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Income Variability: Effects on U.S. Income Inequality and Tax Progressivity

by

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ABSTRACT

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Income variability explains a significant fraction of the increase in annual income inequality. Chapter 2 considers the impact of variability on tax unit inequality. Using income tax return panel data, I estimate that up to a fifth of the increase in top one percent income shares between the early 1980s and 2000s was caused by variability. Increased income variability over this period resulted from mean-reverting fluctuations in the bottom quintile and top one percent. Variability in the top of the distribution seems partly driven by permanent income shifting in response to the Tax Reform Act of 1986.

Chapter 3 examines the individual earnings distribution. Using Social Security Administration earnings panel data, I estimate that variability explains half of the increase in annual inequality in the bottom half of the distribution between 1973 and 1985. When workers with years of zero earnings are included, increasing earnings variability explains almost *all* of this group's increase in inequality. The increase in earnings variability appears to be explained by an increased fraction of working age

men with years of zero earnings.

Annual individual earnings inequality in the bottom half of the distribution not only increased with variability in the 1970s and 1980s, but also fell with variability in the 1950s and early 1960s. This suggests that the U-shaped trend in income inequality observed over these decades was partly caused by first a fall and then a rise in earnings variability.

Between 1985 and 2000, falling variability caused most of the decline in annual earnings inequality within the bottom half of the distribution. Within the top of the distribution, earnings inequality increased over this period because of changes in permanent earnings and not increasing variability.

Income variability means that in a progressive tax system annual and lifetime federal tax rates can diverge. Chapter 4 shows that on an annual basis, those at the bottom of the distribution pay little or no federal income taxes, while on a lifetime basis they pay average tax rates about five percentage points higher. Income variability also means there is a trade-off between vertical and horizontal equity.

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Chapter 1

Introduction

Many researchers have documented increasing annual income inequality in the U.S. over the last four decades. While increasing returns to skill and technological change are common explanations, many other factors could contribute to increasing income dispersion.[1] Piketty and Saez (2003) propose that social norms could have become more accepting of inequality. Others point to compositional changes, such as an increase in the fraction of single households (Fitzgerald, 2008; Levy, 1987) and assortative mating (Schwartz, 2010; Fernndez and Rogerson, 2001). This dissertation uses tax return and Social Security Administration panel data to show that a significant fraction of the increase in inequality is explained by income variability. Changes in tax policy and in men's employment patterns are identified as especially important sources of changing variability.

Income variability implies that workers can have different incomes in a given year, creating annual inequality, but may have more similar incomes when averaged over a number of years, leading to lower multi-year inequality. In this case, variability acts as an equalizer of longer-term incomes. This relates to what other authors refer to as mobility (Buchinsky and Hunt, 1999; Kopczuk, Saez and Song, 2010),

[1]Katz and Autor (1999) and Goldin and Katz (2001) document rising inequality. Katz and Murphy (1992), Juhn, Murphy and Pierce (1993) and Autor, Katz and Kearney (2006) discuss returns to skill. Autor, Katz and Krueger (1998), Acemoglu (2002), Bound and Johnson (1992), Autor, Katz and Kearney (2008) and Guvenen and Kuruscu (2009) address technological change.

instability (Gottschalk and Moffitt, 1994, 2009; Hacker and Jacobs, 2008; Haider, 2001), transitory variance (Moffitt and Gottschalk, 2012), and volatility (Hertz, 2007; Jensen and Shore, 2008).[2]

Income variability has increased at both the top and bottom of the distribution. I estimate that increasing tax unit income variability explains up to a fifth of the increase in top one percent income shares between the early 1980s and early 2000s. In the bottom half of the individual earnings distribution, I find that almost *all* of the increase in individual earnings inequality between the early 1970s and mid-1980s was caused by earnings variability. Administrative data reveal that the fraction of prime-age men with years of zero earnings grew dramatically and caused most of this increase in earnings variability.

While many authors have estimated trends in income and earnings variability,[3] few studies show how variability affects inequality. Gottschalk and Moffitt (2009) use the Panel Study of Income Dynamics (PSID) to estimate that increasing earnings instability caused about half of the increase in male earnings inequality from 1974 to 1990. They also document a dramatic increase in family income instability since the late 1980s but do not estimate the impact on inequality. In contrast, Kopczuk, Saez and Song (2010, hereafter KSS) use Social Security data to estimate that individual earnings variability explains little of the increase in

[2]Following Congressional Budget Office (2008*b*), I use the term *variability*, as I measure a broad range of income and earnings shocks, including years of low or zero earnings.

[3]Dynan, Elmendorf and Sichel (2008) estimate that between 1971 and 2004 household income volatility increased by one-third. Shin and Solon (2011) find that male earnings volatility increased in the 1970s and then remained relatively constant until around 2000. Both of these papers provide summaries of other studies.

earnings inequality. This dissertation reconciles these different findings for individual earnings. Moreover, I show how variability affects tax unit income inequality, which is roughly similar to household inequality measures that are commonly used.

I also demonstrate that the use of different summary statistics to measure income dispersion can lead to different results. It appears that Gottschalk and Moffitt (2009) find a large increase in earnings instability in part because they measure dispersion with the variance of log earnings, which emphasizes the bottom of the distribution. By comparison, KSS appear to have estimated a small and constant level of earnings variability because they measure dispersion with Gini coefficients, which emphasize the middle of the distribution (Sen and Foster, 1973). The difference in their results arises primarily because earnings variability is greatest at the bottom of the distribution and has increased mostly at the bottom and top of the distribution, and these effects are poorly measured by changes in the Gini coefficient, which is relatively insensitive to changes at the ends of the distribution.

Relying on a single summary statistic to measure income dispersion can also lead to suspect interpretations of the data. For example, Hacker (2008) interprets increasing earnings volatility as affecting the middle class, when the summary statistics he uses are likely capturing increasing volatility at the bottom of the distribution. To address these issues, I provide and compare results for a number of different dispersion measures, each of which emphasize a different part of the distribution. I also measure inequality using income shares, which shows how income variability changed at the top and bottom of the distribution. Using these measures and new panel data, I provide perhaps the first estimates of income variability for

the top one percent of the income distribution. These measures also allow me to keep workers with years of zero earnings in my sample, revealing important trends in movements in and out of employment by men since the 1950s and their effects on earnings inequality.

1.1 Tax Unit Income Inequality

Whereas income variability studies often drop the top one percent of the distribution because of top-coding or reporting concerns, tax return panel data allows me to study the effect of income variability within the top one percent. After matching Piketty and Saez (2003) income definitions and shares, I find that a tenth of the increase in top one percent income shares that occurred between the early 1980s and early 2000s was explained by five-year variability. Averaging income over longer periods of time captures more income fluctuations. Eleven-year variability explains a fifth of the increase in top one percent income shares.

Increasing top income concentration and variability appear to be caused in part by permanent income shifting in response to the Tax Reform Act of 1986. This reform lowered the top personal tax rate below the corporate tax rate, causing some closely-held businesses to convert from C-corporations to pass-through entities. This implies that the reporting of relatively variable business profits shifted from corporate to personal tax returns, both increasing top income variability and measured top income shares. The fraction of top one percent income (excluding capital gains) from pass-through profits jumped from 11 to 21 percent in the two years following the 1986 reform—accompanying a large jump in variability—and has steadily increased

to about 30 percent (Piketty and Saez, 2003).

Considering the entire distribution, I find that between the early 1980s and 2000s, variability explains a quarter of the increase in after-tax income inequality and a third of the increase in earnings inequality (when excluding negative and zero earnings). Most of this earnings variability comes from the bottom quintile and top one percent; specifically, from gains at the bottom of the distribution and losses at the top. This *mean reversion* results from negative shocks temporarily pushing families into low earnings groups, and positive shocks temporarily inflating the earnings of families at the top of the distribution.

1.2 Individual Earnings Inequality

Using Social Security Administration panel data, I estimate that earnings variability explains half of the increase in annual inequality in the bottom half of the distribution between 1973 and 1985. When workers with years of zero earnings are included, increasing earnings variability explains almost *all* of this group's increase in inequality. The increase in earnings variability appears to be driven by an increased fraction of working age men with years of zero earnings, reflecting more movements in and out of employment.

Annual individual earnings inequality in the bottom half of the distribution not only increased with variability in the 1970s and 1980s, but also fell with variability in the 1950s and early 1960s. This suggests that the U-shaped trend in income inequality observed over this period was partly caused by first a fall and then

a rise in earnings variability.

The period of the Great Moderation is distinguished by a period of lower macroeconomic volatility. Individual earnings variability may have also decreased during the Great Moderation, but the evidence for this is not clear. A number of studies have found falling earnings variability (Sabelhaus and Song, 2009, 2010; Congressional Budget Office, 2008*b*), while others have found relatively stable earnings variability (Gottschalk, McEntarfer and Moffitt, 2008; Celik et al., 2009; DeBacker et al., 2010) or even increasing variability (Dynan, Elmendorf and Sichel, 2008). As noted above, however, looking only at the entire distribution may obscure different within-group trends. I find *decreasing* inequality in the bottom half of the distribution between 1985 and 2000, which was largely caused by decreasing variability, and *increasing* inequality in the top of the distribution, which was caused by increasing permanent earnings inequality.

I also show that studies measuring dispersion with the variance of log earnings, which often drop workers from the sample who have low or zero earnings, will miss some important variability trends caused by movements in and out of employment.[4] The high fraction of women with zero earnings in a given year also

[4]Gottschalk and Moffitt (1994, 2009) trim the bottom one percent because low earnings "distort estimates of inequality based on the variance of log income because, as incomes go to zero, the log of income goes to minus infinity, thus driving the variance of log income to infinity. As a result, even small absolute changes in incomes at the bottom of the distribution can have large effects on estimates of the instability of incomes." (Gottschalk and Moffitt, 2009, p. 10) Dropping only the bottom one percent is sufficient to address this in the PSID, as a very small fraction of prime-age white males report extremely low earnings in a given year. In contrast, in Social Security Administration earnings data between five and eleven percent of prime-age men had zero earnings in a year (this is after dropping years of zero earnings at the ends of the prime-age window). This suggests that male earnings reported in surveys may be biased upward in years of low earnings.

means that studies usually only consider male earnings variability. My alternative dispersion measures allow me to overcome issues with zero earnings and to retain women in my sample of individual earnings. The prevalence and strong impact of years with zero earnings found in this study suggests that the extensive margin will be important in correctly specifying parametric earnings processes for men and women.

A further contribution of this research is that rather than providing estimates based on survey data from a few thousand workers, I use two administrative panels, each with about a quarter million men and women beginning almost two decades before the PSID. In fact, these appear to be the longest public-use panels of U.S. earnings available and allow me to measure earnings variability over workers' entire lifetimes. This is important because it shows how variability increases with the number of years over which earnings are averaged.

1.3 Lifetime Tax Progressivity

Tax progressivity estimates traditionally use annual tax burdens and incomes to show how tax burdens vary over the income distribution. But if individuals and households can smooth consumption over time, then tax progressivity should be considered from a multi-year or perhaps even lifetime perspective. Annual and multi-year effective tax rates may differ significantly in a progressive tax system because of income variability. While the bottom decile of consistent tax filers pays little or no federal income taxes in a given year, I estimate that over eleven years,

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Gottschalk and Huynh (2010) compare tax data to SIPP survey responses and find that tax based earnings are less equal, as there is a higher fraction of low earnings.

these families pay average effective tax rates of about five percent. I also estimate that the bottom half of the individual earnings distribution pays more taxes over their lifetimes than annual measures suggest.

Income variability also creates horizontal equity issues not apparent with annual estimates because individuals and tax units who are "equal" in terms of a multi-year income measure will not be treated "equally" under a progressive tax system. For example, when two workers have equal lifetime income, the worker with the more variable income will often pay more taxes over their lifetime. I estimate that some workers in the fifth lifetime earnings decile pay taxes equal to nine percent of their lifetime earnings, while others pay up to fourteen percent. A more progressive tax system and a larger divergence in income variability between workers with similar lifetime incomes will increase this horizontal inequity. So while economists are familiar with the trade-off between vertical equity and efficiency, income variability means there is also a trade-off between vertical and horizontal equity, where vertical equity is measured by the progressivity of tax rates on annual income and horizontal equity considers multi-year measures of taxes and income.

Chapter 2

Income Variability in the United States: One Cause of Increasing Annual Income Inequality

2.1 Introduction

Annual income inequality in the U.S. has increased dramatically over the last four decades. Much of increasing U.S. income inequality has been driven by growing concentration at the top of the distribution. This chapter uses tax return panel data to estimate that up to a fifth of the increase in top one percent income shares are explained by income variability. So while annual income concentration among the top one percent grew significantly since the mid-1980s (Piketty and Saez, 2003), income variability among these top earners increased at the same time. Increasing top income concentration and variability appear caused in part by permanent income shifting in response to the Tax Reform Act of 1986. I also find a large and growing amount of variability in the bottom quintile of the distribution.

Most studies of variability have focused on earnings, rather than income. Earnings variability estimates can vary significantly when using different earnings definitions, sample restrictions, and measures of dispersion. Studies that include self-employment earnings and low-earnings workers and measure dispersion using the variance of log earnings show a large effect of variability on inequality. By comparison, studies that exclude self-employment earnings and low-earnings workers and use Gini coefficients

show a small effect.

For example, Gottschalk and Moffitt (2009) use the Panel Study of Income Dynamics (PSID) to estimate that about half of the increase in annual male earnings inequality from 1974 to 1990 was caused by increasing instability. They define transitory earnings as the difference between annual and nine-year average log earnings and instability as the variance of these transitory components. I extend this research in a number of ways. First, I use a more straightforward approach to measure the impact of earnings variability on inequality by comparing inequalities of annual and multi-year earnings. Second, I use a number of dispersion measures, including generalized entropy measures and income shares. These measures allow me to identify the parts of the distribution causing inequality and variability changes. Third, while Gottschalk and Moffitt trim the top one percent because of top-coding issues, I use a panel of tax returns to show the impact of income variability from the top one percent.

By comparison, Kopczuk, Saez and Song (2010) find a small effect of earnings variability on inequality in a study that uses Social Security data, excludes self-employment earnings and low-earnings workers (below $2,575 in 2004 dollars), and estimates dispersion with Gini coefficients. I show that such an approach may be somewhat misleading because self-employment earnings and low-earnings workers contribute significantly to earnings variability. In addition, the Gini coefficient seems to underestimate the impact of variability relative to alternative dispersion measures because it emphasizes the middle of the distribution (Sen and Foster, 1973) and thus downplays the effects of the increasingly volatile ends of the distribution.

Most studies of earnings variability only consider individual male earnings. If one considers earnings inequality as a proxy for consumption inequality, then household income seems like the natural focus, as consumption decisions are thought to be made at the household level. Tax unit level income provides an approximation of household income, especially for the top of the distribution.[1] DeBacker et al. (2010) is perhaps the only other study using tax unit level data to estimate the impact of variability on inequality. The authors estimate that between 1987 and 2006, instability caused 30 to 40 percent of the increase in annual tax unit income inequality. Though their results are similar to those I estimate, their data starts later than that used in this study and misses some of the 1980s increase in top one percent income concentration.

Section 2 of this chapter reviews recent estimates of income and earnings variability. Section 3 explains how earnings variability is measured. Section 4 describes the panel data used in this study. Section 5 examines top one percent income shares. Section 6 examines tax unit income variability across the distribution. Section 7 considers earnings variability. Section 8 discusses causes of increasing variability in the top of the distribution.

2.2 Evidence for Increasing Short-term Volatility

A number of papers find increasing short-term volatility in the U.S. since the 1970s, although they often do not integrate these findings with increasing inequality. Using

[1] Burkhauser, Larrimore and Simon (2012) show some differences between tax unit and household income. Not including dependents, they estimate that in the 1980s about 80 percent of households had only one tax unit, while about 16 percent of households had two tax units.

the PSID, Dynan, Elmendorf and Sichel (2008) estimate that between 1971 and 2004 household income volatility increased by one-third. Jensen and Shore (2008) also find increasing volatility with the PSID.

Earnings variability at the bottom and top of the distribution may contribute significantly to overall earnings variability. Gottschalk and Moffitt (2009) show that male transitory earnings were about three times larger in the bottom quarter of the distribution. Sabelhaus and Song (2009) find that adding the bottom ten percent of Social Security earnings records for workers age 25 to 55 causes volatility to double. Jensen and Shore (2008) find that increasing income volatility since the 1970s has not affected most individuals; the largest volatility increases were in the top five percent of the income distribution and volatile incomes were much more likely among the self-employed and those self-identified as risk-tolerant. Splinter, Bryant and Diamond (2009) find large earnings mean reversion in the 2000s among tax units at the bottom and top of the distribution of consistent filers, with a bottom quintile average annual earnings gain of 37 percent ($3,000) and top 0.01 percent average loss of 27 percent ($3 million).

Rather than relying only on income, many studies instead consider consumption as a better proxy of welfare. Keys (2006, p. 7) expresses the conventional finding: "Consumption volatility is drastically smaller than earnings volatility, and suggests that households are able to smooth consumption across years by borrowing and saving accordingly." Similarly, Blundell, Pistaferri and Preston (2008) explain the growing gap between income and consumption inequality by the increase in transitory income shocks, which is more insurable than permanent income

shocks. Krueger and Perri (2006) estimate that during the 1980s within group income inequality increased three times more than consumption inequality. They theorize that improved credit markets allowed for better consumption smoothing. Dynarski and Gruber (1997) estimate that in the 1970s and 1980s only about 10 percent of household head earnings variability translated into changes in nondurable consumption. Despite improved consumption smoothing, these papers still find that consumption volatility has increased significantly. Gorbachev (2011) estimates that the mean volatility of household food consumption increased 60 percent between 1968 and 1985, suggesting an important impact of rising income variability on consumption.

While consumption inequality may serve as the closest approximation to welfare inequality, multi-year income still may give a better measure than annual incomes. Slemrod (1992) argues that inequality is better represented by multi-year incomes, or what he calls "time-exposure income", rather than annual or "snapshot income", which can give a distorted view of long-term well-being. The increase in the top one percent income concentration caused by variability estimated in this study should be interpreted within this framework—high income households should be able to smooth spending over a number of years and so consumption inequality, proxied by multi-year incomes, should increase less than annual income inequality.

2.3 Measuring Earnings Variability

Simple relationships between annual and multi-year earnings inequalities can be used to estimate the fraction of increasing annual inequality caused by increasing

variability. Following Shorrocks (1978); Maasoumi and Zandvakili (1990); Fields (2010), and Kopczuk, Saez and Song (2010), Equation 2.1 defines the percentage of annual inequality explained by variability as the relative gap between annual and multi-year inequalities—a version of Shorrocks indices—where *Ineq* can be any number of dispersion measures: Theil index, Gini coefficient, income shares, etc.

$$\%Variability = \frac{Ineq_{Annual} - Ineq_{Multi-year}}{Ineq_{Annual}} \tag{2.1}$$

Annual inequality measures the dispersion of annual income, Y, and are usually averaged over the multi-year period to give smoothed annual inequalities: $Ineq_{SmoothedAnnual} = \frac{\sum_{t=1}^{T} Ineq(Y_t)}{T}$. Smoothed annual inequalities should remove the cyclical component of variability. Multi-year inequality measures the dispersion of observation level incomes averaged over the multi-year period: $Ineq_{Multi-year} = Ineq\left(\frac{\sum_{t=1}^{T} Y_t}{T}\right)$.

This measure of variability can be used to examine inequality changes between two points in time. The percentage variability is used to calculate the overall change (Equation 2.2) and the percentage change (Equation 2.3) of annual inequality caused by variability. Equation 2.2 makes clear that variability causes annual inequality to increase by growing the gap between annual and multi-year inequalities.

$$\begin{aligned}
&\Delta Ineq_{Annual from Variability} \\
&\quad = (\%Variability \cdot Ineq_{Annual})_{End} - (\%Variability \cdot Ineq_{Annual})_{Begin} \\
&\quad = (Ineq_{Annual} - Ineq_{Multi-year})_{End} - (Ineq_{Annual} - Ineq_{Multi-year})_{Begin} \qquad (2.2)
\end{aligned}$$

$$\%\Delta Ineq_{Annual from Variability} = \frac{\Delta Ineq_{Annual from Variability}}{\Delta Ineq_{Annual}} \qquad (2.3)$$

A few examples illustrate how these measures work. If the percentage of income inequality caused by variability is constant over a period, then this percentage also measures how much of the change in annual inequality was caused by variability. So if the annual Gini increased from 0.50 to 0.60 and 20 percent of inequality was caused by variability at the beginning and end of the period, then the fraction of the inequality increase caused by variability is also 20 percent: $[(0.20 \cdot 0.60) - (0.20 \cdot 0.50)]/(0.60 - 0.50) = 0.20$. A small increase in *%Variability* can also explain a significant fraction of an inequality increase. For the same increase in annual Gini, if *%Variability* increased from 10 to 25 percent, then variability would have caused all of the inequality increase: $[(0.25 \cdot 0.60) - (0.10 \cdot 0.50)]/(0.60 - 0.50) = 1.0$. In this case, permanent income inequality remained at 0.45, while annual inequality due to variability increased from 0.05 to 0.15.

Table 2.1 shows an example of measuring variability with this method using

the top one percent income share as the measure of inequality. Top income shares shows clearly how rank reversals and mean reversion cause income variability. In the first set of three years, the three top earners rotate positions, with one falling out of the top one percent each year. In addition to this rank reversal, there is also mean reversion—incomes rise after a bad year and fall after an especially good year. The total three-year income for A and B is 21 and for C is 18. This means A and B are in the top one percent when considering three-year average earnings, and their average earnings share is: $(21/3) + (21/3) = 14$. The gap between annual and three-year incomes shares gives a *%Variability* of $(16\% - 14\%)/16\% = 12.5\%$.

The second three year period—years 4 through 6—shows an increase in both income concentration and variability. The three top earners have larger incomes in their best years but also no income in their worst years. So despite annual income shares increasing substantially, three-year average income shares only increase to 16%. Half of the inequality increase is explained by increasing variability: $[(20\% \cdot 20\%) - (12.5\% \cdot 16\%)]/(20\% - 16\%) = 50\%$.

Table 2.1 : Fictional example of top one percent income shares and fraction of inequality explained by variability

Year	**Income Shares**					**Top 1% Income Shares**		**Variability**
	P0	P1-P98	P99	Top 1%		Annual	3-Year Avg.	**over 3-Years**
1	0	80	4_A	7_B	9_C	16%		
2	0	80	4_B	5_C	11_A	16%	14%	12.5%
3	0	80	4_C	6_A	10_B	16%		
4	0_A	80		10_B	10_C	20%		
5	0_B	80		2_C	18_A	20%	16%	20%
6	0_C	80		6_A	14_B	20%		

Whereas the previous example considered incomes averaged over only three years, the effect of income variability on inequality will change with the length of time considered (Poterba, 1989; Barthold, 1993). Ultimately, the appropriate length of time will depend on our concern. For an analysis of poor households unable to insure against transitory shocks, we may focus on the short-term over three or five years (Newman, 2006; Blundell, Pistaferri and Preston, 2008). For an analysis of high-skill workers who knowingly forgo income to earn advanced degrees and higher earnings, we may focus on the long-term over a decade or more. In addition, changes in short-run income inequality may show the effects of business cycle related labor supply and demand shocks, while changes in long-run inequality may result from shifts in the adoption of technology (Autor, Katz and Krueger, 1998). This chapter only considers incomes over five and eleven-year periods, but the next chapter considers up to thirty-one year periods.

2.4 Income Tax Panels: 1979-1990 & 1999-2009

This study compares income variability and inequality in two panels of tax returns: the Continuous Work History Sample (CWHS) and the 1999 Individual Income Tax Return Edited Panel. The CWHS is a panel that tracks data on tax filers between 1979 and 1990. The panel is embedded in IRS public-use tax return micro-files for individual years and chosen randomly based on four-digit endings of primary taxpayers' Social Security numbers. By following Social Security numbers, marriages and divorces cause some secondary taxpayers to enter or leave the sample. Burman et al. (2010, p. 4) write that "non-random attrition behavior in the CWHS panel

mirrors the attrition in the universe, and cannot be characterized as bias or error." Christian and Frischmann (1989) and Congressional Budget Office (2005) show low rates of attrition and Weber (2005) discusses the gender bias that can result from following primary filers, as men are listed as the primary taxpayer on over 95 percent of joint returns.

Although the CWHS tax return dataset has comprehensive information on income received and taxes paid, it only includes tax unit and not individual level incomes. While defining a consistent sample of individuals over many years is relatively straightforward, defining a consistent sample of tax units is not as easy to accomplish due to tax units uniting and splitting over time. As this tax return panel does not allow the tracking of individuals, tax units are the unit of observation and are not adjusted for marriage or divorce. To make comparisons with tax unit based inequality studies, such as Piketty and Saez (2003), this seems like the appropriate approach.

Some observations in the CWHS are sampled every year and others at less frequent intervals. To limit issues arising from taxpayers entering and exiting the sample due to sampling, I restrict the sample to tax units that were planned to be sampled every year of the panel. Hence, sampling is based on a single Social Security number last four digit combination, or a 0.01 percent sample consisting of 16,000 observations. I then drop a tax unit's earnings if they had no earnings throughout the entire panel and in years when the primary filer or both filers claimed age exemptions (at least 65 years old) and the tax unit had reported no earnings for at least two subsequent years. Finally, I drop dependents in the year they filed as dependents and all previous years. This restriction is only available

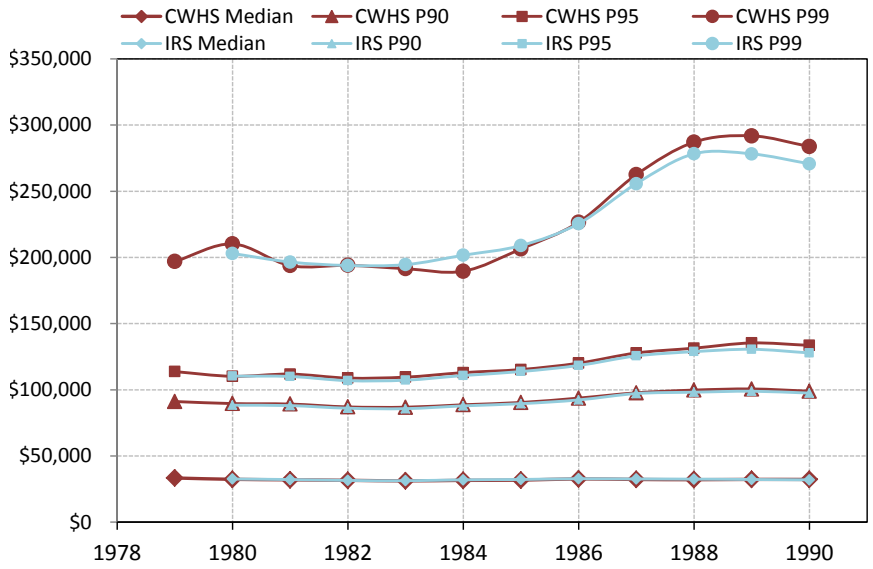
beginning in 1987, but before that far fewer dependents were required to file tax returns.[2] These restrictions create the "non-retired sample", the base sample used for this chapter, with the exception of the Piketty and Saez replications in the next section. Tax unit earnings are present for 8,495 tax units at the beginning of the sample and 9,978 at the end, with tax units filing an average of seven and a half years.

The CWHS is representative, so no weights are assigned to observations. Figure 2.1 shows that adjusted gross income (AGI) percentile cutoffs for the CWHS overlap with cutoffs for all tax returns. As expected, cutoffs are slightly higher for years when more dependents are dropped from the CWHS but included in the IRS data (see Table A1 for percentile cutoffs and cutoff ratios).

A number of other restrictions are made to limit the sample to tax units with at least minimal labor force attachment and consistently in the panel. When including years with incomes or earnings of zero, I follow a method similar to Kopczuk, Saez and Song (2010) by dropping tax units for a given year when their *average* earnings throughout a multi-year period falls below a threshold of about a quarter of the minimum wage ($2,575 in 2004 and indexed with average earnings). I focus on tax units that are present throughout five-year periods. This drops tax units from the "non-retired sample" filing sporadically, leaving the five-year sample in 1981 with 6,067 tax units and in 1988 with 6,459 tax units. The same restrictions are used to

[2]Before 1987, dependents could claim an exclusion on both their own and their parents' tax return, meaning far fewer dependents filed their own returns. Gould (1987, p. 1) wrote at the time, "Under the old law, you needed $1,080 of investment income or $3,560 of gross income before you had to file a tax return. Now, dependent children with gross income that exceeds the standard deduction of $2,540 in 1987 ($3,000 in 1988) or who have more than $500 of investment income must file a Form 1040—even if they ultimately owe no tax." Dependents make up a constant 9 percent of the five-year sample.

Figure 2.1 : Adjusted gross income percentile cutoffs of tax units ($2010, CPI-U-RS)



Source: IRS and CWHS "non-retired sample"

make a "non-retired sample" for the Edited Panel.

The Edited Panel—also called the High Income Cohort or the Sales of Capital Assets panel sample—is a sample of tax returns. The sample begins with 83,434 tax returns in 1999 and follows all individuals listed as taxpayers on these returns until 2009. The base year of the panel oversamples top earners, including about 10,000 tax returns in the top one percent of the earnings distribution (Splinter, Bryant and Diamond, 2009) and *all* tax units with incomes over $5 million (Weber and Bryant, 2005). This oversampling allows income variability estimates even for the top one-hundredth of one percent of the distribution.

The Edited Panel is a stratified random sample, with original stratum bound-

aries set in the base year. This may lead to estimation issues as some returns change strata. For example, tax units starting in low strata—with high base weights due to low sampling rates—can move into higher strata and become over-represented. To address this issue, weights of these stratum changers are trimmed.

Unlike the CWHS, which allows many new tax filers to enter the sample, the Edited Panel follows the same set of taxpayers and so suffers from more problematic attrition. While in the CWHS attrition should generally mirror changes in the population of filers, attrition may bias the Edited Panel, which represents 100 percent of tax returns in 1999 but only 78 percent in 2005. Bryant (2008) estimates that about a third of missing filers were intermittent filers. Of the other missing filers, deaths explain about a third and gross incomes falling below the threshold needed to file a return explain the other two-thirds. The threshold for being required to file was about $11,000 in 1985 and $18,300 in 2004 for joint filers (2010 dollars). As low incomes were relatively stagnant in this period, the growing threshold means there could be more missing returns due to low incomes in the Edited Panel than the CWHS. Also, a growing fraction of single filers—whose threshold was about half of the joint filer threshold—may exacerbate attrition due to non-filers.

It is not clear how the large attrition of low income non-filers will affect income variability estimates of the bottom of the distribution. Upwardly biased variability would result if many non-filers had low variability incomes below the threshold. Meanwhile, downwardly biased variability would result if many non-filers had low income only that year and higher income in other years, as these inconsistent filers may be dropped from the samples in this study. The large amount

of mean reversion found in the bottom quintile—where those at the bottom of the distribution tend to have large gains in subsequent years—suggests that non-filing may downwardly bias bottom quintile variability in the Edited Panel.

This study uses a number of income definitions, all of which are assigned to tax units by filing period years to adjust for late returns and are indexed to 2010 dollars with the CPI-U-RS. *Cash income* includes wages, salaries, tips, net capital gain or loss (unless otherwise specified),[3] taxable and tax-exempt interest, dividend income, net income from business (sole proprietorships, partnerships, and S corporations), farm income, net rental income, royalty income, taxable and non–taxable pension and annuity income, net alimony received/paid, unemployment compensation, state income tax refunds and other income in AGI except for Social Security benefits, as they were unavailable for some years. Cash income is similar to the income definition used by Piketty and Saez (2003), although it includes unemployment benefits and excludes employee payroll taxes. It is also similar to the definition used by Auten and Gee (2009), although it excludes Social Security benefits.

After-tax cash income subtracts federal taxes paid from cash income and adds earned income credits. *Income* is the Piketty and Saez (2003) gross income definition, set in the CWHS by adding the employee component of payroll taxes (as estimated by earnings) to cash income and excluding capital gains and set in the Edited Panel by adding the employee component of payroll taxes to AGI minus capital gains, minus Social Security and unemployment insurance in AGI, and plus

[3]Due to the 60 percent exclusion of long-term capital gains between 1979 and 1986, net capital gains reported on tax returns are multiplied by 2.5 for those years.

adjustments. *Earnings* are total wages, salaries, and tips reported on tax forms.

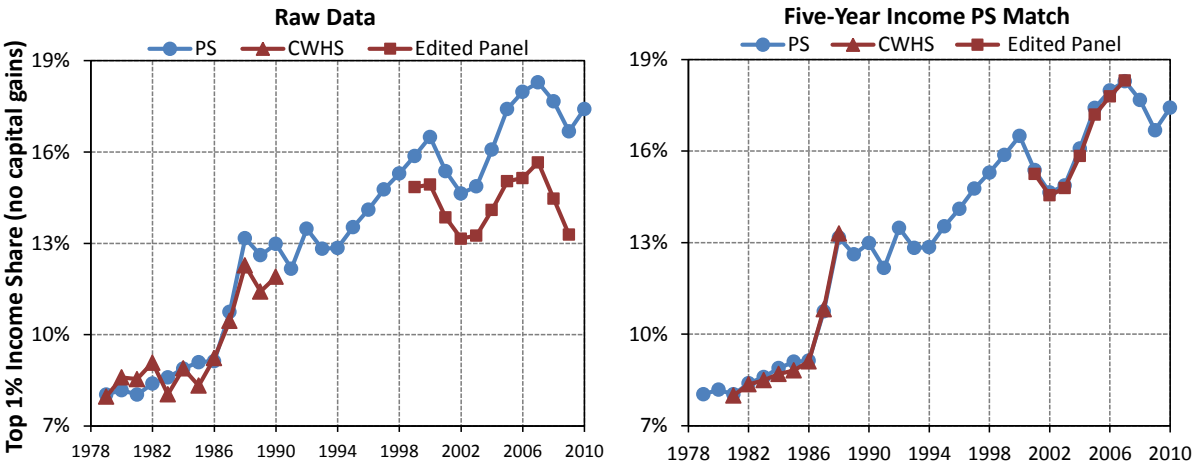
2.5 Top One Percent Income Concentration: Replicating Piketty and Saez (2003)

As increasing top one percent income concentration caused almost all of the increasing inequality in the 1980s and much of the increase since, I match Piketty and Saez (2003, hereafter PS) top income shares and show how five and eleven-year average income shares differ from annual shares. I find that there was little income variability in the top one percent in the early 1980s and somewhat more in the early 2000s, and that most of this increase in variability seems caused by the top tenth of one percent. A jump in top income variability immediately followed the Tax Reform Act of 1986 (TRA86) and this increased variability persisted into the 2000s. At the end of this chapter, I present evidence of increased pass-through income going to top earners, which may explain both the timing of the variability shock and its persistence.

To make a comparable dataset to PS, I make two changes to the "non-retired" CWHS. I add retirees back to the sample and add the fraction of non-filing tax units to the sample estimated by PS. The latter is done with a single observation with zero income throughout the sample and a weight equivalent to the missing number of tax units, usually about eight hundred. To make the Edited Panel comparable to PS, I remove dependents and add non-filers in the same way. Figure 2.2 (left figure) compares top one percent income shares from the CWHS and the Edited Panel with values from PS. Although the CWHS sample has a similar top one percent share until 1987, it shows less income concentration in the last three years of the sample. Meanwhile, the

Edited Panel top income share falls as sample attrition grows over time. To account for differences between the datasets, I match top one percent annual income shares of PS with the CWHS and Edited Panel five-year sample by adjusting the weight of the observation with zero income throughout the sample (Figure 2.2, right figure). Similarly, I match top tenth and hundredth of one percent income shares (Figure A3).

Figure 2.2 : Comparison of top one percent annual income shares for Piketty and Saez and two tax panels

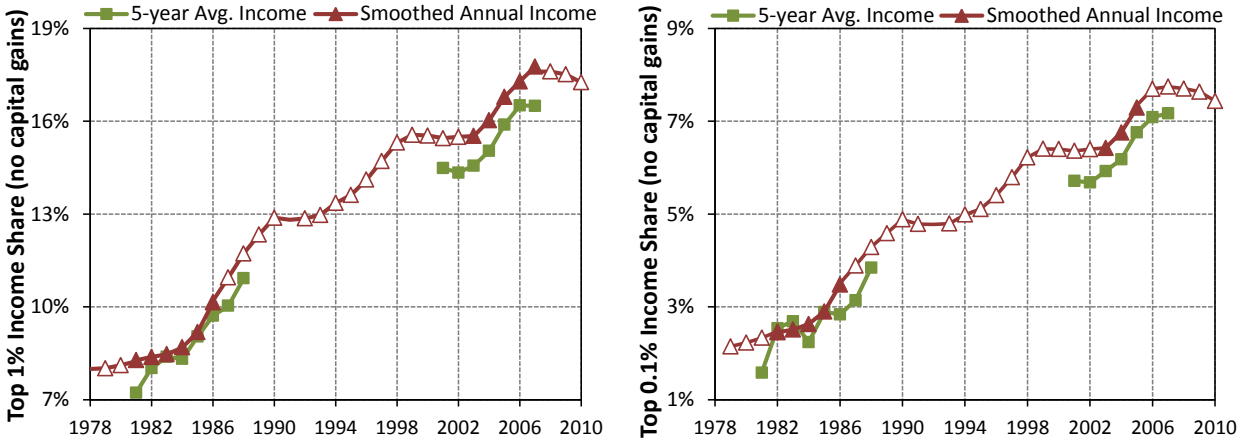


Note: To make data comparable with Piketty and Saez (values from updates on website of Emmanuel Saez), in the left figure the fraction of non-filing tax units used by Piketty and Saez were added to the sample. In the right figure, the number of zero earners added to the CWHS and Edited Panel was adjusted so that the annual shares of the five-year sample match PS shares. Dependents are dropped from both tax panels. Income for the CWHS is cash income (excluding capital gains) plus the employee component of payroll taxes (up to the taxable amount of earnings). Income in the Edited Panel is AGI minus capital gains and transfers in AGI (taxable Social Security and unemployment compensation) plus exemptions and employee payroll taxes. Source: Piketty and Saez (2003, updated 2010 and 2012).

This matched sample can be used to compare annual and five-year income shares. Figure 2.3 shows that there was little income variability in the top one percent from 1982 to 1986, as there was little gap between the annual and five-year income shares. Immediately following TRA86, top one percent income variability began to increase,

and this higher level of variability persisted since the reform. Variability in the 2000s is seen not only for the top one and tenth of one percent, but also for the top one-hundredth of one percent in the 2000s (Figure A4).

Figure 2.3 : Top 1% and 0.1% income shares (no capital gains)



Note: CWHS data shown for years before 1989 and Edited Panel data for years after 2000, where the five-year samples is the matched sample in the right of Figure 2.2. Annual shares are smoothed by averaging shares over five years. Whited-out triangles are smoothed annual PS income shares. For the CWHS top 0.1 percent after 1981, there are 15 observations or more. Source: Piketty and Saez (2003, updated 2010 and 2012).

To estimate the growth of income top income concentrations caused by variability, I need to compare starting and ending periods. In order to compare periods in similar parts of the business cycle, I consider two four-year periods beginning a year after the end of recessions: 1983 to 1986 and 2002 to 2005.

Table 2.2 shows that the top ten percent income share increased 8 percentage points (from 35 to 43 percent), but that the five-year share only increased 7 percentage points (from 34 to 41 percent). This implies a growing gap between annual and

five-year shares and so also increased variability. The final column is obtained with Equation 2.3 by dividing the increase in inequality due to variability by the annual inequality increase. It shows that 12 percent of the increase in annual top ten percent shares was caused by variability. Similarly, annual top one percent shares grew 7 percentage points but five-year shares only 6 percentage points, and about a tenth of the increase in annual top one percent income shares was caused by variability. These results hold for smoothed annual shares (panel A) and non-smoothed annual shares (panel B).

Table 2.2 also shows that income variability increases in the 2000s as one moves to the very top of the distribution. In fact, the top tenth of each group seems to contain over half of each group's variability. The gap between top one percent smoothed annual and five-year average income shares is 0.9 percent (15.9 vs. 15.0 percent), for the top tenth of one percent the gap is 0.5 percent (6.6 vs. 6.1 percent), and for the top hundredth of one percent the gap is 0.4 percent (2.8 vs. 2.4 percent). This suggests that while increasing income concentrations became more extreme as one moves up the top of the distribution, the increasing variability may have also been more extreme at the very top of the distribution.

Income variability seems to have a larger impact over longer periods of time than five years. Table 2.3 shows that eleven-year variability explains a fifth of increasing top one percent income shares. Panel A shows that between 1984 and 2004, top one percent income variability increased from -5 to 7 percent, explaining 22 percent of the increase in the top one percent share.[4] Panel B considers 1985 as the initial

[4]To see an example of negative variability—i.e., multi-year income shares above annual shares—

Table 2.2 : Earnings shares and share changes explained by five-year variability

	1983-1986 Income Shares		2002-2005 Income Shares		Income Variability		Inequality Change due to Variability	Annual Share Change	Percentage Annual Share Change	Fraction Annual Share Change from five-year Variability
	Annual	5-Year Avg.	Annual	5-Year Avg.	1983-86	2002-05				
Panel A: Annual income shares averaged over smoothed annual shares										
Top 10%	0.352	0.343	0.431	0.412	3%	4%	0.0091	0.0785	22%	12%
Top 1%	0.091	0.089	0.159	0.150	3%	6%	0.0065	0.0674	74%	10%
Top 0.1%	0.029	0.027	0.066	0.061	7%	8%	0.0030	0.0377	131%	8%
Top 0.01%	—	—	0.028	0.024	—	14%	—	—	—	—
Panel B: Annual income shares averaged over annual shares										
Top 10%	0.350	0.343	0.426	0.412	2%	3%	0.0071	0.0765	22%	9%
Top 1%	0.088	0.089	0.156	0.150	-1%	4%	0.0072	0.0682	78%	11%
Top 0.1%	0.026	0.027	0.065	0.061	-1%	5%	0.0037	0.0384	146%	10%
Top 0.01%	—	—	0.026	0.024	—	7%	—	—	—	—

Note: Annual inequality measures include tax units in the CWHS or Edited Panel filing all of each five-year period (t-2 to t+2). Earnings groups determined by five-year average incomes. Dependents are dropped. Income as in Figure 2.2 and sample is matched is matched to PS annual share levels as described in text.

year and finds that variability caused a third of the increase in top shares. An issue with these results is that annual earnings were not smoothed. Using PS values and smoothing annual shares over eleven years, the fraction of increasing top one percent shares due to variability in panel A falls to 19 percent and in panel B falls to 26 percent (not shown). Relative to eleven years, longer periods of twenty or thirty years may not show much of an increase in variability at the bottom of the distribution (see chapter 3) but may show much more variability at the top of the distribution. This could happen if in each business cycle top earners are a different set of people; for example, those working or investing in technology and internet sectors in the 1990s and real estate in the early 2000s. Unfortunately, these panels do not allow estimates of income variability over longer periods of time.

So far, we have only considered top income shares. Variability in other parts of the distribution may have an effect on measures of annual income dispersion. Table 2.4 uses income shares to show that the bottom and top of the distribution were both sources of increasing variability. Note that top shares are not matched in this analysis, as this would bias the bottom of the distribution. The bottom quintile clearly had the largest initial level of variability and the largest growth in variability, going from 29 to 45 percent.

Increasing inequality was caused by changes throughout the income distribution. The bottom quintile income share dropped by a third, from 3.7 to 2.4 percent,

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in Table 2.1 switch the income of A and C in year 1 and then reduce A's income in year 2 from 11 to 6. The three-year average share is still 14%, but the smoothed annual share in year 2 falls to 13.7%, implying income variability of about -5 percent.

contributing to the overall inequality increase. Stagnant earnings variability in the top half of the distribution excluding the top one percent (P60-P99) may slightly mitigate the effect of bottom quintile and top one percent variability on increasing inequality. Looking at the entire distribution, it seems that the bottom quintile and top ten percent each caused about half of the overall inequality increase from variability.[5] This resulted from the bottom quintile having a *large* increase in variability and *modest* inequality increase, and the top one percent having a *modest* increase in variability and *large* inequality increase.

2.6 Cash Income and After-Tax Income Variability

Whereas the previous section considered the effect of income variability on increasing inequality using income shares, this section considers the same question using summary statistics of income dispersion. Table 2.5 presents three classes of dispersion measures. For the first two classes—generalized entropy measures and Atkinson indices—measures go from emphasizing a lower to a higher part of the distribution. For example, mean logarithmic deviation (MLD) and the Atkinson index with an inequality aversion of ε=0.75 emphasize the bottom of the distribution, while the Theil Index and Atkinson index with ε=0.25 emphasize the top of the distribution.[6] Two trends are seen for the first two classes of dispersion measures. First, the fraction of annual inequality explained by five-year variability tends to be higher for

[5]Note that the bottom quintile and the top ten percent each caused income share changes due to variability of about 0.5 percent (Table 2.4, column 8).

[6]MLD is calculated as in Jones and Weinberg (2000). See appendix A for generalized entropy measure equations. Following the U.S. Census method for MLD, I replace zero and negative earnings values with $1 for all generalized entropy measures (MLD, symmetric Theil, Theil, and Atkinson indices). The symmetric Theil index is an average of the MLD and Theil index. See Maasoumi and Zandvakili (1990) for a discussion of generalized entropy measures and their application to measuring income mobility.

Table 2.3 : Earnings shares and share changes explained by eleven-year variability

	1980s Income Shares		2004 Income Shares		Income Variability		Inequality Change due to Variability	Annual Share Change	Percentage Annual Share Change	Fraction Annual Share Change from five-year Variability
	Annual	11-Year Avg.	Annual	11-Year Avg.	1980s	2004				
Panel A: 1980s is centered at 1984 (so from 1979 to 1989)										
Top 10%	0.349	0.343	0.451	0.431	2%	5%	0.0149	0.1024	29%	15%
Top 1%	0.088	0.092	0.160	0.149	-5%	7%	0.0161	0.0726	83%	22%
Top 0.1%	0.024	0.026	0.0680	0.0601	-8%	12%	0.0097	0.0440	183%	22%
Top 0.01%	—	—	0.0283	0.0229	—	19%	—	—	—	—
Panel B: 1980s is from 1980 to 1990										
Top 10%	0.350	0.353	0.451	0.431	-1%	5%	0.0237	0.1017	29%	23%
Top 1%	0.088	0.100	0.160	0.149	-14%	7%	0.0239	0.0730	83%	33%
Top 0.1%	0.027	0.033	0.068	0.060	-21%	12%	0.0138	0.0409	151%	34%

Note: Annual inequality measures only include tax units in the CWHS or Edited Panel filing in all of each five-year period (t-2 to t+2) or all eleven years. Earnings groups determined by five-year average incomes. Dependents are dropped. Income is PS income definition and sample is matched is matched to PS annual share levels as described in text.

Table 2.4 : Income shares and share changes explained by variability (no capital gains)

	1983-1986 Income Shares		2002-2005 Income Shares		Income Variability			Inequality Change due to Variability	Annual Inequality Change	Percentage Annual Inequality Change	Fraction Annual Share Change from five-year Variability
	Annual	5-Year Avg.	Annual	5-Year Avg.	1983-86	2002-05	Change				
Bottom 20%	0.037	0.052	0.024	0.044	29%	45%	16%	0.0045	0.0129	35%	35%
P20-P40	0.101	0.103	0.085	0.087	2%	3%	1%	0.0010	0.0161	16%	6%
P60-P80	0.241	0.238	0.214	0.211	1%	2%	0%	0.0003	-0.0273	-11%	-1%
P80-P90	0.165	0.162	0.158	0.154	2%	3%	1%	0.0007	-0.0070	-4%	-10%
Top 10%	0.296	0.286	0.383	0.369	3%	4%	0%	0.0047	0.0873	29%	5%

Note: Annual income concentrations only include tax units in the CWHS or Edited Panel filing all five years (t-2 to t+2) and are smoothed before being averaged over each four-year period. Income groups are determined by five-year average incomes. No threshold is applied and income is PS income with no capital gains as described in text. Variability for the bottom two quintiles is $(Ineq_{Multi-year} - Ineq_{Annual})/Ineq_{Multi-year}$ *and the inequality change due to variability is* $(\%Variability \cdot Ineq_{Multi-year})_{End} - (\%Variability \cdot Ineq_{Multi-year})_{Begin}$*, while for the top two quintiles it follows Equation 2.1. Decreasing income shares for the bottom two quintiles represent inequality increases, while increasing income shares for the top two quintiles represent inequality increases.*

measures emphasizing the bottom of the distribution. Second, income variability levels changed little between the early 1980s and 2000s, although cash income variability fell slightly (panel A) and after-tax income variability increased slightly (panel B). These trends mean that variability only explains about a tenth of the increase in annual cash income inequality, while variability explains up to a quarter of increasing after-tax cash income inequality. Table A2 shows similar results for eleven-year income variability.

Table 2.5 : Smoothed annual income inequality increase and fraction explained by five-year variability

	Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Percentage Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
	1983-86	**2002-05**				
Panel A: Cash Income						
Mean Log Deviation	24%	22%	0.0137	0.0914	23%	15%
Symmetric Theil	18%	17%	0.0220	0.1525	39%	14%
Theil Index	12%	11%	0.0203	0.2034	53%	10%
Atkinson (ε=0.75)	13%	12%	0.0040	0.0570	24%	7%
Atkinson (ε=0.50)	10%	9%	0.0038	0.0498	31%	8%
Atkinson (ε=0.25)	7%	7%	0.0020	0.0333	40%	6%
Gini Coefficient	6%	6%	0.0076	0.0623	14%	12%
Panel B: After-Tax Cash Income						
Mean Log Deviation	26%	26%	0.0212	0.0812	23%	26%
Symmetric Theil	20%	21%	0.0298	0.1250	36%	24%
Theil Index	13%	14%	0.0227	0.1532	45%	15%
Atkinson (ε=0.75)	14%	13%	0.0052	0.0466	22%	11%
Atkinson (ε=0.50)	10%	10%	0.0032	0.0381	27%	8%
Atkinson (ε=0.25)	7%	6%	0.0004	0.0234	32%	2%
Gini Coefficient	6%	8%	0.0125	0.0577	14%	22%

Note: Five-year average incomes are centered and annual incomes are smoothed using t-2 to t+2. Only tax units in the CWHS or Edited Panel "non-retired samples" all five years of each five-year period are included in annual and multi-year samples ($2010, CPI-U-RS). Annual and five-year measures only include tax units with average earnings throughout the five-year period above the threshold ($2,575 in 2004 and indexed with average earnings).

Tax units with self-employment income contributed disproportionately to increasing

variability. While tax units with any self-employment income throughout the sample make up only a fifth of the sample, they caused much of the increase in inequality explained by five-year cash income variability in the 1980s. Self-employment income is three times more variable than earnings.[7] A large fraction of those with self-employment income are at the low and high extremes of the distribution, which fits with the observation that income variability is also highest at these extremes.

Before making an in-depth analysis of earnings variability in the next section, I briefly compare the absolute variability of cash income and earnings. Figure 2.4 shows that relative to cash income variability, earnings variability is higher for the bottom nine deciles, with almost twice as much absolute variability in the bottom four deciles. [8] Cash income variability is lower than earnings variability because it includes relatively consistent income streams—such as interest, dividends, rental, pension and annuity income—as well as sources of income that can offset negative shocks—such as unemployment compensation. After-tax cash income variability levels looks similar to cash income variability across the distribution. The much higher level of absolute variability for earnings foreshadows the large impact of variability on earnings inequality seen in the next section.

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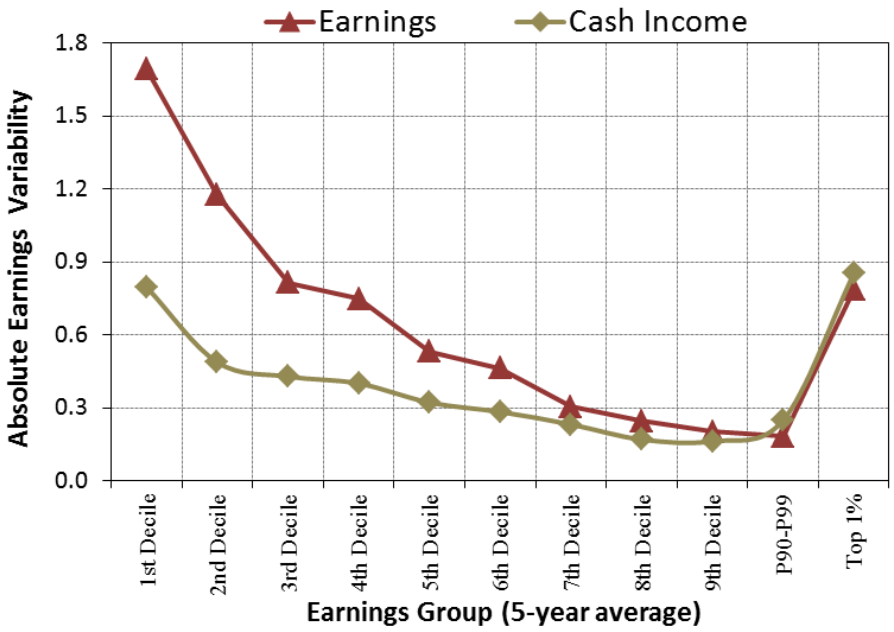
[7]The average variability of self-employment income over the CWHS panel is three times that of earnings when measured by variance of five-year arc percentage changes: 2.8 vs. 0.8.

[8]I measure absolute variability with the dispersion of arc percentage earnings changes within each earnings group, as doing so removes year effects and relates closely to inequality. For example, if all earnings increase by the same percentage, then the variance is zero and inequality should also be unaffected. Arc percentage changes also allow the inclusion of movements from zero to positive earnings, as it equals $2 \cdot (x_{final} - x_{initial})/(x_{final} + x_{initial})$ (Congressional Budget Office, 2008*b*). Note that for non–negative values arc percentages are bounded by negative and positive two, which result from tax units moving to or from zero earnings, and that relative to normal percentages this understates large gains and overstates large losses.

Figure 2.4 : Tax unit absolute variability by earnings group, 1986-1990



Note: Variance of five-year (t to t+4) arc percentage changes in annual tax unit earnings including zeros. Earnings groups over 1986-1990 set by total earnings over the five-year period. CWHS "non-retired sample" sample. ($2010, CPI-U-RS)

2.7 The Effect of Earnings Variability on Annual Inequality

Compared to the more comprehensive measures of income seen in the last section, earnings variability seems to explain more of increasing earnings inequality. Earnings variability explains about a third of the increase of annual earnings inequality between the early 1980s and 2000s, although this ranges from half for the MLD, a fifth for the Theil Index, and a tenth for the Gini coefficient (Table 2.6). As the fraction of annual earnings inequality explained by five-year variability is highest for the MLD, this suggests more variability at the bottom of the distribution. Table A2, panel C shows similar results for eleven-year earnings variability.

Including tax units in the sample who reported negative or zero earnings results in different inequality and variability trends. Table A3, panel A shows that annual inequality *decreased* for the bottom of the distribution (MLD and Atkinson, ε=0.75) and *increased* for the top (Theil index and Atkinson, ε=0.25). Falling earnings variability actually seems to explain more than all of the decrease in annual inequality in the bottom of the distribution. This is because the five-year MLD actually increased from 0.309 to 0.320 (while the annual MLD decreased from 0.578 to 0.423), which basically means that without decreasing variability, annual inequality would have increased. This decrease in inequality was partly caused by a decreasing fraction of consistently filing tax units with zero earnings from 2.4 to 1.7 percent between the early 1980s and 2000s. In contrast, there is a negligible fraction of tax units with zero cash income so including or excluding zero incomes has a small impact on income inequality and variability trends. Table A3, panel B shows similar results for eleven-year earnings variability.

I discuss this divergence of earnings dispersions and earnings variability across the bottom and top of the distribution in Chapter 3, where I find similar results for the individual earnings distribution. I now consider some of the forces driving the high level of earnings variability at the ends of the distribution.

2.7.1 Earnings Variability across the Distribution

Earnings variability changes significantly over the earnings distribution. In fact, high variability in the bottom quintile and increasing variability in the top one percent seem to drive almost all of variability's effect on increasing inequality. Mean

Table 2.6 : Smoothed annual earnings inequality and inequality increase from tax unit five-year earnings variability

	Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Percentage Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
	1983-86	**2002-05**				
Mean Log Deviation	15%	25%	0.0560	0.1024	31%	55%
Symmetric Theil	12%	19%	0.0476	0.1453	46%	33%
Theil Index	9%	13%	0.0365	0.1856	62%	20%
Atkinson (ε=0.75)	11%	16%	0.0185	0.0550	26%	34%
Atkinson (ε=0.50)	10%	15%	0.0139	0.0483	34%	29%
Atkinson (ε=0.25)	9%	16%	0.0112	0.0359	50%	31%
Gini Coefficient	4%	4%	0.0043	0.0436	11%	10%

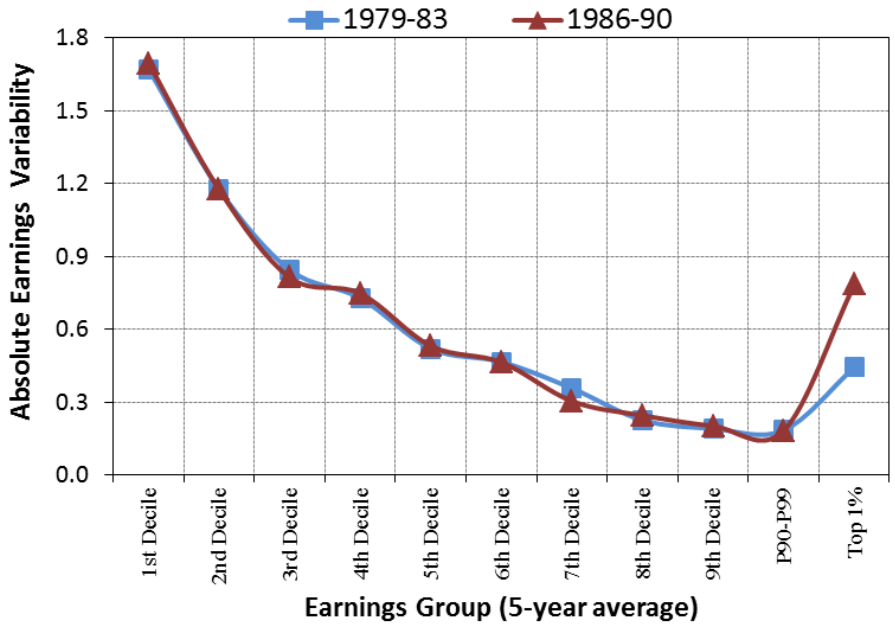
Note: Five-year average earnings are centered and annual earnings are smoothed using t-2 to t+2 earnings, and these are averaged over each four year period (1983-86 and 2002-05) before calculating other values. Only tax units in the CWHS and Edited Panel "non-retired samples" with positive earnings all five years of each five-year period are included in annual and multi-year samples ($2010, CPI-U-RS).

reversion causes this variability with large earnings increases at the bottom of the distribution and large losses at the top.

Absolute earnings variability was largest at the extremes of the distribution in the late 1980s, with the bottom two quintiles and top one percent having the highest variability (Figure 2.5). Comparing earnings variability in the early and late 1980s shows that variability remained constant across the distribution, except for increasing variability in the top one percent.

Variability may differ systematically for different types of workers. As mentioned, tax filers with any self-employment income have almost twice as much earnings variability throughout most of the distribution (Figure A1).

Figure 2.5 : Tax unit absolute earnings variability over the distribution



Note: Variance of five-year (t to t+4) arc percentage changes in annual tax unit earnings including zeros. Earnings groups set by total earnings over each period. CWHS "non-retired sample" sample. ($2010, CPI-U-RS)

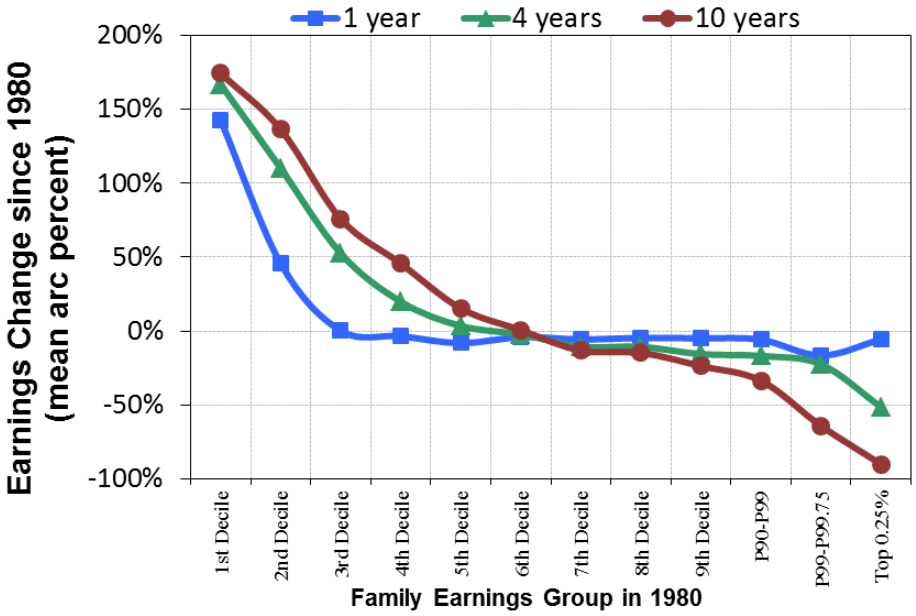
Variability may also differ systematically for different types of filers. Auten and Gee (2009) use a panel of tax returns between 1987 and 2005 to find correlates with relative income mobility. When not adjusting for family size, as in this study and Piketty and Saez (2003), they estimate that getting married is associated with rising a third of the way up the distribution and that divorce or widowhood is associated with falling about a quarter of the way down the distribution. In the CWHS, the correlation between filing status and earnings variability varies over the distribution. The left side of Figure A2 shows that earnings variability is much higher for tax units in the second and third deciles if they are initially married rather than single. To see the effect of divorces and marriages, the right side of Figure A2 shows that variability is higher for constantly married filers at the bottom

of the distribution while higher for those who marry or divorce in the top half of the distribution. Frequent movements in and out of employment by secondary earners may explain the high variability of married households at the bottom of the distribution, while higher labor force attachment of secondary earners in the top of the distribution may cause low variability for constantly married, high earnings households.

Directional earnings changes show how variability equalizes earnings. Tax units that started in the bottom of the distribution in 1980 had the largest earnings increases, and as tax units move up the distribution, they tend to have smaller gains and then larger losses. Specifically, earnings increased for those in the bottom two quintiles in 1980 and decreased for the top two quintiles. These effects become stronger when following a tax unit over more years. Figure 2.6 shows that between 1980 and 1990, tax units starting in the bottom quintile more than doubled their earnings while those starting in the top quarter percent had earnings 90 arc percent lower (this corresponds to about 60 percent lower).

Gains at the bottom of the distribution and losses at the top are caused in part by reversions to the mean: a negative shock can temporarily push a family into a lower earnings group, while a positive shock can temporarily inflate the earnings of a family at the top of the distribution. For example, the first quintile lost an average of 31 arc percent between 1979 and 1980 before gaining 37 arc percent the following year, and the top one percent gained an average of 14 arc percent before losing 13 arc percent. Thus it seems that much of variability at the extremes of the distribution is caused by transitory mean-reverting earnings changes. Similarly, de Fontenay,

Figure 2.6 : Mean Reversion: mean directional earnings changes since 1980 by earnings group

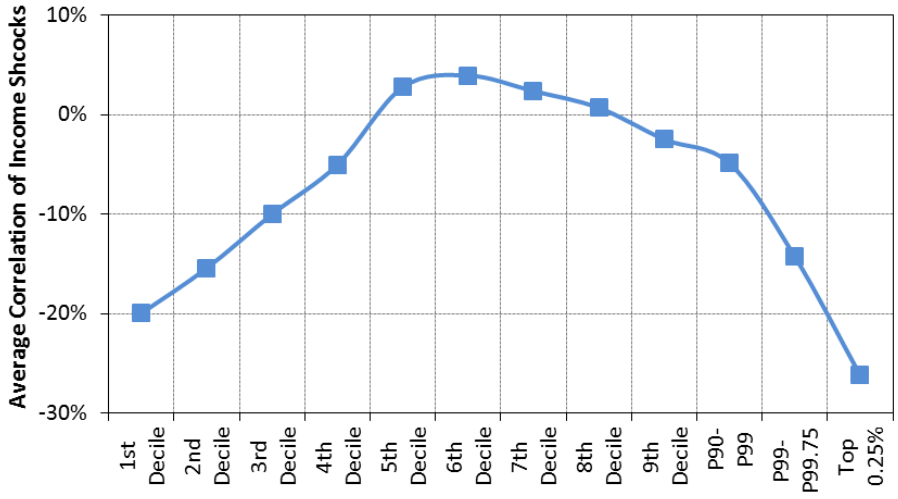


Note: Mean arc percentage changes in annual tax unit earnings for 1-year from 1980 to 1981, 4-year from 1980 to 1984, and 10-year from 1980 to 1990. Earnings groups are for 1980 annual earnings. CWHS "non-retired sample" sample includes zero earnings. ($2010, CPI-U-RS)

Gorgens and Liu (2002) estimate that increased short-term upward mobility for low earners offset decreased earnings in the 1970s.

To verify that mean reversion does explain earnings variability at the ends of the distribution, Figure 2.7 shows correlations of two consecutive annual earnings earnings changes by earnings groups. The negative correlations at the ends of the distribution result from mean reversion: earnings decreases are followed by increases in the bottom four deciles, and earnings increases are followed by decreases in the top two deciles. Meanwhile, earnings changes are relatively uncorrelated in the upper-middle part of the distribution.

Figure 2.7 : Mean Reversion: mean correlation of earnings changes by earnings group by earnings group (1980-1989)



Note: Correlation of arc percentage changes of annual tax unit earnings (t-1 to t and t to t+1). Mean for t=1980 to 1989 is shown. Earnings groups are for annual earnings at time t. CWHS "non-retired sample" sample. ($2010, CPI-U-RS)

2.8 Why did Top One Percent Income Variability Increase?

I discuss three explanations for increasing variability in the top one percent of the distribution: tax-shifting, skill-biased technological change, and industry de-cartelization. The tax-shifting argument explains that by lowering the top individual tax rate below the corporate tax rate, the Tax Reform Act of 1986 (TRA86) motivated many corporations to switch from filing as C to S-corporations, causing some corporate income to be passed through directly to individuals (Feenberg and Poterba, 1993; Slemrod, 1996; Auten and Carroll, 1999; Gordon and Slemrod, 2000). This tax-shifting response can also occur with shifts from corporations

to sole proprietorships and partnerships (Goolsbee, 2002).[9] Note, that the evidence for increasing annual inequality is usually based on measures of personal income, so shifts from corporate to pass-through (i.e., personal) income increase both annual inequality and income variability. This occurs because business income tends to go to the top of the personal income distribution and is more variable.[10]

The skill-biased technological change argument is put forward by Parker and Vissing-Jorgensen (2010). They show that before the 1980s, top one percent income shares were slightly less cyclical than that of the average household, but since then they have been almost two and a half times more cyclical. This correlation of increased top income shares and cyclicality is seen across recent decades, subgroups within the top one percent (such as the top 0.1 percent) and countries. Parker and Vissing-Jorgensen propose that information and communication technologies could have increased the optimal production scale of the most talented and argue that this also increases top income fluctuations by making them more vulnerable to business cycles. Interestingly, some top income households may not smooth all of these income shocks, as Parker and Vissing-Jorgensen (2010) and Frank (2011) provide evidence of increasing top income consumption cyclicality.

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[9] "[T]he relative taxation of corporate to personal income plays an important role in the share of firms, employment and sales that are done by corporations versus partnerships and sole proprietorships. An increase in the [state] corporate tax rate by .10 reduces the corporate share of firms by 5-10 percent..." (Goolsbee, 2002, p. 17)

[10] The average variability of net business income (Schedule C, partnership, and S-corporation) over the CWHS panel is two hundred times more volatile than earnings when measured by variance of annual arc percentage changes: 98.9 to 0.4 for one year changes and 142.8 to 0.8 for five year changes. Over the CWHS panel, the top ten percent of the annual cash income distribution receives an average of 62 percent of net business income.

Alternatively, Rajan and Zingales (2003) observe that in the first half of the twentieth century industries consolidated into vertically integrated firms with sufficient power in labor markets to compress wage differentials. As innovation (they emphasize financial innovation) decreased barriers to entry for new firms in the 1970s, skilled workers found increasing demand for their labor. This allowed them to free their human capital from specific firms and demand higher wages relative to lower skilled workers. While this may have caused more income dispersion over the entire distribution, its effects may have been concentrated among top earners. Rajan and Zingales suggest that the decartelization process was caused by increased access to capital, resulting in more new business owners and an increased scale of operation for financial sector workers (such as hedge fund managers). The resulting increase in risk-taking by top income workers could help explain increasing top earner variability. This narrative fits with this chapter's findings that those with self-employment earnings had much larger increases in variability and with Bakija, Cole and Heim (2010), who show that the top one percent contains many self-employed, executives and financial sector workers with incentive pay and highly variable earnings.

2.8.1 Income Shifting and Top One Percent Shares Over the Long Run

As income shifting seems to have contributed to the growth in income variability, I discuss the basic mechanics and history of shifting among top income households. Jonathan Gruber outlines three kinds of reactions people can have to taxes (Gerber, 2012, p. 1)

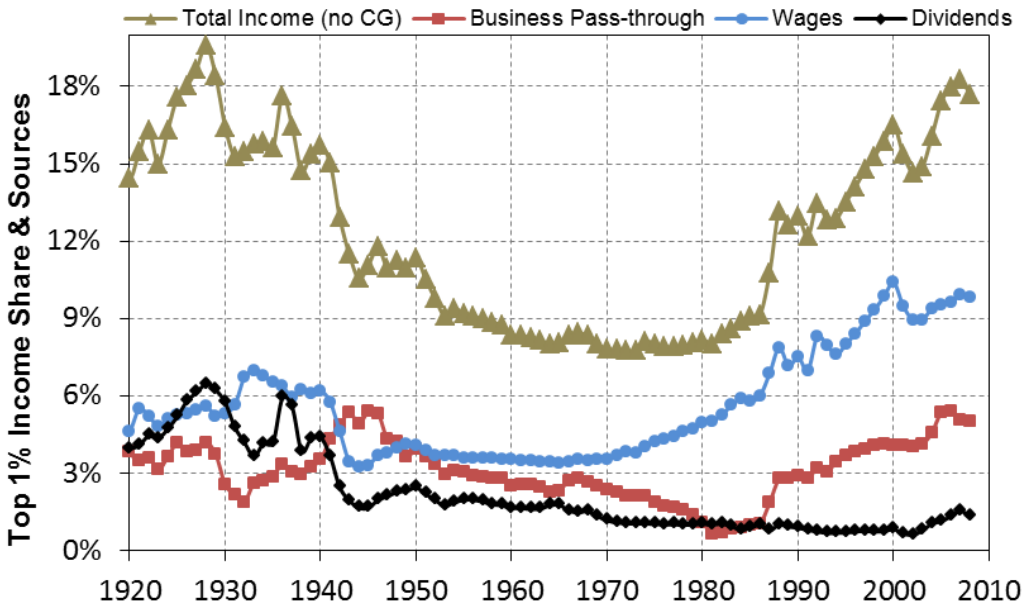
> There are timing reactions like, "Should I realise my capital gains today or tomorrow?" There are financing reactions like, "Should I get paid in stock options or wages?" And then there are behaviour adjustments like, "How hard should I work?"

The income shifting between C-corporations and pass-through entities discussed here is a financing reaction to tax reform, but this shifting can also affect income variability through implicit timing effects. When a business is organized as a C-corporation, then net income is either distributed as dividends or held as retained earnings and eventually shows up as personal income in the form of capital gains realizations. Dividend payments tend to have low variability from year to year. Income variability is also low if the owner of a closely held C-corporation plans on passing on their business to a family member, because then they have an incentive to never realize capital gains due to step up in basis at death. In contrast, pass-through income cannot be accumulated as retained earnings in the same way, leading to more volatile distributions.

A brief description of income shifting since the 1980s gives a picture of the connection between shifting and top income shares. Appendix A describes shifting before the 1980s. Piketty and Saez (2003) estimate that the top one percent income share increased from an average of 8 to 13 percent in the decades before and after the Tax Reform of 1986; but almost all of this two decade change occurred in the two years following the reform. Figure 2.8 shows that business pass-through income contributed to the large increase in the top one percent income share. A jump in wages also occurred in the two years following TRA86—in fact, the four percentage point increase in top one percent income share between 1986 and 1988 is explained by a two percentage point jump in both business pass-through income and wages. The interpretation of "reasonable compensation", which limits the fraction of income that can be taken as tax-preferred pass-through income, explains the

simultaneous jump in pass-through income and wages.[11] To ensure that wages are more than distributions, accountants suggest that business owners follow the 60/40 rule-of-thumb; that is, business owners take 60 percent of net business income as wages (salary) and 40 percent as pass-through income (distributions). It is clear that by reducing top personal tax rates far below the corporate tax rate (Figure A5), TRA86 created an incentive for some business owners to shift their business income from corporate to pass-through form.

Figure 2.8 : Top 1% income share (no capital gains)



Notes: Business pass-through income includes profits from S-corporations, partnerships, sole proprietorships (Schedule C), and farm income. Wages includes wages, salaries, pensions, bonuses, and exercised stock-options. Total income includes the sources shown, interest, and rents. Source: Piketty and Saez (2003).

[11] Pass-through income is not subject to payroll taxes, in particular, the uncapped Medicare portion, while wage income is subject to payroll taxes.

Since 1990, incentive pay seems to have caused top income shares to fluctuate with business cycles,[12] but pass-through income also continuously grew. The top one percent income share from business pass-through income increased one percentage point between 1991 and 1996 and another percentage point between 2003 and 2005 (Figure 2.8). The increase in the 1990s happened despite the 1993 increase in the top personal tax rate from 31 to 39.6 percent. Other factors mitigated the effect of this tax increase. The top bracket only included a fraction of the top of the distribution (those in the top 0.5 percent) and strong economic growth resulted in growing business profits. In addition, there is a lock-in effect because businesses who switch from filing as S-corporation to C-corporations must wait five years before they can again file as S-corporations. The increase in top one percent income share from pass-through income in the 2000s immediately followed the 2003 tax reform. While this reform's decrease in dividends and capital gains tax rates lessened the double tax burden on C-corporations, the decrease in top personal tax rates to 35 percent lessened the tax burden for pass-through income.

2.9 Conclusion

Earnings variability means that measures of annual earnings inequality can be larger than measures of inequality defined over a longer-run period. Increasing tax unit income variability caused up to a fifth of the increase in top one percent income shares since the early 1980s. These results suggest that annual top income shares since 1986 overstate top income shares relative to a multi-year perspective. This

[12]Desai (2012) notes that the equity based share of senior management compensation increased between 1990 and 2007 from 20 to 70 percent. Stock options usually show up as wage income, hence the strong cyclicality of top wages over the last two decades. Including capital gains exacerbates the cyclicality of top income shares seen in Figure 2.8 over this period.

is because the large gains pushing tax units to the very top of the distribution are often followed by large losses.

Top one percent income variability increases were pronounced in the years following the 1986 tax reform. Permanent income shifting in response to tax reform seems to have caused a significant fraction of both increasing inequality and variability. This suggests that future tax reforms may lead to income shifting and changing income variability at the top of the distribution. For example, proposed increases in top personal tax rates and decreases in corporate tax rates could lead to shifting out of pass-through entities. This would decrease measured annual top income concentration, reinforced by a decrease in income variability, but will likely have little effect on these households' consumption potential. This highlights the problem with using annual income concentrations as a proxy for consumption inequality.

Increasing income variability may also have real economic effects. The top five percent of the distribution now accounts for 60 percent of income taxes paid and 35 percent of consumption (Frank, 2011). This means variability at the top of the distribution can exaggerate cyclicality in tax revenues and perhaps even overall macroeconomic cyclicality. These macroeconomic spillovers may cause significant stress for others less able to smooth negative shocks.

While mean reversion of income implies top earner gains are followed by losses, at the bottom of the income distribution it implies losses are followed by gains. Growing income variability at the bottom of the distribution also appears to have contributed to growing annual inequality. A concern is that the heavy attrition

of non-filers due to incomes low enough to not have to file a tax return may bias results for the bottom quintile. Comparisons with the PSID, which covers non-filers, could help address this concern. Also, individual earnings data seem to confirm the important impact of variability in the bottom half of the distribution, as seen in the next chapter.

Chapter 3

Individual Income Variability and Inequality: Social Security Administration Data, 1951-2006

3.1 Introduction

U.S. individual earnings inequality has increased since the mid-1960s (Kopczuk, Saez and Song, 2010, KSS). Skill-biased technical change may explain slower earnings growth in the middle of the distribution and faster growth at the top because of dispersion of hourly wages (Juhn, Murphy and Pierce, 1993). In addition to growing dispersion between the bottom and top halves of the distribution, there has been growing dispersion within parts the distribution. KSS find growing inequality in the bottom half of the individual distribution, with the log(P50/P20) ratio increasing a third between 1970 and the mid-1980s. Using Social Security Administration individual earnings data for the bottom of the distribution, I find that increasing variability explains most of the increase in annual earnings inequality in the 1970s and early 1980s.

As discussed in chapter 2, variability tends to equalize annual earnings over multi-year periods. This means earnings averaged over a number of years will have lower inequality than annual earnings inequalities, and when the gap between multi-year and annual inequalities widens, then variability has increased and caused annual inequality to be higher. As earnings inequality is often measured by the variance of

log earnings, years of zero earnings are often dropped in other studies. Gottschalk and Moffitt (2009) follow this approach with the Panel Study of Income Dynamics (PSID) and estimate that about half of the increase in annual male earnings inequality from 1974 to 1990 was caused by increasing instability. When following this restriction by dropping workers with years of zero earnings, I also find that about half of the increase in annual inequality in this period was caused by variability.

By removing observations with any zero earnings in multi-year periods, many studies do not address these movements in and out of employment. I find that this has a large effect on individual earnings variability. In fact, including years of zero earnings shows that for the bottom half of the earnings distribution, increasing variability explains *all* of the increase in individual earnings inequality.

I extend previous research on individual earnings in a number of other ways. Whereas the standard measure of variance of log earnings means women's earnings are ignored because of the high frequency of zero annual earnings, I retain women in the sample by using a number of alternative dispersion measures. A further contribution is that rather than providing estimates based on survey data from a few thousand workers, I use two administrative panels each with about a quarter million men and women beginning almost two decades before the PSID. In fact, these appear to be the longest public-use panels of U.S. earnings available and allow me to measure earnings variability over workers' entire lifetimes. This is important because it shows how variability increases with the number of years over which earnings are averaged.

In the most comparable study to this one, KSS find a small effect of earnings variability on inequality when using Social Security data, excluding self-employment earnings and workers with low-earnings for at least one year within a multi-year period (below $2,575 in 2004), and estimating dispersion with Gini coefficients. While my data appear similar to that used by KSS, I focus on the bottom half of the distribution and find large fluctuations in this group's earnings variability. Other studies find that earnings variability at the bottom of the distribution seems to contribute significantly to overall earnings variability. Sabelhaus and Song (2009) find that adding the bottom ten percent of Social Security earnings records for workers age 25 to 55 causes volatility to double. While Jensen and Shore (2008) find that volatile incomes were much more likely in the PSID among the self-employed and those self-identified as risk-tolerant. I also include self-employment earnings in my sample, but it is not clear how much this makes my results differ from those of KSS.

3.1.1 Variability and Inequality: Falling then Rising Together

This paper presents evidence that annual individual earnings inequality for the bottom of the distribution has moved with variability over the long run: falling with variability in the late 1950s and early 1960s and then rising in the 1970s and early 1980s. This suggests that the U-shaped inequality pattern over this three decade period was partly caused by a fall and then a rise in variability.

The most significant inequality decrease occurred in the "Great Compression" of the 1940s as high tax rates and wage controls coincided with sharp reductions in top income shares (Piketty and Saez, 2004). Overall earnings inequality also fell in

the 1940s, with the individual earnings Gini coefficient declining 16 percent (KSS). This earnings compression continued at a slower pace in the 1950s, with the earnings Gini coefficient falling another 6 percent, although this conceals rising inequality in the top of the distribution. So while the "Great Compression" began with decreasing top income shares, the effect of wartime taxes and wage controls seemed to reverse in the 1950s as earnings concentration increased in the top half of the distribution.[1] Without the earnings compression in the bottom half of the distribution—shown to be largely driven by falling variability in this paper—overall inequality may have fallen significantly less in the 1950s.

The U-shaped individual earnings variability trend between the 1950s and 1980s raises two related questions: "Why was variability so low in the 1960s?" and "Why did variability increase?" Low earnings variability appears to be explained by a small fraction of working age men with years of zero earnings, which I refer to as low *movement in and out of employment* by men. Similarly, increasing variability seems explained by more movements in and out of employment by men. Cappellari and Leonardi (2006) estimate that each year of job tenure reduces earnings instability by 15 percent. As increased movement in and out of employment decreases tenure length, we expect earnings instability and hence variability to increase. In the U.S., these effects seem driven by institutional changes leading to decreased worker-firm attachment (Bhagwati and Dehejia, 1994; Farber, 2008) and were perhaps exacerbated by cohort effects resulting from the 1930s baby bust and post-war baby boom (Macunovich, 2000).

[1] In the 1950s, bottom earnings inequality decreased by 13 percent and top earnings inequality increased 7 percent, as measured by log(P50/P20) and log(P80/P50) estimates by KSS.

3.1.2 Mixed Evidence for Increasing Individual Earnings Variability since the mid-1980s

The period of the Great Moderation is distinguished by a period of lower macroeconomic volatility. While *household* income variability seems to have continued increasing since the mid-1980s,[2] *individual* earnings variability may have decreased during the Great Moderation, although there is mixed evidence for individual earnings variability trends. Sabelhaus and Song (2009, 2010) use Social Security Administration data similar to that used in this study. They exclude zero earnings from their sample and estimate falling annual volatility from 1985 to 2000. Congressional Budget Office (2008*b*) uses similar data and also finds falling earnings volatility, although they include zero earnings in their sample. This seems largely due to a flattening of male earnings instability since 1990 (Gottschalk and Moffitt, 2009; Kopczuk, Saez and Song, 2010). Leonesio and Del Bene (2011) estimate Social Security earnings averaged over two twelve-year periods between 1981 and 2004. These estimates suggest that male variability increased slightly—similar to another study including self-employment earnings (Dynan, Elmendorf and Sichel, 2008)—but that female earnings variability increased substantially since the 1980s.

A number of papers use the Longitudinal Employment and Household Dynamics (LEHD) panel, which covers nearly all U.S. workers since the mid-1990s. Gottschalk, McEntarfer and Moffitt (2008) find relatively stable or slightly falling male instability in the 1990s. Celik et al. (2009) use LEHD, CPS, and SIPP data

[2]Hertz (2007) finds increasing household income volatility since the mid-1980s with the Current Population Survey. Gottschalk and Moffitt (2009) estimate that between 1990 and 2000 family income instability increased about 40 percent.

and find stable male instability in the 1990s and 2000s, except for a jump in 2001. DeBacker et al. (2010) use a panel of tax returns from 1987 to 2006. They estimate that about a third of male earnings inequality is transitory, but that this explains little of increasing inequality.

Some studies may find falling variability and others flat variability because patterns were different across the distribution. I find that decreasing inequality in the bottom half of the distribution was largely caused by decreasing variability. Meanwhile, inequality increased for the top of the distribution while their variability remained flat. Hence permanent earnings, not variability, seemed to drive increasing inequality for top earners.

Section 2 of this chapter introduces two Social Security Administration datasets. Section 3 examines increasing individual earnings variability and inequality in the bottom half of the distribution from 1973 to 1985 and falling variability and inequality from the mid-1950s to mid-1960s. Section 4 discusses inequality and variability changes between 1985 and 2000.

3.2 Social Security Administration Earnings Data

This study uses two long panels of Social Security Administration (SSA) earnings data: the 2004 Benefits and Earnings Public-Use File (BEPUF) and the 2006 Earnings Public-Use File (EPUF). The BEPUF includes individual level annual Social Security taxable earnings from 1951 to 2003 for 473,366 workers. This is a one percent random, representative sample of beneficiaries entitled to receive

Social Security benefits in December 2004. The sample is drawn from records of 47 million individuals in the Master Beneficiary Record, which the SSA validates and keeps current in order to administer benefits programs. The panel lacks data on other income sources, taxes paid, hours worked and household status, but includes year of birth, sex, and combined wages and net self-employment income subject to taxes for the Federal Insurance Contributions Act (FICA) and Self-Employment Contributions Act (Mulvey, 2010).

Workers covered by Social Security have changed over the period of this sample. Kopczuk, Saez and Song (2010, p. 102) describe some of these changes:

> Initially, Social Security covered only "commerce and industry" employees, defined as most private for-profit sector employees...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...with coverage increasing significantly further in 1954 and then slowly expanding since then.

The dates of entry of new worker groups are important, as the entrance into the data of government employees with stable earnings may explain some of the fall in earnings variability estimated in the early 1950s. Also, military personnel were covered by Social Security only since 1957. This may explain some of the high level of earnings variability in the early 1950s, as many Korean War soldiers left and then re-entered the sample between 1951 and 1953, and the especially large drop in men's measured variability in 1957.[3] While the entry of these groups created

[3]The measured fall in highly variable movements between 1951 and 1957 (Figure 3.9) shows a fall from 30 to 20 percent of men with both positive and zero earnings in an eleven year period. Some of the falling fraction with years of zero earnings is likely caused by military personnel entering the sample due to coverage changes. The two million members of the armed forces at this time only

downward pressure on earnings variability, there appears to have been other long-run forces pushing down variability, as the short-term and long-term earnings variability of the bottom half of the distribution consistently fell until the mid-1960s (Figure 3.4).

The BEPUF does not allow the identification of workers from specific sectors or whether earnings were from self-employment. Kopczuk, Saez and Song (2010) have employee sectors in their SSA data and use it to follow non-self-employment earnings of a consistent group of "commerce and industry" workers. In contrast, my group of workers changes over time, starting with a number of worker groups and growing with the expansion of Social Security coverage. To mitigate the effect of these sample changes, I focus on earnings from 1957 and afterward.

To make the sample representative of the labor force in past years, I estimate sample weights to make a representative sample of workers based on year, age and sex. Census data on labor force participation by age and sex in various years are used to construct weights (see appendix B) and earnings are indexed to 2010 dollars with the CPI-U. The sample has a number of other limitations. The BEPUF only includes those receiving benefits in 2004, so deceased workers and those not yet receiving benefits are not included in the sample. Also, younger cohorts in the sample are non-representative because they retired early and tended to have low earnings. Thus cohorts since the second half of the baby boom (born after 1954) are excluded.

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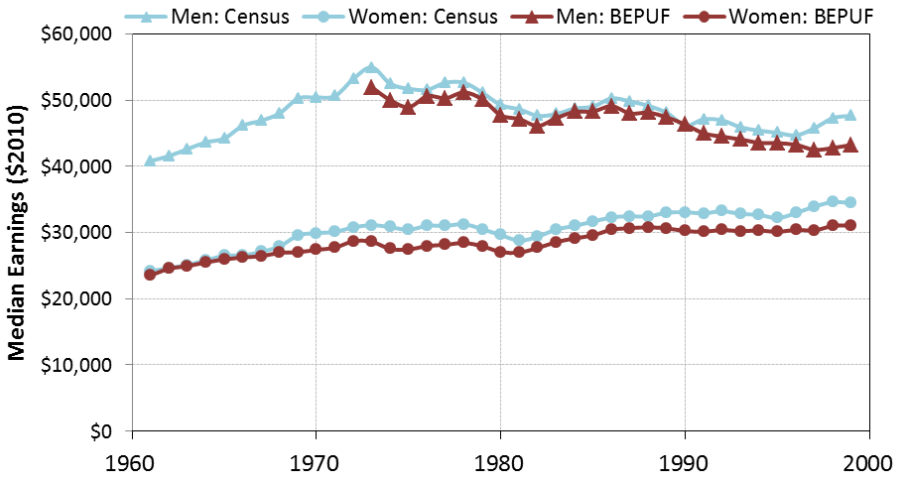
account for about 4 percent of men in the labor force, and women made up only one percent of active military personnel. So the addition of military earnings to the sample may explain about half of this fall in earnings variability.

Earnings values in the BEPUF are random rounded with a base of $25 and are also top-coded. The top-coding level is the amount of earnings subject to Social Security taxation in a given year. Congress originally set the taxable limit by statute. Since 1972, the limit has been indexed to the increase in average wages. To increase revenue, Congress increased the taxable earnings base with 1977 amendments to cover 90 percent of all earnings (Mulvey, 2010). The top-coded fraction of the sample (zero earnings excluded)—which is used in this study to set cutoffs—increases from 34 percent in 1951, to 52 percent in 1965 before dropping to 41 percent the next year, to 25 percent in 1974, and below 10 percent in 1981. Top-coding clearly limits how this sample can be used.

To avoid top-coding issues, I focus on later years suffering from less top-coding and limit the sample to the bottom half of the distribution for most estimates. Despite these issues, the BEPUF looks similar to other estimates of the individual earnings distribution: median earnings of men and women look similar to Census estimates (Figure 3.1) and percentile ratios look similar to estimates by KSS (Figure B1), although the exclusion of workers from recent cohorts may push my inequality estimates above theirs in more recent years.

I limit this study to prime-age workers between the ages of 25 and 60 and focus on earnings changes between 1973 and 1985 due to data issues and because this is the period of rapidly growing earnings inequality (Goldin and Katz, 2007). Beyond 1990, much of the sample retires and younger cohorts do not enter the sample. In the bottom half of the distribution, the median ages in 1973 and 1985 were 38 and 40, so

Figure 3.1 : "Full-time" median individual earnings in Census and BEPUF data



Note: Census data for full-time, year-round workers. Social Security earnings data (BEPUF) includes those who are at least 16 years old and in order to remove non-full-time workers, drops those with earnings below 1.5 times the full-year full-time minimum wage ($10,300 in 2004) indexed by nominal average wages ($2010, CPI-U).

age-bias does not appear to significantly affect the sample in this period. The fraction of top-coded annual earnings in the bottom half of the 1973 centered distribution increases with longer periods: from 3 percent over three years, to 14 percent over eleven years, and 27 percent over thirty-one years (although this decreases to 18 percent when including workers with zero earnings in some years). Top-coding in 1985 is not much of an issue, with the fraction of top-coded annual earnings only 0.1 percent over eleven years and 5 percent over thirty-one years. The higher initial fraction of top-coded earnings may bias the initial variability downward and thus the fraction of inequality explained by variability upward. I perform a number of robustness checks to show that alternative cutoffs give similar results. Top-coding should not affect the analysis of falling earnings variability between 1958 and 1965, as the fraction top-coded over three-year periods increases from 8 to 10 percent.

The BEPUF may not be representative for older cohorts if longevity and earnings are correlated. It may also not be representative for the remaining younger cohorts, as early retirement appears correlated with low earnings. To verify results from the BEPUF and extend the analysis to later years, I turn to another dataset without these issues. The EPUF is a recently released public use microdata set with similar earnings data as the BEPUF. Instead of the sample being drawn from those receiving benefits at a given point in time, the EPUF is drawn from a one percent random sample of all Social Security numbers issued before 2007. The SSA notes that except for a few exceptions, all of this data comes from the summary segment of the SSA's Master Earnings File.

The EPUF includes over 60 million annual earnings records for approximately 3 million individuals. See Compson (2011) for more discussion of the EPUF and how it compares with the BEPUF. A 10 percent random sample is drawn from the EPUF, leaving 264,390 workers in the panel. Compared with the Census and KSS, the EPUF yields similar estimates of earnings levels and inequalities (Figures B3 and B4).[4]

3.3 Earnings variability for the bottom of the distribution

Using BEPUF and EPUF, I find that between 1973 and 1985 at least half of increasing annual inequality among the bottom half of the distribution is attributable to

[4]I follow the same restrictions as Fig. III in KSS—keeping only workers above the threshold all five years—to estimate Gini coefficients for annual and five-year average earnings and then using Eqn. 2.1 to estimate variability. Only later years in the sample are somewhat comparable because of less top-coding. In 1985, both the KSS and EPUF samples have 5 percent variability and in 1990 they both have 4 percent variability. After this, KSS earnings variability falls to 3 percent, while the EPUF remains at 4 percent.

increasing variability. This effect grows when considering variability over more years: variability over 21 years caused two-thirds of the increase in annual inequality, and variability over 31 years caused three-quarters. When years of zero earnings are included, variability explains *all* of the increase in inequality. Variability also caused falling inequality between the late-1950s and mid-1960s. I verify these results with a number of dispersion measures and show that increasing variability resulted from increasing movements in and out of employment by men. First, I show these results for the BEPUF and then confirm them with the EPUF.

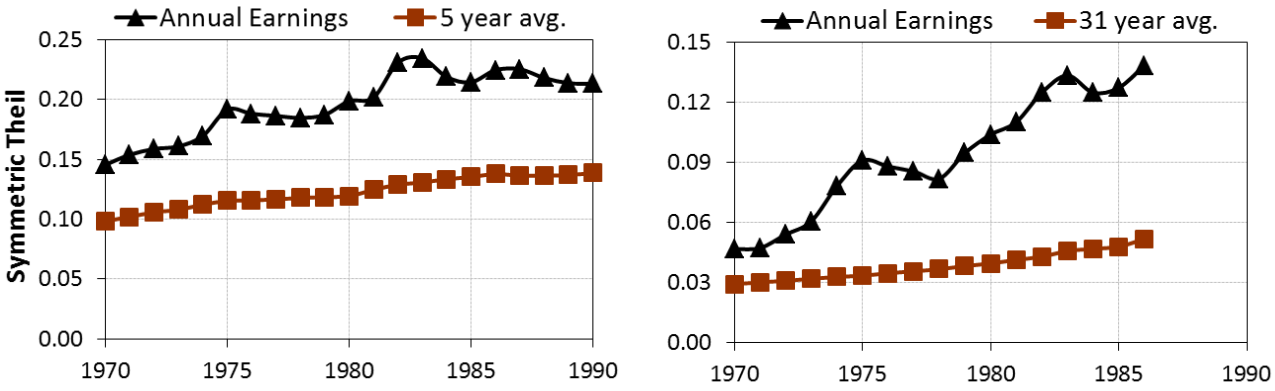
3.3.1 Individual Earnings Variability: 1973-1985

Annual earnings inequality is larger than five-year average earnings inequality. The gap between these annual and multi-year inequalities represents the fraction of annual inequality explained by variability. For example, the left side of Figure 3.2 shows that five-year variability in the bottom half of the BEPUF caused about one third of annual earnings inequality in the 1970s.[5] As the number of years over which earnings are averaged increases, the fraction of increasing inequality caused by variability also increases. For example, the right side of Figure 3.2 shows that the gap between annual and thirty-one-year average earnings inequalities grew much wider than the gap between annual and five-year average earnings inequalities.

Using the methodology outlined in Chapter 2, Table 3.1 shows individual earnings variability and its effect on annual inequality. Measuring dispersion with the Symmetric Theil index, earnings variability over five years explains half of the increase

[5]Variability measures are Shorrocks indices and follow Equation 2.1.

Figure 3.2 : Annual and multi-year individual earnings Symmetric Theil Indices for the bottom half of the distribution (zero earnings excluded)



Note: Annual and multi-year indices only include those in the BEPUF sample turning 25 to 60 years old and with positive earnings throughout the multi-year period. Multi-year measures are centered and cutoffs (medians) are set with multi-year earnings. ($2010, CPI-U).

in annual inequality and variability over thirty-one years explains three-quarters of the increase in annual inequality. The Atkinson index, an entropy measure emphasizing the middle of the distribution when the inequality aversion (ϵ) is one half, gives similar results as the symmetric Theil index. Variance of log earnings shows variability explaining a larger fraction of annual inequality, as it emphasizes low earnings, but it shows similar estimates for the fraction of annual inequality increase explained by variability. Compared with these dispersion measures, the Gini coefficient shows variability explaining about half as much of annual inequality. Estimates for the percent of annual inequality increase explained by variability are also about half the size for Gini coefficients, but the gap with other dispersion measures narrows over longer multi-year periods.

I perform a number of alternative top censoring strategies and find that the

Table 3.1 : Increasing individual earnings inequality and variability for bottom half of distribution (zero earnings excluded)

		Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
		1973	1985			
Symmetric Theil	**3 Years**	25%	29%	0.0217	0.0518	42%
	5 Years	33%	37%	0.0263	0.0537	49%
	11 Years	40%	47%	0.0398	0.0670	59%
	21 Years	45%	53%	0.0391	0.0611	64%
	31 Years	47%	62%	0.0507	0.0668	76%
Atkinson Index ϵ=0.5	**3 Years**	23%	26%	0.0084	0.0215	39%
	5 Years	30%	34%	0.0104	0.0226	46%
	11 Years	37%	44%	0.0166	0.0289	58%
	21 Years	43%	51%	0.0173	0.0279	62%
	31 Years	45%	61%	0.0231	0.0309	75%
Variance of Log Earnings	**3 Years**	36%	39%	0.459	1.082	42%
	5 Years	44%	47%	0.514	1.019	50%
	11 Years	51%	56%	0.655	1.129	58%
	21 Years	57%	63%	0.485	0.737	66%
	31 Years	62%	71%	0.679	0.922	74%
Gini Coefficient	**3 Years**	11%	12%	0.0082	0.0363	23%
	5 Years	15%	17%	0.0105	0.0401	26%
	11 Years	19%	24%	0.0256	0.0599	43%
	21 Years	19%	28%	0.0380	0.0793	48%
	31 Years	16%	36%	0.0663	0.1006	66%

Note: Annual and multi-year measures only include those in the BEPUF sample turning 25 to 60 years old and with positive earnings throughout the multi-year period. Multi-year measures are centered and cutoffs (medians) are set with multi-year earnings. Summary statistics in Table B1. ($2010, CPI-U).

results in Table 3.1 are robust to considering the bottom three, four or six deciles. Results are also robust to setting various thresholds on minimum earnings, moving the time window backwards or forwards one year, and relaxing the age restrictions to include earnings for anyone at least 16 years old (Table B2). Considering just men, the fraction of annual inequality from variability is slightly lower, but the fraction of annual inequality increase from variability is similar to that of the entire population (Table B3). Also, replacing annual inequalities in Equation 2.1 with

smoothed annual inequalities gives similar results for three, five and eleven-year periods (Table B4). Over longer periods, smoothed annual inequalities are relatively constant between 1973 and 1985 and so there is no trend to explain, as the initial year includes high inequalities in later years and the final year includes low values in earlier years.

Including years of zero individual earnings in the sample dramatically increases the estimated impact of variability on annual inequality. This is because including these years of no earnings—but still during one's "working life"[6]—captures more movements in and out of employment, where spells of non-employment last at least one calendar year. To limit the effect of workers with tenuous labor force participation, workers only remain in a multi-year sample if their average earnings throughout the multi-year period was above the threshold ($2,575 in 2004 and indexed with average earnings). Note that the absolute dollar cutoff for the bottom of the sample does not change when adding zero earnings. Although this results in more than half of workers being in the "bottom half" of the zeros included sample, it means individual workers are only added to the zeros excluded sample and none are dropped.

Symmetric Theil indices show that including zero earnings increases the fraction of annual inequality explained by variability in 1985 by at least twenty percentage points (Table 3.2). Whether measuring dispersion with symmetric Theil or Atkinson indices, including years of zero earnings means earnings variability explains almost

[6]To limit years of zero earnings due to late entry into the labor force or early retirement, an individual's "working life" is set with two restrictions. First, earnings before they turn 25 years old and after they turn 60 years old are dropped. Then any years of zero earnings before the first year of positive earnings or after the last year of positive earnings are dropped.

Table 3.2 : Increasing individual earnings inequality and variability for bottom half of distribution (zero earnings included)

		Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
		1973	1985			
Symmetric Theil	**3 Years**	62%	69%	0.1157	0.1250	93%
	5 Years	69%	75%	0.1598	0.1735	92%
	11 Years	77%	81%	0.2239	0.2379	94%
	21 Years	80%	82%	0.1976	0.2132	93%
	31 Years	81%	83%	0.1192	0.1231	97%
Atkinson Index ϵ=0.5	**3 Years**	41%	50%	0.0278	0.0326	85%
	5 Years	49%	57%	0.0388	0.0456	85%
	11 Years	56%	65%	0.0583	0.0654	89%
	21 Years	60%	67%	0.0557	0.0633	88%
	31 Years	62%	68%	0.0432	0.0453	95%
Gini Coefficient	**3 Years**	14%	18%	0.0212	0.0406	52%
	5 Years	18%	23%	0.0312	0.0558	56%
	11 Years	20%	30%	0.0590	0.0875	67%
	21 Years	20%	32%	0.0732	0.1017	72%
	31 Years	19%	34%	0.0818	0.0959	85%

Note: Annual and multi-year measures only include those in the BEPUF sample turning 25 to 60 years old, in their "working life", and with average earnings throughout the multi-year period above the threshold ($2,575 in 2004 and indexed with average earnings). Multi-year measures are centered and medians are set with multi-year earnings of the sample excluding zeros, i.e., the same medians as in Table 3.1. Summary statistics in Table B1. ($2010, CPI-U).

all of the increase in annual inequality. With the Gini coefficient, including years of zero earnings doubles the fraction of the annual inequality increase explained by variability to over half for three and five-year periods, two-thirds over eleven years, and nearly three-quarters over twenty-one years. Variance of log earnings is not shown because the heavy weighting of zeros overwhelms annual inequality measures.

The variability increase when including years of zero earnings seems mostly due to men, as inequality and variability both *decrease* for the sample of only women. Before discussing how this trend is explained by increased movement in and out of

employment by men, I first support these findings with measures of relative and absolute earnings variability.

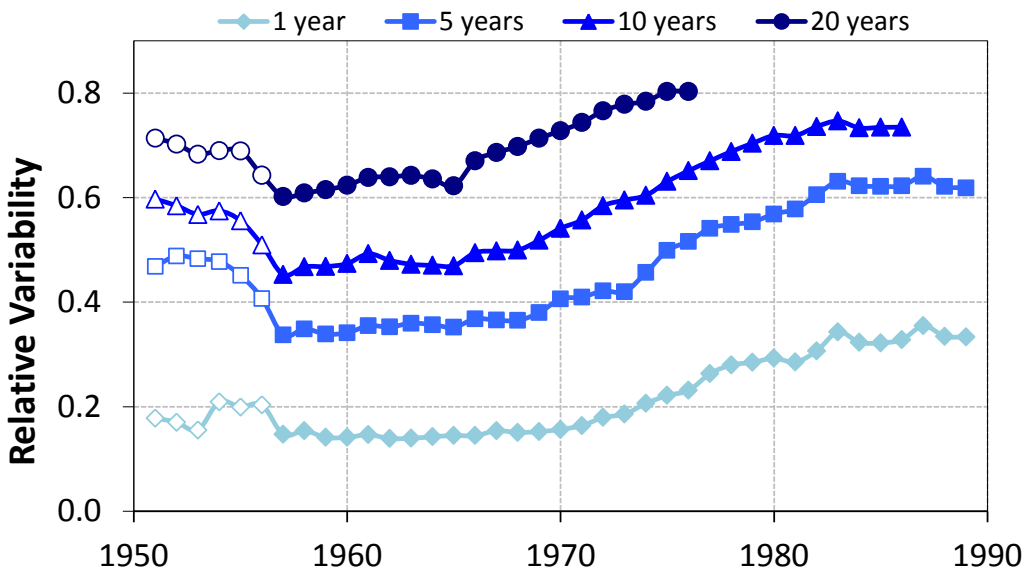
3.3.2 Relative and Absolute Earnings Variability

While I have emphasized Shorrocks indices, earnings variability can also be measured by the amount of rank reversals, or *relative variability*, and the size of earnings changes, or *absolute variability*. As inequality increases, workers at the same place in the distribution tend to have larger proportional gaps between themselves, so the same amount of rank-reversal requires larger absolute earnings moves. This means absolute variability should increase at least as fast as relative variability for the fraction of inequality from variability to maintain the same level, and larger increases in absolute earnings variability for the fraction to increase. The data support this reasoning, showing large increases in relative mobility and larger increases in absolute mobility.

Between 1965 and 1985, annual relative variability doubled (Figure 3.3). While long-run relative variability only increased by one-third, absolute variability in the short and long-run more than doubled (Figure 3.4). So growing absolute variability accompanied growing relative variability. These variability increases look similar when excluding zero earnings.

Variability measures before the addition of military earnings in 1957 are shown with whited-out markers. This compositional change appears to explain the sharp fall in variability the year of the change. Much of the high mobility between 1951 and 1953 may be due to soldiers—including over one million Korean War draftees—moving

Figure 3.3 : Relative variability for bottom half of the distribution (zero earnings included)

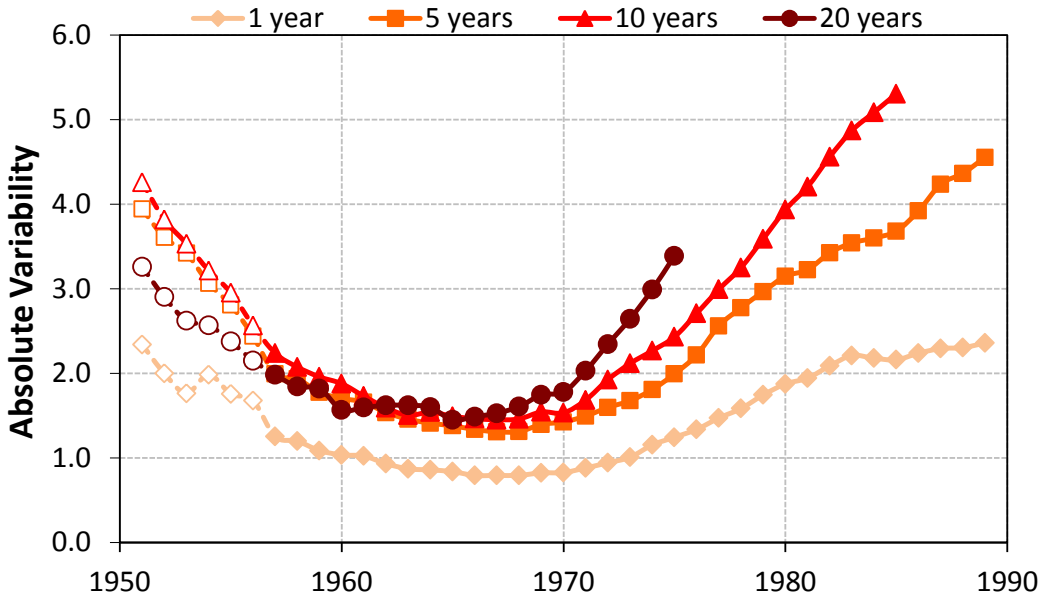


Note: Relative variability measured by 1-Spearman's rank correlation coefficients between year t and t+n real earnings. Same BEPUF sample as in Table 3.2, except median cutoffs are set with initial year earnings of the sample excluding zeros. Markers are whited-out in early years because of narrower sample coverage, which may bias variability estimates upward.

in or out of the sample. Annual relative variability measures suggest only a slight fall or constant relative variability in the 1950s, while absolute variability clearly fell in the late 1950s and early 1960s. The small annual variability rise in 1954 is possibly associated with the post-Korean War recession (Figures 3.3 and 3.4), as for the bottom of the distribution, recessions tend to increase variability and recoveries decrease variability.

Levels and changes in absolute variability differ across the income distribution. Absolute variability, as measured by the variance of earnings changes over a decade, is highest for the bottom of the earnings distribution and decreases as one moves up

Figure 3.4 : Absolute variability for bottom half of the distribution (zero earnings included)

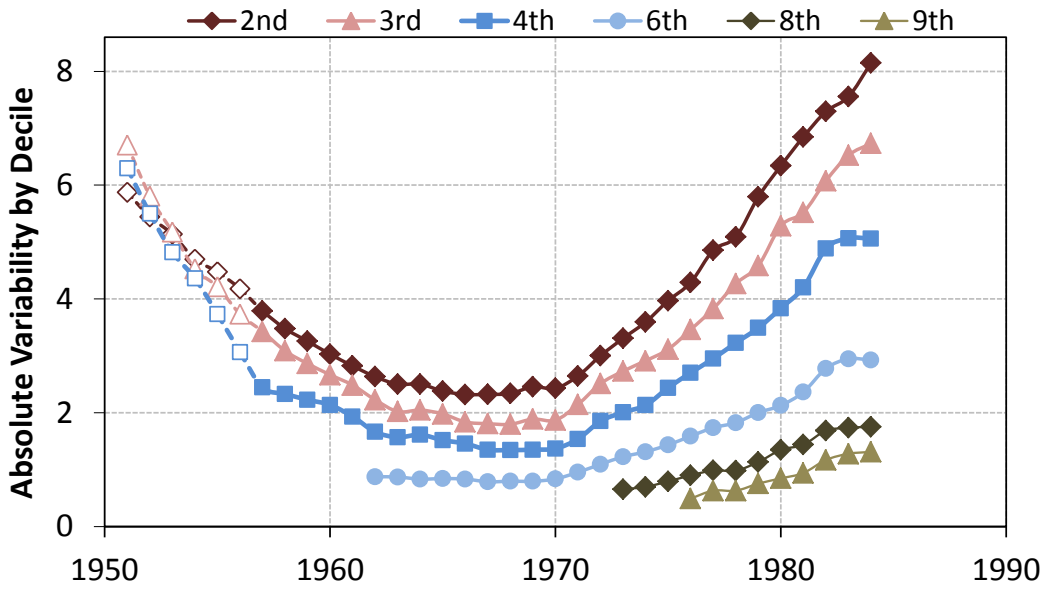


Note: Variance of arc percentage change in real annual earnings between year t and t+n. Same BEPUF sample as in Table 3.2, except median cutoffs are set with initial year earnings of the sample excluding zeros.

the earnings distribution (Figure 3.5). Since 1970, absolute earnings variability increased dramatically for the bottom seven deciles and somewhat for the eighth and ninth deciles.[7] This has led to a dramatic fanning out of absolute variability over the distribution, which is also seen in tax unit earnings data (Figure 2.5). This pattern repeats itself when looking at annual earnings changes and changes over twenty years. The bottom decile (not shown) mirrors the third decile since the mid-1960s, but is flat before that, likely because it contains many women with low labor force attachment and few changes to extensive margin variability.

[7]Top-coding prevents the estimation of variability for the top one percent, so the BEPUF data cannot confirm the top one percent variability trends studied in chapter 2.

Figure 3.5 : Absolute variability by decile (zero earnings included)



Note: Variability measured by variance of arc percentage changes between year t and t+10. Same BEPUF sample as in Table 3.2, except deciles are set with t to t+10 average earnings of the sample including zero earnings.

3.3.3 Falling Variability: 1957-1966

There is a striking decline in observed absolute variability from 1957 to the mid-1960s. This fall is seen for both short and long-term absolute earnings variability and across the bottom of the distribution (Figures 3.4 and 3.5). This falling variability also explains much of falling annual inequality.

From 1958 to 1965, decreasing three-year earnings variability for the bottom two quintiles explains 93 percent of decreasing symmetric Theil indices, 85 percent of decreasing annual Atkinson indices, and 69 percent of decreasing Gini coefficients (Table 3.3, panel A). A similar impact of decreasing earnings variability on inequality is seen between 1959 and 1966 for three and five-year variability (panel B). A

potential bias in this analysis may come from missing older workers, as the maximum age in the sample was 48 in 1958 and 55 in 1965. This does not seem to be an issue, as results are similar for the EPUF, which does not suffer from age bias. By looking at cohort specific variabilities, we can identify one possible cause of this fall in variability. Figure B2 suggests that overall earnings variability declined because of a fall in middle aged worker variability and as younger cohorts with lower variability entered the sample.

Winship (2009, Fig. A1) also comments on declining relative mobility over this period, finding that between WWII and the mid-1960s the fraction of people rising out of the bottom two quintiles in one year fell from a third to a fifth. These observations suggest that without falling variability in the bottom of the earnings distribution, annual inequality would have been higher in the 1960s.[8]

Income variability at the top of the distribution may have also fallen since the mid-1940s. Winship (2009) finds that between the mid-1940s and mid-1960s the fraction of individuals falling out of the top two earnings quintiles in one year decreased from 16 to 9 percent. If top earnings variability followed a similar correlation as bottom earnings, then decreasing variability may have also caused part of decreasing inequality in the 1940s and 1950s. Capital gains, which were low and less cyclical throughout the 1960s than other periods (Piketty and Saez, 2003), may have also contributed to falling top income variability.

[8]While the late 1950s inequality decrease is seen for the bottom of the distribution, it is not seen in measures for the entire distribution. This is because increasing upper middle class inequality seems to have cancelled out the compression of bottom earnings. KSS estimate that between 1955 and 1965 log(P50/P20) decreased from 0.60 to 0.55, while log(P80/P50) increased from 0.33 to 0.35.

Table 3.3 : Decreasing individual earnings inequality and variability for bottom two quintiles (zero earnings included)

		Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Percentage Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
Panel A: 1958-1965		**1958**	**1965**				
Symmetric Theil	**3 Years**	72%	58%	-0.1814	-0.1950	-38%	93%
Atkinson (ϵ=0.5)	**3 Years**	55%	41%	-0.0372	-0.0435	-27%	85%
Gini Coefficient	**3 Years**	22%	14%	-0.0340	-0.0490	-10%	69%
Panel B: 1959-1966		**1959**	**1966**				
Symmetric Theil	**3 Years**	67%	56%	-0.1104	-0.1206	-28%	92%
	5 Years	73%	63%	-0.1596	-0.1734	-33%	92%
Atkinson (ϵ=0.5)	**3 Years**	49%	40%	-0.0214	-0.0261	-17%	82%
	5 Years	56%	46%	-0.0297	-0.0361	-21%	82%
Gini Coefficient	**3 Years**	20%	16%	-0.0158	-0.0263	-5%	60%
	5 Years	23%	20%	-0.0171	-0.0309	-5%	56%

Note: See Table 3.2 for sample details. Second quintile cutoffs (P40) set with multi-year average earnings of the sample excluding zeros.

Cohort size fluctuations may have contributed to falling then rising earnings variability, especially in the bottom half of the distribution. The 1930s baby bust could have raised low wages and decreased variability as this small cohort entered the labor force in the mid-1950s, and the large 1946-1956 baby boom could have depressed low wages and increased variability as they started working in the 1970s (Macunovich, 1998, 2000). One reason for this cohort effect may come from younger workers having a more volatile number of hours worked and so more earnings variability (Jaimovich and Siu, 2009).

Different cohorts have persistently low or high earnings variability throughout their working lives. The birth cohorts entering the labor market in the Great

Depression have persistently high variability (left side of Figure B2), cohorts entering the labor market in the 1950s and 1960s have persistently low variability, and cohorts entering the labor market in the 1970s have persistently high variability (right side). These findings relate to those of Storesletten, Telmer and Yaron (2004), who show that cohorts entering the labor force during economic downturns have persistently higher idiosyncratic labor earnings risk. I now discuss two other pathways for falling and then rising earnings variability: changes in movements in and out of employment and changes in directional mobility.

3.3.4 Men's Movements in and out of Employment: From Organization Man to Rolling Stone

Earnings variability trends differ starkly between men and women. Falling earnings variability in the 1950s and early 1960s appears almost completely due to men (left side of Figure 3.6). By measuring the fraction of men of men with both zero and positive earnings over an eleven-year period in their "working life", the right side of Figure 3.6 measures a subset of extensive margin effects, which I refer to as movements in and out of employment. It appears that decreasing movement in and out of employment by men caused their decreasing earnings variability. Similarly, it appears that increasing movement in and out of employment by men later caused their increasing earnings variability in the 1970s and 1980s. The flat trend in movements in and out of employment by women suggests that their increasing earnings variability was caused by intensive margin variability, i.e., changes in hourly wages or the number of hours worked, which I refer to as *mobility*.

William H. Whyte's classic *The Organization Man* was first published in 1956.

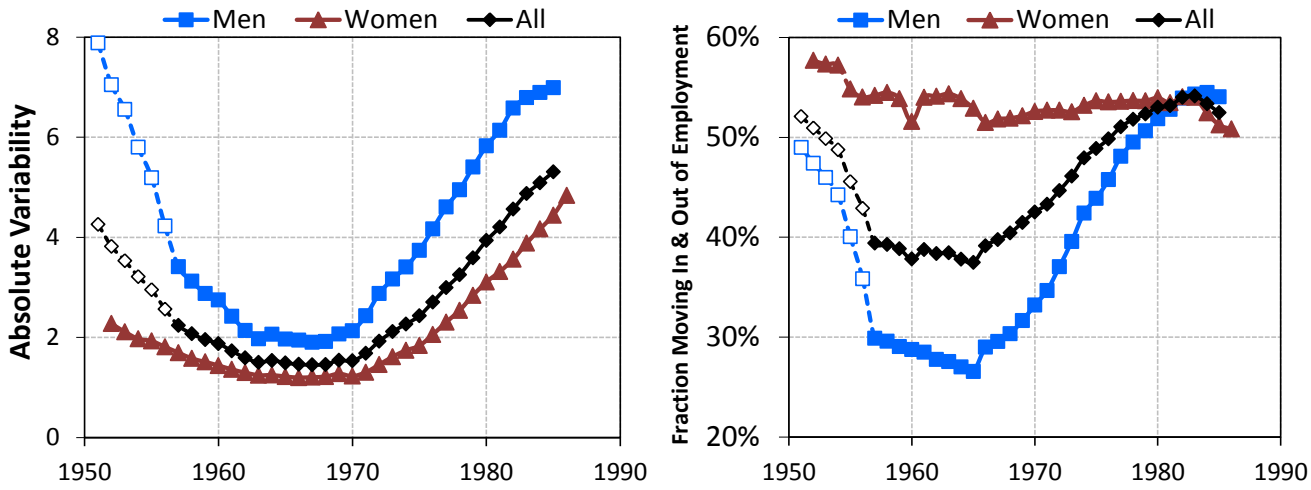
He comments on the trend of middle class men becoming more strongly linked to a particular organization, in many cases, a specific corporate or government job. Whereas some may value a smaller fraction of workers moving in and out of employment because of greater stability, Whyte criticized the decreasing individualism accompanying this change. However, he would perhaps not celebrate the rise in variability in the bottom half of the distribution studied here as it does not appear to necessarily result from increased individualism.

Bhagwati and Dehejia (1994) propose how institutional changes led to more movement in and out of employment. Rising trade, diffusion of know-how, and integration of capital markets caused more footloose industries and more volatility in comparative advantage. This caused more labor turnover between industries and frictional unemployment.[9] Indeed, over half of male workers in the bottom of the distribution had a year of zero earnings between 1980 and 1990, twice the fraction with zero earnings between 1965 and 1975. Industry level volatility may have also flattened earnings growth profiles because of decreased firm-specific human accumulation: "a rolling stone gathers no moss and a moving worker gathers no skills" (p. 56). Bhagwati and Dehejia thus paint a picture of a transformation from organization man to rolling stone.

This rolling stone phenomenon is seen in declining worker-firm attachment. Controlling for age, Farber (2008) estimates that between 1973 and 1988 the mean tenure for men in the private sector declined 10 percent, while holding relatively

[9]Comin, L.Groshen and Rabin (2009) find that since 1980, rising turbulence in the sales of large U.S. firms caused increased earnings volatility, much of which was likely from job loss.

Figure 3.6 : Absolute individual earnings variability (zeros earnings included) and fraction moving in and out of employment



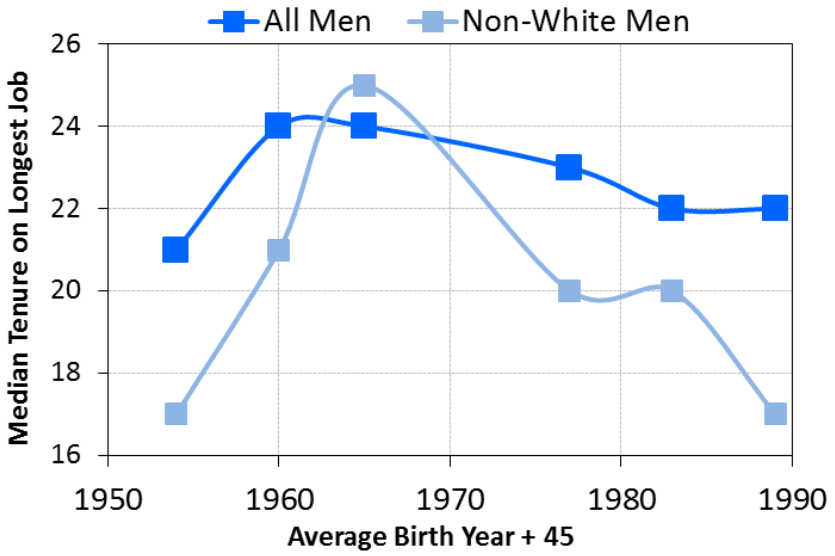
Note: BEPUF set as in Table 3.2, where medians are set with eleven-year average earnings (t to t+10) in the sample with zero earnings excluded. Variability measured by variance of arc percentage change of earnings between year t and t+10 and movements in and out of employment measured by the fraction with both zero and positive earnings in the eleven-year period.

constant for women. Figure 3.7 shows a similar decrease in men's tenure on their longest job, while an increase in tenure length from the 1950s to the early 1960s corresponds to the fall in variability. The long-run trend is even more pronounced for non-white men. Increased churning between employers is also reflected in measures of unemployment. Comparing 1973 and 1985, the probability that a male household head who was employed two years prior was unemployed grew from 2 to 4 percent (Keys and Danziger, 2008, Fig. 3.5).[10]

In addition to the U-shaped fraction of men moving in and out of employment, another

[10]For a review of literature on job stability in recent decades see Winship (2009, pp. 169–177). Using the PSID, Leonardi (2003) finds that earnings instability increased much more over the 1970s and 1980s among job changers than job stayers.

Figure 3.7 : Median tenure on the longest job for men



Source: Stevens (2008). Five-year cohort ranges with Retirement History Survey used for 1909 cohort.

trend emerges: the fraction of men and women moving in and out of employment converged. While less than 30 percent of men in the bottom half of the distribution moved in and out of the employment over an eleven-year period in the early 1960s, over 50 percent did so by the 1980s.[11] Meanwhile, over half of women in the bottom half of the distribution moved in or out of employment throughout this period. Besides this convergence of movements in and out of employment, other aspects of earnings patterns—such as earnings mobility—have become more similar between men and women.

[11] Practically all of the men moving in and out of employment were in the bottom half of the distribution.

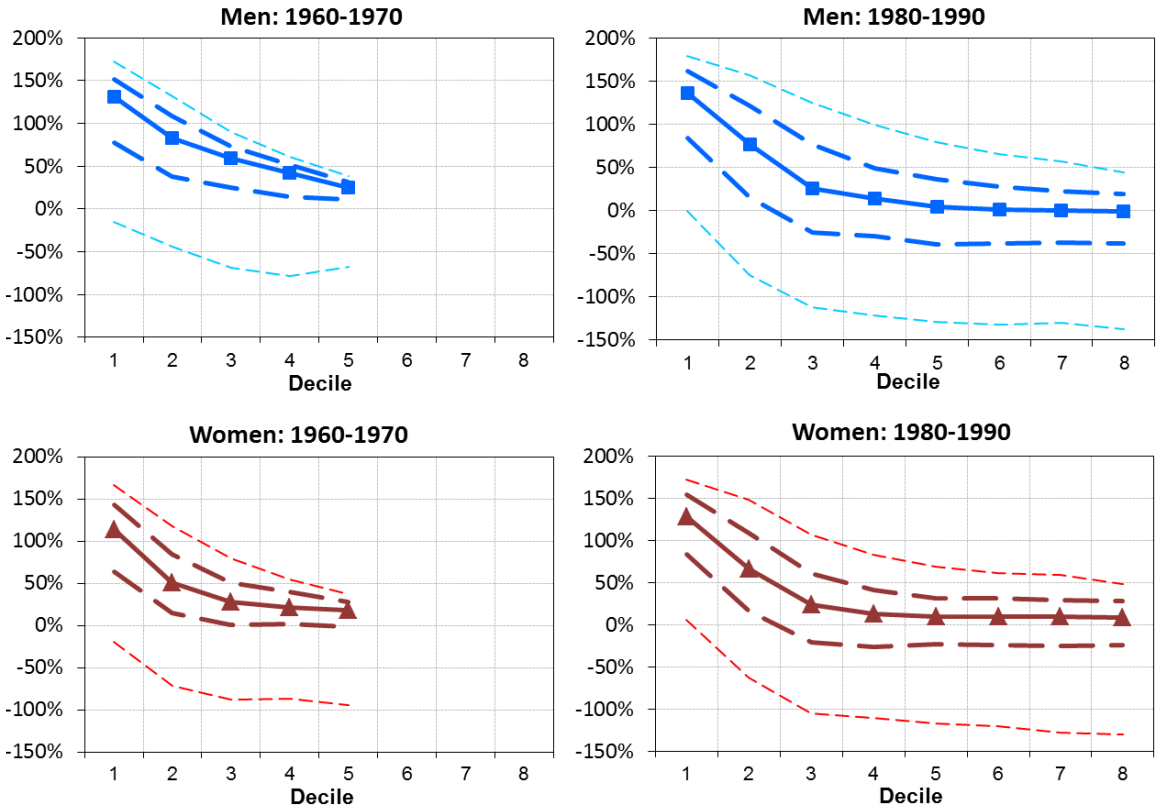
3.3.5 Increasing Relative Upward Mobility

We can focus on earnings mobility, rather than movements in and out of employment, by removing workers falling below an annual earnings threshold. Using a threshold of $2,575 in 2004 and indexed with average earnings, I make two observations about how earnings mobility changed between the 1960s and 1980s. First, median earnings mobility became more similar for men and women. Second, the distribution of earnings mobilities shows larger relative upward mobility; that is, the workers with the largest gains made much larger gains relative to median earnings changes in the 1980s than in the 1960s.

Earnings mobility, as measured by within decile median arc percentage earnings changes, converged between men and women across the earnings distribution. Figure 3.8 compares earnings mobility in two periods—1960 to 1970 and 1980 to 1990—and shows that men had higher median upward mobility than women in the 1960s, but that by the 1980s median mobility looked similar for men and women. This convergence resulted from a decrease in the median mobility of most men. A minor difference in the 1980s is that women's median earnings mobility in the fifth to eighth deciles remained slightly positive, whereas men's was zero. The trends in Figure 3.8 look similar for twenty-one year earnings changes.

Gaps between workers' earnings gains widened in the 1980s. Between the 1960s and 1980s, within decile median earnings changes fell, while the 95th percentile increased. This created a large gap between median and 95th percentile of earnings changes and represents an increase in relative upward mobility for a handful of workers.

Figure 3.8 : Distribution of absolute earnings mobility over the 1960s and 1980s



Note: Real arc percentage earnings changes shown: medians with solid line, interquartile range (25th and 75th percentiles) with dashed line and 5th and 95th percentiles with light dashed lines. To measure mobility, workers in the BEPUF with initial or final year earnings below threshold ($2,575 in 2004 and indexed with average earnings) are excluded. Deciles assigned with initial year earnings for men and women together and excluding zero earnings. ($2010, CPI-U).

Ignoring the median gains made by the bottom three deciles, the 1980s trend of stagnant median earnings accompanied by larger gains for some workers seems to fit a popular narrative of how inequality increased with the weakening of unions. Unions and collective bargaining may partly explain the narrow range of earnings changes in the 1960s, while the decline of unions could facilitate the widening of earnings changes (Katz and Autor, 1999). These observations also fit with the search literature emphasizing how better matching across heterogeneous workers

could explain increased heterogeneity of earnings changes, even for apparently similar workers a priori—in this case, in the same initial decile (Bagger et al., 2011; Leonardi, 2003). Alternatively, the increased dispersion of earnings changes may have also resulted from increased movements in and out of employment, as many of these movements would not be removed by the low threshold applied in Figure 3.8.

Longitudinal earnings changes by decile stand in sharp contrast to cross-sectional hourly wage changes in the 1980s. Real earnings changes are strongly positive for the bottom of the distribution and fall to near zero for the middle and upper parts of the distribution. Cross-sectional relative six-year wage changes by decile form an upward sloping trend from negative to positive 9 percent in the 1980s (Juhn, Murphy and Pierce, 1993, Fig. 4). Earnings variability is a function of changes in hourly wage rates and hours worked. Whereas changes in the supply and demand of skills may affect hourly wages, fluctuations in hours worked cause a significant fraction of earnings changes. Dynan, Elmendorf and Sichel (2008) estimate that between 1973 and 1985 there was about a 20 percent increase in the volatility of both household head real wages and hours worked. This paper captures both of these effects in measures of earnings variability and suggests that trends in volatility of hours worked were driven by long unemployment spells among men.

3.3.6 Movements in and out of employment by men explain increasing earnings variability

So did earnings variability increase because of extensive margin movements in and out of employment or intensive margin changes? To identify the source inequality growth due to variability, I make a number of additional restrictions and repeat the

analysis in Table 3.2, where zero earnings are included unless removed by one of the restrictions explained below. I find that extensive margin movements explain all of the earnings inequality increase due to variability between 1973 and 1985.

In order to isolate extensive margin variability, I remove intensive margin variability. This is done by replacing any annual earnings over six times the threshold (about one and a half times the minimum wage) with that worker's multi-year average earnings, thus removing intensive margin variability by closing the gap between annual and multi-year earnings. The increase in annual inequality is still completely explained by the remaining extensive margin variability for both the entire sample and the sample of only men (using five-year earnings and the symmetric Theil). Meanwhile, none of the increase in annual inequality is explained by variability for the entire sample and the sample of only women.

In order to isolate intensive margin variability, I remove extensive margin variability by replacing any annual earnings under four times the threshold (about the minimum wage) with that worker's multi-year average earnings. As a worker earning less than the annual equivalent of the minimum wage was most likely not working part of the year, this is exactly the extensive margin variability I would like to remove. Once the extensive margin variability is removed, none of the increase in inequality is explained by variability. This results hold when using the Symmetric Theil for five and thirty-one year earnings.

Finally, I want to see if women's increased labor force participation caused part of the increase in earnings variability. Women have higher levels of variability

because of a greater fraction in the bottom half of the distribution moving in and out of employment. So a larger fraction of workers being women will tend to increase earnings variability. However, this higher level of variability is offset by the long-run decrease in movements in and out of employment by women. It appears that two opposing forces resulted in no effect from a changing fraction of workers being women. When I fix the weight of women at their 1973 level (or even at half that level) I see no change in the effect of variability on inequality.

3.3.7 Similar Results with the Earnings Public-Use File (EPUF)

An alternative Social Security Administration earnings panel sample, the EPUF, shows similar impacts of variability on earnings inequality as the BEPUF. Table 3.4, panel A shows that from 1973 to 1985 increasing variability explained at least half of increasing inequality when excluding workers with any zero earnings in each multi-year period. When including workers with years of zero earnings, increasing variability again explains *all* of increasing individual earnings inequality (panel B). Also similar to the BEPUF results, Table 3.5 shows that in the EPUF falling earnings inequality in the late 1950s and early 1960s was almost entirely explained by falling variability.

Movements in and out of employment have a similar U-shaped trend in the EPUF (Figure 3.9). This trend emerges for the fraction of men who had one, two, four or six years of zero earnings over an eleven-year period within their "working life" (top, left figure) and is also seen for the fraction of men with one, two or three quarters of zero earnings in a year with positive earnings (top, right figure). Notice that we are considering the entire distribution here, as top-coding will not interfere with

Table 3.4 : Earnings inequality and variability for bottom half of the distribution

		Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Percentage Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
		1973	**1985**				
Panel A: Zero Earnings Excluded, No Threshold							
Symmetric Theil	**3 Years**	27%	29%	0.0126	0.0247	12%	51%
	5 Years	35%	39%	0.0142	0.0211	12%	67%
	11 Years	43%	48%	0.0188	0.0239	18%	79%
Atkinson Index (ϵ=0.5)	**3 Years**	24%	26%	0.0047	0.0098	11%	48%
	5 Years	32%	36%	0.0055	0.0086	11%	64%
	11 Years	41%	46%	0.0080	0.0103	16%	78%
Variance of Log Earnings	**3 Years**	37%	40%	0.0805	0.1373	18%	59%
	5 Years	46%	51%	0.0838	0.1110	18%	75%
	11 Years	55%	60%	0.0843	0.1017	22%	83%
Gini Coefficient	**3 Years**	12%	12%	0.0046	0.0144	5%	32%
	5 Years	16%	18%	0.0055	0.0129	5%	42%
	11 Years	21%	24%	0.0120	0.0198	8%	61%
Panel B: Zero Earnings Included, Threshold Applied to Multi-year Earnings							
Symmetric Theil	**3 Years**	66%	68%	0.0353	0.0351	7%	100%
	5 Years	73%	74%	0.0497	0.0521	8%	95%
	11 Years	79%	80%	0.0891	0.0923	11%	96%
Atkinson Index (ϵ=0.5)	**3 Years**	46%	49%	0.0104	0.0105	7%	100%
	5 Years	53%	56%	0.0145	0.0156	9%	93%
	11 Years	60%	64%	0.0255	0.0270	13%	94%
Gini Coefficient	**3 Years**	16%	18%	0.0098	0.0125	4%	79%
	5 Years	20%	22%	0.0140	0.0183	5%	77%
	11 Years	24%	29%	0.0300	0.0349	9%	86%

Note: EPUF with same restrictions as Tables 3.1 and 3.2.

these extensive margin measures. The fraction of the entire population moving in and out of employment increased from 17 to 27 percent, while the fraction of the entire sample from the bottom half of the BEPUF increased from about 13 to 27 percent. Hence almost all of the increase in movements in and out of employment were concentrated in the bottom half of the distribution. This is not surprising, as those with years of zero earnings will naturally be lower in the distribution, but it makes clear that the secular increase in extensive margin variability was largely due to low earnings male workers. Women's fraction of years and quarters with

Table 3.5 : Individual earnings inequality and variability for bottom two quintiles, zero earnings included

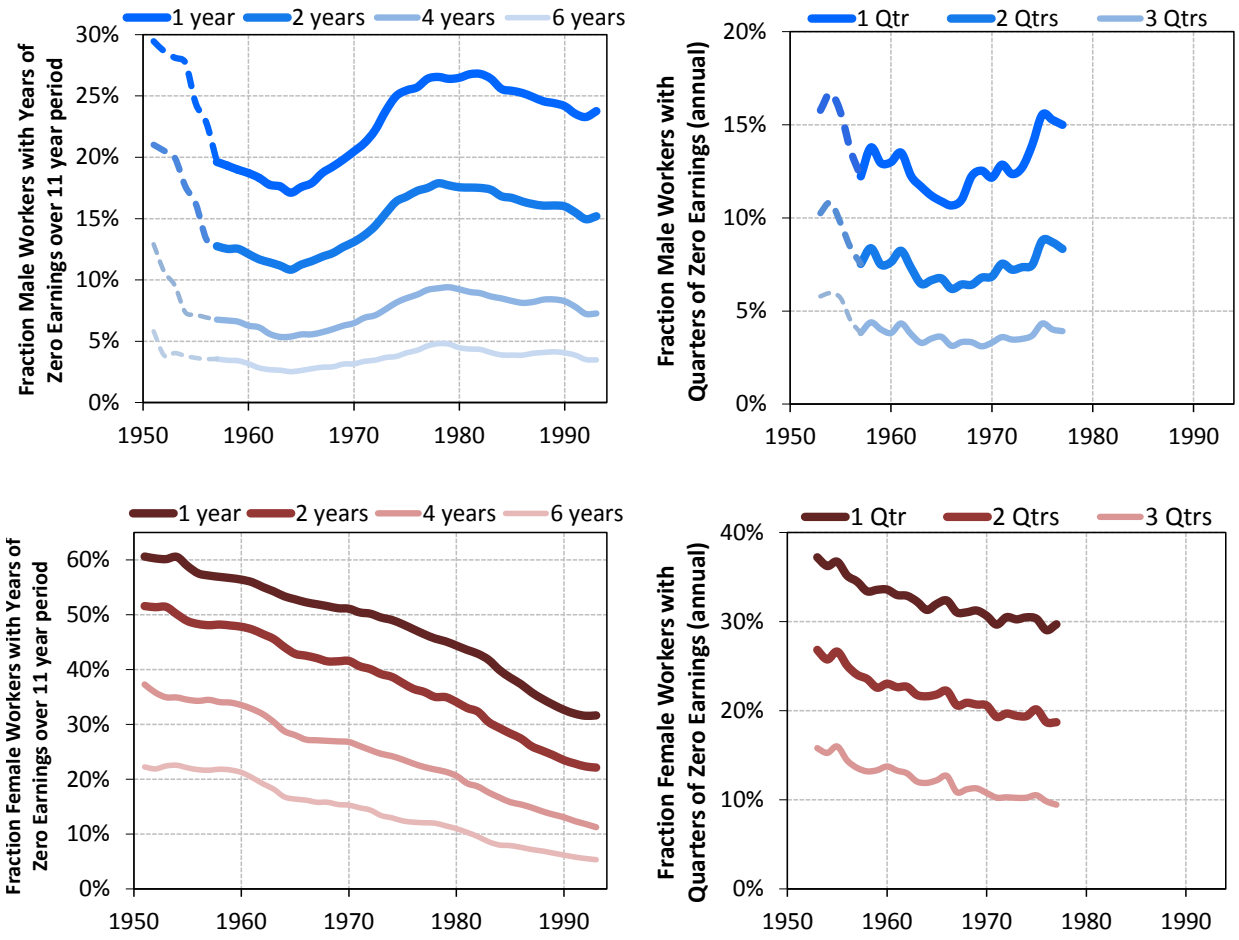
		Fraction Annual Inequality from Variability		Annual Inequality Change due to Variability	Annual Inequality Change from	Percentage Annual Inequality Change	Fraction Annual Inequality Change Variability
Panel A: 1958-1965		**1958**	**1965**				
Symmetric Theil	**3 Years**	67%	61%	-0.0712	-0.0751	-17%	95%
Atkinson (ϵ=0.5)	**3 Years**	52%	46%	-0.0164	-0.0183	-12%	90%
Gini Coefficient	**3 Years**	22%	19%	-0.0162	-0.0214	-5%	76%
Panel B: 1959-1966		**1959**	**1966**				
Symmetric Theil	**3 Years**	64%	57%	-0.0643	-0.0684	-18%	94%
	5 Years	71%	65%	-0.0956	-0.1017	-20%	94%
Atkinson (ϵ=0.5)	**3 Years**	48%	42%	-0.0139	-0.0159	-11%	88%
	5 Years	55%	49%	-0.0201	-0.0230	-14%	87%
Gini Coefficient	**3 Years**	19%	17%	-0.0117	-0.0177	-4%	66%
	5 Years	23%	20%	-0.0158	-0.0235	-4%	67%

Note: EPUF with same restrictions as Tables 3.2 except second quintile cutoffs (P40) set with multi-year average earnings of the sample excluding zeros.

zero earnings declined steadily since 1951 (bottom of Figure 3.9). The longer EPUF panel also shows that extensive margin variability seemed to have peaked in the early 1980s and since then has decreased modestly for men and rapidly for women. Absolute earnings variability, seen in the next section, shows similar trends.

The cyclical trend of variability is seen clearly in the EPUF. Variability tends to increase just before and at the beginning of a recession and fall immediately following a recession. The spike in variability before recessions may result from a heated expansion just before a downturn. Figure 3.10 shows that for the bottom two quintiles of the EPUF, annual earnings variability had the same pronounced U-shaped trend seen in the BEPUF. The EPUF shows that variability peaked following the early 1980s recession and then began a secular decline until 2000. Declining variability for the bottom two quintiles was briefly interrupted by the 1991 recession, but quickly returned to

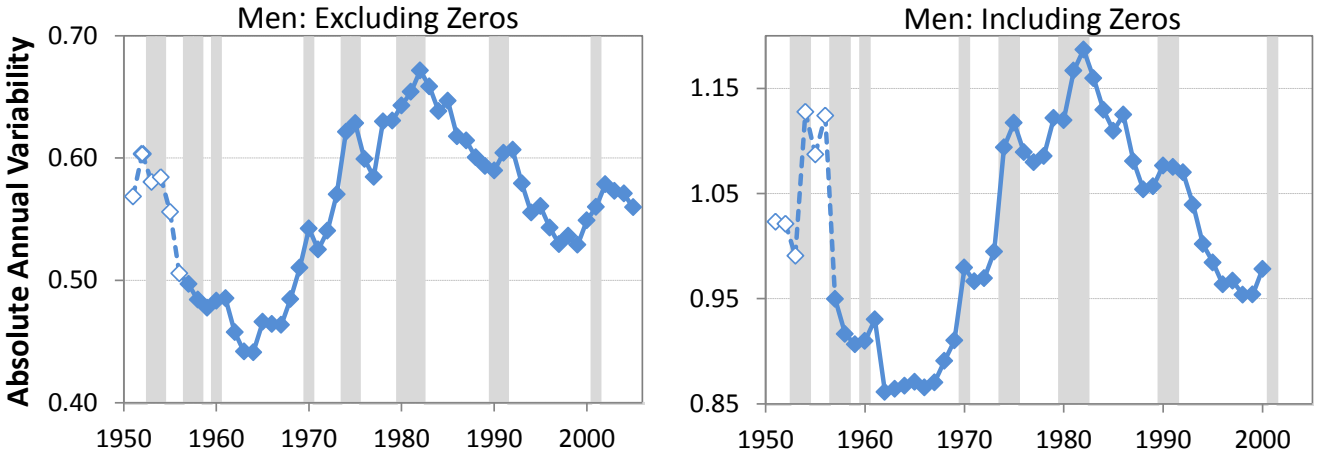
Figure 3.9 : Fraction of men and women moving in and out of employment by years and quarters (full sample above multi-year average earnings threshold)



Note: Only includes those in the EPUF sample turning 25 to 60 years old and average earnings throughout each eleven-year period above the threshold ($2,575 in 2004 and indexed with average earnings). Full sample is included, not just bottom half, and only 1% subsample. Movements in and out of employment measured by the fraction with both zero and positive earnings in each eleven-year period from t to t+10 (left figures) and the fraction with quarters of zero earnings but positive earnings that year (right figures).

the two decade trend. Earnings variability appears to have permanently increased with the 2001 recession and as the 2008 recession likely caused an even larger increase in variability, it is possible that 2000 marked a trough in a new U-shaped variability trend starting in the early 1980s. Adding zero earnings (right side of Figure 3.10)

Figure 3.10 : Absolute annual variability of bottom two quintiles (EPUF)



Note: Recessions lasting at least one full quarter in a year are shown in gray. Absolute variability measured by variance of annual arc percentage earnings changes (between years t and t+1). Only include those in the EPUF turning 25 to 60 years old. The left figure only includes male workers with positive earnings throughout each two-year period. The right figure adds men with zero earnings. P40 cutoffs are set by initial year earnings for the sample excluding zeros. ($2010, CPI-U).

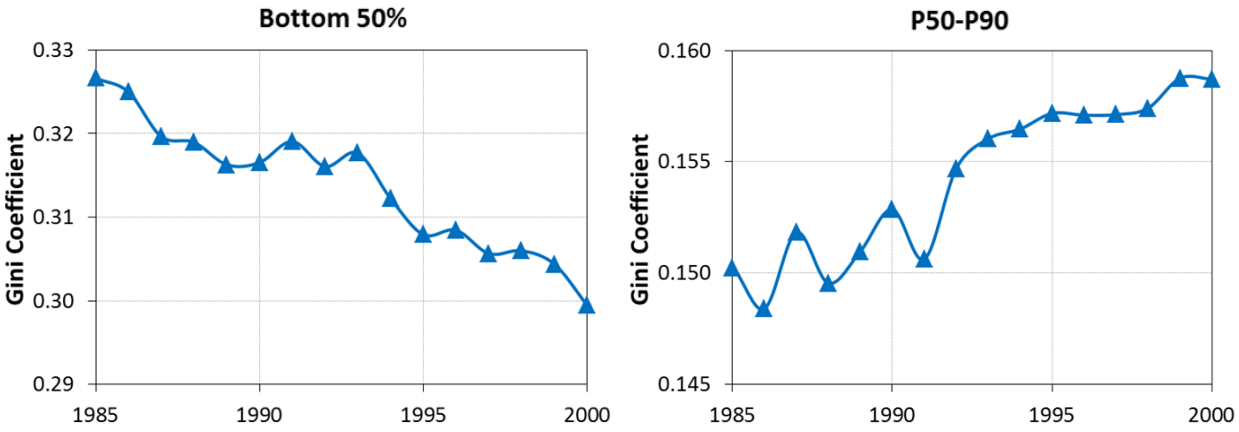
doubles the level of variability and makes the effect of recessions starker. The same pattern emerges over multiple years and for women, although women have a more shallow U-shape pattern from 1950 to 1985 (Figure B5).

3.4 Variability and Inequality Trends, 1985-2000: Was there a Great Moderation in Micro Earnings?

Recent studies on earnings variability since 1985 have provided mixed results, with most studies finding flat variability, while others find either increasing or decreasing variability. By dividing my sample, I show that different trends in the bottom and top of the distribution may help explain the divergence of findings.

Between 1985 and 2000, annual earnings inequality within the bottom half of the

Figure 3.11 : Falling annual earnings inequality in the bottom of the distribution and increasing inequality in the top (zero earnings excluded)



Note: EPUF sample set as in Table 3.1, but is only a one percent subsample. Sample only includes workers with positive earnings throughout the five-year period, no threshold applied. Bottom half of the distribution shown in left figure and the sixth to ninth deciles (P50-P90) shown in right figure.

Table 3.6 : Decreasing individual earnings inequality and variability for bottom half of the distribution 1985-2000 (zero earnings excluded)

		Fraction Annual Inequality from Variability		Annual Inequality Change due to Variability	Annual Inequality Change	Percentage Annual Inequality Change	Fraction Annual Inequality Change from Variability
		1985	2000				
Symmetric Theil	**3 Years**	29%	26%	-0.0137	-0.0225	-10%	61%
	5 Years	39%	34%	-0.0138	-0.0148	-8%	93%
	11 Years	48%	42%	-0.0165	-0.0148	-9%	111%
Atkinson Index (e=0.5)	**3 Years**	26%	23%	-0.0057	-0.0102	-10%	56%
	5 Years	35%	31%	-0.0061	-0.0069	-8%	88%
	11 Years	46%	39%	-0.0074	-0.0069	-9%	107%
Variance of Log Earnings	**3 Years**	40%	37%	-0.0540	-0.0620	-7%	87%
	5 Years	50%	46%	-0.0489	-0.0338	-5%	145%
	11 Years	60%	53%	-0.0595	-0.0424	-7%	140%
Gini Co-efficient	**3 Years**	12%	10%	-0.0087	-0.0179	-6%	49%
	5 Years	18%	15%	-0.0102	-0.0124	-4%	82%
	11 Years	24%	20%	-0.0137	-0.0130	-5%	105%

Note: Annual and multi-year measures only include those in the EPUF sample turning 25 to 60 years old and positive earnings throughout each multi-year period. Multi-year measures are centered and medians are set with multi-year earnings in the sample excluding zeros. ($2010, CPI-U).

distribution fell (Figure 3.11, left side). Meanwhile, within the top of the distribution earnings inequality increased (right side). Falling annual inequality in the bottom of the distribution was largely caused by falling variability—half of the fall is explained by falling three-year variability and all is explained by falling eleven-year variability (Table 3.6). Most of the fall in both inequality and variability was caused by men, especially over longer multi-year periods (Table B5).

Table 3.7 : Increasing individual earnings inequality and flat variability for top earners, P50–P90 (zero earnings excluded)

		Fraction Annual Inequality from Variability		Annual Inequality Change due to Variability	Annual Inequality Change	Percentage Annual Inequality Change	Fraction Annual Inequality Change from Variability
		1985	2000				
Symmetric Theil	**3 Years**	27%	25%	0.0010	0.0058	16%	16%
	5 Years	38%	36%	0.0018	0.0077	21%	23%
	11 Years	56%	48%	0.0012	0.0091	25%	14%
Atkinson Index (ε=0.5)	**3 Years**	26%	24%	0.0004	0.0028	16%	15%
	5 Years	37%	34%	0.0008	0.0037	21%	21%
	11 Years	55%	47%	0.0006	0.0045	26%	14%
Variance of Log Earnings	**3 Years**	36%	34%	0.0022	0.0110	14%	20%
	5 Years	50%	48%	0.0057	0.0167	19%	34%
	11 Years	69%	60%	-0.0012	0.0138	15%	-8%
Gini Coefficient	**3 Years**	11%	11%	0.0004	0.0120	8%	4%
	5 Years	16%	16%	0.0013	0.0164	11%	8%
	11 Years	26%	23%	0.0006	0.0235	16%	3%

Note: Annual and multi-year measures only include those in the EPUF sample turning 25 to 60 years old and positive earnings throughout each multi-year period. Multi-year measures are centered and cutoffs (P50 and P90) are set with multi-year earnings in the sample excluding zeros. ($2010, CPI-U).

Increasing earnings inequality within the top of the distribution (P50-P90) between 1985 and 2000 appears to have been caused by changes in permanent earnings and not increasing variability. Table 3.7 shows a large annual inequality increase of up to a quarter for this part of the distribution, but that variability explains almost none

of this increase when using Gini coefficients. Other dispersion measures are noisier, but it appears that variability explains under a quarter of the increase in annual inequality. The increase in top earnings inequality appears largely due to women and variability explains about a third of increasing female earnings inequality (Table B6). Meanwhile, men in the top of the distribution had relatively stagnant or even falling earnings variability in this period. Results are similar using smoothed annual earnings for the bottom and top of the distribution over three and five-years, but in 2000 the annual inequality level is higher over eleven-years because of higher post-2000 inequality.

Skill-biased technical change (SBTC) may help explain this divergence in variability trends between the bottom and top of the distribution. SBTC could mostly affect the permanent component of earnings of higher-skilled workers in the top of the distribution, hence the flat trend in their earnings variability. Meanwhile, it is not clear how SBCT would cause falling earnings variability and movements in and out of employment among lower-skilled workers. Perhaps the 1970s institutional changes proposed by Bhagwati and Dehejia (1994) began to have a less disruptive effect on these workers in the period of the Great Moderation.

3.5 Conclusion

Annual earnings inequality can grow rapidly while longer-run earnings inequality grows more slowly. This implies that earnings variability explains part of the change in annual inequality. Between 1973 and 1985, I estimate that increasing individual earnings variability in the bottom half of the distribution caused at least half of

this group's increase in annual inequality. When including years of zero earnings, increasing individual earnings variability explains all of this group's increase in annual earnings inequality. Similarly, I present evidence that decreasing earnings variability in the bottom of the distribution caused most of the decrease in annual inequality between the late 1950s and mid-1960s. This suggests that the U-shaped annual inequality trend between the 1950s and mid-1980s was largely caused by falling and then rising variability. Long-run trends in movements in and out of employment by men seem to have caused these changes in earnings variability.

Between 1985 and 2000, movements in and out of employment have declined for both men and women. This has led to falling variability and inequality in the bottom of the distribution. However, the 2001 recession seems to have caused earnings variability to increase again and the 2008 recession has precipitated a period of high rates of long-term unemployment, which will further increase earnings variability. This paper suggests that these changes in variability could also have large impacts on measures of annual earnings inequality.

Individual earnings variability may not translate into household consumption volatility. While variability explains much of individual earnings inequality, it explains about half as much tax unit after-tax income inequality (compare Tables 3.6 and 3.7 to Table 2.5). Much of this difference may be explained by intra-household earnings smoothing, which can reduce consumption volatility (Dynarski and Gruber, 1997; Gottschalk and Danziger, 2005; Shore, 2010).[12] Negative earnings shocks are

[12]Since 1985, however, family income variability and inequality seem to have continued increasing despite decreasing individual earnings variability and inequality within the bottom half of the

also partly offset by income stabilizers like unemployment insurance. Guvenen and Smith (2010) find that income shocks are not very persistent and individuals have a good idea about their future income prospects, allowing for consumption smoothing. Intra-household earnings smoothing, income stabilizers, low persistence of earnings shocks, and knowledge of future earnings suggest that changes in individual earnings inequality and variability may be a poor guide to underlying welfare changes, despite communicating important information about the labor market.

Even if low-income households know what their future income is likely to be, some may be unable to fully smooth their consumption when they face negative transitory shocks (Blundell, Pistaferri and Preston, 2008). For example, households that can rely less on these insurance strategies likely include low-income, single parent households. A focus on inequality or variability measured by summary statistics for the entire population dilute information about subgroups much more likely to suffer real impacts from income variability.

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distribution. Relative to earlier decades, Juhn and Potter (2007) find that the value of "marriage insurance" from the added-worker effect decreased as employment became more positively correlated within couples.

Chapter 4

Lifetime Income Tax Progressivity

4.1 Introduction

Tax progressivity measures how tax burdens vary over the income distribution. Although tax progressivity estimates traditionally use annual tax burdens and incomes, if individuals and households can smooth consumption over time, then tax progressivity should be considered from multi-year and perhaps even lifetime perspectives. Income variability means annual and multi-year effective tax rates may differ significantly. While those in the bottom decile of consistent tax filers pay little or no income taxes in a given year, I estimate that over eleven years, these families pay tax rates about five percentage points higher than annual rates suggest. I also estimate that individuals in the bottom half of the earnings distribution pay more taxes over their lifetimes than annual measures suggest.

Changes in tax progressivity capture much public attention because of vertical equity concerns, but most estimates only present changes in annual tax progressivity.[1] Income variability means that in a progressive tax system annual

[1]While punctuated by periods of reform, Hayes, Lambert and Slottje (1995) find that since the 1950s the tax code has generally become more progressive. Kasten, Sammartino and Toder (1994) estimate that in the early 1980s progressivity declined but by 1993 had increased. Congressional Budget Office (2008*a*) estimates decreasing effective federal tax rates across the income distribution since 1970 with the largest cuts in the bottom half of the distribution. They also estimate a flattening of progressivity within the top one percent. Similarly, Piketty and Saez (2007) find decreasing progressivity among the top one percent since 1960 due to declining burdens of federal estate and

and lifetime federal tax incidence can diverge, since for two workers with the same lifetime income, the worker with the more variable income will pay more taxes over their lifetime and so have a higher effective lifetime tax rate. A more progressive tax system and a larger divergence in income variability between workers with similar lifetime incomes will increase this horizontal inequity. So while economists are familiar with the trade-off between vertical equity and efficiency, income variability means there is also a trade-off between vertical and horizontal equity.

Previous studies find that lifetime tax burdens are more proportional than annual taxes, as income taxes become less progressive and consumption taxes less regressive (Davies and France St-Hilaire, 1984; Fullerton and Rogers, 1991, 1993, 1996; Metcalf, 1994). This difference may be especially pronounced at the bottom of the distribution, where many taxpayers are young workers or retirees facing low tax rates during the low points of their income profile. These studies have not addressed the issue of heterogeneity in effective tax rates within lifetime income groups due to differences in income variability. By considering the impact of income variability on lifetime tax burdens, I estimate the extent of this horizontal inequity.

Estimating annual and lifetime tax burdens presents many difficulties because of the short nature of most income panels and the limited size of the popular Panel Study of Income Dynamics (PSID). Early data will be missing for older workers in most panel data sets and future incomes are obviously unavailable for those still working. A popular approach to overcoming these limitations has been to estimate

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corporate income taxes.

lifetime income tax progressivity using current consumption as a proxy for lifetime income (Davies, 1960; Poterba, 1989; Metcalf, 1994). Instead of trying to estimate lifetime tax burdens, Congressional Budget Office (2005) estimates the difference between annual and ten-year effective tax rates and finds that households in the bottom two quintiles pay multi-year effective tax rates that are slightly higher than annual tax rates. An alternative approach is to use parametric models of earnings processes. Fullerton and Rogers (1993) construct a model in which wages change smoothly over agents' lifetimes and hours worked are optimized taking into account tax policy, which implies that annual and lifetime tax incidence tend to differ primarily because of average life-cycle income changes. In reality, each year over a quarter of workers experience earnings increases or decreases of at least 50 percent (Congressional Budget Office, 2008*b*). These idiosyncratic income shocks imply that life-cycle effects will capture only a fraction of true income variability.[2] In order to capture the effects of income variability, I estimate lifetime effective tax rates using a recently released Social Security Administration dataset, which is the longest public-use panel of U.S. earnings available and includes over two million individuals.

Section 2 of this chapter presents estimates of annual and eleven-year tax progressivity for tax units. Section 3 presents estimates of annual and lifetime tax progressivity for individuals. Section 4 concludes.

[2]In order to study the impact of a Hall-Rabushka flat tax, Ventura (1999) creates a model in which agents have a common life-cycle wage profile and face idiosyncratic income shocks calibrated to match aggregate U.S. earnings inequality, but he only reports cross-sectional distribution results.

4.2 Differences in tax progressivity across tax units

I use the CWHS tax return panel (described in chapter 2) to compare annual and eleven-year tax progressivities. For tax units, I find that within income group effective tax rate heterogeneity decreases over time. Eleven-year tax rates are also higher than annual tax rates at the bottom of the distribution.

Annual effective tax rates are calculated by dividing total taxes paid by cash income (see chapter 2 for a definition of cash income). To calculate eleven-year effective tax rates, incomes and taxes are first set to 2010 dollars with the CPI-U-RS and then averaged over eleven years. A tax units average taxes paid over the eleven-year period are then divided by their average income, which means eleven-year tax rates are equivalent to dividing total constant dollar taxes paid by total constant dollar income. I show tax rates for 1985 as this year allows the calculation of eleven-year averages despite the short nature of the CWHS panel from 1979 to 1990.

Individuals within a specific income group may have significantly different tax rates. The 2012 Economic Report of the President (p. 88) shows within each income quintile the average tax rates for the bottom and top tax rate deciles. Tax rates range between negative 14 to positive 16 percent in the bottom income quintile, 2 to 24 percent in the middle quintile, and 9 to 35 percent in the top one percent.

Tax rate heterogeneity within income groups may result from different tax rates on different forms of income, such as exclusions or preferential rates for capital gains, or because of differences resulting from exemptions, itemized deductions,

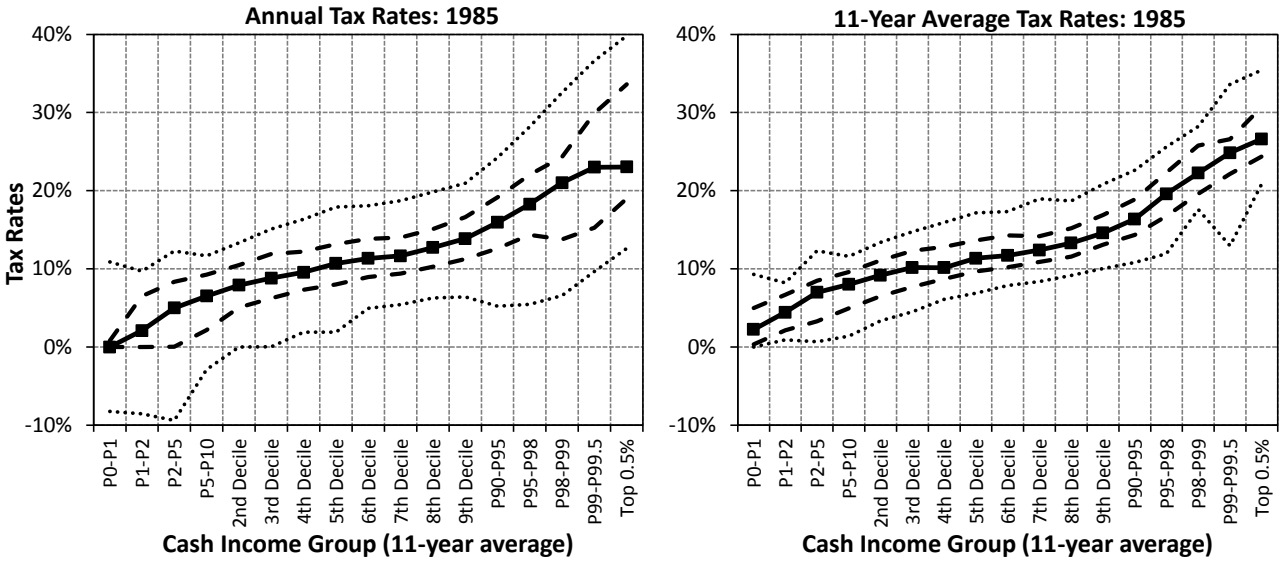
and credits. Figure 4.1 shows within income group tax rate heterogeneity with the gaps between median tax rates, the interquartile range of tax rates (25th and 75th percentiles) and the extreme 5th and 95th percentile of tax rates. It is clear that eleven-year tax rates (right side) have much more heterogeneity than annual tax rates (left side), especially at the ends of the distribution. The bottom decile tax rate gap (between the 5th to 95th percentiles) decreases from 20 to 10 percentage points, and top half of one percent gap decreases from about 28 to 15 percentage points.

Tax rate heterogeneity is lower over a decade, as compared to a single year. This is because within income group differences even out over time. At the bottom of the distribution, this may come from tax units with negative annual tax rates due to claiming earned income credits and paying positive taxes in other years. At the top of the distribution, other factors drive the convergence of within income group tax rates over time. While large capital gains realizations may push down a tax unit's tax rate in a specific year, over a decade these gains and losses will converge within an income group, driving down tax rate heterogeneity. Similarly, when a tax unit initially buys a house, they will likely initially deduct a significant amount of mortgage interest. Over time this interest deduction will dissipate, so averaging over many years will smooth out this itemized deduction heterogeneity.

Part of the decrease in the heterogeneity of tax incidence may be due to the Tax Reform Act of 1986. This reform broadened the tax base and decreased some of the reasons for tax rate heterogeneity. However, annual tax rate heterogeneity looks similar in 1985 and 1988, so the reform does not seem to explain most of the

patterns seen in Figure 4.1.

Figure 4.1 : Annual and eleven-year tax unit average tax rates: 1985



Note: The middle line is the earnings decile median tax rate. The dashed lines are the 25th and 75th tax rate percentiles and the dotted lines are the 5th and 95th percentiles. Income groups are set with eleven-year average cash income, so these two figures include the same individuals in each group. Cash income is for all non-dependent tax units in the CWHS and only tax units present all eleven years are included in the sample. Incomes and taxes are averaged over eleven years after setting to 2010 dollars with the CPI-U-RS.

In addition to comparing annual and eleven-year tax rate heterogeneity, I also compare differences in average tax rate levels on an annual and eleven-year basis. To control for changing tax policy over the 1980s, I average annual tax rates over the eleven-year period. The left side of Figure 4.2 shows that eleven-year and annual tax rates are similar over the income distribution, but that the bottom three deciles have higher eleven-year tax rates than annual tax rates. The gap is about 5 percentage points for the bottom decile, but only about 2 percentage points for the second decile and 1 percentage point for the third decile. The right side of Figure 4.2 shows

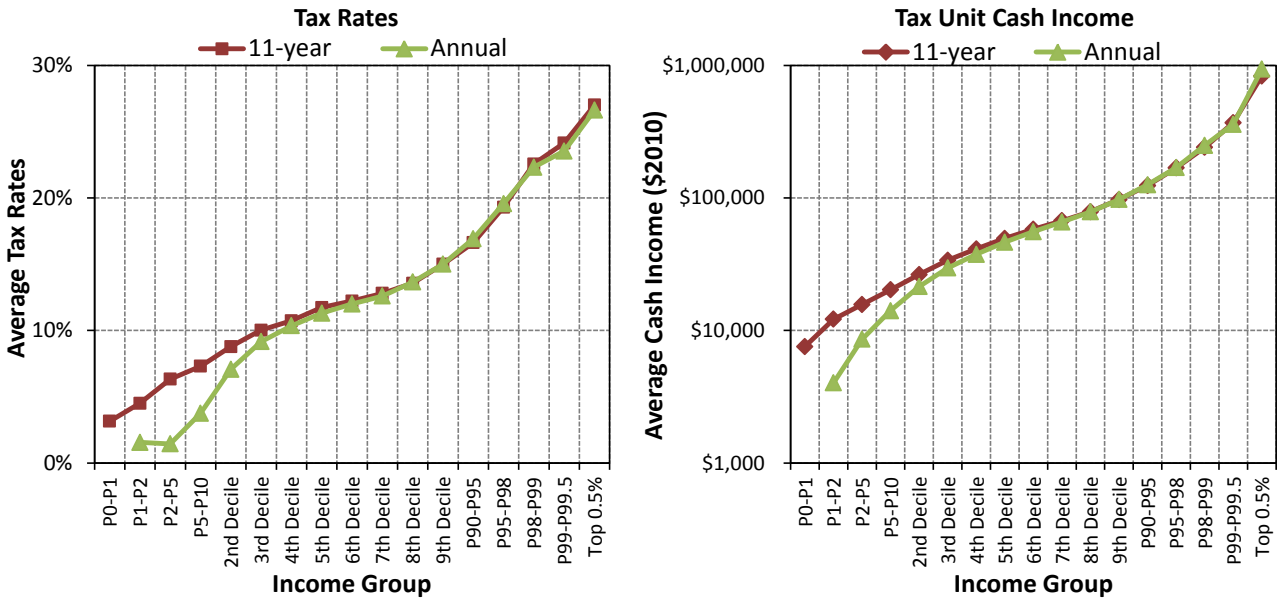
that eleven-year income is higher than annual income at the bottom of the distribution, which should explain much of the gap between eleven-year and annual tax rates.

There is no gap between annual and eleven-year tax rates at the top of the distribution. This results from the relatively small amount of income variability in this part of the distribution. In Chapter 2, we saw that there was a negligible amount of five-year income variability in the top of the distribution in the early 1980s (Table 2.4). In the next section, we see a gap between annual and lifetime effective tax rates emerge in the top two deciles. This may be because lifetime earnings variability may capture life-cycle changes not captured over eleven years.

One issue with this analysis is that intermittent filers and non-filers are not included. Including them would likely exacerbate the gap between multi-year and annual tax rates at the bottom of the distribution. However, it is not clear how to include these tax units in the sample as it is not evident which tax units did not file because they exited the sample due to marriage, divorce, or death. Even if non-filing tax units did not exit the sample for these reasons, it is not clear how to impute their incomes. About 47 percent of tax units did not have positive income tax liabilities in 2009 (Williams, 2009). While much of this was a function of lower incomes and tax rates due to the recession, a significant fraction are explained by many tax units having no income in a specific year because of income variability. Following these non-taxpaying tax units over multiple years shows that many will end up with larger incomes and positive tax burdens over the long run. The next section on individual tax rates allows me to better address non-filing, as there are no filing status changes for individuals, and there is no non-filing due to low incomes for Social Security

taxable earnings.

Figure 4.2 : Annual and eleven-year tax unit average tax rates and cash income: 1985



Note: The same individuals are used to estimate eleven-year and annual tax rates, but income groups may include different individuals. Eleven-year income groups are set with average incomes from 1980 to 1990 and annual income groups are set with annual incomes. So workers in the bottom decile in one year could be in a higher decile over the entire eleven- year period. Annual tax rates are smoothed by averaging over the eleven- year period. Incomes are for non-dependents in the CWHS and only tax units present all eleven years are included in the sample. Incomes and taxes are averaged over eleven years after setting to 2010 dollars with the CPI-U-RS.

4.3 Differences in tax progressivity across individuals

I use a Social Security Administration earnings panel to estimate individual income tax progressivities. Earnings variability means that lifetime effective tax rates are higher than annual effective tax rates at the bottom of the distribution and lower than annual effective tax rates at the top of the distribution.

It is not clear how to estimate federal individual tax liabilities using only individual earnings because this excludes non-earnings income sources and spousal income. The analysis in this section deals with these issues by estimating federal tax burdens as if each individual filed separately and their only income was earnings. This is done by subtracting one personal exemption and the standard deduction from earnings up to the Social Security taxable limit and then calculating the tax burden based on the remaining taxable earnings. This will understate income, as all non-earnings income is ignored—but note that earnings still make up about three-quarters of income[3]—and because top-coding will exclude some earnings in the top two deciles in early years and the top decile in later years. The exclusion of non-earnings will especially tend to bias effective tax rates at the top of the distribution, as they accrue the majority of non-earnings income. Tax rates at the top of the distribution will also be biased by the exclusion of non-earnings income and earnings above the Social Security taxable maximum amount. I ignore payroll taxes because this section's strictly tax side analysis does not capture any of the progressive benefits of Social Security and Medicare. Also, proportional payroll taxes on taxable earnings should primarily increase the tax rate levels in the following estimates while not affecting the substantive findings for tax rate heterogeneity or progressivity.

Social Security earnings data allow an analysis of thirty-one year average earnings, or what I will refer to as *lifetime earnings*. Using a ten percent subsample of the EPUF panel dataset (described in Chapter 3), these lifetime earnings are centered in 1991 and so include annual earnings from 1976 to 2006. As only individuals turning

[3]The 1993 IRS Individual Complete Report (Publication 1304) Table 1.4 shows that total salaries and wages were 78 percent of adjusted gross income.

25 to 60 years old and considered to be in their "working life" all thirty-one years are included in the sample, the remaining individuals turn 40 to 45 years old in 1991.[4] This leaves 12,848 individuals in the sample, most of whom are male. This is the latest period possible to study with this data, which means most of the top-coding issues early in the sample are avoided. Earnings above the taxable limit are still top-coded, meaning earnings variability at the top of the distribution will be biased downward, especially in the tenth decile. Lifetime earnings and taxes are averaged over thirty-one years after setting all values to 2010 dollars with the CPI-U.

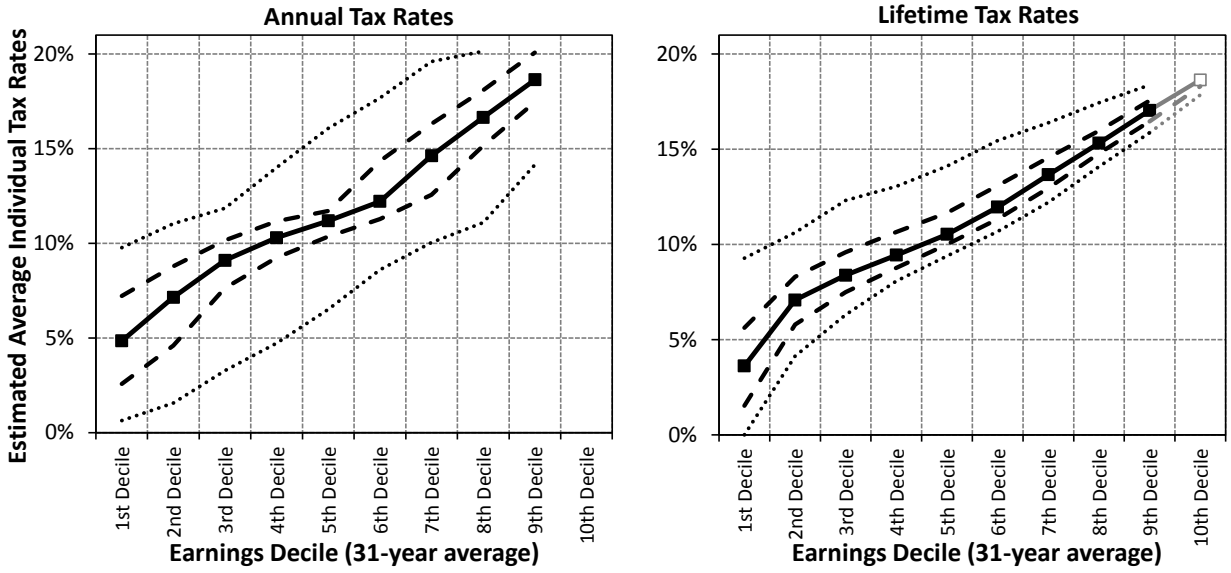
Compared to annual tax rates, lifetime tax rates have much less heterogeneity within earnings deciles (Figure 4.3). As with tax units, most of the compression of within earnings group tax rates happens at the top of the distribution. Using lifetime tax rates rather than eleven-year tax rates, we also see a compression of low within-decile tax rates over the entire distribution (note that the 5th percentile of rates moves up towards median tax rates). So while workers who have low earnings in a given year or even over eleven-years will pay very low tax rates, over their lifetime they will pay substantially higher tax rates.

Figure 4.3 makes clear some of the vertical and horizontal equity problems that can results from earnings variability in a progressive tax system. Workers in the bottom lifetime earnings decile pay between 0 and 9 percent lifetime tax rates (at the 5th and 95th tax rate percentiles). The lifetime tax rates paid by some individuals in

[4] An individual's "working life" begins with their first positive earnings once they turn 25 years old and ends with their final positive earnings before turning 61. This means someone with positive earnings at age 25 and retiring at age 54 will only have thirty years in their working life and so be excluded from the lifetime sample.

the bottom decile are equal to those paid by some in the fifth decile. This horizontal inequity decreases for higher lifetime earnings, as in the eighth decile where the tax rate gap falls to only about 3 percentage points. Note that none of these differences come from income sources or deductions, as discussed in the previous section. This is because all taxes in this section are based on earnings and the standard deduction is applied to everyone, hence all the horizontal inequity seen in Figure 3.3 comes from the interaction between earnings variability and a progressive tax system.

Figure 4.3 : Annual and lifetime (31-year) estimated individual tax rates: 1991



Note: The middle line is the earnings decile median tax rate. The dashed lines are the 25th and 75th tax rate percentiles and the dotted lines are the 5th and 95th percentiles. Taxes are estimated using individual Social Security taxable earnings as the income base for the U.S. federal personal income tax, where the standard deduction and one personal exemption are subtracted from earnings before applying individual tax rates. The tenth decile is not shown for annual tax rates and whited-out for lifetime tax rates because of taxable earnings top-coding. These two figures include the same individuals in each decile. Earnings are for individuals turning 25 to 60 years old in the EPUF and only individuals in their working life" all thirty-one years are included in the sample, so only those turning 40 to 45 years old in 1991. Annual tax rates are only in 1991. Lifetime tax rates are average taxes divided by average earnings over thirty-one years (centered in 1991, so from 1976 to 2006) where incomes and taxes are averaged after setting to 2010 dollars with the CPI-U.

As with the similar analysis of tax units, individuals in the bottom decile have a multi-year tax rate 4 percentage points higher than their annual rate (Figure 4.4, left side). While this gap diminishes for the second decile of tax units, it persists for the second and third deciles of individuals. The gap is only 2 percentage points in the fourth decile and about 1 percentage point in the fifth and sixth deciles.

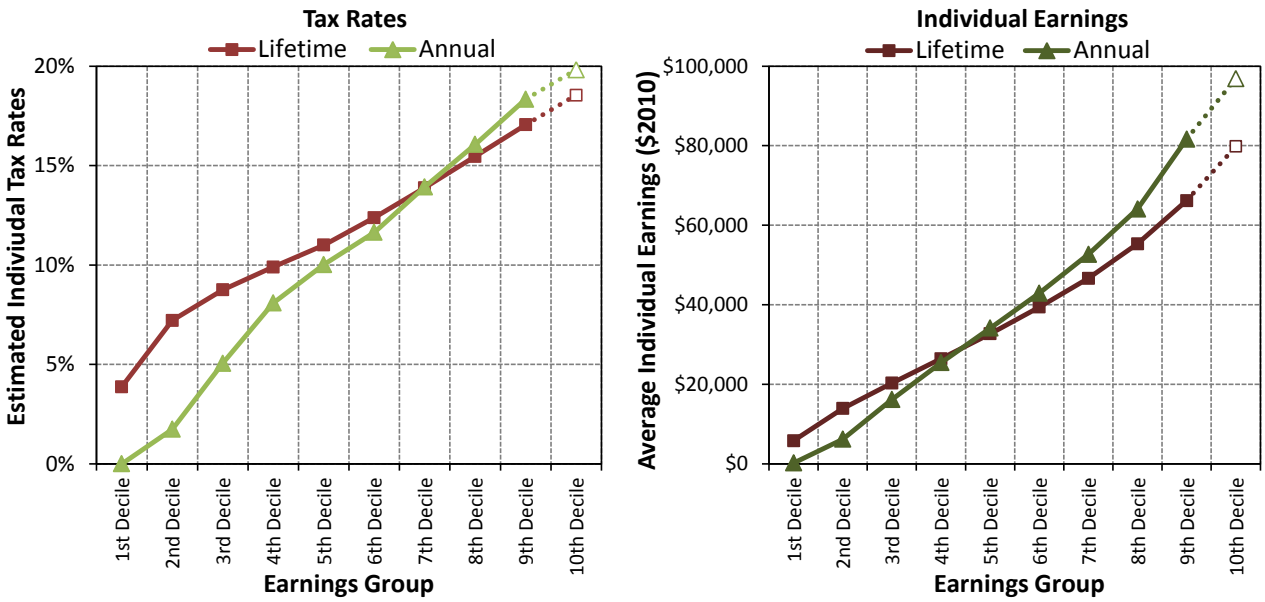
The gaps between lifetime and annual tax rates follow the pattern of gaps between lifetime and annual earnings (Figure 4.4, right side). One difference is that tax rates cross in the seventh decile while earnings cross at the bottom of the fifth decile ($50,000 versus $30,000). Progressive taxes, including the implicit zero rate from exclusions and the standard deduction, mean that these low lifetime earnings workers will pay substantial taxes in those years of high earnings. This explains the large gap between lifetime and annual tax rates at the bottom of the distribution and the small gap in earnings.

4.4 Conclusion

Although estimates often focus on annual progressivity because of the abundance of cross-sectional data, a welfare perspective seems more consistent with multi-year tax progressivity. I estimate eleven-year and lifetime tax progressivity and compare them to annual tax progressivity. While on an annual basis, those at the bottom of the distribution pay little or no federal income taxes, on a lifetime basis they pay effective tax rates about five percentage points higher.

Income variability causes annual and lifetime federal effective tax rates to dif-

Figure 4.4 : Annual and lifetime tax rates and earnings: 1991



Note: The same individuals are used to estimate lifetime and annual tax rates, but deciles may include different individuals. Lifetime earnings deciles are set with average earnings over thirty-one years (t-15 to t+15) and the annual earnings deciles are set with annual earnings. So workers in the bottom decile in one year could be in a higher decile over the entire thirty-one year period. Annual tax rates are smoothed by averaging over the thirty-one year period. Taxes are estimated using individual Social Security taxable earnings as the income base for the U.S. federal personal income tax, where the standard deduction and one personal exemption are subtracted from earnings before applying individual tax rates. The tenth decile is whited-out because taxable earnings top-coding makes these estimates unreliable. Earnings are for individuals turning 25 to 60 years old in the EPUF and only individuals present all thirty-one years are included in the sample, so only those turning 40 to 45 years old in 1991. Incomes and taxes are averaged over thirty-one years after setting to 2010 dollars with the CPI-U.

fer in a progressive tax system. This is because for two workers with the same lifetime income, the worker with the more variable income will pay more taxes over their lifetime. I estimate that this horizontal inequity implies that in most deciles some workers pay lifetime effective federal income tax rates five percentage points than other workers in the same decile. While the progressivity of annual taxes leads to this inequity, a more progressive tax system also provides insurance when there

is imperfect consumption smoothing (Eaton and Rosen, 1980; Varian, 1980; Conesa and Krueger, 2006). This is because annual tax rates will increase in years of positive income shocks and decrease in years of negative shocks. This means we can also think of the vertical and horizontal equity trade-off as an insurance and horizontal equity trade-off.

Appendix A

Generalized Entropy Measures

$$Theil\ Index = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{x_i}{\bar{x}} \cdot ln\frac{x_i}{\bar{x}}\right) \tag{A1}$$

$$Mean\ Log\ Deviation\ (MLD) = \frac{1}{N}\sum_{i=1}^{N}\left(ln\frac{\bar{x}}{x_i}\right) \tag{A2}$$

$$Symmetric\ Theil = \frac{Theil + MLD}{2} = \frac{1}{N}\sum_{i=1}^{N}\left[\left(\frac{x_i}{\bar{x}} - 1\right) ln\left(x_i\right)\right] \tag{A3}$$

$$Atkinson\ Index = 1 - \frac{1}{\bar{x}}\left(\frac{1}{N} \cdot \sum_{i=1}^{N} x_i^{1-\varepsilon}\right)^{1/(1-\varepsilon)} \tag{A4}$$

Tax policy and top income shares: 1940 to 1986

To put into context the 1986 to 1988 increase of business pass-through income and wages among the top one percent, I turn to the interaction of changing tax policy and top income concentration in other periods. I first consider falling inequality during World War II and then the period of stable top income concentration during the 1970s.

Between 1940 and 1943—the early part of the period known as the Great Compression—top one percent income shares fell about four percentage points. This fall was caused by a decrease of five percentage points for wages and dividends combined and a one percentage point decrease in interest and rents (Figure 2.8).[5] However, these decreases were offset by a two percentage point increase in business pass-through income.

A confluence of policy changes caused the Great Compression. The fall in top one percent wages was likely caused by wage controls by the National War Labor Board, which limited wage growth of top earners between 1942 and 1945 (Goldin and Margo, 1992; Piketty and Saez, 2004). Meanwhile, the fall in dividends may have been precipitated by a sharp increase in corporate tax rates: the top marginal statutory corporate rate increased from 19 to 40 percent between 1939 and 1942, while the average rate increased from 18 to 53 percent due to the wartime excess profits tax. The shift to pass-through income during WWII may have offered some temporary reprieve from these high corporate tax rates. With the expiration of

[5]Note that the initial fall in dividends at the onset of the Great Depression followed a surge in the late 1920s stock market run-up. The spike in dividends in 1936 and 1937 was a temporary response to the undistributed profits tax (Holland, 1962).

the excess profits tax in 1947, pass-through income among the top one percent fell dramatically and this trend continued through the 1950s. Thus the WWII era income shifting into pass-through income was an episodic event.

In order to examine the period of low and stable top income shares in the 1970s, I first compare tax burdens on corporate and pass-through income. Figure A5 attempts to compare tax rates faced by closely-held business owners in the top of the distribution. These owners are more likely to be able to minimize their tax burden by switching between C-corporation and pass-through entity status. We can see the relative advantage of filing status by comparing the marginal personal tax rate that would apply to pass-through income at the 99.9th percentile and the average corporate tax rate plus dividend taxes. The "effective" corporate tax rate is constructed by first dividing the total corporate taxes paid in a year by net corporate income. This average corporate tax rate is then added to the personal rate applicable to the residual income. This double taxation component is estimated by taking half the residual and applying the dividends tax rate, i.e., the P99.9 personal rate. In later years, capital gains become the dominant form of paying out corporate profits, and so instead of applying the dividends tax rate, the capital gains tax is applied to the entire income remaining after paying corporate taxes.

Figure A5 shows a number of clear trends. Between 1920 and 1970, similar tax rates were applied to C-corporation income and business pass-through income for those at the top of the distribution—although a temporary gap emerged during the five years after the excess profits tax expired and before corporate tax rates increased. During this period the C-corporation and pass-through income as a

fraction of GDP also moved together (Figure A6).

S-corporations, created in 1958, allowed pass-through income to enjoy the benefits of limited liability, although with some additional restrictions relative to C-corporations.[6] Despite the more favorable treatment of pass-through income with limited liability, there appears to have a been a shifting out of pass-through entities and into C-corporations, with the gap between the two forms of income growing from 2 percent of GDP in the 1960s to 4 percent between 1975 and 1985 (see Figure A6) Between 1970 and 1986, C-corporation income faced a lower "effective" tax rate than business pass-through income (Figure A5). Not surprisingly, in the 1970s there was increased income sheltering into C-corporations (Gordon and Slemrod, 2000). Koowattanatianchai, Charles and Eddie (2009, p. 8) give reasons for falling average corporate tax burdens: "In 1971, another major change in depreciation practice occurred. Treasury created the Asset Depreciation Range (ADR) system, which allowed firms to write off their assets over a period that was, in most cases, 20% shorter than the 1962 guidelines allowed."

[6]S-corporations must be domestic enterprises and were originally restricted to being owned by U.S. residents. The number of shareholders was initially limited to 15; this was increased to 35 in 1982, again to 75 in 1996, and most recently to 100 in 2005 (Sullivan, 2011).

Tables and Figures

Table A1 : Income percentile cutoffs for "non-retired" CWHS sample

		1979 Cutoff	1990 Cutoff	1979 Cutoff to Median Ratio	1990 Cutoff to Median Median Ratio
25th Percentile	Earnings	11,900	14,100	0.38	0.43
	Cash Income, with CG	15,900	19,200	0.46	0.51
	After-Tax Cash Income	15,200	18,500	0.49	0.54
Median	Earnings	31,000	32,500	–	–
	Cash Income, with CG	35,300	37,700	–	–
	After-Tax Cash Income	37,800	34,200	–	–
75th Percentile	Earnings	58,300	61,100	1.88	1.88
	Cash Income, with CG	63,000	67,500	1.82	1.80
	After-Tax Cash Income	55,000	59,700	1.77	1.74
90th Percentile	Earnings	84,500	94,500	2.72	2.91
	Cash Income, with CG	93,500	105,800	2.69	2.80
	After-Tax Cash Income	78,600	90,900	2.52	2.66
99th Percentile	Earnings	171,000	235,500	5.51	7.24
	Cash Income, with CG	217,000	309,900	6.58	8.21
	After-Tax Cash Income	164,500	248,700	5.33	7.26

Note: All values in 2010 dollars using the CPI-U-RS.

Table A2 : Smoothed annual income and earnings inequality increase and fraction explained by eleven-year variability

	Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Percentage Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
	1985	**2004**				
Panel A: Cash Income						
Mean Log Deviation	30%	30%	0.0419	0.1374	39%	30%
Symmetric Theil	26%	23%	0.0272	0.1686	46%	16%
Theil Index	22%	17%	0.0124	0.1998	53%	6%
Atkinson (ε=0.75)	18%	17%	0.0108	0.0746	35%	14%
Atkinson (ε=0.50)	16%	14%	0.0057	0.0580	39%	10%
Atkinson (ε=0.25)	15%	11%	0.0001	0.0338	43%	0%
Gini Coefficient	7%	10%	0.0187	0.0878	22%	21%
Panel B: After-Tax Cash Income						
Mean Log Deviation	33%	35%	0.0527	0.1272	40%	41%
Symmetric Theil	29%	28%	0.0325	0.1367	42%	24%
Theil Index	25%	20%	0.0124	0.1462	43%	8%
Atkinson (ε=0.75)	21%	20%	0.0119	0.0623	33%	19%
Atkinson (ε=0.50)	18%	16%	0.0044	0.0444	34%	10%
Atkinson (ε=0.25)	18%	11%	-0.0023	0.0226	32%	—
Gini Coefficient	8%	12%	0.0247	0.0831	22%	30%
Panel C: Earnings						
Mean Log Deviation	19%	32%	0.0889	0.1720	67%	52%
Symmetric Theil	12%	26%	0.0879	0.2127	87%	41%
Theil Index	4%	19%	0.0839	0.2502	108%	34%
Atkinson (ε=0.75)	14%	22%	0.0343	0.0927	55%	37%
Atkinson (ε=0.50)	11%	22%	0.0268	0.0746	66%	36%
Atkinson (ε=0.25)	8%	23%	0.0201	0.0507	89%	40%
Gini Coefficient	5%	7%	0.0125	0.0782	22%	16%

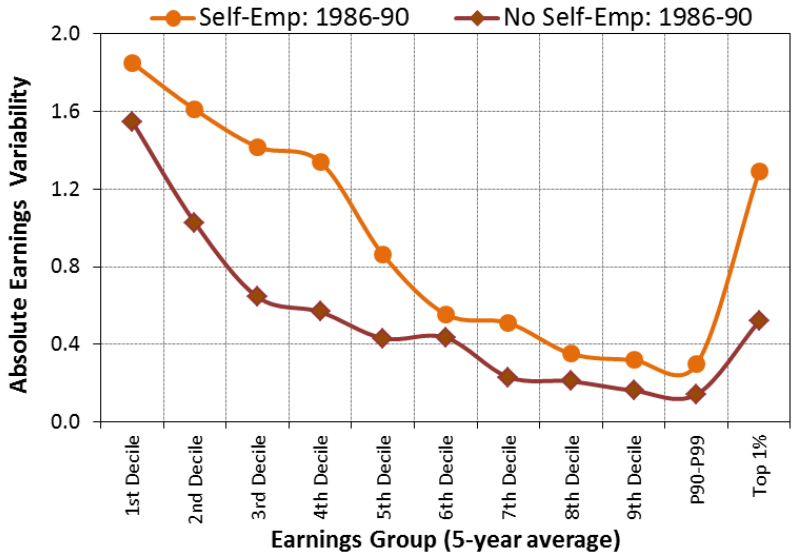
Note: Eleven-year average incomes are centered from t-5 to t+5. Annual inequalities are not smoothed. Only tax units in the CWHS and Edited Panel "non-retired samples" all eleven years of each eleven-year period are included in annual and multi-year samples ($2010, CPI-U-RS). Annual and eleven-year income measures only include tax units with average earnings throughout the eleven-year period above the threshold ($2,575 in 2004 and indexed with average earnings) and earnings measures only include tax units with positive earnings all eleven years of each eleven-year period.

Table A3 : Smoothed annual tax unit earnings inequality and increase from earnings variability (zero and negative earnings included)

	Fraction Annual Inequality from Variability		Annual Inequality Change due to Variability	Annual Inequality Change	Percentage Annual Inequality Increase	Fraction Annual Inequality Change from Variability
Panel A: Five-year Variability	**1983-86**	**2002-05**				
Mean Log Deviation	47%	24%	-0.1666	-0.1550	-27%	107%
Symmetric Theil	34%	19%	-0.0666	0.0023	1%	—
Theil Index	12%	13%	0.0204	0.1466	44%	14%
Atkinson (ε=0.75)	25%	13%	-0.0350	-0.0173	-6%	—
Atkinson (ε=0.50)	18%	10%	-0.0129	0.0093	6%	—
Atkinson (ε=0.25)	14%	6%	-0.0063	0.0125	15%	-51%
Gini Coefficient	5%	7%	0.0127	0.0351	8%	36%
Panel B: Eleven-year Variability	**1985**	**2004**				
Mean Log Deviation	58%	32%	-0.2160	-0.1835	-30%	118%
Symmetric Theil	43%	25%	-0.0809	0.0020	0%	—
Theil Index	12%	19%	0.0542	0.1874	65%	29%
Atkinson (ε=0.75)	34%	19%	-0.0413	-0.0113	-4%	—
Atkinson (ε=0.50)	24%	15%	-0.0107	0.0192	12%	—
Atkinson (ε=0.25)	17%	11%	-0.0030	0.0189	26%	-16%
Gini Coefficient	7%	11%	0.0194	0.0577	14%	34%

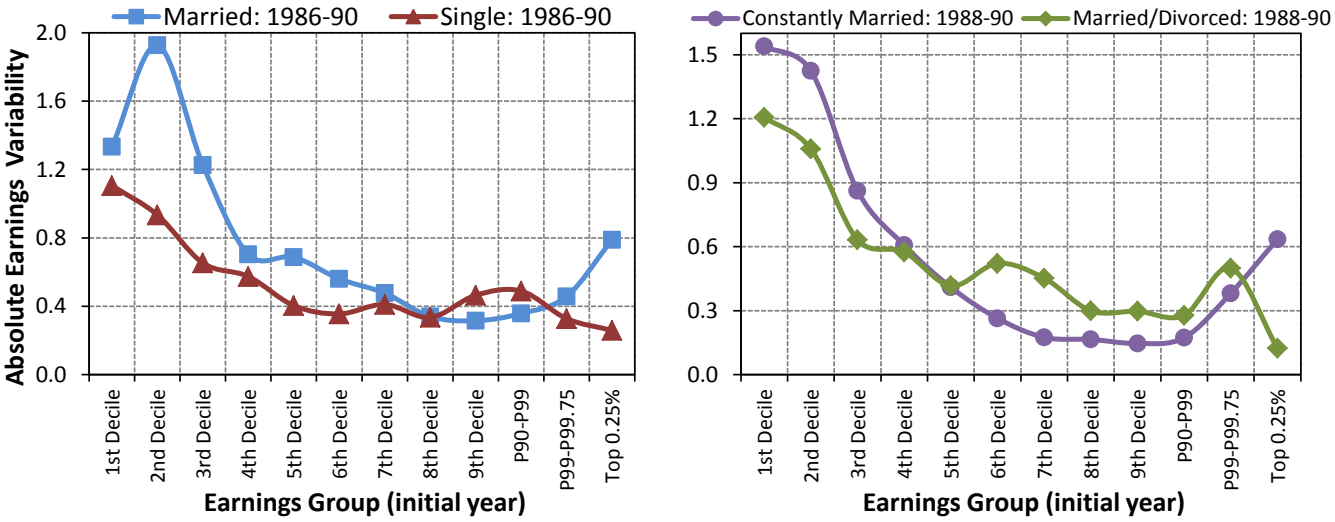
Note: Multi-year average incomes are centered. For five-year periods, annual inequalities are smoothed by averaging annual inequalities from t-2 to t+2, and then five-year inequalities are averaged over each four year period (1983-86 and 2002-05) before calculating other values. Eleven-year annual inequalities are not smoothed. Only tax units in the CWHS and Edited Panel "non-retired samples" all years of each multi-year period are included in annual and multi-year samples ($2010, CPI-U-RS). Annual and multi-year income measures only include tax units with average earnings throughout the multi-year period above the threshold ($2,575 in 2004 and indexed with average earnings).

Figure A1 : Absolute earnings variability for tax units with any self-employment income in the sample and those with none



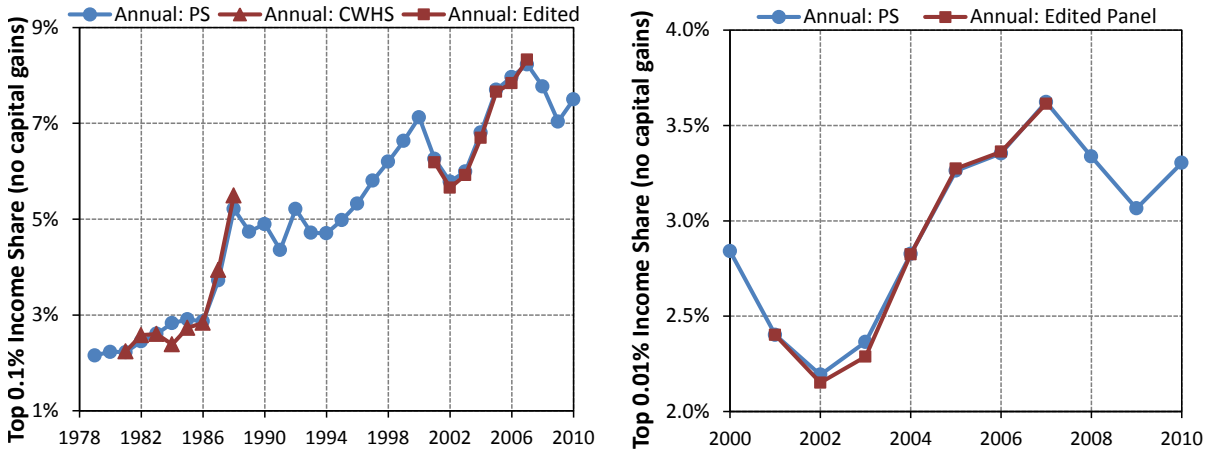
Note: Variance of arc-percent change in real annual earnings between initial and final years. Only tax units in the CWHS "non-retired sample" sample in both the initial and final year are included and earnings cutoffs are based on initial year earnings.

Figure A2 : Absolute earnings variability for tax units filing married and together or as another filing status



Note: Variance of arc-percent change in real annual earnings between initial and final years. Only tax units in the CWHS "non-retired sample" sample in both the initial and final year are included, where earnings cutoffs are based on initial year earnings. For the left figure, tax units are classified as married if filing jointly in 1986 and single if filing single in 1986.

Figure A3 : Top one percent and one-hundreth of one percent income shares (no capital gains)

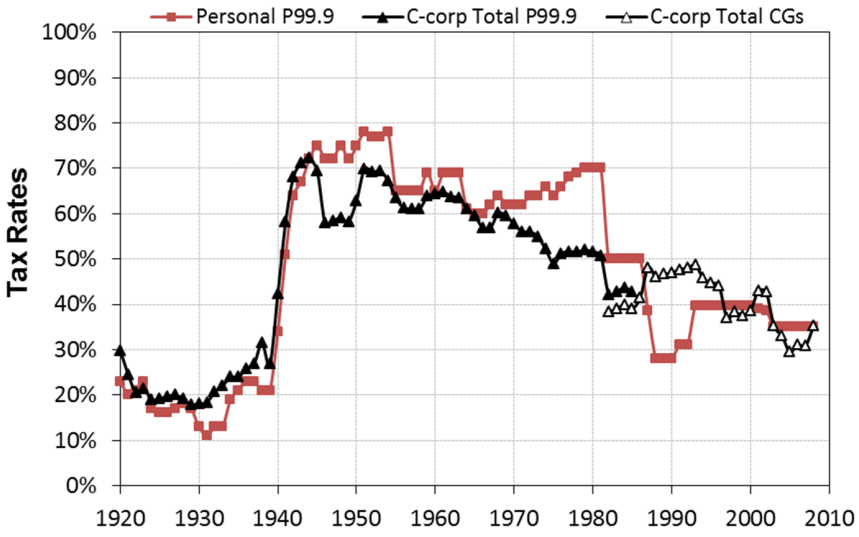


Note: To make data comparable with Piketty and Saez (2003), the number of zero earners added to the CWHS and Edited Panel were adjusted so that the annual shares of the five-year sample match Piketty and Saez shares. Source: Piketty Saez (2003, updated 2010 and 2012).

Figure A4 : Top one-hundreth of one percent income shares (no capital gains)

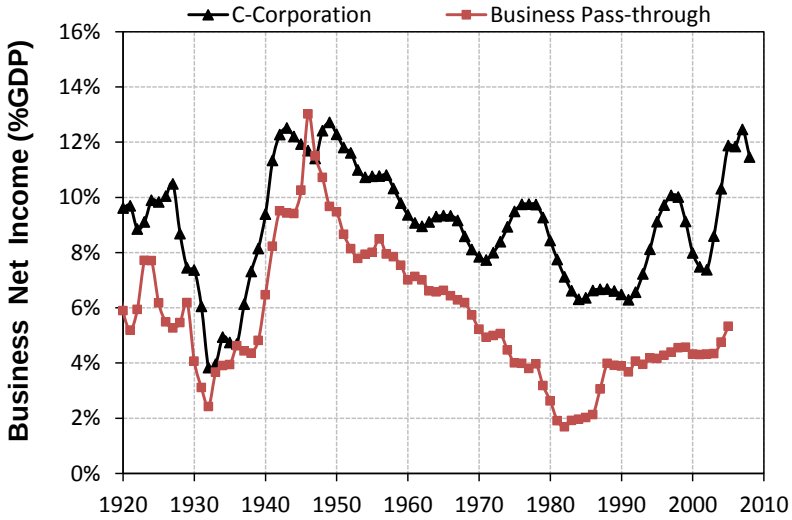
Note: Edited Panel data used, where the five-year samples is the matched sample in the right of Figure A3. Annual shares are smoothed by averaging shares over five years. Whited-out triangles are smoothed annual PS income shares. Source: Piketty Saez (2003, updated 2010 and 2012).

Figure A5 : Marginal personal income tax rate at the 99.9th percentile and "effective" corporate tax rates



Note: "Effective" corporate tax rate is the sum of the average corporate tax rate (total taxes paid divided by total net corporate income) and the personal component of corporate taxation, which is applied to half of the after-corporate tax net income at the 99.9th percentile personal rate and since 1981 the capital gains tax is applied to the entire after-corporate tax net income (with a 60 percent exclusion until 1985). Sources: IRS, Piketty and Saez (2003), www.ctj.org/pdf/regcg.pdf

Figure A6 : Corporate and business pass-through income as a fraction of GDP



Note: Business income is income less loss for partnerships, sole proprietorships and S-corporations. Source: IRS, BLS, NBER Series 08166, and author's calculations.

Appendix B

Creating weights based on age, cohort and sex

To make the SSA data representative of the U.S. labor force for each year, the fraction of the fraction of the civilian labor force by age groups and gender are taken from the Statistical Abstract of the United States (see www.census.gov/compendia/statab/2011/tables/11s0591.xls). Missing years are interpolated. Age groups include 16-19, 20-24, 25-34, 45-54, 55-64, and 65 years and over. Ten-year age groups are divided into five-year groups. The fraction of female workers to male workers doubles from 42 to 85 percent between 1951 and 1995.

Table B1 : Summary Statistics for Tables 3.1 and 3.2: Bottom half of the individual earnings distribution

	Cutoffs		**Mean Earnings**		**%Topcoded**		**%Female**		**Median Age**		**%Zero Earnings**		**No. Observations**	
	1973	**1985**	**1973**	**1985**	**1973**	**1985**	**1973**	**1985**	**1973**	**1985**	**1973**	**1985**	**1973**	**1985**
Panel A: Table 3.1 (Zeros Excluded)														
1 Year	41,991	29,790	21,304	13,757	0%	0%	46%	55%	37	39	–	–	148,494	104,339
3 Years	43,441	32,782	25,325	17,542	3%	0%	42%	55%	38	39	–	–	132,122	90,165
5 Years	43,919	34,768	27,419	19,607	7%	0%	38%	54%	39	39	–	–	119,374	79,293
11 Years	46,864	37,882	32,261	23,100	14%	0%	32%	51%	42	39	–	–	94,301	56,421
21 Years	46,884	44,662	35,013	29,240	23%	1%	22%	43%	43	43	–	–	47,312	27,418
31 Years	46,738	48,768	36,173	34,309	27%	5%	14%	29%	42	43	–	–	12,919	5,816
Panel B: Table 3.2 (Zeros Included)														
1 Year	41,991	29,790	16,938	10,442	0%	0%	51%	55%	38	40	20%	24%	201,294	137,454
3 Years	43,441	32,782	19,023	12,615	3%	0%	49%	54%	38	39	12%	12%	205,466	139,019
5 Years	43,919	34,768	20,126	13,845	6%	0%	47%	54%	39	39	9%	7%	205,282	136,807
11 Years	46,864	37,882	23,369	16,278	11%	0%	44%	53%	41	39	4%	2%	192,901	117,824
21 Years	46,884	44,662	24,928	20,784	16%	1%	40%	49%	42	43	1%	0%	124,965	71,375
31 Years	46,738	48,768	25,230	24,554	18%	5%	37%	43%	42	43	0%	0%	43,918	17,963

Table B2 : Robustness checks for Table 3.1: Increasing individual earnings inequality and variability for bottom half of distribution, excluding zero earnings: 1973-1985

		3 years	5 years	11 years	21 years	31 years
Panel A: Robustness Checks of Fraction Annual Inequality Increase from Variability						
	P30	61%	65%	68%	74%	80%
	P40	52%	59%	65%	70%	79%
	P50 (>Half period)	76%	85%	91%	89%	86%
	P50 (Avg.>Threshold)	69%	65%	71%	65%	76%
	P50 (Annual>Threshold)	69%	72%	80%	62%	71%
Symmetric Theil	**P50 (All Ages >15)**	34%	43%	55%	66%	76%
	P50	**42%**	**49%**	**59%**	**64%**	**76%**
	P60	35%	41%	53%	60%	73%
	1972-84	46%	54%	64%	70%	77%
	1974-86	49%	54%	59%	57%	68%
	P30	55%	57%	64%	54%	66%
	P40	36%	40%	51%	49%	66%
	P50 (>Half period)	26%	34%	52%	45%	43%
	P50 (Avg.>Threshold)	34%	33%	48%	48%	66%
	P50 (Annual>Threshold)	38%	39%	57%	48%	62%
Gini Coefficient	**P50 (All Ages >15)**	25%	35%	47%	52%	67%
	P50	**23%**	**26%**	**43%**	**48%**	**66%**
	P60	16%	21%	37%	47%	65%
	1972-84	27%	37%	53%	58%	71%
	1974-86	34%	33%	35%	31%	52%
Panel B: Fraction of sample top-coded (averaged over multi-year periods)						
	P30	1%	1%	4%	10%	15%
	P40	1%	3%	8%	16%	21%
	P50 (>Half period)	3%	6%	11%	17%	22%
	P50 (Avg.>Threshold)	3%	7%	14%	23%	27%
	P50 (Annual>Threshold)	3%	7%	14%	23%	27%
Initial Year	**P50 (All Ages >15)**	1%	3%	6%	17%	23%
	P50	**3%**	**7%**	**14%**	**23%**	**27%**
	P60	8%	13%	21%	29%	32%
	1972-84	7%	9%	16%	25%	29%
	1974-86	2%	4%	11%	20%	25%
	P30	0%	0%	0%	0%	3%
	P40	0%	0%	0%	1%	4%
	P50 (>Half period)	0%	0%	0%	1%	4%
	P50 (Avg.>Threshold)	0%	0%	0%	1%	5%
	P50 (Annual>Threshold)	0%	0%	0%	1%	5%
Final Year	**P50 (All Ages >15)**	0%	0%	0%	1%	4%
	P50	**0%**	**0%**	**0%**	**1%**	**5%**
	P60	0%	0%	0%	2%	7%
	1972-84	0%	0%	0%	1%	7%
	1974-86	0%	0%	0%	1%	4%

Note: Sample set as in Table 3.1 except for changes to cutoffs and age restrictions. Threshold is $2,575 in 2004 and indexed with average earnings.

Table B3 : Annual male earnings inequality and variability for men in the bottom half of the distribution, zero annual earnings excluded

		Fraction Annual Inequality from Variability		Annual Inequality Increase due to Variability	Annual Inequality Increase	Fraction Annual Inequality Increase from Variability
		1973	1985			
Symmetric Theil	**3Years**	33%	35%	0.0345	0.0936	37%
	5 Years	40%	43%	0.0424	0.0910	47%
	11 Years	48%	53%	0.0554	0.0970	57%
	21 Years	51%	62%	0.0530	0.0733	72%
	31 Years	52%	72%	0.0630	0.0728	86%
Atkinson Index (ε=0.5)	**3 Years**	31%	32%	0.0134	0.0395	34%
	5 Years	38%	40%	0.0168	0.0389	43%
	11 Years	46%	51%	0.0232	0.0423	55%
	21 Years	49%	61%	0.0237	0.0335	71%
	31 Years	50%	71%	0.0288	0.0336	86%
Variance of Log Earnings	**3 Years**	43%	43%	0.751	1.765	43%
	5 Years	50%	52%	0.924	1.748	53%
	11 Years	59%	60%	1.165	1.936	60%
	21 Years	63%	70%	0.784	1.075	73%
	31 Years	66%	80%	0.948	1.140	83%
Gini Coefficient	**3 Years**	17%	17%	0.0127	0.0721	18%
	5 Years	21%	22%	0.0184	0.0751	25%
	11 Years	25%	30%	0.0375	0.0948	40%
	21 Years	22%	36%	0.0585	0.0996	59%
	31 Years	16%	45%	0.0874	0.1129	77%

Note: Sample set as in Table 3.2 and then women dropped.

Table B4 : Smoothed individual earnings inequality and variability the bottom half of the distribution, zero annual earnings excluded

		Fraction Smoothed Annual Inequality from Variability		Smoothed Annual Inequality Increase due to Variability	Smoothed Annual Inequality Increase	Fraction Smoothed Annual Inequality Increase from Variability
		1973	1985			
Symmetric Theil	**3 Years**	27%	31%	0.0245	0.0545	45%
	5 Years	38%	39%	0.0201	0.0475	42%
	11 Years	43%	47%	0.0327	0.0599	55%
Atkinson Index (e=0.5)	**3 Years**	24%	28%	0.0094	0.0225	42%
	5 Years	35%	36%	0.0076	0.0198	38%
	11 Years	40%	44%	0.0136	0.0258	53%
Variance of Log Earnings	**3 Years**	38%	42%	0.537	1.160	46%
	5 Years	50%	52%	0.595	1.099	54%
	11 Years	57%	54%	0.529	1.004	53%

Note: Sample set as in Table 3.2, but annual earnings are smoothed by averaging over multi-year periods.

Table B5 : Decreasing individual earnings inequality and variability for bottom half of the distribution (zero earnings excluded)

		Fraction Annual Inequality from Variability		Annual Inequality Change due to Variability	Annual Inequality Change	Pecentage Annual Inequality Change	Fraction Annual Inequality Change from Variability
		1985	2000				
Panel A: Men Only							
Symmetric Theil	**3 Years**	32%	26%	-0.0158	-0.0219	-12%	72%
	5 Years	43%	35%	-0.0184	-0.0184	-12%	100%
	11 Years	53%	43%	-0.0218	-0.0204	-13%	107%
Atkinson Index (ε=0.5)	**3 Years**	33%	28%	-0.0088	-0.0121	-12%	72%
	5 Years	44%	37%	-0.0104	-0.0108	-12%	96%
	11 Years	55%	45%	-0.0129	-0.0124	-14%	103%
Variance of Log Earnings	**3 Years**	45%	39%	-0.0745	-0.0572	-6%	130%
	5 Years	57%	52%	-0.0822	-0.0885	-11%	93%
	11 Years	66%	59%	-0.1003	-0.1038	-13%	97%
Gini Co-efficient	**3 Years**	18%	14%	-0.0151	-0.0212	-7%	71%
	5 Years	24%	19%	-0.0198	-0.0178	-6%	111%
	11 Years	32%	24%	-0.0257	-0.0209	-7%	123%
Panel B: Women Only							
Symmetric Theil	**3 Years**	19%	17%	-0.0061	-0.0151	-9%	41%
	5 Years	27%	25%	-0.0049	-0.0082	-5%	61%
	11 Years	37%	34%	-0.0062	-0.0054	-4%	115%
Atkinson Index (ε=0.5)	**3 Years**	22%	19%	-0.0037	-0.0085	-8%	44%
	5 Years	30%	27%	-0.0031	-0.0046	-5%	66%
	11 Years	40%	36%	-0.0038	-0.0030	-3%	129%
Variance of Log Earnings	**3 Years**	38%	36%	-0.0427	-0.0660	-8%	65%
	5 Years	47%	45%	-0.0279	-0.0310	-4%	90%
	11 Years	56%	51%	-0.0340	-0.0152	-2%	224%
Gini Co-efficient	**3 Years**	9%	8%	-0.0045	-0.0146	-5%	31%
	5 Years	13%	12%	-0.0037	-0.0082	-3%	45%
	11 Years	19%	17%	-0.0064	-0.0068	-2%	95%

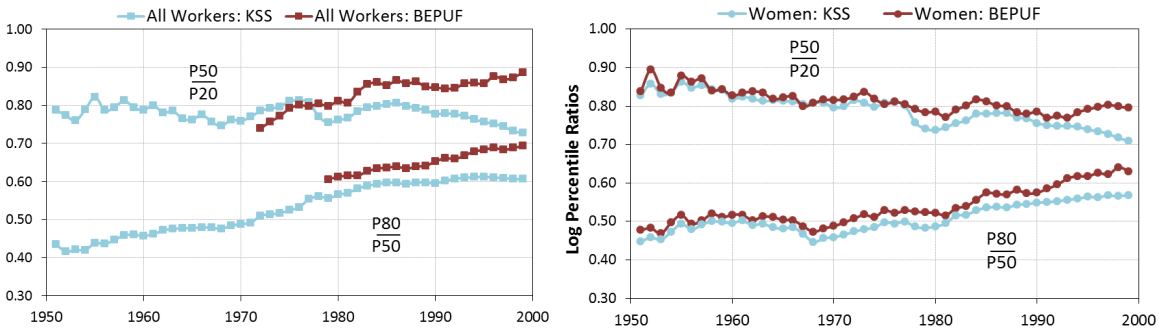
Note: Note: Annual and multi-year measures only include those in the EPUF sample turning 25 to 60 years old and positive earnings throughout each multi-year period. Multi-year measures are centered and medians are set with multi-year earnings in the sample excluding zeros. ($2010, CPI-U).

Table B6 : Increasing individual earnings inequality and flat variability for P50-P90 (zero earnings excluded)

		Fraction Annual Inequality from Variability		Annual Inequality Change due to Variability	Annual Inequality Change	Pecentage Annual Inequality Change	Fraction Annual Inequality Change from Variability
		1985	2000				
Panel A: Men Only							
Symmetric Theil	**3 Years**	30%	27%	0.0006	0.0061	17%	10%
	5 Years	41%	37%	0.0016	0.0082	22%	20%
	11 Years	59%	49%	0.0006	0.0087	24%	7%
Atkinson Index (ε=0.5)	**3 Years**	29%	26%	0.0003	0.0030	17%	9%
	5 Years	40%	36%	0.0007	0.0039	22%	17%
	11 Years	57%	48%	0.0003	0.0043	24%	6%
Variance of Log Earnings	**3 Years**	41%	37%	0.0010	0.0109	13%	9%
	5 Years	54%	51%	0.0067	0.0188	20%	36%
	11 Years	71%	61%	-0.0019	0.0137	14%	-14%
Gini Coefficient	**3 Years**	12%	11%	0.0001	0.0138	9%	1%
	5 Years	17%	16%	0.0011	0.0183	13%	6%
	11 Years	27%	23%	-0.0002	0.0241	17%	-1%
Panel B: Women Only							
Symmetric Theil	**3 Years**	21%	22%	0.0019	0.0071	34%	26%
	5 Years	34%	33%	0.0033	0.0110	38%	30%
	11 Years	53%	46%	0.0040	0.0132	46%	30%
Atkinson Index (ε=0.5)	**3 Years**	20%	22%	0.0012	0.0047	34%	25%
	5 Years	33%	32%	0.0015	0.0054	38%	29%
	11 Years	51%	45%	0.0020	0.0065	46%	30%
Variance of Log Earnings	**3 Years**	27%	29%	0.0074	0.0213	37%	34%
	5 Years	44%	42%	0.0089	0.0240	37%	37%
	11 Years	66%	57%	0.0068	0.0247	38%	28%
Gini Coefficient	**3 Years**	9%	9%	0.0020	0.0203	15%	10%
	5 Years	15%	14%	0.0026	0.0238	18%	11%
	11 Years	25%	22%	0.0027	0.0307	23%	9%

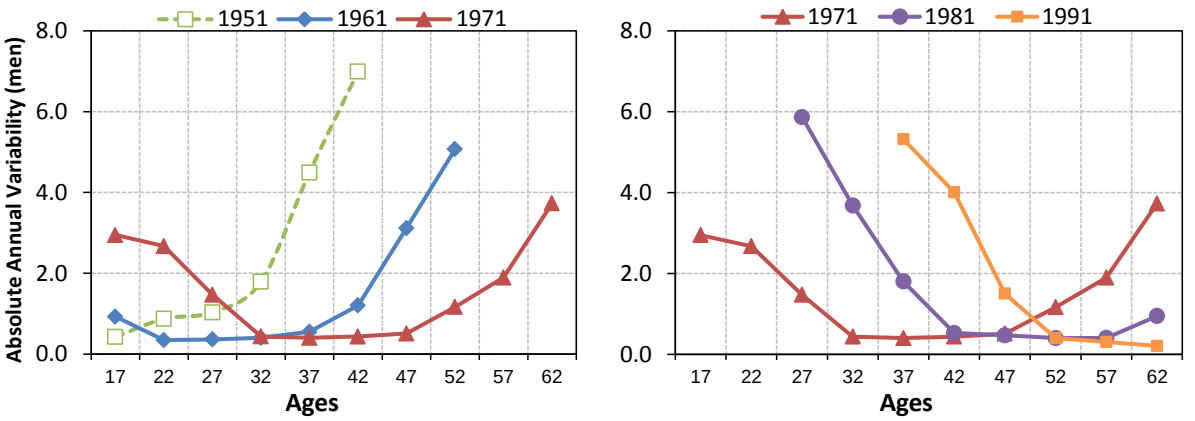
Note: Note: Annual and multi-year measures only include those in the EPUF sample turning 25 to 60 years old and positive earnings throughout each multi-year period. Multi-year measures are centered and medians are set with multi-year earnings in the sample excluding zeros. ($2010, CPI-U).

Figure B1 : Annual log percentile ratios of individual earnings of womenand all workers. Comparison of Social Security Administration data (BEPUF) and data used in Kopczuk, Saez and Song (2010, KSS)



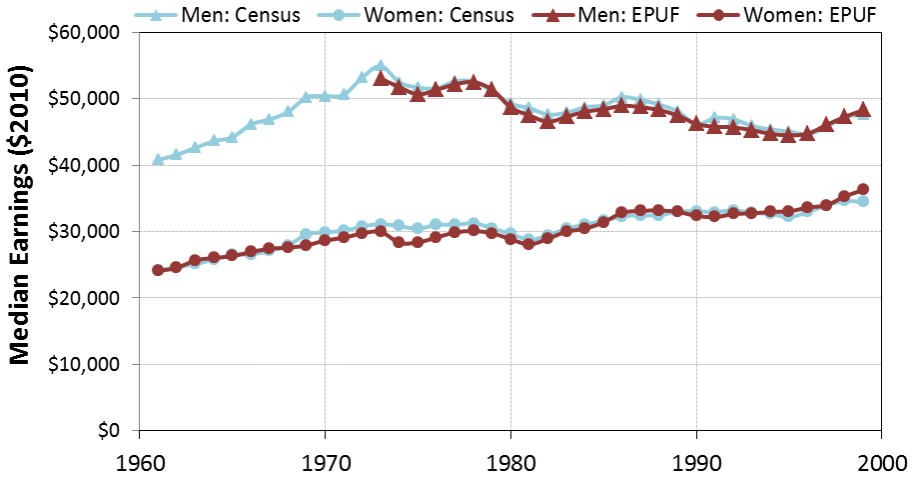
Note: Both data sets include workers aged 25 to 60 and with annual earnings above a threshold ($2,575 in 2004 indexed using the SSA average wages). The KSS data are for commerce and industry earnings only, excluding earnings of government employees, agriculture, hospitals, educational services, social services, religious and membership organizations, and private households, as well as self-employment earnings.

Figure B2 : Absolute variability for men by five-year centered age cohorts including zeros for bottom half of the individual earnings distribution



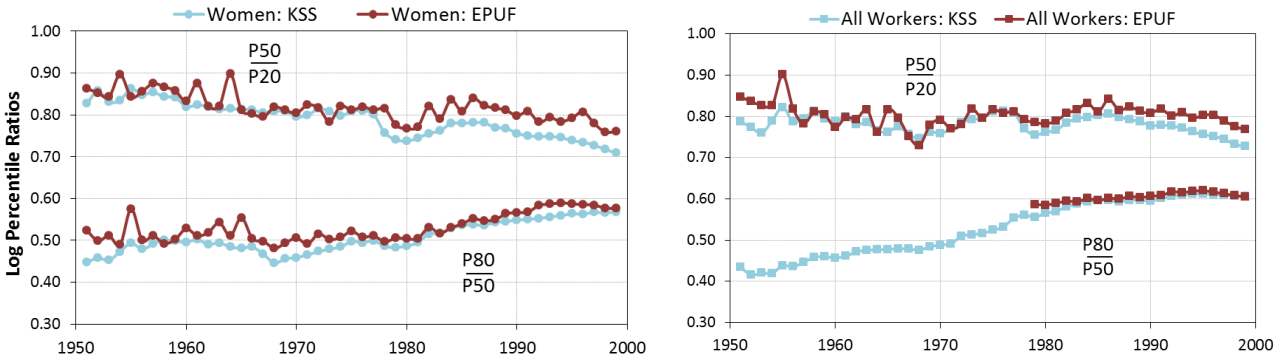
Note: Variance of arc percentage change in real annual earnings between year t and t+1. Trends are the same for t+5 and t+10. BEPUF set as in Table 3.2, except medians are set by initial year earnings, excluding zeros.

Figure B3 : Comparison of "full-time" median individual earnings in Census and EPUF data



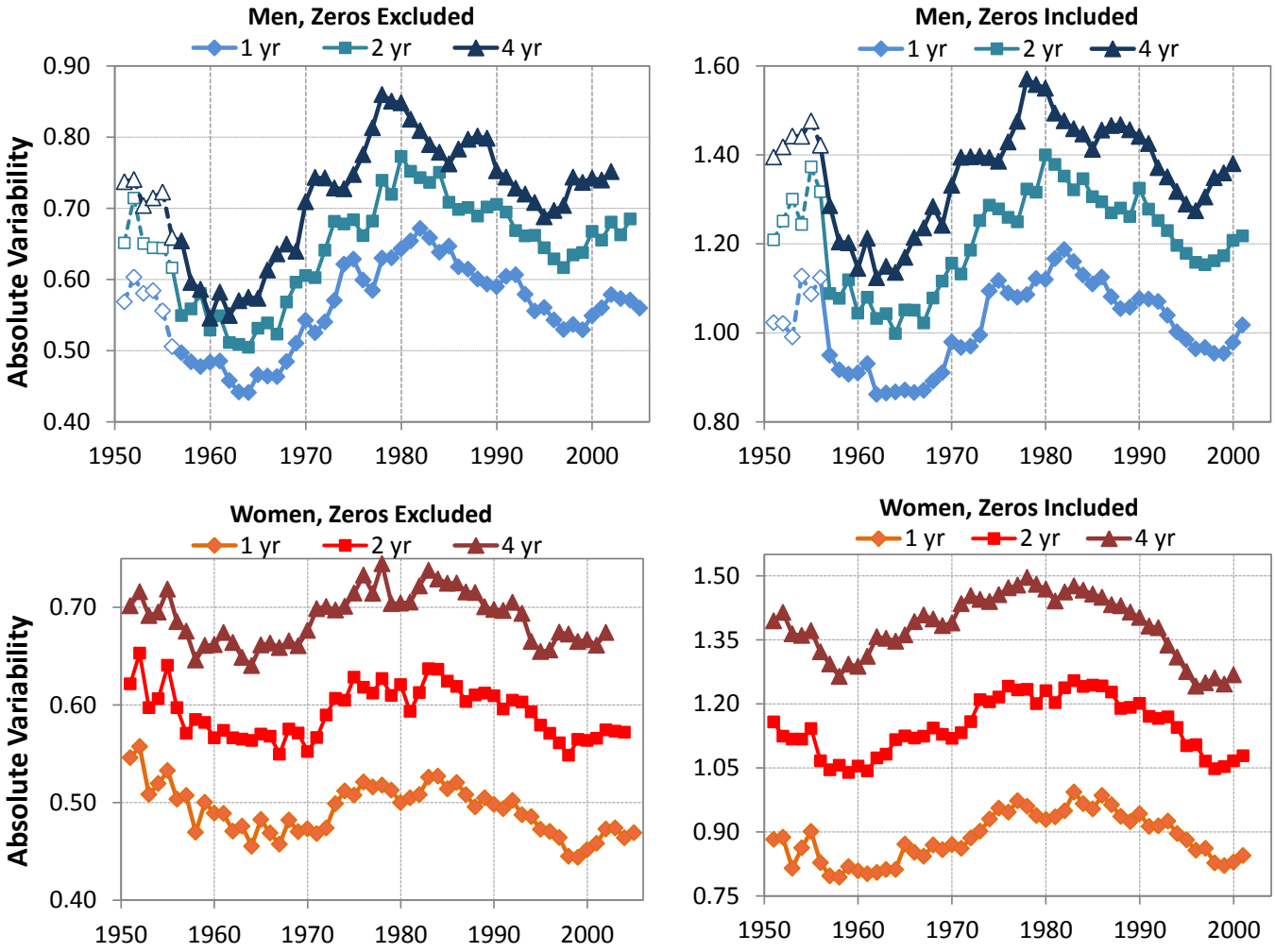
Note: Census data for full-time, year-round workers. EPUF data is Social Security Administration earnings and includes those who are at least 16 years old and in order to remove non-full-time workers, drops those with earnings below 1.5 times the full-year full-time minimum wage ($10,300 in 2004) indexed by nominal average wages ($2010, CPI-U).

Figure B4 : Annual log percentile ratios of individual earnings of women and all workers. Comparison of Social Security Administration data (EPUF, 5% sample) and data used in Kopczuk, Saez and Song (2010, KSS)



Note: Both data sets include workers aged 25 to 60 and with annual earnings above a threshold ($2,575 in 2004 indexed using the SSA average wages). The KSS data are for commerce and industry earnings only, excluding earnings of government employees, agriculture, hospitals, educational services, social services, religious and membership organizations, and private households, as well as self-employment earnings.

Figure B5 : Absolute annual variability of bottom two quintiles (EPUF)



Note: Absolute variability measured by variance of annual arc percentage earnings changes (between years t and t+1, t+2, and t+4). The sample only includes workers in the EPUF turning 25 to 60 years old. The left figures only includes workers with positive earnings in both the initial and final years. The right figures adds wrokers with zero earnings in either or both of the initial and final years. P40 cutoffs are set by initial year earnings for the sample including both men and women but excluding zeros. ($2010, CPI-U).

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