EARNINGS INEQUALITY AND MOBILITY
IN THE UNITED STATES: EVIDENCE FROM
SOCIAL SECURITY DATA SINCE 1937*

Wojciech Kopczuk
Emmanuel Saez
Jae Song

This paper uses Social Security Administration longitudinal earnings micro data since 1937 to analyze the evolution of inequality and mobility in the United States. Annual earnings inequality is U-shaped, decreasing sharply up to 1953 and increasing steadily afterward. Short-term earnings mobility measures are stable over the full period except for a temporary surge during World War II. Virtually all of the increase in the variance in annual (log) earnings since 1970 is due to increase in the variance of permanent earnings (as opposed to transitory earnings). Mobility at the top of the earnings distribution is stable and has not mitigated the dramatic increase in annual earnings concentration since the 1970s. Long-term mobility among all workers has increased since the 1950s but has slightly declined among men. The decrease in the gender earnings gap and the resulting substantial increase in upward mobility over a lifetime for women are the driving force behind the increase in long-term mobility among all workers.

I. Introduction

Market economies are praised for creating macroeconomic growth but blamed for the economic disparities among individuals they generate. Economic inequality is often measured using high-frequency economic outcomes such as annual income. However, market economies also generate substantial mobility in earnings over a working lifetime. As a result, annual earnings inequality might substantially exaggerate the extent of true economic disparity among individuals. To the extent that individuals can smooth changes in earnings using savings and credit markets, inequality based on longer periods than a year is a better measure

The Quarterly Journal of Economics, February 2010

of economic disparity. Thus, a comprehensive analysis of disparity requires studying both inequality and mobility.

A large body of academic work has indeed analyzed earnings inequality and mobility in the United States. A number of key facts from the pre–World War II years to the present have been established using five main data sources:[1] (1) Decennial Census data show that earnings inequality decreased substantially during the "Great Compression" from 1939 to 1949 (Goldin and Margo 1992) and remained low over the next two decades; (2) the annual Current Population Surveys (CPS) show that earnings inequality has increased substantially since the 1970s and especially during the 1980s (Katz and Murphy 1992; Katz and Autor 1999); (3) income tax statistics show that the top of the annual earnings distribution experienced enormous gains over the last 25 years (Piketty and Saez 2003); (4) panel survey data, primarily the Panel Study of Income Dynamics (PSID), show that short-term rank-based mobility has remained fairly stable since the 1970s (Gottschalk 1997); and (5) the gender gap has narrowed substantially since the 1970s (Goldin 1990, 2006; Blau 1998). There are, however, important questions that remain open due primarily to lack of homogeneous and longitudinal earnings data covering a long period of time.

First, no annual earnings survey data covering most of the U.S. workforce are available before the 1960s, so that it is difficult to measure overall earnings inequality on a consistent basis before the 1960s, and in particular to analyze the exact timing of the Great Compression. Second, studies of mobility have focused primarily on short-term mobility measures due to lack of longitudinal data with large sample size and covering a long time period. Therefore, little is known about earnings mobility across an entire working life, let alone how such long-term mobility has evolved over time. Third and related, there is a controversial debate on whether the increase in inequality since the 1970s has been offset by increases in earnings mobility, and whether consumption inequality has increased to the same extent as income inequality.[2] In particular, the development of performance pay such as bonuses and stock options for highly compensated employees might have increased year-to-year earnings variability substantially among

1. A number of studies have also analyzed inequality and mobility in America in earlier periods (see Lindert [2000] for a survey on inequality and Ferrie [2008] for an analysis of occupational mobility).

2. See, for example, Cutler and Katz (1991), Slesnick (2001), Krueger and Perri (2006), and Attanasio, Battistin, and Ichimura (2007).

top earners, so that the trends documented in Piketty and Saez (2003) could be misleading.

The goal of this paper is to use the Social Security Administration (SSA) earnings micro data available since 1937 to make progress on those questions. The SSA data we use combine four key advantages relative to the data that have been used in previous studies on inequality and mobility in the United States. First, the SSA data we use for our research purposes have a large sample size: a 1% sample of the full US covered workforce is available since 1957, and a 0.1% sample since 1937. Second, the SSA data are annual and cover a very long time period of almost seventy years. Third, the SSA data are longitudinal balanced panels, as samples are selected based on the *same* Social Security number pattern every year. Finally, the earnings data have very little measurement error and are fully uncapped (with no top code) since 1978.[3]

Although Social Security earnings data have been used in a number of previous studies (often matched to survey data such as the Current Population Survey), the data we have assembled for this study overcome three important previous limitations. First, from 1946 to 1977, we use quarterly earnings information to extrapolate earnings up to four times the Social Security annual cap.[4] Second, we can match the data to employer and industry information starting in 1957, allowing us to control for expansions in Social Security coverage that started in the 1950s. Finally, to our knowledge, the Social Security annual earnings data before 1951 have not been used outside the SSA for research purposes since Robert Solow's unpublished Harvard Ph.D. thesis (Solow 1951).

Few sociodemographic variables are available in the SSA data relative to standard survey data. Date of birth, gender, place of birth (including a foreign country birthplace), and race are available since 1937. Employer information (including geographic location, industry, and size) is available since 1957. Because we do not have information on important variables such as family

---

3. A number of studies have compared survey data to matched administrative data to assess measurement error in survey data (see, e.g., Abowd and Stinson [2005]).

4. Previous work using SSA data before the 1980s has almost always used data capped at the Social Security annual maximum (which was around the median of the earnings distribution in the 1960s), making it impossible to study the top half of the distribution. Before 1946, the top code was above the top quintile, allowing us to study earnings up to the top quintile over the full period.

structure, education, and hours of work, our analysis will focus only on earnings rather than on wage rates and will not attempt to explain the links between family structure, education, labor supply, and earnings, as many previous studies have done. In contrast to studies relying on income tax returns, the whole analysis is also based on individual rather than family-level data. Furthermore, we focus only on employment earnings and hence exclude self-employment earnings as well as all other forms of income such as capital income, business income, and transfers. We further restrict our analysis to employment earnings from commerce and industry workers, who represent about 70% of all U.S. employees, as this is the core group always covered by Social Security since 1937. This is an important limitation when analyzing mobility as (a) mobility within the commerce and industry sector may be different than overall mobility and (b) mobility between the commerce and industry sector and all other sectors is eliminated.

We obtain three main findings. First, our annual series confirm the U-shaped evolution of earnings inequality since the 1930s. Inequality decreases sharply up to 1953 and increases steadily and continuously afterward. The U-shaped evolution of inequality over time is also present within each gender group and is more pronounced for men. Percentile ratio series show that (1) the compression in the upper part of the distribution took place from 1942 to 1950 and was followed by a steady and continuous widening ever since the early 1950s, and (2) the compression in the lower part of the distribution took place primarily in the postwar period from 1946 to the late 1960s and unraveled quickly from 1970 to 1985, especially for men, and has been fairly stable over the last two decades.

Second, we find that short-term relative mobility measures such as rank correlation measures and Shorrocks indices comparing annual vs. multiyear earnings inequality have been quite stable over the full period, except for a temporary surge during World War II.[5] In particular, short-term mobility has been remarkably stable since the 1950s, for a variety of mobility measures and also when the sample is restricted to men only. Therefore, the

---

5. Such a surge is not surprising in light of the large turnover in the labor market generated by the war.

evolution of annual earnings inequality over time is very close to the evolution of inequality of longer term earnings. Furthermore, we show that most of the increase in the variance of (log) annual earnings is due to increases in the variance of (log) permanent earnings, with modest increases in the variance of transitory (log) earnings. Finally, mobility at the top of the earnings distribution, measured by the probability of staying in the top percentile after one, three, or five years, has also been very stable since 1978 (the first year in our data with no top code). Therefore, in contrast to the stock-option scenario mentioned above, the SSA data show very clearly that mobility has not mitigated the dramatic increase in annual earnings concentration.

Third, we find that long-term mobility measures among all workers, such as the earnings rank correlations from the early part of a working life to the late part of a working life, display significant increases since 1951 either when measured unconditionally or when measured within cohorts. However, those increases mask substantial heterogeneity across gender groups. Long-term mobility among males has been stable over most of the period, with a slight decrease in recent decades. The decrease in the gender earnings gap and the resulting substantial increase in upward mobility over a lifetime for women is the driving force behind the increase in long-term mobility among all workers.

The paper is organized as follows. Section 2 presents the conceptual framework linking inequality and mobility measures, the data, and our estimation methods. Section 3 presents inequality results based on annual earnings. Section 4 focuses on short-term mobility and its effect on inequality, whereas Section 5 focuses on long-term mobility and inequality. Section 6 concludes. Additional details on the data and our methodology, as well as extensive sensitivity analysis and the complete series, are presented in the Online Appendix.

II. FRAMEWORK, DATA, AND METHODOLOGY

II.A. Conceptual Framework

Our main goal is to document the evolution of earnings inequality. Inequality can be measured over short-term earnings (such as annual earnings) or over long-term earnings (such as earnings averaged over several years or even a lifetime). When there is mobility in individual earnings over time, long-term

inequality will be lower than short-term inequality, as moving up and down the distribution of short-term earnings will make the distribution of long-term earnings more equal. Therefore, conceptually, a way to measure mobility (Shorrocks 1978) is to compare inequality of short-term earnings to inequality of long-term earnings and define mobility as a coefficient between zero and one (inclusive) as follows:

(1)   Long-term earnings inequality
        $=$ Short-term earning inequality $\times$ (1 − Mobility).

Alternatively, one can define mobility directly as changes or "shocks" in earnings.[6] In our framework, such shocks are defined broadly as any deviation from long-term earnings. Those shocks could indeed be real shocks such as unemployment, disability, or an unexpected promotion. Changes could also be the consequence of voluntary choices such as reducing (or increasing) hours of work, voluntarily changing jobs, or obtaining an expected pay raise. Such shocks can be transitory (such as working overtime in response to a temporarily increased demand for an employer's product, or a short unemployment spell in the construction industry) or permanent (being laid off from a job in a declining industry). In that framework, both long-term inequality and the extent of shocks contribute to shaping short-term inequality:

(2) Short-term earnings inequality
        $=$ Long-term earnings inequality $+$ Variability in earnings.

Equations (1) and (2) are related by the formula

(3) Variability in earnings
        $=$ Short-term earnings inequality $\times$ Mobility
        $=$ Long-term earnings inequality $\times$ Mobility/(1 − Mobility).

Thus, equation (3) shows that a change in mobility with no change in long-term inequality is due to an increase in variability in earnings. Conversely, an increase in inequality (either short-term or long-term) with no change in mobility implies an increased

6. See Fields (2007) for an overview of different approaches to measuring income mobility.

variability in earnings. Importantly, our concept of mobility is relative rather than absolute.[7]

Formally, we consider a situation where a fixed group of individuals $i = 1, \ldots, I$ have *short-term* earnings $z_{it} > 0$ in each period $t = 1, \ldots, K$. For example, t can represent a year. We can define *long-term* earnings for individual i as average earnings across all K periods: $\bar{z}_i = \sum_t z_{it}/K$. We normalize earnings so that average earnings (across individuals) are the same in each period.[8]

From a vector of individual earnings $\mathbf{z} = (z_1, \ldots, z_I)$, an inequality index can be defined as $G(\mathbf{z})$, where $G(.)$ is convex in $\mathbf{z}$ and homogeneous of degree zero (multiplying all earnings by a given factor does not change inequality). For example, $G(.)$ can be the Gini index or the variance of log earnings. Shorrocks (1978, Theorem 1, p. 381) shows that

$$G(\bar{\mathbf{z}}) \leq \sum_{t=1}^{K} G(\mathbf{z}_t)/K,$$

where $\mathbf{z}_t$ is the vector of earnings in period t and $\bar{\mathbf{z}}$ the vector of long-term earnings (the average across the K periods). This inequality result captures the idea that movements in individual earnings up and down the distribution reduce long-term inequality (relative to short-term inequality). Hence we can define a related Shorrocks mobility index $0 \leq M \leq 1$ as

$$1 - M = \frac{G(\bar{\mathbf{z}})}{\sum_{t=1}^{K} G(\mathbf{z}_t)/K},$$

which is a formalization of equation (1) above. $M = 0$ if and only if individuals' incomes (relative to the mean) do not change over time. The central advantage of the Shorrocks mobility index is that it formally links short-term and long-term inequality, which is perhaps the primary motivation for analyzing mobility. The disadvantage of the Shorrocks index is that it is an indirect measure of mobility.

---

7. Our paper focuses exclusively on relative mobility measures, although absolute mobility measures (such as the likelihood of experiencing an earnings increase of at least $X\%$ after one year) are also of great interest. Such measures might produce different time series if economic growth or annual inequality changed over time.

8. In our empirical analysis, earnings will be indexed to the nominal average earnings index.

Therefore, it is also useful to define direct mobility indices such as the rank correlation in earnings from year t to year $t + p$ (or quintile mobility matrices from year t to year $t + p$). Such mobility indices are likely to be closely related to the Shorrocks indices, as reranking from one period to another is precisely what creates a wedge between long-term inequality and (the average of) short-term inequality. The advantage of direct mobility indices is that they are more concrete and transparent than Shorrocks indices. In our paper, we will therefore use both and show that they evolve very similarly over time.

One specific measure of inequality—the variance of log earnings—has received substantial attention in the literature on inequality and mobility. Introducing $y_{it} = \log z_{it}$ and $\bar{y}_i = \sum_t \log z_{it}/K$, we can define deviations in (log) earnings as

$$\varepsilon_{it} = y_{it} - \bar{y}_i.$$

It is important to note that ε_{it} may reflect both transitory earnings shocks (such as an i.i.d. process) and permanent earnings shocks (such as a Brownian motion). The deviation ε_{it} could either be uncertain *ex ante* from the individual perspective, or predictable.[9]

The Shorrocks theorem applied to the inequality index variance of log-earnings implies that

$$\text{var}_i(\bar{y}_i) \leq \text{var}_{it}(y_{it}),$$

where the variance $\text{var}_{it}(y_{it})$ is taken over both $i = 1, \ldots, I$ and $K = 1, \ldots, t$. If, for illustration, we make the statistical assumption that $\varepsilon_{it} \perp \bar{y}_i$ and we denote $\text{var}(\varepsilon_{it}) = \sigma_\varepsilon^2$, then we have

$$\text{var}_{it}(y_{it}) = \text{var}_i(\bar{y}_i) + \sigma_\varepsilon^2,$$

which is a formalization of equation (2) above. The Shorrocks inequality index in that case is

$$M = \sigma_\varepsilon^2/\text{var}_{it}(y_{it}) = \sigma_\varepsilon^2/\left(\text{var}_i(\bar{y}_i) + \sigma_\varepsilon^2\right).$$

This shows that short-term earnings variance can increase because of an increase in long-term earnings variance or an increase in the variance of earnings deviations. Alternatively and

9. Uncertainty is important conceptually because individuals facing no credit constraints can fully smooth predictable shocks, whereas uncertain shocks can only be smoothed with insurance. We do not pursue this distinction in our analysis, because we cannot observe the degree of uncertainty in the empirical earnings shocks.

equivalently, short-term inequality can increase while long-term inequality remains stable if mobility increases. This simple framework can help us understand the findings from the previous literature on earnings mobility in the United States. Rank-based mobility measures (such as year-to-year rank correlation or quintile mobility matrices) are stable over time (Gottschalk 1997), whereas there has been an increase in the variance of transitory earnings (Gottschalk and Moffitt 1994). Such findings can be reconciled if the disparity in permanent earnings has simultaneously widened to keep rank-based mobility of earnings stable.

In the theoretical framework we just described, the same set of individuals are followed across the K short-term periods. In practice, because individuals leave or enter the labor force (or the "commerce and industry" sector we will be focusing on), the set of individuals with positive earnings varies across periods. As the number of periods K becomes large, the sample will become smaller. Therefore, we will mostly consider relatively small values of K such as $K = 3$ or $K = 5$. When a period is a year, that allows us to analyze short-term mobility. When a period is a longer period of time such as twelve consecutive years, with $K = 3$, we cover 36 years, which is almost a full lifetime of work, allowing us to analyze long-term mobility, that is, mobility over a full working life.

Our analysis will focus on the time series of various inequality and mobility statistics. The framework we have considered can be seen as an analysis at a given point in time s. We can recompute those statistics for various points in time to create time series.

II.B. Data and Methodology

Social Security Administration Data. We use primarily data sets constructed in SSA for research and statistical analysis, known as the continuous work history sample (CWHS) system.[10] The annual samples are selected based on a fixed subset of digits of (a transformation of) the Social Security number (SSN). The same digits are used every year so that the sample is a balanced panel and can be treated as a random sample of the full population data. We use three main SSA data sets.

(1) The 1% CWHS file contains information about taxable Social Security earnings from 1951 to 2004, basic demographic

---

10. Detailed documentation of these data sets can be found in Panis et al. (2000).

characteristics such as year of birth, sex, and race, type of work (farm or nonfarm, employment or self-employment), self-employment taxable income, insurance status for the Social Security programs, and several other variables. Because Social Security taxes apply up to a maximum level of annual earnings, however, earnings in this data set are effectively top-coded at the annual cap before 1978. Starting in 1978, the data set also contains information about full compensation derived from the W2 forms, and hence earnings are no longer top-coded. Employment earnings (either FICA employment earnings before 1978 or W2 earnings from 1978 on) are defined as the sum of all wages and salaries, bonuses, and exercised stock options exactly as wage income reported on individual income tax returns.[11]

(2) The second file is known as the employee–employer file (EE-ER), and we will rely on its longitudinal version (LEED), which covers 1957 to date. Although the sampling approach based on the SSN is the same as the 1% CWHS, individual earnings are reported at the employer level so that there is a record for each employer a worker is employed by in a year. This data set contains demographic characteristics, compensation information subject to top-coding at the employer–employee record level (and with no top code after 1978), and information about the employer, including geographic information and industry at the three-digit (major group and industry group) level. The industry information allows us to control for expansion in coverage overtime (see below). Importantly, the LEED (and EE-ER) data set also includes imputations based on quarterly earnings structure from 1957 to 1977, which allows us to handle earnings above the top code (see below).[12]

(3) Third, we use the so-called 0.1% CWHS file (one-tenth of 1%) that is constructed as a subset of the 1% file but covers 1937–1977. This file is unique in its covering the Great Compression of the 1940s. The 0.1% file contains the same demographic variables as well as quarterly earnings information starting with 1951 (and quarter at which the top code was reached for 1946–1950), thereby extending our ability to deal with top-coding problems (see below).

---

11. FICA earnings include elective employee contributions for pensions (primarily 401(k) contributions), whereas W2 earnings exclude such contributions. However, before 1978, such contributions were almost nonexistent.

12. To our knowledge, the LEED has hardly ever been used in academic publications. Two notable exceptions are Schiller (1977) and Topel and Ward (1992).

Top Coding Issues. From 1937 to 1945, no information above the taxable ceiling is available. From 1946 to 1950, the quarter at which the ceiling is reached is available. From 1951 to 1977, we rely on imputations based on quarterly earnings (up to the quarter at which the annual ceiling is reached). Finally, since 1978, the data are fully uncapped.

To our knowledge, the exact quarterly earnings information seems to have been retained only in the 0.1% CWHS sample since 1951. The LEED 1% sample since 1957 contains imputations that are based on quarterly earnings, but the quarterly earnings themselves were not retained in the data available to us. The imputation method is discussed in more detail in Kestenbaum (1976, his method II) and in the Online Appendix. It relies on earnings for quarters when they are observed to impute earnings in quarters that are not observed (when the taxable ceiling is reached after the first quarter). Importantly, this imputation method might not be accurate if individual earnings were not uniform across quarters. We extend the same procedure to 1951–1956 using the 0.1% file and because of the overlap of the 0.1% file and 1% LEED between 1957 and 1977 are able to verify that this is indeed the exact procedure that was applied in the LEED data. For 1946–1950, the imputation procedure (see the Online Appendix and Kestenbaum [1976, his method I]) uses Pareto distributions and preserves the rank order based on the quarter when the taxable maximum was reached.

For individuals with earnings above the taxable ceiling (from 1937 to 1945) or who reach the taxable ceiling in the first quarter (from 1946 to 1977), we impute earnings assuming a Pareto distribution above the top code (1937–1945) or four times the top code (1946–1977). The Pareto distribution is calibrated from wage income tax statistics published by the Internal Revenue Service to match the top wage income shares series estimated in Piketty and Saez (2003).

The number of individuals who were top-coded in the first quarter and whose earnings are imputed based on the Pareto imputation is less than 1% of the sample for virtually all years after 1951. Consequently, high-quality earnings information is available for the bottom 99% of the sample, allowing us to study both inequality and mobility up to the top percentile. From 1937 to 1945, the fraction of workers top-coded (in our sample of interest defined below) increases from 3.6% in 1937 to 19.5% in 1944 and 17.4% in 1945. The number of top-coded observations increases

to 32.9% by 1950, but the quarter when a person reached the taxable maximum helps in classifying people into broad income categories. This implies that we cannot study groups smaller than the top percentile from 1951 to 1977 and we cannot study groups smaller than the top quintile from 1937 to 1950.

To assess the sensitivity of our mobility and multiyear inequality estimates with respect to top code imputation, we use two Pareto imputation methods (see the Online Appendix). In the first or main method, the Pareto imputation is based on draws from a uniform distribution that are independent across individuals but also across time periods. As there is persistence in ranking even at the top of the distribution, this method generates an upward bias in mobility within top-coded individuals. In the alternative method, the uniform distribution draws are independent across individuals but fixed over time for a given individual. As there is some mobility in rankings at the top of the distribution, this method generates a downward bias in mobility. We always test that the two methods generate virtually the same series (see Online Appendix Figures A.5 to A.9 for examples).[13]

Changing Coverage Issues. Initially, Social Security covered only "commerce and industry" employees, defined as most private for-profit sector employees, and excluding farm and domestic employees as well as self-employed workers. Since 1951, there has been an expansion in the workers covered by Social Security and hence included in the data. An important expansion took place in 1951 when self-employed workers and farm and domestic employees were included. This reform also expanded coverage to some government and nonprofit employees (including large parts of the education and health care industries), with coverage increasing significantly further in 1954 and then slowly expanding since then. We include in our sample only commerce and industry employment earnings in order to focus on a consistent definition of workers. Using SIC classification in the LEED, we define commerce and industry as all SIC codes excluding agriculture, forestry, and fishing (01–09), hospitals (8060–8069), educational services (82), social services (83), religious organizations and nonclassified membership organizations (8660–8699), private households (88), and public administration (91–97).

---

13. This is not surprising because, starting with 1951, imputations matter for just the top 1% of the sample and mobility measures for the full population are not very sensitive to what happens within the very top group.

Between 1951 and 1956, we do not have industry information, as the LEED starts in 1957. Therefore, we impute "commerce and industry" classification using 1957–1958 industrial classification as well as discontinuities in covered earnings from 1950 to 1951 (see the Online Appendix for complete details). In 2004, commerce and industry employees are about 70% of all employees, and this proportion has declined only very modestly since 1937. Using only commerce and industry earnings is a limitation for our study for two reasons. First, inequality and mobility within the commerce and industry sector may be different from those in the full population. Second and more important, mobility between the commerce and industry sector and all other sectors is eliminated. Because in recent decades Social Security covers over 95% of earnings, we show in the Online Appendix that our mobility findings for recent decades are robust to including all covered workers. However, we cannot perform such a robustness check for earlier periods when coverage was much less complete. Note also that, throughout the period, the data include immigrant workers only if they have valid SSNs.

Sample Selection. For our primary analysis, we are restricting the sample to adult individuals aged 25 to 60 (by January 1 of the corresponding year). This top age restriction allows us to concentrate on the working-age population.[14] Second, we consider for our main sample only workers with annual (commerce and industry) employment earnings above a minimum threshold defined as one-fourth of a full year–full time minimum wage in 2004 ($2,575 in 2004), and then indexed by nominal average wage growth for earlier years. For many measures of inequality, such as log-earnings variance, it is necessary to trim the bottom of the earnings distribution. We show in Online Appendix Figures A.2 to A.9 that our results are not sensitive to choosing a higher minimum threshold such as a full year–full time minimum wage. We cannot analyze the transition into and out of the labor force satisfactorily using our sample because the SSA data cover only about 70% of employees in the early decades. From now on, we refer to our main sample of interest, namely "commerce and industry" workers aged 25 to 60 with earnings above the indexed minimum threshold (of $2,575 in 2004), as the "core sample."

---

14. Kopczuk, Saez, and Song (2007) used a wider age group from 18 to 70 and obtain the same qualitative findings.
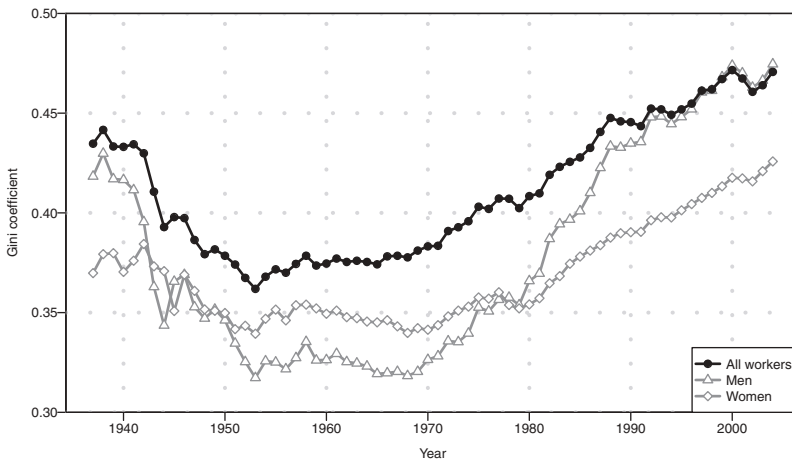
FIGURE I

Annual Gini Coefficients

The figure displays the Gini coefficients from 1937 to 2004 for earnings of individuals in the core sample, men in the core sample, and women in the core sample. The core sample in year *t* is defined as all employees with commerce and industry earnings above a minimum threshold ($2,575 in 2004 and indexed using average wage for earlier years) and aged 25 to 60 (by January 1 of year *t*). Commerce and industry are defined as all industrial sectors excluding government employees, agriculture, hospitals, educational services, social services, religious and membership organizations, and private households. Self-employment earnings are fully excluded. Estimations are based on the 0.1% CWHS data set for 1937 to 1956, the 1% LEED sample from 1957 to 1977, and the 1% CWHS (matched to W-2 data) from 1978 on. See the Online Appendix for complete details.

III. ANNUAL EARNINGS INEQUALITY

Figure I plots the annual Gini coefficient from 1937 to 2004 for the core sample of all workers, and for men and women separately in lighter gray. The Gini series for all workers follows a U-shape over the period, which is consistent with previous work based on decennial Census data (Goldin and Margo 1992), wage income from tax return data for the top of the distribution (Piketty and Saez 2003), and CPS data available since the early 1960s (Katz and Autor 1999). The series displays a sharp decrease of the Gini coefficient from 0.44 in 1938 down to 0.36 in 1953 (the Great Compression) followed by a steady increase since 1953 that accelerates in the 1970s and especially the 1980s. The Gini coefficient surpassed the prewar level in the late 1980s and was highest in 2004 at 0.47.

Our series shows that the Great Compression is indeed the period of most dramatic change in inequality since the late 1930s

and that it took place in two steps. The Gini coefficient decreased sharply during the war from 1942 to 1944, rebounded very slightly from 1944 to 1946, and then declined again from 1946 to 1953. Among all workers, the increase in the Gini coefficient over the five decades from 1953 to 2004 is close to linear, which suggests that changes in overall inequality were not limited to an episodic event in the 1980s.

Figure I shows that the series for males and females separately display the same U-shaped evolution over time. Interestingly, the Great Compression as well as the upward trend in inequality is much more pronounced for men than for all workers. This shows that the rise in the Gini coefficient since 1970 cannot be attributed to changes in gender composition of the labor force. The Gini for men shows a dramatic increase from 0.35 in 1979 to 0.43 in 1988, which is consistent with the CPS evidence extensively discussed in Katz and Autor (1999).[15] On the other hand, stability of the Gini coefficients for men and for women from the early 1950s through the late 1960s highlights that the overall increase in the Gini coefficient in that period has been driven by a widening of the gender gap in earnings (i.e., the between- rather than within-group component). Strikingly, there is more earnings inequality among women than among men in the 1950s and 1960s, whereas the reverse is true before the Great Compression and since the late 1970s.

Finally, the increase in the Gini coefficient has slowed since the late 1980s in the overall sample. It is interesting to note that a large part of the 3.5 points increase in the Gini from 1990 to 2004 is due to a surge in earnings within the top percentile of the distribution. The series of Gini coefficients estimated, excluding the top percentile, increases by less than 2 points since 1990 (see Online Appendix Figure A.3).[16] It should also be noted that, since the 1980s, the Gini coefficient has increased faster for men and women separately than for all workers. This has been driven by

---

15. There is a controversial debate in labor economics about the timing of changes in male wage inequality, due in part to discrepancies across different data sets. For example, Lemieux (2006), using May CPS data, argues that most of the increase in inequality occurs in the 1980s, whereas Autor, Katz, and Kearney (2008), using March CPS data, estimate that inequality starts to increase in the late 1960s. The Social Security data also point to an earlier increase in earnings inequality among males.

16. Hence, results based on survey data such as official Census Bureau inequality statistics, which do not measure the top percentile well, can give an incomplete view of inequality changes even when using global indices such as the Gini coefficient.
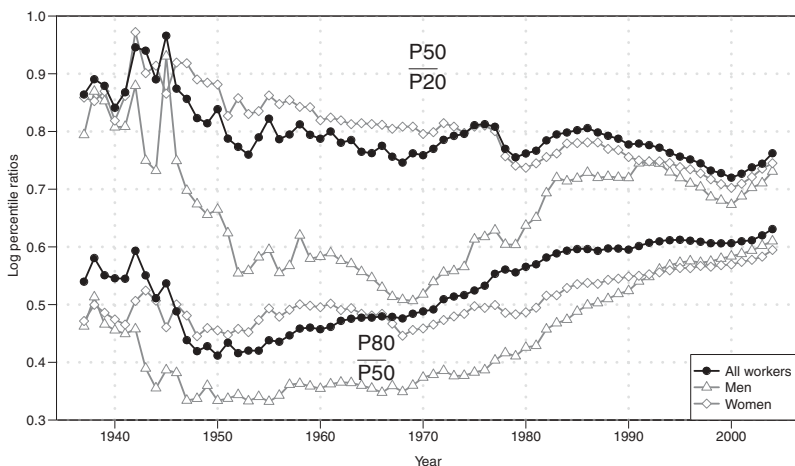
FIGURE II

Percentile Ratios log(P80/P50) and log(P50/P20)

Sample is the core sample (commerce and industry employees aged 25 to 60; see Figure I). The figure displays the log of the 50th to 20th percentile earnings ratio (upper part of the figure) and the log of the 80th to 50th percentile earnings ratio (lower part of the figure) among all workers, men only (in lighter gray), and women only (in lighter gray).

an increase in the earnings of women relative to men, especially at the top of the distribution, as we shall see.

   Most previous work in the labor economics literature has focused on gender-specific measures of inequality. As men and women share a single labor market, it is also valuable to analyze the overall inequality generated in the labor market (in the "commerce and industry" sector in our analysis). Our analysis for all workers and by gender provides clear evidence of the importance of changes in women's labor market behavior and outcomes for understanding overall changes in inequality, a topic we will return to.

   To understand where in the distribution the changes in inequality displayed in Figure I are occurring, Figure II displays the (log) percentile annual earnings ratios P80/P50—measuring inequality in the upper half of the distribution—and P50/P20—measuring inequality in the lower half of the distribution. We also depict the series for men and women only separately in lighter gray.[17]

   17. We choose P80 (instead of the more usual P90) to avoid top-coding issues before 1951 and P20 (instead of the more usual P10) so that our low percentile

The P80/P50 series (depicted in the bottom half of the figure) are also U-shaped over the period, with a brief but substantial Great Compression from 1942 to 1947 and a steady increase starting in 1951, which accelerates in the 1970s. Interestingly, P80/P50 is virtually constant from 1985 to 2000, showing that the gains at the top of the distribution occurred above P80. The series for men is similar except that P80/P50 increases sharply in the 1980s and continues to increase in the 1990s.

The P50/P20 series (depicted in the upper half of the figure) display a fairly different time pattern from the P80/P50 series. First, the compression happens primarily in the postwar period from 1946 to 1953. There are large swings in P50/P20 during the war, especially for men, as many young low income earners leave and enter the labor force because of the war, but P50/P20 is virtually the same in 1941 and 1946 or 1947.[18] After the end of the Great Compression in 1953, the P50/P20 series for all workers remains fairly stable to the present, alternating periods of increase and decrease. In particular, it decreases smoothly from the mid-1980s to 2000, implying that inequality in the bottom half shrank in the last two decades, although it started increasing after 2000. The series for men only is quite different and displays an overall U shape over time, with a sharper great compression that extends well into the postwar period, with an absolute minimum in 1969 followed by a sharp increase up to 1983 and relative stability since then (consistent with recent evidence by Autor, Katz, and Kearney [2008]). For women, the P50/P20 series display a secular and steady fall since World War II.

Table I summarizes the annual earnings inequality trends for all (Panel A), men (Panel B), and women (Panel C) with various inequality measures for selective years (1939, 1960, 1980, and 2004). In addition to the series depicted in the Figures, Table I contains the variance of log-earnings, which also displays a U-shaped pattern over the period, as well as the shares of total earnings going to the bottom quintile group (P0–20), the top quintile group (P80–100), and the top percentile group (P99–100). Those last two series also display a U shape over the period. In particular, the top percentile share has almost doubled from 1980

---

estimate is not too closely driven by the average wage-indexed minimum threshold we have chosen ($2,575 in 2004).

18. In the working paper version (Kopczuk, Saez, and Song 2007), we show that compositional changes during the war are strongly influencing the bottom of the distribution during the early 1940s.

TABLE I
ANNUAL EARNINGS INEQUALITY

Year (1)	Gini (2)	Variance log earnings (3)	Log percentile ratios			Earnings shares			Average earnings (2004 $) (10)	#Workers ('000s) (11)
			P80/P20 (4)	P50/P20 (5)	P80/P50 (6)	P0–20 (7)	P80–100 (8)	P99–100 (9)		
					A. All					
1939	0.433	0.826	1.43	0.88	0.55	3.64	46.82	9.55	15,806	20,404
1960	0.375	0.681	1.24	0.79	0.46	4.54	41.66	5.92	27,428	35,315
1980	0.408	0.730	1.33	0.76	0.57	4.34	44.98	7.21	35,039	50,129
2004	0.471	0.791	1.39	0.76	0.63	3.91	51.41	12.28	44,052	75,971
					B. Men					
1939	0.417	0.800	1.32	0.85	0.47	3.82	45.52	9.58	17,918	15,493
1960	0.326	0.533	0.94	0.58	0.35	5.89	38.80	5.55	32,989	24,309
1980	0.366	0.618	1.06	0.64	0.43	5.25	42.02	6.85	44,386	30,564
2004	0.475	0.797	1.34	0.73	0.61	3.92	51.83	13.44	52,955	42,908
					C. Women					
1939	0.380	0.635	1.36	0.87	0.49	4.49	42.25	6.11	9,145	4,911
1960	0.349	0.570	1.31	0.82	0.50	4.98	39.18	4.05	15,148	11,006
1980	0.354	0.564	1.22	0.74	0.49	5.15	40.38	4.37	20,439	19,566
2004	0.426	0.693	1.34	0.74	0.59	4.45	47.36	8.00	32,499	33,063

0.1% sample from 1937 to 1956, 1% from 1957 to 2004. Number of workers in thousands

Notes. The table displays various annual earnings inequality statistics for selected years, 1939, 1960, 1980, and 2004 for all workers in the core sample (Panel A), men in the core sample (Panel B), and women in the core sample (Panel C). The core sample in year t is defined as all employees with commerce and industry earnings above a minimum threshold ($2,575 in 2004 and indexed using average wage for earlier years) and aged 25 to 60 (by January 1 of year t). Commerce and industry are defined as all industrial sectors excluding government employees, agriculture, hospitals, educational services, social services, religious and membership organizations, and private households. Self-employment earnings are fully excluded. Estimates are based on the 0.1% CWHS data set for 1937 to 1956, the 1% LEED sample from 1957 to 1977, and the 1% CWHS from 1978 on. See the Online Appendix for complete details. Columns (2) and (3) report the Gini coefficient and variance of log earnings. Columns (4), (5), and (6) report the percentile log ratios P80/P20, P50/P20, and P80/P50. P80 denotes the 80th percentile, etc. Columns (7), (8), and (9) report the share of total earnings accruing to P0–20 (the bottom quintile), P80–100 (the top quintile), and P99–100 (the top percentile). Column (10) reports average earnings in 2004 dollars using the CPI-U-RS index (the new CPI-U-RS index is used after 1978). Column (11) reports the number of workers in thousands.

to 2004 in the sample of men only and the sample of women only and accounts for over half of the increase in the top quintile share from 1980 to 2004.

IV. THE EFFECTS OF SHORT-TERM MOBILITY ON EARNINGS INEQUALITY

In this section, we apply our theoretical framework from Section II.A to analyze multiyear inequality and relate it to the annual earnings inequality series analyzed in Section III. We will consider each period to be a year and the longer period to be five years ($K = 5$).[19] We will compare inequality based on annual earnings and earnings averaged over five years. We will then derive the implied Shorrocks mobility indices and decompose annual inequality into permanent and transitory inequality components. We will also examine some direct measures of mobility such as rank correlations.

Figure III plots the Gini coefficient series for earnings averaged over five years[20] (numerator of the Shorrocks index) and the five-year average of the Gini coefficients of annual earnings (the denominator of the Shorrocks index). For a given year t, the sample for both the five-year Gini and the annual Ginis is defined as all individuals with "Commerce and Industry" earnings above the minimum threshold in all five years, $t - 2, t - 1, t, t + 1, t + 2$ (and aged 25 to 60 in the middle year t). We show the average of the five annual Gini coefficients between $t - 2$ and $t + 2$ as our measure of the annual Gini coefficient, because it matches the Shorrocks approach. Because the sample is the same for both series, Shorrocks' theorem implies that the five-year Gini is always smaller than the average of the annual Gini (over the corresponding five years), as indeed displayed in the figure.[21] We also display the same series for men only (in lighter gray). The annual Gini displays the same overall evolution over time as in Figure I. The level is lower, as there is naturally less inequality in the group of

19. Series based on three-year averages instead of five year generates display a very similar time pattern. Increasing K beyond five would reduce sample size substantially, as we require earnings to be above the minimum threshold in each of the five years, as described below.

20. The average is taken after indexing annual earnings by the average wage index.

21. Alternatively, we could have defined the sample as all individuals with earnings above the minimum threshold in any of the five years, $t - 2, t - 1, t, t + 1, t + 2$. The time pattern of those series is very similar. We prefer to use the positive-earnings in all five years criterion because this is a necessity when analyzing variability in log-earnings, as we do below.
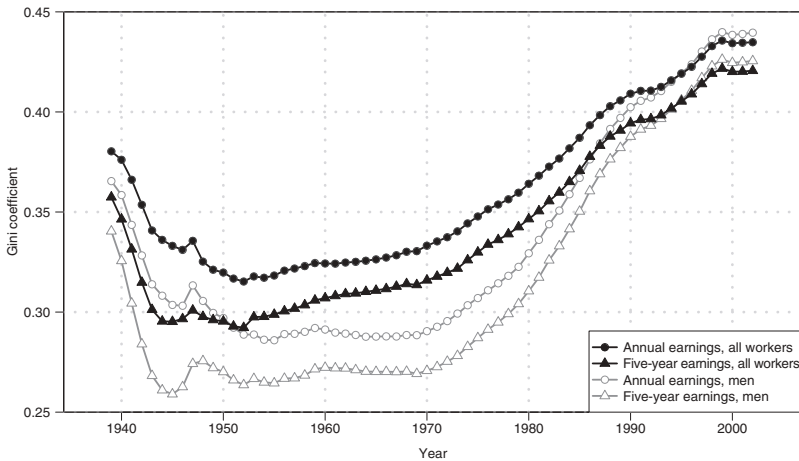
FIGURE III

Gini Coefficients: Annual Earnings vs. Five-Year Earnings

The figure displays the Gini coefficients for annual earnings and for earnings averaged over five years from 1939 to 2002. In year t, the sample for both series is defined as all individuals aged 25 to 60 in year t, with commerce and industry earnings above the minimum threshold in *all* five years $t - 2, t - 1, t, t + 1, t + 2$. Earnings are averaged over the five-year span using the average earnings index. The Gini coefficient for annual earnings displayed for year t is the average of the Gini coefficient for annual earnings in years $t - 2, \ldots, t + 2$. The same series are reported in lighter gray for the sample restricted to men only.

individuals with positive earnings for five consecutive years than in the core sample. The Gini coefficient estimated for five-year earnings average follows a very similar evolution over time and is actually extremely close to the annual Gini, especially in recent decades.

Interestingly, in this sample, the Great Compression takes place primarily during the war from 1940 to 1944. The war compression is followed by a much more modest decline till 1952. This suggests that the postwar compression observed in annual earnings in Figure I was likely due to entry (of young men in the middle of the distribution) and exit (likely of wartime working women in the lower part of the distribution). Since the early 1950s, the two Gini series are remarkably parallel, and the five-year earnings average Gini displays an accelerated increase during the 1970s and especially the 1980s, as did our annual Gini series. The five-year average earnings Gini series for men show that the Great Compression is concentrated during the war, with little change in the Gini from 1946 to 1970, and a very sharp increase over the next three decades, especially the 1980s.
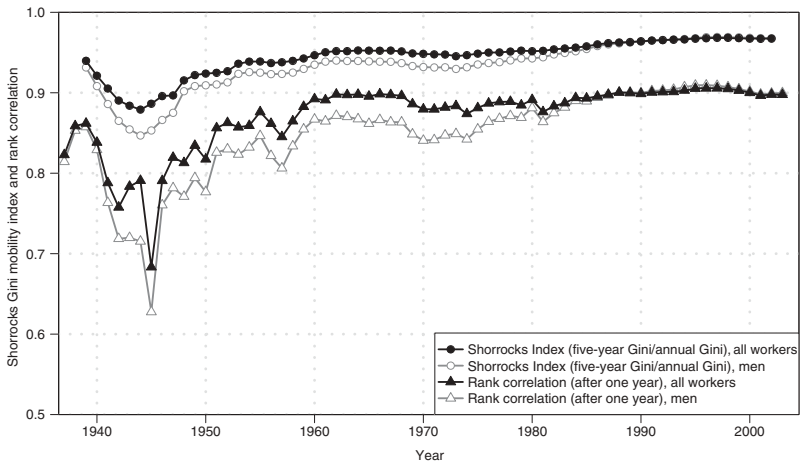
FIGURE IV

Short-Term Mobility: Shorrocks' Index and Rank Correlation

The figure displays the Shorrocks mobility coefficient based on annual earnings Gini vs. five-year average earnings Gini and the rank correlation between earnings in year t and year $t + 1$. The Shorrocks mobility coefficient in year t is defined as the ratio of the five-year earnings (from $t - 2$ to $t + 2$) Gini coefficient to the average of the annual earnings Gini for years $t - 2, \ldots, t + 2$ (those two series are displayed in Figure III). The rank correlation in year t is estimated on the sample of individuals present in the core sample (commerce and industry employees aged 25 to 60; see Figure I) in *both* year t and year $t + 1$. The same series are reported in lighter gray for the sample restricted to men only.

Figure IV displays two measures of mobility (in black for all workers and in lighter gray for men only). The first measure is the Shorrocks measure, defined as the ratio of the five-year Gini to (the average of) the annual Gini. Mobility decreases with the index, and an index equal to one implies no mobility at all. The Shorrocks index series is above 0.9, except for a temporary dip during the war. The increased earnings mobility during the war is likely explained by the large movements into and out of the labor force of men serving in the army and women temporarily replacing men in the civilian labor force. The Shorrocks series have very slightly increased since the early 1970s, from 0.945 to 0.967 in 2004.[22] This small change in the direction of *reduced* mobility further confirms that, as we expected from Figure III, short-term mobility has played a minor role in the surge in annual earnings inequality documented in Figure I.

22. The increase is slightly more pronounced for the sample of men.

The second mobility measure displayed on Figure IV is the straight rank correlation in earnings between year t and year $t + 1$ (computed in the sample of individuals present in our core sample in both years t and $t + 1$).[23] As with the Shorrocks index, mobility decreases with the rank correlation and a correlation of one implies no year-to-year mobility. The rank mobility series follows the same overall evolution over time as the Shorrocks mobility index: a temporary but sharp dip during the war followed by a slight increase. Over the last two decades, the rank correlation in year-to-year earnings has been very stable and very high, around .9. As with the Shorrocks index, the increase in rank correlation is slightly more pronounced for men (than for the full sample) since the late 1960s.

Figure V displays (a) the average of variance of annual log earnings from $t - 2$ to $t + 2$ (defined on the stable sample as in the Shorrocks index analysis before), (b) the variance of five-year average log-earnings, $\mathrm{var}((\sum_{s=t-2}^{t+2} \log z_{is})/5)$, and (c) the variance of log earnings deviations, estimated as

$$D_t = \mathrm{var}\left(\log(z_{it}) - \frac{\sum_{s=t-2}^{t+2} \log z_{is}}{5}\right),$$

where the variance is taken across all individuals i with earnings above the minimum threshold in all five years $t - 2, \ldots, t + 2$. As with the previous two mobility measures, those series, displayed in black for all workers and in lighter gray for men only, show a temporary surge in the variance of transitory earnings during the war, and are stable after 1960. In particular, it is striking that we do not observe an increased earnings variability over the last twenty years, so that all the increase in the log-earnings variance can be attributed to the increase in the variance of permanent (five-year average) log-earnings.

Our results differ somewhat from those of Gottschalk and Moffitt (1994), using PSID data, who found that over one-third of the increase in the variance of log-earnings from the 1970s to the 1980s was due to an increase in transitory earnings (Table 1, row 1, p. 223). We find a smaller increase in transitory earnings in

---

23. More precisely, within the sample of individuals present in the core sample in both years t and $t + 1$, we measure the rank r_t and r_{t+1} of each individual in each of the two years, and then compute the correlation between r_t and r_{t+1} across individuals.
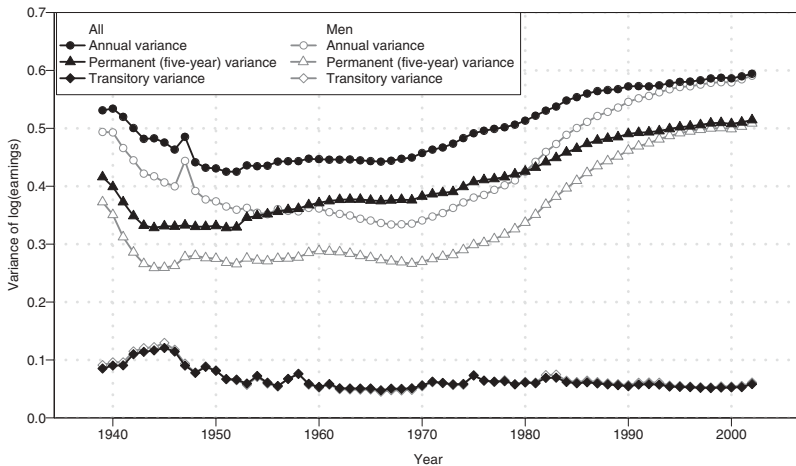
FIGURE V

Variance of Annual, Permanent, and Transitory (log) Earnings

The figure displays the variance of (log) annual earning, the variance of (log) five-year average earnings (permanent variance), and the transitory variance, defined as the variance of the difference between (log) annual earnings and (log) five-year average earnings. In year t, the sample for all three series is defined as all individuals aged 25 to 60 in year t, with commerce and industry earnings above the minimum threshold in all five years $t-2, t-1, t, t+1, t+2$. The (log) annual earnings variance is estimated as the average (across years $t-2, \ldots, t+2$) of the variance of (log) annual earnings. The same series are reported in lighter gray for the sample restricted to men only.

the 1970s and we find that this increase reverts in the late 1980s and 1990s so that transitory earnings variance is virtually identical in 1970 and 2000. To be sure, our results could differ from those of Gottschalk and Moffitt (1994) for many reasons, such as measurement error and earnings definition consistency issues in the PSID or the sample definition. Gottschalk and Moffitt focus exclusively on white males, use a different age cutoff, take out age-profile effects, and include earnings from all industrial sectors. Gottschalk and Moffitt also use nine-year earnings periods (instead of five as we do) and include all years with positive annual earnings years (instead of requiring positive earnings in all nine years as we do).[24]

24. The recent studies of Dynan, Elmendorf, and Sichel (2008) and Shin and Solon (2008) revisit mobility using PSID data. Shin and Solon (2008) find an increase in mobility in the 1970s followed by stability, which is consistent with our results. Dynan, Elmendorf, and Sichel (2008) find an increase in mobility in recent decades, but they focus on household total income instead of individual earnings.
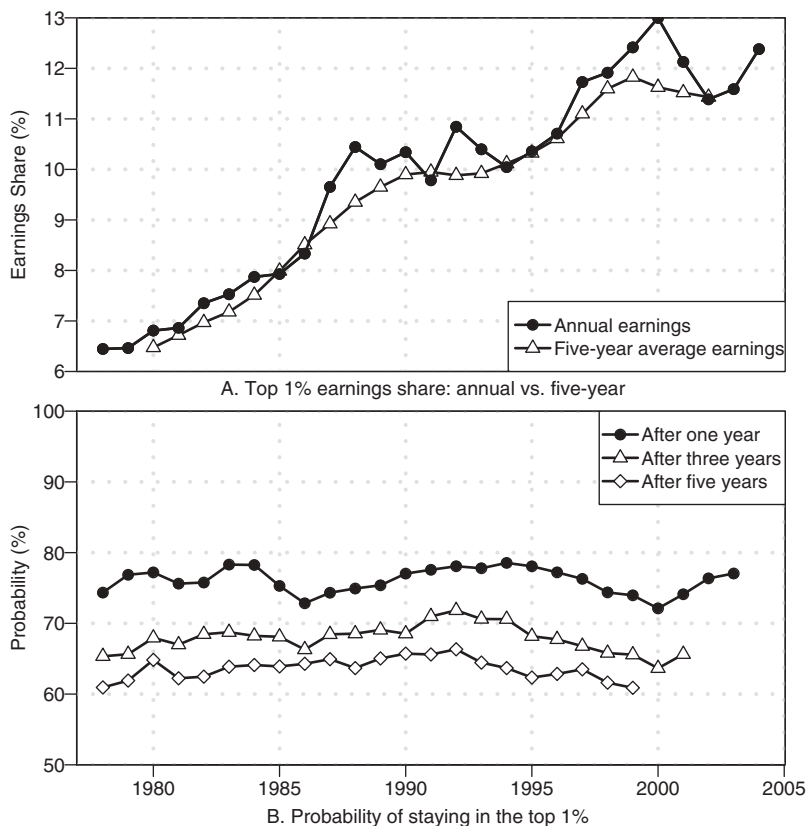
FIGURE VI

Top Percentile Earnings Share and Mobility

In Panel A, the sample in year t is all individuals aged 25 to 60 in year t and with commerce and industry earnings above the minimum threshold in all five years $t-2, t-1, t, t+1, t+2$. In year t, Panel A displays (1) the share of total year t annual earnings accruing to the top 1% earners in that year t and (2) the share of total five-year average earnings (from year $t-2, \ldots, t+2$) accruing to the top 1% earners (defined as top 1% in terms of average five-year earnings). Panel B displays the probability of staying in the top 1% annual earnings group after X years (where $X = 1, 3, 5$). The sample in year t is all individuals present in the core sample (commerce and industry employees aged 25 to 60; see Figure I) in *both* year t and year $t+X$. Series in both panels are restricted to 1978 and on because sample has no top code since 1978.

The absence of top-coding since 1978 allows us to zoom on top earnings, which, as we showed in Table I, have surged in recent decades. Figure VI.A uses the uncapped data since 1978 to plot the share of total annual earnings accruing to the top 1% (those with

earnings above \$236,000 in 2004). The top 1% annual earnings share doubles from 6.5% in 1978 to 13% in 2004.[25] Figure VI.A then compares the share of earnings of the top 1% based on annual data with shares of the top 1% defined based on earnings averaged at the individual level over five years. The five-year average earnings share series naturally smoothes short-term fluctuations but shows the same time pattern of robust increase as the annual measure.[26] This shows that the surge in top earnings is not due to increased mobility at the top. This finding is confirmed in Figure VI.B, which shows the probability of staying in the top 1% earnings group after one, three, and five years (conditional on staying in our core sample) starting in 1978. The one-year probability is between sixty and seventy percent and it shows no overall trend. Therefore, our analysis shows that the dramatic surge in top earnings has not been accompanied by a similar surge in mobility into and out of top earnings groups. Hence, annual earnings concentration measures provide a very good approximation to longer-term earnings concentration measures. In particular, the development of performance-based pay such as bonuses and profits from exercised stock options (both included in our earnings measure) does not seem to have increased mobility dramatically.[27]

Table II summarizes the key short-term mobility trends for all (Panel A) and men (Panel B) with various mobility measures for selected years (1939, 1960, 1980, and 2002). In sum, the movements in short-term mobility series appear to be much smaller than changes in inequality over time. As a result, changes in short-term mobility have had no significant impact on inequality trends in the United States. Those findings are consistent with previous studies for recent decades based on PSID data (see, e.g., Gottschalk [1997] for a summary) as well as the most recent SSA

25. The closeness of our SSA-based (individual-level) results and the tax return–based (family-level) results of Piketty and Saez (2003) shows that changes in assortative mating played at best a minor role in the surge of family employment earnings at the top of the earnings distribution.

26. Following the framework from Section II.A (applied in this case to the top 1% earnings–share measure of inequality), we have computed such shares (in year t) on the sample of all individuals with minimum earnings in all five years, $t-2, \ldots, t+2$. Note also that, in contrast to Shorrocks' theorem, the series cross because we do not average the annual income share in year t across the five years $t-2, \ldots, t+2$.

27. Conversely, the widening of the gap in annual earnings between the top 1% and the rest of the workforce has not affected the likelihood of top-1% earners falling back into the bottom 99%.

TABLE II
FIVE-YEAR AVERAGE EARNINGS INEQUALITY AND SHORT-TERM MOBILITY

Year (1)	5-year earnings average Gini (2)	Annual earnings Gini (average $t-2,\ldots,t+2$) (3)	Rank correlation after 1 year (4)	Permanent (5-year average) log-earnings variance (5)	Annual log-earnings variance (average $t-2,\ldots,t+2$) (6)	Transitory log-earnings variance (7)	#Workers ('000s) (8)
				A. All			
1939	0.357	0.380	0.859	0.416	0.531	0.085	14,785
1960	0.307	0.324	0.883	0.371	0.447	0.054	26,479
1980	0.347	0.364	0.885	0.426	0.513	0.061	35,500
2002	0.421	0.435	0.897	0.514	0.594	0.058	55,108
				B. Men			
1939	0.340	0.365	0.853	0.373	0.494	0.091	11,700
1960	0.272	0.291	0.855	0.288	0.362	0.052	19,577
1980	0.310	0.329	0.869	0.337	0.425	0.062	23,190
2002	0.426	0.440	0.898	0.509	0.591	0.061	32,259

Notes. The table displays various measures of 5-year average earnings inequality and short-term mobility measures centered around selected years, 1939, 1960, 1980, and 2002 for all workers (Panel A) and men (Panel B). In all columns (except (4)), the sample in year t is defined as all employees with commerce and industry earnings above a minimum threshold ($2,575 in 2004 and indexed using average wage for earlier years) in *all* five years $t-2, t-1, t, t+1$, and $t+2$, and aged 25 to 60 (by January 1 of year t). Column (2) reports the Gini coefficients based on average earnings from year $t-2$ to year $t+2$ (averages are computed using indexed wages). Column (3) reports the average across years $t-2,\ldots,t+2$ of the Gini coefficients of annual earnings. Column (4) reports the rank correlation between annual earnings in year t and annual earnings in year $t+1$ in the sample of workers in the core sample (see Table I footnote for the definition) in both years t and $t+1$. Column (5) reports the variance of average log-earnings from year $t-2$ to year $t+2$. Column (6) reports the average across years $t-2,\ldots,t+2$ of the variance of annual log-earnings. Column (7) reports the variance of the difference between log earnings in year t and the average of log earnings from year $t-2$ to $t+2$. Column (8) reports the number of workers in thousands.

data–based analysis of the Congressional Budget Office (2007)[28] and the tax return–based analysis of Carroll, Joulfaian, and Rider (2007). They are more difficult to reconcile, however, with the findings of Hungerford (1993) and especially Hacker (2006), who find great increases in *family* income variability in recent decades using PSID data. Our finding of stable transitory earnings variance is also at odds with the findings of Gottschalk and Moffitt (1994), who decompose transitory and permanent variance in log-earnings using PSID data and show an increase in both components. Our decomposition using SSA data shows that only the variance of the relatively permanent component of earnings has increased in recent decades.

V. LONG-TERM MOBILITY AND LIFETIME INEQUALITY

The very long span of our data allows us to estimate long-term mobility. Such mobility measures go beyond the issue of transitory

---

28. The CBO study focuses on probabilities of large earnings increases (or drops).

earnings analyzed above and instead describe mobility across a full working life. Such estimates have not yet been produced for the United States in any systematic way because of the lack of panel data with large sample size and covering a long time period.

V.A. *Unconditional Long-Term Inequality and Mobility*

We begin with the simplest extension of our previous analysis to a longer horizon. In the context of the theoretical framework from Section II.A, we now assume that a period is eleven consecutive years. We define the "core long-term sample" in year t as all individuals aged 25–60 in year t with average earnings (using the standard wage indexation) from year $t-5$ to year $t+5$ above the minimum threshold. Hence, our sample includes individuals with zeros in some years as long as average earnings are above the threshold.[29]

Figure VII displays the Gini coefficients for all workers, and for men and women separately based on those eleven-year average earnings from 1942 to 1999. The overall picture is actually strikingly similar to our annual Figure I. The Gini coefficient series for all workers displays on overall U shape with a Great Compression from 1942 to 1953 and an absolute minimum in 1953, followed by a steady increase that accelerates in the 1970s and 1980s and slows down in the 1990s. The U-shaped evolution over time is also much more pronounced for men than for women and shows that, for men, the inequality increase was concentrated in the 1970s and 1980s.[30]

After exploring base inequality over those eleven-year spells, we turn to long-term mobility. Figure VIII displays the rank correlation between the eleven-year earnings spell centered in year t and the eleven-year earnings spell after T years (i.e., centered in year $t+T$) in the same sample of individuals present in the "long-term core sample" in both year t and year $t+T$. The figure presents such correlations for three choices of T: ten years, fifteen years, and twenty years. Given our 25–60 age restriction (which applies in both year t and year $t+T$), for $T=20$, the sample in year t is aged 25 to 40 (and the sample in year $t+20$ is aged 45 to 60). Thus, this measure captures mobility from early career to late career. The figure also displays the same series for men only

29. This allows us to analyze large and representative samples as the number of individuals with positive "commerce and industry" earnings in eleven consecutive years is only between 35% and 50% of the core annual samples.

30. We show in Online Appendix Figures A.8 and A.9 that these results are robust to using a higher minimum threshold.
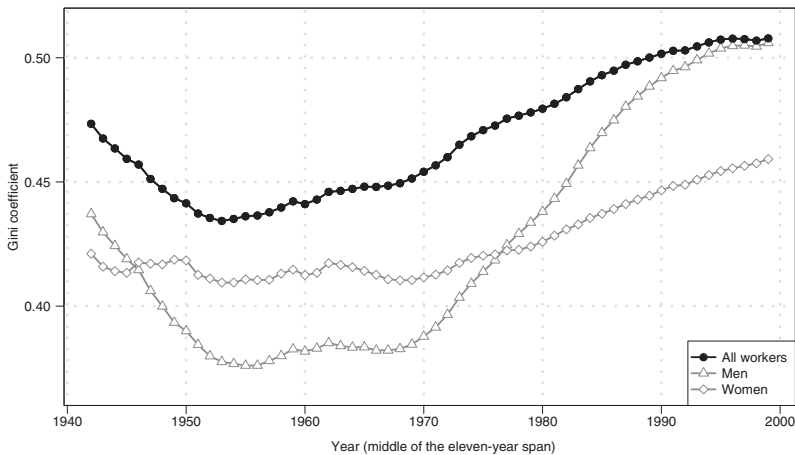
FIGURE VII
Long-Term Earnings Gini Coefficients
   The figure displays the Gini coefficients from 1942 to 1999 for eleven-year average earnings for all workers, men only, and women only. The sample in year t is defined as all employees aged 25 to 60 in year t, alive in all years $t-5$ to $t+5$, and with average commerce and industry earnings (averaged using the average wage index) from year $t-5$ to $t+5$ above the minimum threshold. Gini coefficient in year t is based on average (indexed) earnings across the eleven-year span from year $t-5$ to $t+5$.

in lighter gray, in which case rank is defined within the sample of men. Three points are worth noting.

   First, the correlation is unsurprisingly lower as T increases, but it is striking to note that even after twenty years, the correlation is still substantial (in the vicinity of .5). Second, the series for all workers shows that rank correlation has actually significantly decreased over time: for example, the rank correlation between 1950s and 1970s earnings was around .57, but it is only .49 between 1970s and 1990s earnings. This shows that long-term mobility has *increased* significantly over the last five decades. This result stands in contrast to our short-term mobility results displaying substantial stability. Third, however, Figure VIII shows that this increase in long-term mobility disappears in the sample of men. The series for men displays a slight decrease in rank correlation in the first part of the period followed by an increase in the last part of the period. On net, the series for men displays almost no change in rank correlation and hence no change in long-term mobility over the full period.
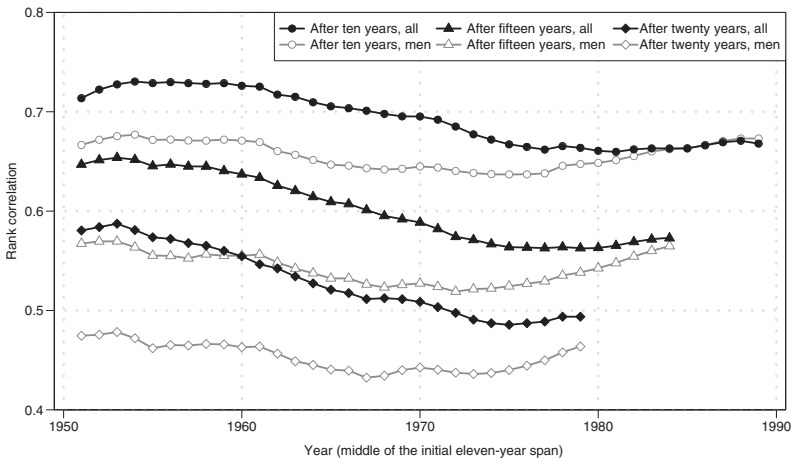
FIGURE VIII
Long-Term Mobility: Rank Correlation in Eleven-Year Earnings Spans

The figure displays in year t the rank correlation between eleven-year average earnings centered around year t and eleven-year average earnings centered around year $t + X$, where $X =$ ten, fifteen, twenty. The sample is defined as all individuals aged 25 to 60 in year t and $t + X$, with average eleven-year earnings around years t and $t + X$ above the minimum threshold. Because of small sample size, series including earnings before 1957 are smoothed using a weighted three-year moving average with weight of 0.5 for cohort t and weights of 0.25 for $t - 1$ and $t + 1$. The same series are reported in lighter gray for the sample restricted to men only (in which case, rank is estimated within the sample of men only).

V.B. Cohort-Based Long-Term Inequality and Mobility

The analysis so far ignored changes in the age structure of the population as well as changes in the wage profiles over a career. We turn to cohort-level analysis to control for those effects. In principle, we could control for age (as well as other demographic changes) using a regression framework. In this paper, we focus exclusively on series without controls because they are more transparent, easier to interpret, and less affected by imputation issues. We defer a more comprehensive structural analysis of earnings processes to future work.[31]

We divide working lifetimes from age 25 to 60 into three stages: Early career is defined as from the calendar year the

---

31. An important strand of the literature on income mobility has developed covariance structure models to estimate such earnings processes. The estimates of such models are often difficult to interpret and sensitive to the specification (see, e.g., Baker and Solon [2003]). As a result, many recent contributions in the mobility literature have also focused on simple measures without using a complex framework (see, e.g., Congressional Budget Office [2007] and in particular the discussion in Shin and Solon [2008]).
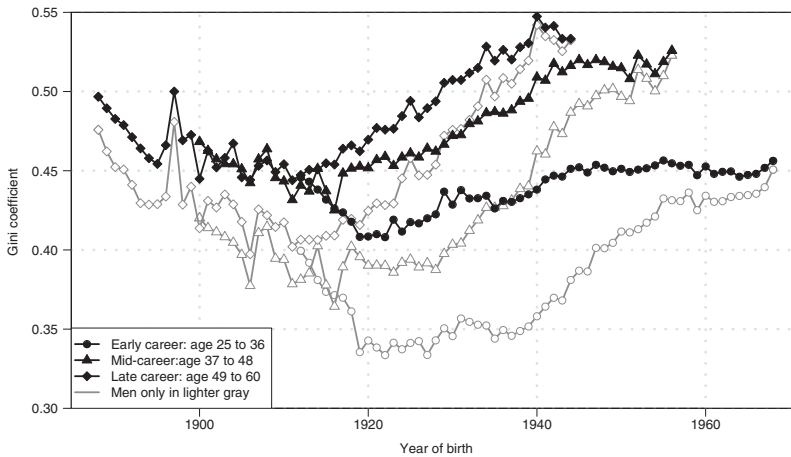
FIGURE IX

Long-Term Earnings Gini Coefficients by Birth Cohort

Sample is career sample defined as follows for each career stage and birth cohort: all employees with average commerce and industry earnings (using average wage index) over the twelve-year career stage above the minimum threshold ($2,575 in 2004 and indexed on average wage for earlier years). Note that earnings can be zero for some years. Early career is from age 25 to 36, middle career is from age 37 to 48, late career is from age 49 to 60. Because of small sample size, series including earnings before 1957 are smoothed using a weighted three-year moving average with weight of 0.5 for cohort t and weights of 0.25 for $t-1$ and $t+1$.

person reaches 25 to the calendar year the person reaches 36. Middle and later careers are defined similarly from age 37 to 48 and age 49 to 60, respectively. For example, for a person born in 1944, the early career is calendar years 1969–1980, the middle career is 1981–1992, and the late career is 1993–2004. For a given year-of-birth cohort, we define the "core early career sample" as all individuals with average "commerce and industry" earnings over the twelve years of the early career stage above the minimum threshold (including zeros and using again the standard wage indexation). The "core mid-career" and "core late career" samples are defined similarly for each birth cohort. The earnings in early, mid-, and late career are defined as average "commerce and industry" earnings during the corresponding stage (always using the average wage index).

Figure IX reports the Gini coefficient series by year of birth for early, mid-, and late career. The Gini coefficients for men only are also displayed in lighter gray. The cohort-based Gini coefficients

are consistent with our previous findings and display a U shape over the full period. Three results are notable. First, there is much more inequality in late career than in middle career, and in middle career than in early career, showing that long-term inequality fans out over the course of a working life. Second, the Gini series show that long-term inequality has been stable for the baby-boom cohorts born after 1945 in the sample of all workers (we can observe only early- and mid-career inequality for those cohorts, as their late-career earnings are not completed by 2004). Those results are striking in light of our previous results showing a worsening of inequality in annual and five-year average earnings. Third, however, the Gini series for men only show that inequality has increased substantially across baby-boom cohorts born after 1945. This sharp contrast between series for all workers versus men only reinforces our previous findings that gender effects play an important role in shaping the trends in overall inequality. We also find that cohort-based rank mobility measures display stability or even slight decreases over the last five decades in the full sample, but that rank mobility has decreased substantially in the sample of men (figure omitted to save space). This confirms that the evolution of long-term mobility is heavily influenced by gender effects, to which we now turn.

V.C. *The Role of Gender Gaps in Long-Term Inequality and Mobility*

As we saw, there are striking differences in the long-term inequality and mobility series for all workers vs. for men only: Long-term inequality has increased much less in the sample of all workers than in the sample of men only. Long-term mobility has increased over the last four decades in the sample of all workers, but not in the sample of men only. Such differences can be explained by the reduction in the gender gap that has taken place over the period.

Figure X plots the fraction of women in our core sample and in various upper earnings groups: the fourth quintile group (P60–80), the ninth decile group (P80–90), the top decile group (P90–100), and the top percentile group (P99–100). As adult women aged 25 to 60 are about half of the adult population aged 25 to 60, with no gender differences in earnings, those fractions should be approximately 0.5. Those representation indices with no adjustment capture the total realized earnings gap including labor
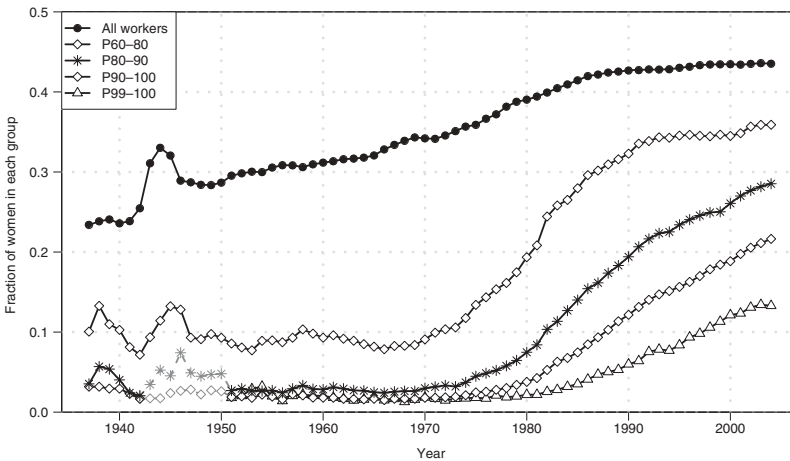
FIGURE X

Gender Gap in Upper Earnings Groups

Sample is core sample (commerce and industry employees aged 25 to 60; see Figure I). The figure displays the fraction of women in various groups. P60–80 denotes the fourth quintile group from percentile 60 to percentile 80, P90–100 denotes the top 10%, etc. Because of top-coding in the micro data, estimates from 1943 to 1950 for P80–90 and P90–100 are estimated using published tabulations in Social Security Administration (1937–1952, 1967) and reported in lighter gray.

supply decisions.[32] We use those representation indices instead of the traditional ratio of mean (or median) female earnings to male earnings because such representation indices remain meaningful in the presence of differential changes in labor force participation or in the wage structure across genders, and we do not have covariates to control for such changes, as is done in survey data (see, e.g., Blau, Ferber, and Winkler [2006]). Two elements in Figure X are worth noting.

First, the fraction of women in the core sample of commerce and industry workers has increased from around 23% in 1937 to about 44% in 2004. World War II generated a temporary surge in women's labor force participation, two-thirds of which was reversed immediately after the war.[33] Women's labor force participation has been steadily and continuously increasing since the mid-1950s and has been stable at around 43%–44% since 1990.

---

32. As a result, they combine not only the traditional wage gap between males and females but also the labor force participation gap (including the decision to work in the commerce and industry sector rather than other sectors or self-employment).

33. This is consistent with the analysis of Goldin (1991), who uses unique micro survey data covering women's workforce history from 1940 to 1951.

Second, Figure X shows that the representation of women in upper earnings groups has increased significantly over the last four decades and in a staggered time pattern across upper earnings groups.[34] For example, the fraction of women in P60–80 starts to increase in 1966 from around 8% and reaches about 34% in the early 1990s and has remained about stable since then. The fraction of women in the top percentile (P99–100) does not really start to increase significantly before 1980. It grows from around 2% in 1980 to almost 14% in 2004 and is still quickly increasing. Those results show that the representation of women in top earnings groups has increased substantially over the last three to four decades. They also suggest that economic progress of women is likely to impact measures of upward mobility significantly, as many women are likely to move up the earnings distribution over their lifetimes. Indeed, we have found that such gender effects are strongest in upward mobility series such as the probability of moving from the bottom two quintile groups (those earning less than $25,500 in 2004) to the top quintile group (those earning over $59,000 in 2004) over a lifetime.

Figure XI displays such upward mobility series, defined as the probability of moving from the bottom two quintile groups to the top quintile group after twenty years (conditional on being in the "long-term core sample" in both year t and year $t + 20$) for all workers, men, and women.[35]

The figure shows striking heterogeneity across groups. First, men have much higher levels of upward mobility than women. Thus, in addition to the annual earnings gap we documented, there is an upward mobility gap as well across groups. Second, the upward mobility gap has also been closing over time: the probability of upward mobility among men has been stable overall since World War II, with a slight increase up to the 1960s and declines after the 1970s. In contrast, the probability of upward mobility of women has continuously increased from a very low level of less than 1% in the 1950s to about 7% in the 1980s. The increase in upward mobility for women compensates for the stagnation or slight decline in mobility for men, so that upward mobility among

34. There was a surge in women in P60–80 during World War II, but this was entirely reversed by 1948. Strikingly, women were better represented in upper groups in the late 1930s than in the 1950s.
35. Note that quintile groups are always defined based on the sample of all workers, including both male and female workers.
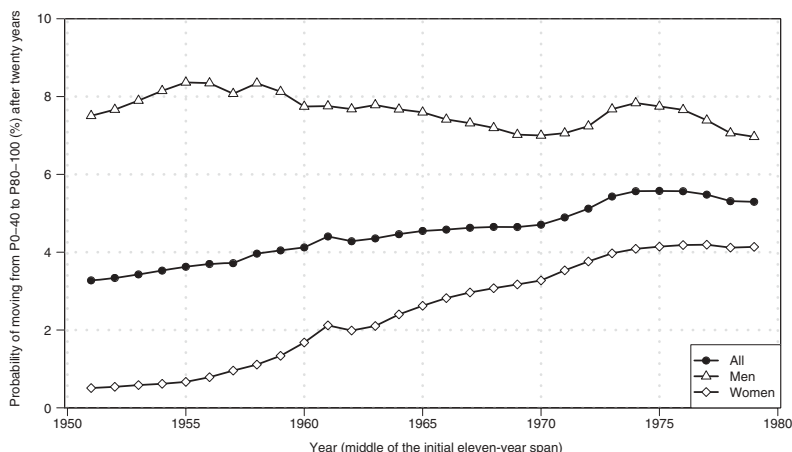
FIGURE XI

Long-Term Upward Mobility: Gender Effects

The figure displays in year t the probability of moving to the top quintile group (P80–100) for eleven-year average earnings centered around year $t + 20$ conditional on having eleven-year average earnings centered around year t in the bottom two quintile groups (P0–40). The sample is defined as all individuals aged 25 to 60 in year t and $t + 20$, with average eleven-year "commerce and industry" earnings around years t and $t + 20$ above the minimum threshold. Because of small sample size, series including earnings before 1957 are smoothed using a weighted three-year moving average with weight of 0.5 for cohort t and weights of 0.25 for $t - 1$ and $t + 1$. The series are reported for all workers, men only, and women only. In all three cases, quintile groups are defined based on the sample of all workers.

all workers is slightly increasing.[36] Figure XI also suggests that the gains in female annual earnings we documented above were in part due to earnings gains of women already in the labor force rather than entirely due to the entry of new cohorts of women with higher earnings. Such gender differential results are robust to conditioning on birth cohort, as series of early- to late-career upward mobility display a very similar evolution over time (see Online Appendix Figure A.10). Hence, our upward mobility results show that the economic progress of women since the 1960s has had a large impact on long-term mobility series among all U.S. workers.

Table III summarizes the long-term inequality and mobility results for all (Panel A), men (Panel B), and women (Panel C) by

36. It is conceivable that upward mobility is lower for women because even within P0–40, they are more likely to be in the bottom half of P0–40 than men. Kopczuk, Saez, and Song (2007) show that controlling for those differences leaves the series virtually unchanged. Therefore, controlling for base earnings does not affect our results.

TABLE III
LONG-TERM INEQUALITY AND MOBILITY

Year (1)	11-year earnings average Gini (2)	Rank correlation after 20 years (3)	Upward mobility after 20 years (4)	#Workers ('000s) (5)
		A. All		
1956	0.437	0.572	0.037	42,753
1978	0.477	0.494	0.053	61,828
1999	0.508			94,930
		B. Men		
1956	0.376	0.465	0.084	27,952
1978	0.429	0.458	0.071	37,187
1999	0.506			52,761
		C. Women		
1956	0.410	0.361	0.008	14,801
1978	0.423	0.358	0.041	24,641
1999	0.459			42,169

Notes. The table displays various measures of eleven-year average earnings inequality and long-term mobility centered around selected years, 1956, 1978, and 1999, for all workers (Panel A), men (Panel B), and women (Panel C). The sample in year t is defined as all employees with commerce and industry earnings averaged across the eleven-year span from $t-5$ to $t+5$ above a minimum threshold ($2,575 in 2004 and indexed using average wage for earlier years) and aged 25 to 60 (by January 1 of year t). Column (2) reports the Gini coefficients for those eleven-year earnings averages. Column (3) reports the rank correlation between eleven-year average earnings centered around year t and eleven-year average earnings centered around year $t+20$ in the sample of workers (1) aged between 25 and 60 in both years t and $t+20$, and (2) with eleven-year average earnings above the minimum threshold in both earnings spans $t-5$ to $t+5$ and $t+15$ to $t+25$. Column (4) reports the probability of moving to the top quintile group (P80–100) for eleven-year average earnings centered around year $t+20$ conditional on having eleven-year average earnings centered around year t in the bottom two quintile groups (P0–40). The sample is the same as in column (3). Column (5) reports the number of workers in thousands.

reporting measures for selected eleven-year spans (1950–1960, 1973–1983, and 1994–2004).

VI. CONCLUSIONS

Our paper has used U.S. Social Security earnings administrative data to construct series of inequality and mobility in the United States since 1937. The analysis of these data has allowed us to start exploring the evolution of mobility and inequality over a lifetime as well as to complement the more standard analysis of annual inequality and short-term mobility in several ways. We found that changes in short-term mobility have not substantially affected the evolution of inequality, so that annual snapshots of the distribution provide a good approximation of the evolution of the longer-term measures of inequality. In particular, we find that increases in annual earnings inequality are driven almost entirely by increases in permanent earnings inequality, with much more modest changes in the variability of transitory earnings.

However, our key finding is that although the overall measures of mobility are fairly stable, they hide heterogeneity by gender groups. Inequality and mobility among *male* workers has worsened along almost any dimension since the 1950s: our series display sharp increases in annual earnings inequality, slight reductions in short-term mobility, and large increases in long-term inequality with slight reduction or stability of long-term mobility. Against those developments stand the very large earning gains achieved by women since the 1950s, due to increases in labor force attachment as well as increases in earnings conditional on working. Those gains have been so great that they have substantially reduced long-term inequality in recent decades among all workers, and actually almost exactly compensate for the increase in inequality for males.

COLUMBIA UNIVERSITY AND NATIONAL BUREAU OF ECONOMIC RESEARCH
UNIVERSITY OF CALIFORNIA BERKELEY AND NATIONAL BUREAU
OF ECONOMIC RESEARCH
SOCIAL SECURITY ADMINISTRATION

REFERENCES

Abowd, John M., and Martha Stinson, "Estimating Measurement Error in SIPP Annual Job Earnings: A Comparison of Census Survey and SSA Administrative Data," Cornell University, Mimeo, 2005.

Attanasio, Orazio, Erich Battistin, and Hidehiko Ichimura, "What Really Happened to Consumption Inequality in the US?" in *Measurement Issues in Economics—The Paths Ahead. Essays in Honor of Zvi Griliches*, Ernst Berndt and Charles Hulten, eds. (Chicago: University of Chicago Press, 2007).

Autor, David, Lawrence F. Katz, and Melissa Schettini Kearney, "Trends in U.S. Wage Inequality: Revising the Revisionists," *Review of Economics and Statistics*, 90 (2008), 300–323.

Baker, Michael, and Gary Solon, "Earnings Dynamics and Inequality among Canadian Men, 1976–1992: Evidence from Longitudinal Income Tax Records," *Journal of Labor Economics*, 21 (2003), 289–321.

Blau, Francine D., "Trends in the Well-being of American Women, 1970–1995," *Journal of Economic Literature*, 36 (1998), 112–165.

Blau, Francine D., Marianne Ferber, and Anne Winkler, *The Economics of Women, Men and Work*, 4th ed. (Prentice-Hall, 2006).

Carroll, Robert, David Joulfaian, and Mark Rider, "Income Mobility: The Recent American Experience," Andrew Young School of Policy Studies, Georgia State University Working Paper 07-18, 2007.

Congressional Budget Office, "Trends in Earnings Variability over the Past 20 Years," Letter to the Honorable Charles E. Schumer and the Honorable Jim Webb, April 2007. Available at http://www.cbo.gov/ftpdocs/80xx/doc8007/04-17-EarningsVariability.pdf.

Cutler, David, and Lawrence Katz, "Macroeconomic Performance and the Disadvantaged," *Brookings Papers on Economic Activity*, 2 (1991), 1–74.

Dynan, Karen E., Douglas W. Elmendorf, and Daniel E. Sichel, "The Evolution of Household Income Volatility," Brookings Institution Working Paper, 2008.

Ferrie, Joseph P., "History Lessons: The End of American Exceptionalism? Mobility in the United States since 1850," *Journal of Economic Perspectives*, 19 (2005), 199–215.

Fields, Gary S., "Income Mobility," Cornell University ILR School Working Paper 19, 2007. Available at http://digitalcommons.ilr.cornell.edu/workingpapers/19.

Goldin, Claudia, *Understanding the Gender Gap: An Economic History of American Women*, NBER Series on Long-Term Factors in Economic Development (New York/Oxford/Melbourne: Oxford University Press, 1990).

——, "The Role of World War II in the Rise of Women's Employment," *American Economic Review*, 81 (1991), 741–756.

——, "The Quiet Revolution That Transformed Women's Employment, Education, and Family," *American Economic Review Papers and Proceedings*, 96 (2006), 1–21.

Goldin, Claudia, and Robert A. Margo, "The Great Compression: The Wage Structure in the United States at Mid-Century," *Quarterly Journal of Economics*, 107 (1992), 1–34.

Gottschalk, Peter, "Inequality, Income Growth, and Mobility: The Basic Facts," *Journal of Economic Perspectives*, 11 (1997), 21–40.

Gottschalk, Peter, and Robert Moffitt, "The Growth of Earnings Instability in the U.S. Labor Market," *Brookings Papers on Economic Activity*, 2 (1994), 217–254.

Hacker, Jacob S, *The Great Risk Shift: The Assault on American Jobs, Families Health Care, and Retirement—And How You Can Fight Back* (Oxford, UK: Oxford University Press, 2006).

Hungerford, Thomas L., "U.S. Income Mobility in the Seventies and Eighties," *Review of Income and Wealth*, 39 (1993), 403–417.

Katz, Lawrence F., and David Autor, "Changes in the Wage Structure and Earnings Inequality," in *Handbook of Labor Economics*, Orley Ashenfelter and David Card, eds. (Amsterdam/New York: Elsevier/North Holland, 1999).

Katz, Lawrence F., and Kevin M. Murphy, "Changes in Relative Wages, 1963–87: Supply and Demand Factors," *Quarterly Journal of Economics*, 107 (1992), 35–78.

Kestenbaum, Bert, "Evaluating SSA's Current Procedure for Estimating Untaxed Wages," *American Statistical Association Proceedings of the Social Statistics Section*, *Part 2* (1976), 461–465.

Kopczuk, Wojciech, Emmanuel Saez, and Jae Song, "Uncovering the American Dream: Inequality and Mobility in Social Security Earnings Data since 1937," National Bureau of Economic Research Working Paper 13345, 2007.

Krueger, Dirk, and Fabrizio Perri, "Does Income Inequality Lead to Consumption Inequality? Evidence and Theory," *Review of Economic Studies*, 73 (2006), 163–193.

Lemieux, Thomas, "Increasing Residual Wage Inequality: Composition Effects, Noisy Data, or Rising Demand for Skill?" *American Economic Review*, 96 (2006), 461–498.

Lindert, Peter, "Three Centuries of Inequality in Britain and America," in *Handbook of Income Distribution*, Anthony B. Atkinson and Francois Bourguignon, eds. (Amsterdam/New York: Elsevier/North Holland, 2000).

Panis, Constantijn, Roald Euller, Cynthia Grant, Melissa Bradley, Christine E. Peterson, Randall Hirscher, and Paul Steinberg, SSA Program Data User's Manual, RAND, 2000. Prepared for the Social Security Administration.

Piketty, Thomas, and Emmanuel Saez, "Income Inequality in the United States, 1913–1998," *Quarterly Journal of Economics*, 118 (2003), 1–39.

Schiller, Bradley R., "Relative Earnings Mobility in the United States," *American Economic Review*, 67 (1977), 926–941.

Shin, Donggyun, and Gary Solon, "Trends in Men's Earnings Volatility: What Does the Panel Study of Income Dynamics Show?" National Bureau of Economic Research Working Paper 14075, 2008.

Shorrocks, Anthony F., "Income Inequality and Income Mobility," *Journal of Economic Theory*, 19 (1978), 376–93.

Slesnick, Daniel T., *Consumption and Social Welfare: Living Standards and Their Distribution in the United States* (Cambridge/New York/Melbourne: Cambridge University Press, 2001).

Social Security Administration, *Handbook of Old-Age and Survivors Insurance Statistics* (annual), (Washington, DC: U.S. Government Printing Office, 1937–1952).

——, *Social Security Bulletin: Annual Statistical Supplement* (Washington, DC: Government Printing Press Office, 1967).

Solow, Robert M., "On the Dynamics of the Income Distribution," Ph.D. dissertation (Harvard University, 1951).

Topel, Robert H., and Michael P. Ward, "Job Mobility and the Careers of Young Men," *Quarterly Journal of Economics*, 107 (1992), 439–479.