LIFETIME EARNINGS PATTERNS, THE DISTRIBUTION OF FUTURE SOCIAL SECURITY BENEFITS, AND THE IMPACT OF PENSION REFORM

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

by

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Abstract

This paper describes an analysis of career earnings patterns developed for predicting the impact of Social Security reform. We produce estimates of age-earnings profiles of American men and women born between 1931 and 1960. The estimates are obtained using lifetime earnings records maintained by the Social Security Administration. We use a standard econometric approach to develop forecasts of future individual earnings, and we supplement these estimates by developing estimates of the shape and prevalence of nine stylized earnings patterns of U.S. workers. These two alternative approaches to estimating career earnings patterns have significant advantages over the traditional analytical approach of examining a small number of representative workers who are assumed to have steady earnings throughout their careers. Few workers have level career earnings, so the traditional approach to policy simulation represents a serious distortion of actual labor market experience. Moreover, differences in the pattern of career earnings can produce wide disparities in pension entitlements, even for workers with the same average earnings, under individual account and other retirement plans. Since defined-contribution pension plans are frequently proposed as a supplement or replacement for traditional Social Security, it is important that policy simulation be based on accurate representations of career earnings patterns.

I. Introduction

TO EVALUATE THE RELATIONSHIP between individual earnings and Social Security benefits and predict the distributional impact of Social Security reform, analysts have traditionally relied on policy simulations covering a handful of representative workers. The Social Security benefit formula is extremely complicated. Before the introduction 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 fell dramatically, however, analysts and policymakers often found it easier to understand the impact of reform by examining the effects on three or four representative workers rather than thousands of workers whose earnings patterns span the actual experiences of the U.S. workforce.

The recent Social Security Advisory Council performed fairly typical policy analysis based on a handful of representative cases.[2] The Council assessed the potential 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 roughly the minimum wage throughout his or her career; the second worker consistently earned wages corresponding to the economy-wide average wage; the third earned two-thirds of the maximum taxable 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 his or her earnings level. To account for this 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 straightforward conclusions about the distributional impact of reform on different kinds of families. One traditional goal of Social Security is to offer special protection to low-wage workers. The Advisory Council's analysis shows whether this goal is achieved under each of the three plans examined in its *Report*.

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[2] See Advisory Council on Social Security (1997), especially pp. 35 and 165-230.

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 this simple characterization is sufficient to predict the effects of some uncomplicated changes in the Social Security benefit formula, it provides an inadequate representation to examine other 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 careers were 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 proposal is to reduce the defined-benefit pension now provided by Social Security and introduce a new defined-contribution benefit that would be financed out of contributions into individual retirement accounts. Benefits from this 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 contributions into the retirement accounts. Workers who make large contributions early in their careers 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 workers earn fixed relative wages throughout their careers can yield misleading conclusions.

In this paper we examine two alternatives to the traditional method of Social Security distributional analysis. The first alternative is microsimulation. Under this approach we examine lifetime earnings patterns of tens of thousands of workers and predict their future earnings through the age when they become eligible to receive Old-Age Insurance pensions. 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 development of more realistic approximations of the lifetime earnings patterns of typical American workers. In particular, we develop estimates of nine typical career earnings patterns that span the experiences of workers who become eligible to draw Old-Age Insurance 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. If we could develop appropriate population weights for each of the earnings patterns we examine, we could produce reasonably accurate estimates of the overall effects of reform as well as the distributional effects across different types of workers.

The unique aspect of this study is that we have access to the Social Security earnings records of a representative sample of the total population, namely, workers included in the 1990-93 Surveys of Income and Program Participation (SIPP). These data have shortcomings, but they provide generally accurate information about the pattern of earnings over workers' entire careers.

The remainder of this paper is organized as follows. The next section describes the data we use and the estimation of future earnings patterns under the microsimulation analytical approach. The following section describes our stylized representation of earnings for the second policy simulation approach. We examine career earnings patterns for people born in the 1930s who substantially completed their careers by 1996, when our earnings information ends. We also examine predicted career earnings patterns among workers born after the 1930s, although these 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. In the next section we perform policy simulations based on the nine stylized earnings patterns. The paper concludes with a brief summary of conclusions.

II. Prediction of Lifetime Earnings

The pattern of annual earned income has a characteristic hump-shaped pattern when population-average earnings is 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 erode or as workers reduce their hours and enter retirement.

The characteristic pattern of lifetime earnings profiles is displayed in Figure 1. Panel A shows the cross-sectional pattern of earned income among American men based on 1996 data from the Current Population Survey. The higher line in the figure shows the age profile of earnings among all men who had positive earned incomes. The profile is estimated as a quadratic function of age using Census Bureau tabulations of average earnings within broad age categories (age 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 earnings declines beginning sometime after age 50. The lower and darker line in the figure shows the lifetime profile of average earnings calculated using information for all potential workers, including men who do not work. This line shows lower average earnings at each age, but it reveals the same characteristic pattern of rapidly rising income when workers are in their 20s and 30s and declining earnings when they are in their 50s and 60s.

Panel B provides a contrasting perspective based on the Social Security earnings data for the 1931-40 birth cohort. In broad terms, the age-earnings profile of a specific cohort, followed over time, is similar to the cross-sectional results of panel A. There is a general hump-shaped pattern in the male profile 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 age 38-42, rather than between 44 and 47. Moreover, they reach a peak earlier than women's earnings, which reach a career maximum around age 50-55.

The lines in the figure clearly do not represent the earnings experiences of *each* U.S. worker. Instead they reflect the average of a widely diverse set of experiences. 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 earnings change.

Basic specification. To make a forecast of future earnings for workers who have only partially completed their careers, 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. We treat individual-level earnings as a step-function of age:

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

where

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

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 ϵ_{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 specification is far more flexible than the quadratic function used to estimate the cross-sectional age-earnings profiles in the top panel of Figure 1.

We do not have a reliable basis for predicting the future trend of economy-wide average earnings. This 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. Relative earnings in this study is defined as the ratio of a worker's earnings in a given year and 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 paper 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 one to three years of college education; those with a college diploma; and those with at least one year of education beyond college. Workers can of course be divided into even narrower categories, for example, by race, occupational attachment, marital status, and geographic region. In order to keep the estimation and projection simple, we decided not to examine career earnings profiles in these narrower groups.

We estimated the earnings equation under a fixed-effect specification. That is, we assume that each person in a given sub-population differs from other workers in his or her peer group by a fixed average amount. This 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 these 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 30-34 and the omitted age category, ages 35-39. This is determined by an estimate of the average gain in relative earnings that persons actually experienced between ages 30-34, on the one hand, and ages 35-39, on the other. This 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 who are 30-34 and people who are 35-39 in a given year.)

For estimates based on this model to be valid, it must be the case that future relative earnings increases will 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 these people we can form estimates of the average increase or decline in earnings that takes place between ages 50-54, 55-57, and 58-59. Under the assumptions of the model, the relative earnings gains or losses experienced by this cohort will be duplicated by later cohorts when they reach ages 50-54, 55-57, and 58-59. 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. It would be desirable to generalize the model to produce separate estimates of the career pattern of employment and the career path of earnings, conditional on employment. Some workers leave the labor force at a comparatively young age as a result of disability or early retirement. These workers may have rising earnings up through the point they leave the labor force. In a single-equation model of earnings, the effect of the labor market withdrawal of these early retirees is combined with the effect of continued earnings gains among workers who remain employed. The estimates of the β_A in our model provide reasonable estimates of the path of *unconditional* earnings, that is, earnings of workers and nonworkers alike. Unfortunately, they obscure the potentially distinctive path of average earnings of those workers who remain employed.

Estimation procedures. 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 completed the second periodic interview. The sample was further restricted to persons born between 1926 and 1965.[3]

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

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

upward bias in estimates of the growth rate in earnings for men who have high expected earned incomes.[4] Though we did not develop a formal censoring model, we took account of censoring in an informal way in deriving estimates of the earnings function. We created estimates of "expected earnings above the taxable maximum, but below a hypothetical ceiling based on the 1990-96 average ratio of the ceiling to the average economy-wide earnings" for all individuals with Social Security covered earnings at the taxable maximum. Thus, the revised series should reflect a consistent degree of censoring. For brevity, we refer to this transformed measure of earnings as "less censored" earnings.[5] Once we obtained these estimates of less censored earnings for men at the taxable wage ceiling, we used this estimate of earnings as the dependent variable in our earnings regression.

Estimated age-earnings profile. 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. This ratio is designated y_i in equation 1. For men in the sample, less censored earnings is substituted for Social-Security-covered earnings in calculating the earnings ratio. The period used in estimating the earnings function is 1987 through 1996, the last ten 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 gender and 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. Table 1 shows the coefficient estimates, standard errors, and 95-percent confidence intervals for the age-earnings profiles of potential workers who have completed high school but received no education beyond high school. The upper panel shows estimates for women;

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[4] 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 1990-96 period when the ceiling was indexed to the average wage with a two-year lag.

[5] 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, based on data from the Current Population Survey, to reflect a hypothetical wage ceiling equivalent to the average wage ceiling of the 1990-96 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 et al. (September 1999), pp. 14-15.

the lower panel, estimates for men.[6] Obviously, the large sample sizes allow us to estimate the age coefficients with great precision.

We estimated a total of 10 earnings profiles, five for women and five for men. The estimated age-earnings profiles are displayed in Figure 2. The top panel shows profiles for five educational classes of women; the lower panel, profiles for men. Note that men and women with greater educational attainment have significantly higher earnings than lower education groups at all ages past about age 30. Their peak career earnings are also attained somewhat later in life.[7] 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 completed 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 post-graduate educations. 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 middle 50s. Bear in mind that the age-earnings profiles displayed in Figure 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 these phenomena. If 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. It is straightforward to generate predictions of earnings outside of the estimation period. 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

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[6] The regression results are displayed in full in Toder et al. (September 1999), pp. 17-20.

[7] The age-earnings profiles of college graduates and workers with post-college 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. This is misleading. The average value of the individual-specific effect probably differs for workers with college and post-graduate degrees, implying that the average level of earnings – not just the pattern of rise and fall over time – also differs between the two groups.

a time-varying error term to the prediction. The error term was generated by forming estimates of each person's time-varying error term for each year between 1987-1996. We then randomly selected an error term from the ten estimated error terms.

Rather than estimate a two-part model in which worker's employment status and earnings conditional on employment are separately estimated, we estimated a single-equation model of unconditional earnings. Several implications of this choice should be mentioned. First, the method produces too few predictions of consistently low or zero earnings, especially for workers nearing the typical retirement age. In policy simulations where the exact number of years with positive earnings is important (for example, in predicting the impact of increasing eligibility quarters for disability and old-age benefits) this shortcoming could represent a significant problem. Second, the method yields too few predictions of non-standard age-earnings profiles for ages and years where earnings must be predicted. For example, few people who are age 40 or younger in 1996 will be predicted to have a "slumped" pattern of lifetime earnings, even though such a pattern occurs fairly often (see Section III below). By estimating the average shape of the age-earnings profile for all potential workers, our regression procedure essentially collapses all the distinctive earnings patterns into a single common pattern. Of course, 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. It will have a much bigger effect in the case of young workers in our sample.

The absence of an auto-regressive error pattern in the predictions means that our predictions of labor market withdrawal 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 labor force re-entry after retirement is common, the popular conception of retirement (complete and permanent exit from the work force) is probably the dominant pattern for most workers. The prediction method used here will under-represent this dominant pattern.

Our estimates and predictions of individual age-earnings profiles do 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 standard policy analysis techniques, which focus on three or four representative workers with stable earnings profiles. Our method of predicting future annual earnings introduces substantially more year-to-year variability in post-1996 earnings than procedures that assume future earnings will remain fixed at some predicted average earnings level. Our procedure for imputing year-to-year error terms in each individual profile 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.

Average lifetime earnings. Our predictions of future earnings seem plausible. Both the mean of predicted earnings and the variance of the predictions are sensible in view of the observed trend and distribution of actual earnings over the 1974-1996 period. Comparisons performed by the Social Security Administration suggest the means and distributions of our predictions correspond fairly closely to earlier predictions made by Iams and Sandell (1997). The calculations displayed below are based on our estimates of each worker's AIME. Our predictions of future annual covered earnings are converted into indexed earnings and averaged with past actual earnings to calculate the AIME. For workers who claim an Old-Age Insurance (OAI) pension 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).[8] After forecasting annual earnings for 1997 and later years, we can create projected lifetime earnings histories for people in the matched SIPP-SSER sample. Our forecasts of future earnings are adjusted to reflect early mortality and disability. Rand Corporation analysts predicted age of death for people in the matched SSIP-SSER sample. People predicted to die before attaining age 62 are removed from the sample we use for predicting AIME. We also

[8] The AIME formula for workers claiming DI pensions uses a smaller number of years in the calculation, because workers typically apply for benefits before reaching age 62, but the principal of the calculation is the same. The actual AIME of a worker who is predicted to receive a DI pension is calculated at the age of predicted DI onset. This nominal earnings estimate is then indexed through the calendar year that the workers attains 62 and is compared with economy-wide average earnings at age 62. Thus our estimate of the AIME for both DI and OAI beneficiaries is calculated relative to economy-wide earnings in the same year, namely, the year the worker reaches age 62.

disregard earnings after the onset of Disability Insurance entitlement for sample members who are predicted to begin receiving DI pensions before age 62.[9]

Figure 3 shows trends in predicted AIME, measured as a percentage of economy-wide earnings in the year a worker attains age 62, for men and women. 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 OAI or DI pensions. The trends are tabulated within fifths of the AIME distribution. The top line in the top panel, for example, shows the trend across cohorts of the average AIME for women in the top fifth of the female AIME distribution. Women born between 1931-35 who were in the top fifth of the AIME distribution for women in their cohort on average earned almost exactly the economy-wide average wage during their careers. Women born between 1946-50 in the top fifth of the women's AIME distribution earned almost 1.45 times the economy-wide average wage during their careers, or about 40 percent more than high-AIME women in the 1931-35 cohort.

Women in all parts of the AIME distribution saw improvements in their lifetime earnings in comparison with economy-wide earnings, at least in the case of the cohorts born before the early 1950s. The gains are smaller and, for women earning below-average wages, actually disappear among the cohorts born after 1950. On the whole, however, women have enjoyed substantial gains in their lifetime earnings, partly because of the increased length of their work careers and partly because of 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, male cohorts born in the late 1940s enjoyed relatively higher earnings gains in comparison with high-AIME men born in the 1930s. For men in the bottom two-fifths of the AIME distribution, our estimates show that relative earnings reached a peak for the cohorts born before 1940 and has fallen steadily since that time. This reflects a trend toward growing earnings inequality in the American 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).

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

In part the initial rise in predicted AIME's is explained by increasing levels of school attainment in the work force. 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 school attainment. 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 post-college 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 recent cohorts is the result of their low levels of relative earnings when they were young. Since the *relative* earnings of these workers was lower than those of earlier cohorts at the same age, these workers will be predicted to have lower *relative* lifetime earnings under the assumptions of our model. The AIME is simply the unweighted average of relative earnings for the 35 years of highest relative earnings in a worker's career. If the first 10 or 15 years of a worker's career are scarred by low relative earnings, it will be impossible, under the assumptions of our model, for this poor performance to be overcome.

As already noted, the AIME distribution has grown more unequal over time both for men and women, though the pattern differs somewhat across the two sexes. Men at the top of the earnings distribution experienced an accelerating rise in the proportional distance between their earnings and those of men in the middle. Men at the bottom suffered only a small decline in their relative earnings compared with men in the middle fifth. In contrast, among women the upward trend in relative earnings at the top of the distribution is more moderate, but the downward drift of relative earnings at the bottom is faster than it is among men. The average AIME of women born in 1956-60 is 30 percent higher than the average AIME of women born between 1931 and 1935. In contrast, the average AIME of men born in 1956-1960 is 3 percent *lower* than the average AIME of men born between 1931 and 1935. Both among men and women the AIME gains are fastest among workers in the top fifth of the AIME distribution. But in contrast to the poor performance of the AIME in the middle three fifths of the male AIME distribution, women in the same positions in the female AIME distribution have experienced increases in their earnings relative to economy-wide average earnings.

In sum, these estimates show that women have made and will continue to make 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 twenty years. Finally, workers born in the middle and toward the end of the Baby Boom will receive lower relative earnings over their lifetimes compared with the first Baby Boom cohort. Workers born immediately after World War II had significantly higher educational attainments than the generations born before them, but successive cohorts of Baby Boomers have not sustained the rapid gains in schooling attainment that earlier generations 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 these cohorts *absolute* as well as relative earnings declined. This bad fortune will leave typical members of the later Baby Boom with lower *relative* career wages than those earned by the first cohort born after World War II.

III. 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 this 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 for ages before age 32, because nearly all workers have sharply rising earnings early in their careers. Many workers have low earnings while they are in their twenties because they are still in school. Consequently, their earnings in this phase of their lives do not have much predictive power in forecasting their earnings at later ages.

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 information for this sample, and we can reliably classify workers by their observed earnings. Workers born after 1940 will not have completed their careers by 1996, so our classification of such workers must be based on a prediction of their earnings late in their careers. Our overall analysis sample, which is drawn from matched SIPP-SSER files described earlier, includes all SIPP respondents who have at least one 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 these subperiods we calculate the worker's "average relative earnings." As noted in Section II above, a worker's relative earnings in a given calendar year is simply his or her actual earnings divided by the economy-wide average earnings for that year. The 10-year average earnings is the unweighted average of the worker's relative earnings in each of the ten years of a subperiod.

Our initial classification of workers' earnings patterns focused on three characteristics of the time path of earnings: (1) The average earnings *level*, which is simply the 30-year average of the worker's relative earnings; (2) 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 (3) The *profile* of earnings change, which measures whether the average wage between ages 42-51 is greater than, less than, or equal to the average wage earned when the worker is 32-41 and 52-61.[10] 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 are divided into "low," "average," and "high" earners, depending on whether their career relative earnings are less than, equal to, or above economy-wide average earnings. Career earnings are divided into "declining," "level," and "rising" paths depending on whether the *trend* in earnings is falling, level, or rising over the worker's career. *Profiles* of earnings change are divided into "sagging," "linear," and "humped."

Suppose we define average relative earnings between ages 32 - 41 as A, relative earnings between 42 - 51 as B, and relative earnings between 52 - 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

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

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

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 creation of 27 (= 3 x 3 x 3) stylized earnings patterns.

The distribution of individuals among the 27 patterns is shown in Table 2. The most striking aspect of these tabulations is the remarkable diversity of individual workers' age-earnings profiles. 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 Figure 1. Roughly the same number of workers have declining relative earnings over their careers as have rising relative earnings. In addition, more than a quarter of workers have a "sag" in earnings during the middle years of their careers, 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 worker. The results of this exercise are displayed in Table 3. The first column in the table shows the percentages of nondisabled workers who fall in various stylized earnings categories. Columns to the right show equivalent percentages for subgroups of workers defined by gender, race and ethnicity, and schooling attainment. 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. On the other hand, women 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 earnings decline. 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 African American 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 lives. Unsurprisingly, workers with low levels of education are far more likely to be in the bottom of the earnings distribution and to experience a decline in their relative earnings over their careers. The two columns on the right show the prevalence of different earnings patterns among two groups of workers with exceptionally good or exceptionally poor earnings records. The first of these columns shows earnings patterns among workers who accumulate at least 40 quarters of Social-Security-covered 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.) 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 Insurance benefits, on the other hand, are much more likely to have low lifetime earnings and a declining trend in career earnings.

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 ultimate funds accumulation 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 variations in the *level* and *trend* of age-earnings patterns.

The nine basic earnings patterns -- three average earnings *levels* interacted with three earnings *trends* -- are shown in Figure 4. The dark lines in each graph show the lifetime relative earnings patterns of men with the indicated combination of *level* and *trend*; the lighter lines show earnings patterns for women with the same combination of *level* and *trend*. The percentage of all men with the indicated combination is shown in the top left of each graph; the percentage of women with that combination is shown in the top right. 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 - 0.3 of the economy-wide average wage in the three low-wage groups up to 0.5 - 0.7 for the three high-wage patterns. Thus, this 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 this possibility, we recalculated the earnings patterns to exclude workers in years when their earnings dropped to zero. The results of these tabulations are displayed in Figure 5. While the exclusion of zero earnings years substantially raises the level of the profiles, it has surprisingly little effect on the basic shapes of the lifetime earnings patterns.[11] 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, that there is a 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 ranged as high as 80 percent; the proportion averages nearly 60

[11] This 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 calender year average cannot accurately identify the duration of a period of non-employment. That adjustment also had very little effect on the shape of the patterns; it did little to reduce the degree of hump or slump.

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 non-participation are very comparable within each stylized earnings category. Because years of zero earnings are much more common at the very beginning and very end of the work life, these years have a significant, although not a dominant, impact on the trend in earnings.

The tabulations in Table 2 and Figures 4 and 5 represent the experiences of workers born between 1931 and 1940, nearly all of whom had substantially competed their careers by 1996. We can make predictions of 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 1931-40 birth cohorts to classify workers born between 1941 and 1960. The results of these calculations are displayed in Table 4. Our earnings forecasts imply that there will be large offsetting shifts in the distributions of men and women across the nine stylized earnings categories. For example, they imply there will be a sharp increase in the proportion of women in the top third of the lifetime earnings distribution. The proportion is predicted to rise from 10 percent of female earners in the 1931-40 birth cohort to 22 percent of women in the 1951-60 cohort. This 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 1931-40 birth cohort to 47 percent of men in the 1951-60 cohort. Our forecast also implies there will be a significant falloff in the proportion of workers who have a rising trend in their lifetime earnings. This latter result is especially pronounced among men.[12]

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. While we will not report those correlations in this paper, they show a strong trend over time for wives to move up in the earnings distribution while the

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

relative earnings of husbands are stagnant or modestly declining. The result of this trend will be a substantial rise in couples' combined lifetime earnings and Social Security retirement benefits.

IV. 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 had 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 this average amount. In our discussion of policy evaluation below we refer to these traditional patterns as "Social Security Administration (SSA) stylized earnings patterns."

The development of more representative stylized profiles permits us to make comparisons between our profiles and the stylized SSA earnings patterns with respect to issues involving Social Security wealth accumulation and rates of return. It is also possible to trace out how the pattern of earnings over time can affect the accumulation of pension wealth in a reformed system that includes defined-contribution individual retirement accounts. The accumulation patterns will be very different under the two sets of stylized earnings profiles.[13]

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 is typical of the population as a whole. Thus, SSA's low earner is closer to someone with between low and average career earnings; its person 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.

[13] See the Annex below for an exact description of the stylized earnings patterns we use in this policy analysis.

- Mainly because of these differences, we find that our own representatives of low, average, and high earners tend to have lower Social Security wealth but higher internal rates of return than is 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. That is, the worker starts working, remains at work, and retires from work at the highest (and lowest) wage of his or her career (relative to the economy-wide wage). The worker is never out of the labor force at any time in a career. Implicitly, then, SSA's stylized earnings pattern takes the average wage for all earners in a given year rather than the average wage for all people who participate in Social Security, whether they work or not in a given year.

  As a consequence, given normal earnings patterns, the replacement rate defined as the percentage of *peak* year's earnings replaced by Social Security is much lower for the typical worker than is detectable using traditional stylized earnings patterns. The primary insurance amount as a percent of the economy-wide average wage is also lower. However, the primary insurance amount as a percentage of the worker's *average* (indexed) earnings 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 upon the rate of return in the account and the variance in lifetime earnings patterns. At higher rates of return, those with lifetime earnings that come earlier in life fare relatively better under individual accounts than do those whose earnings come later in life.

Analysis. Table 5 shows annualized average indexed monthly earnings (AIME) for the SSA traditional profiles and our own (MINT) profiles.[14] It is striking that SSA profiles reflect significantly higher *average* earnings than their MINT counterparts. In most cases, SSA profiles reflect higher wages than MINT profiles in *every year of work*.

For the 1931-1935 birth cohort, AIMEs for SSA's traditional profiles range from 1.3 to 3 times the AIMEs for comparable MINT profiles. MINT men born in between 1931 and 1935 earned a weighted average AIME of $2,555 across all 9 profiles, while MINT women earned a weighted average amount of $909. In comparison with the "Middle" or average SSA profile's AIME of $2,290, MINT men earn 12 percent more while MINT women earn an AIME that is 60 percent lower. The differential distribution of men and women across the 9 MINT profiles explains the large

[14] 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 (MINT) research program.

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 lower panel in Table 5 shows our AIME predictions for men and women born in 1951-1955. To make the estimates comparable to those in the top panel, all dollar amounts are calculated in constant year 2000 dollars. 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. (In fact, the distribution of 1951-1955-birth-cohort men in the MINT profiles is less concentrated in the higher income profiles than it was for the 1931-1935 birth cohort, so men are predicted to lose ground.) While 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. The net result is that the average MINT woman earner in the 1951-1955 cohort is predicted to earn an AIME of $1,729. This amount is just 37 percent lower than the SSA average worker, whereas the gap between the weighted MINT profile and the SSA average earner is 60 percent for women born between 1931 and 1935. The ratio of male to female weighted average AIME is 1.7 in the 1951-1955 birth-year cohort, showing that women will gain ground relative to men.

Table 6 contains 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. We have calculated the benefits at age 65 that workers could expect to obtain if their Social Security contributions were invested at a two percent real rate of return. This amount is then compared with the discounted value of traditional Social Security benefits the same worker would obtain, assuming retirement at age 65. The calculations are performed for single earners, breadwinners in one-earner, married-couple families, and workers in dual-earner families.[15] Values

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[15] For a more detailed description of these profiles, see the Annex at the end of this paper. Our comparison of the wealth accumulation in individual accounts with the accumulation under the traditional Social

in the table that are less than 1.00 indicate that the individual account offers lower benefits than does traditional Social Security for the indicated wage earner in the indicated household.

The weighted average values shown in the bottom row of the table summarize our findings. For workers born between either 1931-1935 or 1951-1955, Social Security usually provides equal or higher benefits than an individual account yielding a real return of 2 percent. Social Security benefits are higher for all single female profiles and for all workers, whether male or female, in one-earner and two-earner couples. Single males in the high earnings categories and, in the 1951-1955 cohort, in the average earner category would obtain higher benefits under the individual account plan, however. Since the majority of males in the MINT sample fall into the higher income profiles, individual accounts usually provide them 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. It is therefore more likely for earners in the later cohort than in the earlier cohort that individual accounts will offer better benefits than traditional Social Security.

Table 7 extends the analysis in Table 6 but uses a 5 percent rather than a 2 percent real interest rate for calculating accumulations in the individual retirement account. As shown in the bottom row of the table, 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 wage earner types, only those falling in the low-level or low-increasing profiles would receive higher benefits under Social Security than under an individual account plan yielding a real return of 5 percent. As in Table 6, the ratios of individual account wealth to lifetime Social Security benefits increase for workers in the later birth cohort.

Security system should not be interpreted to mean we believe these 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), this 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 our paper, this implicit tax is ignored in our calculations of the wealth that workers accumulate under an individual retirement system.

Table 8 shows the internal rates of return (IRR) that different worker types receive under the existing Social Security system. Several general patterns emerge. 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.[16] 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. It is interesting to compare how workers fare under Social Security when they are assumed to have the traditional SSA profiles and when they have the MINT profiles. On average, the workers assumed to have the MINT profiles fare better than workers with the corresponding SSA profiles. There are two main reasons for this result. MINT workers have significantly lower wage levels than the corresponding SSA profiles, and thus they benefit more from the redistributional tilt in Social Security's benefit formula. Second, the difference in earnings between MINT spouses is larger than it is for the SSA spouses we chose to model. As the difference in AIME between spouses increases, so too does the value of survivor's and spousal benefits for MINT retirees. A general theme that emerges from the IRR comparison is that the Social Security system favors 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 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 these 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

[16] 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 males depends on assuming workers will be free to choose whether to convert their retirement savings into an annuity or, alternatively, will be free to purchase an annuity that discriminates between men and women.

differ based on the career pattern of workers' earnings. In most cases, we see that the declining wage profiles (numbers 1, 4, and 7) look relatively better under individual retirement accounts, because workers with these earnings patterns contribute more at the beginning of their careers and therefore enjoy more compound income growth than workers with level or rising earnings patterns.

Table 10 shows the percentage of annual earnings that Social Security benefits replace for each worker type. There are various ways to measure the "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 received at age 65 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 to a worker's career *average* earnings (the average of the best 35 years of worker earnings).

Note that under either definition, replacement rates decline as average earnings rise. One-earner couples can expect the highest replacement rates (our calculations include the 50% spousal benefit), while single males can expect the lowest. The traditional SSA profiles show higher replacement rates under the PIA-to-Peak Wage method because the peak wage in the traditional profile is equal to the average wage (which determines the AIME and, therefore, the PIA). For MINT profiles, on the other hand, the worker's peak earnings may be 1.5 to 2.5 times the lifetime average wage. The PIA-to-AIME method thus produces higher replacement rates overall (and higher rates for the MINT profiles than for the traditional SSA profiles).

IV. Conclusions

Our analysis suggests that the traditional method of Social Security distributional analysis can produce misleading results for certain kinds of policy analysis. One kind of reform where the error is particularly large is the substitution of individual defined-contribution retirement accounts for part of the traditional Social Security defined-benefit pension. Since individual retirement accounts are now commonly proposed as a supplement or substitute for traditional Social Security, this shortcoming of the standard analytical method represents a serious problem.

Our findings also highlight possible shortcomings of the two alternative methods of policy forecasting we examine in this paper. 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, it is straightforward to predict the average population effects and distribution of effects of particular reform proposals using microsimulation. The proper weights for people represented 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 requires that we forecast future career earnings, however. Ironically, this step of the simulation exercise eliminates much of the diversity 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, this over-simplification 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 declining earnings over the life cycle. This prototypical hump-shaped pattern of earnings is in fact typical for only a minority of American workers. Some workers have approximately stable relative earnings over their careers, as assumed in the traditional Social Security distributional analysis. But an even larger fraction has either a slumped pattern in which earnings fall significantly in mid-career or a pattern of declining earnings after a comparatively early age. The enormous diversity in real life earnings patterns suggests that age-earnings profiles are poorly captured in the traditional Social Security distributional analysis. The 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. When we do not observe the full career earnings path of a worker it is very difficult to predict which stylized earnings pattern the ultimate path will follow. This uncertainty makes it very difficult to forecast suitable population weights to reflect the relative future importance of each of the nine stylized earnings patterns.

Annex: Methodology

We use 9 stylized earnings patterns for both men and women born between 1931 and 1960 inclusive. The stylized patterns categorize workers based on whether their lifetime earnings are low, average, or high and whether their average earnings between ages 32-41 and 52-61 are decreasing, level, or increasing. Annex Table 1 shows the distribution of earnings patterns for the *1931-35* 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 SIPP data. Female spouses were most typically in earnings patterns 1, 3 or 6 (that is, low or middle income increasing or low decreasing).

ANNEX TABLE 1: MINT WAGE PATTERN DESCRIPTIONS AND SAMPLE WEIGHTS FOR 1931-1935 BIRTH COHORT

Wage Pattern	**Description of Pattern**	**Male Sample Size**	**Female Sample Size**	**Percent Distribution**		**(Two-Earner) Spouse's Profile**
				Male	**Female**	
1	Low earnings, decreasing	458	1,218	10.3	25.9	1
2	Low earnings, level	25	235	0.6	5.0	3
3	Low earnings, increasing	183	1,221	4.1	26.0	3
4	Average earnings, decreasing	753	382	16.9	8.1	1
5	Average earnings, level	164	251	3.7	5.3	3
6	Average earnings, increasing	187	1,039	4.2	22.1	6
7	High earnings, decreasing	1,092	55	24.5	1.2	3
8	High earnings, level	1,055	90	23.7	1.9	3
9	High income, increasing	536	213	12.0	4.5	3
	All earnings patterns	*4,453*	*4,704*	*100.0*	*100.0*	--

The table shows that profiles 1, 4, 7, and 8 represent 75 percent of the 1931-35 sample of male earners. (For the 1951-55 sample, these same four profiles comprise 92 percent of earners).

Additionally,

- We took 5-year averages of the data so that we are modeling 6 cohorts: 1931-35, 1936-40, 1941-45, 1946-50, 1951-55, and 1956-60.

- 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, while our profile multiples vary from year to year. The "Average" or middle Social Security profile is always 1, corresponding to the average wage in that year; the "Low" profile is always 0.45 times the average wage; 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 distribution of individuals among the nine patterns, although the criteria for classifying persons among the groups remains 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.

- In our calculations we assume 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 based on 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. *This factor is important because our model includes all possible, expected streams of OASI survivors', spousal, or workers' benefits that can be received in each year of a worker's career and retirement, in its estimates of lifetime Social Security benefits.*

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Table 1.
Age-Earnings Profiles for Workers with a High School Diploma, by Gender: Fixed-Effect Model Estimates

Women with four years of high school.

sd(u_id) = 43.81776		Number of obs =	174680
sd(e_id_t) = 22.76773		n =	17769
sd(e_id_t + u_id) = 49.37981		T-bar =	9.8306
corr(u_id, Xb) = 0.0397		R-sq within =	0.0279
		between =	0.0353
		overall =	0.0292
		F(13,156898) =	346.19
		Prob > F =	0.0000

yratio	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Age24	-10.89394	.5343841	-20.386	0.000	-11.94132	-9.846557
Age29	-7.162824	.3191782	-22.441	0.000	-7.788407	-6.537241
Age34	-4.314175	.2373817	-18.174	0.000	-4.779438	-3.848912
Age44	3.997877	.2495359	16.021	0.000	3.508791	4.486962
Age49	5.875282	.3386881	17.347	0.000	5.211461	6.539104
Age54	4.455451	.424028	10.507	0.000	3.624365	5.286537
Age57	1.000265	.5142488	1.945	0.052	-.0076523	2.008181
Age59	-2.859324	.5814337	-4.918	0.000	-3.998922	-1.719726
Age61	-6.803079	.615085	-11.060	0.000	-8.008633	-5.597525
Age62	-12.33316	.7109171	-17.348	0.000	-13.72654	-10.93978
Age64	-20.02395	.6727037	-29.766	0.000	-21.34243	-18.70546
Age65	-24.95934	.8005149	-31.179	0.000	-26.52834	-23.39035
Age67	-27.52117	.8508359	-32.346	0.000	-29.1888	-25.85355
_cons	46.38095	.2162292	214.499	0.000	45.95714	46.80475
id	F(17768,156898) =		36.405			

Men with four years of high school.

sd(u_id) = 64.88506		Number of obs =	140285
sd(e_id_t) = 35.38793		n =	14230
sd(e_id_t + u_id) = 73.9079		T-bar =	9.8584
corr(u_id, Xb) = -0.1640		R-sq within =	0.0756
		between =	0.0291
		overall =	0.0308
		F(13,126042) =	792.46
		Prob > F =	0.0000

yratio	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Age24	-19.81902	.8722068	-22.723	0.000	-21.52853	-18.10951
Age29	-7.842719	.5171317	-15.166	0.000	-8.856288	-6.82915
Age34	-.9857611	.3810928	-2.587	0.010	-1.732696	-.2388258
Age44	-1.930576	.4260428	-4.531	0.000	-2.765613	-1.09554
Age49	-7.554708	.60333	-12.522	0.000	-8.737225	-6.372192
Age54	-17.07835	.7593425	-22.491	0.000	-18.56665	-15.59005
Age57	-30.66509	.9234691	-33.206	0.000	-32.47507	-28.85511
Age59	-44.29774	1.055965	-41.950	0.000	-46.36741	-42.22806
Age61	-59.72219	1.122345	-53.212	0.000	-61.92197	-57.52242
Age62	-75.31036	1.314187	-57.306	0.000	-77.88614	-72.73457
Age64	-94.51296	1.242308	-76.079	0.000	-96.94786	-92.07805
Age65	-109.1274	1.49186	-73.149	0.000	-112.0514	-106.2034
Age67	-117.2749	1.579743	-74.237	0.000	-120.3712	-114.1786
_cons	107.1683	.3496285	306.521	0.000	106.4831	107.8536
id	F(14229,126042) =		31.504			

Table 2. Distribution of Workers by Characteristics of Career Earnings Path, Both Sexes

Percentage distribution of workers born 1931-40

Low earnings level		*Profile*			
		"Sag"	*"Linear"*	*"Humped"*	*All profiles*
	Declining	10.4	2.0	5.4	*17.8*
Trend	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		*Profile*			
		"Sag"	*"Linear"*	*"Humped"*	*All profiles*
	Declining	3.8	4.5	5.5	*13.8*
Trend	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		*Profile*			
		"Sag"	*"Linear"*	*"Humped"*	*All profiles*
	Declining	1.2	5.1	6.5	*12.8*
Trend	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 1990-93 matched SIPP-SSER files.

Table 3. Distribution of Individuals by Personal Characteristics and Earnings Profiles, 1931-1940 Birth Cohort

Percent

	Non-disabled									
						Highest Degree Attained				
	All workers	Male	Female	Black	Hispanic	No degree	High School Diploma	College Degree	Attained 40 quarters of covered earnings	Became disabled*
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*

* Collected Social Security Disability Insurance benefits.
Source: Authors' tabulations of 1990-93 matched SIPP-SSER files.

Table 4. Distribution of Earners by Income Level and Trend, All Workers Born 1931-1960

Percent

Level of earnings	Trend in earnings	Men born in -- 1931-40	Men born in -- 1941-50	Men born in -- 1951-60	Women born in -- 1931-40	Women born in -- 1941-50	Women born in -- 1951-60
		Distribution by Income Level and Trend					
Low	Declining	10	13	18	25	19	12
	Level	0	1	2	5	4	9
	Increasing	4	3	1	24	22	21
Middle	Declining	19	20	29	9	9	7
	Level	3	4	3	5	9	21
	Increasing	4	4	1	22	18	8
High	Declining	25	19	21	1	2	1
	Level	24	31	26	3	9	19
	Increasing	10	5	0	6	8	2
	Total	*100*	*100*	*100*	*100*	*100*	*100*
		Distribution by 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*
		Distribution by Trend Pattern					
All levels	Declining	54	52	67	35	30	21
	Level	28	36	31	13	22	49
	Increasing	18	12	2	52	49	30
	Total	*100*	*100*	*100*	*100*	*100*	*100*

Source: Authors' tabulations of 1990-93 matched SIPP-SSER files.

TABLE 5: AVERAGE INDEXED MONTHLY EARNINGS FOR SSA AND MINT WAGE PROFILES, 1931-1935 AND 1951-1955 BIRTH COHORTS

Birth Years of Cohort	Profile	SSA Profiles	MINT Profiles				SSA-to-MINT Ratio	
			Male Worker	Percent of Males	Female Worker	Percent of Females	Male Worker	Female Worker
1931-35	**Low**	$1,031	$ 528	15.0	$ 348	56.9	1.95	2.96
	Middle	2,290	1,717	24.8	1,386	35.5	1.33	1.65
	High (Max.)	4,559	3,403	60.2	2,861	7.6	1.34	1.59
	Weighted Avg.	—	*$2,555*	*100.0*	*$ 909*	*100.0*	—	—
1951-55	**Low**	1,236	$ 619	19.0	$ 477	41.2	2.00	2.59
	Middle	2,747	2,076	31.8	1,754	36.8	1.32	1.57
	High (Max.)	6,688	4,514	49.2	4,030	22.0	1.48	1.66
	Weighted Avg.	—	*$2,997*	*100.0*	*$1,729*	*100.0*	—	—

Note: Amounts are in constant year-2000 dollars. The MINT profiles “Low,” “Middle,” and “High” are weighted averages of the 3 Low, 3 Middle, and 3 High profiles. The weighted average of all 9 profiles for a given cohort is listed last.

TABLE 6: RATIOS OF INDIVIDUAL ACCOUNT WEALTH TO SOCIAL SECURITY WEALTH AT A TWO PERCENT REAL INTEREST RATE, 1931-1935 AND 1951-1955 BIRTH COHORTS

Wage Profile	Description (wage level, trend)	1931-35 Birth Cohort				1951-55 Birth Cohort			
		Male Worker	Female Worker	One-Earner Couple	Two-Earner Couple	Male Worker	Female Worker	One-Earner Couple	Two-Earner Couple
1	Low, decreasing	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, increasing	0.45	0.37	0.21	0.35	0.56	0.47	0.26	0.43
4	Middle, decreasing	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, decreasing	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, increasing	1.33	0.87	0.60	0.65	1.15	1.01	0.56	0.61
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 Max., level	1.49	1.18	0.67	0.91	1.97	1.61	0.93	1.19
Weighted Average (MINT)		*1.08*	*0.53*	*0.48*	*0.55*	*1.22*	*0.76*	*0.58*	*0.66*

Note: MINT profiles are numbers 1-9; SSA profiles are numbers 11-12. Contributions to worker individual accounts are made at the OASI 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 total accumulated wealth at age 65, adjusted for the chance of death in all years after age 21. This amount is then divided by the present value at age 65 of lifetime Social Security benefits a worker would have received given his/her wage history and average life expectancy for his/her birth cohort and gender, also adjusted for the chance of death in each year after age 21. (Note that workers always retire at age 65 and those retiring after 2003 have their benefits actuarially reduced in line with increases in the NRA stipulated in current law). Ratios less than one indicate that the present value of lifetime Social Security benefits at age 65 exceed individual account wealth at age 65. MINT two-earner couples are described in Annex Table 1. We define three hypothetical two-earner SSA couples as follows: SSA Low = low wage male and low wage female; SSA Average = average wage male and low wage female; SSA Max. = maximum wage male and average wage female.

TABLE 7: RATIOS OF INDIVIDUAL ACCOUNT WEALTH TO SOCIAL SECURITY WEALTH AT A FIVE PERCENT REAL INTEREST RATE, 1931-1935 AND 1951-1955 BIRTH COHORTS

		1931-35 Birth Cohort				1951-55 Birth Cohort			
Wage Profile	**Description (wage level, trend)**	**Male Worker**	**Female Worker**	**One-Earner Couple**	**Two-Earner Couple**	**Male Worker**	**Female Worker**	**One-Earner Couple**	**Two-Earner Couple**
1	Low, decreasing	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, increasing	0.87	0.64	0.40	0.64	1.18	1.09	0.55	0.95
4	Middle, decreasing	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, increasing	1.57	1.11	0.72	1.02	1.94	1.55	0.93	1.37
7	High, decreasing	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, increasing	2.40	1.45	1.09	1.17	2.10	1.89	1.02	1.15
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 Max., level	2.67	2.09	1.21	1.68	4.09	3.31	1.94	2.47
Weighted Average (MINT)		*2.14*	*0.99*	*0.96*	*1.09*	*2.66*	*1.58*	*1.26*	*1.46*

Note: MINT profiles are numbers 1-9; SSA profiles are numbers 11-12. Contributions to worker individual accounts are made at the OASI 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 total accumulated wealth at age 65, adjusted for the chance of death in all years after age 21. This amount is then divided by the present value at age 65 of lifetime Social Security benefits a worker would have received given his/her wage history and average life expectancy for his/her birth cohort and gender, also adjusted for the chance of death in each year after age 21. (Note that workers always retire at age 65 and those retiring after 2003 have their benefits actuarially reduced in line with increases in the NRA stipulated in current law). Ratios less than one indicate that the present value of lifetime Social Security benefits at age 65 exceeds individual account wealth at age 65. MINT two-earner couples are described in Annex Table 1. We define three hypothetical two-earner SSA couples as follows: SSA Low = low wage male and low wage female; SSA Average = average wage male and low wage female; SSA Max. = maximum wage male and average wage female.

Table 8: Real Internal Rate of Return for MINT and SSA Wage Profiles, 1931-1935 and 1951-1955 Birth Cohorts

Wage Profile	Description (wage level, trend)	1931-35 Birth Cohort Male Worker	1931-35 Female Worker	1931-35 One-Earner Couple	1931-35 Two-Earner Couple	1951-55 Birth Cohort Male Worker	1951-55 Female Worker	1951-55 One-Earner Couple	1951-55 Two-Earner Couple
1	Low, decreasing	3.62	4.56	6.25	5.15	3.02	3.78	5.12	4.22
2	Low, level	3.61	4.68	6.34	5.55	3.21	3.95	5.63	4.54
3	Low, increasing	4.68	5.62	7.45	5.99	3.77	4.03	6.40	4.67
4	Middle, decreasing	2.08	3.08	4.62	4.16	1.67	2.42	3.83	3.22
5	Middle, level	1.95	3.03	4.74	4.25	1.64	2.40	3.95	3.51
6	Middle, increasing	2.36	3.52	5.48	4.01	2.11	2.72	4.54	3.22
7	High, decreasing	1.46	2.45	4.12	3.85	1.02	1.83	3.26	3.09
8	High, level	1.03	2.28	3.85	3.60	0.51	1.59	2.88	2.75
9	High, increasing	0.96	2.54	3.89	3.63	1.49	1.96	4.05	3.69
10	SSA Low, level	2.44	3.20	5.30	3.30	2.01	2.61	4.34	2.64
11	SSA Average, level	1.45	2.25	4.22	3.22	1.08	1.73	3.41	2.56
12	SSA Max., level	0.49	1.41	3.49	2.36	(0.17)	0.54	2.21	1.46
	Weighted Average (MINT)	*1.82*	*4.25*	*4.56*	*4.07*	*1.47*	*2.92*	*3.72*	*3.27*

Note: MINT profiles are numbers 1-9; SSA profiles are numbers 11-12. While we assume that although both SSA Men and Women earn the same exact wages, women's longer life spans give them different IRRs. All Social Security contribution and benefit amounts are adjusted for the chance of death in all years after age 21. MINT two-earner couples are described in Annex Table 1. We define three hypothetical two-earner SSA couples as follows: SSA Low = low wage male and low wage female; SSA Average = average wage male and low wage female; SSA Max. = maximum wage male and average wage female.

TABLE 9: RELATIVE NORMALIZED INDIVIDUAL ACCOUNT WEALTH AT FIVE PERCENT REAL INTEREST FOR MINT WAGE PROFILES, 1931-1935 BIRTH COHORT

MINT Wage Profile	**Description (wage level, trend)**	**Male Worker**	**Female Worker**	**One-Earner Couple**	**Two-Earner Couple**
1	Low, decreasing	0.85	1.03	0.85	1.03
2	Low, level	0.93	1.01	0.93	0.96
3	Low, increasing	0.74	0.82	0.74	0.86
4	Middle, decreasing	1.02	1.07	1.02	1.13
5	Middle, level	1.00	1.00	1.00	1.00
6	Middle, increasing	0.84	0.84	0.84	0.92
7	High, decreasing	1.05	1.08	1.05	1.03
8	High, level	0.98	1.00	0.98	0.99
9	High, increasing	0.90	0.86	0.90	0.95
	Weighted Average	*0.96*	*0.93*	*0.96*	*1.01*

Note: Figures are worker profile individual account wealth divided by worker profile #5's individual account wealth. Worker's wages for each profile have been "normalized," i.e., 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."

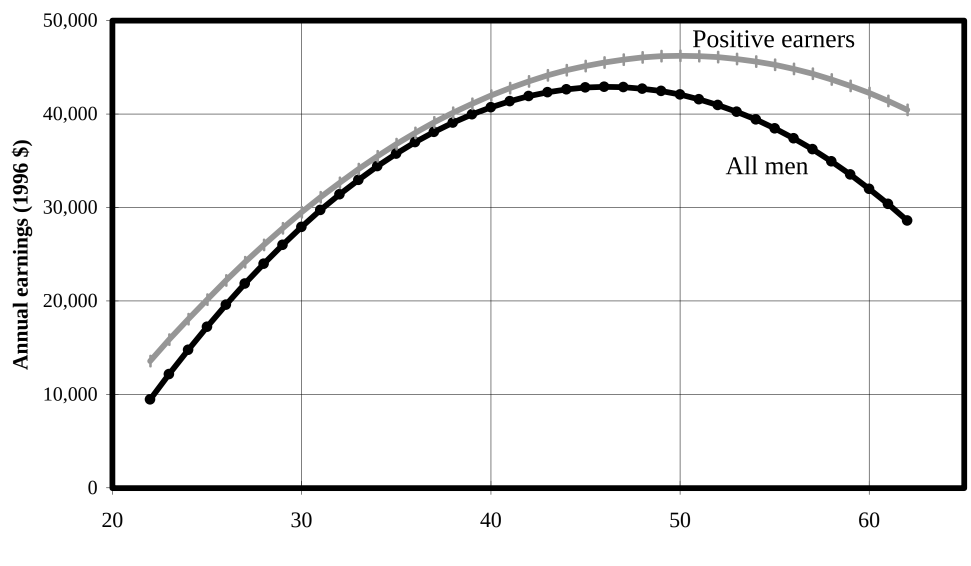
TABLE 10: TWO WAYS TO MEASURE REPLACEMENT RATES FOR MINT AND SSA, 1931-1935 BIRTH COHORT (FIGURES IN PERCENT)

		Ratio of PIA to Peak Wage				Ratio of PIA to AIME			
Wage Profile	**Description (wage level, trend)**	**Male Worker**	**Female Worker**	**One-Earner Couple**	**Two-Earner Couple**	**Male Worker**	**Female Worker**	**One-Earner Couple**	**Two Earner Couple**
1	Low, decreasing	37.7	50.9	56.5	41.9	78.5	86.6	117.8	81.4
2	Low, level	38.7	55.6	58.1	42.0	75.4	86.6	113.1	79.7
3	Low, increasing	40.0	47.8	60.0	43.6	86.6	86.6	129.9	86.6
4	Middle, decreasing	28.2	31.1	42.3	35.5	46.5	51.9	69.8	52.8
5	Middle, level	36.3	34.9	54.5	41.5	46.8	50.4	70.3	54.1
6	Middle, increasing	25.9	28.8	38.9	27.2	49.2	50.6	73.8	49.9
7	High, decreasing	23.0	25.2	34.5	30.5	39.6	40.9	59.4	44.9
8	High, level	25.2	28.8	37.8	33.2	35.9	40.6	53.9	40.9
9	High, increasing	24.6	25.0	36.8	32.6	34.8	40.3	52.2	39.6
10	SSA Low, level	51.8	51.8	77.7	51.8	57.8	57.8	86.6	57.8
11	SSA Average, level	38.5	38.5	57.7	42.6	42.9	42.9	64.4	47.5
12	SSA Max., level	21.9	21.9	32.9	26.6	31.3	31.3	46.9	35.2
	Weighted Average (MINT)	*27.5*	*41.1*	*41.3*	*34.3*	*46.1*	*70.4*	*69.2*	*50.8*

Note: MINT profiles are numbers 1-9; SSA profiles are numbers 11-12. SSA's 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). MINT two-earner couples are described in Annex Table1. We define three hypothetical two-earner SSA couples as follows: SSA Low = low wage male and low wage female; SSA Average = average wage male and low wage female; SSA Max. = maximum wage male and average wage female.

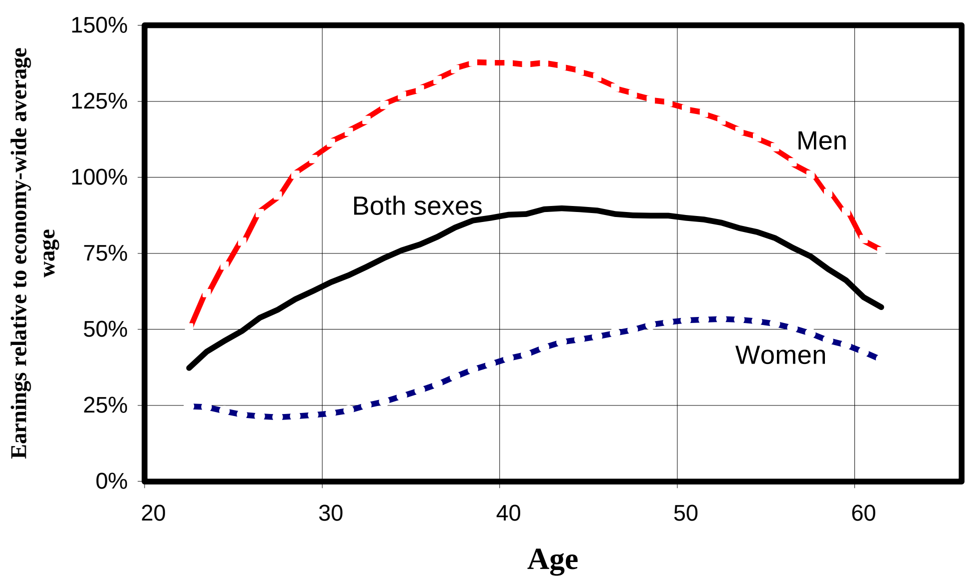
Figure 1. Cross-sectional and Cohort Measures of the Age Earnings Profile

Panel A. Age-Earnings Profile of U.S. Men, Cross-sectional data, 1996



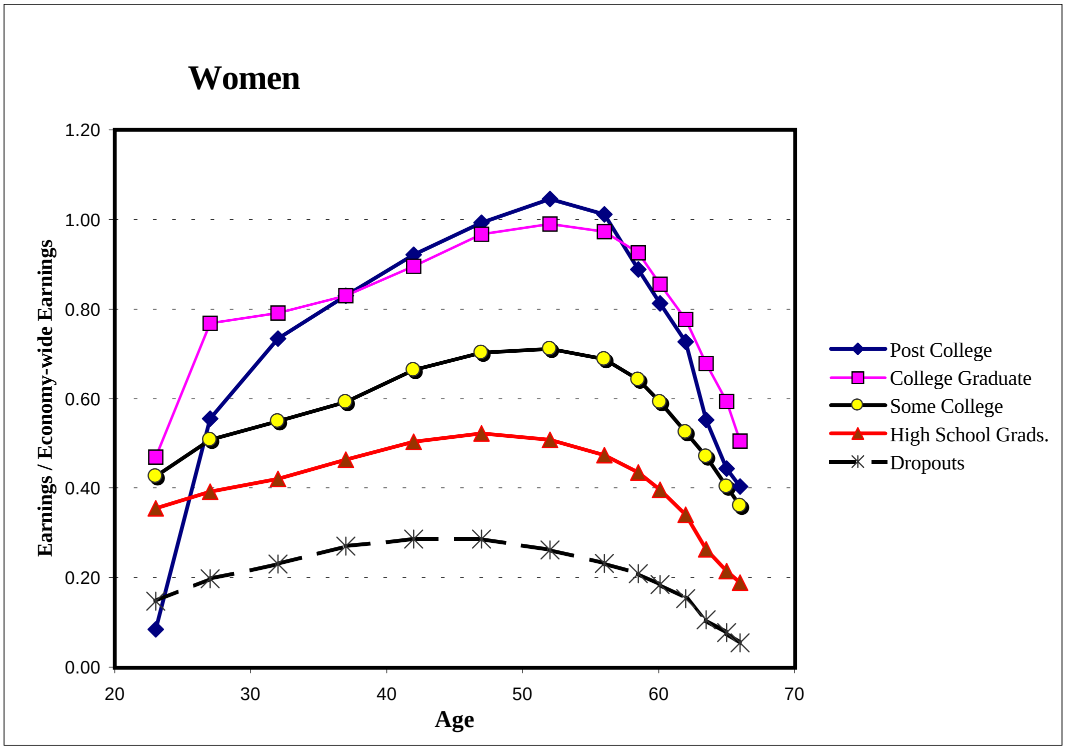
Source: U.S. Bureau of Census (1997).

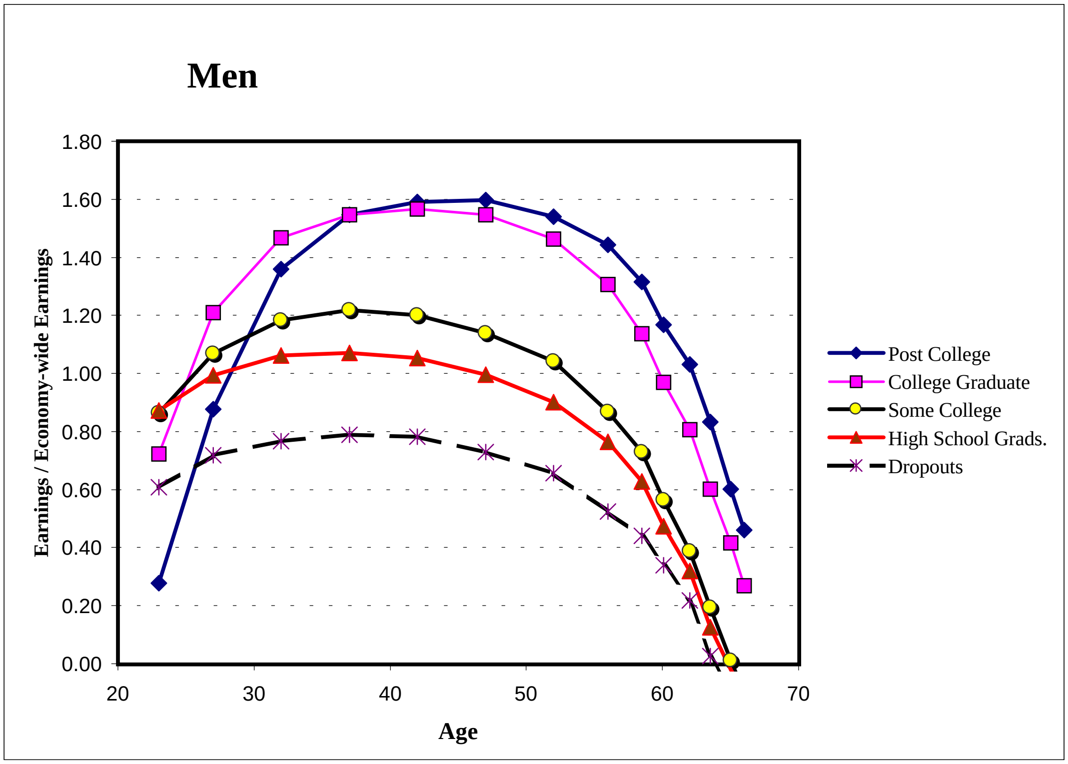
Panel B. Age-Earnings Profile, 1931-40 Birth Cohorts



Source: Authors' tabulations of merged 1990-1993 SIPP and SSER files (see text).

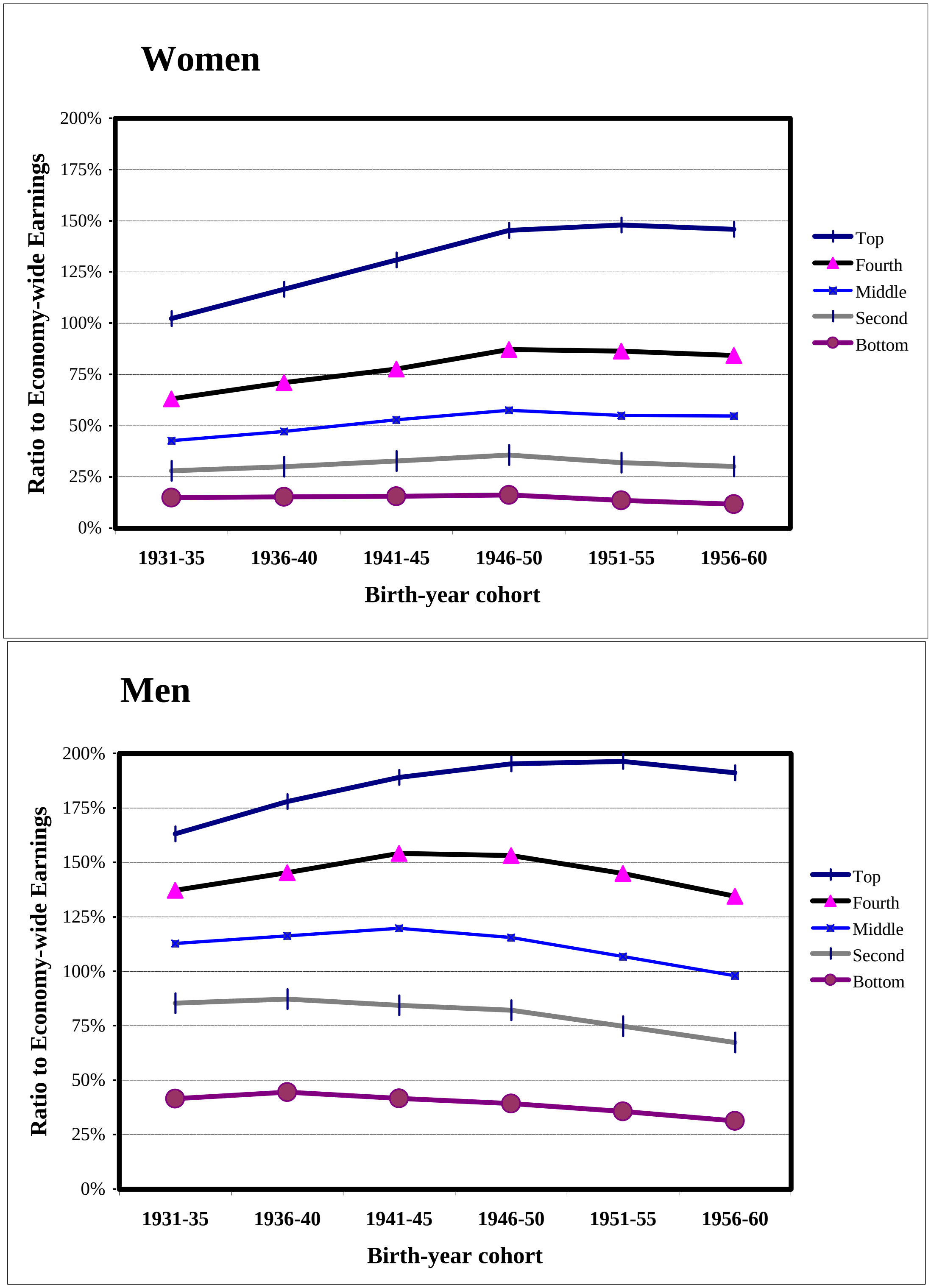
Figure 2. Estimated Age-Earnings Profiles, by Sex and Educational Attainment





Source: Author's estimates using the 1990-93 matched SIPP-SSER data files. (Social Security earnings records for 1987-1996.)

Figure 3. Trend in Average AIME within Fifths of AIME Distribution, by Sex



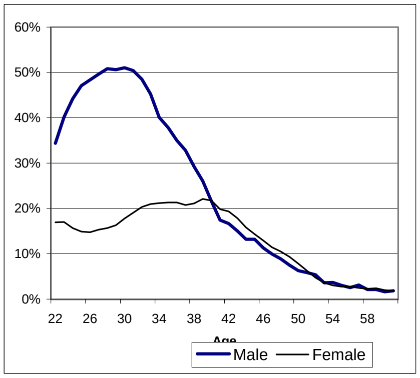
Source: Authors' tabulations of matched SIPP-SSER records.

Figure 4. Basic Earnings Patterns, Male and Female, Nine Groups 1931-40 Cohort

Low Income

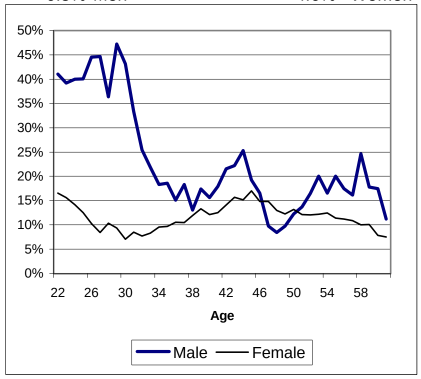
Declining Trend

10.2% Men 25.0% Women



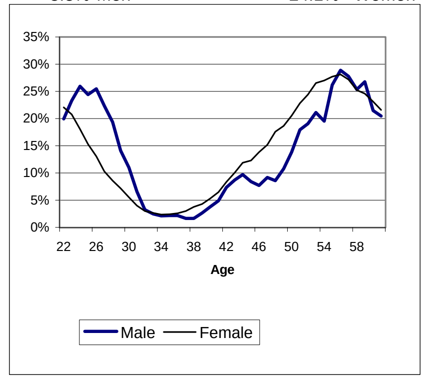
Level Trend

0.5% Men 4.6% Women



Rising Trend

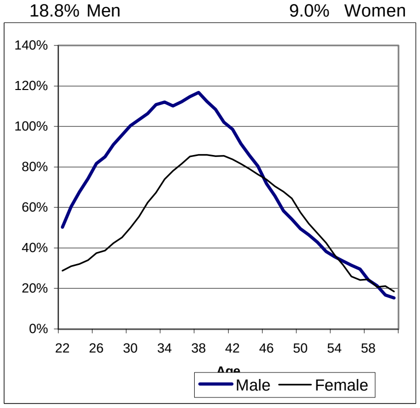
3.8% Men 24.1% Women



Middle Income

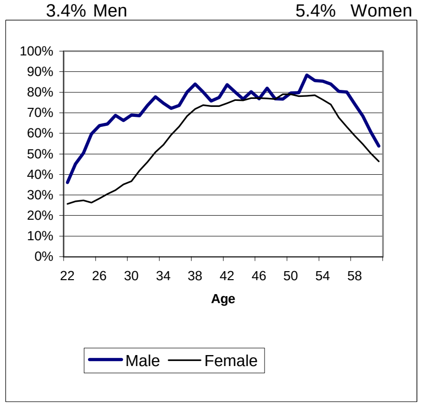
Declining Trend

18.8% Men 9.0% Women



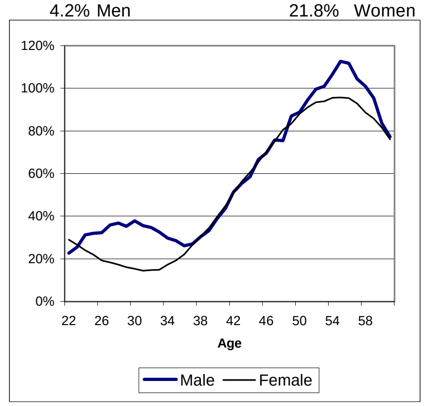
Level Trend

3.4% Men 5.4% Women



Rising Trend

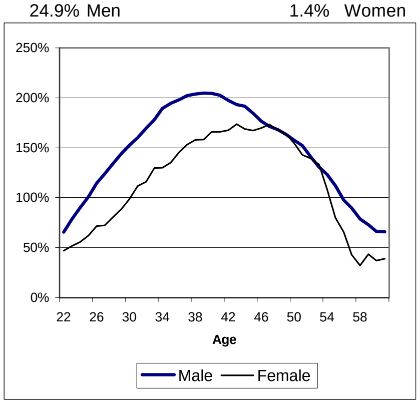
4.2% Men 21.8% Women



High Income

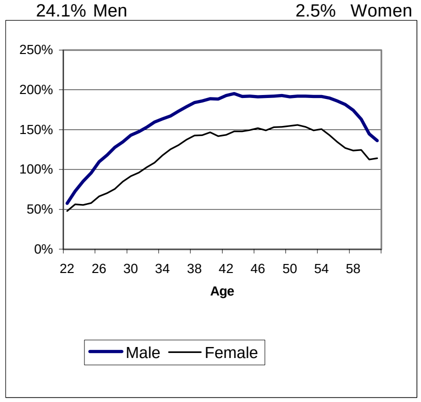
Declining Trend

24.9% Men 1.4% Women



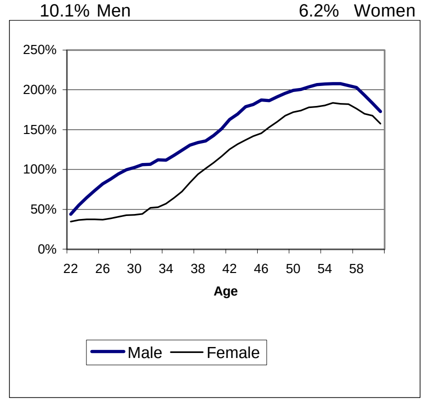
Level Trend

24.1% Men 2.5% Women



Rising Trend

10.1% Men 6.2% Women



Average earnings as a percent of economy-wide average earnings are measured on the left scale.

Source: Authors' tabulations of 1990-93 matched SIPP-SSER files.

Figure 5. Earnings Profiles With and Without Zero Earnings Years, All Persons 1931-40 Cohort

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

Source: Authors' tabulations of 1990-93 matched SIPP-SSER files.