

Productivity trends in business cycles: a visual essay

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Productivity measures are used to assess the state of the economy. The series of charts in this visual essay provides an overview of labor productivity and related measures in the U.S. nonfarm business and manufacturing sectors. The nonfarm business sector accounts for three-fourths of output and employment in the total economy; manufacturing—a subsector of nonfarm businesses—produces about a quarter of U.S. output and accounts for just under 10 percent of its employment.

Capital-intensive investment, improvements in technology, and better skilled workers, among other factors, translate into labor productivity growth in the long term. More than 60 years of data—spanning 11 cycles of recessions and expansions—highlight long-term trends in productivity, output, and hours worked. Productivity data are cyclical. In a recession, output and hours worked decline, although usually not in tandem. Thus, productivity, which is the measure of output per hour worked, provides a window through which to analyze business cycles.

The National Bureau of Economic Research (NBER) is responsible for identifying the month in which changes in economic activity signal the end of a business-cycle expansion, as well as the month in which the ensuing recession ends. The last month of expansion is called the peak; the last month of a business-cycle contraction, or recession, is called the trough. Recessions are measured by the time between the peak and the trough, and expansions are measured by the time between the trough and the peak.

The productivity measures in this visual essay are quarterly data. In order to represent quarterly data in the context of business cycles that NBER defines using months, the quarter that contains the month designated by NBER as the peak or trough of economic activity is identified in this visual essay as the peak quarter or trough quarter. For example, the peak marking the onset of the present recession is considered for the purpose of this essay to be the fourth quarter of 2007, because NBER designated December 2007 as the most recent peak month of the business cycle.

Since 1947, the first year for which nonfarm productivity data are available, there have been 11 recessions, including the one beginning in December 2007. The dates below are the years and quarters that mark these recessions and expansions; no trough has been designated for the present recession.

<i>Year/quarter of the peak</i>	<i>Year/quarter of the trough</i>
1948:4	1949:4
1953:2	1954:2
1957:3	1958:2
1960:2	1961:1
1969:4	1970:4
1973:4	1975:1
1980:1	1980:3
1981:3	1982:4
1990:3	1991:1
2001:1	2001:4
2007:4	Not yet designated

The current recession continues to show declining output and hours worked through the first quarter

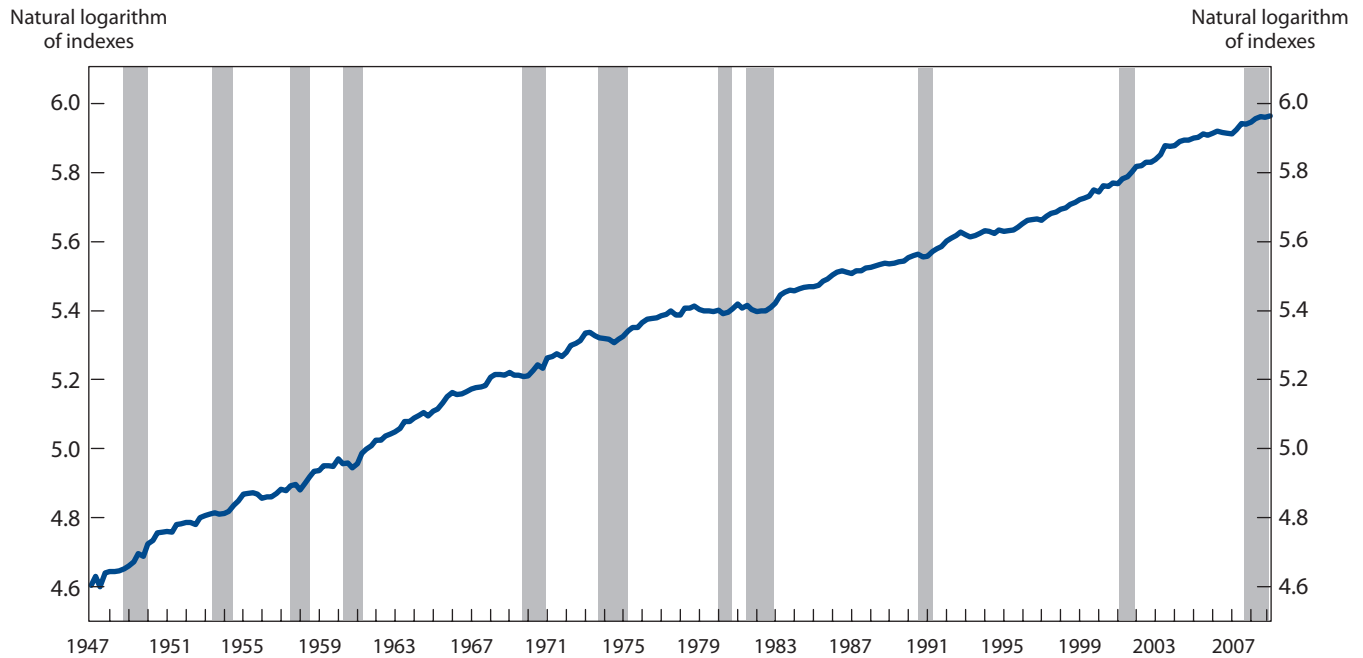
of 2009. Two other post-WWII recessions, from the fourth quarter of 1973 to the first quarter of 1975 and from the third quarter of 1981 to the fourth quarter of 1982, also lasted through five quarters; the rest were shorter. Manufacturing data are available from 1949 onward.

The charts in this visual essay highlight output and hours worked as well as output per hour worked, or labor productivity; data on labor costs are also included. Data are presented as indexes and growth rates. Index measures are derived from data on output, hours worked, and compensation. Comparing data based on different units and levels—such as billions of dollars or thousands of hours—can skew the analysis. To improve comparative analysis, the long-term trends are based on the natural logarithm of the index measures. The natural logarithm creates a straighter line of data when comparing different data series based on widely different levels over long periods of time. Growth rates are based on percent changes in indexes and are compounded to create an-

nual rates. Averages of productivity measures across recessions and expansions are weighted averages of compound annual rates, in which the weights are based on the number of quarters that compose the various time periods, excluding the current recession. All data are seasonally adjusted.

The data in these charts are updated eight times a year in the Productivity and Costs news release prepared by BLS. The charts prepared for this visual essay are based on the June 4, 2009, Productivity and Costs news release. All data are quarterly, unless otherwise noted. Data are available at the BLS website, www.bls.gov/data/home.htm, or by contacting the BLS Division of Major Sector Productivity by telephone at (202) 691-5606 or by email at DPRWEB@bls.gov. This essay was prepared by Michael Chernousov, economist; Susan E. Fleck, division chief; and John Glaser, supervisory economist; in the Division of Major Sector Productivity in the Office of Productivity and Technology, Bureau of Labor Statistics.

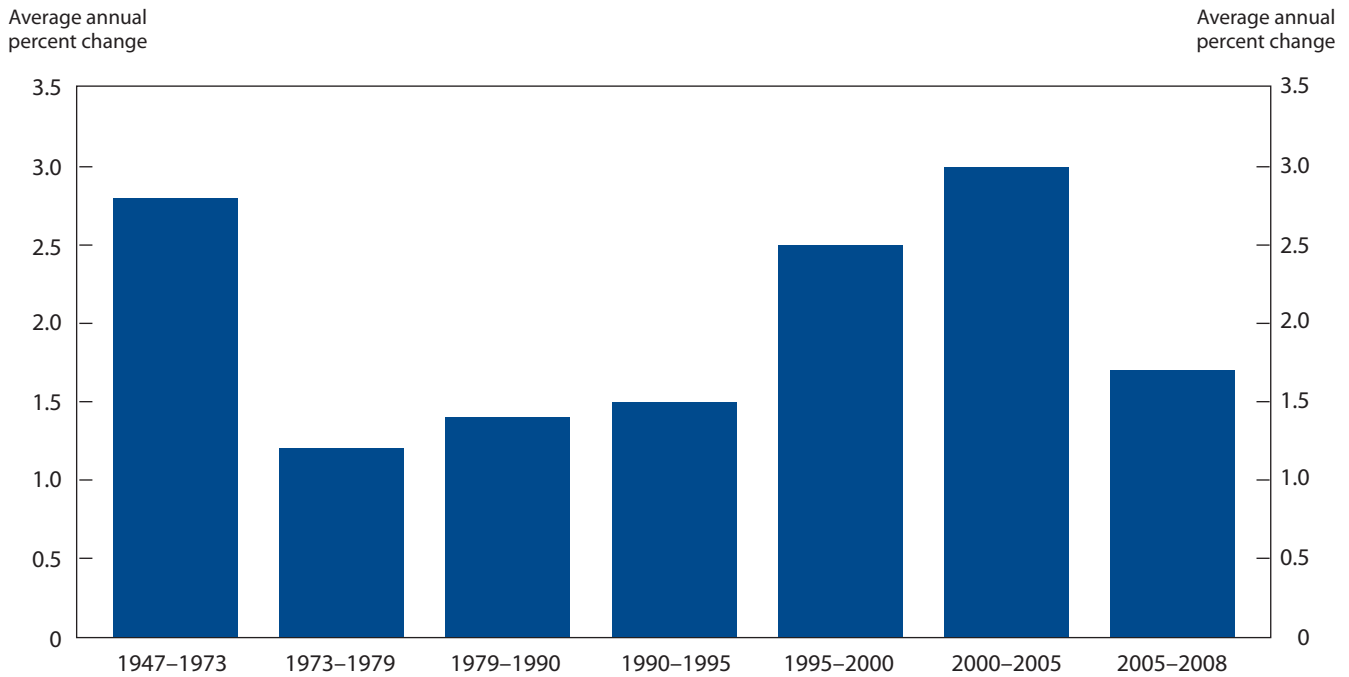
1. Productivity in the nonfarm business sector, 1947–2009



NOTE: The shaded bars denote recessions. Because the data in the chart are quarterly, peaks and troughs of economic activity are assigned to quarters instead of months. An endpoint for the most recent recession has yet to be designated.

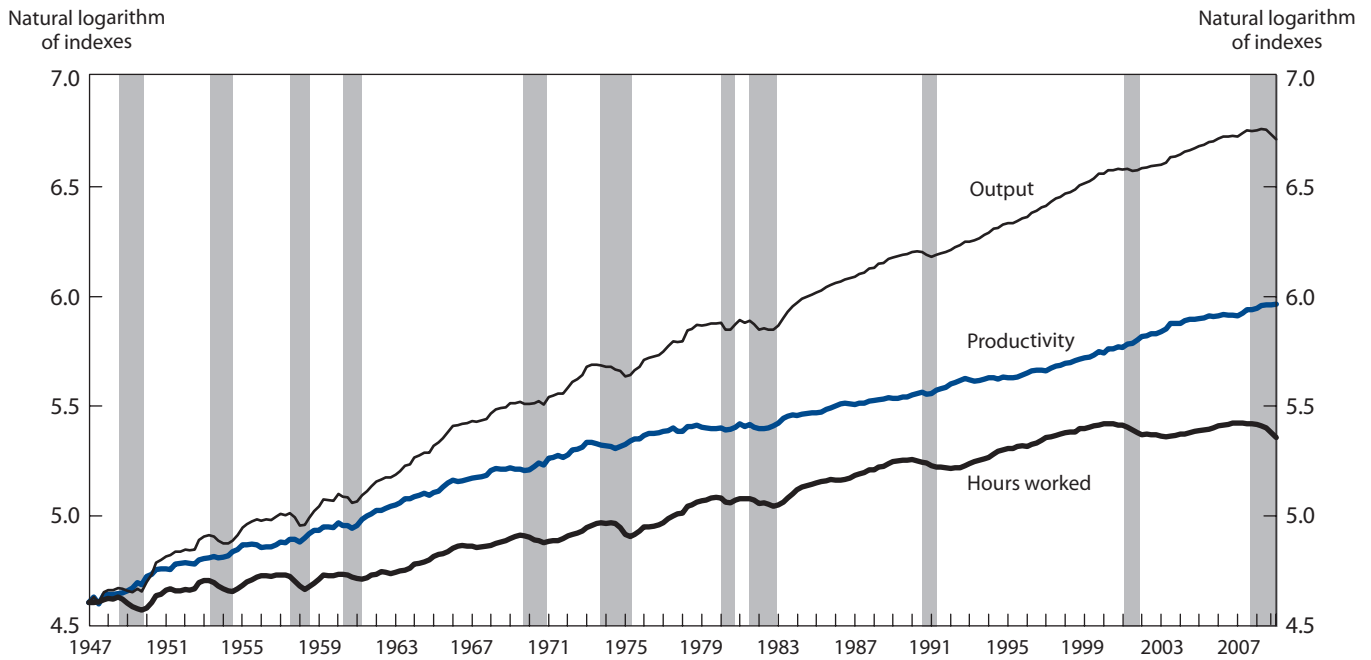
- Labor productivity is defined as total output divided by total hours worked by all people: employees, the self-employed, and unpaid family workers. Productivity in the nonfarm business sector often dips during recessions.
- Overall, productivity growth has been positive since the series began in 1947.

2. Productivity growth in the nonfarm business sector, 1947–2008



- Though productivity growth has trended upwards over the last 60 years, a slowdown in productivity growth in nonfarm businesses took place from the early 1970s through 1995.
- After 1995 productivity growth shifted upwards, until recently. This productivity boost is often attributed to capital-intensive investments and improvements in technology.

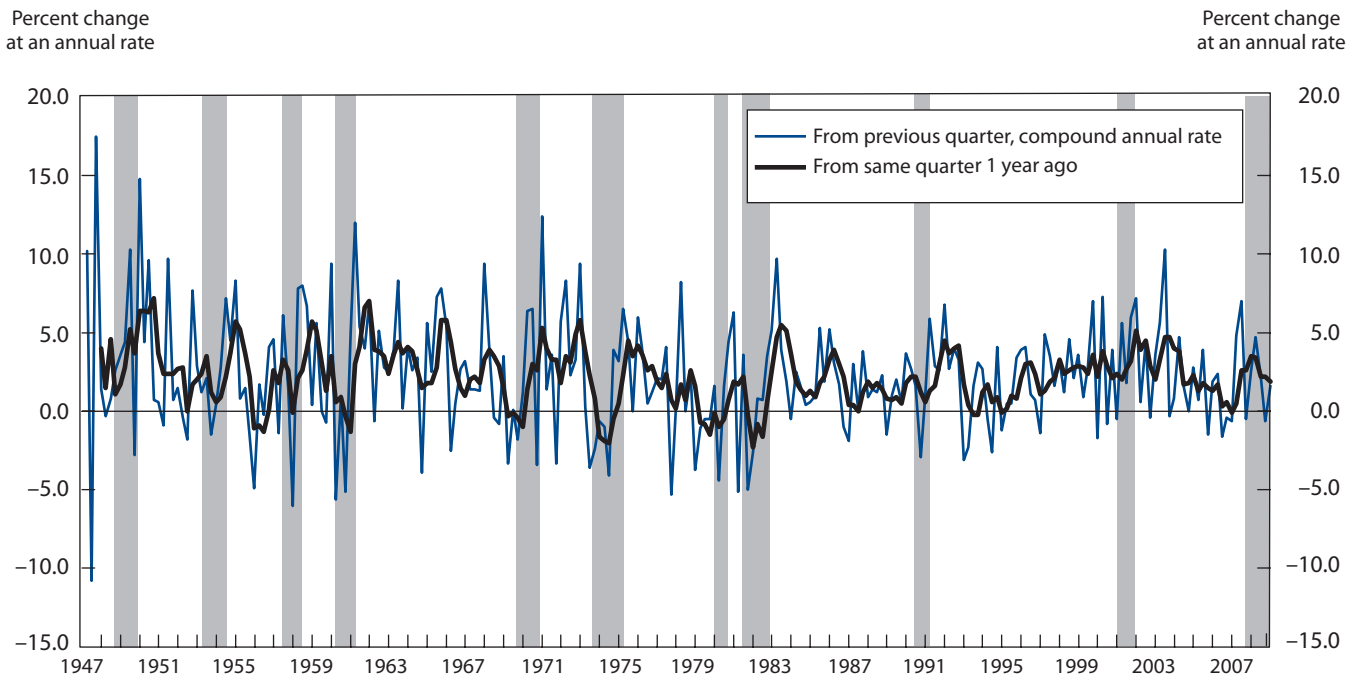
3. Productivity, output, and hours worked, nonfarm business sector, 1947–2009



NOTE: The shaded bars denote recessions. Because the data in the chart are quarterly, peaks and troughs of economic activity are assigned to quarters instead of months. An endpoint for the most recent recession has yet to be designated.

- In recessions both output and hours worked contract. Output usually slows earlier than hours worked in a recession and recovers sooner during an expansion.
- Over the long term, output has outpaced hours worked. Hours worked have taken longer to return to prerecession levels, especially in the most recent recessions.

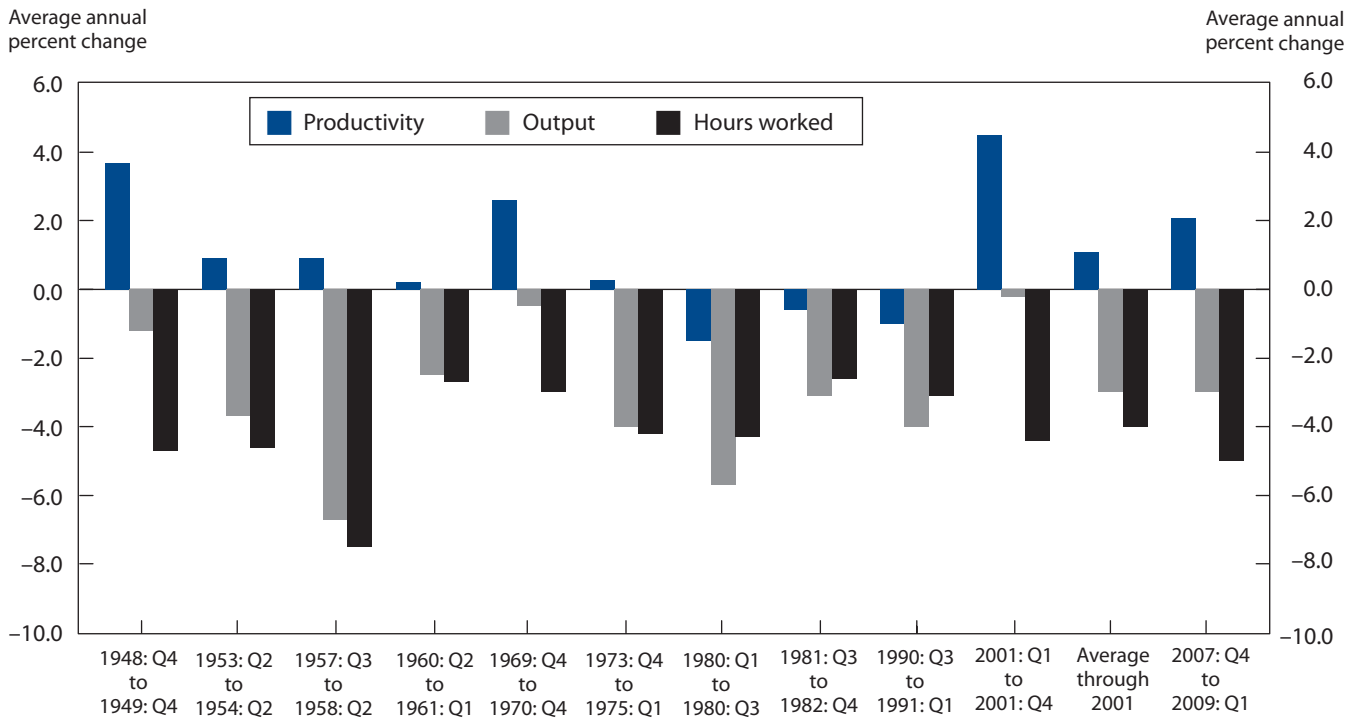
4. Productivity growth, nonfarm business sector, first quarter 1947–first quarter 2009



NOTE: The shaded bars denote recessions. Because the data in the chart are quarterly, peaks and troughs of economic activity are assigned to quarters instead of months. An endpoint for the most recent recession has yet to be designated.

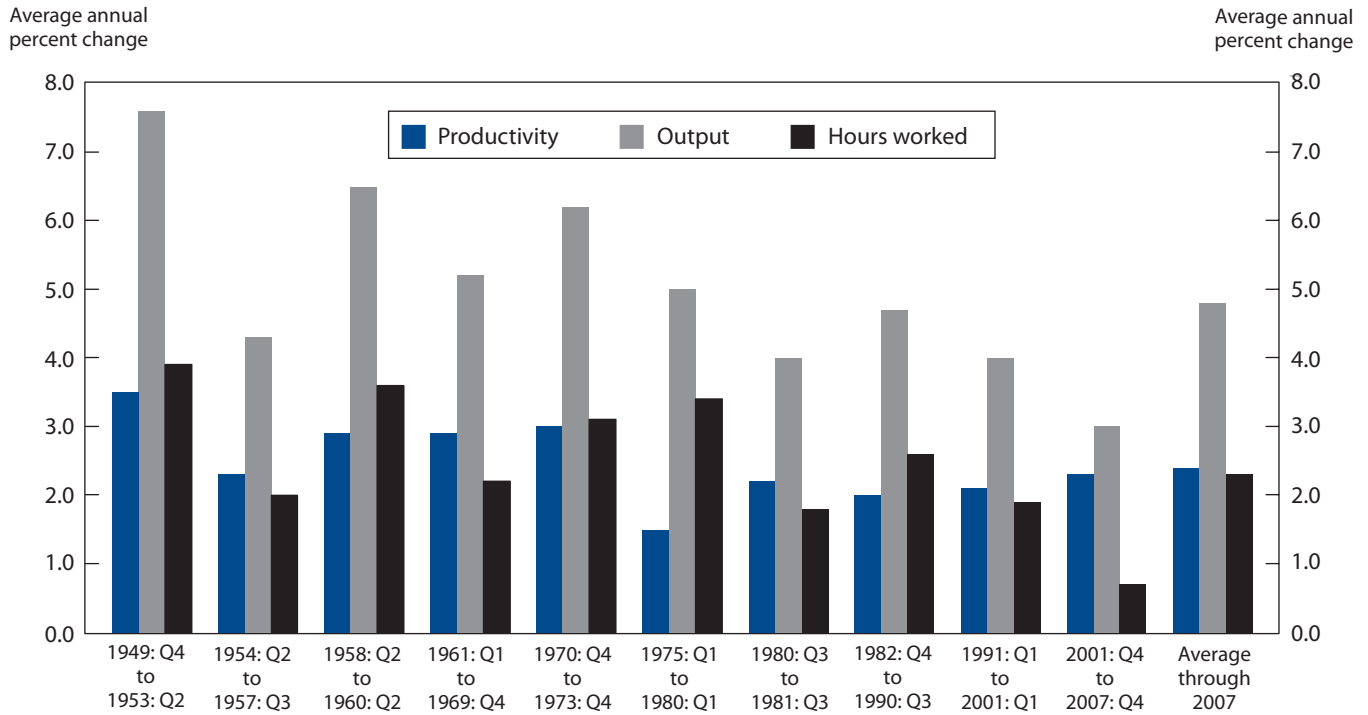
- Quarterly movement in the growth of nonfarm business output per hour is highly volatile. The percent change from a given quarter of one year to the same quarter of the following year provides a longer term perspective.
- Recessions generally end with high productivity growth that carries on into the initial few quarters of the recovery, illustrated by spikes in the blue line just beyond the shaded areas.

5. Growth in productivity, output, and hours worked during recessions, nonfarm business sector, fourth quarter 1948–first quarter 2009



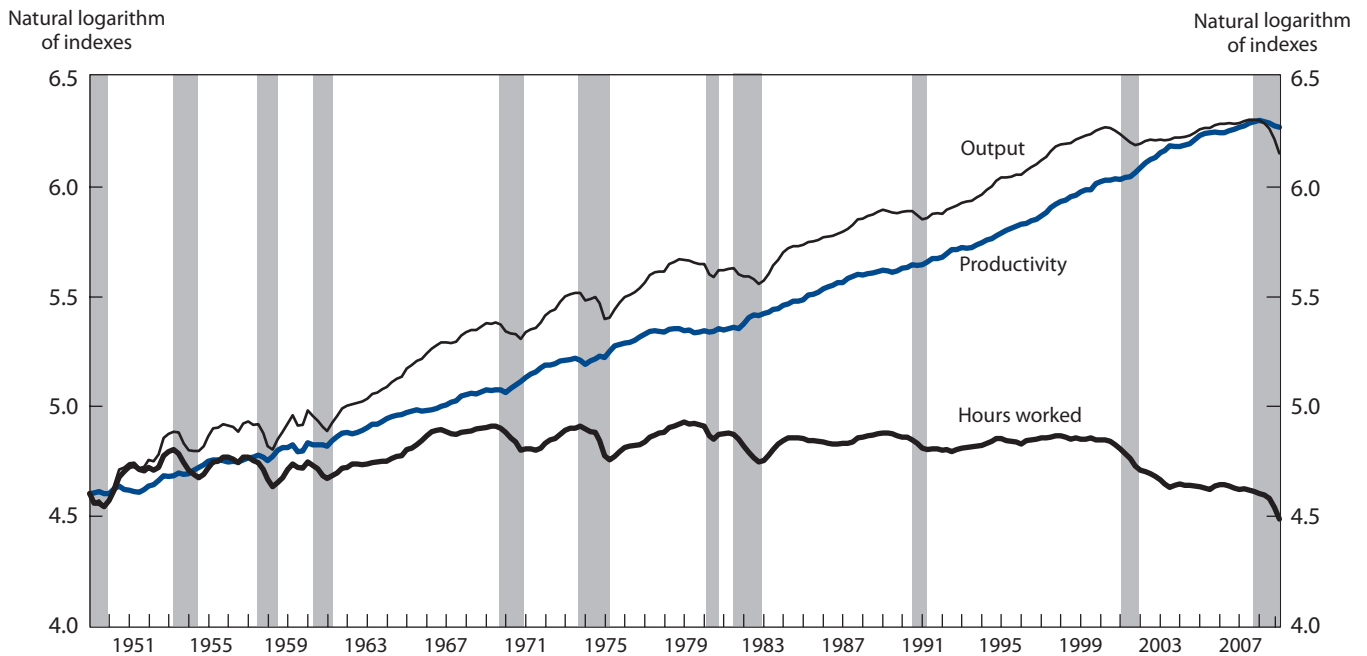
- Negative productivity growth is more likely during recessions than expansions. Three of the 10 recessions prior to the current one involved a contraction in output that surpassed the decline in hours in the nonfarm business sector.
- Productivity growth in recessions may also be positive, albeit weak, when the change in hours worked is less positive or more negative than the change in output. In 4 of the last 10 recessions before the current one, nonfarm business productivity experienced more than 1.0 percent growth. For the 10 recessions combined, productivity growth averaged 1.1 percent.

6. Growth in productivity, output, and hours worked during expansions, nonfarm business sector, fourth quarter 1949–fourth quarter 2007



- Expansions are marked by growth in total hours worked and even higher growth in output. This combination results in higher productivity growth during the upturn in the business cycle.
- Expansions typically last much longer than recessionary periods and exhibit greater productivity growth, which has averaged 2.4 percent.

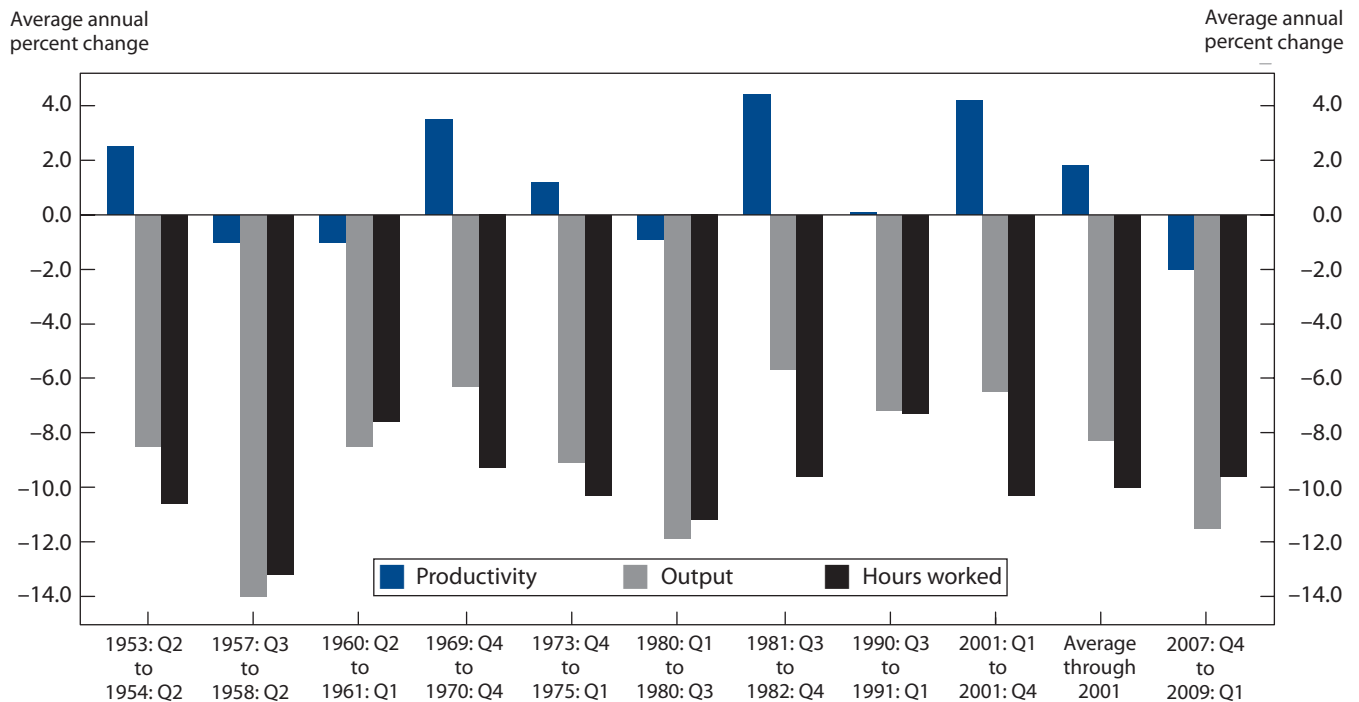
7. Productivity, output, and hours worked, manufacturing sector, first quarter 1949–first quarter 2009



NOTE: The shaded bars denote recessions. Because the data in the chart are quarterly, peaks and troughs of economic activity are assigned to quarters instead of months. An endpoint for the most recent recession has yet to be designated.

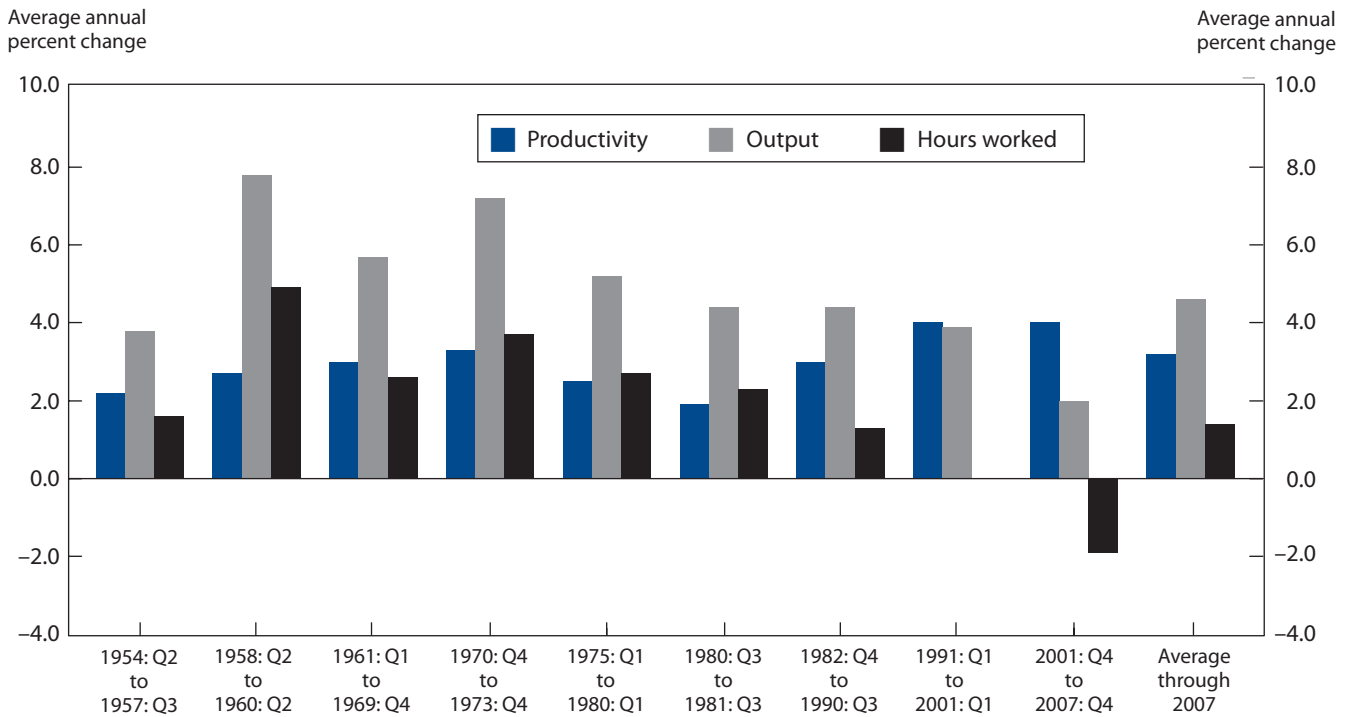
- Manufacturing-sector data from 1949 onward highlight how labor productivity has improved steadily over the last six decades. Over the last three decades, this is due partly to a fall-off in hours worked.
- Recessions are clearly marked in historical manufacturing-sector data by downward shifts in output and hours worked.
- The 2001 recession saw a large dip in manufacturing output, as well as a decline in hours worked that continued throughout the subsequent expansion.

8. Growth in productivity, output, and hours worked during recessions, manufacturing sector, second quarter 1953–first quarter 2009



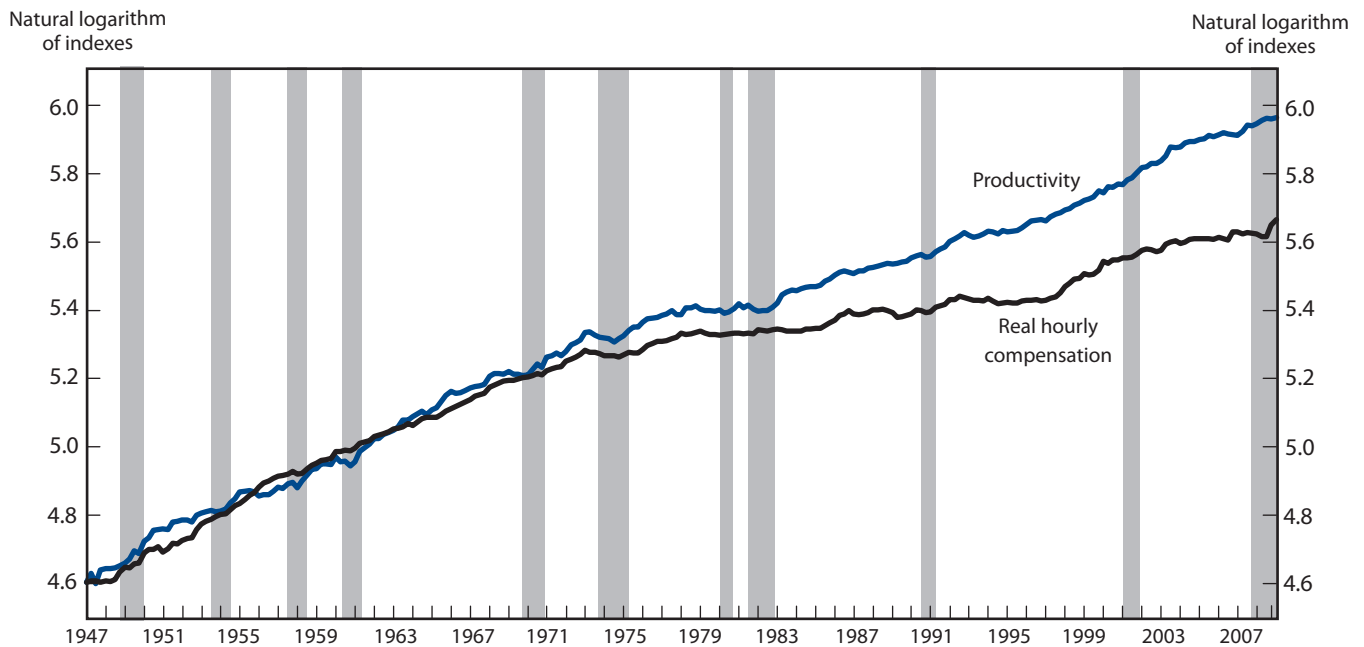
- In the manufacturing sector, recessions are consistently characterized by reductions in output and hours worked that are deeper than in the nonfarm business sector as a whole. (See chart 5.)
- Half of the recessions showed positive productivity growth because the decline in hours worked outpaced the contraction of output. On average, productivity has grown 1.8 percent in the manufacturing sector in the nine recessionary periods beginning with the recession that started in 1953.

9. Growth in productivity, output, and hours worked during expansions, manufacturing sector, second quarter 1954–fourth quarter 2007



- In the manufacturing sector, expansions—in contrast to recessions—consistently show positive productivity growth because output advances faster than hours worked. The average rate of manufacturing-sector productivity growth during recoveries since 1949 is 3.2 percent.
- Beginning with the economic recovery in 1970, hours worked in manufacturing grew more slowly with each successive expansion and fell outright from 2001 to 2007.

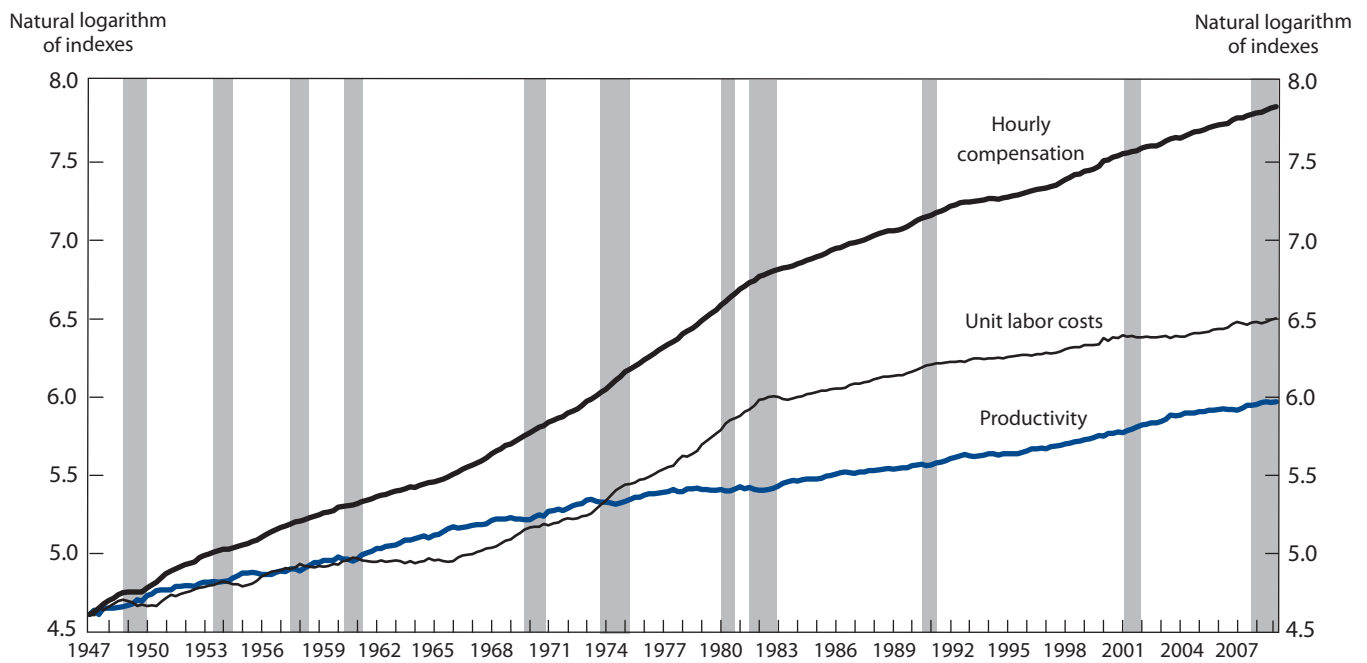
10. Productivity and real hourly compensation, nonfarm business sector, 1947–2009



NOTE: The shaded bars denote recessions. Because the data in the chart are quarterly, peaks and troughs of economic activity are assigned to quarters instead of months. An endpoint for the most recent recession has yet to be designated.

- Real hourly compensation, which measures wages plus benefits adjusted for consumer prices, does not typically experience dips during recessions. This trend implies that workers who maintain jobs during a recession do not see a loss in their purchasing power.
- Output per hour closely tracked real hourly compensation through the 1970s. After 1982 productivity began growing faster than real hourly compensation.

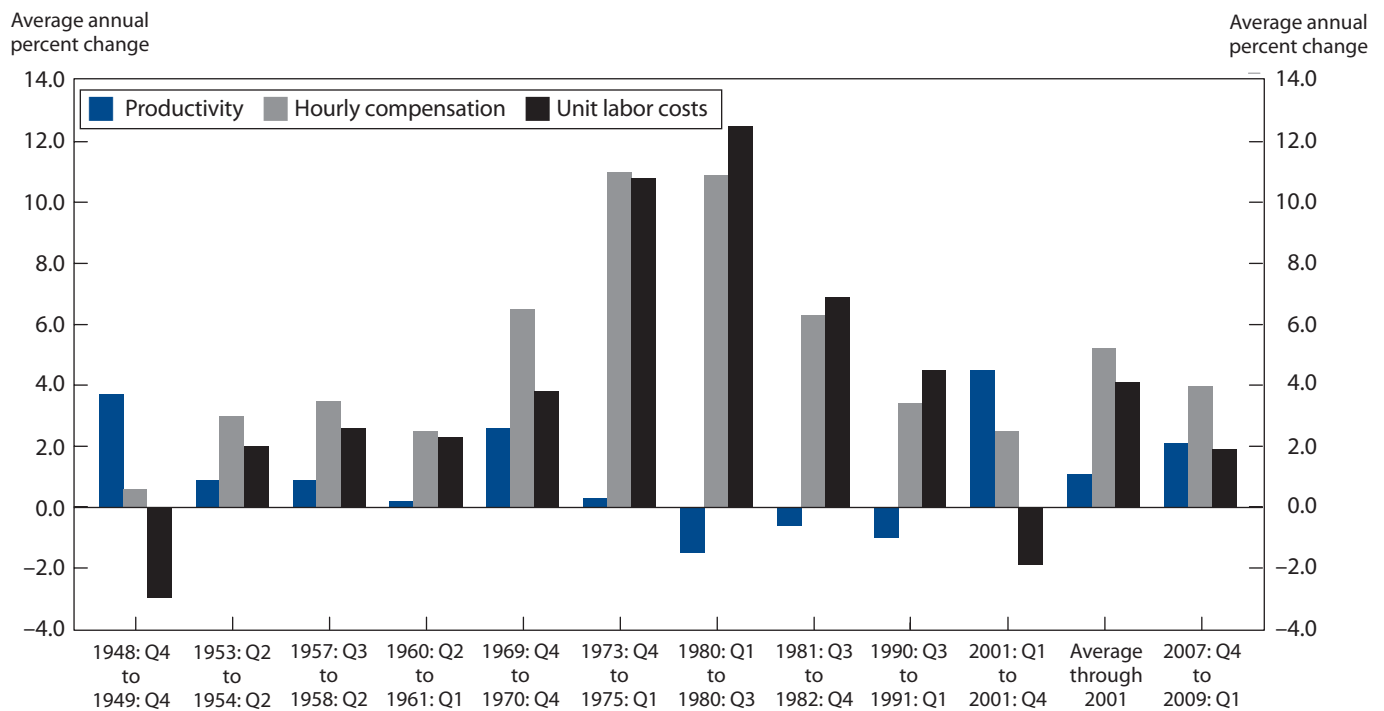
11. Productivity, hourly compensation, and unit labor costs, nonfarm business sector, 1947–2009



NOTE: The shaded bars denote recessions. Because the data in the chart are quarterly, peaks and troughs of economic activity are assigned to quarters instead of months. An endpoint for the most recent recession has yet to be designated.

- Unit labor costs are the ratio of hourly compensation to productivity. Because productivity has steadily improved, unit labor costs have not increased as fast as hourly compensation.
- Unit labor costs tend to rise in the beginning of recessions, as output falls faster than hours worked and productivity stagnates.

12. Growth in productivity, hourly compensation, and unit labor costs during recessions, nonfarm business sector, fourth quarter 1948–first quarter 2009



- During the recessions of the 1970s and early 1980s, unit labor costs soared as productivity gains failed to keep up with hourly compensation increases. High inflation was characteristic of the 1970s and early 1980s.