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The Evolution of Lifetime Earnings Patterns in the U.S.: Evidence from Social Security Longitudinal Earnings Records

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Summary[1]

The paper examines changes in lifetime earnings patterns in the United States during the second half of the 20th century. The data source is the Social Security Administration's Continuous Work History Sample (CWHS), a restricted-access data file that contains earnings records for 3.1 million workers. The study focuses on earnings during ages 31-61 for workers born in 1920-66.

The CWHS data show a substantial increase in inequality in the distribution of annual real earnings since the late 1970s for both men and women, consistent with findings based on other data sources. Increased inequality of annual earnings appears to be positively correlated with increased inequality of lifetime earnings for men, but far less so for women.

Median age-earnings profiles are constructed and compared across cohorts. For both men and women, concave lifetime profiles peak during the 45-55 age range. Although real earnings in the economy have increased steadily through time, the evidence suggests that the annual real earnings of successive cohorts of men have not always equaled or exceeded those of older cohorts during the same phase of the life cycle. Women's cohort profiles, although reflecting lower earnings than for men on average, almost invariably show growth in real earnings for successive groups of cohorts. Rates of growth in various segments of the age-earnings profiles are compared across cohorts and sizeable differences are noted, especially among men. Generally, earnings grow fastest for workers aged 31-40 (but not for the 1920-24 cohorts), with the rate of growth slowing during ages 41-50, and especially during ages 51-61.

Although the median age-earnings profiles for both sexes are consistent with the stylized textbook depiction, there is considerable variation in practice. A simple classification scheme used for 170,000 earnings histories for people born in 1920-39 shows that 31-46 percent of men have nonstandard earnings histories (negative slopes and/or convex), with similar results for women. For men, nonstandard age-earnings profiles appear to have become more common over time.

During 1979-2000, the variability in the annual real earnings of white men increased by 50 percent. That change is driven primarily by an increase in the variance of the permanent component of earnings.

[1] The authors thank Ben Bridges, Mike Compson, Joyce Manchester, David Pattison, and Bernie Wixon for advice and helpful comments on an earlier draft. The views expressed are the authors' and do not necessarily represent the position of the U.S. Social Security Administration.

Introduction

The analysis of earnings data is motivated by both theoretical and practical concerns. The research reported in this paper has been stimulated by two interests. First, increased annual earnings inequality in the U.S. since the 1970s has been well documented, but the extent to which that trend may translate into changes in the distribution of lifetime earnings is unclear. If lifetime measures of earnings are better indicators of well-being, it is important to know whether the increases in short-run inequality persist for individuals. More specifically, Social Security retirement benefits, the primary source of income for Americans over the age of 65, are based on lifetime earnings. Changes in the distribution of lifetime earnings have important implications for the economic well-being of the aged and for the performance of the nation's most important retirement program. Second, for at least a decade, opinion surveys and the media have often reported widespread anxiety among American families about their economic status, despite the fact that for the most part, the economy has performed well as indicated by most macroeconomic statistics. There is speculation that these worries may be tied to low levels of personal savings, accumulating amounts of consumer debt, long work hours, or perceptions of increased exposure to various types of economic risk. Related to these concerns are reports of stagnant wage growth for many workers and increased variability of earnings.

This paper provides a preliminary report on how lifetime earnings patterns changed in the United States during the past half century. It uses relatively simple procedures and statistics in a preliminary effort to address several questions:

- What is the trend in earnings inequality during the latter half of the 20th century? Increased inequality in the distribution of earnings of American workers since the 1970s has been well documented in numerous articles using several data sources (for instance, Levy and Murnane [1992], Haider [2001], Gittleman and Joyce [1996], Juhn, Murphy, and Pierce [1993], and Utendorf [1998, 1999, 2001-2]). Although the growth in earnings inequality during the last quarter of the 20th century is a well-established fact for men, our analysis includes results for women that span a longer time period (1951-2001).

- To what extent does the trend in annual earnings inequality translate into any trend in lifetime earnings inequality? This is a relatively unexplored topic, largely due to the limitations of the most widely used data sets for research on the earnings distribution. Notable recent work has been conducted by Aaronson [2002] and Haider and Solon [2006].

- Are the general shapes of lifetime earnings profiles changing in any noticeable way, perhaps becoming less concave through time due to changes in the rate of real wage growth? To our knowledge, the only recent work on this topic for American workers is Bosworth, Burtless, and Steuerle [1999].

- If the completed earnings profiles of individuals are divided into decades, has there been any noticeable change in the rate of growth in real earnings during any phase of life?

- Have lifetime earnings paths become less stable through time? Change in the variability of earnings has been the subject of three interesting papers by Moffitt and Gottschalk [1993, 1994, and 1998], who have found that increased variability of annual earnings has been more attributable to a rise in the variance of the transitory component of annual earnings rather than due to any change in the variability of permanent earnings.

Studies of lifetime earnings are very much limited by the availability of adequate data on individual earnings, most of which is cross sectional. The most widely-used longitudinal data sets that track American workers (for example, the University of Michigan's Panel Study of Income Dynamics, or the Ohio State University's National Longitudinal Surveys) have limitations such as relatively short observation periods that omit substantial portions of lifetime earnings, small numbers of birth cohorts, and limited sample sizes due to a combination of panel attrition and the sample selection criteria imposed by researchers. Perhaps the most promising data sources for tracking lifetime earnings patterns are the administrative files maintained by government agencies. The data source used for the empirical research in this paper is a very large longitudinal file of annual earnings reports maintained by the U.S. Social Security Administration, the agency responsible for administering the nation's main public pension and disability programs. Because both benefit eligibility and dollar amounts are determined by an applicant's lifetime earnings history, the Agency's earnings records necessarily represent a comprehensive record of annual earnings in the economy over a long period of time.

Data Overview

The paper's primary data source is the U.S. Social Security Administration's Continuous Work History Sample (CWHS). The CWHS is a collection of restricted-access files based on the Agency's earnings and benefit records that are updated annually [Smith 1989]. More specifically, the project uses information from the CWHS Active file, which contains longitudinal earnings records for approximately 3.1 million people, representing about 1 percent of all Social Security numbers that have been issued since the program's inception seven decades ago. The primary strengths of the CWHS data are the unusually large sample size and the high degree of accuracy relative to survey data sets in reported earnings amounts.

Our interests are both in tracking individual lifetime earnings patterns and making comparisons across birth cohorts. Even the very large CWHS file imposes certain limitations. Because the file's annual earnings amounts date only from 1951 (for years prior to 1951, the CWHS reports only total nominal earnings for the 1937-50 interval), we focus on cohorts born in 1920-66 (*i.e.,* 47 single-year cohorts) and restrict attention to ages 31-61 (*i.e.,* 31 years).[2] The cohort and age restrictions mean that the entire 31-61 age window is observed only for people born during 1920-40; later cohorts have incomplete earnings histories. The final year of reported earnings in our version of the CWHS file is 2001, at which time the youngest cohort was aged 35 and can contribute very little to the paper's findings.

Our focus on earnings during ages 31-61 means that the analysis concentrates on the core years of most people's work lives. Earnings histories up to age 30 reflect many different behaviors including delayed entry into the labor force due to schooling, time-outs for further

[2] The CWHS Active file contains the earnings histories of 1.7 million workers born in 1920-66.

education and training, frequent job switches, and the like, making those earlier years in earnings histories all the more difficult to interpret when only administrative data are available. Since 1961, the earliest age to begin receiving Social Security retired-worker benefits has been 62, and that age has been the most popular age of first receipt since the 1970s. Because retirement decisions become an important determinant of earnings at that age, and retirement trends across cohorts could influence some of the results, we restrict the window of observation to ages 31-61. Clearly, expanding the observation period beyond that age range would reduce the number of cohorts for whom there are fully-observed earnings histories.

The advantages of the CWHS data do, however, come with some substantial limitations which we attempt to address where possible. First, as is often the case with administrative record data, there is little of the economic and demographic information typically used in economic studies of earnings. Other than date of birth, sex, and race, file content is more or less limited to annual covered earnings amounts and information pertaining to benefits received from the Social Security program.

A second limitation in the CWHS file is that only earnings covered under the Social Security program are recorded.[3,4] There is no way to discern whether the absence of recorded earnings during a year represents no labor market earnings, or whether employment was in a job not covered by Social Security, or for that matter, whether low earnings amounts reflect only part of a worker's total employment during the year, the other part being in noncovered employment. To complicate the interpretation of trends in at least some aspects of lifetime earnings, Social Security coverage rates among civilian workers varied substantially during the 1951-2001 observation period, rising from 61 percent in 1951 to a near-universal 96 percent in 2001. Therefore, earnings records reflect only those portions of careers that were covered under the program. In much of the analysis that follows, we require that workers exhibit strong lifetime work attachment as indicated by CWHS earnings, a restriction that we impose through a combination of rules about Social Security insurance status and minimum thresholds for earnings during individual years. More specifically, most of the longitudinal analyses and calculations of lifetime earnings require that sample members either be fully insured for Social Security retired-worker benefits, or if younger than age 61 in 2001, exhibit an earnings history that is on track to attain full insurance status by age 62.[5] That rule inescapably excludes workers who were in noncovered employment, a nontrivial exclusion as recently as 1970, when 10 percent of civilian jobs were not covered by Social Security. The direction and extent of bias that this may introduce in our results is unclear.

[3] A worker's employment is said to be covered under Social Security if earnings are creditable for the retirement and disability programs and payroll taxes are paid accordingly.

[4] In fact, the CHWS has contained information on earnings from non-covered employment since 1978, a year when the coverage rate for American workers had attained 90 percent. Those data were not used in the work presented in this paper.

[5] Social Security insured-status rules have evolved over the decades. Since 1990 it has been necessary to accumulate 40 Social Security credits to qualify for retired-worker benefits. A credit is awarded for earning a specified amount that is adjusted annually for average wage growth in the economy. The 2006 figure is $970 per credit, with a maximum of 4 credits that can be earned each calendar year. The main point is that under the current and earlier versions of the program's insurance rules, the accumulation of Social Security credits does not require very large amounts of earnings. Nonetheless, eligibility for retired-worker benefits eliminates from the study's sample large numbers of individuals with very low lifetime covered earnings. See Table 1 for a list of important sample selection rules and consequent reductions in the number of sample members.

A third shortcoming of the earnings data is that the CWHS records annual amounts only up to the maximum earnings that are subject to Social Security payroll taxes each year.[6] At least for our purposes, this is a prominent feature of the recorded annual earnings amounts in the CWHS data. Up until 1972, the annual taxable maximum earnings amount was increased on an *ad hoc* basis every few years; after 1972, the taxable maximum has increased each year in proportion to the growth in average earnings in the economy (with a few minor exceptions).[7] Over the period 1951-2001, the proportion of workers in the economy whose earnings attain the taxable maximum each year has declined from 25 percent to 5 percent, and has been as high as 36 percent (1965). Because women's earnings have generally been lower than men's, the censoring problem is far more prevalent in the men's data. For example, in 1951, 35 percent of male earners reached the taxable maximum but only 3 percent of women. Through the mid-1970s, typically 40 percent or more of men's annual earnings attained the taxable maximum in a given year. Where necessary, we address this problem by imputing earnings above the taxable maximum in cases where the censoring threshold is attained.[8]

Two important sample restrictions are used throughout the paper. First, the study's scope is limited to wage and salary workers. No calculation in this paper includes self-employment income. In longitudinal calculations, individuals who report any self-employment earnings during ages 31-61 are eliminated from the sample. Second, any worker who was ever a Social Security disability beneficiary is excluded. We impose other significant sample restrictions, mostly pertaining to longitudinal calculations, which are explained as they are used below.

Finally, the paper's earnings data are expressed in real terms. Except where explicitly noted in the computation of lifetime indexed earnings measures, annual earnings amounts are converted to real earnings based on year 2000 values using the GDP Implicit Price Deflator for Personal Consumption Expenditures.[9]

Preliminaries: the distribution of annual earnings over time

We begin by examining the trend in the annual distribution of earnings in wage and salary employment for men and women over the period 1951-2001. The main purpose is to verify that the trend in annual earnings inequality that has been extensively documented in other data sets is also evident in the CWHS data. We construct two measures of inequality in the annual distribution of earnings and track their performance over time. The data are processed as a series of independent cross-section samples of calendar year earnings with no restrictions on birth cohort. Zero- and low-earners are excluded from each year's distribution if reported

[6] More precisely, earnings up to the taxable maximum are available for each job during the year and the CWHS records total earnings for all jobs. Therefore, multiple job holders can have reported earnings that exceed the taxable maximum for the year.

[7] Those exceptions are nicely detailed in Myers [1993], pages 214-16. The 1973-74 adjustments were legislated in 1972. Adjustments in 1979-81 were a result of 1977 legislation.

[8] In this preliminary version of the paper, imputations are based on an assumption that real annual earnings amounts each year are independent and identically distributed log normal. See Greene [1997], pages 950-3, for an outline of the approach used in this paper. The main shortcoming of the procedure is that it ignores the information content of each individual's earnings history beyond the recorded value for the imputation year, information that is potentially valuable in making the imputation in any given year.

[9] Because we examine earnings histories that span many decades, this deflator is preferable to the Consumer Price Index, which measures price increases for a fixed consumption pattern.

earnings are less than $100. Trimming the lower tail of the distribution leaves a minimum of 504,000 earnings observations (in 1951) and as many as 1,364,000 (in 2000).

First, Gini coefficients are calculated for each year in the designated observation period.[10] High proportions of earnings censoring in the men's data prior to 1979 requires that large portions of their earnings distribution be imputed each year, often affecting in excess of 40 percent of earners. The Gini coefficients were found to be very sensitive to the imputed earnings amounts. Consequently, for men (Figure 1a) the presentation is restricted to the 1979-2001 interval, when the degree of censoring is less problematic. During 1979-2001, the proportion of censored earnings amounts varies from 9 to 16 percent in our sample, and is less than 10 percent during 11 years. To improve confidence that the data display a trend of increasing inequality, Gini coefficients for each year are calculated using the data in three different ways. The top panel in Figure 1a shows how the Gini varies when the complete earnings distribution is used, including all imputed earnings values in the upper tail. The middle panel trims (discards observations) the top 5 percent of earners each year, all of whom have imputed earnings amounts. The bottom panel trims the top 10 percent of earners. Despite the censoring problems, the data suggest increasing real earnings inequality among men during this interval, although the degree of change can not be identified with much precision. All three graphs support the view that earnings inequality notably increased during the early 1980s, declined in 1989-90, and perhaps increased at a less rapid rate during the latter part of the 1990s. The increase in inequality of earnings in the 1980s is consistent with findings reported by the U.S. Census Bureau [2000] based on Current Population Survey data. In terms of the Gini coefficient, our data do not identify a clear trend from 1993 onward.

Women's earnings have been subject to far less censoring in the CWHS data and we are able to present more reliable data (that is, less dependent on imputations) that span a longer time period. Figure 1b shows the trend in the Gini for the entire 1951-2001 period, omitting calculations for 1963-5, the only years when the women's earnings censoring rate reaches 10 percent (10, 12, and 13 percent). The three panels in Figure 1b show results for the fully-imputed real earnings distribution, as well as with 2 and 5 percent trimming of the upper tail. In fact, the proportion of censored annual earnings values after 1973 never exceeds 3 percent and is usually less than 2 percent. During 1979-2001, the results are similar to those for men – one of increasing real earnings inequality. Prior to the mid-1960s, the trend is consistent with improved earnings opportunities for women associated with the large increase in their post-World War II labor force participation.

To verify the conclusions in Figures 1a and 1b, we track the behavior of three earnings ratios based on quantile values from the annual distribution of earnings. For each year, the 10^{th} (low), 50^{th} (*i.e.*, median), 80^{th}, and 90^{th} (high) percentile earnings amounts are determined. Those quantile values are then used to form three annual ratios — 90/10, 80/10, and 50/10 — that are tracked over the 1979-2001 period for men (Figure 2a). The graphs present changes in the ratios with respect to their 1979 values. Again, earnings inequality as measured by all three ratios increases noticeably in the 1980s. The censoring problem in the men's data makes results for the 90/10 ratio unreliable. In the top panel, behavior of the 80/10 ratio is little affected by censoring and confirms increased inequality during the early 1980s, but note that the 2001 value

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[10] The Gini coefficient ranges from 0.0 (perfect equality—everyone with the same earnings amount) to 1.0 (perfect inequality—one person has all the earnings). An excellent introduction to this and other measures of inequality is found in Sen [1973].

is not much different from the 1985 value whether the distribution is fully imputed or trimmed. A similar story is told by the 50/10 ratio.[11]

Results for women for 1951-2001 are generally consistent with the Gini-based calculations. Figure 2b again omits the three high censoring years (1963-5) for the women's earnings data. There is a clear increase in real earnings inequality during the early 1980s. During much of the 1990s, real earnings inequality among women varies but displays no discernable trend; it peaks during 1992-94, and declines moderately until 2000. During the earlier interval from 1951 to the 1970s, there is a notable increase in inequality of women's real earnings as measured by all three ratios.

Lifetime earnings inequality

The trend in greater inequality of annual earnings may not necessarily cause a commensurate increase in the inequality of lifetime earnings if there is substantial year-to-year variability in individual earnings or mobility in the earnings distribution as cohorts age. This section documents the trend in the distribution of lifetime earnings. To the earlier important sample restrictions (no self-employed or disabled workers), two further requirements are added: 1) the individual must have survived until 2001; and 2) the individual must have earned — or be on course to earn — enough Social Security earnings credits to qualify for retirement benefits at age 62. The additional restrictions are intended to omit from the computations those individuals with the weakest lifetime labor force attachment, including those whose health ever precluded work. The net effect of the added restrictions reduces the sample size to 817,000 workers.

Our measure of lifetime earnings for ages 31-61 is akin to, but not the same as, the Social Security program's measure of lifetime earnings.[12] We compute a measure called *Average Indexed Annual Earnings (AIAE)* for the entire sample. The idea is to index the nominal earnings amounts during ages 31-61 to wage levels that prevail in the economy at age 61. The computation is done as follows. For each person in the sample, we determine the economy-wide average wage index (*AWI*) value for the year the person is 61, or, in the case of younger cohorts who haven't reached age 61 by 2001, the value of *AWI* in 2001 ($32,921.92).[13] Denote AWI_{age} as the value of *AWI* at a particular *age* and E_{age} as the value of an individual's nominal earnings at that age. For someone who has attained age 61 by 2001, the *AIAE* is given by:

$$AIAE = \sum_{age=31}^{61} \frac{E_{age}}{31} \left[\frac{AWI_{61}}{AWI_{age}} \right]$$

[11] Although the 80/10 and 50/10 ratios may be largely unaffected by the censoring problem, note that the distribution's decile values are altered when observations are discarded from one panel to the next in Figures 2a and 2b.

[12] Central to the computation of the Social Security retired-worker benefit amount is Average Indexed Monthly Earnings (AIME), the mean monthly value of the person's 35 highest wage-indexed earnings years. More details about the calculation can be found at http://www.ssa.gov/policy/docs/statcomps/supplement/2005/prog_desc.html.

[13] The average wage index (*AWI*) is a statistic updated annually by the Social Security Administration and is fundamental to the administration of the program. The entire series can be found at http://www.ssa.gov/OACT/COLA/AWI.html#Series.

Of the 1920-66 birth cohorts under consideration, only those born in 1940 or earlier have completely observed earnings histories as of 2001. For sample respondents who have not yet reached age 61 by 2001, we calculate:

$$AIAE = \sum_{age=31}^{A} \frac{E_{age}}{A-30}\left[\frac{32{,}921.92}{AWI_{age}}\right]$$

where A is the person's age in 2001. In words, if the entire earnings history for ages 31-61 is observed, then all earnings are indexed to the average wage index's value in the year they attained age 61. The mean is found by dividing by 31. For younger cohorts, their abbreviated earnings histories are indexed to the *AWI* in 2001 and the mean is computed on the basis of fewer years. To reduce the likelihood that very high but erroneous imputed annual earnings amounts appreciably distort an individual's average lifetime earnings, annual earnings amounts are capped at 20 times average annual earnings (AWI).

Once the *AIAE* values are computed for all sample members from all cohorts, we then compute for each birth cohort the Gini coefficient for the distribution of lifetime earnings. Because cohorts born after 1955 have completed earnings histories for less than half of the age 31-61 observation period, results are displayed only for the 1920-55 birth cohorts in Figure 3. The graph shows the percentage change in each cohort's lifetime Gini with respect to the value for the 1920 cohort. The results for men indicate a clear positive trend in the Gini beginning with the 1921 cohort (.314) rising to a peak for the 1955 cohort (.499). The lifetime Gini value for the 1955 men's cohort is 55 percent higher than that of the 1920 cohort. For women, there has been a much smaller percentage increase in inequality of lifetime earnings measured by the Gini, rising from .438 (1920 cohort) to .479 (1955 cohort), a 9 percent change.

There are two caveats in interpreting Figure 3 results. First, it should be emphasized that the lifetime earnings measures and derivative Gini coefficients for the later cohorts are based on incomplete earnings histories, where as many as 15 years can be unobserved. The 1941-46 cohorts have reported earnings up through at least age 55; the youngest of the 1947-55 cohorts are missing earnings for the 47-61 age range. The verdict on lifetime earnings inequality for those later cohorts is very much still to be determined.[14]

Second, and more important, the results for men's lifetime earnings are dependent on substantial amounts of imputation during 1951-78, particularly prior to 1973. Earlier birth cohorts are more likely to have extensive amounts of imputed income. Unlike the cross-section analysis in the previous section where it is unimportant to whom an imputed amount is assigned — the shape of the imputed tail is all that matters — in this analysis imputing the right amounts to the wrong individuals could substantially alter earnings histories. The large number of imputations that are used to calculate many underlying *AIAE* values substantially limits the confidence that can be placed in the accuracy of the cohort Gini coefficients.

That said, there are three reasons why our general finding of increased inequality of lifetime earnings for men is plausible. First, a positive aspect of our simple imputation

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[14] It would be instructive to compare the distributions of the partially completed lifetime earnings for the later cohorts with those of the earlier cohorts at the same age.

procedure is that within individual earnings histories, imputation errors can be offsetting over time; imputation values across years are independent. Thus, for earnings histories that are subject to more years of censoring, erroneously high and low estimates for different years can partially cancel each other when averaged. Second, even for the earliest cohorts analyzed, most men do not reach the taxable maximum in a majority of years during ages 31-61. For example, for the 1920-24, 1925-29, 1930-34, and 1935-39 cohorts, the percentages who attain the taxable maximum earnings a majority of the time during ages 31-61 are 45, 35, 25, and 19 percent, respectively. That is, the censoring problem as reflected in the lifetime earnings lessens as we move to later cohorts. Third, we conducted a set of experiments in which 5 to 15 percent of the upper tails of the cohort *AIAE* distributions for men were trimmed. Results are qualitatively similar to those in Figure 3; the alternative graphs also show a gradual increase in lifetime earnings inequality for the 1920-45 cohorts, but flatten or decline slightly for later cohorts depending on the amount of trimming. In general, the increase in lifetime earnings inequality is still apparent, but the percentage change with respect to the earliest cohorts is smaller the more high-lifetime-earners are dropped. These reasons lead us to conclude that the qualitative finding of increased inequality of lifetime earnings is more reliable than the assessment of the actual amount of change.

Comparing cohort lifetime earnings histories

This section compares the lifetime earnings histories of the 1920-66 cohorts from several perspectives. First, we contrast the sex-specific age-earnings profiles experienced by different birth cohorts. We then look at rates of real wage growth in various segments of the cohort profiles to ascertain whether rates differ appreciably across cohorts. Finally, some results are presented that describe how the overall shape (height, trend, and concavity) of lifetime profiles is changing.

Age-earnings profiles

Because it is unlikely that lifetime earnings profiles vary substantively between adjacent birth cohorts, in the interest of economy of presentation we combine the data for 47 cohorts into nine 5-year groups (1920-24, 1925-29, …, 1960-64) and a 2-year group (1965-66). The sample is restricted to wage and salary workers who have earned, or who are on track to earn, Social Security retired-worker benefits.

Figures 4a and 4b depict median lifetime real earnings profiles for the 10 cohort groups, by sex. The determination of the median earnings value at each age is made by omitting zero-earners from the computation for that specific age, but zero-earners in one year can appear in the cohort calculations at other ages. The decision to exclude the zero values has no important bearing on the results that follow.[15] Because the age 31-61 interval is only partially observed for persons born after 1940, the later cohort groups have incomplete profiles.

[15] The decision to exclude zeros naturally has its main effect in generally raising the heights of the profiles for both men and women. For men, the profiles are generally higher by a few thousand dollars. The effect is somewhat larger for women, especially in the earlier earnings years of the older cohorts for whom labor force participation rates were quite low.

Results for women (Figure 4b) are notably predictable: the earnings profiles of successive cohort groups are almost invariably higher than those of earlier cohorts and cohort profiles seldom intersect. The plotted earnings functions are mostly positively sloped until the age 45-55 interval, after which they decline. By and large, successive cohorts earn higher real wages at all ages. With real wage levels in the economy trending upward over time, the real earnings profiles of successive cohorts of workers should generally reflect that growth. In fact, over the 1951-2001 interval, real earnings growth in the U.S. averaged 1.14 percent per year. There is some slight evidence that real earnings may plateau or peak at an earlier age for later birth cohorts. The figures must be interpreted in light of the very large increases in women's labor force participation rates that have occurred throughout the 1951-2001 period. Thus, Figure 4b reflects a number of important changes in the labor supply of women including higher annual participation rates, increased lifetime labor force attachment, greater levels of human capital, and improved earnings opportunities.

The results are somewhat more complicated for men than women, where the calculated profiles do not exhibit the same clear monotonic trends across cohort groups (Figure 4a). Overall, the expected hump-shaped lifetime contour is in evidence, with real earnings peaking in the 45-55 age range. Predictably, the three earliest cohort groups (1920-24, 1925-29, 1930-34) have the lowest median real earnings during the 31-43 age interval. During that early phase of the life cycle, the next lowest real earnings levels are experienced by much more recent birth cohorts (1960-64, 1965-66, 1950-54). The youngest cohorts (1965-66), who are observed for only 5 years, show relatively low earnings at age 31 but have experienced strong earnings growth during their early 30s. The cohorts with the strongest median earnings profiles are the three groups born in 1935-49, all of whom start with the highest real earnings levels and whose profiles fairly consistently remain higher than those of the other groups. The chart provides some evidence for the view that the later birth cohorts have had earnings experiences and prospects that do not measure up to those of the older cohorts during the same phase of the life cycle.

Real earnings growth in various phases of the life cycle

The lifetime real earnings profiles shown in Figures 4a and 4b indicate that all cohorts do not fare equally well in all phases of the life cycle. To explore this point further, we calculate average rates of real earnings growth experienced in different phases of the life cycle. The 31 years of adult earnings are divided into three (unequal) segments: ages 31-40, 41-50, and 51-61. The idea is to calculate the mean annual rate of growth in real earnings for each person during each of the three age intervals.

As simple and straightforward as this exercise sounds, the implementation encountered numerous practical problems. To cite a few examples:

- Censored earnings values or inaccurate imputations for the censored amounts potentially introduce many inaccuracies among men during the first half of the observation period.
- Zero-earnings years cause computational problems in determining year-to-year rates of increase. For that matter, even anomalous low earnings amounts for someone with an

otherwise strong earnings history can cause the average growth rate for the decade to be quite high.[16]

- Many workers who otherwise meet the longitudinal sample restrictions have large numbers of zero-earnings years. Those workers with relatively weak lifetime labor force attachments often have erratic earnings histories that introduce very large year-to-year swings in earnings growth.

In light of these types of concerns, individual growth rates were computed according to criteria that were developed via trial and error, checking the robustness of results under alternative data processing rules. All censored earnings amounts were treated as missing values. The effect of that large number of deletions is unclear. Some workers have phases in their earnings histories where labor force earnings are frequently zero. For any person who has more than three zero-earnings years in an age range, mean real wage growth is assumed to be missing for the entire interval. Finally, for a year's earnings to be included in a growth rate calculation it has to be greater than some threshold value. We experimented with various thresholds including: 1) Social Security's required level of earnings to earn one Social Security credit;[17] 2) annual earnings at least equal to 1,750 multiplied times the hourly minimum wage;[18] and 3) annual earnings that equal or exceed 25 percent of the average earnings level in the economy, as measured by the Average Wage Index (*AWI*) cited earlier. Table 2 displays results that are based on the last two of these criteria: earnings at least equal to 25 percent of the *AWI* (upper panel) and earnings at least equal to the earnings of a full-time minimum wage worker (lower panel). Note that the minimum wage criterion is always the higher threshold, on average 60 percent higher during 1951-2001, ranging from a low of 6 percent higher in 2001 to a high of 101 percent in 1968.[19]

Using these data processing rules, mean average growth rates for real earnings in each of the three segments of the earnings profile are calculated for each sample member. For each cohort group, the median growth rate is determined in each segment. Those rates are displayed in Table 2. Although the numbers differ modestly under the two alternative earnings criteria for sample inclusion (annual growth rates are a little lower when the threshold is higher), the main results are qualitatively similar using either criterion. For men, with the exception of the 1920-24 cohorts, the growth in real earnings is highest in the age 31-40 segment, declining markedly in the 41-50 segment, and falling further during ages 51-61 (excepting the 1940-44 cohorts, who exhibit a slight increase). There is a notable decline in real earnings growth during the 41-50 age interval for cohorts born in 1940 and later. Thus, although the previous section showed that the 1940s birth cohorts have the highest levels of lifetime real earnings throughout much of their profiles, they experience lower rates of real earnings growth during ages that are traditionally considered to be prime earnings years.

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[16] For example, think of a person who begins a decade with a $20,000 salary, and gets a 5 percent real increase each year. The decade mean growth of 5 percent will change to 30 percent if the 6th year's earnings is replaced by $1000.
[17] In the earlier years of the 1951-2001 observation period, the required earnings amounts for a wage credit were very low, but the rules changed in the late 1970s. To apply this rule consistently for all cohorts, we backcast the current requirements using current law procedures.
[18] This criterion might be thought of as the equivalent of requiring full-time work. The U.S. Bureau of Labor Statistics defines full-time employment to be weekly hours greater than or equal to 35. (50 weeks/year *times* 35 hours/week=1,750 hours)
[19] This relationship comes as no surprise if one considers the history of the Federal minimum wage. Although the *AWI* has exhibited a fairly continuous upward trend during 1951-2001 (geometric growth rate equals 5.1 percent) , the minimum wage has been increased only sporadically and reached its current value of $5.15 per hour in 1997.

Other features of the results for two particular cohort groups should be mentioned. First, the 1920-24 cohorts show the lowest real earnings growth in the first segment of the earnings profile but do fare relatively well in the last age intervals. The last cohorts for whom earnings histories are fully observed for the age 31-40 interval, those born in 1960-64, have the second highest growth in annual real earnings. Note, however, that this group was found to have lower real earnings levels than several of the older groups in that initial segment of the lifetime profile.

Although it was previously noted that women's median real earnings profiles were lower than those of men, their rates of annual real earnings growth tend to be higher, and in a few instances, markedly so (for example, during ages 31-40 for the 1920-24 and 1950-54 cohorts). The general pattern of declining real earnings growth as cohorts move through the three phases of the life cycle holds for women as well as men. As is mostly the case for men, women's lowest rates of median earnings growth invariably occur during the 51-61 age interval.

The results trigger two thoughts. First, the evidence clearly indicates that all cohorts do not fare equally well in the labor market over the course of the life cycle when compared with the experience of preceding groups. Real earnings levels do not invariably increase in all phases of the life cycle from one cohort to the next. If cohorts compare their experience with that of prior cohorts, they may rightfully view themselves as disadvantaged in terms of real earnings levels at the same phase of the life cycle, or perhaps in terms of the slower rates of real wage growth. Second, there is some evidence among both men and women that there may often be a weak inverse relationship between level of real earnings and the rate of increase. If such a trade-off exists for many workers, it is unclear how the individual's perception of well-being is influenced. For instance, there is some evidence that individuals prefer positively sloped income profiles to horizontal profiles with the same present value (for example, Frank and Hutchens [1993]).

Has the basic shape of age-earnings profiles evolved over time?

The standard model of lifetime earnings that is depicted in economics books is a smooth, continuous, concave function in age, usually motivated by a human capital story about schooling and work experience and the growth of real earnings with age. This stylized version of an age-earnings profile is reinforced by earnings equations estimated on samples of workers selected to weed out workers with weaker labor attachment; that is, individuals with zero or negligible earnings during a portion of the observation period. That practice can be viewed as a crude control for variation in tastes regarding work, but it also has the effect of reducing earnings variation in the sample. The CWHS earnings data indicate that even restricting the sample to wage and salary workers who have earned or are on course to earn sufficient Social Security earnings credits to qualify for retirement benefits at age 62, there are still many zero-earnings years present in the remaining data.[20]

[20] For example, among women born during 1920-24, 49 percent report at least five years with zero earnings during ages 31-40; 26 percent report at least five years with zero earnings during ages 41-50, and 22 percent at least five years with zero earnings during ages 51-60. That may come as little surprise for women born in that era, but, for example, the comparable percentages for men born during 1935-39 are 10, 15, and 19 percent. Zero- or low-earnings years are common throughout the underlying database, even for the most recent birth cohorts.

In this section of the paper, wage and salary earners are included in the calculations even if they have many low- or zero-earnings years in their earnings histories. As in the prior longitudinal analysis, individuals are included in the calculations only if they have earned enough Social Security credits to qualify for retirement benefits at age 62. That fairly weak criterion eliminates many women from the sample, but leaves a large number of people with earnings histories that are atypical by textbook standards.

Because lifetime earnings profiles for the U.S. population show considerable variability, it is not immediately obvious how to summarize the general pattern of earnings over the adult life in a comprehensible manner. We adapt a method to characterize individual earnings histories that dates to research conducted by Grundmann and Bye (1976). That method summarizes an individual's lifetime earnings along three dimensions:

- mean earnings level (the average annual real earnings over the lifetime)
- trend ratio (whether earnings generally trend upward or downward over time)
- profile ratio (general concavity or convexity of the lifetime earnings profile)

Again, the familiar textbook sketch of a lifetime earnings profile exhibits a concave pattern with an upward trend.

The earnings profiles between ages 29 and 61 are examined for the first four of the cohort groups (1920-24, 1925-29, 1930-34, and 1935-39), the groups with completely observed earnings histories.[21] To measure the mean earnings level over the lifetime, we use the Average Indexed Annual Earnings (*AIAE*) concept used earlier in examining lifetime earnings inequality. For each cohort group, the distribution of *AIAE* means is then divided into tertiles, each containing one-third of the *AIAE* values.

To compute the trend, we divide the period a person is aged 29-61 into three 11-year intervals: ages 29-39, 40-50, and 51-61. We sum the indexed earnings during each of the three intervals and call the answers *A, B,* and *C*. The *TREND* ratio is calculated as:

$$TREND = \frac{(C - A)/2}{(C + A)/2}$$

If $A = C = 0$, then $TREND = 0$. The trend can range in value from -1.0 (all earnings in the first and third periods are in the first period) to +1.0 (all earnings in the third period). Following Grundmann and Bye, we categorize *TREND* as:

[21] Note that results in this section reflect two slight procedural differences from other sections of the paper. First, information is included for ages 29-30 for all cohorts. That inclusion requires imputations for the 1920 and 1921 birth cohorts. Second, wage-indexing for the *AIAE* variable is done using average wage levels (*AWI*) observed when a cohort attained age 60.

$$\text{Decreasing } if \qquad -1.0 \le TREND < -\frac{1}{9}$$

$$\text{Level } if \qquad -\frac{1}{9} < TREND < \frac{1}{9}$$

$$\text{Increasing } if \qquad \frac{1}{9} < TREND \le 1.0$$

Finally, we compute the *PROFILE* ratio as:

$$PROFILE = \frac{B-(A+C)/2}{B+(A+C)/2}$$

PROFILE also ranges from -1.0 (all earnings are in the first and/or third periods) to 1.0 (all earnings in the middle period). We categorize *PROFILE* as:

$$\text{Convex } if \qquad -1.0 \le PROFILE < -\frac{1}{9}$$

$$\text{Linear } if \qquad -\frac{1}{9} < PROFILE < \frac{1}{9}$$

$$\text{Concave } if \qquad \frac{1}{9} < PROFILE \le 1.0$$

Convex earnings profiles will appear to sag in the middle while concave ones are humped-shaped. If *PROFILE* = 0, then the mean of *A* and *C* is equal to *B*, and the trend in earnings across the three periods is linear; that is, a graph of the A, B, and C values plotted against age will be a straight line.

Tables 3a and 3b present the results of categorizing lifetime earnings histories for men and women. The three vertical panels represent the earnings tertiles, within each of which are the trend and profile information. Note that tertile cutoff values are computed for the combined men's and women's earnings data. Hence, men are disproportionately represented in the highest tertile (58 to 66 percent across the four groups) and women in the lowest two tertiles (90 to 92 percent, with nearly half of all women in the lowest tertile). For each cohort group, columns in the tables provide percentages that show how earnings histories of individuals are distributed across different *TREND-PROFILE* pairs. Columns should sum to 100 percent but may not due to rounding.

The textbook concave earnings profile would be captured in the Table 3 taxonomy by an increasing trend and a concave, or perhaps even linear, profile. Across the four cohort groups of men (Table 3a), the relevant percentages are 51, 50, 41, and 32 percent. That is, among a large sample of actual earnings histories for men, real earnings profiles are not well characterized as increasing concave functions. Including men with level earnings trends, the percentages for the four groups increase to 69, 68, 61, and 54 percent. Thus, even under the broadest of criteria, 31-46 percent of men from these four cohort groups have somewhat nonstandard earnings histories and the trend has been away from the textbook characterization. One might note that the large amount of empirical work on the estimation of age-earnings profiles ordinarily excludes the nonstandard cases from the estimation, perhaps subtly reinforcing the view that the textbook case is highly representative.

Among women (Table 3b), the results are about the same except for the fact the trend through time is for the age-earnings profiles to become more like the textbook model. Again, if an increasing concave profile can be characterized by an increasing trend and either concave or linear profiles, the corresponding percentages for women in the four cohort groups are 47, 47, 56, and 56 percent. Including the women who have level earnings trends in the tallies, the percentages increase to 56, 56, 64, and 66 percent. In terms of the general shape of the lifetime real earnings profiles, the main conclusion is similar to that for men.

There are several other features worth noting. One is that there has been a modest decline in the proportion of men in the highest lifetime earnings tertile (66 to 58 percent) and an increase in the proportion in the lowest tertile (9 to 16 percent), reflecting the labor market gains of women. Second, at least among these cohorts, the proportional representation of women in the three lifetime earnings tertiles is remarkably stable across the four cohort groups, but there are simply many more women in the labor market as we move to later cohorts. Third, among men there is a notable increase in the percentage of men whose lifetime real earnings are characterized as decreasing (17 percent for the 1920-24 cohorts, but 36 percent for the 1935-39 cohorts). That change is much less pronounced for women (19 to 26 percent).

Trends in the variability of earnings

By the 1990s, increased inequality in the distribution of annual earnings of American workers was a well-established fact (Levy and Murnane [1992]). One concern is whether the widening of the annual distribution is related to an increased instability of earnings. Much of the speculation about the forces driving the increase in wage dispersion involves factors that can be characterized as determinants of permanent earnings: the age-experience composition of the labor force, education levels, returns to skill, the supply of immigrant labor, changes in institutions that affect wage-setting in the economy (for example, declining union influence and a stagnant minimum wage), and the like. It may be the case, however, that increased variability in earnings is associated with more transitory phenomena such as demand shocks associated with business cycle fluctuations or a rising share of work associated with less stable employment (for example, the rise of the contingent labor force).

We present results from preliminary exploration of this issue using the standard decomposition of earnings (y_{it}) of person *i* at time *t* into permanent (μ) and transitory (v_{it}) components:

$$y_{it} = \mu_i + v_{it}$$

where the variance of total earnings (σ_y^2) conveniently partitions into permanent (σ_μ^2) and transitory (σ_v^2) variances.

The numerous statistical issues that arise from implementing this framework in panel data are best addressed econometrically in models that encompass both time-varying parameters and error structures that allow for autoregressive moving average processes (MaCurdy [1982], Moffitt and Gottschalk [1993, 1998], Haider [2001], Mazumdar[2001], and Baker and Solon [2003]). Our first attempts to examine earnings variation are more primitive. We select a sample of white men – presumably a group with high labor force attachment – and examine trends in the variability in permanent and transitory earnings during the period 1979-2001.[22] In an effort to reduce earnings variability that is caused by entry and exit from the labor market, we impose the restriction that annual real earnings exceed $100 in a minimum of 15 years during 1979-2001, a restriction that leaves a sample of 130,000 men.

To address the censoring problem in the data, the analysis of earnings variance is actually conducted on the residuals from a random effects Tobit model of the natural logarithm of annual real earnings regressed on a quartic function of age. The residuals represent individual earnings purged of the effects of age. The permanent component of earnings is estimated by computing 5-period moving averages of the residuals.[23] The transitory earnings component is calculated as the difference between the permanent component and the Tobit residual.

The results of this exercise are displayed in Figure 5. The data suggest an increase in the overall variance of earnings of about 50 percent from 1979 to the end of the century.[24] About half of that increase appears to have occurred during 1979-83, a result that may be influenced by a one-third reduction in the proportion of censored observations in the sample during those years. The Tobit procedure may not adequately control for that problem. We are aware of no other study that reports changes in the variance of annual real earnings for the same time period, but the increase that we find is smaller than other researchers have found for earlier periods of similar duration. For example, Moffitt and Gottschalk [1998] report roughly 100-percent increases for men during 1969-87. For about the same time period (1967-91), Haider [2001] finds a 75 percent increase.

The annual variance in permanent earnings is found by calculating the sample variance each calendar year. In contrast, transitory earnings variances are computed for each person during two 11-year time intervals, 1979-89 and 1990-2000. The mean of the transitory real earnings variance is calculated across the sample for the two periods. As displayed in Figure 5, the variance in transitory earnings is virtually unchanged across the two periods (the calculated mean falls from .065 to .064). The increase in the total variance of real earnings is solely attributable to the increase in the variance of the permanent component, which accounts for about 85 percent of the total variance at the end of the observation period. Conclusions are similar using 3-period and 6-period moving averages. We are somewhat skeptical of this result for two reasons. First, it is a somewhat different finding than found in Moffitt and Gottschalk [1998], who report that, at least for 1979-83, the increased variance of earnings was approximately equally caused by increased variance in the permanent and transitory components. Second, the moving average procedure for computing permanent earnings is likely to divert some transitory earnings variation into the permanent component. This is an issue that we will continue to explore.

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[22] High levels of censoring in the earnings data for this group prior to 1979 make variance calculations highly dependent on the choice of statistical procedure to address the problem.

[23] The moving average is a simple way to allow permanent earnings and its variance to evolve through time. The disadvantage is that it potentially captures some transitory variability in the permanent component.

[24] The end year for the calculation depends on the length of the moving average process for calculating permanent earnings. The availability of earnings data for years prior to 1979 means that no observations are lost at the start of the observation window; however, observations are lost at the end.

Concluding Thoughts

This paper reviews some preliminary analyses that use lifetime administrative earnings records maintained by the U.S. Social Security Administration. Those efforts have been primarily directed towards understanding the quality and limitations of the data source, and trying to establish the extent to which some important facts about labor market earnings that have been derived from other data sets can be corroborated in these data. To that end, the administrative data corroborate increased inequality of annual real earnings, which, at least for men, are associated with increasing inequality of lifetime earnings. Lifetime earnings histories display considerably more heterogeneity than is suggested by simplified textbook depictions of earnings over the life cycle. A substantial proportion of workers have lifetime earnings patterns that significantly depart from the conventional smooth, concave profile. During the final two decades of the 20^{th} century, there is evidence of increased variability of annual real earnings among white males, on the order of 50 percent. Calculations suggest that the increased variability is mostly attributable to an increase in the variance of permanent earnings rather than due to any change associated with transitory earnings, but that result should be seen as provisional and subject to change as research proceeds.

Our research agenda is necessarily driven by the Agency's policy interests. Retirement and disability benefits paid by Social Security are largely dependent on lifetime earnings histories. Thus, understanding the distribution of policy outcomes under current law — or under proposed alternatives — is improved by knowing how and why the earnings patterns of American workers are changing. Real earnings levels, the shapes of lifetime earnings profiles, and earnings variability have critical bearing on both the Social Security program's long-term financial outlook and its treatment of individuals.

A central challenge of conducting earnings-related research in a policy research environment is the high degree of heterogeneity observed in actual earnings records. Often the simplest of computations is compromised by sparse or erratic earnings histories. As researchers, it is tempting to discard such troublesome cases. But it is also important to recognize that often those troublesome analytical cases — and there are many of them! — often represent people who are critically dependent on the Social Security program.

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Table 1. Sample size and reasons for deletion from sample

	# remaining in sample
Total in 2001 CWHS	3,102,550
Eliminated if:	
not in 1920-66 cohorts	1,693,408
dead in 2001	1,511,968
disabled	1,440,456
not on track to earn 40+ credits	1,191,947
reported self emp during ages 31-61	816,862
unknown sex	816,853

Source: Continuous Work History Sample

Table 2. Real earnings growth over the life cycle, by cohort group

Median growth of real earnings, by sex and age

	Men			Women		
Cohort group	31-40	41-50	51-61	31-40	41-50	51-61
			Drop earnings less than 25% of AWI			
1920-24	2.30	4.72	3.10	5.12	5.05	1.94
1925-29	4.36	3.95	2.12	5.73	4.31	2.16
1930-34	5.49	4.19	1.36	6.54	3.54	2.11
1935-39	4.50	3.37	1.19	5.78	4.04	1.96
1940-44	4.68	2.05	2.08	5.36	3.90	2.43
1945-49	4.32	1.88		5.57	3.49	
1950-54	3.75	2.81		5.14	3.85	
1955-59	4.00			4.80		
1960-64	5.37			5.57		
1965-66						
			Drop earnings less than minimum wage			
1920-24	2.12	4.52	3.04	3.91	4.03	1.73
1925-29	4.08	3.94	2.05	4.31	3.49	1.90
1930-34	5.40	4.06	1.32	4.90	2.98	1.95
1935-39	4.32	3.21	1.17	4.41	3.43	1.89
1940-44	4.49	1.98	2.04	4.16	3.48	2.32
1945-49	4.21	1.82		4.63	3.29	
1950-54	3.53	2.73		4.59	3.67	
1955-59	3.84			4.46		
1960-64	5.22			5.25		
1965-66						

Source: Continuous Work History Sample

Table 3a. Categorizing the shapes of lifetime earnings profiles, men

Comparing lifetime earnings histories, men (in percents)

	1920-24 Cohorts	1925-29 Cohorts	1930-34 Cohorts	1935-39 Cohorts
Highest tertile of AIAE				
Increasing, convex	6	2	1	1
Increasing, linear	39	40	32	21
Increasing, concave	2	2	4	6
Level, convex	0	0	0	0
Level, linear	14	12	9	10
Level, concave	1	3	8	10
Decreasing, convex	0	0	0	0
Decreasing, linear	2	1	1	2
Decreasing, concave	2	4	6	8
Middle tertile of AIAE				
Increasing, convex	2	1	1	1
Increasing, linear	4	3	2	2
Increasing, concave	5	3	2	2
Level, convex	0	0	1	1
Level, linear	2	2	2	3
Level, concave	1	1	1	1
Decreasing, convex	1	2	3	3
Decreasing, linear	2	2	3	5
Decreasing, concave	5	6	7	6
Lowest tertile of AIAE				
Increasing, convex	3	3	3	3
Increasing, linear	0	1	0	0
Increasing, concave	1	1	1	1
Level, convex	0	0	0	0
Level, linear	0	0	0	0
Level, concave	0	0	0	0
Decreasing, convex	2	4	7	9
Decreasing, linear	1	1	1	1
Decreasing, concave	2	2	2	2
Total percent	100	100	100	100
Total number	14,255	18,660	20,604	23,563

Lifetime Earnings Categories:

Average Indexed Annual Earnings (AIAE)	Trend	Profile
Highest tertile	Increasing	Convex
Middle tertile	Level	Linear
Lowest tertile	Decreasing	Concave

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Table 3b. Categorizing the shapes of lifetime earnings profiles, women

Comparing lifetime earnings histories, women (in percents)

	1920-24 Cohorts	1925-29 Cohorts	1930-34 Cohorts	1935-39 Cohorts
Highest tertile of AIAE				
Increasing, convex	0	0	0	0
Increasing, linear	5	5	5	4
Increasing, concave	1	1	2	3
Level, convex	0	0	0	0
Level, linear	2	1	1	1
Level, concave	0	1	1	1
Decreasing, convex	0	0	0	0
Decreasing, linear	0	0	0	0
Decreasing, concave	0	0	1	1
Middle tertile of AIAE				
Increasing, convex	5	5	5	4
Increasing, linear	11	10	10	10
Increasing, concave	14	14	14	14
Level, convex	1	1	1	1
Level, linear	3	3	3	3
Level, concave	2	2	2	2
Decreasing, convex	1	1	1	1
Decreasing, linear	1	2	2	2
Decreasing, concave	4	4	5	5
Lowest tertile of AIAE				
Increasing, convex	17	14	13	11
Increasing, linear	5	5	4	4
Increasing, concave	11	12	11	11
Level, convex	1	1	1	1
Level, linear	1	1	0	1
Level, concave	1	1	1	2
Decreasing, convex	5	7	8	8
Decreasing, linear	2	2	2	2
Decreasing, concave	6	7	8	7
Total percent	100	100	100	100
Total number	19,624	23,521	25,423	27,239

Lifetime Earnings Categories:

Average Indexed Annual Earnings (AIAE)	Trend	Profile
Highest tertile	Increasing	Convex
Middle tertile	Level	Linear
Lowest tertile	Decreasing	Concave

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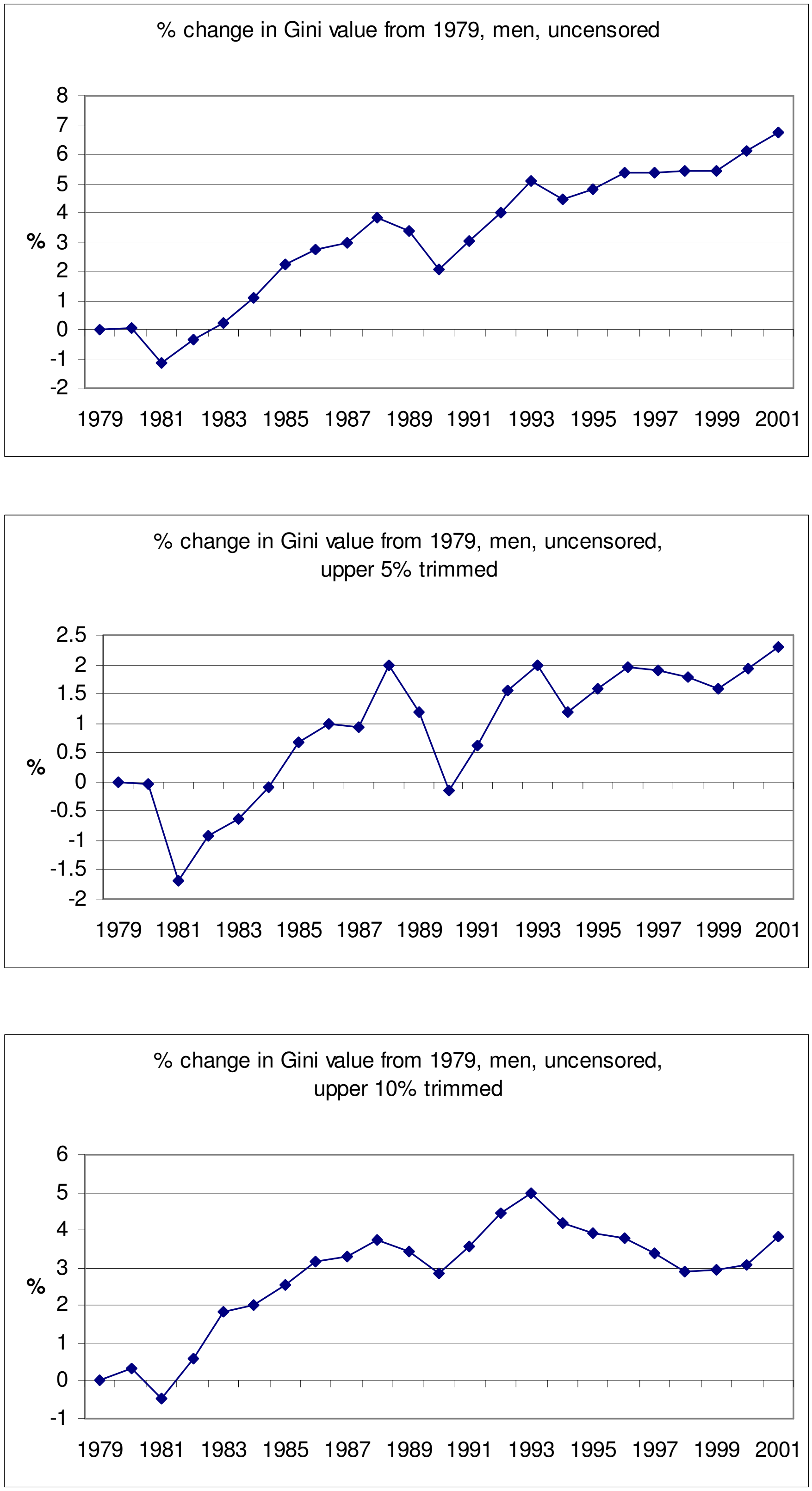
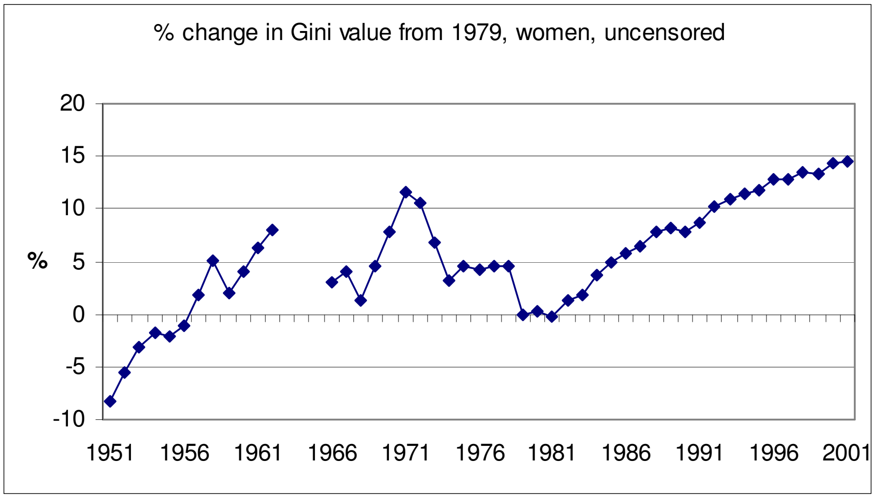
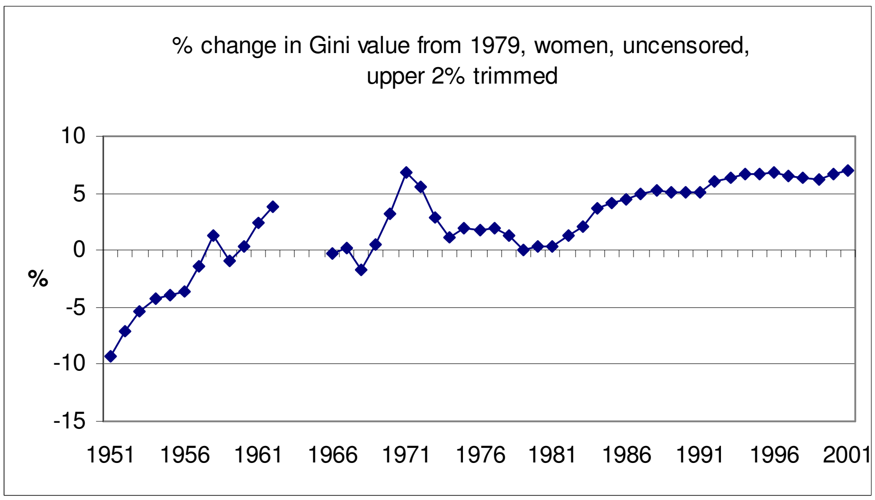
Figure 1a. Real earnings inequality through time, men

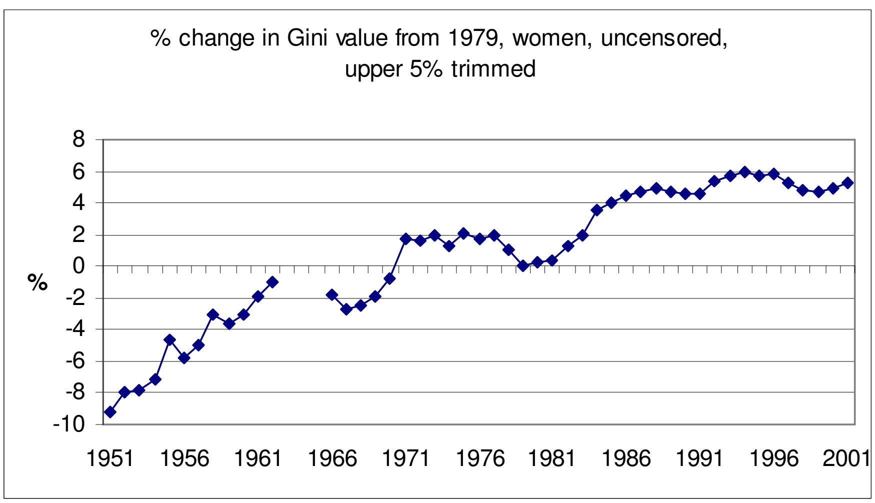


Source: Continuous Work History Sample with authors' imputations above the taxable maximum.

Figure 1b. Real earnings inequality through time, women

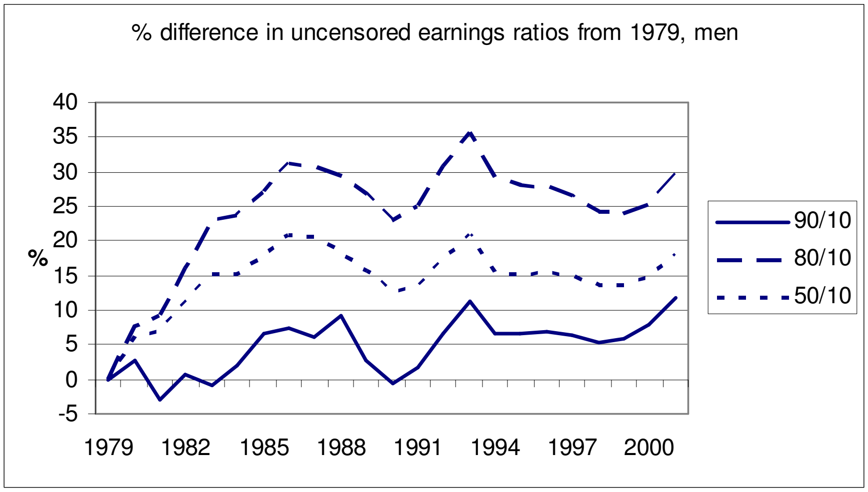


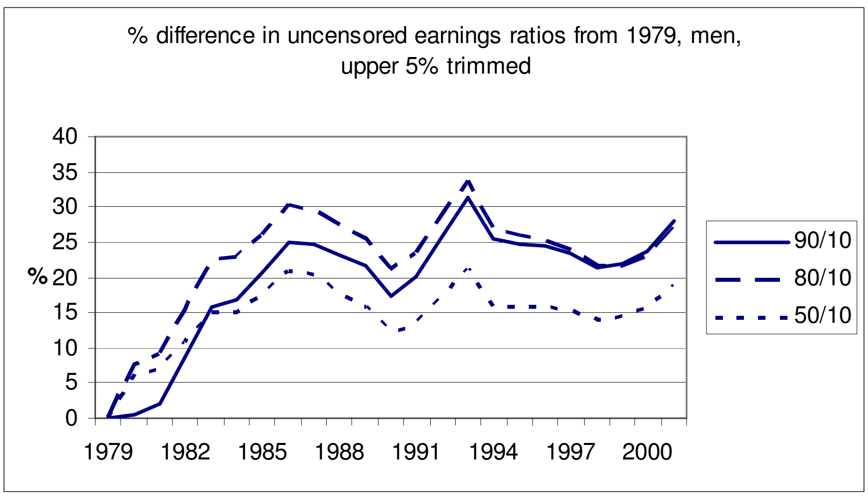


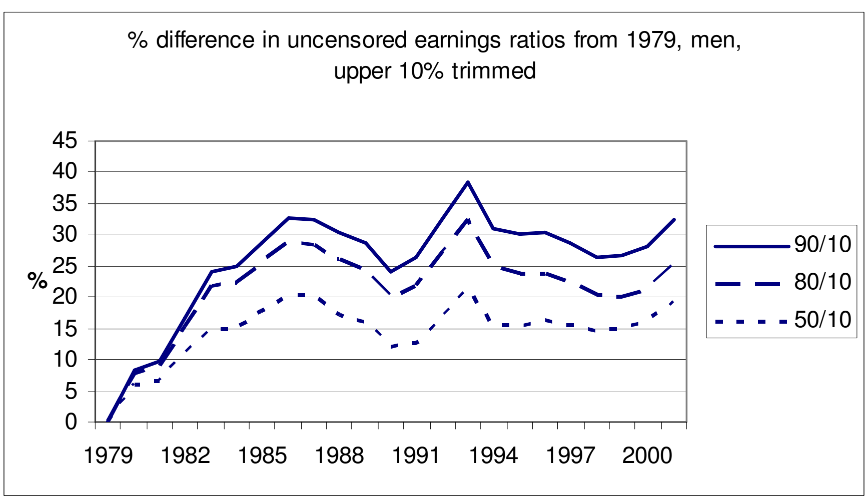


Source: Continuous Work History Sample with authors' imputations above the taxable maximum.

Figure 2a. Real earnings inequality through time, men

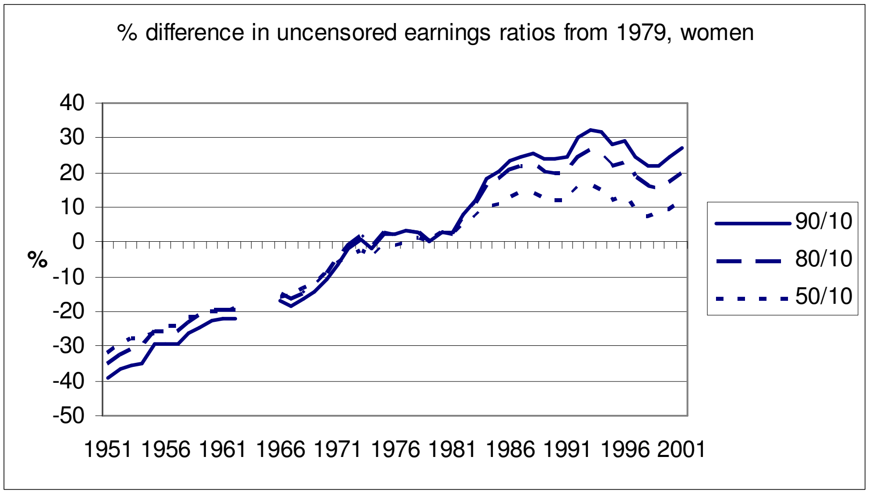


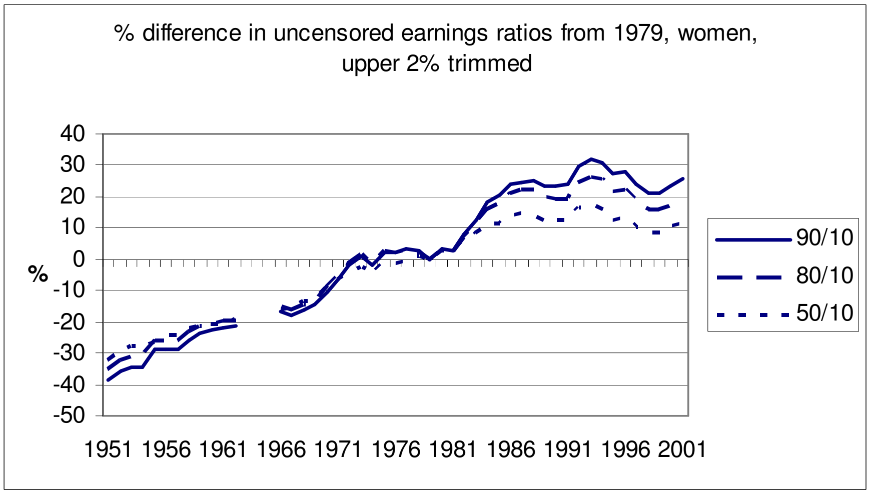


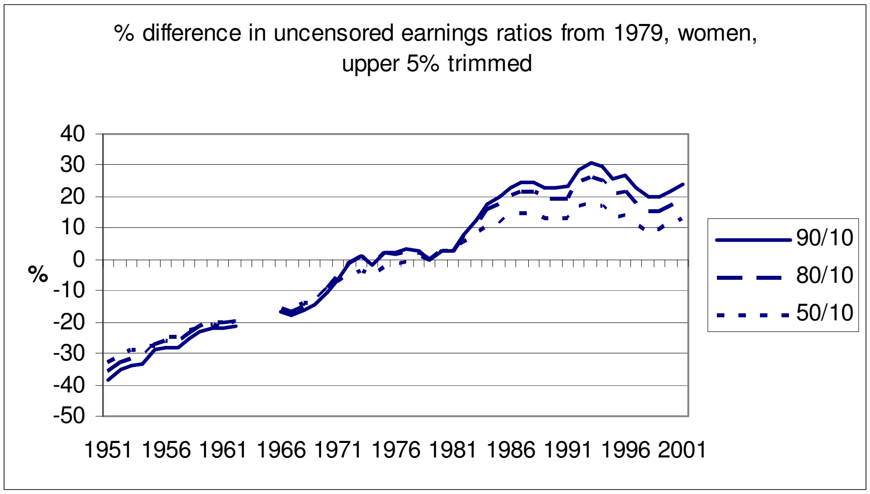


Source: Continuous Work History Sample with authors' imputations above the taxable maximum.

Figure 2b. Real earnings inequality through time, women

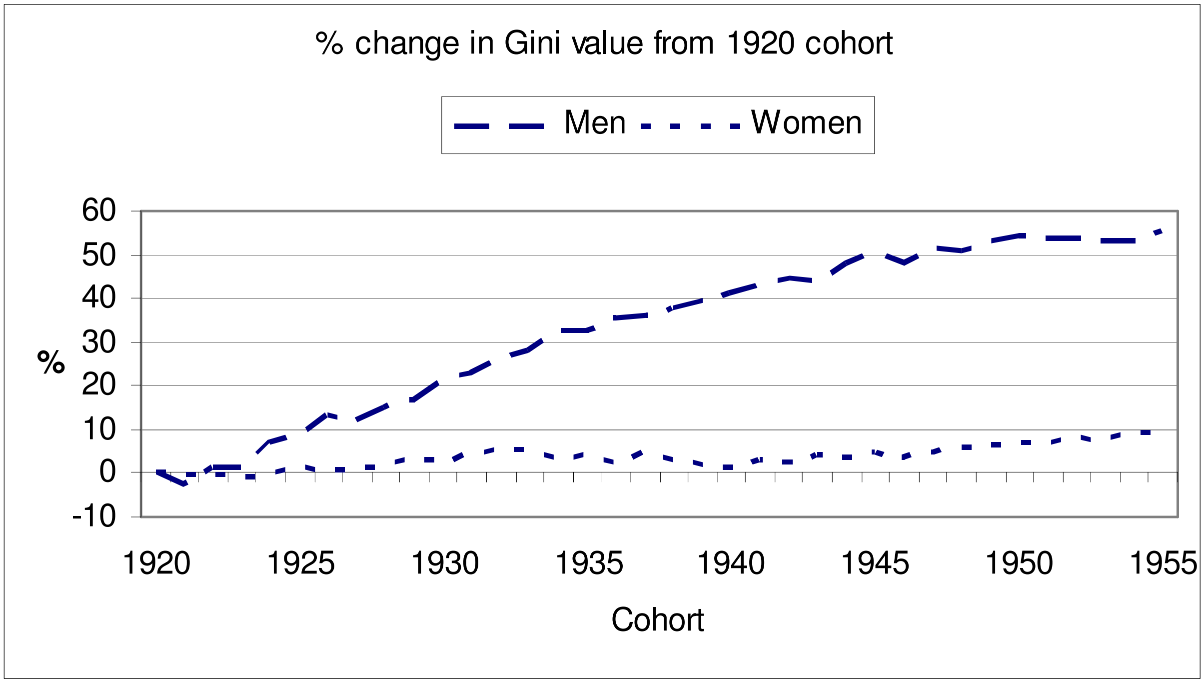






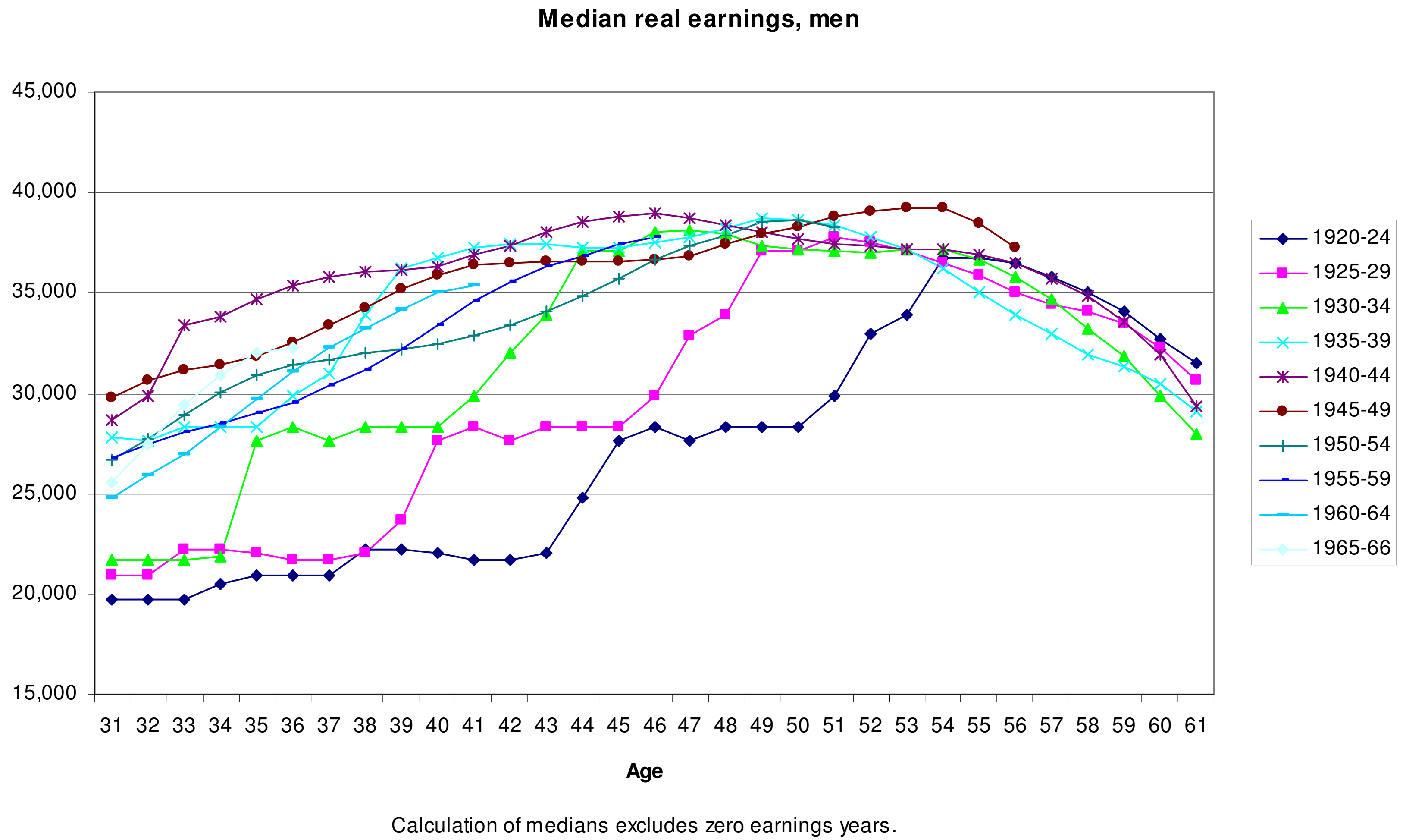
Source: Continuous Work History Sample with authors' imputations above the taxable maximum.

Figure 3. Inequality of lifetime earnings, 1920-55 birth cohorts



Source: Continuous Work History Sample with authors' imputations above the taxable maximum. Gini coefficients measure the distribution of lifetime earnings measured by Average Indexed Annual Earnings (AIAE) during ages 31-61.

Figure 4a. Lifetime earnings profiles, ages 31-61, 1920-66 birth cohorts



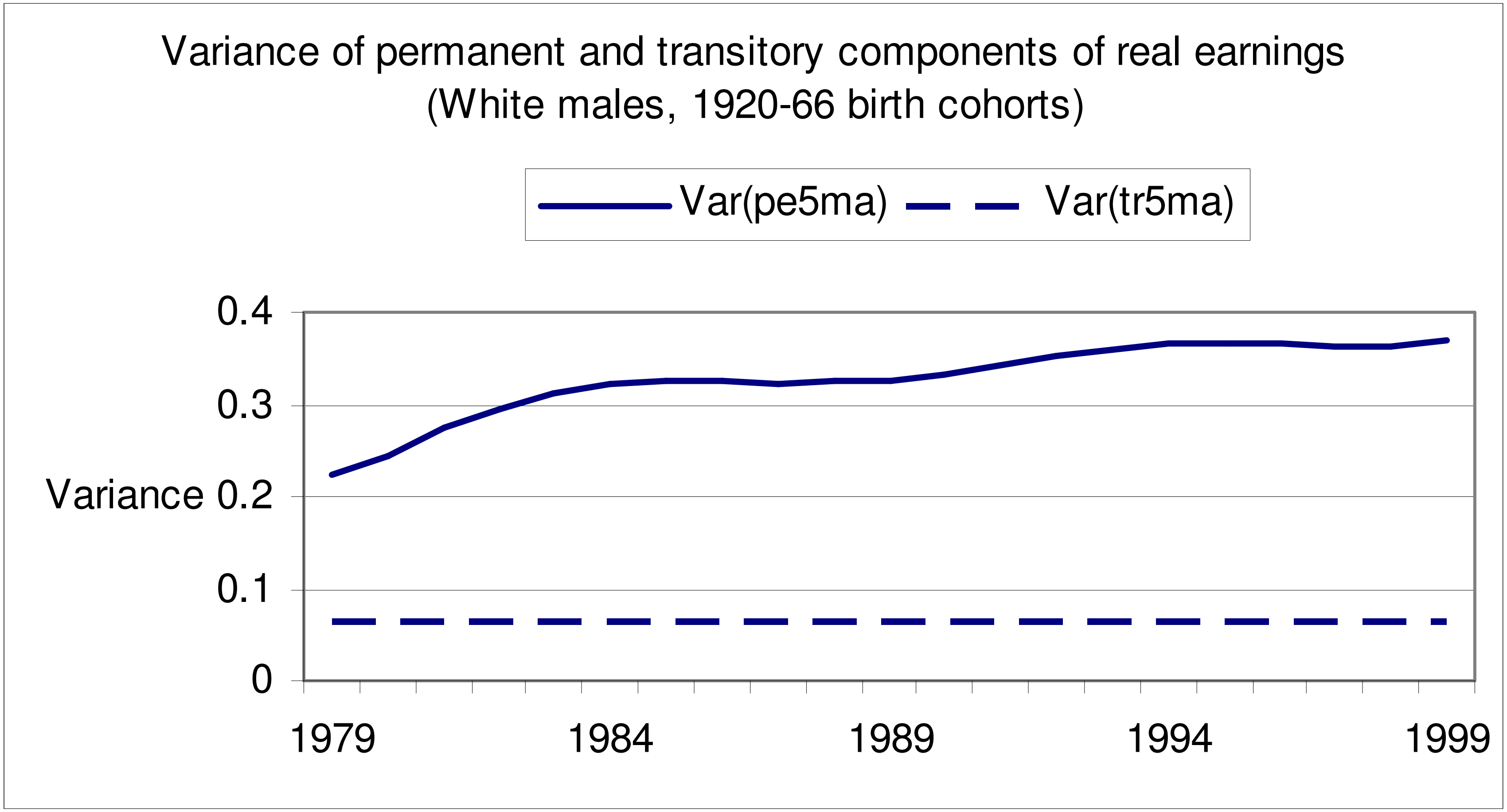
Source: Continuous Work History Sample

Figure 4b. **Lifetime earnings profiles, ages 31-61, 1920-66 birth cohorts**

Calculation of medians excludes zero earnings years.

Source: Continuous Work History Sample

Figure 5. Variance of permanent and transitory components of real earnings, 1920-66 birth cohorts, white men



Source: Continuous Work History Sample
Calculation based on 130,000 men with real earnings that exceed $100 for a minimum of 15 years during 1979-2001.