Estimates of Year-to-Year Volatility in Earnings and in Household Incomes from Administrative, Survey, and Matched Data

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ABSTRACT

We document trends in the volatility in earnings and household incomes between 1985 and 2005 in three different data sources: administrative earnings records, the Survey of Income and Program Participation (SIPP) matched to administrative earnings records, and SIPP survey data. In all data sources, we find a substantial amount of year-to-year volatility in workers' earnings and household incomes. In the data sources that contain administrative earnings, we find that volatility has been roughly constant, and has even declined slightly, since the mid-1980s. These findings differ from what is found using survey data and what has been reported in previous studies.

I. Introduction

There is a large literature documenting the rise in individual earnings and household income inequality since the early 1980s. In trying to explain these increases in inequality, a growing body of research has explored patterns in individual earnings and incomes over time. These include analyses of mobility—that is,

how individual earnings or incomes move workers from one part of the distribution to another—and analyses of volatility—the extent to which workers and households experience large changes in earnings or incomes from one year to another. Linking patterns in volatility and mobility to inequality has proven difficult and at least part of that difficulty is due to the fact that there is not wide agreement on the patterns of individual earnings or household income volatility over time.

In a longitudinal framework, changes in inequality may be due to different earnings patterns of workers throughout the earnings distribution. That is, an increase in inequality can occur if those at the top of the earnings or income distribution are more likely to have large, positive transitory shocks while those at the bottom are more likely to have large, negative transitory shocks. Following the seminal work of Gottschalk and Moffitt (1994), who use the Panel Study of Income Dynamics (PSID) and were the first to decompose men's earnings into permanent and transitory shocks, a growing literature now exists that explores the patterns of earnings and income volatility.

In this paper, we measure individual earnings and household income volatility between 1984 and 2005 using three data sources: (1) administrative earnings records from the Social Security Administration (SSA), (2) survey data from the Survey of Income and Program Participation (SIPP) that have been matched to administrative earnings records, and (3) survey data from the SIPP. In all three data sources, we find a substantial amount of volatility—for example, between 2004 and 2005 more than 26 percent of workers saw their earnings increase or decrease by more that 50 percent (many of these workers were entering or exiting employment) and about 9 percent of households saw their incomes increase or decrease by more than 50 percent. Moreover, in both the administrative earnings data and in the income data based on the SIPP matched to administrative earnings, we find that this volatility has been roughly constant since the mid-1980s. These findings are in contrast to what we find in survey data and to what other recent studies have found using other data sources. Differences between our findings and those of other studies are most likely due to differences in data sources.

II. Previous Literature

There is an active literature in economics assessing the extent of earnings and income volatility and what the trends in volatility have been in recent decades. Many of the papers in this literature are similar to ours in approach, but some find different results for the trends in earnings and income volatility since the mid-1980s. All previous studies use survey data—often the PSID. A major contribution of our study to the existing literature is that it uses administrative earnings data and linked survey-administrative data to estimate trends in earnings and income volatility. We are, therefore, able to compare trends in volatility across survey and administrative data sources using a common method.

Early studies of earnings volatility focused on decomposing the cross-sectional variance in earnings into permanent and transitory components to better assess the extent to which rising earnings inequality is a policy concern. Gottschalk and Moffitt (1994) and Haider (2001), for example, use the PSID and find that both the per-

manent and transitory components of male earnings volatility increased between the 1970s and 1980s but were flat thereafter (through the early 1990s). As Moffitt and Gottschalk (2002) argue, increases in the transitory component of earnings are equivalent to increases in earnings mobility. One may be less concerned about an increase in earnings inequality if it is driven by an increase in mobility than if it is the result of permanent changes. Cameron and Tracy (1998) use Current Population Survey (CPS) data as a panel to estimate a simple earnings component model (where earnings are estimated as a function of basic demographics and the errors are decomposed into the permanent and transitory components) and similarly find an increase in both measures of variability between the 1970s and 1980s and no increase thereafter.

To summarize, the increase in the permanent and transitory components of earnings variance found in the earlier studies tended to occur in the late 1970s and mid 1980s. These studies might be limited in that they used survey data, focused only on the earnings of men, and dropped men with zero earnings.

More recently, studies have examined earnings volatility using simpler, more descriptive, measures of volatility (see, for example, Congressional Budget Office 2007a, 2008, Dynan, Elmendorf, and Sichel 2008, Moffitt and Gottschalk 2008, Shin and Solon 2009, and Bollinger, Hardy, and Ziliak 2010).[1] Most of these studies find more variability in the 1980s than in the 1970s and fairly flat trends in variability during the 1980s and early 1990s. They differ in their findings since the early 1990s, however. Shin and Solon, Dynan et al., and Bollinger et al. all find continued increases in volatility since the early 1990s. By contrast, Moffitt and Gottschalk find that volatility increased substantially in the 1980s and then remained at this new higher level through 2004; CBO found declining rates of earnings volatility from 1984 through 2004.

Although most studies focus on earnings, Dynan, Elmendorf and Sichel (2008) examine both earnings and income volatility at the family level.[2] Their work, based on the PSID, shows an increase in the volatility of both head earnings and family income. However, they argue that nearly all of this increase occurs at the time of the change in PSID survey structure in 1992 and they attribute most of this increase to changes in the portion of survey respondents who report large changes in earnings (from $0 to more than $10,000). After adjusting for survey changes, they still find some increases in volatility after 1992.

The most common data source used in the diverse set of papers in this literature is the PSID, a panel data set that began in 1968 and contains a variety of employment and household-level information. Authors have debated over the best way to deal with changes in the survey in the early 1990s when constructing consistent series of income measures. (See, for example, the extensive discussion in Shin and Solon 2009, Dynan, Elmendorf, and Sichel 2008, and in Kim, Loup, Lupton and Stafford 2000). One of the contributions of this paper is to provide measures of variability

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1. Gottschalk and Moffitt (1994) also examine, among other measures, a measure of volatility based on the difference between log annual earnings and the log of a five-year average of earnings, see page 229. This measure is similar to those used by Dynan et al. (2008), CBO (2007a), Shin and Solon (2009), and this paper.

2. Previous studies that have examined income volatility include Dynarski and Gruber (1997), Kniesner and Ziliak (2002), Blundell and Pistaferri (2003), and Keys (2008).

from administrative data sources that can be contrasted with those presented in other studies that use the PSID.

III. Data and Methods

A. Data Sources

To examine trends in individual earnings volatility, we use the Continuous Work History Sample (CWHS), administrative longitudinal earnings data provided by SSA. The CWHS is a longitudinal 1 percent sample of issued Social Security numbers and contains annual earnings from 1951 through 2005; we examine earnings of individuals who were aged 25 to 55 between 1984 and 2005.[3] Earnings include wage and salary earnings, tips, and some other sources of compensation and are not topcoded; that is, there are data for the very highest earners. Although the main measure of earnings excludes self-employment earnings, in previous work we explore the impact of including these sources of earnings on estimates of individual earnings volatility and find little difference with the main results (CBO 2008).[4]

To examine trends in household income volatility, we use demographic and nonlabor income information from the SIPP matched to longitudinal administrative earnings information provided by SSA, which we refer to as the SIPP-SSA data. The SIPP comprises a number of panel data sets that were collected annually from 1984 to 1988, from 1990 to 1993, and then again in 1996, 2001, and 2004; we use 8 SIPP panels (1984, 1990, 1991, 1992, 1993, 1996, 2001, and 2004) for which linked administrative data are available. In each panel, interviews are conducted at four-month intervals. The sample sizes for each panel range from 14,000 to 36,700 and the panels range in duration from eight to 12 interviews (about two and one-half to four years). At each interview, the survey collects information from households on the labor market earnings of each household member (survey earnings) as well as on all other sources of cash income (survey nonlabor income) for each month over the past four months, as well as a comprehensive set of demographic information. Nonlabor income includes income from a wide array of possible sources, including unemployment insurance, welfare payments, retirement income, disability and Supplemental Security Income payments, and interest and dividends.

Our measure of household income is total (pretax) household income. In our primary analysis, we construct total household income for each calendar year by summing the annual SSA earnings for each household member and adding the total household survey nonlabor income from each month for that calendar year. We restrict our sample to those whose household heads are between the ages of 25 and 55 and trim the top and bottom 2 percent of the sample based on household income.[5]

3. CWHS earnings records prior to 1978 are subject to the Social Security taxable maximum. Although not subject to the taxable maximum, CWHS earnings records between 1978 and 1983 appear to be subject to some error (Kopczuk, Saez, and Song 2010).

4. Basic metrics—means, medians, and percentiles—do differ from those in other commonly used public data sets, such as the CPS. For a comparison of the CPS and CWHS, see CBO (2009). Appendix Table A1 shows basic earnings and demographic information from the CWHS for the full sample period.

5. Most studies discussed in the previous section apply similar sample restrictions. For example, Moffitt and Gottschalk (2002) restrict their sample to male household heads between the ages of 20 and 59 and trim the top and bottom 1 percent of their sample based on earnings. The analyses we present in this paper are not highly sensitive to trimming at a 1 percent level or not at all.

Because of the limited number of panels with matched SSA data (and because the SSA earnings are available only for calendar years), we are able to construct a measure of total household income for the years 1984–85, 1990–94, 1997–98, 2001–2002, and 2004–2005.

In a secondary set of analyses of household income volatility, we construct total household income for each calendar year by summing the total household survey earnings and total household survey nonlabor income for each calendar year, which we refer to as "total household (survey) income".

B. Methods

To construct the measures of volatility used in this paper, we construct the arc percent change in income or earnings between two years for each household or worker in our samples,[6]

$$(1) \quad arc\ percent\ change = 100 \times (Y_t - Y_{t-1})/((Y_t + Y_{t-1})/2).$$

The arc percent change has the nice features of (1) being symmetric with respect to the measures of income or earnings in the two years and (2) being defined even when either Y_t or Y_{t-1} are zero. The arc percent change is not defined when both Y_t and Y_{t-1} are zero, and in the analysis of earnings, we drop observations with no earnings in either year.[7] For the remainder of the paper, we will refer to the "arc percent change" as the "percent change" for expositional purposes.

We calculated the percent change in individual earnings in every year from 1985 and 2005.[8] We calculate the percent change in total household income for each household for those years in which matched SIPP-SSA data are available for that year and for the previous year (1985, 1991–94, 1998, 2002, and 2005). Using income directly from the survey, we also calculate the percent change in total household (survey) income for each household in the same set of years.

We consider a variety of measures of earnings and income volatility. Our primary measure is the fraction of workers and households with large percent changes from one year to the next in earnings and income. In particular, we calculate the fraction of workers (households) with percent changes in earnings (income) greater than or equal to $+/- 50$ percent. Other measures we examined include various percentiles (the 1st, 5th, 10th, 25th, 50th, 75th, 90th, and 95th, and 99th percentiles) of the percent change in income distributions and the standard deviation of the percent

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6. See Allen (1934), pp.226–29 or Hensher, Rose, and Greene (2005), page 392.

7. Our overall result of declining volatility between the mid 1980s and early 1990s and then relatively unchanged volatility thereafter is robust to the measure of percentage change used. The same trend occurs when we use a standard measure of percentage change (in which the base is income in year $t - 1$.) One difference between the two measures is that the fraction of households with large increases in income is much larger than the fraction of households with large decreases in income when changes in income are measured using the more standard measure of percentage change. Note that under that definition, the size of decreases in income are bounded from below by -100 (when income in the base year is positive and income in Year 2 is zero) but the size of increases in income is not bounded from above.

8. Dynan et al. (2008) use a two-year arc-percent change in earnings or income in their measure of volatility as a result of the structure of the PSID. Our measured trends in earnings volatility using the CWHS are not substantively different if we also use a two-year arc-percent change in our measure of volatility.

change in income. These measures of volatility are related to those measures used by many aforementioned studies of volatility (for example, Dynan, Elmendorf, and Sichel 2008, Shin and Solon 2009, CBO 2007a, 2008, and Gottschalk and Moffitt 1994).

C. Match Rates in the SIPP-SSA Data Set and Imputation of Survey Data in the SIPP

Two facts complicate the construction of the SIPP sample. First, approximately 10 to 20 percent of the households in the 1984, 1990, 1991, 1992, 1993, 1996, and 2004 panels, and approximately 40 percent of the households in the 2001 panel are unable to be matched (via Social Security number) to their administrative earnings record.[9]

Tables 1 and 2 present summary statistics from the SIPP and matched SIPP samples. The average age is very nearly equivalent in the two samples. The share of household heads with more than a high school education is about 0.7 percentage points higher in the matched sample than in the public-use SIPP in the 1984 through 1994 panels; after the 1994 panel, however, that difference becomes larger. In nearly all of the panels, average earnings in the matched samples are roughly equal to those in the public-use SIPP. The one exception is the 2004 panel, in which earnings are 7 to 9 percent higher in the matched sample than in the public-use SIPP. Though it is beyond the scope of this paper, other research has identified that differences between survey and administrative earnings vary across the earnings distribution (see, for example, Cristia and Schwabish 2009).

A second complication is that a large and growing percentage of household observations in the SIPP survey have imputed earnings. For example, in the 1984 panel of the SIPP, roughly 20 percent of households had imputed earnings data over a two-year period. In the 2001 panel, this percentage had risen to roughly 60 percent.[10] Although this is not a major issue in the SIPP-SSA matched file—since we use administrative earnings in the construction of household income in place of survey earnings—it is a concern in our analyses using total household income constructed solely from the survey data.

Although imputing missing data often can result in improved estimates of the cross-sectional means and variances (see Rubin 1987), the use of imputed data can be problematic when constructing measures based on the change in earnings or income over multiple periods (or deviations from averages of earnings or income).[11] The Census imputes missing data using a variety of methods (U.S. Census Bureau 2001, Chapters 4 and 6), the most common being a hot-deck imputation method. The hot-deck imputation replaces missing values with randomly selected values from

9. To be in our sample, every member of the household ages 18 to 64 had to match to their administrative earnings record. In 1985, 89 percent of households were matched; 87 percent in 1991; 84 percent in 1992; 85 percent in 1993; 84 percent in 1994; 82 percent in 1998; 62 percent in 2002; and 80 percent in 2005.
10. In 1985, 21 percent of households had imputed earnings; 28 percent in 1991; 31 percent in 1992; 33 percent in 1993; 35 percent in 1994; 54 percent in 1998; 60 percent in 2002; and 46 percent in 2005.
11. For example, see the concerns raised over the use of imputed data in the SIPP in Williams (1992).

Table 1
Summary Statistics—SIPP-SSA Matched Sample

| Year[a] | Characteristics of the Head of Household | | | | | Annual Household Income ($2006) | | | |
| | Age | Education | | | Sex | Year 1 | | Year 2 | |
		Less than High School	High School	Greater than High School	Male	Mean	Standard Deviation	Mean	Standard Deviation
1985	38.2	16.2	38.1	45.6	74.0	54,480	31,300	57,920	32,890
1986	—	—	—	—	—	—	—	—	—
1987	—	—	—	—	—	—	—	—	—
1988	—	—	—	—	—	—	—	—	—
1989	—	—	—	—	—	—	—	—	—
1990	—	—	—	—	—	—	—	—	—
1991	38.7	12.8	35.6	51.6	68.8	59,590	35,030	60,600	36,290
1992	38.7	11.7	36.3	52.0	70.8	58,980	35,650	61,030	37,370
1993	39.1	11.3	35.6	53.1	69.2	59,250	36,030	60,620	36,950
1994	39.4	11.8	34.4	53.8	68.4	59,520	37,050	61,360	37,740
1995	—	—	—	—	—	—	—	—	—
1996	—	—	—	—	—	—	—	—	—
1997	—	—	—	—	—	—	—	—	—
1998	40.3	10.2	28.4	61.4	56.0	59,900	37,070	63,580	39,380
1999	—	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—
2001	—	—	—	—	—	—	—	—	—
2002	40.8	9.0	27.0	64.0	52.4	61,250	39,280	62,400	39,960
2003	—	—	—	—	—	—	—	—	—
2004	—	—	—	—	—	—	—	—	—
2005	41.2	5.2	23.6	71.2	44.1	63,310	41,020	64,350	41,860

Source: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
Note: The sample consists of households whose heads were between the ages of 25 and 55, inclusive. Income is inflated to 2006 dollars using the CPI-U-RS. The household head is the person (or one of the persons) in whose name the home is owned or rented. If the house is owned jointly by a married couple, either the husband or the wife may be listed first, thereby becoming the householder. The top and bottom 2 percent of households in the income distribution in either Year 1 or Year 2 are excluded from the sample.
a. Year is the second year of a two year period.

Table 2
Summary Statistics—SIPP Sample

| Year[a] | Age | Characteristics of the Head of Household | | | | Annual Household Income ($2006) | | | |
| | | Education | | | Sex | Year 1 | | Year 2 | |
		Less than High School	High School	Greater than High School	Male	Mean	Standard Deviation	Mean	Standard Deviation
1985	38.5	16.9	37.5	45.4	74.3	56,000	30,330	57,310	31,380
1986	—	—	—	—	—	—	—	—	—
1987	—	—	—	—	—	—	—	—	—
1988	—	—	—	—	—	—	—	—	—
1989	—	—	—	—	—	—	—	—	—
1990	—	—	—	—	—	—	—	—	—
1991	38.9	13.7	36.0	50.3	69.6	60,250	33,360	59,180	33,310
1992	39.0	12.8	36.1	51.1	71.7	58,980	32,930	59,060	33,280
1993	39.3	12.2	35.3	52.5	70.2	58,600	33,050	58,770	33,030
1994	39.5	12.5	34.1	53.4	69.0	59,370	33,990	59,580	33,690
1995	—	—	—	—	—	—	—	—	—
1996	—	—	—	—	—	—	—	—	—
1997	—	—	—	—	—	—	—	—	—
1998	40.3	11.4	28.4	60.2	56.5	59,420	33,650	61,840	34,800
1999	—	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—	—
2001	—	—	—	—	—	—	—	—	—
2002	40.8	10.4	27.7	61.9	53.9	61,390	35,050	61,680	35,430
2003	—	—	—	—	—	—	—	—	—
2004	—	—	—	—	—	—	—	—	—
2005	41.1	7.1	24.7	68.1	44.7	58,980	35,950	58,970	35,790

Source: Various panels of the Survey of Income and Program Participation.
Note: The sample consists of households whose heads were between the ages of 25 and 55, inclusive. Income is inflated to 2006 dollars using the CPI-U-RS. The household head is the person (or one of the persons) in whose name the home is owned or rented. If the house is owned jointly by a married couple, either the husband or the wife may be listed first, thereby becoming the householder. The top and bottom 2 percent of households in the income distribution in either Year 1 or Year 2 are excluded from the sample.
a. Year is the second year of a two-year period.

observationally similar (based on a small number of variables) and complete records in the same data set.[12]

The use of observations that have been imputed using hot-deck imputation methods in longitudinal analyses is problematic because observed changes in measures are not "real" in that they are not calculated from differences in reported values over time for a given observation, but rather are calculated from differences in values across observations. For example, consider an observation in which income data in Year 1, Y_1, is provided by the respondent but not provided (was missing and imputed using a hot-deck) in Year 2. The measure of arc percent change for that observation, $100 \times (Y_2 - Y_1)/((Y_2 + Y_1)/2)$, is based on the difference between an observation's actual income in Year 1 and some other observation's income in Year 2. This measure using imputed data is closely related to an observation's percent deviation from the sample average—a measure of cross-sectional volatility. Since it is likely that cross-sectional income volatility (the volatility of income across households) is substantially greater than the volatility in income for households over time, using imputed data to estimate the percent change in income likely leads to an overestimate of the amount of volatility. Moreover, as the imputation rates in the SIPP have grown over time, including imputed observations likely leads to an upward bias in the estimated trend in income volatility. We confirm the direction of this bias in our analysis below.

One could deal with imputed longitudinal data in a number of ways: (a) use the imputed data as it is (which is problematic for the reasons explained above), (b) replace the potentially imputed data with administrative earnings records (which is the approach we prefer), or (c) drop the imputed observations (which may bias the results because the resulting sample may no longer be representative). In our analysis of survey data, we drop observations with imputed data and explore the sensitivity of the results to that decision.

Labor economists have approached imputed data in a number of ways. Most studies use imputed data when it is available (though a separate concern is whether one should employ multiple imputation techniques to get the correct standard errors; see Rubin (1987) for a discussion). However, many studies, perhaps beginning with Lillard, Smith, and Welch (1986), question the use of hot-decked data in empirical analyses. For example, in their studies of the wage distribution using the CPS, DiNardo, Fortin, and Lemieux (1996) and Autor, Katz, and Kearney (2008) drop observations with imputed wage data. Other studies that drop observations with imputed earnings or income in their cross-sectional analyses include Hirsch and Schumacher (2004), Mellow and Sider (1983), Dooley and Gottschalk (1984), Welch (1979), and Bollinger and Hirsch (2006).

Studies that employ panel data to conduct longitudinal analyses also often do not include imputed observations. For example, Bound and Krueger (1991), in their influential study comparing measurement error in survey data with administrative data from the SSA, drop observations with imputed earnings data. Their finding that "longitudinal [survey] earnings data may be more reliable than previously believed"

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12. According to the Census, "SIPP hot-deck imputation procedures are designed to preserve the univariate distribution of each variable subject to imputation, but not the covariances among variables. Thus, imputation can introduce inconsistencies into the data." (U.S. Census 2008).

(page 1) is based only on nonimputed data. Additional panel studies that drop imputed earnings data include, Shin and Solon (2009), Bound, Brown, Duncan, and Rodgers (1994), Bollinger (1998), and Bollinger, Hardy, and Ziliak (2010).

Other studies, such as Moffitt and Gottschalk (1995) include observations with imputed earnings data and document that dropping these observations minimally affects the results. They suggest that this is likely due to the fact that in their data set, the PSID, there were very few observations with imputed earnings data during their period of the analysis (1969–87).

Many authors have suggested exercising caution when using imputed data in the SIPP (and have made varying choices of whether to include or exclude these observations). Among these, Williams (1992), Blank and Ruggles (1992), and Holden (1992) are notable in that they each suggest using linked administrative data as a way around the problems raised by imputed data in longitudinal analyses.

IV. Results

In this section, we first document the year-to-year change in household incomes from the matched SIPP files between 1985 and 2005 for all households. Second, we examine patterns of married couple and individual earnings volatility in the matched SIPP and of individual earnings volatility in the CWHS. Third, we look at volatility for subsamples of households (by income quintile, household structure (married/unmarried, with or without children), age, and educational attainment). Fourth, we look at potential bias in the SIPP survey data associated with the increases in imputations over time.

A. Volatility in Total Household Income using Matched SIPP-SSA Data

Using the matched SIPP-SSA data, we find that the share of households with large increases in income (+50 percent from one year to the next) was about the same as the share of households with large declines in income (−50 percent from one year to the next) for most of the sample period (see Figure 1). We find that over 12 percent of households in the matched SIPP-SSA data had a change in total income that exceeded 50 percent between 1984 and 1985; by the early 1990s that share had declined to about 9 percent. It declined further before increasing back to the early 1990s levels by 2005. Decomposing these large changes into large rises and declines separately, we find that, aside from the change between 1984 and 1985, a roughly equal share of households (about 4 percent) experienced a large rise or decline in total household income from one year to the next.

An examination of selected percentiles of the percent change in household income demonstrates substantial dispersion in year-to-year variability. Figure 2 shows the trends in selected percentiles (the 1st, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 99th) of the distribution of percent changes in total household income from 1985 to 2005. We find that in 2005 the 25th percentile of the arc percent change distribution was −8 percent, the 50th percentile was 1 percent, and the 75th percentile was 12 percent, all three of which are more or less unchanged from the percent change at the beginning of the sample period. Put differently, the trends in these percentiles

(Percent)
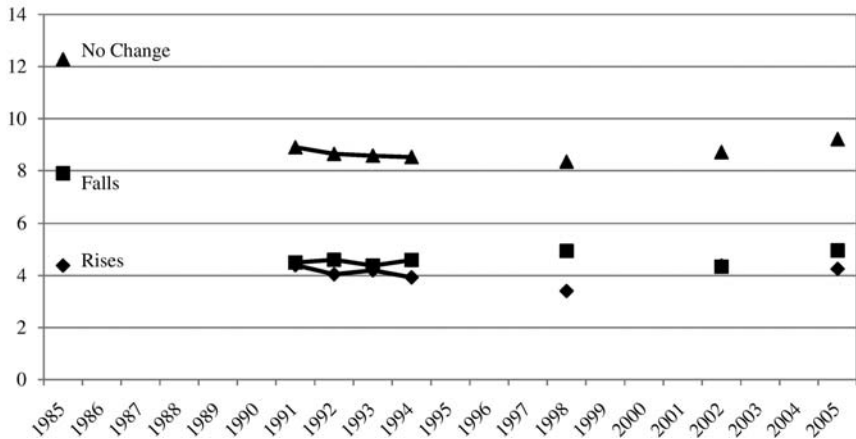
Figure 1

Percentage of Households Whose Income Changed by 50 Percent or More over the Previous Year, Matched SIPP-SSA Data

Source: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

for much of the distribution remain largely unchanged over the 1985 to 2005 period, suggesting that the variability in household income has been relatively constant over the past 20 years. The two exceptions are the patterns in variability at the tails of the distribution: Between 1998 and 2005, the 1st percentile of the percent change distribution became more negative and the 99th percentile grew slightly. This finding seems to agree with those by Sabelhaus and Song (2009) who find that the very bottom of the distribution has significant impacts on their estimates of permanent and transitory shocks of individual earnings.

Although most of the distribution of household income volatility was unchanged between 1985 and 2005, the changes in volatility at the 1st percentile and at the 99th percentile result in an initial narrowing and then widening in the dispersion of income volatility over the period. In Figure 3 we show the standard deviation of the arc percent change in household income between 1985 and 2005.[13] The standard deviation of the year-to-year percent change falls from about 40 percentage points between 1984–85 to 29 percentage points between 1990–91. Over the next few years—during most of the 1990s—the dispersion in the percent change of total household income volatility—is basically unchanged. Beginning with the percent change in incomes between 2001 and 2002, dispersion in household income vola-

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13. Estimates using the standard deviation of the percent change in household income yield similar results to those shown here.
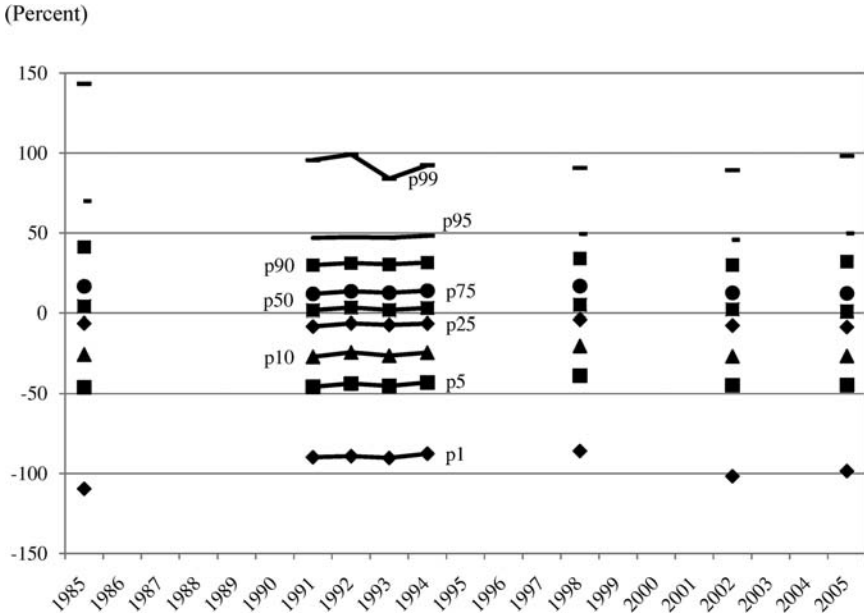
(Percent)

Figure 2

Distribution of the Arc Percent Change in Household Income Over the Previous Year, Matched SIPP-SSA Data

Source: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

tility rises slightly following the changes at the 1st and 99th percentiles of the percent change distribution shown in Figure 2. In 2005 the standard deviation of the percent change in total household income was 30 percent.

B. Patterns in Individual and Family Earnings Volatility

We step away from total household income volatility for the moment to consider patterns in individual earnings volatility. Differences in estimates of individual earnings volatility in the existing literature is often confounded by different definitions of the *individual*, be it a prime-age worker (CBO 2007a) or household head (Moffitt and Gottschalk 2008; Dynan, Elmendorf, and Sichel 2008). Here, we compare different estimates of individual earnings volatility in the matched SIPP-SSA data (all prime-age workers, heads and spouses as individuals, and heads and spouses combined) to estimates of individual earnings volatility from the CWHS. (The CWHS does not contain information linking family members.)

Estimates of individual earnings volatility from the CWHS show that the share of workers whose earnings changed by 50 percent or more from one year to the

(Percentage points)
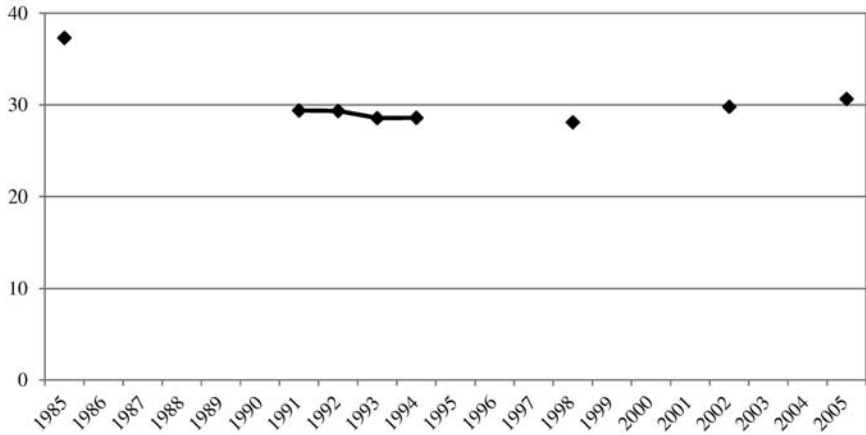
Figure 3

Standard Deviation of the Arc Percent Change in Household Income Over the Previous Year, Matched SIPP-SSA Data

Source: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

next declined from about 35 percent in 1985 to nearly 27 percent in 2005 (see Figure 4). Most of the decline occurs during the latter part of the 1980s, after which volatility is relatively flat, declines again slightly between 1994 and 1996, and is basically unchanged thereafter. Also plotted in Figure 4 is the same metric for three groups from the matched SIPP-SSA data: all prime-age workers, married heads and their spouses (as denoted in the SIPP), and the combined earnings from married heads and their spouses. All three trends also show a slight decline in individual earnings volatility between the mid-1980s and the early 1990s, but are largely unchanged during the latter half of the 1990s and first half of the 2000s.

The share of workers with earnings that change by 50 percent or more is roughly the same magnitude in the CWHS and SIPP-SSA data. Individual earnings volatility in the CWHS and volatility among all prime-age workers and heads and spouses (calculated as individuals) are about the same between 1985 and 2005, falling from around 35 percent to 40 percent to between 29 percent to 32 percent. Not surprisingly, when heads' and spouses' earnings are combined the share of "families" with changes in earnings that exceed 50 percent is significantly smaller than when individual workers' earnings are considered separately. For combined earnings among spouses, generally between 10 percent and 12 percent of workers have earnings that change by more than 50 percent, about a third lower than that of all individual workers. This lower level of volatility suggests at least some offsetting earnings effects within the household.
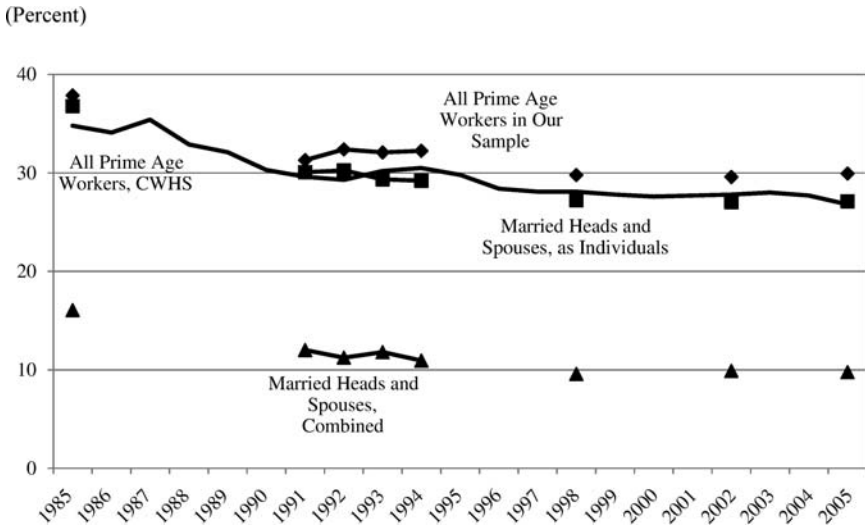
(Percent)

Figure 4

*Percentage of Workers Whose Earnings Change by 50 Percent or More Over the
Previous Year, Matched SIPP-SSA Data and CWHS*

Sources: Various panels of the Survey of Income and Program Participation matched to the administrative
earnings data from the Social Security Administration and the Continuous Work History Sample, 1984–
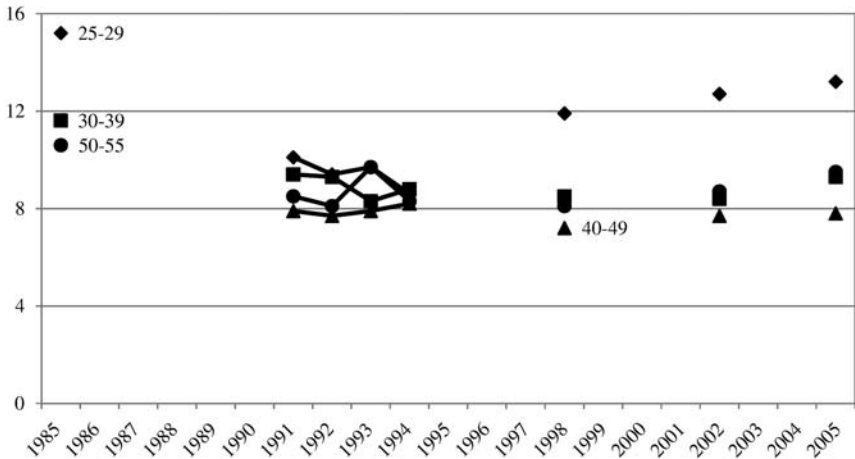2005.

Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-
U-RS. The year is the second year of a two-year period.

C. Changes in Household Income Volatility by Household Characteristic

Households with household heads between the ages of 25 and 29 tended to expe-
rience higher levels of income volatility, and a greater increase in volatility over the
latter part of the sample period, than did those households with older household
heads (see Figure 5). Between 1994 and 1998, the share of the youngest households
(as measured by the age of the household head) that experienced an income change
of 50 percent or more grew from about 9 percent to nearly 12 percent; the share of
other households whose incomes changed by 50 percent or more was essentially
unchanged over the same period. After 1998, the share of the youngest households
that experienced a large income change continued to climb, reaching 13 percent by
2005; changes in household income volatility among older households changed by
a much smaller amount, reaching about 9 percent for household heads aged 30–39
and 50–55 and about 8 percent for household heads aged 40 to 49 in 2005.

Between 10 percent and 14 percent of households in which the household head
had less than a high school education experienced year-to-year changes in household
income of more than 50 percent. A smaller share of households in which the head
had a high school degree or the head had more than a high school degree experienced
such changes (see Figure 6).

(Percent)

Figure 5

Percentage of Households Whose Income Changed by 50 Percent or More Over the Previous Year, Matched SIPP-SSA Data, by Age of Household Head
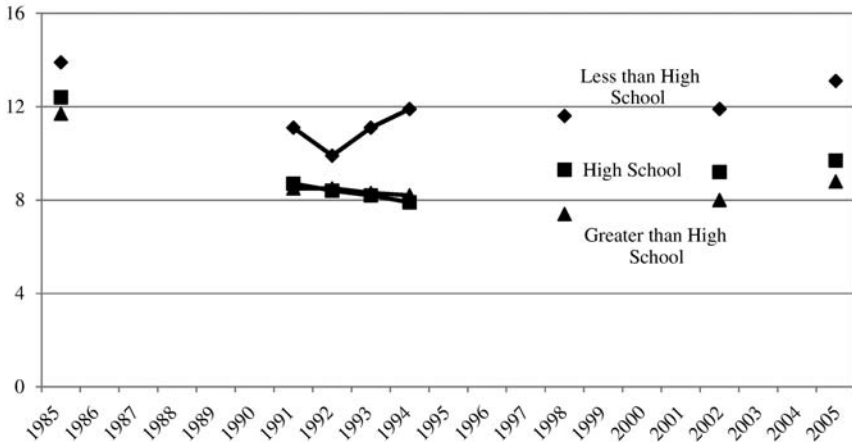
Sources: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.

Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

Between married and unmarried households, there are significant differences in the share of households that experience large changes in income over time (see Figure 7). Among married households, the share that saw large changes in income fell between 1985 and 1994 and remained relatively flat thereafter. By the end of the sample period—between 2004 and 2005—about 7 percent of married households (either with or without children) experienced a change in income that exceeded 50 percent. Among unmarried households, a larger share of households had large changes in income: between 2004 and 2005, 11 percent of unmarried households without children and 14 percent of unmarried households with children did so. In addition, while a relatively constant portion of married households saw such large changes, the share of unmarried households with children that had large income changes grew dramatically: by 2005, 14 percent of unmarried households with children had incomes change by more than 50 percent, up from 11 percent in 1998.

Finally, when we examine the trends in total household income volatility by quintile of the household income distribution, we find little change in variability among the top four quintiles between 1985 and 2005 (see Figure 8). However, while volatility in total household income declined substantially among households in the lowest quintile between 1985 and 1994—from about 27 percent to about 18 percent—it has increased steadily since, rising to about 21 percent in 1998 and to 24

(Percent)

Figure 6

Percentage of Households Whose Income Changed by 50 Percent or More Over the Previous Year, Matched SIPP-SSA Data, by Education of the Head

Sources: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.

Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

percent by 2005. This finding is consistent with those patterns found for younger households and households with lower levels of educational attainment.

D. Potential Sources of Income Fluctuations

Knowing the trends in income volatility does not, unfortunately, tell us why income fluctuations occur. To get a better sense of the potential sources of these fluctuations, we examined, descriptively, changes in family structure, sources of income, and hours worked for those whose incomes rose or fell by more than 50 percent relative to those whose incomes did not change as much.

Changes in household structure are associated with changes in income (see Table 3). We find that about 5.5 percent of households with decreases in incomes that exceeded 50 percent had an additional child between 2004 and 2005. While the differences are not statistically significant, about 4 percent of households that experienced a change in income of less than 50 percent had an additional child. Households with large decreases in incomes were more likely to get married (3.4 percent) than households that did not have a large change in income (1.8 percent) and this difference is statistically meaningful. Households with large increases in household income were similarly more likely to have gotten married than households with no change in income.

Changes in employment are also highly associated with large changes in household income. Households with large increases in income were more than four times

(Percent)
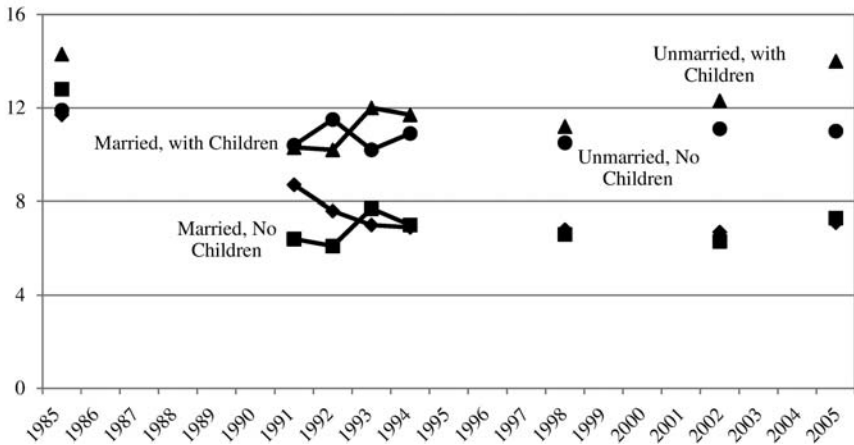
Figure 7

Percentage of Households Whose Income Changed by 50 Percent or More Over the Previous Year, Matched SIPP-SSA Data, by Household Structure

Sources: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

as likely to have a head enter employment as households with no change in income. In 12 percent of households with large declines in income, the head stopped working altogether. In addition, households with large declines were more than two times more likely to add unemployment insurance as a source of income than households with no change income, but not more likely to add disability as a source of income.

E. Sensitivity of Survey-Based Measures of Income Variability to the Treatment of Imputed Values

In this section, we show how the trends in the survey-based measure of total household income are sensitive to the treatment of imputed values. To do so, we return to the version of the SIPP available to the public; that is, without any administrative earnings information attached to the worker's record. We then compute our standard measure of volatility—the share of households with large changes in income from one year to the next—for household income based on the survey data with and without imputed values and compare those to estimates of volatility derived from the matched administrative records.

As we discussed above, the percentage of households with imputed earnings in the SIPP grew dramatically between 1985 and 2005. This increase in imputation rates could lead to an artificial increase in measured volatility. To address this concern, we show the patterns in household income volatility from the SIPP-SSA
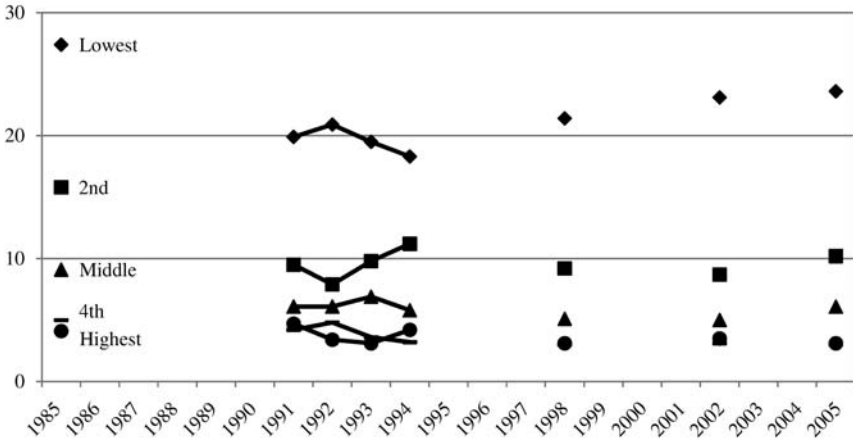
(Percent)

Figure 8

Percentage of Households Whose Income Changed by 50 Percent or More Over the Previous Year, Matched SIPP-SSA Data, by Income Quintile

Sources: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.

Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

matched data and from the public-use SIPP data with and without imputed earnings data (see Figures 9 and 10). As reported above from the administrative records, the share of households with large income changes fell between 1985 and 1991 and then remained relatively constant through 2005. In the public-use SIPP (including imputed earnings data), the share of households with large income changes between 1984 and 1985 was lower than in the matched data and remained relatively un-changed through 1994. By 2005, however, the share of households with large changes grew to 14 percent and exceeded the same point in the matched data set by nearly 5 percentage points. When households with imputed earnings are dropped from the sample, measured income volatility is about the same as in the case when imputed earnings are included through 1994. However, beginning in 1994, the share of households with large changes in income grew fastest when all observations are included in the calculations, rising by four percentage points, from about 10 percent in 1994 to 14 percent in 2005. By comparison, among households that did not have any imputed earnings data, that same fraction rose by about two percentage points less, from about 9 percent in 1994 to about 11 percent in 2005. And among the sample that uses the administrative earnings data, the share of households with such large changes rose by a smaller 0.7 percentage points over the latter half of the sample period. We see similar patterns using the standard deviation of the arc percent change as the measure of volatility (see Figure 10).

Table 3

Percentage of Households Experiencing Changes in Total Household Income due to Changes in Family Structure or Employment

	Change in Household Income		
	Decrease of 50 Percent or More	Change of Less than 50 Percent	Increase of 50 Percent or More
Family structure			
Percentage of households in which			
the number of children younger than age six increases	5.5	4.1	4.0
the household head marries	3.4**	1.8	3.1*
Employment and income changes			
Percentage of households in which			
the household head enters employment	3.1	2.4	10.0***
the household head exits employment	12.0***	3.3	3.8
unemployment insurance is added as an income source	9.8***	3.8	2.9
disability is added as an income source	1.2	1.0	1.6

Source: 2004 panel of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
Note: Both the events and the change in real household income are measured between 2004 and 2005.
* Statistically different from households with a change in income of less than 50 percent at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level.

V. Discussion

How can we reconcile our results with those in the literature? When we compute trends in income volatility using the publically available SIPP, including observations with imputed earnings, income volatility appears to be increasing in the late 1990s and early 2000s. That increase appears to be data-driven: when we restrict our sample to those households without imputed earnings, household income volatility is roughly flat. Similarly, when we use linked administrative-survey data and replace survey earnings with administrative earnings in constructing household income, our results show no upward trend in volatility.

This finding is in contrast to some recent studies of income and earnings volatility, which find that volatility of family income or earnings increased in the mid-1990s (Dynan et al. 2008; Bollinger et al. 2010; Shin and Solon 2009; Gosselin and Zimmerman 2007; Hacker 2008). By contrast, Jacobs (2007), and Moffitt and Gottschalk (2008) use the PSID and find no increase in volatility between 1980 and 2004. All
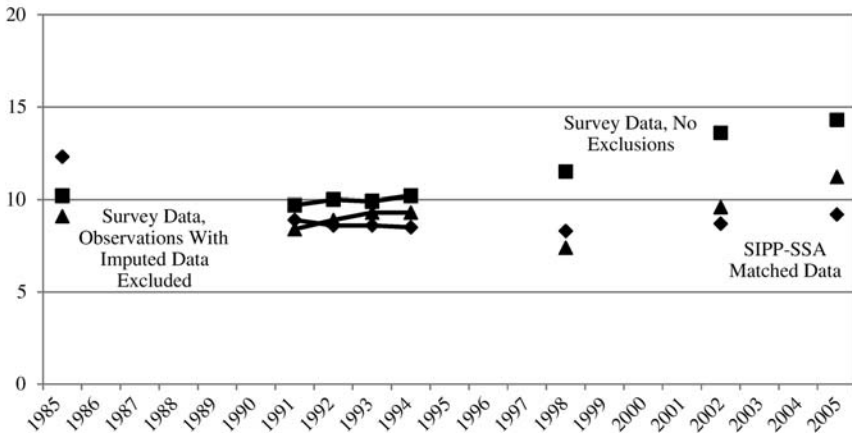
(Percent)

Figure 9

The Effect of Imputations on the Percentage with a 50 Percent or Greater Change in the Arc Percent Change in Household Income over the Previous Year

Sources: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
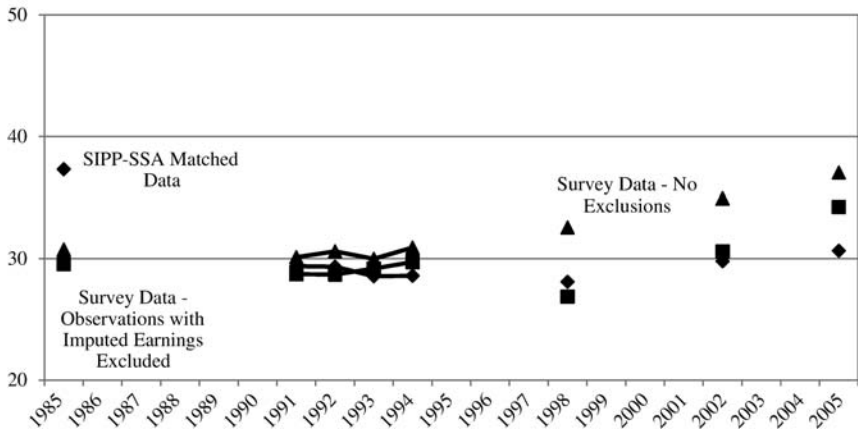
Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

studies agree that both earnings volatility and family income volatility increased between the 1970s and early 1980s.

While we cannot reconcile our results with the divergent set of results from papers using the PSID and other sources of survey data, a comparison with other papers suggests two conclusions. First, there are differences across data sources. The papers that use very similar measures of volatility as we do but use the PSID—Dynan et al. (2008) and Shin and Solon (2009)—tend to find secular trends in earnings and in family income that differ from those found in administrative earnings data and in matched SIPP-SSA data. Second, how one treats the sample affects the trends. In particular, we find that the increasing presence of hot-decked values of income and earnings in the SIPP can lead to an upward bias in the measured trend in year-to-year variability. Imputation alone, however, likely cannot explain the differences; for example, Bollinger et al. (2010)—using the CPS as a panel—find increases in volatility even after eliminating imputed observations.

Some caveats apply to our analysis. First, the measures used in this paper do not reflect the "risk" workers and households may face. Variable earnings can be completely forecastable and stable earnings might reflect the realization of downside risk (for example, lack of advancement). Second, we do not attempt to separate permanent from transitory variance in earnings. Permanent changes in earnings and income, in our view, also represents "volatility" and, as Moffitt and Gottschalk (1995) argue, the transitory component of earnings might best be thought of as mobility.

(Percentage points)

Figure 10
The Effect of Imputations on the Standard Deviation of the Arc Percent Change in Household Income over the Previous Year

Sources: Various panels of the Survey of Income and Program Participation matched to the administrative earnings data from the Social Security Administration.
Note: Please see the text for a description of the sample. Income is inflated to 2006 dollars using the CPI-U-RS. The year is the second year of a two-year period.

Third, some changes in earnings or in household income may be the result of voluntary choices (such as a parent's decision to leave the work force to stay at home with a child) while others are involuntary (such as losing one's job). Although we restrict the age range in our samples to minimize some common voluntary transitions such as returning to school or retirement, we do not know how much of the volatility we do observe is voluntary. Fourth, the data used in both sections of this analysis reflect only pretax income. The "automatic stabilizer" features of the tax system likely works to mitigate some volatility (see CBO 2007b), though both changes in the tax system over time (including expansions in the EITC, for example) and taxes at a given point in time might have either increased or decreased income volatility. Fifth, the Social Security earnings data we use in the majority of our analyses, while of very high quality, are not perfect. They do not include earnings from some sources (such as under the table jobs) and do not include self-employment earnings (though see the discussion of the insensitivity of the results to the inclusion of self-employment earnings on page 18). Sixth, this analysis does not examine the extent to which household assets, such as equity in a home or savings, might be related to household income volatility. Seventh, and finally, the analysis does not examine the effect of change in household incomes on measures of household economic well-being, such as consumption, on the health of household members, or on their future well-being.

VI. Conclusions

This study shows that many workers and households experience relatively large changes in their earnings and incomes from one year to the next. Those changes in earnings and income likely have important and far-reaching implications for the households who experience them. Not all of this volatility is necessarily negative nor is it necessarily unanticipated—such changes in earnings or income may be due to changes in family formation, life circumstances, or jobs, to name a few. Fully decomposing volatility into its component reasons is beyond the scope of this paper but is certainly worthy of further research.

We find that a significant number of workers experience substantial changes in their earnings from one year to the next. For example, more than 25 percent of workers saw their earnings change by at least 50 percent between 2004 and 2005. We also find that a significant number of households experience substantial year-to-year variability in their incomes. However, household income tends to vary less than individual worker's earnings. This is in part because households tend to have more than one source of income: many have multiple earners and may also have other nonlabor income. Moreover, the earnings of other household members and other nonlabor sources of income tend to offset changes in individual worker's earnings. For example, if one household member were to lose his or her job, another household member might then enter the labor force thereby (at least partially) offsetting the initial loss in household income. As with the trends in earnings volatility, household income volatility declined slightly over the 1985 to 2005 period.

A dynamic labor market is a strength of the U.S. economy. Changes in workers' incomes from one year to the next are a characteristic of a dynamic labor market: workers move in and out of employment, change jobs (voluntarily or involuntarily), and change locations. At the same time dislocations, job loss, and marital dissolutions all can lead to large drops in family incomes that can place a substantial burden on family members. The potential for these burdens has important implications for the design of well-functioning social insurance and tax systems.

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Appendix Table A1
Summary Statistics-Earnings Sample

Year[a]	Sample Size	Annual Earnings ($2006)				Age in Year 2		Percent Male
		Year 1		Year 2				
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
1985	744,697	30,510	47,050	32,440	39,370	37.7	8.3	54.4
1986	769,451	31,720	38,580	32,930	43,460	37.7	8.2	54.0
1987	811,181	31,560	42,270	34,290	70,900	37.8	8.2	53.6
1988	844,084	33,250	69,580	34,030	59,220	37.9	8.2	53.3
1989	872,364	33,170	57,940	34,050	55,050	38.0	8.1	53.1
1990	898,680	33,280	53,860	33,920	52,090	38.1	8.1	52.9
1991	914,545	33,490	51,300	33,340	53,550	38.3	8.1	52.8
1992	923,763	33,100	52,640	34,200	64,110	38.5	8.1	52.7
1993	936,313	33,790	63,060	33,760	58,030	38.7	8.1	52.6
1994	948,055	33,340	57,600	34,120	65,330	38.9	8.1	52.5
1995	970,070	33,350	64,740	34,600	57,150	39.0	8.1	52.3
1996	988,145	33,950	55,770	35,090	64,100	39.2	8.2	52.2
1997	1,002,664	34,520	62,870	36,440	85,970	39.3	8.2	52.0
1998	1,014,531	35,760	84,620	37,780	89,190	39.5	8.2	51.9
1999	1,026,090	37,070	87,830	38,950	113,110	39.7	8.2	51.8
2000	1,038,889	38,250	111,570	39,960	109,730	39.9	8.3	51.7
2001	1,046,428	39,400	101,270	39,440	126,290	40.1	8.3	51.7
2002	1,041,763	39,210	124,700	38,850	95,900	40.2	8.3	51.7
2003	1,032,839	38,620	94,650	38,750	86,720	40.3	8.4	51.6
2004	995,639	38,970	86,850	40,170	117,460	40.8	8.1	51.6
2005	962,037	40,310	118,700	40,790	129,940	41.4	7.8	51.5

Source: Social Security Administration's Continuous Work History Sample.
Notes: Sample consists of workers aged 25 to 55 who have positive earnings in at least one of the two years of interest. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation. Earnings are inflated to 2006 dollars using the CPI-U-RS.
a. Year is the second year of a two-year transition period.