference in career earnings patterns between men and women has narrowed dramatically over time. Workers with greater educational attainment earn substantially higher wages than those with less education, and they attain their peak career earnings later in life. For example, among men with the least education, peak earnings are often attained around or even before age 40, whereas many men with substantial postsecondary schooling do not reach their peak career earnings until after 50.

Our tabulations of the lifetime earnings profiles of the oldest cohorts (born around 1930) and projections of the earnings of the youngest profiles (born around 1960) imply that the inequality of lifetime earnings has increased noticeably over time. Women in the top one-fifth of female earners and men in the top one-fifth of male earners are predicted to receive a growing multiple of the economy-wide average wage during their career. Women born between 1931 and 1935 who were in the top fifth of female earners had lifetime average earnings that were approximately equal to the average economy-wide wage. In contrast, women born after 1951 who were in the top fifth of earners are predicted to earn almost 50 percent more, that is, roughly 150 percent of the economy-wide average wage. Women with a lower rank in the female earnings distribution will also see gains in their lifetime average earnings, but their gains are predicted to be proportionately much smaller than those of women with a high rank in the distribution. Men with high earnings are also predicted to enjoy substantial gains in their relative lifetime earnings, while men with a lower rank in the earnings distribution will probably see a significant erosion in their typical wages relative to the economy-wide average wage. That is mainly the result of a sharp decline in the relative earnings of low-wage men born after 1950.

In creating stylized earnings profiles that are represen,, tative of those of significant minorities of U.S. workers, we emphasized three critical elements of the earnings path: the average level of earnings over a worker's career, the upward or downward trend in earnings from the worker's 30s through his or her early 60s, and the "sagging" or "hump-shaped" profile of earnings over the worker's career. That classification scheme yields 27 characteristic patterns of lifetime earnings. Surprisingly, the difference between men and women *within* each of those categories is quite modest. The main difference between men and women is in the proportions of workers who fall in each category. Only 14 percent of men born between 1931 and 1940 fall in earnings categories with the lowest one-third of lifetime earnings, whereas 53 percent of women born in those years have low-average-earnings profiles. On the other hand, women born in those years are more likely to have a rising trend in lifetime earnings, while men are more likely to have a declining trend. We find that the distribution of lifetime earnings contains relatively more workers with below-average earnings and relatively fewer with very high earnings than assumed in the Social Security Administration's traditional policy analysis. For example, the "low earner" traditionally assumed by the Office of the Chief Actuary is assigned a level of average lifetime earnings that we find to be higher than the average earnings of persons in the bottom one-third of the lifetime earnings distribution.

The stylized earnings profiles developed here can be used for policy evaluation, and the results can be com,, pared with those from the more traditional analysis. That comparison produces several notable findings. Because earnings profiles that are actually representative of the population tend to have lower average earnings than assumed in the traditional analysis, workers typically accumulate somewhat less Social Security wealth than implied in the traditional analysis. On the other hand, because the basic benefit formula is tilted in favor of lower-income workers, the internal rate of return on Social Security contributions is somewhat higher than detected in the traditional analysis. Moreover, the primary insurance amount measured as a percentage of the worker's average indexed earnings tends to be higher

than implied by the traditional analysis. Finally, the stylized earnings patterns can be used to compare benefit levels enjoyed by workers under the traditional Social Security formula and under an alternative plan based on individual investment accounts. That comparison shows, as expected, that the traditional formula favors low-wage workers and one-earner couples, while an investment account favors single, high-wage workers. Comparing two workers with the same lifetime average earnings, the traditional formula favors workers with rising earnings profiles (that is, with lifetime earnings heavily concen,, trated at the end of their career), while investment account pensions favor workers with declining earnings profiles (that is, with earnings concentrated early in their career).

Introduction

To evaluate the relationship between individual earnings and Social Security benefits and predict the distributional impact of Social Security reform, analysts have tradition,, ally relied on policy simulations covering a handful of representative workers. The Social Security benefit formula is extremely complicated. Before the introduc,, tion of inexpensive electronic computation, it was not feasible to examine the detailed effects of reform on large numbers of individual workers. Even after the price of computation had fallen dramatically, however, analysts and policymakers often found it easier to under,, stand the impact of reform by examining the effects on three or four representative workers rather than thou,, sands of workers whose earnings patterns span the actual experiences of the U.S. workforce.

Traditional Analytic Approach

The recent Social Security Advisory Council performed fairly typical policy analysis based on a handful of representative cases.[1] The Council assessed the poten,, tial impacts of three alternative reform plans using calculations for four representative workers. The workers were assumed to have lifetime earnings patterns corresponding to four levels of stable relative wages. The lowest-wage worker was assumed to earn 45 percent of the economy-wide average wage throughout his or her career; the second worker consistently earned wages corresponding to the average wage; the third earned 1.6 times the average wage; and the fourth received the maximum taxable wage throughout his or her career.

A person's Social Security entitlement depends on the number of family dependents as well as on his or her earnings level. To account for that complication, the Advisory Council examined the effect on benefits of various combinations of earnings patterns among married spouses (a high-wage husband married to an average-wage wife, for example, or an average-wage husband married to a wife with no career earnings). The Council's calculations permit readers to draw straightfor,, ward conclusions about the impact of reform on different kinds of families. For example, a traditional goal of Social Security is to offer special protection to low-wage workers. The Council's analysis shows whether that goal is achieved under each of the three plans examined in its 1997 report.

An important shortcoming of the traditional analysis is that it accurately characterizes just one dimension of a worker's career earnings pattern—namely, the career average level of earnings. While that simple character,, ization is sufficient to predict the effects of some changes in the Social Security benefit formula, it provides an inadequate representation to examine other, more funda,, mental kinds of reform. Workers who have low career earnings may have below-average earnings either because they earned low wages over a full career or because their career was interrupted several times by lengthy periods in which they earned no wages at all. Workers with high career earnings may have earned moderately high wages in every year of a lengthy career or below-average wages in some years and well-above-average earnings in others. For some kinds of reform, these differences can have major effects on a worker's retirement benefits.

One recent reform proposal would reduce the defined benefit pension now provided by Social Security and introduce a defined contribution benefit that would be financed out of contributions into individual retirement accounts. Benefits from that kind of retirement account vary with the investment earnings on contributions and thus depend crucially on the pattern of contributions over the course of a worker's career. Workers with the same average level of career earnings can obtain very different monthly pensions depending on the timing of their contri,, butions into the retirement accounts. Workers who make large contributions early in their career receive much bigger benefits than workers whose largest contributions occur near retirement. If there is a correlation between the timing of workers' earnings and the average level of their career earnings, distributional analysis that is based on assuming that workers earn fixed relative wages throughout their career can yield misleading conclusions.

Two Alternative Analytic Approaches

This article examines two alternatives to the traditional method of Social Security distributional analysis. The first alternative is microsimulation. Under that approach, we examine lifetime earnings patterns of tens of thou,, sands of workers and predict their future earnings

through the age when they become eligible to receive Social Security retirement benefits. Policy simulation can then be performed by calculating the effects of alternative benefit formulas on the pension entitlements of each worker in the sample.

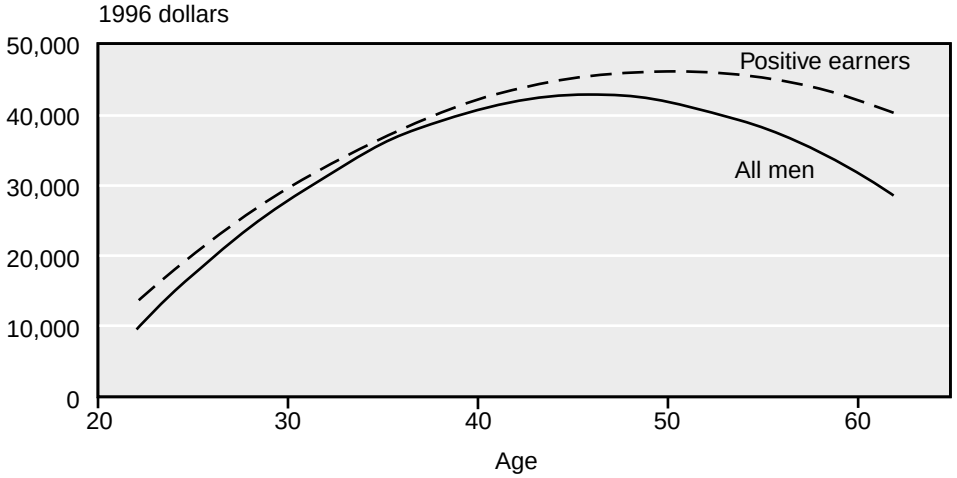
The second alternative is similar to the traditional method, but it involves developing more representative approximations of the lifetime earnings patterns of U.S. workers. In particular, we develop estimates of nine stylized career earnings patterns that span the experi,, ences of workers who become eligible to draw retirement or Disability Insurance benefits. We use simple mathematical formulas to characterize each stylized earnings pattern, and we then produce estimates of the average path of annual earnings for workers whose career earnings path falls in each of the nine stylized patterns. Policy simulation is then performed by calculating pension entitlements under alternative benefit formulas for each of the stylized earnings patterns.

The unique aspect of this study is its access to the Social Security earnings records of a representative sample of the total population, namely, workers included in the 1990-1993 Survey of Income and Program Participation (SIPP).[2] Those data have shortcomings, but they provide generally accurate information about the pattern of earnings over the workers' entire career. In this article, we:

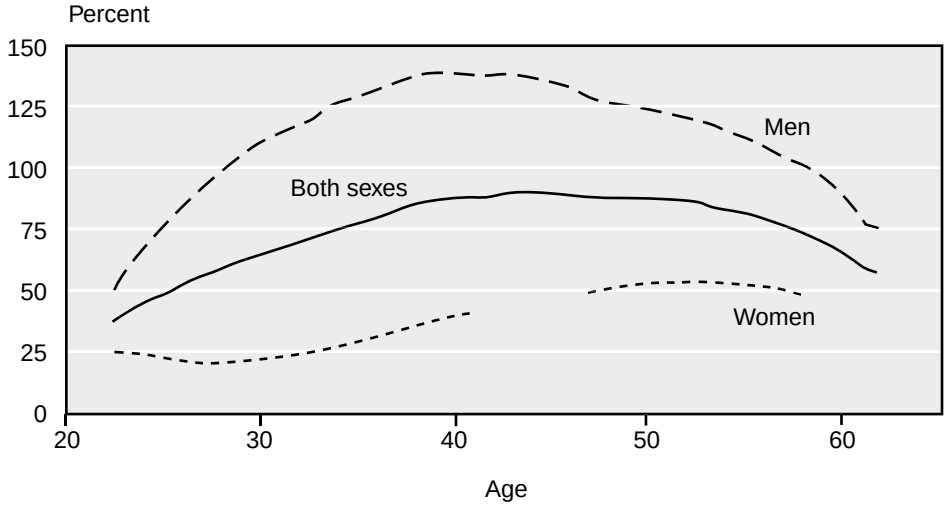
- Describe the data we use and the estimation of future earnings patterns under the microsimulation analytical approach;
- Describe our stylized representation of earnings for the second policy simulation approach;
- Examine career earnings patterns for people born in the 1930s who substantially completed their career by 1996, when our earnings information ends;
- Examine the career earnings patterns among workers born after the 1930s, although those tabulations are based in part on predicted earnings for years after 1996 (the predictions of post-1996 earnings are derived from the estimates produced for the microsimulation policy analysis approach); and
- Present policy simulations based on the nine stylized earnings patterns.

Chart 1.
Cross-sectional and cohort measures of the age-earnings profile

Annual earnings of U.S. men, cross-sectional data, 1996[a]



Earnings of workers in the 1931-1940 cohort relative to economy-wide average earnings[b]



a. U.S. Census Bureau, March 1997 Current Population Survey.
b. Authors' tabulations of merged 1990-1993 SIPP and SSER files (see text).

Prediction of Lifetime Earnings

The pattern of annual earned income has a characteristic hump-shaped pattern when population-average earnings are treated as a function of workers' ages. Average earnings of workers below age 30 are low, reflecting young workers' initially modest levels of job tenure, skill, and experience. Average earnings rise with age, as workers accumulate human capital and earn wages that reflect their increasing skill and experience. Average earnings then fall sometime after age 45 or 50 as the value of workers' skills erodes or as workers reduce their hours and enter retirement.

The age profile of lifetime earnings of U.S. men and those with positive earnings is displayed in Chart 1. The top panel shows the cross-sectional pattern of earned income among U.S. men based on 1996 data from the Current Population Survey. The earnings profile is estimated as a quadratic function of age using Census Bureau tabulations of average earnings within broad age categories (18-24, 25-34, 35-44, and so on). The age pattern of earned income, conditional on having positive earnings, shows a rapid rise from ages 22 through 40, slower earnings growth for workers in their 40s, and a decline in earnings beginning sometime after age 50. The chart also shows the average age profile of earnings calculated using information for all potential workers, including men who did not work. Although that profile shows lower average earnings at each age, it reveals the same pattern of rapidly rising income when men are in their 20s and 30s and declining earnings when they are in their 50s and 60s.

The bottom panel of Chart 1 provides a contrasting perspective based on the Social Security earnings data for the 1931-1940 birth cohort.[3] It shows the age-earnings profile of a specific cohort, followed over time. Individual earnings are expressed as a proportion of the economy-wide average wage in each year. In broad terms, the age pattern is very similar to that obtained from the cross-sectional data of the top panel. The male profile has a general hump-shaped pattern with rising earnings into the middle years followed by a period of gradual decline. But the single-cohort data suggest that men's earnings peak earlier in their work life, around ages 38 to 42, rather than between 44 and 47. Moreover, they reach a peak earlier than women's earnings, which reach a career maximum around ages 50 to 55.

The data in Chart 1 clearly do not represent the earnings experiences of *each* U.S. worker. Instead, they reflect the average of a widely diverse set of experi,, ences. The age pattern of earnings differs widely for workers with different characteristics. In comparison with workers who have limited education, workers who have more schooling show a pattern of steeper earnings growth in their 20s and 30s. Better educated workers attain their peak earnings at a later age. The age profile of earnings also has not remained fixed over the past few decades. In the 1960s, the cross-sectional age pattern of earnings showed smaller earnings differences between 25-year-old and 45-year-old workers. In other words, the age profile of earnings is now more steeply sloped than it was in the past. Finally, individual workers differ widely from one another. Even among workers with identical observable characteristics, including age, educational attainment, occupational attachment, and job tenure, there are enormous variations in annual earnings and in the pattern of year-to-year changes in earnings.

Basic Specification

To forecast future earnings for workers who have only partially completed their career, it is necessary to make plausible predictions about the structure of future age-earnings profiles. We adopted a simple specification of the basic relation between workers' ages and the change in their earnings, treating individual-level earnings as a step-function of age:

$$y_{it} = \mu_i + f(Age) + \xi_{it}, \qquad (1)$$

where

$$f(Age) = \beta_1 A_1 + \beta_2 A_2 + \beta_3 A_3 + \ldots + \beta_T A_T, \text{ and}$$

A_1 = 1 if Age is less than 25,
= 0, otherwise;
A_2 = 1 if Age is between 25 and 29,
= 0, otherwise;
A_3 = 1 if Age is between 30 and 34,
= 0, otherwise;
A_4 = 1 if Age is between 35 and 39,
= 0, otherwise; *[This category is omitted in the estimation.]*
A_5 = 1 if Age is between 40 and 44,
= 0, otherwise;
A_6 = 1 if Age is between 45 and 49,
= 0, otherwise;
A_7 = 1 if Age is between 50 and 54,
= 0, otherwise;
A_8 = 1 if Age is between 55 and 57,
= 0, otherwise;
A_9 = 1 if Age is between 58 and 59,
= 0, otherwise;
A_{10} = 1 if Age is between 60 and 61,
= 0, otherwise;
A_{11} = 1 if Age is 62,
= 0, otherwise;
A_{12} = 1 if Age is between 63 and 64,
= 0, otherwise;
A_{13} = 1 if Age is 65,
= 0, otherwise;
A_{14} = 1 if Age is 66 or more,
= 0, otherwise.

Ignoring μ_i and ξ_{it}, this specification implies that earnings rise by varying amounts, β_A, at each of the age breaks specified in the function f(Age). The specifica,, tion is far more flexible than the quadratic function used to estimate the cross-sectional age-earnings profiles in Chart 1.

We do not have a reliable basis for predicting the future trend of economy-wide average earnings. That trend will crucially affect the actual earnings profiles of workers who are currently young and middle-aged. Rather than estimate the trend in economy-wide earnings directly, we estimate the relationship between workers' *relative* earnings and their age. This study defines relative earnings as the ratio of a worker's earnings in a given year to the economy-wide average covered wage estimated by the Social Security Administration. Thus, the coefficients β_A in equation (1) refer to the change in a worker's relative earnings at each of the age breaks in the age-earnings function, f(Age). If economy-wide average earnings climb rapidly, the β's will be associated with steep growth in actual earnings during the phase in a worker's career when his or her relative earnings are climbing. If economy-wide real wages are stagnant or declining, the β's will be associated with very modest or even shrinking annual earnings.

As noted above, the pattern of career earnings differs across population groups. Earnings profiles differ between men and women and among workers with differing levels of educational attainment. In this study, we estimate separate earnings functions for men and women, who in turn are divided into five educational groups:

- Those who did not complete high school,
- Those with a high school diploma but no schooling beyond high school,
- Those with 1 to 3 years of college education,
- Those with a college diploma, and
- Those with at least 1 year of education beyond college.

Workers can of course be divided into even narrower categories, for example, by race, occupational attach,, ment, marital status, and geographic region. In order to keep the estimation and projection simple, we decided not to examine career earnings profiles in those narrower groups.

We estimated the earnings equation under a fixed-effect specification. That is, we assumed that each person in a given subpopulation differs from other workers in his or her peer group by a fixed average amount. That individual-specific difference persists over a worker's entire career and is captured by the error term μ_i in equation (1) above. Under the assumptions of the fixed-effect model, we cannot obtain estimates of coefficients of variables that do not change over time for a single observation. The effects of those variables are all captured by the person-specific individual effect.

The coefficients of the age terms, β_A, are essentially determined by the average observed change in relative earnings as workers move up from one age category to the next. For example, the coefficient β_3 shows the average difference in earnings between ages 30 and 34 and the omitted age category, ages 35 to 39.[4] That difference is determined by an estimate of the average gain in relative earnings that persons actually experienced between ages 30 and 34, on the one hand, and ages 35 and 39, on the other. That kind of estimate can only be obtained with longitudinal information for a sample of workers. (It is *not* an estimate of the average difference in earnings between people aged 30-34 and those aged 35-39 in a given year.)

For estimates based on this model to be valid, future increases in relative earnings must mirror the pattern observed during the period covered by the estimation sample. Suppose the sample consists of people born between 1931 and 1960, and earnings are observed for the period from 1981 to 1990. The oldest people in the sample are between 50 and 59 years old during the estimation period. From the experiences of those people, we can form estimates of the average increase or decline in earnings that takes place between ages 50 and 54, 55 and 57, and 58 and 59. Under the assumptions of the model, the relative earnings gains or losses experienced by the oldest members of the 1931-1960 cohort (people who are 59 in 1990) will be duplicated by later birth-year cohorts when they reach those ages. Of course, the actual average earnings of younger cohorts will differ from those of the older cohort. The model offers two explanations for the difference. First, if economy-wide earnings grow faster when the younger cohorts are between 50 and 59, their actual earnings will grow faster (or decline more slowly) than was the case for the older cohort. Second, the average value of the individual specific error term, μ_i, may differ between the two cohorts, although the difference between two large birth cohorts will probably be small.

Employment Patterns

The specification defined by equation (1) represents a single-equation model of the earnings generation process. An alternative approach would be to develop a two-step model in which we first predict whether the individual is employed and then predict earnings conditional on employment. Some workers leave the labor force at a comparatively young age as a result of disability or early retirement In a single-equation model of earnings, those early retirees are combined with workers to produce

estimates of the path of *unconditional* earnings, that is, earnings of workers and nonworkers alike. Although the two-stage procedures would yield a more realistic pattern of lifetime earnings, we were not able to obtain reliable first-stage estimates of employment patterns.

Data

Our earnings equation is estimated with data from the 1990-1993 Survey of Income and Program Participation (SIPP) panels matched to Social Security Earnings Records (SSER). The sample consists of 44,792 women and 40,794 men for whom matched SIPP and SSER records could be obtained. The sample was restricted to respondents in the 1990-1993 SIPP samples who com,, pleted the second periodic interview. The sample was further restricted to persons born between 1926 and 1965.[5]

The SSER records contain information on Social Security-covered earnings by calendar year for the period from 1951 through 1996. Those records contain information only on earnings up to the taxable wage ceiling, not on *all* labor earnings.

Censoring at the taxable maximum wage is a major problem for men in the sample, though not for women. Our tabulations show that less than 1 percent of the person-year observations of women in the sample are affected by censoring. Censoring is much more common for men in the sample. Among men born between 1921 and 1960 who were at least 22 years old, 23 percent earned wages above the taxable maximum at least once between 1984 and 1993, and 13 percent earned wages above the taxable maximum at least once between 1994 and 1996. Men with above-average expected earnings—for example, college graduates between 35 and 55 years old—face a high likelihood of reaching the taxable maximum in a given year.

Censoring would not be a concern if the taxable maximum remained relatively constant. Unfortunately, it increased relative to average earnings over the analysis period, creating an upward bias in estimates of the growth rate in earnings for men who have high expected earned income.[6] Though we did not develop a formal censoring model, we took account of censoring informally by deriving estimates of the earnings function. For all individuals with Social Security-covered earnings at the taxable maximum, we created estimates of expected earnings above the taxable maximum but below a hypothetical ceiling based on the 1990-1996 average ratio of the ceiling to the average economy-wide earn,, ings. Thus, the revised series should reflect a consistent degree of censoring. For brevity, we refer to the transformed measure of earnings as "less censored" earnings.[7]

Estimation Procedures

The dependent variable in the estimation equation is the worker's annual Social Security-covered earnings divided by the economy-wide average wage for the relevant year. That ratio is designated y_{it} in equation (1). The period used in estimating the earnings function is 1987 through 1996, the last 10 years of available earnings data on the SSER. For each birth cohort included in the sample, the 10-year estimation period allows each cohort to move between at least two and possibly as many as six age categories defined in the age-earnings function, f(Age).

The basic earnings equation was separately estimated for eight different samples, defined by sex and the five levels of educational attainment. Respondents in the two highest educational attainment groups were combined into a single estimation sample; the other three educational groups were included in separate estimation samples. As described earlier, we also employed a fixed-effect estimation that allowed each individual's earnings to differ from the group average by a fixed amount over his or her full career. Table 1 shows the coefficient esti,, mates, standard errors, and t-statistics for the age-earnings profiles of potential workers who completed high school but received no education beyond high school. The upper panel shows estimates for men; the lower panel, estimates for women.[8]

The result of the estimation is the 10 earnings profiles (five for women and five for men) that are displayed in Chart 2. Note that men and women with greater educa,, tional attainment have significantly higher earnings than groups with less education at all ages past about age 30. Their peak career earnings are also attained somewhat later in life.[9] These estimates imply that relative earnings begin to decline for men between ages 40 and 50. Among men with the least schooling, relative earnings begin to fall as early as age 40. Men who have com,, pleted college do not experience sizable relative earnings declines until their 50s. Earnings peak at a lower level but at a later age among women. Peak lifetime earnings are only slightly higher than the economy-wide average wage for women with college and postgraduate educa,, tion. In contrast, among men with similar educational levels, peak earnings are approximately 60 percent higher than economy-wide earnings. Whereas men experience sizable or at least modest drops in average earnings by age 55, well-educated women do not attain their peak lifetime earnings until their mid-50s. Bear in mind that the age-earnings profiles displayed in Chart 2 show the combined effects of changing annual earnings among people who continue to work full time as well as steep earnings reductions associated with disability and early retirement for workers affected by those phenomena. If

Table 1.
Age-earnings profiles for workers with a high school diploma

Variable	Coefficient	Standard error	t	P>|t| (percent)
		Men		
Age 24	-19.82	0.872	-22.72	0
Age 29	-7.84	0.517	-15.17	0
Age 34	-0.99	0.381	-2.59	1.0
Age 44	-1.93	0.426	-4.53	0
Age 49	-7.55	0.603	-12.52	0
Age 54	-17.08	0.759	-22.49	0
Age 57	-30.67	0.923	-33.21	0
Age 59	-44.30	1.056	-41.95	0
Age 61	-59.72	1.122	-53.21	0
Age 62	-75.31	1.314	-57.31	0
Age 64	-94.51	1.242	-76.08	0
Age 65	-109.13	1.492	-73.15	0
Age 67	-117.27	1.580	-74.24	0
Constant	107.17	0.350	306.52	0

Standard deviation (μ_i) = 64.89 R-sq within = 0.0756
Standard deviation (ξ_{it}) = 35.39 between = 0.0291
Standard deviation ($\mu_i + \xi_{it}$) = 73.91 overall = 0.0308
Number of individuals = 14,230 F(13,126,042) = 792.46
Average number of time periods per observation = 9.86

Variable	Coefficient	Standard error	t	P>|t| (percent)
		Women		
Age 24	-10.89	0.534	-20.39	0
Age 29	-7.16	0.319	-22.44	0
Age 34	-4.31	0.237	-18.17	0
Age 44	4.00	0.250	16.02	0
Age 49	5.88	0.339	17.35	0
Age 54	4.46	0.424	10.51	0
Age 57	1.00	0.514	1.95	5.2
Age 59	-2.86	0.581	-4.92	0
Age 61	-6.80	0.615	-11.06	0
Age 62	-12.33	0.711	-17.35	0
Age 64	-20.02	0.673	-29.77	0
Age 65	-24.96	0.801	-31.18	0
Age 67	-27.52	0.851	-32.35	0
Constant	46.38	0.216	214.50	0

Standard deviation (μ_i) = 43.82 R-sq within = 0.0279
Standard deviation (ξ_{it}) = 22.77 between = 0.0353
Standard deviation ($\mu_i + \xi_{it}$) = 49.38 overall = 0.0292
Number of individuals = 17,769 F(13,156,898) = 346.19
Average number of time periods per observation = 9.83

SOURCE : Authors' calculations with the 1990-1993 matched SIPP and SSER files as described in the text.

NOTE: The dependent variable is worker's annual earnings divided by the economy-wide average wage multiplied by 100.

the estimates were based solely on earnings patterns among men and women who continue to work full time, we would see a later and higher peak in lifetime earnings.

Pattern of Future Earnings Growth

Predicting relative earnings outside of the estimation period is a straightforward process, and we have such predictions extending through 2020. They can be com,, bined with a projection of average earnings, such as that of the Social Security Trustees' Report, to obtain nominal earnings. An estimate of the individual-specific fixed effect (μ_i) is added to estimates of $X_{it}\beta$ to produce an estimate of the person's expected covered earnings in year *t*. In order to generate predictions that have a similar variance to actual covered earnings, we also added a time-varying error term to the prediction. The error term was generated from the 10 individual-specific residuals for each year of the estimation period, 1987,, 1996. For each year of the projection period, we ran,, domly selected an error term from the 10.

The decision to estimate a single-equation model of unconditional earnings has several implications. First, compared with the historical data on actual earnings, the method produces too few predictions of zero or near-zero earnings. Thus, it also generates relatively few strings of zero earnings, such as would be expected, for example, in years following the typical retirement age. In policy simulations in which the exact number of years with positive earnings is important (for example, in predicting the impact of increasing quarters of eligibility for disability and old-age benefits), that shortcoming could represent a significant problem.

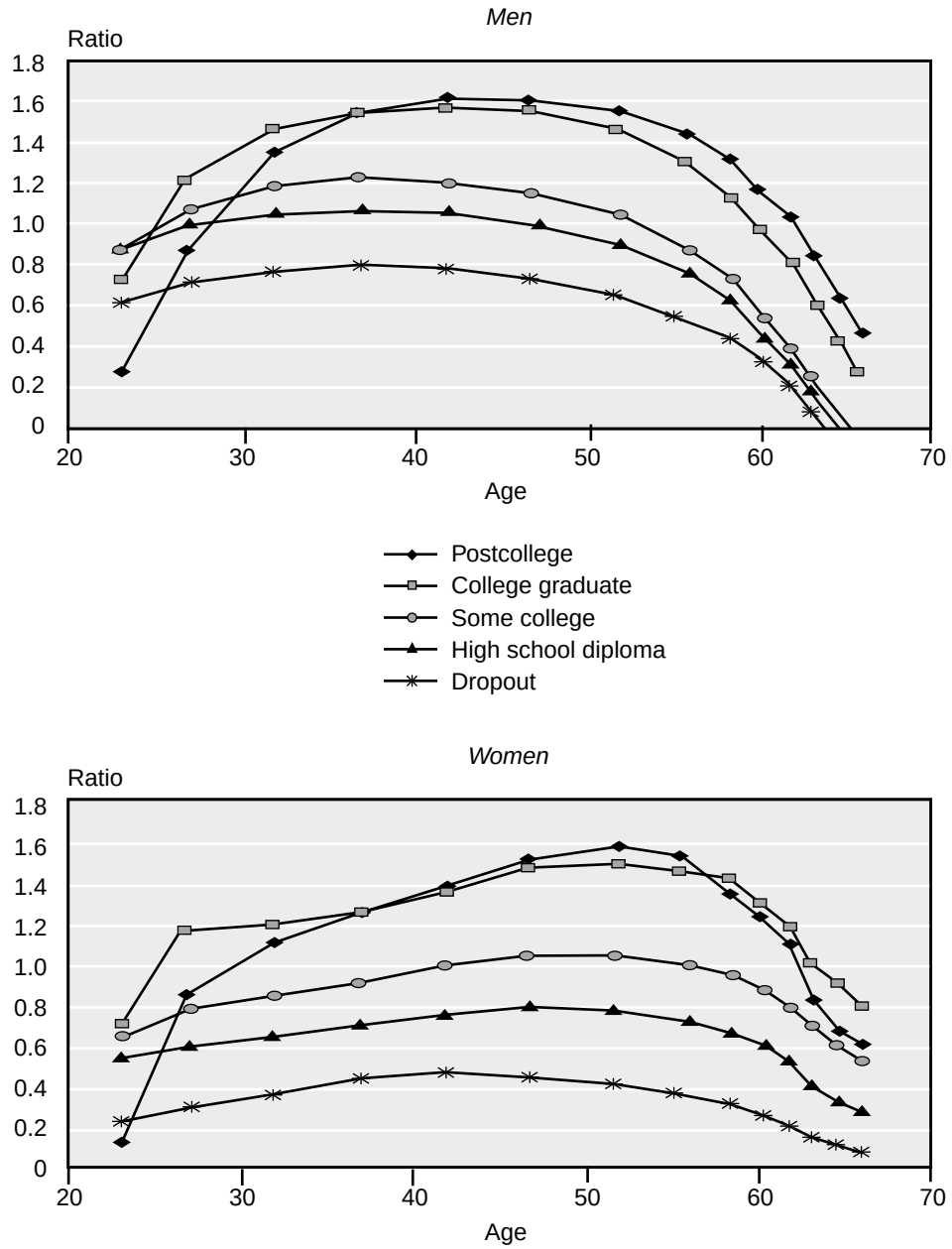
Second, the method yields too few predictions of nonstandard age-earnings profiles. Our regression procedure, which lies at the core of the projections, essentially collapses all the distinctive earnings patterns into a single, common age-earnings pattern. The inclu,, sion of the fixed-effect error term generates considerable variation in average career earnings, and the imputation of year-specific and individual-specific error terms produces a unique prediction profile for each worker. But relatively few workers in the sample are predicted to have late-career earnings profiles that diverge wildly from the common pattern. Note that this will have comparatively little effect for workers who are already near retirement age in 1997, when we begin to predict annual earnings, but it will have a much bigger effect for the young workers in our sample.

Third, the absence of an autoregressive error pattern in the predictions means that our predictions of with,, drawal from the labor market late in life will not mirror actual patterns. "Retirement" is generally interpreted to mean that people's earnings go to zero and then remain

there. Although analysts have found that reentry into the labor force after retirement is common, the popular conception of retirement (complete and permanent exit from the workforce) is probably the dominant pattern for most workers. The prediction method used here will underrepresent that dominant pattern.

Our estimates and predictions of individual age-earnings profiles have important advantages over naive characterizations of earnings profiles. In particular, our estimated and predicted profiles capture far more of the variability in individual profiles than do standard policy analysis techniques, which focus on three or four illustrative workers with level earnings profiles. Our procedure for imputing year-to-year error terms in each individual profile also allows year-to-year earnings fluctuations to differ in a systematic way from one person to the next, based on the observed variability of each person's earnings during the estimation period.

Chart 2.
Estimated age-earnings profiles, by sex and educational attainment (ratio of earnings to economy-wide average earnings)



SOURCE: Authors' estimates using the 1990-1993 matched SIPP and SSER files.

Average Lifetime Earnings

Our predictions of future earnings through 2020 seem plausible. Both the mean of predicted earnings and the variance of the predictions are consistent with the observed trend and distribution of actual earnings over the 1974-1996 period. Comparisons performed by the Social Security Administration suggest that the means and distributions of our predictions correspond fairly closely to earlier predictions made by Iams and Sandell (1997). Our predictions of future earnings are averaged with past actual earnings to calculate the average indexed monthly earnings (AIME) for each person in the matched SIPP-SSER sample. For workers who claim retirement benefits at age 62, the AIME is calculated by choosing the highest 35 years of indexed earnings up through age 61 and then dividing by 35 × 12 (35 years times 12 months per year). Our forecasts of future earnings are adjusted to reflect early mortality and disability. RAND analysts predicted age of death for people in the matched SIPP-SSER sample. People predicted to die before attaining age 62 are removed from the sample we use for predicting the AIMEs. We also disregard earnings after the onset of Disability Insurance entitlement for sample members who are predicted to begin receiving DI pensions before age 62.[10]

Trends in predicted AIME, measured as a percentage of economy-wide earnings in the year a worker attains age 62, are shown separately for men and women in

Chart 3.[11] The trends are also tabulated for workers at different positions in the AIME distribution. Women born between 1931 and 1935 who were in the top fifth of the AIME distribution for women in their cohort earned, on average, almost exactly the economy-wide average wage during their career. In contrast, their counterparts in the 1946-1950 cohort earned almost 1.45 times the economy-wide average wage during their career, an increase of about 40 percent.

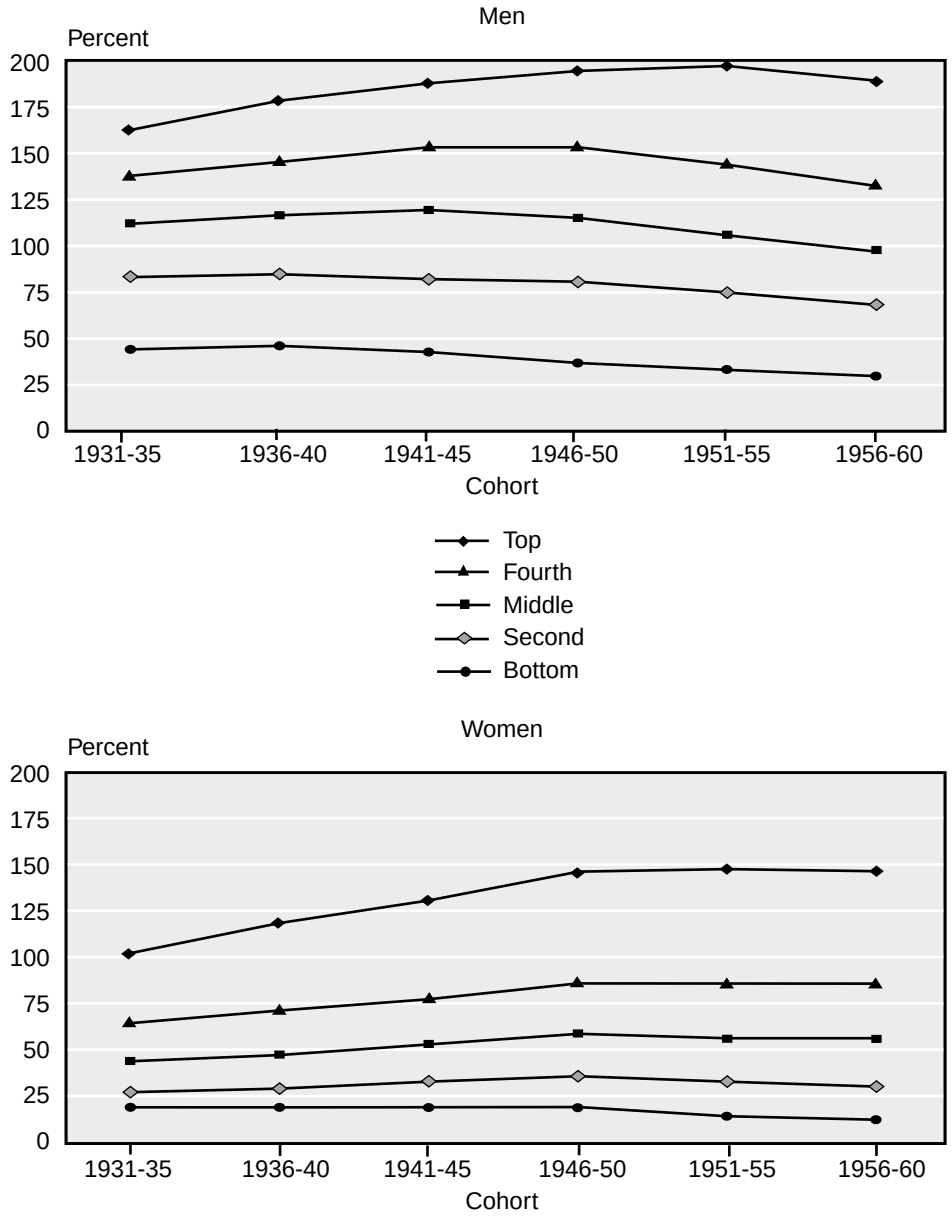
Successive cohorts of women born before 1950 experienced a substantial improvement in their lifetime earnings in comparison with economy-wide earnings at all parts of the earnings distribution. But for the cohorts born after 1950, the gains are smaller, and for women earning below-average wages, they actually disappear. The improvement in lifetime earnings of women reflect both the increased length of their work careers and the gains in their hourly earnings relative to those earned by men.

The pattern of improving wages is mirrored in the case of men in the top fifth of the AIME distribution. For example, men born in the late 1940s enjoy relatively higher earnings in comparison with high-AIME men born in the 1930s. For men in the bottom two-fifths of the AIME distribution, relative earnings reach a peak for the cohorts born before 1940 and steadily decline for later cohorts. That reflects a trend toward growing earnings inequality in the U.S. workforce, a trend that has particularly hurt the wages of men born after the early 1950s and men with less than a college degree (see Levy and Murnane 1992; Burtless 1995; and Freeman 1997).

The initial rise in predicted AIMEs is partly explained by increasing levels of school attainment in the workforce. Workers with more education enjoy a steeper gain in earnings when they are young and reach their peak earnings at later ages. Over time, there has been a sharp fall in the percentage of men and women who have not completed high school and a sharp increase in the fraction with advanced levels of education. Improvements in educational attainment have slowed in the youngest cohorts, however. Among both women and men, there has been a small drop in the proportion of workers with postcollege education, at least in comparison with the proportion attaining advanced degrees in the early baby-boom cohorts.

The decline in average AIMEs among low-income workers in the 1951-1960 birth cohorts is the result of their low levels of relative earnings when they were young.

Chart 3.
Trend in average AIME for men and women within fifths of AIME distribution (as a percentage of economy-wide average wages in the year a worker attains age 62)



SOURCE: Authors' tabulations of matched SIPP and SSER files.
NOTE: AIME = average indexed monthly earnings.

Since their *relative* earnings were lower than those of earlier cohorts at the same age, those workers will be predicted to have lower *relative* lifetime earnings under the assumptions of our model.

In sum, these estimates show that women have made and will continue to make noticeable earnings gains compared with men. Workers of both sexes will also experience substantial increases in lifetime earnings inequality, mirroring the annual pattern of growing earned income inequality the nation has experienced over the past 20 years. Finally, workers born in the middle and toward the end of the baby boom will receive lower relative earnings over their lifetime compared with the first baby-boom cohort. Workers born immediately after World War II had significantly higher educational attain,, ment than the generations born before them, but succes,, sive cohorts of baby boomers have not sustained the rapid gains in schooling attainment that earlier genera,, tions achieved. The later baby-boom cohorts also had the misfortune of entering the labor force when the relative earnings of young workers fell. Indeed, for men in those cohorts, *absolute* as well as relative earnings declined. That bad fortune will leave typical members of the later baby-boom cohorts with lower *relative* career wages than those earned by the first cohort born after World War II.

Stylized Earnings Patterns

An alternative approach to modeling and predicting future earnings is to examine a small number of characteristic lifetime earnings patterns and then determine how common such earnings patterns will be over the next few decades. We refer to that as the "stylized earnings approach." Our goal is to categorize all workers in a small number of stylized earnings patterns. The earnings patterns are based on workers' relative earnings between the ages of 32 and 61. Our classification ignores a worker's earnings before age 32, because nearly all workers have sharply rising earnings early in their career. Many workers have low earnings while they are in their twenties because they are still in school. Consequently, their earnings in that phase do not have much predictive power in forecasting their earnings at later ages.

The 1931-1940 Birth Cohorts

Our initial analysis focuses on workers born between 1931 and 1940, because their careers were nearly complete by 1996, the last year with observed earnings data. We have nearly complete career earnings informa,, tion for that sample, and we can reliably classify workers by their observed earnings. Workers born after 1940 will not have completed their career by 1996, so our classifi,, cation of such workers must be based on the prediction of their future earnings as described in the prior section. Our overall analysis sample, which is drawn from the matched SIPP-SSER files described earlier, includes all SIPP respondents who have at least 1 year of Social Security-covered earnings and who were born between 1931 and 1960.

We divide a worker's 30-year career between ages 32 and 61 into three 10-year subperiods—ages 32-41, 42-51, and 52-61. For each of those subperiods, we calculate the worker's average relative earnings. As noted above, a worker's relative earnings in a given calendar year are simply his or her actual earnings divided by the economy-wide average earnings for that year. The 10-year average earnings are the unweighted average of the worker's relative earnings in each of the 10 years of a subperiod.

Our initial classification of workers' earnings patterns focused on three characteristics of the time path of earnings:

- The average earnings *level*, which is simply the 30,, year average of the worker's relative earnings;
- The *trend* in earnings, which captures the direction and magnitude of change in relative earnings between the first and last periods of the worker's career; and
- The *profile* of earnings change, which measures whether the average wage between ages 42 and 51 is greater than, less than, or equal to the average wage earned when the worker is 32-41 and 52-61.[12]

For each characteristic of the career earnings path, we divided workers into three mutually exclusive groups. In the case of the average earnings *level*, workers were divided into low, middle, and high earners, depending on whether their career relative earnings were less than, equal to, or above economy-wide average earnings. Career earnings were divided into declining, level, and rising paths depending on whether the *trend* in earnings was falling, level, or rising over the worker's career. *Profiles* of earnings change were divided into sagging, linear, and humped patterns.

Suppose we define average relative earnings between ages 32 and 41 as A, relative earnings between 42 and 51 as B, and relative earnings between 52 and 61 as C. Then the *trend* in earnings, t, can be measured as

$$t = (C-A) / (C+A)$$

and the *profile* of earnings change, p, can be represented as

$$p = [B- (A + C) / 2] / [B + (A + C) / 2].$$

After measuring t for a worker, we classified the worker in one of three *trend* groups using the following scheme:

Declining: $t < -1/9$

Level: $-1/9 < t < 1/9$

Rising: $t > 1/9$.

After measuring p for a worker, we classified the worker in one of three *profile* groups using the following cutoffs:

Sagging: $p < -1/9$

Linear: $-1/9 < p < 1/9$

Humped: $p > 1/9$.

Workers were classified as having low, average, or high career earnings in a way that divided workers born between 1931 and 1960 into three approximately equal groups. Our definitions of the *trend* and *profile* cutoffs, shown above, also resulted in roughly equal three-way divisions of the sample. Our initial classification scheme resulted in 27 (= 3 x 3 x 3) stylized earnings patterns.

The most striking aspect of the distribution of individu,, als among the 27 patterns is the remarkable diversity of individual workers' age-earnings profiles (see Table 2). Less than 14 percent of workers have the rising, humped pattern of lifetime earnings that is considered to be normal. Even adding the workers who have level and linear earnings patterns, less than half of workers have a career pattern that even approximates the prototypical pattern displayed in the top panel of Chart 1. Roughly the same number of workers have declining relative earnings over their career as have rising relative earn,, ings. In addition, more than a quarter of workers have a sag in earnings during the middle years of their career, only slightly less than the proportion who have the humped earnings profile that is widely thought to be the norm.

In an effort to account for the diversity of earnings patterns across workers, we examined the prevalence of different stylized earnings patterns in different groups of workers. The biggest difference in the *level* of average career earnings is traceable to gender differences. Only 14 percent of the men are in the lowest third of the distribution compared with 53 percent for women (see Table 3). Women, however, are more likely than men to have a rising pattern of earnings over their work life. Perhaps surprisingly, the most common trend among men is one of a decrease in earnings. With regard to the *profile* of earnings change, women are somewhat more likely to be at the extremes. Many have either a hump or a sag in their earnings growth during their middle working years.

As expected, both black and Hispanic workers are scarce in the upper portions of the wage distribution. Black workers are somewhat more likely than average to have declining relative earnings over their work life. Unsurprisingly, workers with a low level of education are far more likely to be in the bottom of the earnings distri,, bution and to experience a decline in their relative earnings over their career.

We also looked at the prevalence of different earnings patterns among two groups of workers with exceptionally good or exceptionally poor earnings records. Workers with a minimum of 40 quarters of earnings credits have above-average lifetime earnings and are less likely than average to have declining earnings or a sag in their earnings profile. Workers who collect Disability Insur,, ance benefits, on the other hand, are much more likely to have low lifetime earnings and a declining trend in career earnings. (Nondisabled workers with fewer quarters of coverage are not eligible for Social Security retirement benefits at age 62, though they may become eligible if they accumulate additional earnings credits after age 61.)

The tabulations in Table 3 shed little light on reasons for variation in the *profile* of earnings patterns (sagging, linear, or humped). Nor is it obvious whether the profile of earnings change is critical in evaluating Social Security reform proposals. While the *trend* of earnings has a large impact on the value of the funds that ultimately accumulate in individual retirement accounts, the role of a hump or sag in earnings is less significant. For these reasons, we decided to reduce the number of earnings patterns analyzed from 27 to 9, focusing only on varia,, tions in the *level* and *trend* of age-earnings patterns.

Table 2.
Distribution of career earnings patterns of workers born between 1931 and 1940 (in percent)

Trend	Sagging	Linear	Humped	All profiles
		Low earnings level		
Declining	10.4	2.0	5.4	17.8
Level	0.6	0.2	1.7	2.6
Rising	7.3	1.8	5.1	14.3
All trends	18.3	4.0	12.2	34.6
		Middle earnings level		
Declining	3.8	4.5	5.5	13.8
Level	0.6	2.2	1.6	4.5
Rising	2.2	4.7	6.4	13.3
All trends	6.6	11.4	13.5	31.5
		High earnings level		
Declining	1.2	5.1	6.5	12.8
Level	0.4	10.2	2.3	13.0
Rising	0.4	5.4	2.3	8.1
All trends	2.1	20.7	11.1	33.9

SOURCE: Authors' tabulations of 1990-1993 matched SIPP and SSER files.

The nine basic earnings patterns—three average earnings *levels* interacted with three earnings *trends*—are shown in Chart 4. The percentages of all men and all women with the indicated combination of level and trend are shown in parentheses below the designated trend in each graph. Except for the low-earnings groups, men and women have quite similar shapes in their age-earnings profiles within each combination of level and trend. The most important difference between the two sexes is in the percentage distribution of workers in the nine categories.

We also calculated standard deviations for the annual average of the relative wage in each pattern. Those standard deviations ranged from 0.2 to 0.3 of the economy-wide average wage in the three low-wage groups up to 0.5 to 0.7 for the three high-wage groups. Thus, that measure of variation rises with income but much less than proportionately to the increase in average earnings. There is also no particular tendency for the standard errors to rise or fall with increases in age, nor are there significant differences by sex within an earnings category.

One possibility is that the diversity of the earnings patterns across workers is simply the result of individuals withdrawing from covered employment. To investigate that possibility, we recalculated the earnings patterns to exclude workers in years when their earnings dropped to zero (see Chart 5). We found that while excluding zero-earnings years substantially raises the level of the pro„ files, it has surprisingly little effect on the basic shape of the lifetime earnings patterns.[13] Thus, the characteristic earnings patterns we see when all potential years are included in the calculations are also visible when only positive earnings years are included.

Note, however, the large difference in the frequency of zero-earnings years across the different stylized earnings categories. For the low-average-earnings categories, the proportion of workers with zero earnings in a specific year ranges as high as 80 percent; the proportion averages nearly 60 percent between ages 22 and 61. In contrast, the above-average earners are distinguished by the stability of their employment rates. The nonparticipation rate of above-average earners is typically less than 10 percent. Women are twice as likely as men to have years of zero earnings between ages 32 and 61, but the rates of nonparticipation are very compa„ rable within each stylized earnings category. Because years of zero earnings are much more common at the

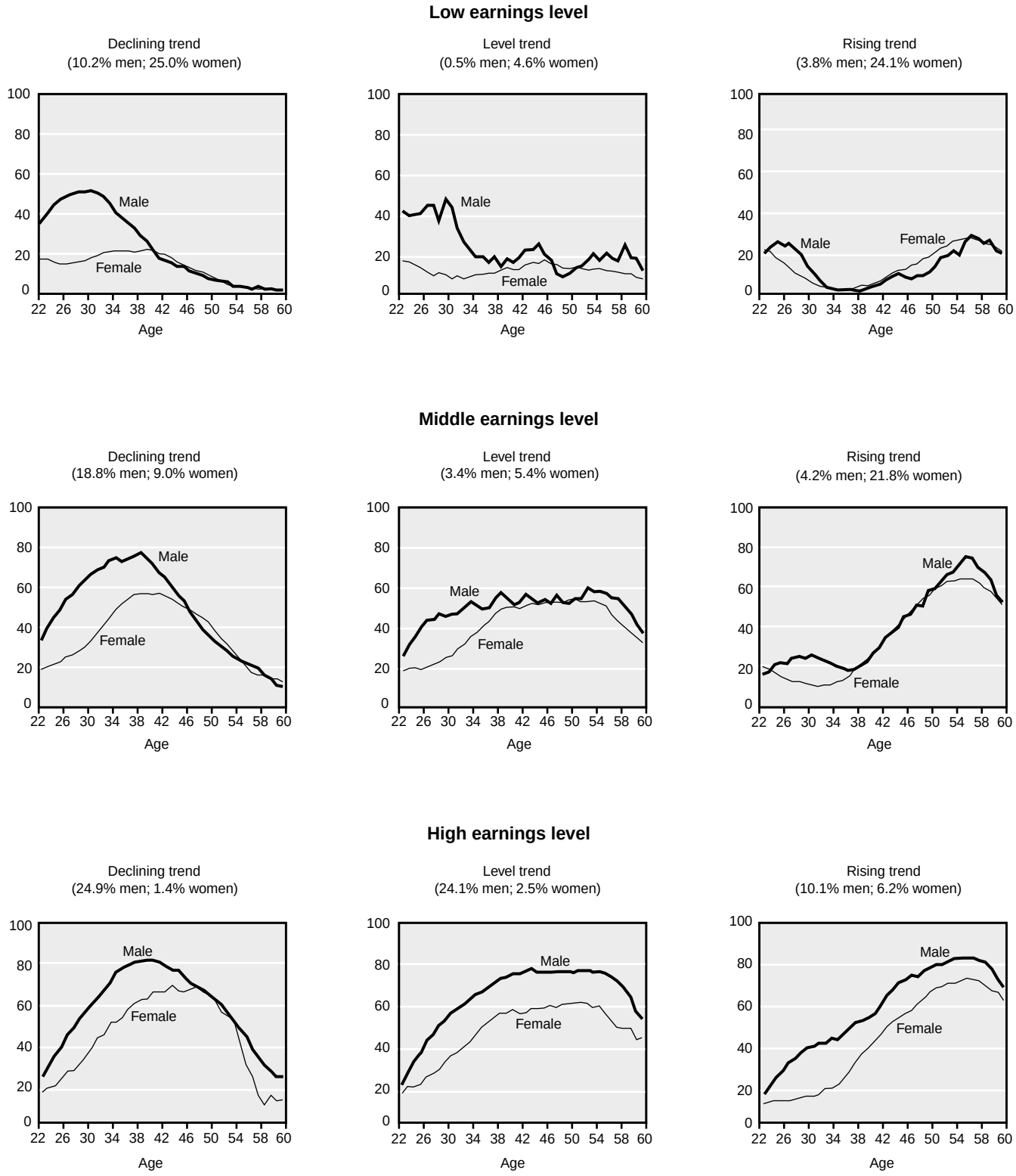
Table 3.
Personal characteristics and earnings profiles of workers in the 1931-1940 cohort (in percent)

	Nondisabled									
						Highest degree attained				
	All workers	Sex		Race/ethnicity		No degree	High school diploma	College degree	Attained 40 quarters of covered earnings	Became disabled [a]
		Male	Female	Black	Hispanic					
						Earnings level				
Low	34.4	13.7	52.9	38.9	44.3	46.5	34.0	25.4	24.1	35.8
Middle	29.9	22.8	36.2	40.4	32.4	31.1	32.8	21.1	34.6	42.0
High	35.6	63.4	10.9	20.7	23.3	22.4	33.3	53.5	41.3	22.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
						Trend				
Declining	40.0	48.0	32.8	45.1	40.6	50.4	38.6	34.6	37.9	74.1
Level	21.4	31.3	12.6	18.9	18.4	19.9	21.4	22.9	23.3	10.6
Rising	38.6	20.7	54.6	36.1	41.1	29.6	40.0	42.5	38.8	15.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
						Profile				
Sagging	27.3	21.1	32.7	32.1	30.1	32.2	26.9	23.8	21.1	25.4
Linear	38.2	50.8	27.0	34.8	29.7	32.2	37.8	44.6	43.6	22.4
Humped	34.6	28.1	40.3	33.1	40.2	35.6	35.3	31.5	35.3	52.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Authors' tabulations of 1990-1993 matched SIPP and SSER files.

a. Collected or expected to collect Social Security Disability Insurance benefits.

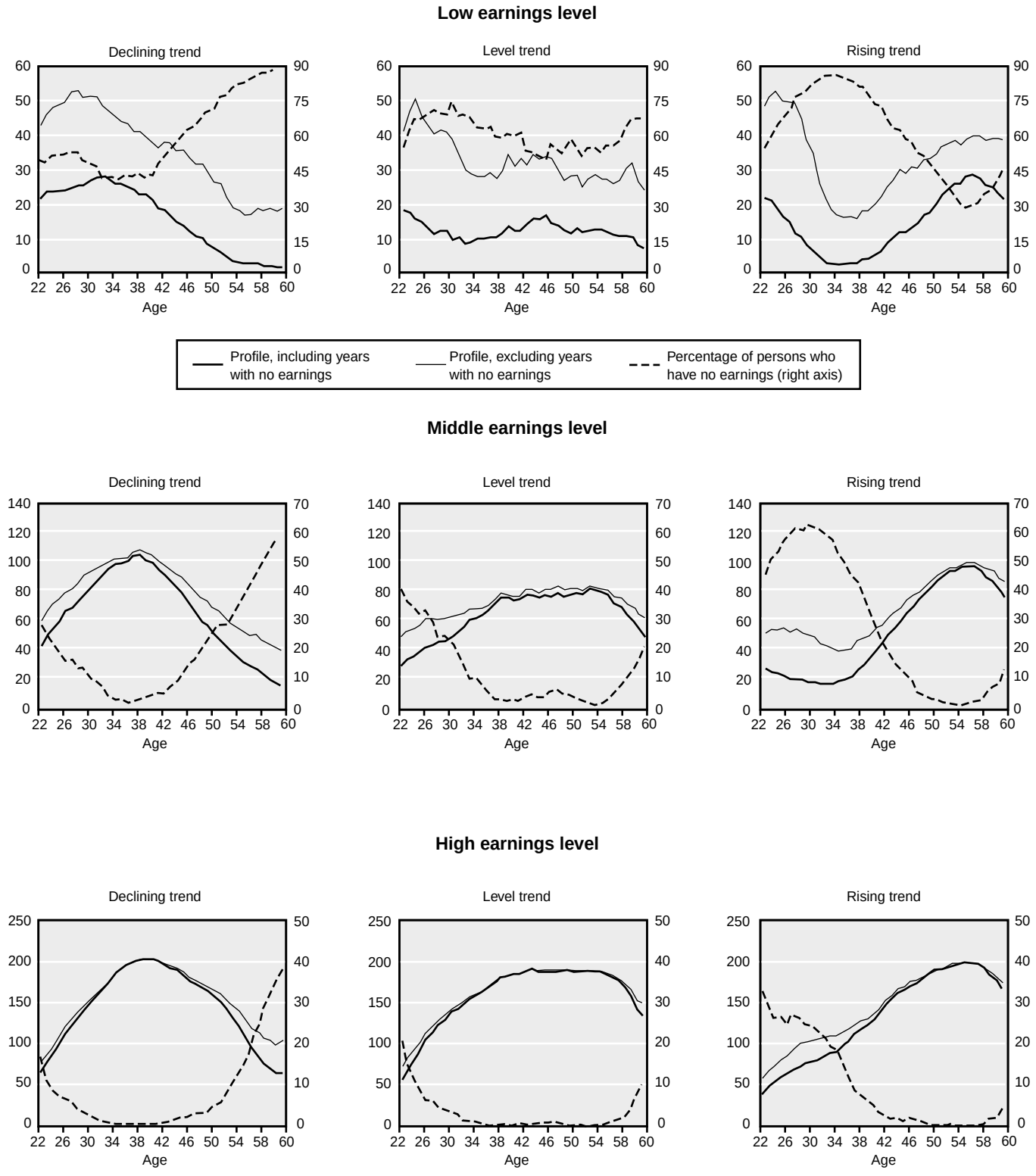
Chart 4.
Basic earnings patterns of nine groups of workers in the 1931-1940 cohort (in percent)



SOURCE: Authors' tabulations of 1990-1993 matched SIPP and SSER files.

NOTES: Average earnings as a percentage of economy-wide average earnings are measured on the left scale. The percentages of men and women with the indicated combination of *level* and *trend* are shown in parentheses below the designated trend.

Chart 5.
Earnings profiles with and without zero-earnings years for workers in the 1931-1940 cohort



SOURCE: Author's tabulations of 1990-1993 matched SIPP and SSER files.

NOTES: Average earnings as a percentage of economy-wide average earnings are measured on the left scale. The percentage of the category with zero earnings in each year is measured on the right scale.

very beginning and very end of the work life, those years have a significant, although not a dominant, impact on the trend in earnings.

The 1941-1960 Birth Cohorts

The tabulations in Table 2 and Charts 4 and 5 represent the experiences of workers born between 1931 and 1940, nearly all of whom had substantially completed their career by 1996. We can predict the prevalence of stylized earnings patterns in younger cohorts by using forecasts of future earnings for workers in those cohorts. Thus, we can apply the same methodology used to classify workers in the 1931-1940 birth cohorts to classify workers born between 1941 and 1960.

Our earnings forecasts imply that there will be large offsetting shifts in the distribution of men and women across the nine stylized earnings categories. For ex,, ample, the proportion of women in the top third of the lifetime earnings distribution is predicted to increase sharply—from 10 percent in the 1931-1940 cohort to 22 percent in the 1951-1960 cohort (see Table 4). That improvement for women is exactly counterbalanced by declining percentages of men in the highest earnings category. That percentage falls from 59 percent of men in the 1931-1940 birth cohort to 47 percent of men in the 1951-1960 cohort. Our forecast also implies that there will be a significant drop in the proportion of workers who have a rising trend in their lifetime earnings, espe,, cially among men.[14]

Married Spouses

Our econometric estimates of earnings patterns can also be used to link the earnings patterns of married spouses. For each of the nine stylized earnings patterns, we can estimate or predict the correlation between spouses' earnings patterns. Though not reported in this article, those correlations show a strong trend over time for wives to move up in the earnings distribution while the relative earnings of husbands are stagnant or modestly declining. The result of that trend will be a substantial rise in couples' combined lifetime earnings and Social Security retirement benefits.

Table 4.
Earnings level and trend of workers born between 1931 and 1960 (in percent)

	Men			Women		
	1931-40	1941-50	1951-60	1931-40	1941-50	1951-60
			Earnings level and trend			
Low						
Declining	10	13	18	25	19	12
Level	0	1	2	5	4	9
Rising	4	3	1	24	22	21
Middle						
Declining	19	20	29	9	9	7
Level	3	4	3	5	9	21
Rising	4	4	1	22	18	8
High						
Declining	25	19	21	1	2	1
Level	24	31	26	3	9	19
Rising	10	5	0	6	8	2
Total	100	100	100	100	100	100
			Average earnings level			
Low (All trends)	14	17	20	54	45	42
Middle (All trends)	26	28	33	36	36	36
High (All trends)	59	55	47	10	19	22
Total	100	100	100	100	100	100
			Trend pattern			
All levels						
Declining	54	52	67	35	30	21
Level	28	36	31	13	22	49
Rising	18	12	2	52	49	30
Total	100	100	100	100	100	100

SOURCE: Authors' tabulations of 1990-1993 matched SIPP and SSER files.

Policy Simulation and Evaluation

Analysts of the Social Security program have traditionally assessed policy reform and developed estimates of the returns to Social Security on the basis of three or four stylized earnings patterns. For example, a high-income worker may be selected to represent workers who have earnings at the maximum taxable amount in every year. Such a worker would fairly represent a maximum taxpayer but certainly not all higher-income taxpayers. The middle-earnings group is represented by someone who earns the average taxable earnings amount in every year, and the low-earnings group is typically

represented by a worker who earns 45 percent of that average amount. The following discussion of policy evaluation refers to these traditional patterns as "Social Security Administration (SSA) stylized earnings pat,, terns."

Our stylized profiles are more representative of the actual population of retirees because they reflect the actual distribution of career earnings (low, middle, and high). And by incorporating variations in the pattern of earnings over a worker's career, we can more ad,, equately explore issues involving Social Security wealth accumulation and rates of return. It is also possible to trace out how the pattern of earnings over time would affect the accumulation of pension wealth in a reformed system that includes a defined contribution system of individual retirement accounts. The accumulation patterns will be very different under the two sets of stylized earnings profiles, which are described in the appendix.

Our principal conclusions, using the nine stylized earnings patterns developed above, are as follows:

- For low, middle, and high earners, the traditional SSA stylized patterns generally represent workers with higher career earnings than are typical of the population as a whole. Thus, SSA's low earner is closer to someone with between low and average career earnings; its worker with average earnings is closer to someone between average and high earnings; and its maximum-wage worker earns more than many workers who have earnings well above the average.
- Mainly because of these differences, our own representatives of low, middle, and high earners tend to have lower Social Security wealth but higher internal rates of return than can be detected using SSA's traditional stylized earners.
- SSA's traditional measure of earnings growth assumes that a worker earns the same wage, relative to the average wage in the economy, every year and that the worker is never out of the labor force at any time in a career. Our alternative incorporates variability in earnings over the normal work life. As a consequence, the replacement rate (defined as the percentage of *peak* year's earnings replaced by Social Security) is much lower than can be detected using traditional stylized earnings patterns. However, the primary insurance amount as a percentage of the worker's AIME tends to be *higher* for the typical worker, especially for low earners and one-earner couples.
- How one fares with an individual account in comparison with the Social Security benefit formula depends on the rate of return in the account and the variance in lifetime earnings patterns. At higher rates of return, those whose lifetime earnings come earlier in life fare relatively better under individual accounts than do those whose earnings come later in life.

Analysis

SSA profiles reflect significantly higher *average* earnings than their Modeling Income in the Near Term (MINT) counterparts (see Table 5, which shows annualized AIMEs for the 1931-1935 and 1951-1955 cohorts for the SSA traditional profiles and our own (MINT) profiles).[15] For the 1931-1935 birth cohort, AIMEs for SSA's tradi,, tional profiles range from 1.3 to 3 times the AIMEs for comparable MINT profiles. MINT men born between 1931 and 1935 earned a weighted average AIME of $2,555 (in 2000 dollars) across all nine profiles, and MINT women earned a weighted average of $909. In comparison with the SSA middle, or average, profile's AIME of $2,290, MINT men earned 12 percent more and MINT women earned an AIME that was 60 percent lower.

The differential distribution of men and women across the nine MINT profiles explains the large gap between the weighted average AIME of men, on the one hand, and women, on the other. Sixty percent of men in the MINT sample fall into the three higher income profiles, whereas 57 percent of women fall into the three lower income profiles. Within the MINT profiles, the AIME spread between high and low profiles is roughly 6.4 to 1 for men and 8.2 to 1 for women. The ratio of male to female weighted average AIME is 2.8.

The primary difference between the 1931-1935 and 1951-1955 birth cohorts in terms of AIMEs is that women will gain ground, both relative to men and relative to the SSA prototypical earners. Although women earners in the 1951-1955 cohort are still concentrated in the lower and middle earnings groups, the percentage of women in the lowest income profiles decreases 16 percentage points while women's participation in the highest income profiles nearly triples, from around 8 percent to 22 percent.

Individual Accounts

Evidence on the value of a defined contribution individual retirement account in comparison with traditional Social Security benefits for workers with the nine MINT earnings profiles is shown in Table 6. We have calcu,, lated the benefits at age 65 that workers could expect to obtain if their Social Security contributions were invested at a 2 percent real rate of return. That amount is then compared with the discounted value of traditional Social

Security benefits the same worker would obtain, assum,, ing retirement at age 65. The calculations are performed for single earners and for workers in one-earner couples and in two-earner families.[16] Values in the table that are less than 1.00 indicate that individual accounts offer lower benefits than does traditional Social Security for the indicated wage earner in the indicated household.

For workers in either the 1931-1935 or 1951-1955 birth cohort, Social Security usually provides equal or higher benefits than an individual account yielding a real return of 2 percent (see the weighted average values in Table 6). Social Security benefits are higher for workers, whether male or female, in one-earner and two-earner couples. Single males in the high earnings categories, however, would obtain higher benefits under the individual account plan. The same is true for single high-income females in the 1951-1955 cohort. Since the majority of males in the MINT sample fall into the higher income profiles, individual accounts usually would provide them with higher total benefits than would Social Security. If the existing benefit formula is left unchanged, workers born in later cohorts will obtain declining real returns under Social Security. Earners in the later cohort are more likely than those in the earlier cohort to receive better benefits from individual accounts than from traditional Social Security.

The findings are quite different, however, when the same analysis is performed using a 5 percent rather than a 2 percent real interest rate for calculating accumula,, tions in the individual retirement account. As the weighted averages in Table 7 indicate, individual accounts typically produce a higher total level of benefits than Social Security would provide for all types of wage earners. Recall that males are assumed to be the earners in one-earner couples. As noted above, the majority of males earn wages that place them in the higher earnings profiles, which explains why even one-earner couples are typically better off under an individual account plan than under traditional Social Security. Among the other types of wage earners, only those falling in the low-level or low-rising profiles would receive higher benefits under Social Security than under an individual account plan yielding a real return of 5 percent. As with a 2 percent real return (Table 6), the ratios of individual account wealth to lifetime Social Security benefits increase for workers in the later birth cohort.

Several general patterns emerge when one looks at the internal rates of return (IRR) that different types of workers receive under the existing Social Security system (see Table 8). Within a cohort, couples earn higher real returns than single workers because of Social Security's spousal and survivor's benefits. Women earn higher returns than men because they live longer and can expect to receive benefits for more years.[17] One-earner couples receive the highest IRRs overall because of Social Security's generous spousal benefits. Workers in earlier cohorts enjoy higher IRRs than workers born later. A general theme that emerges from the IRR comparison is that the Social Security system favors

Table 5.
Average indexed monthly earnings for SSA and MINT earnings profiles, 1931-1935 and 1951-1955 cohorts

		MINT					
		Men		Women		Ratio of SSA to MINT	
Earnings profile	SSA (dollars)	Dollars	Percentage of workers	Dollars	Percentage of workers	Men	Women
				1931-1935 cohort			
Low	1,031	528	15.0	348	56.9	2.0	2.96
Middle	2,290	1,717	24.8	1,386	35.5	1.3	1.65
High (Maximum)	4,559	3,403	60.2	2,861	7.6	1.3	1.59
Weighted average [a]	n.a.	2,555	100.0	909	100.0	n.a.	n.a.
				1951-1955 cohort			
Low	1,236	619	19.0	477	41.2	2.0	2.59
Middle	2,747	2,076	31.8	1,754	36.8	1.3	1.57
High (Maximum)	6,688	4,514	49.2	4,030	22.0	1.5	1.66
Weighted average [a]	n.a.	2,997	100.0	1,729	100.0	n.a.	n.a.

NOTES: Amounts are in 2000 dollars. The MINT Low, Middle, and High profiles are weighted averages of the three Low, three Middle, and three High profiles.

n.a. = not applicable.

a. The weighted average of all nine profiles for a given cohort.

those groups that would receive the least under an individual account system, specifically, low-income earners, women, and one-earner couples.

To analyze the effect of the pattern or "shape" of workers' earnings on the wealth they would accumulate under an individual account system, we normalized their wages (that is, we divided each year of a worker's wages by that worker's career average wage). Thus, all workers are now assumed to have career average wages of "1.00." Since we are interested in how profiles do relative to one another, we divided all wealth values by the approximate "average" wage profile—profile number 5. Results of those calculations are displayed in Table 9. Because the accumulation in individual accounts is particularly sensitive to the sequence in which wages are earned, the wealth totals will differ based on the career pattern of workers' earnings. In most cases, the declining wage profiles (numbers 1, 4, and 7) look relatively better under individual retirement accounts, because workers with those earnings patterns contribute more at the beginning of their career and therefore enjoy more compound income growth than workers with level or rising earnings patterns.

We also calculated the percentage of annual earnings that Social Security benefits replace for each type of worker (see Table 10). There are various ways to measure the so-called replacement rate. All of the MINT profiles show rapid declines in earnings at the very end of workers' careers (past age 58), so it does not make sense to calculate the replacement rate using an earner's "final wage." Our first estimate of the replacement rate compares the annual Social Security benefit

Table 6.
Ratio of individual account wealth to Social Security wealth at a 2 percent real interest rate, 1931-1935 and 1951-1955 cohorts

Earnings profile	1931-1935 cohort				1951-1955 cohort			
	Single male worker	Single female worker	One-earner couple	Two-earner couple	Single male worker	Single female worker	One-earner couple	Two-earner couple
MINT profiles [a]								
1 Low, declining	0.54	0.39	0.24	0.34	0.66	0.50	0.31	0.44
2 Low, level	0.58	0.42	0.26	0.36	0.61	0.50	0.27	0.42
3 Low, rising	0.45	0.37	0.21	0.35	0.56	0.47	0.26	0.43
4 Middle, declining	0.97	0.70	0.43	0.50	1.12	0.86	0.53	0.65
5 Middle, level	1.01	0.73	0.46	0.53	1.12	0.88	0.53	0.62
6 Middle, rising	0.91	0.68	0.42	0.61	0.97	0.80	0.46	0.69
7 High, declining	1.18	0.87	0.53	0.58	1.39	1.06	0.66	0.70
8 High, level	1.32	0.92	0.60	0.64	1.59	1.14	0.76	0.79
9 High, rising	1.33	0.87	0.60	0.65	1.15	1.01	0.56	0.61
Weighted average	1.08	0.53	0.48	0.55	1.22	0.76	0.58	0.66
SSA traditional profiles [b]								
10 SSA Low, level	0.88	0.69	0.39	0.69	1.00	0.81	0.47	0.82
11 SSA Average, level	1.18	0.93	0.53	0.70	1.34	1.09	0.64	0.84
12 SSA Maximum, level	1.49	1.18	0.67	0.91	1.97	1.61	0.93	1.19

NOTES: Contributions to workers' individual accounts are made at the Old-Age and Survivors Insurance tax rate in effect for the given year and compound at a 2 percent real annual interest rate with all amounts reinvested. Individual account wealth is thus the total accumulated wealth at age 65, adjusted for the chance of death in all years after age 21. That amount is then divided by the present value at age 65 of lifetime Social Security benefits a worker would have received given his or her wage history and average life expectancy for his or her birth cohort and sex, also adjusted for the chance of death in each year after age 21. (Note that workers always retire at age 65 and that those retiring after 2003 have their benefits actuarially reduced in line with increases in the normal retirement age stipulated in current law.) Ratios less than 1.00 indicate that the present value of lifetime Social Security benefits at age 65 exceeds that of individual account wealth at age 65.

a. MINT two-earner couples in the 1931-1935 cohort are described in Appendix Table 1.

b. The three hypothetical two-earner SSA couples are defined as follows: SSA Low = low-wage male and low-wage female; SSA Average = average-wage male and low-wage female; SSA Maximum = maximum-wage male and average-wage female.

received at age 65 (the primary insurance amount, or PIA) with the worker's *highest* year of earnings, which for many earnings patterns will occur many years before age 65. The second estimate compares benefits in the first year of retirement with a worker's career *average* earnings (the AIME).

Note that under either definition, replacement rates decline as average earnings rise. One-earner couples can expect the highest replacement rates (our calcula,, tions include the 50 percent spousal benefit), and single males can expect the lowest. Under the PIA-to-peak-wage method, the traditional SSA profiles show higher replacement rates than the MINT profile because the peak wage is the same as the average wage. By con,, trast, the MINT worker's peak earnings may be 1.5 to 2.5 times the lifetime average wage. For most purposes, the ratio of the PIA to the AIME seems most useful. The MINT replacement rates are higher than those shown for the representative SSA workers simply because the MINT workers have lower AIMEs than the corresponding SSA cases.

Conclusions

Our analysis suggests that the standard method of Social Security distributional analysis has limited applicability in certain kinds of policy analysis. The limitations are particularly important for reform proposals that involve introducing a defined contribution system of retirement accounts. The analysis of such proposals requires going

Table 7.
Ratio of individual account wealth to Social Security wealth at a 5 percent real interest rate, 1931-1935 and 1951-1955 cohorts

Earnings profile		1931-1935 cohort				1951-1955 cohort			
		Single male worker	Single female worker	One-earner couple	Two-earner couple	Single male worker	Single female worker	One-earner couple	Two-earner couple
		MINT profiles [a]							
1	Low, declining	1.33	0.89	0.58	0.82	1.71	1.21	0.80	1.11
2	Low, level	1.27	0.84	0.57	0.72	1.62	1.09	0.72	1.03
3	Low, rising	0.87	0.64	0.40	0.64	1.18	1.09	0.55	0.95
4	Middle, declining	2.14	1.44	0.95	1.10	2.55	1.89	1.21	1.51
5	Middle, level	1.98	1.37	0.89	1.02	2.37	1.76	1.12	1.31
6	Middle, rising	1.57	1.11	0.72	1.02	1.94	1.55	0.93	1.37
7	High, declining	2.37	1.73	1.07	1.15	3.00	2.26	1.42	1.52
8	High, level	2.49	1.72	1.12	1.20	3.25	2.23	1.54	1.63
9	High, rising	2.40	1.45	1.09	1.17	2.10	1.89	1.02	1.15
Weighted average		2.14	0.99	0.96	1.09	2.66	1.58	1.26	1.46
		SSA traditional profiles [b]							
10	SSA Low, level	1.73	1.35	0.77	1.37	2.11	1.71	1.00	1.73
11	SSA Average, level	2.33	1.82	1.04	1.39	2.84	2.30	1.35	1.77
12	SSA Maximum, level	2.67	2.09	1.21	1.68	4.09	3.31	1.94	2.47

NOTES: Contributions to workers' individual accounts are made at the Old-Age and Survivors Insurance tax rate in effect for the given year and compound at a 5 percent real annual interest rate with all amounts reinvested. Individual account wealth is thus the total accumulated wealth at age 65, adjusted for the chance of death in all years after age 21. That amount is then divided by the present value at age 65 of lifetime Social Security benefits a worker would have received given his or her wage history and average life expectancy for his or her birth cohort and sex, also adjusted for the chance of death in each year after age 21. (Note that workers always retire at age 65 and that those retiring after 2003 have their benefits actuarially reduced in line with increases in the normal retirement age stipulated in current law.) Ratios less than 1.00 indicate that the present value of lifetime Social Security benefits at age 65 exceeds that of individual account wealth at age 65.

a. MINT two-earner couples in the 1931-1935 cohort are described in Appendix Table 1.

b. The three hypothetical two-earner SSA couples are defined as follows: SSA Low = low-wage male and low-wage female; SSA Average = average-wage male and low-wage female; SSA Maximum = maximum-wage male and average-wage female.

beyond the traditional focus on average lifetime income to consider the pattern of earnings over the work life.

We have evaluated two alternative approaches to policy analysis. The microsimulation estimates appear to provide the greatest flexibility in analyzing the impact of different career earnings paths on retirement benefits. Tens of thousands of workers can be included in the simulation, and each worker is allowed to have a unique pattern of career earnings. If the sample of workers used in the exercise is a representative sample of people who will become eligible for Social Security pensions, microsimulation is a straightforward way to predict the average population and distributional effects of particular reform proposals. The proper weights for people repre,, sented on the file are simply the sampling weights used in selecting or interviewing sample members, adjusted to reflect differential mortality over time.

The microsimulation method, however, requires that we forecast future career earnings. Ironically, that step of the simulation exercise eliminates much of the diver,, sity in individual career earnings patterns. Because we estimate a standard econometric age-earnings function, the wide diversity in actual earnings paths is collapsed to a single dominant pattern, with random variation around that pattern. For some kinds of policy analysis, that oversimplification of the diversity in earnings patterns can produce misleading results.

Under our second approach to policy simulation, we estimate the shape and prevalence of nine stylized earnings patterns. Our tabulations suggest that few workers have career earnings paths that strictly follow the population-average pattern of rising and then declin,, ing earnings over the life cycle. That prototypical hump-shaped pattern of earnings is in fact typical for only a minority of U.S. workers. Some workers have approxi,, mately stable relative earnings over their career, as assumed in the traditional Social Security distributional analysis. But an even larger fraction of workers have either a slumped pattern, in which earnings fall signifi,, cantly in midcareer, or a pattern of declining earnings after a comparatively early age.

The enormous diversity in actual earnings patterns suggests that age-earnings profiles are poorly captured in the traditional Social Security distributional analysis. The

Table 8.
Real internal rate of return for MINT and SSA earnings profiles, 1931-1935 and 1951-1955 cohorts

Earnings profile		1931-1935 cohort				1951-1955 cohort			
		Single male worker	Single female worker	One-earner couple	Two-earner couple	Single male worker	Single female worker	One-earner couple	Two-earner couple
		MINT profiles [a]							
1	Low, declining	3.6	4.6	6.2	5.2	3.0	3.8	5.1	4.2
2	Low, level	3.6	4.7	6.3	5.6	3.2	4.0	5.6	4.5
3	Low, rising	4.7	5.6	7.4	6.0	3.8	4.0	6.4	4.7
4	Middle, declining	2.1	3.1	4.6	4.2	1.7	2.4	3.8	3.2
5	Middle, level	2.0	3.0	4.7	4.2	1.6	2.4	4.0	3.5
6	Middle, rising	2.4	3.5	5.5	4.0	2.1	2.7	4.5	3.2
7	High, declining	1.5	2.4	4.1	3.8	1.0	1.8	3.3	3.1
8	High, level	1.0	2.3	3.8	3.6	0.5	1.6	2.9	2.8
9	High, rising	1.0	2.5	3.9	3.6	1.5	2.0	4.0	3.7
Weighted average		1.8	4.2	4.6	4.1	1.5	2.9	3.7	3.3
		SSA traditional profiles [b]							
10	SSA Low, level	2.4	3.2	5.3	3.3	2.0	2.6	4.3	2.6
11	SSA Average, level	1.4	2.2	4.2	3.2	1.1	1.7	3.4	2.6
12	SSA Maximum, level	0.5	1.4	3.5	2.4	-0.2	0.5	2.2	1.5

NOTES: Although we assume that both SSA men and women earn the same exact wages, women's longer life spans give them different internal rates of return. All Social Security contribution and benefit amounts are adjusted for the chance of death in all years after age 21.

a. MINT two-earner couples in the 1931-1935 cohort are described in Appendix Table 1.

b. The three hypothetical two-earner SSA couples are defined as follows: SSA Low = low-wage male and low-wage female; SSA Average = average-wage male and low-wage female; SSA Maximum = maximum-wage male and average-wage female.

Table 9.
Relative normalized individual account wealth at 5 percent real interest for MINT earnings profiles, 1931-1935 cohort

MINT earnings profile		Single male worker	Single female worker	One-earner couple	Two-earner couple
1	Low, declining	0.85	1.03	0.85	1.03
2	Low, level	0.93	1.01	0.93	0.96
3	Low, rising	0.74	0.82	0.74	0.86
4	Middle, declining	1.02	1.07	1.02	1.13
5	Middle, level	1.00	1.00	1.00	1.00
6	Middle, rising	0.84	0.84	0.84	0.92
7	High, declining	1.05	1.08	1.05	1.03
8	High, level	0.98	1.00	0.98	0.99
9	High, rising	0.90	0.86	0.90	0.95
Weighted average		0.96	0.93	0.96	1.01

NOTE: The data reflect the individual account wealth of the worker profile divided by the individual account wealth of the "average" profile (number 5). Worker's wages for each profile have been normalized, that is, we divided each year of a worker's wages by that worker's career average wage. Thus, all workers will now have career average wages of 1.00.

Table 10.
Two ways to measure replacement rates for MINT and SSA profiles, 1931-1935 cohort (in percent)

Earnings profile		Ratio of PIA to peak wage				Ratio of PIA to AIME			
		Single male worker	Single female worker	One-earner couple	Two-earner couple	Single male worker	Single female worker	One-earner couple	Two-earner couple
		MINT profiles [a]							
1	Low, declining	38	51	56	42	78	87	118	81
2	Low, level	39	56	58	42	75	87	113	80
3	Low, rising	40	48	60	44	87	87	130	87
4	Middle, declining	28	31	42	36	46	52	70	53
5	Middle, level	36	35	54	42	47	50	70	54
6	Middle, rising	26	29	39	27	49	51	74	50
7	High, declining	23	25	34	31	40	41	60	45
8	High, level	25	29	38	33	36	41	54	41
9	High, rising	25	25	37	33	35	40	52	40
Weighted average (MINT)		28	41	41	34	46	70	69	51
		SSA traditional profiles [b]							
10	SSA Low, level	52	52	78	52	58	58	87	58
11	SSA Average, level	38	38	58	43	43	43	64	48
12	SSA Maximum, level	22	22	33	27	31	31	47	35

NOTES: The SSA profiles do not differentiate between men and women; both earn the exact same wages and therefore receive the exact same benefit in the first year of retirement (although differences in age-adjusted life expectancy will produce different expected annual and total lifetime benefits for the two sexes under these SSA profiles).

PIA = primary insurance amount; AIME = average indexed monthly earnings.

a. MINT two-earner couples are described in Appendix Table 1.

b. The three hypothetical two-earner SSA couples are defined as follows: SSA Low = low-wage male and low-wage female; SSA Average = average-wage male and low-wage female; SSA Maximum = maximum-wage male and average-wage female.

full diversity of earnings profiles is also not accurately reflected in the standard econometric approach that collapses all earnings paths into a single standard career pattern. Thus, our second alternative approach to policy simulation has a powerful advantage over the other two approaches. Unfortunately, it is not easy to project the proportions of future workers that will fall in each of the stylized earnings patterns.

Appendix: Methodology of Policy Simulations

We use nine stylized earnings patterns for both men and women born in 1931 through 1960. The stylized patterns categorize workers based on whether their lifetime earnings are low, middle, or high and whether their average earnings between ages 32-41 and 52-61 are declining, level, or rising. Appendix Table 1 shows the distribution of earnings patterns for the 1931-1935 birth cohort of males. We also matched a female's earnings profile to each male profile based on a plurality of such observed marriages in the Survey of Income and Pro,, gram Participation data. Female spouses were most typically in earnings patterns 1, 3, or 6 (that is, low-declining or low- or middle-rising). The data indicate that profiles 1, 4, 7, and 8 represent 75 percent of the 1931-1935 sample of male earners. (For the 1951-1955 sample, the same four profiles account for 92 percent of earners.)

The microsimulation also involves the following steps and assumptions:

- Using 5-year averages of the data, we have modeled six cohorts: 1931-1935, 1936-1940, 1941-1945, 1946-1950, 1951-1955, and 1956-1960.
- Earnings are measured as multiples of the Social Security average wage in each year and then aligned by the age of the individual. The Social Security low and average profiles (hereafter called SSA profiles) are constant multiples of the average wage in every year of a worker's career, whereas our profile multiples vary from year to year. The middle, or average, Social Security profile is always 1.00, corresponding to the average wage in that year; the low profile is always 0.45 times the average wage; and the high profile is the ratio of the taxable maximum to the average wage in a given year.
- The actual shapes of the age-earnings patterns change from cohort to cohort along with the distri,, bution of individuals among the nine patterns, although the criteria for classifying persons among the groups remain the same. The general trend is for relative earnings to increase over time, but there is wide diversity with considerable numbers of persons whose earnings decline with age, especially in the lower income groups.
- Our calculations assume that workers pay both the employee's and employer's share of Social Security taxes under the presumption that employers will in practice transfer the burden of such taxes to workers in the form of reduced wages.
- All persons are assumed to retire at age 65. Hence, those retiring in 2003 and later see their monthly benefits actuarially reduced on the basis of the schedule in current law.
- Couples are assumed to be the same age and have two children, born when parents are aged 25 and 30. That factor is important because our model's estimates of lifetime Social Security benefits include all possible, expected streams of Old-Age and Survivors Insurance survivors', spousal, or workers' benefits that can be received in each year of a worker's career and retirement.

Appendix Table 1.
MINT wage patterns and sample weights for the 1931-1935 cohort

Earnings profile		Sample size		Percentage distribution		(Two-earner) spouse's profile
		Male	Female	Male	Female	
1	Low, declining	458	1,218	10.3	25.9	1
2	Low, level	25	235	0.6	5.0	3
3	Low, rising	183	1,221	4.1	26.0	3
4	Middle, declining	753	382	16.9	8.1	1
5	Middle, level	164	251	3.7	5.3	3
6	Middle, rising	187	1,039	4.2	22.1	6
7	High, declining	1,092	55	24.5	1.2	3
8	High, level	1,055	90	23.7	1.9	3
9	High, rising	536	213	12.0	4.5	3
All earnings patterns		4,453	4,704	100.0	100.0	n.a.

NOTE: n.a. = not applicable.

Notes

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[1] See Advisory Council on Social Security (1997), espe,, cially pp. 35 and 165-230.

[2] The earnings projections were originally developed as part of the Social Security Administration's Modeling Income in the Near Term (MINT) research program.

[3] The Social Security earnings data are truncated in each year at the ceiling for taxable earnings. However, as described in a later section, we use information from the earnings records to adjust the data to be consistent with a ceiling that is a constant proportion of the average wage.

[4] In the regressions, one category must be omitted for purposes of estimation. In effect, it becomes the base case relative to which all the other categories are measured.

[5] The out-of-sample projections described in this section pertain to the sample members born between 1931 and 1960, since they were the principal focus of the study. To improve the estimation of the earnings function at older ages and to generate earnings predictions for people born outside the 1931-1960 time frame, the estimates were derived using a sample that included people born between 1926 and 1965. In other parts of the project, those estimates are needed to estimate the distribution of earnings among people who might marry or divorce people born between 1931 and 1960.

[6] The taxable maximum ranged from a low of 1.03 times the economy-wide average wage in 1965 to an average of 2.46 in the 1990-1996 period when the ceiling was indexed to the average wage with a 2-year lag.

[7] In our adjustments of censored earnings data, we did not alter the wage data for years after 1989, nor did we alter any wage reports when the reported wage was below the taxable ceiling. We adjusted the pre-1990 wage reports, using data from the Current Population Survey, to reflect a hypothetical wage ceiling equivalent to the average wage ceiling of the 1990-1996 period—that is, a ceiling equal to 2.46 times average earnings. For a full description of our derivation of less censored earnings, see Toder and others (1999), pp. 14-15.

[8] The regression results for the full set of sex and educa,, tion categories are displayed in full in Toder and others (1999), pp. 17-20.

[9] The age-earnings profiles of college graduates and workers with postcollege education have a somewhat different pattern (earnings of people with advanced degrees are sharply lower at early ages, for example), but the two profiles seem to have a similar average level. That is misleading. The average value of the individual-specific effect probably differs for workers with college and postgraduate degrees, implying that the average level of earnings—not just the pattern of rise and fall over time—also differs between the two groups.

[10] Details of the adjustments for early mortality and disability are provided in Toder and others (1999), pp. 22-29.

[11] The tabulations cover SIPP-SSER sample members who have full panel weights on the 1990-1993 SIPP surveys, who survive until age 62, and who accumulate enough quarters of Social Security-covered earnings to become entitled to old-age or disability pensions.

[12] The methodology is adapted from work by Herman Grundman and Barry Bye of the Social Security Administration as reported in Committee on Finance (1976).

[13] The same exercise was done for the original 27 groups and for men and women separately, with very similar results. We also computed the average of nonzero earnings to exclude the year before and the year after a year of zero earnings on the grounds that the calendar year average cannot accurately identify the duration of a period of nonemployment. That adjustment also had very little effect on the shape of the patterns; it did little to reduce the degree of hump or slump.

[14] The trend may be exaggerated by an inconsistency in our treatment of disabled workers' earnings. The inconsis,, tency may result in a downward bias for the predicted growth of average earnings of nondisabled workers.

[15] We refer to our nine stylized earnings patterns as "MINT" profiles in recognition of the fact that they were developed in the course of the Social Security Administration's Modeling Income in the Near Term research program.

[16] For a more detailed description of these calculations, see the appendix. Our comparison of the wealth accumulation in individual accounts with the accumulation under the traditional Social Security system should not be interpreted to mean that we believe those accumulations are comparable in every respect. As shown in Geanakopolos, Mitchell, and Zeldes (1998), part of a worker's contributions to Social Security represents an implicit tax to pay for generous transfers to early generations participating in the system. Unless voters decide to default on prior obligations (for example, by reducing benefits to current retirees or workers near retirement), that implicit tax will have to be paid by workers under either the existing pension system or any individual account system that replaces it. Because it is difficult to calculate and beyond the scope of this article, the implicit tax is ignored in our calcula,, tions of the wealth that workers accumulate under an indi,, vidual account system.

[17] Women would enjoy a similar rate-of-return advantage with individual retirement accounts if funds in the accounts were forcibly converted into annuities when workers reached age 65 and annuities were calculated using one-sex life tables. The reason for women's advantage is that they live longer and thus can expect to receive annuities for more years. Part of the apparent advantage of individual accounts for men depends on assuming that workers will be free to choose whether to convert their retirement savings into an annuity or, alterna,, tively, will be free to purchase an annuity that discriminates between men and women.

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