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## Trends in Earnings Variability Over the Past 20 Years

U.S. Congressional Budget Office

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## Trends in Earnings Variability Over the Past 20 Years

### Abstract

[Excerpt]– A significant number of workers experience substantial variability in their total wage earnings from year to year. About one-in-five workers saw their earnings fall by more than 25 percent between 2002 and 2003, and about one-in-seven saw their earnings fall by more than 50 percent. Roughly the same shares of workers experienced increases in earnings of 25 percent or 50 percent.

-- Some variability in earnings stems from workers' voluntary actions, such as deciding to stay home and rear children, and some stems from involuntary events, such as the loss of a job. Moreover, earnings variability was higher for younger workers and for workers with lower levels of educational attainment.

-- The decline in macroeconomic volatility over the past several decades does not appear to have translated into lower levels of variability in workers' earnings. Since 1980, there has been little change in earnings variability for both men and women. There is some evidence that, between 1960 and 1980, earnings variability increased for men but was offset by a decrease for women. Those findings are consistent with most existing studies of the topic that use publicly available survey data, which tend to find higher levels of earnings variability for men in the 1980s and 1990s relative to the 1970s, but little change since around 1980.

### Keywords

worker, federal, wage, earnings, job, education, macroeconomic, survey data, men, women, Charles Schumer, Jim Webb

### Comments

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April 17, 2007

The Honorable Charles E. Schumer  
Chairman  
Joint Economic Committee  
United States Senate  
Washington, D.C. 20510

The Honorable Jim Webb  
Joint Economic Committee  
United States Senate  
Washington, D.C. 20510

Dear Senators:

In response to your request, the Congressional Budget Office (CBO) is analyzing the extent to which workers' earnings and family incomes vary from year to year and whether that variability has changed over the past 20 years. CBO's analysis of lifetime earnings patterns is a key input into its projections for Social Security and Medicare, because revenues and outlays are directly tied to individual workers' earnings through tax and benefit formulas. This letter reports some initial findings from CBO's work, which focuses on workers' earnings. CBO intends to carry out additional research in this area for the purpose of studying earnings patterns for long-term Social Security and Medicare modeling, including examining trends in family earnings and income variability, and will issue a final report when that analysis is complete.

The analysis described in the attachment to this letter is based on data from the Social Security Administration's Continuous Work History Sample from 1980 to 2003. Those administrative data are supplemented with survey data from the 2001 panel of the U.S. Census Bureau's Survey of Income and Program Participation. Those sources provide the most current data available with which CBO can conduct its analysis. The major findings from CBO's analysis to date are the following:

- A significant number of workers experience substantial variability in their total wage earnings from year to year. About one-in-five workers saw their earnings fall by more than 25 percent between 2002 and 2003, and about one-in-seven saw their earnings fall by more than 50 percent. Roughly the same shares of workers experienced increases in earnings of 25 percent or 50 percent.

Honorable Charles E. Schumer  
Honorable Jim Webb  
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- Some variability in earnings stems from workers' voluntary actions, such as deciding to stay home and rear children, and some stems from involuntary events, such as the loss of a job. Moreover, earnings variability was higher for younger workers and for workers with lower levels of educational attainment.
- The decline in macroeconomic volatility over the past several decades does not appear to have translated into lower levels of variability in workers' earnings. Since 1980, there has been little change in earnings variability for both men and women. There is some evidence that, between 1960 and 1980, earnings variability increased for men but was offset by a decrease for women. Those findings are consistent with most existing studies of the topic that use publicly available survey data, which tend to find higher levels of earnings variability for men in the 1980s and 1990s relative to the 1970s, but little change since around 1980.

The data used in this analysis reflect only workers' pretax earnings. This analysis does not examine workers' family income or assets. It is possible that trends in the variability of family income or assets may differ from those of workers' earnings.

The analysis was prepared by Molly Dahl, Thomas DeLeire, and Jonathan Schwabish of CBO's Health and Human Resources Division. If you or your staff have any questions or would like further details, please feel free to call me at (202) 226-2700 or Thomas DeLeire at (202) 226-2668.

Sincerely,



Peter R. Orszag  
Director

Attachment

cc: Honorable Jim Saxton  
Ranking Republican Member  
Joint Economic Committee

# **Trends in Earnings Variability Over the Past 20 Years**

April 2007



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In response to a request from Senators Charles Schumer and Jim Webb, the Congressional Budget Office (CBO) analyzed the extent to which workers' earnings vary from year to year and whether that variability has increased over the past 20 years. To analyze those issues, CBO used data and techniques it has developed for projecting individual earnings in its long-term model for Social Security and Medicare.<sup>1</sup> Understanding past trends in variability is key for projecting future earnings patterns, and those patterns are an important input into CBO's projections for Social Security and Medicare (because revenues and outlays are directly tied to individual workers' earnings through tax and benefit formulas).

For its analysis, CBO used data from the Social Security Administration's Continuous Work History Sample (CWHS) and the U.S. Census Bureau's Survey of Income and Program Participation (SIPP). Although the use of the CWHS allows for a more accurate picture of the extent of earnings variability than do survey data, the analysis based on the CWHS is limited in several ways. Most notably, aside from age and sex, no information on workers' characteristics is available. Nor is any information available on the reasons for changes in workers' earnings. CBO therefore supplemented administrative data from the CWHS with data from the SIPP, which contains information on workers' levels of education and the reasons for which many workers experience large declines in earnings—such as illness, unemployment, or exiting the labor force to have or care for children.

## **Methodology**

In its analysis of administrative records, CBO looked at a sample of workers whose earnings information was collected by the Social Security Administration between 1980 and 2003. The measure of annual total wage earnings available for this analysis includes wage and salary earnings, tips, and some other sources of compensation; it excludes self-employment earnings and deferred compensation. The measure also includes earnings above the maximum amount subject to the Social Security payroll tax. Earnings are indexed to 2006 dollars using the research series for the consumer price index for all urban consumers. The analysis focuses on workers who were between 22 and 59 years old at any time during the 1980–2003 period.

For each worker, CBO calculated the percentage change in earnings from one year to the next.<sup>2</sup> CBO then calculated, in each year from 1981 to 2003, the fraction of workers whose earnings fell by at least 50 percent from the previous year, the fraction whose earnings fell by at least 25 percent, the fraction whose earnings increased by at

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1. See Congressional Budget Office, *Projecting Labor Force Participation and Earnings in CBO's Long-Term Microsimulation Model* (October 2006).
  2. Most existing studies adjust for workers' ages. CBO's analysis does not; that is, a portion of the trends in variability may be the result of the aging of the workforce. An analysis that does account for age is presented in the appendix to this report.

least 25 percent, and the fraction whose earnings increased by at least 50 percent.<sup>3</sup> Because the extent to which earnings vary from year to year within those categories is also important, CBO calculated the standard deviation of the one-year change in earnings. The standard deviation can be used to construct an interval (from the average percentage change minus the standard deviation value to the average percentage change plus the standard deviation value) within which roughly 80 percent of workers fall.<sup>4</sup> CBO also calculated two additional measures of variability: the fraction of workers in each year who had no earnings at all in the previous calendar year, and the fraction of workers in each year who had no earnings in the subsequent calendar year.

In its analysis of survey data from the 2001 panel of the SIPP, CBO focused on the annual earnings of workers between the ages of 22 and 59 in 2001 and 2002. The 2001 panel of the SIPP is the latest available from which the annual percentage change in workers' earnings can be calculated. Because the survey collects demographic information on workers, CBO's analysis was able to determine how the changes in earnings varied with the workers' education level and age. Finally, CBO used information on the reasons for which individuals were not working to help provide insight into the causes of large declines in earnings.

### **Analysis of Variability Using Administrative Data**

Individual earnings tend to rise over a worker's lifetime.<sup>5</sup> From year to year, however, there is substantial variability in those earnings, according to data from the CWHS. For example, between 2002 and 2003, one-in-five workers saw his or her real (inflation-adjusted) earnings increase by at least 25 percent, and roughly the same share of workers saw his or her earnings decline by at least 25 percent. A substantial portion of workers, about one-in-seven, saw their earnings decline by at least half.

Relatively little research to date has explored whether earnings variability has risen over the past 20 years. Resolving questions about those trends is important not only to inform policymakers, but also to allow CBO to construct more accurate long-term projections of earnings for its analyses of the Social Security and Medicare programs.

- 
3. Individuals with no earnings in both years of a two-year pairing are excluded from the analysis. Workers with no earnings in the first year and positive earnings in the second year of a two-year pairing are coded as having a 100 percent increase in earnings; the percentage increase in earnings for those workers would otherwise not be defined. The analysis of the trends in earnings volatility is not sensitive to that choice. See the appendix for a discussion of how CBO's analysis is related to that used in other studies.
  4. CBO calculated this statistic on the basis of the empirical distribution of the one-year percentage change in total wage earnings in the CWHS.
  5. For a discussion of trends in hourly wages, hourly wage dispersion, and earnings dispersion, see Congressional Budget Office, *Changes in Low-Wage Labor Markets Between 1979 and 2005* (December 2006); and Jonathan A. Schwabish, *Earnings Inequality and High Earners: Changes During and After the Stock Market Boom of the 1990s*, Congressional Budget Office Working Paper 2006-06 (April 2006).

To examine trends in earnings variability, CBO used administrative data from its long-term Social Security model. Administrative data have advantages over survey data because the administrative records yield very large samples of workers, allowing for more precise statistical analyses. Furthermore, administrative data more accurately measure year-to-year variability in earnings, because individuals' responses to surveys—which rely on the respondents' recall—are often in error. Such error could lead researchers to either overstate or understate workers' actual changes in earnings.<sup>6</sup>

Analyses using administrative data are also limited in a number of ways, however; the primary limitation is that, beyond the age and sex of the worker, little or no demographic information is available. Moreover, the administrative data only reflect workers' earnings: No information on workers' family income or assets is available. Therefore, the analyses cannot examine how changes in a worker's earnings might be offset by changes in other sources of family income or by the existence of financial assets. Furthermore, the analyses do not account for the impact of income or payroll taxes. The tax system can help to smooth fluctuations in income—sometimes quite significantly—so workers' after-tax income can vary less from year to year than their pretax income does.

CBO's analysis of the CWS administrative data indicates that, since 1980, the trend in year-to-year earnings variability has been roughly flat. That finding is consistent with the results of existing studies, which tend to show more variability in earnings in the 1980s and 1990s (on a percentage basis) than in the 1970s but relatively stable trends in earnings variability since about 1980.<sup>7</sup>

Although the trend in earnings variability has been roughly flat since 1980, it does appear to vary with the business cycle; large declines in total wage earnings were more frequent in years in which the growth rate of gross domestic product (GDP) was relatively low. Between 1980 and 1981, for example, when the U.S. economy was in a

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6. See John Bound and Alan Krueger, "The Extent of Measurement Error in Longitudinal Surveys: Do Two Wrongs Make a Right?" *Journal of Labor Economics*, vol. 9, no. 1 (January 1991), pp. 1–24; and Julian Cristia and Jonathan A. Schwabish, *Measurement Error in the SIPP: Evidence from Matched Administrative Records*, Congressional Budget Office Working Paper 2007-03 (January 2007).

7. See, for example, Peter Gottschalk and Robert Moffitt, "The Growth of Earnings Instability in the U.S. Labor Market," *Brookings Papers on Economic Activity*, no. 2 (1994); Steven Haider, "Earnings Instability and Earnings Inequality of Males in the United States: 1967–1991," *Journal of Labor Economics*, vol. 19, no. 4 (2001); Maury Gittleman and Mary Joyce, "Earnings Mobility in the United States, 1967–91," *Monthly Labor Review*, vol. 118, no. 9 (September 1995), pp. 3–13; Robert Moffitt and Peter Gottschalk, "Trends in the Transitory Variance of Earnings in the United States," *Economic Journal*, vol. 112, no. 478 (2002), pp. 68–73.

Gottschalk and Moffitt (1994) examine earnings variability through 1984. Haider (1991) and Gittleman and Joyce (1995) examine earnings variability through 1991. Finally, Moffitt and Gottschalk (2002) examine earnings variability through 1996. Each study finds relatively stable trends in comparable measures of variability after 1980.

recession and GDP growth was slowing, nearly one-in-five workers experienced a 50 percent drop in earnings, and nearly one-in-four experienced a 25 percent drop in earnings, adjusted for inflation (see Figure 1 on page 9 and Figure 2 on page 10). By 1983, when the economy had recovered somewhat, only one-in-five workers experienced a decline in earnings of at least 25 percent from one year to the next and only 15 percent experienced declines of at least 50 percent. Since 2000, earnings variability has increased slightly: By 2003, almost one-in-five workers experienced at least a 25 percent drop in earnings and one-in-seven workers experienced a 50 percent drop.

The percentage of workers who experienced at least a 50 percent increase in earnings from one year to the next declined somewhat between 1981 and 2003—from about 23 percent to 16 percent—and the percentage of workers who experienced at least a 25 percent rise in earnings declined slightly, falling from 27 percent to 22 percent (see Figure 3 on page 11 and Figure 4 on page 12). Between 1980 and 2003, women were more likely to have experienced large changes in earnings than men were, although the difference between the two sexes narrowed over that period. That narrowing occurred during a period in which the participation rate of women in the labor force increased substantially.

The measures of earnings variability displayed in Figures 1 through 4 rely on changes in earnings that are greater or less than prespecified amounts. An alternative measure, which incorporates changes of any size, is the standard deviation of the one-year change in inflation-adjusted earnings. Unlike the other measures, which generally show stable levels of variability since 1980, the measure of variability based on the standard deviation has declined somewhat over the 1981–2003 period (see Figure 5 on page 13).

CBO's analysis of earnings includes the variability that stems from transitions between years in which workers had no earnings and years in which they had positive earnings. Both the percentage of workers in each year who did not have any earnings in the previous calendar year and the percentage of workers who did not have any earnings in the subsequent calendar year have declined over the 1980–2003 period (see Figure 6 on page 14). In 1981, for example, 11 percent of workers had no earnings in the previous year (1980) and 12 percent had no earnings in the subsequent year (1982). In 2002, by contrast, 5 percent of workers had no earnings in the previous year (2001) and about 6 percent had no earnings in the subsequent year (2003).

There was no increase in the level of earnings variability in selected years between 1980 and 2003 for workers of different ages or in the overall population. In general, younger workers (those ages 22 to 29) tend to experience more variability in earnings than do older workers (see Table 1 on page 7). Because older workers have more stable earnings than do younger workers, earnings variability among all workers should

decline somewhat as the workforce ages. Indeed, the declines in variability observed in Figures 3 through 6, in part, are the result of that aging.<sup>8</sup>

In addition to analyzing the trends since 1980 in workers' total wage earnings, CBO analyzed the trend in variability since 1960 in the earnings on which workers paid Social Security taxes. That measure of earnings is more limited than the measure of total wage earnings, because if a worker's earnings exceed the Social Security maximum taxable income, only that maximum value is reported. That maximum was relatively low in the 1960s, so the analysis examines the fraction of workers in the bottom two quintiles (or fifths) of the earnings distribution who experienced large declines—of 25 percent or 50 percent—in their Social Security taxable earnings. The changes in the maximum taxable income would not be expected to affect those workers because the maximum is above the 40th percentile of annual earnings throughout the 1960–2003 period.

Between the early 1960s and the early 1980s, the fraction of male workers in the bottom two quintiles of the earnings distribution who experienced at least a 50 percent decline in their Social Security taxable earnings over the previous year increased—from roughly one-in-six workers in 1961 to one-in-four workers in 1982 (see Figure 7 on page 15). Between 1982 and 2003, by contrast, there was little change in earnings variability for male workers (although it did vary with the business cycle, increasing slightly during the 1991 and 2001 recessions).

The pattern differs significantly for female workers. Between the early 1960s and the mid 1980s, the percentage of female workers who experienced 50 percent or greater declines in earnings fell from 30 percent to less than 25 percent. Since 1984, earnings variability among female workers has been roughly constant. For all workers in the bottom two quintiles of the earnings distribution, there has been little change in this measure of earnings variability over the entire 1960–2003 period.

For workers in the bottom two quintiles whose Social Security taxable earnings fell by at least 25 percent from one year to the next between 1961 and 2003, the trends are similar to those displayed in Figure 7. The overall trend in earnings variability between 1960 and 2003 for all workers has been roughly flat (see Figure 8 on page 16). The results for male workers are consistent with most existing studies that find less earnings variability in the late 1960s and 1970s than in the 1980s and early 1990s. They do suggest, however, that there may have been a decline in earnings variability among women that offset the increase among men.

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8. See the appendix for a discussion of an analysis that more closely follows that of Gottschalk and Moffitt (1994). In particular, that analysis controls for workers' ages and excludes workers who transition between years of no annual earnings and years with positive earnings.

## **Analysis of Variability Using Survey Data**

To determine how changes in earnings varied by workers' characteristics and to examine potential reasons for large changes in workers' earnings, CBO analyzed recent data from the Survey of Income and Program Participation. The analysis focused on workers ages 22 to 59. As with the analysis based on administrative data, this analysis showed substantial variation in workers' earnings from 2001 to 2002. Over that one-year period, one-in-four workers saw his or her earnings increase by at least 25 percent after inflation, while one-in-five saw his or her earnings decline by at least 25 percent. A substantial portion of workers, 11 percent, saw their earnings decline by at least half (see Figure 9 on page 17).

Workers with less education tend to experience more volatility in their earnings than do workers with more education (see Table 2 on page 8). For example, from 2001 to 2002, 16 percent of workers without a high school education had their earnings decline by 50 percent or more, compared with 10 percent of workers with more than a high school education.

Such fluctuations in earnings can result from many sources, including job changes, losses, or gains; voluntary exits from the labor force, perhaps to care for children or other family members; changes in the number of hours worked per year; or changes in the wage rate received by workers. Most workers who experienced at least a 50 percent drop in earnings between 2001 and 2002 were not working for at least one month and typically did not work for nine months in 2002. When those survey respondents were asked why they were not working, the most common answers were that they were caring for a child or other family member or were pregnant; were not able to find work or had been laid off; were unable to work because of disability, illness, or injury; or were not interested in working or were retired.<sup>9</sup> The responses appear to be split evenly between workers suggesting that their departure from the labor force was voluntary and those suggesting that it was not.

For another point of comparison, CBO conducted its analysis using data from 1997 to 1998—a period of relatively rapid economic growth, in contrast to the relatively slow growth from 2001 to 2002—and found similar results.<sup>10</sup>

## **Conclusion**

CBO's analysis finds that a significant number of workers experience substantial variability in their total wage earnings from year to year. An examination of trends over the past 20 years shows little change in such earnings variability for both men and women. The reduction in macroeconomic volatility over the past several decades does not appear to have translated into lower levels of variability in workers' earnings. CBO will be examining trends in family income variability in its future work.

---

9. Only those survey respondents who had at least four consecutive months without a job were asked this question.

10. The data are from the 1996 and 2001 panels of the SIPP, the latest panels available for which the annual percentage change in workers' earnings can be calculated.



**Table 1.**


---

## Percentage of Workers for Whom Total Wage Earnings Dropped or Rose by 50 Percent or 25 Percent, by 10-Year Age Category

---

(Percent)

	Total Wage Earnings			
	50% Drop	25% Drop	25% Rise	50% Rise
<b>Ages 20 to 29</b>				
1983	17.5	23.2	36.0	29.6
1993	16.0	22.4	33.2	25.6
2003	16.4	23.7	32.6	24.8
<b>Ages 30 to 39</b>				
1983	15.1	19.9	29.5	24.4
1993	14.1	19.4	23.0	17.5
2003	13.8	19.9	22.2	16.2
<b>Ages 40 to 49</b>				
1983	13.7	18.1	25.4	20.9
1993	12.0	16.8	18.5	14.0
2003	11.9	17.1	17.8	12.8
<b>Ages 50 to 59</b>				
1983	15.1	19.7	21.7	18.1
1993	14.6	19.7	15.7	12.0
2003	13.1	18.6	14.2	10.3
<b>All Workers Ages 22 to 59</b>				
1983	15.5	20.5	29.4	24.2
1993	14.1	19.5	23.1	17.7
2003	13.6	19.5	21.3	15.7

---

Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation. Workers without any earnings in the previous calendar year are included, and their percentage change in earnings is coded as 100.

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**Table 2.**


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**Distribution of Changes in Workers' Annual Real Earnings, by Educational Attainment and Age, 2001 to 2002**


---

(Percent)

	Decrease in Earnings of at Least		Changes in Earnings of Less Than 25 Percent	Increase in Earnings of at Least	
	50 Percent	25 Percent		25 Percent	50 Percent
All Workers Ages 22 to 59	11.3	20.2	52.2	27.6	17.4
Educational Attainment					
Less than high school	15.9	25.9	43.8	30.3	21.5
High school	12.4	20.8	51.7	27.6	17.5
More than high school	10.1	19.0	53.7	27.2	16.8
Age					
22 to 30	12.8	21.4	45.3	33.3	22.1
31 to 40	11.0	19.7	52.7	27.6	17.1
41 to 59	10.9	19.9	54.9	25.2	15.6

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Source: Congressional Budget Office based on data from the 2001 panel of the Bureau of the Census's Survey of Income and Program Participation.

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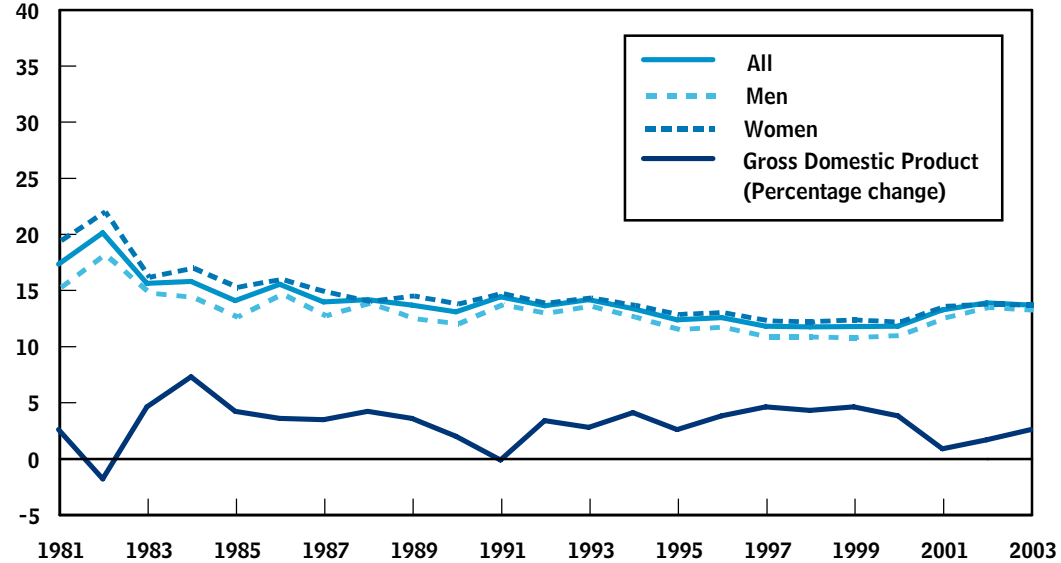
**Figure 1.**

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**Percentage of Workers for Whom Total Wage Earnings Declined by 50 Percent or More Over the Previous Year, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation. Workers without any earnings in the previous calendar year are included, and their percentage change in earnings is coded as 100.

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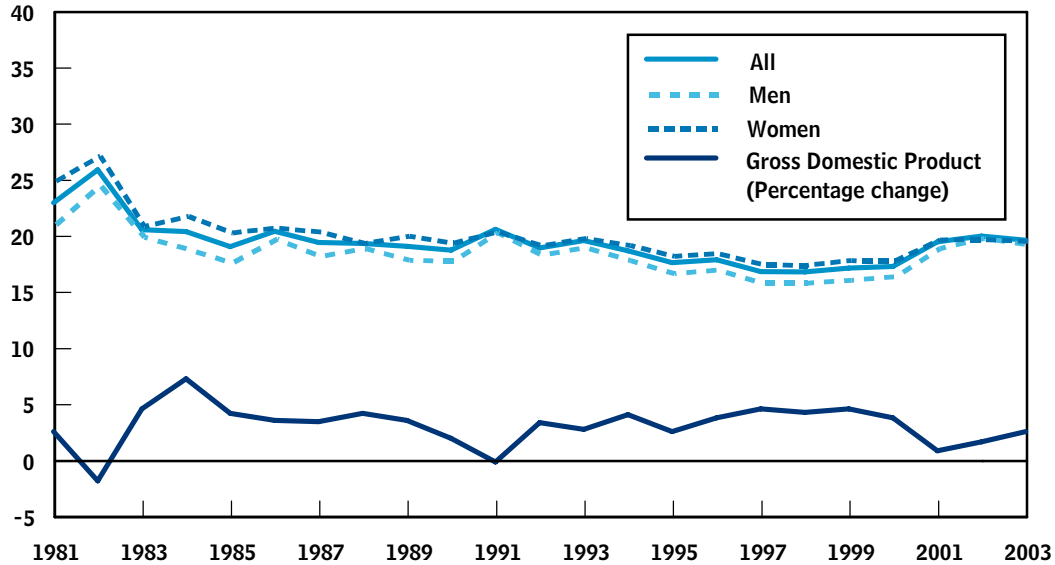
**Figure 2.**

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**Percentage of Workers for Whom Total Wage Earnings Declined by 25 Percent or More Over the Previous Year, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation. Workers without any earnings in the previous calendar year are included, and their percentage change in earnings is coded as 100.

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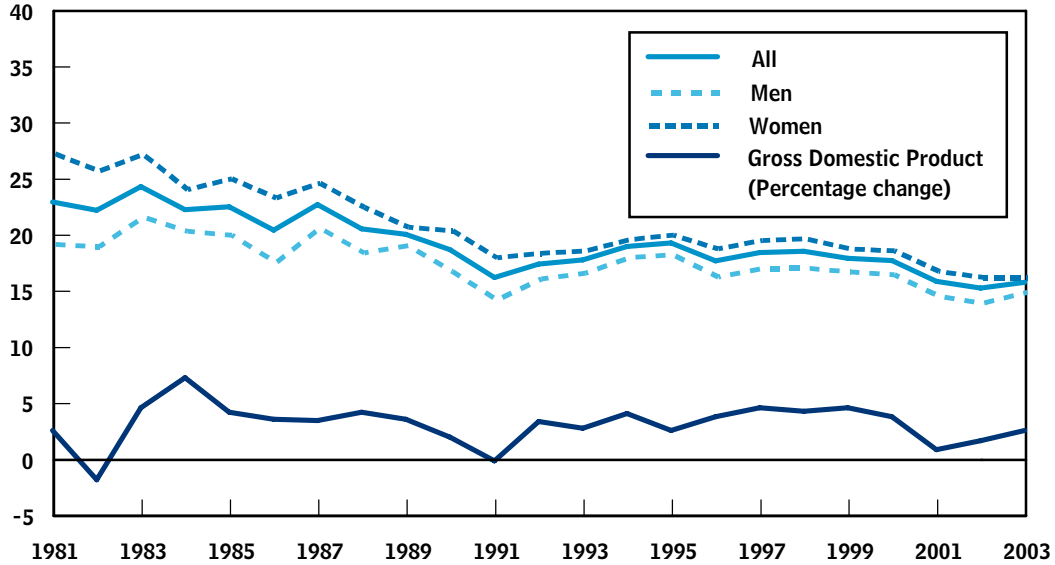
**Figure 3.**

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**Percentage of Workers for Whom Total Wage Earnings Rose by 50 Percent or More Over the Previous Year, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation. Workers without any earnings in the previous calendar year are included, and their percentage change in earnings is coded as 100.

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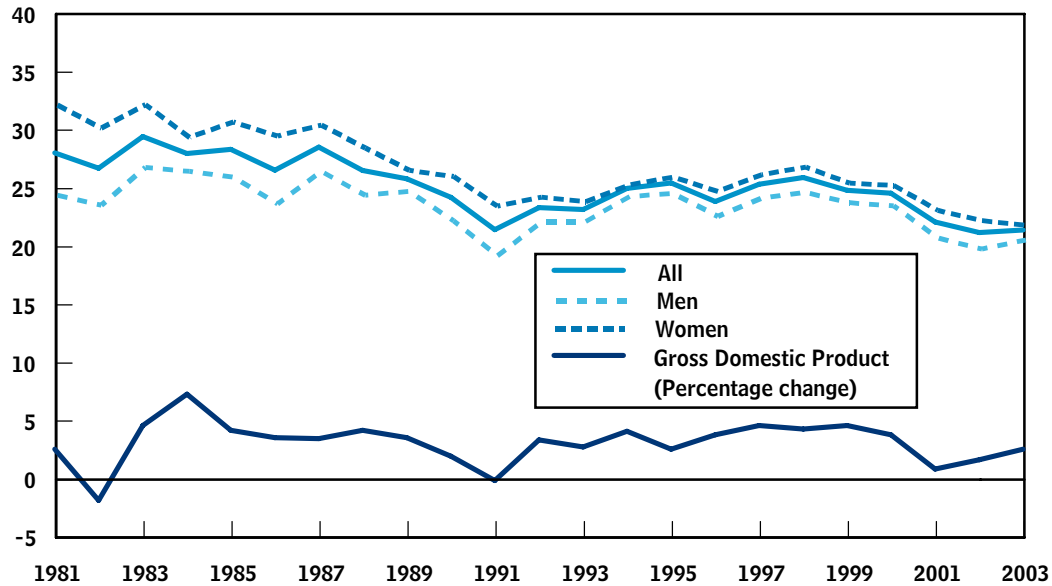
**Figure 4.**

---

**Percentage of Workers for Whom Total Wage Earnings Rose by 25 Percent or More Over the Previous Year, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation. Workers without any earnings in the previous calendar year are included, and their percentage change in earnings is coded as 100.

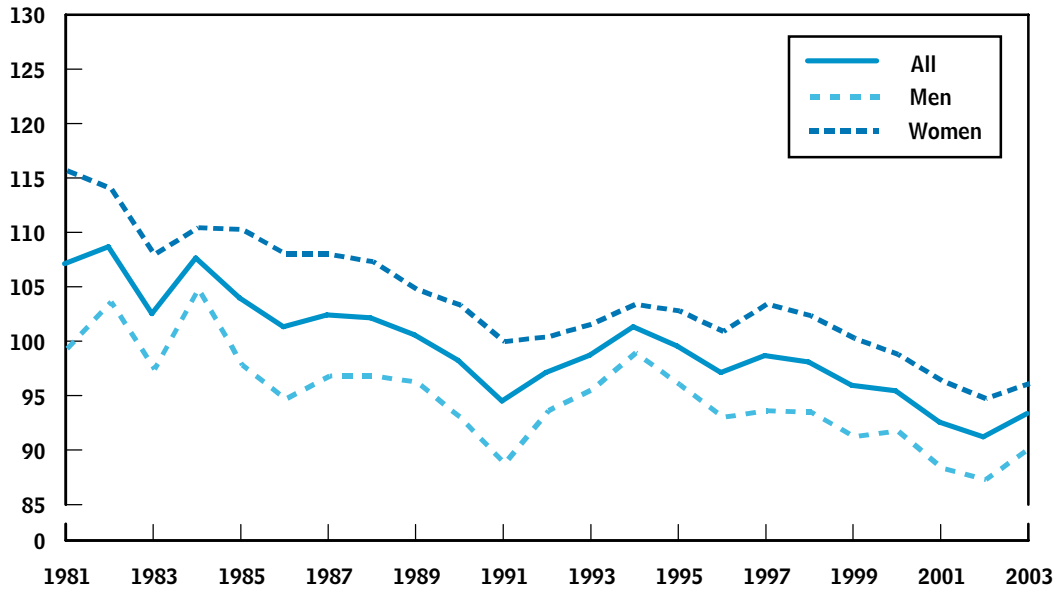
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**Figure 5.**

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**Standard Deviation of the Percentage Change in Workers' Total Wage Earnings Over the Previous Year, by Sex**

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Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation. Workers without any earnings in the previous calendar year are included, and their percentage change in earnings is coded as 100. The sample is restricted to workers with percentage changes below 1,000 percent.

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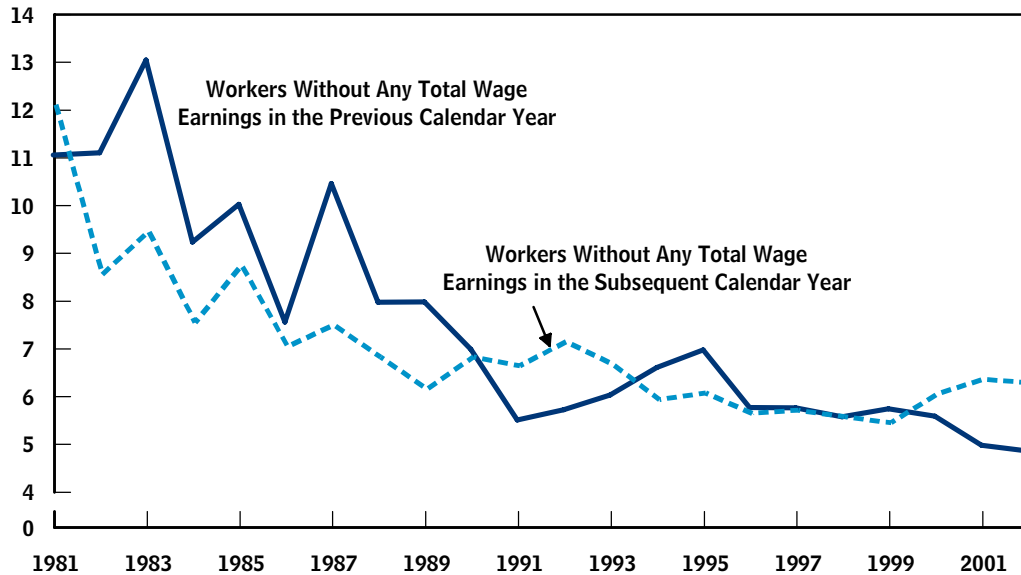
**Figure 6.**

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**Percentages of Workers Without Any Total Wage Earnings in the Previous or Subsequent Calendar Years**

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(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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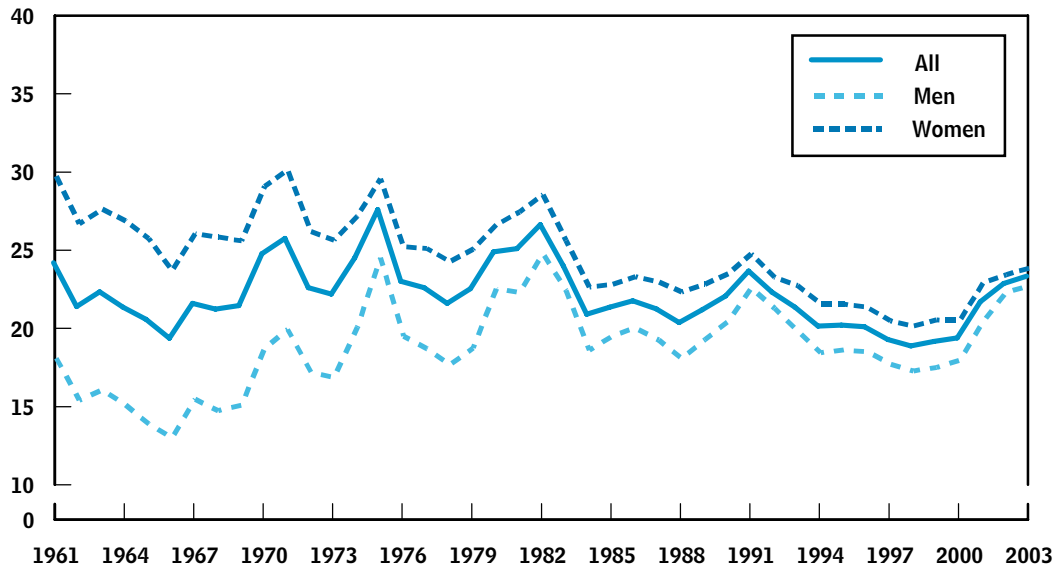
**Figure 7.**

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**Percentage of Workers in the Bottom Two-Fifths of the Earnings Distribution for Whom Annual Social Security Taxable Earnings Declined by 50 Percent or More Over the Previous Year, by Sex**

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(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Sample is restricted to workers ages 22 to 59 whose Social Security taxable earnings in the previous calendar year placed them in the bottom two-fifths of their respective sex-specific Social Security taxable earnings distribution. Social Security taxable earnings are available only up to the taxable maximum. That maximum is above the 40th percentile of annual earnings throughout the 1960–2003 period.

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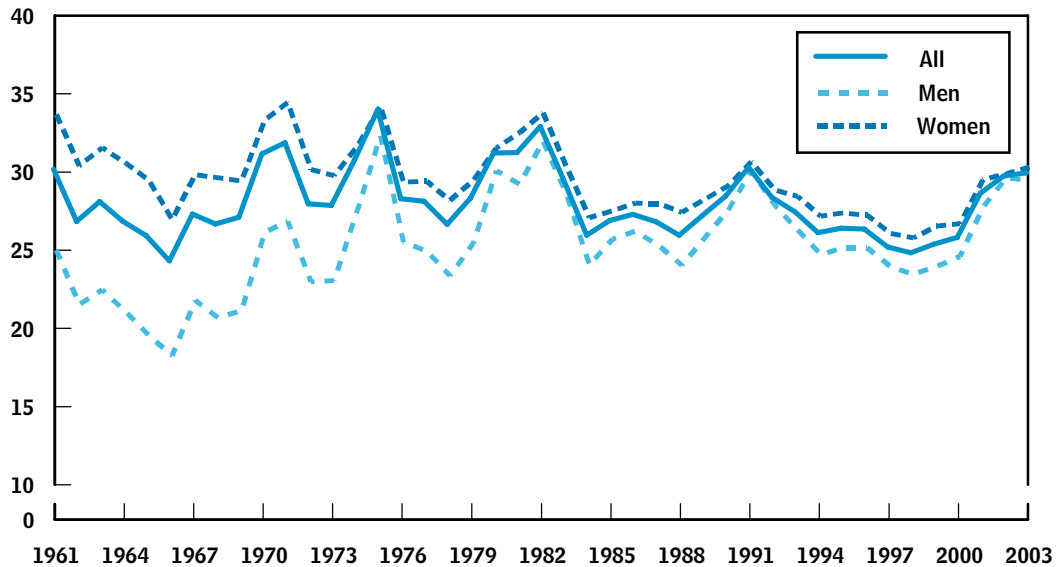
**Figure 8.**

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**Percentage of Workers in the Bottom Two-Fifths of the Earnings Distribution for Whom Annual Social Security Taxable Earnings Declined by 25 Percent or More Over the Previous Year, by Sex**

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(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Sample is restricted to workers ages 22 to 59 whose Social Security taxable earnings in the previous calendar year placed them in the bottom two-fifths of their respective sex-specific Social Security taxable earnings distribution. Social Security taxable earnings are available only up to the taxable maximum. That maximum is above the 40th percentile of annual earnings throughout the 1960–2003 period.

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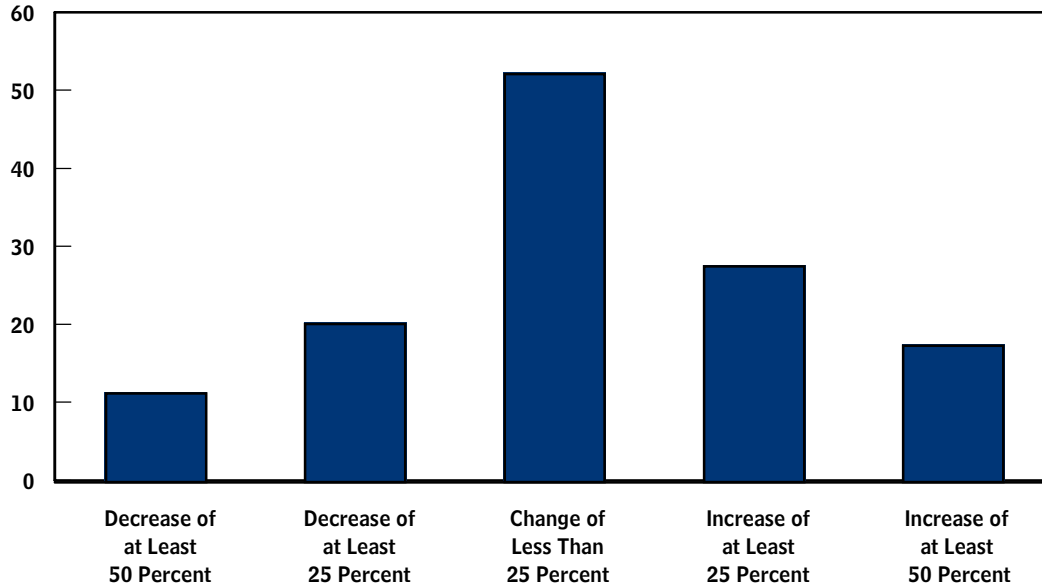
**Figure 9.**

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**Distribution of Changes in Workers' Annual Real Earnings,  
2001 to 2002**

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(Percent)



Source: Congressional Budget Office based on data from the 2001 panel of the Bureau of the Census's Survey of Income and Program Participation.

Note: The sample comprises individuals ages 22 to 59.

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# Appendix:

## Alternative Measures of Earnings Variability

The results presented in the main text are based on the methodology used by Peter Gottschalk and Robert Moffitt in their paper titled “The Growth of Earnings Instability in the U.S. Labor Market,” which was published in the *Brookings Papers on Economic Activity* series in 1994 (no. 2, pp. 217–272).

The Congressional Budget Office’s (CBO’s) primary analysis uses administrative data from the Continuous Work History Sample (CWHS). Those data are provided by the Social Security Administration to CBO so that CBO may closely examine patterns in earnings over time and continue to improve the accuracy of its long-term models of the Social Security and Medicare programs.

The use of the CWHS involves trade-offs.<sup>1</sup> On the one hand, administrative data are well-suited to an examination of year-to-year variability in earnings, as the data are not subject to the same measurement error as are survey data, which rely on the survey respondent’s recall. The presence of that measurement error may cause one to overstate or understate the actual change in earnings from year to year.<sup>2</sup> Furthermore, the CWHS data contain a large number of observations, allowing for relatively precise statistical analyses. On the other hand, the CWHS is limited in scope in that it only contains reliable data on an individual’s earnings, birth year, and sex. There is no additional information on the individual, such as education, nor is there any information on the individual’s family members. Using those data alone, one cannot examine the circumstances under which a change in earnings occurred—whether it is the result of a job change, job loss, job gain, or changes in hours worked or wages paid at the same job. Nor can one examine whether a change in earnings was mitigated or exacerbated by changes in the earnings of other family members. In addition, there is no information on other sources of income or assets, both of which could serve as important buffers against the consequences of changes in earnings (especially a decline in earnings).

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1. For a comparison of CWHS data to survey data from the Current Population Survey, see Jonathan A. Schwabish, *Earnings Inequality and High Earners: Changes During and After the Stock Market Boom of the 1990s*, Congressional Budget Office Working Paper 2006-06 (April 2006).
  2. See John Bound and Alan Krueger, “The Extent of Measurement Error in Longitudinal Surveys: Do Two Wrongs Make a Right?” *Journal of Labor Economics*, vol. 9, no. 1 (January 1991), pp. 1–24; and Julian Cristia and Jonathan A. Schwabish, *Measurement Error in the SIPP: Evidence from Matched Administrative Records*, Congressional Budget Office Working Paper 2007-03 (January 2007).

Earnings in the CWS are total wage earnings; they include wages and salaries, tips, and other forms of compensation and are not subject to top-coding. Self-employment earnings and deferred compensation are excluded. The earnings are pretax; the mitigating effect of the tax system on the consequences of changes in earnings cannot be captured here. Finally, earnings are inflation-adjusted, using the research series for the consumer price index for all urban consumers.

The sample consists of males and females ages 22 to 59, which results in the (intentional) exclusion of many transitions—from school to work, for example, or from work to retirement—from the analysis.

The results presented in Figures 1 through 5 in the main analysis are based on one measure of earnings variability: the inflation-adjusted percentage change in a person's earnings between a given year ( $e_t$ ) and the previous year ( $e_{t-1}$ ), calculated as

$$\frac{e_t - e_{t-1}}{e_{t-1}} \cdot 100$$

That measure is undefined for individuals with earnings of zero in both years; those individuals are excluded from the analysis. The treatment of workers with positive earnings in one year and zero earnings in the other is asymmetric, as those individuals who transition from positive to zero earnings have a calculated change in earnings of -100 percent. For workers who transition from zero to positive earnings, the percentage change in earnings is undefined. To capture those transitions symmetrically in Figures 1 through 5, CBO assigned those workers moving from zero to positive earnings a percentage change in earnings of +100 percent.

Gottschalk and Moffitt (1994) measure the percentage change in earnings somewhat differently. Instead of comparing earnings in a given year with earnings in the previous year, they compare earnings in a given year with a five-year moving average of earnings around that year. To determine whether the results presented in its main analysis are sensitive to such a distinction, CBO examined the percentage change in a worker's earnings between a given year ( $e_t$ ) and the average earnings of that worker over a five-year period ( $e_{t-4}$  to  $e_t$ ), calculated as

$$\frac{e_t - \text{avg}(e_t, e_{t-1}, e_{t-2}, e_{t-3}, e_{t-4})}{\text{avg}(e_t, e_{t-1}, e_{t-2}, e_{t-3}, e_{t-4})} \cdot 100$$

The measure is undefined for individuals with no earnings in all five years; those individuals are excluded from the analysis.

The results presented in the main analysis are robust to that slight change in methodology. The fraction of workers experiencing a 50 percent or 25 percent decline in their earnings remains relatively stable over time (see Figure A-1 on page 23 and Figure A-2 on page 24), while the fraction of workers experiencing a 50 percent or 25 percent increase in their earnings trends slightly downward over time (see Figure A-3 on page 25 and Figure A-4 on page 26). That downward trend in the measure of variabil-

ity remains, even when CBO examined the standard deviation of the percentage change (which captures the entire distribution of changes) rather than focusing on single points in the distribution of changes (see Figure A-5 on page 27).

Another difference between the methodology used in this analysis and that used by Gottschalk and Moffitt (1994) and in many other studies is that those studies examine variability in the natural logarithm of earnings and also control for the age of the worker. Using the natural logarithm of earnings in place of the level of earnings eliminates workers with any years of zero earnings; thus, changes in earnings between years of zero earnings and years with positive earnings would not be included in this measure of variability. As shown in Figure 6 of the main analysis, roughly 6 percent of workers in the latter part of the period had no earnings in either the prior or subsequent year.

To determine whether the results in the main analysis are sensitive to those differences in specification, CBO first conducted its analysis using the natural logarithm of earnings and, second, estimated a fixed-effects model in which the natural logarithm of earnings for all individuals in all years is regressed on a quartic in age. The residuals ( $\epsilon_t$ ) from that regression were calculated for each individual. For a given individual, the five-year moving average of those residuals was used as the basis of the percentage difference, calculated as

$$(\epsilon_t - \text{avg}(\epsilon_t, \epsilon_{t-1}, \epsilon_{t-2}, \epsilon_{t-3}, \epsilon_{t-4})) \cdot 100$$

The findings using the natural logarithm of earnings are presented in Figures A-6 through A-10. Comparing those results with the results in the main analysis, the trends over time in the fraction of workers experiencing a 50 percent or 25 percent decline in earnings remains relatively stable (see Figure A-6 on page 28 and Figure A-7 on page 29). Eliminating transitions between years of zero earnings and years of positive earnings eliminates any downward trend in the fraction of workers experiencing a 50 percent or 25 percent increase in earnings over time (see Figure A-8 on page 30 and Figure A-9 on page 31). And, finally, examining the standard deviation (and thus capturing the full distribution of changes over time), a small portion of the downward trend seen in Figure 5 is eliminated (see Figure A-10 on page 32).

Adopting the natural log specification and controlling for workers' age results in even flatter trends over time than were observed in the previous two specifications (see Figures A-11 through A-15). The consistent flattening of the trends in earnings variability after controlling for age suggests that a portion of the decline in the variability in earnings seen in Figures 1 through 5 in the main analysis is probably because of the aging of the population. As the population of workers ages, older workers, who tend to have less-variable earnings, make up a larger fraction of the overall population. As a result, workers overall have less-variable earnings.

The results presented in this report are consistent with those of Gottschalk and Moffitt (1994) for the early 1980s (the only years for which the two analyses overlap). Both show relatively stable levels of earnings variability during that period. The results presented in Figure A-10 are consistent with the findings of other studies that use more-formal statistical models of earnings dynamics. Those studies include later work by Moffitt and Gottschalk (“Trends in the Transitory Variance of Earnings in the United States,” published in *The Economic Journal* in 2002) as well as work by Steven Haider (“Earnings Instability and Earnings Inequality of Males in the United States: 1967–1991,” published in the *Journal of Labor Economics* in 2001). Haider examined earnings variability through 1991, and Moffitt and Gottschalk captured variability in earnings through 1996.



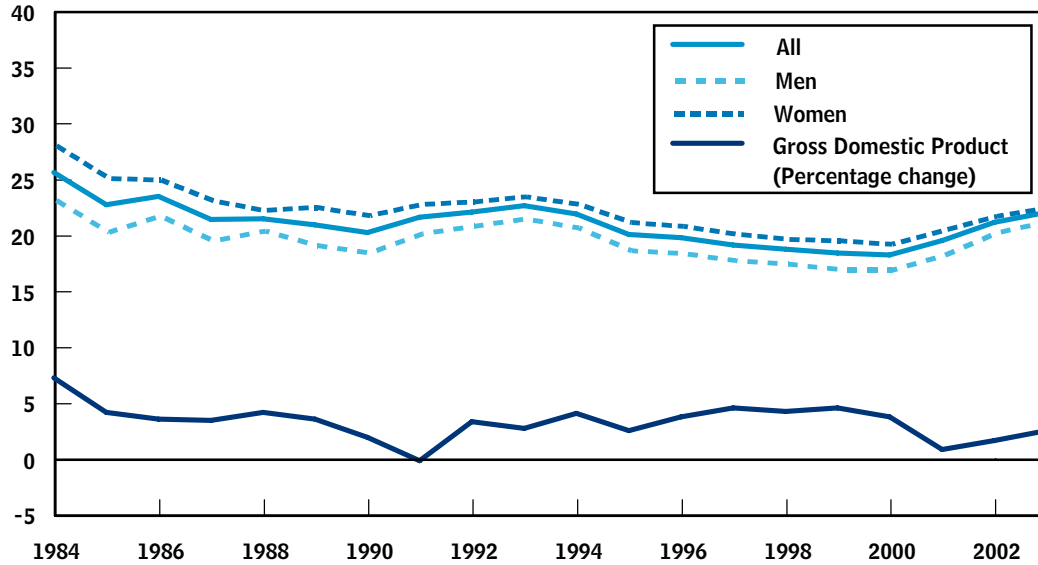
**Figure A-1.**

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**Percentage of Workers for Whom Total Wage Earnings Declined by 50 Percent or More Over the Previous Five Years, by Sex**

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(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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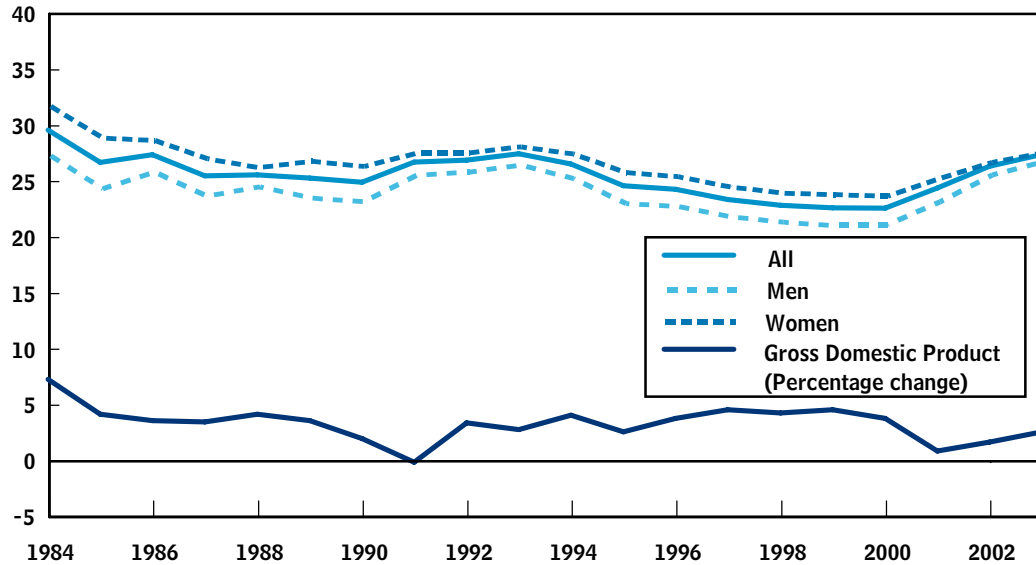
**Figure A-2.**

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**Percentage of Workers for Whom Total Wage Earnings Declined by 25 Percent or More Over the Previous Five Years, by Sex**

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(Percent)



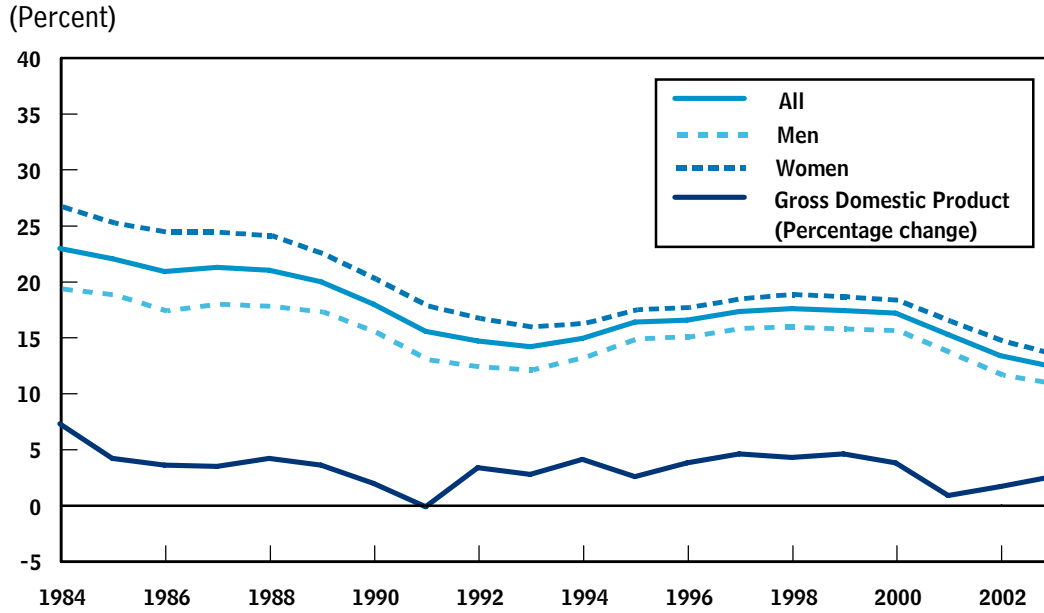
Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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**Figure A-3.**

**Percentage of Workers for Whom Total Wage Earnings Rose by 50 Percent or More Over the Previous Five Years, by Sex**



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

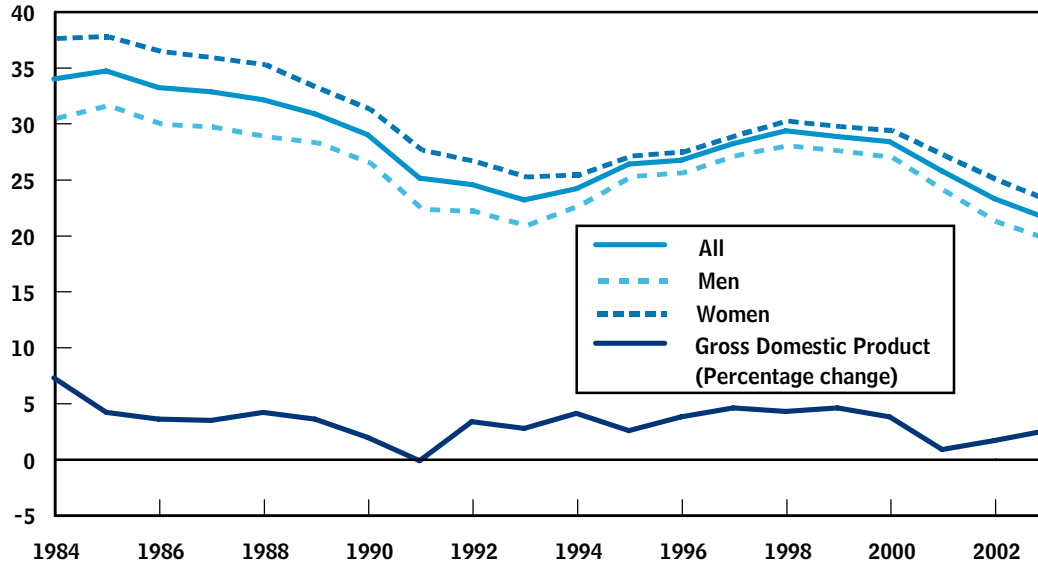
**Figure A-4.**

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**Percentage of Workers for Whom Total Wage Earnings Rose by 25 Percent or More Over the Previous Five Years, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

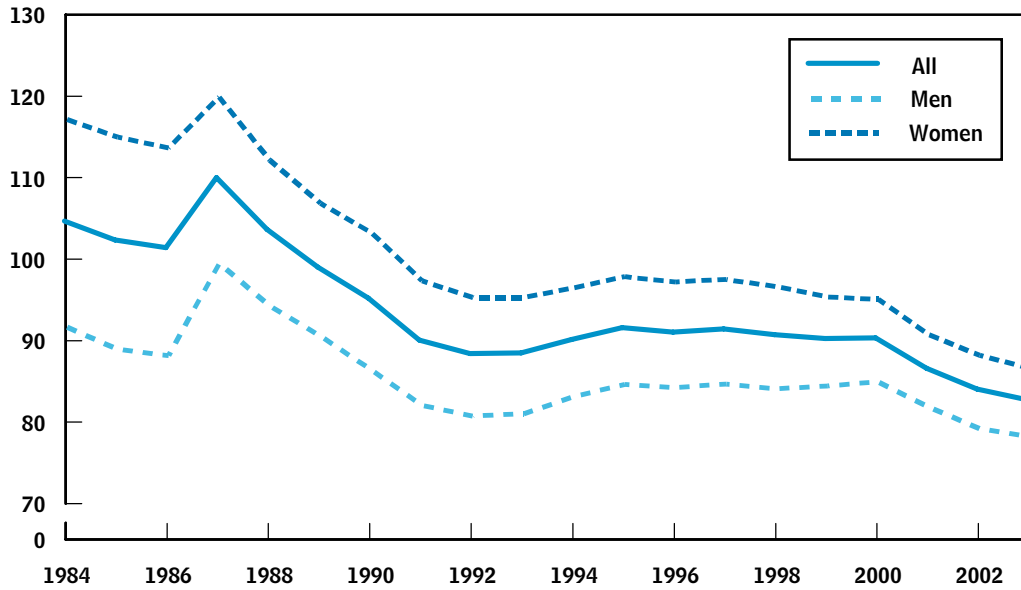
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**Figure A-5.**

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**Standard Deviation of the Percentage Change in Workers' Total Wage Earnings Over the Previous Five Years, by Sex**

---



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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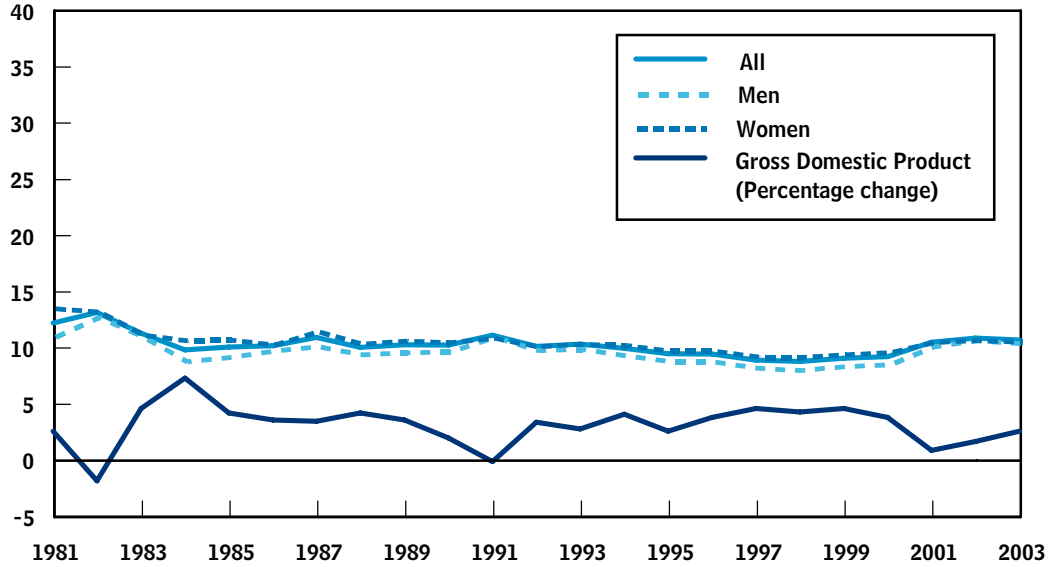
**Figure A-6.**

---

**Percentage of Workers for Whom the Log of Total Wage Earnings Declined by 50 Percent or More Over the Previous Year, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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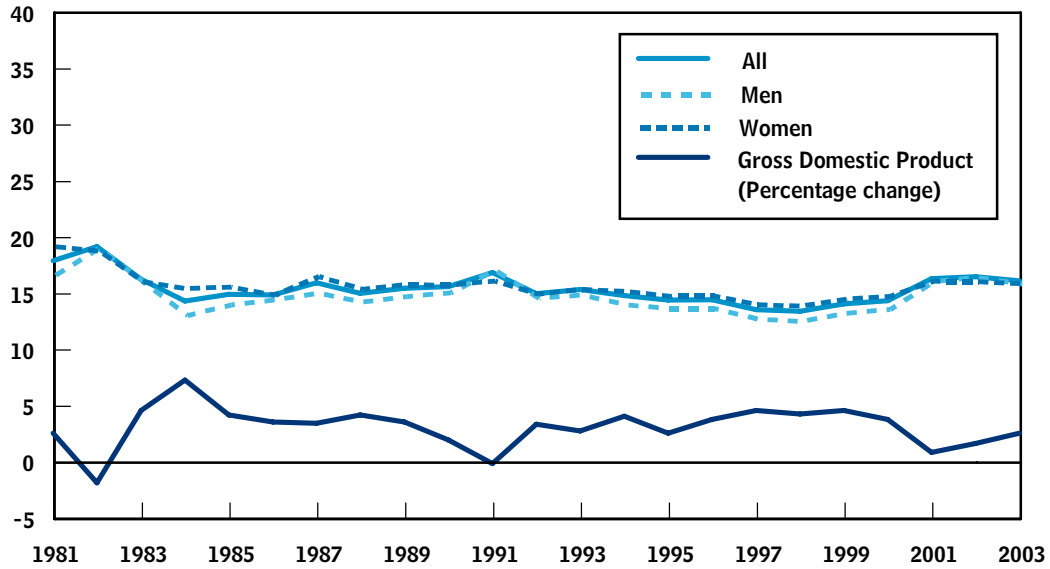
**Figure A-7.**

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**Percentage of Workers for Whom the Log of Total Wage Earnings Declined by 25 Percent or More Over the Previous Year, by Sex**

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(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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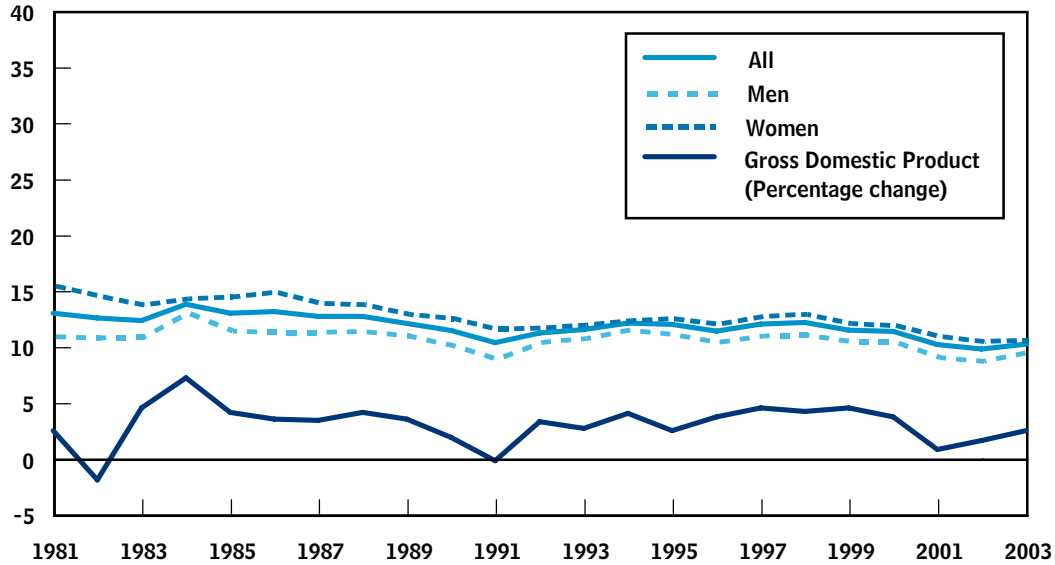
**Figure A-8.**

---

**Percentage of Workers for Whom the Log of Total Wage Earnings Rose by 50 Percent or More Over the Previous Year, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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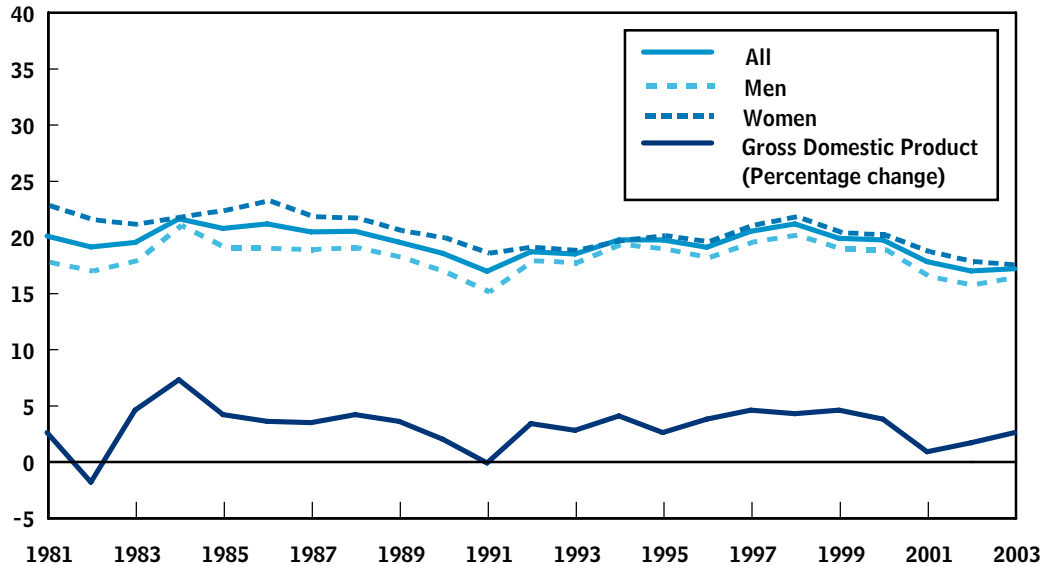
**Figure A-9.**

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**Percentage of Workers for Whom the Log of Total Wage Earnings Rose by 25 Percent or More Over the Previous Year, by Sex**

---

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

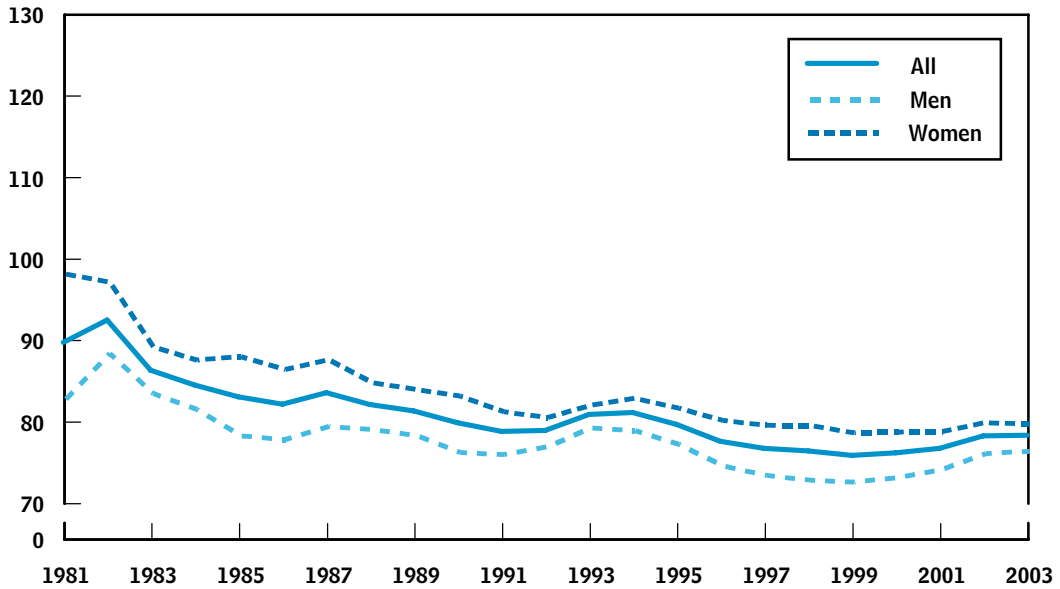
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**Figure A-10.**

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**Standard Deviation of the Difference in the Log of Workers' Total Wage Earnings from the Previous Year, by Sex**

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Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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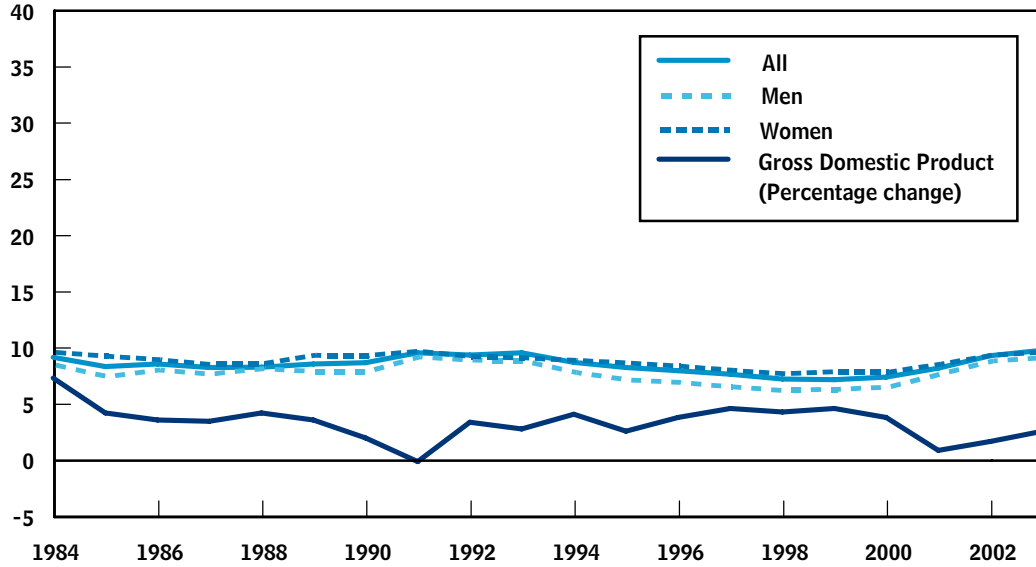
**Figure A-11.**

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**Percentage of Workers for Whom Total Age-Adjusted Wage Earnings Declined by 50 Percent or More Over the Previous Five Years, by Sex**

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(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

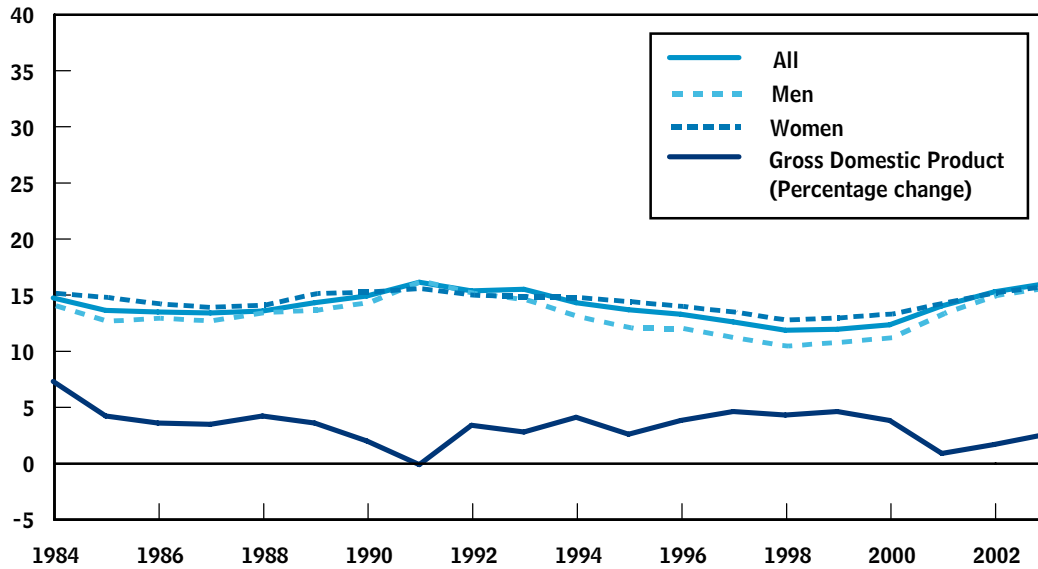
Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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**Figure A-12.**

**Percentage of Workers for Whom Total Age-Adjusted Wage Earnings Declined by 25 Percent or More Over the Previous Five Years, by Sex**

(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

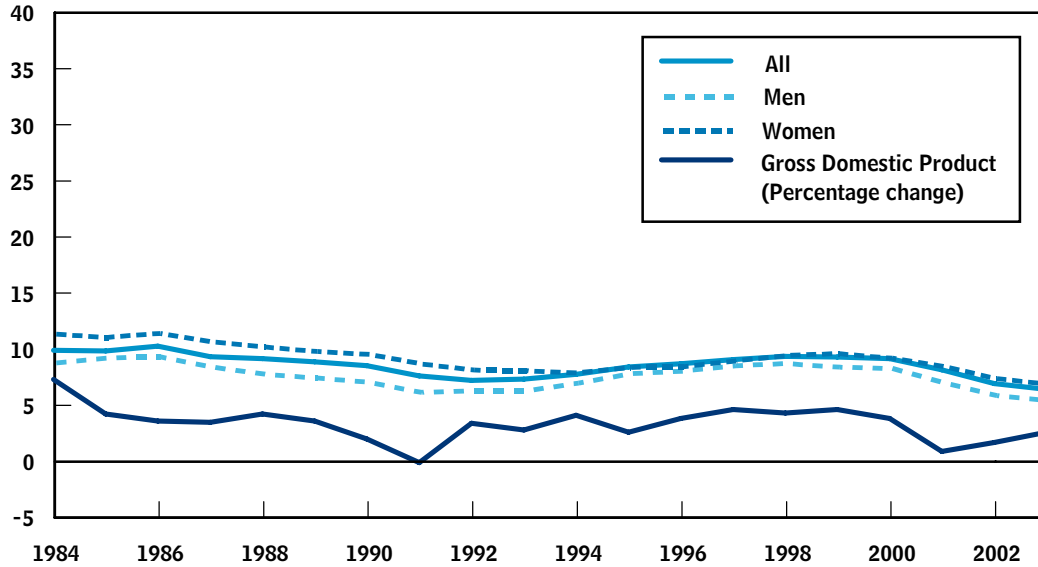
**Figure A-13.**

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**Percentage of Workers for Whom Total Age-Adjusted Wage Earnings Rose by 50 Percent or More Over the Previous Five Years, by Sex**

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(Percent)



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

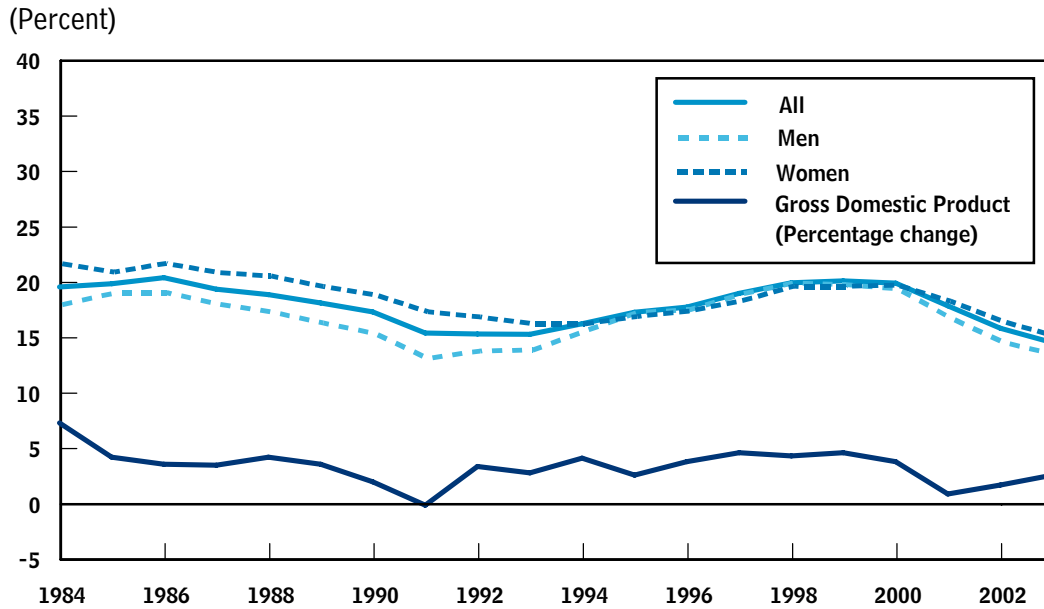
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**Figure A-14.**

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**Percentage of Workers for Whom Total Age-Adjusted Wage Earnings Rose by 25 Percent or More Over the Previous Five Years, by Sex**

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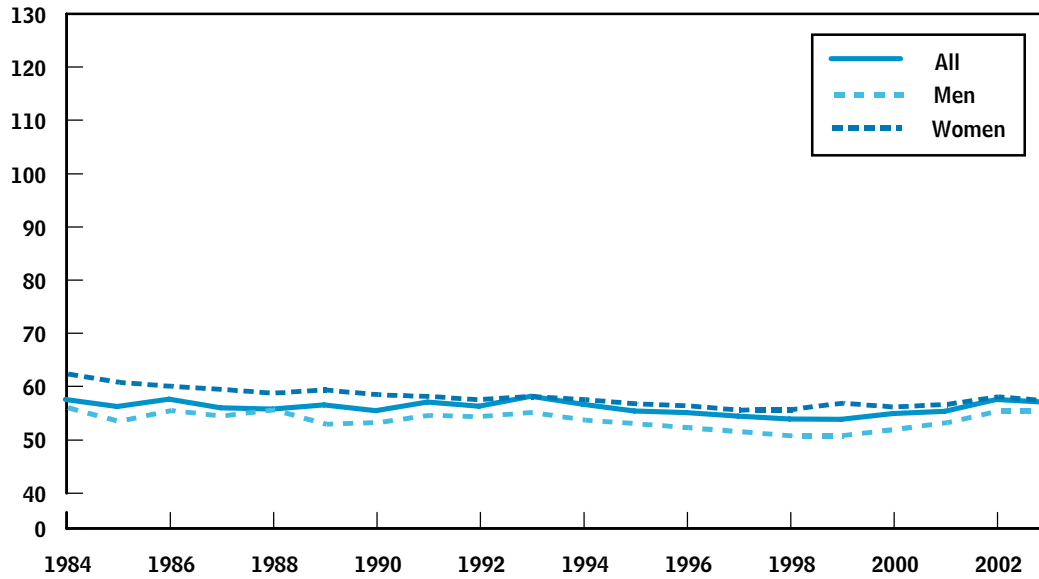
Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample and the Bureau of Economic Analysis.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.

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**Figure A-15.**

**Standard Deviation of the Difference in the Log of Workers' Total Age-Adjusted Wage Earnings from the Previous Five Years, by Sex**



Source: Congressional Budget Office based on data from the Social Security Administration's Continuous Work History Sample.

Note: Sample is restricted to workers ages 22 to 59. Total wage earnings include wages and salaries, tips, and other forms of compensation; they exclude self-employment earnings and deferred compensation.