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PRODUCTIVITY

What can labor productivity tell us about the U.S. economy?

By Shawn Sprague

This fact might strike some as surprising: workers in the U.S. business sector worked virtually the same number of hours in 2013 as they had in 1998—approximately 194 billion labor hours.[1] What this means is that there was ultimately *no growth at all* in the number of hours worked over this 15-year period, despite the fact that the U.S population gained over 40 million people during that time, and despite the fact that there were thousands of new businesses established during that time.

And given this lack of growth in labor hours, it is perhaps even more striking that American businesses still managed to produce 42 percent—or $3.5 trillion—more output in 2013 than they had in 1998, even after adjusting for inflation. One might wonder how such a large amount of additional output came into existence, given that American workers did not put in any more hours of work in this most recent year than they had 15 years earlier. One thing can be said for certain: the entirety of this additional output growth must have come from productive sources other than the number of labor hours. For example, businesses may increase output growth by investing in faster equipment, hiring more high-skilled and experienced workers, and reducing material waste or equipment downtime. In these and other cases, output may be increased without increasing the number of labor hours used. Gains in output such as these are indicative of growth in labor productivity over a period.

This issue of **Beyond the Numbers** focuses on labor productivity and the corresponding changes in output and labor hours data in the context of historical and business cycle periods; a case study of the Great Recession of 2007 to 2009 is provided as an example of using labor productivity data to analyze cyclical changes in an economy.

Definition, concepts, and uses

Labor productivity is defined as real output per labor hour, and growth in labor productivity is measured as the change in this ratio over time. Labor productivity growth is what enables workers to produce more goods and services than they otherwise could for a given number of work hours. As an example, suppose workers in a factory can make 20 cars an hour. One month, the company modernizes machinery and the workers take training classes to help improve their performance. Using the new machinery and recently acquired knowledge, the same workers can now make 30 cars an hour—which is a productivity gain of 10 cars per hour, a 50 percent gain. As this example illustrates, there are multiple sources and factors of production that can lead to labor productivity growth. The labor productivity estimate encompasses the overall contribution of all of these factors over a given period.[2]

The BLS measure of labor productivity is a principal federal economic indicator—along with other series like unemployment, the jobs data, and the consumer price index—and is used to understand and analyze both recent and historical changes to the economy. BLS calculates and publishes quarterly and annual data on labor productivity for major sectors of the U.S. economy beginning with data for 1947.[3]

Labor productivity can be estimated by calculating the difference between the output growth rate and the corresponding labor hours growth rate. An example of this is demonstrated by the period from 1998 to 2013. During this period, business sector output grew by 42 percent and hours did not grow at all (i.e., a zero-percent growth rate), and so labor productivity —the difference in these growth rates—grew by 42 percent. Hypothetically, if labor hours had grown instead by 10 percent

during the period, then labor productivity would have grown by 10 percent less, or 32 percent. If labor hours had instead grown by a full 42 percent, then labor productivity would not have grown at all during the period. These examples illustrate that it is the interplay of output growth and labor hours growth that is fundamentally important to understanding labor productivity.

So, why is it important for us to measure labor productivity? Because, over the long run, productivity growth is the economic factor that has the potential to lead to improved living standards for the participants of an economy—in the form of higher consumption of goods and services. With growth in labor productivity, an economy is able to produce increasingly more goods and services for the same amount of work. And, because of this additional production, it is possible for a greater quantity of goods and services to ultimately be *consumed* for a given amount of work. This consumption is possible with gains in (a) labor income, (b) profits and capital gains of businesses, and (c) public sector revenue. As labor productivity grows, it may be possible for all of these to increase simultaneously, without gains in one coming at the cost of one of the others.[4]

It is evident from the reported estimates of productivity growth that the U.S. economy's ability to produce a greater number goods and services for a given amount of work has in fact grown substantially over the years. (See chart 1.) In fact, U.S. business sector output has increased more than nine-fold since 1947 while the hours worked to produce that output have not quite doubled. However, although historical increases in labor productivity have been substantial, the gains have not been linear and constant. The data since 1947 show that long-term productivity growth rates can vary substantially between time periods, decades, and eras. (See chart 2.) This has implications for the participants of an economy, including employees, investors, and business leaders, as well as for government policymakers. For example, because the amount of tax revenue received by the government is partially dependent upon the extent to which productivity grows over a period, paying attention to trends in productivity is vital for policymakers who help guide budgeting decisions. If productivity grows by less than expected, fiscal deficits could result; if productivity grows by more than expected, then there may be fiscal surpluses.

Chart 1

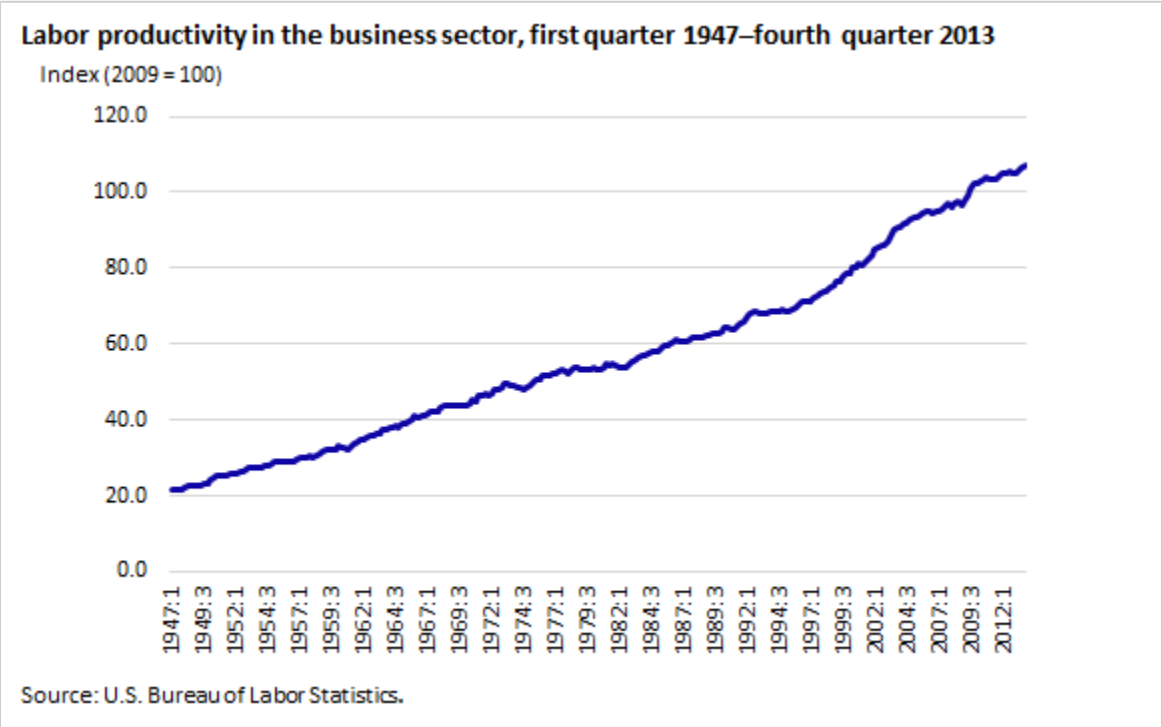
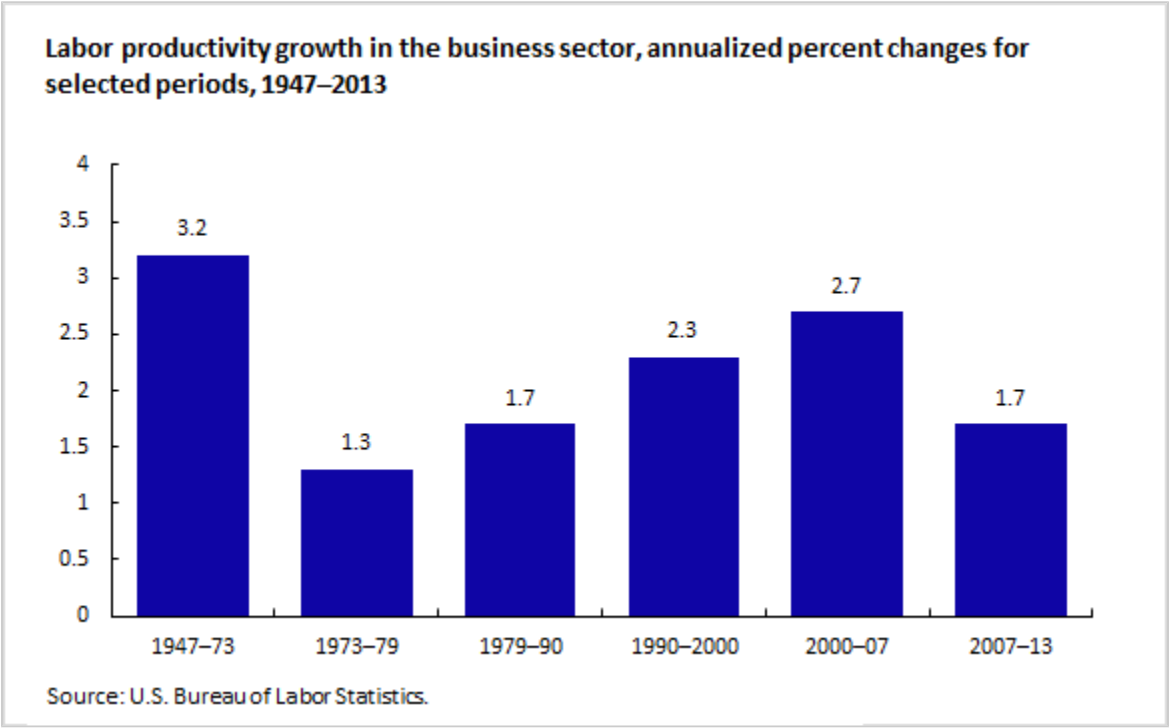


Chart 2



Short-term and cyclical analysis

Productivity is also useful in examining short-term and cyclical changes in the economy. This is because the quarterly labor productivity series itself consists of two highly informative short-term indicators: quarterly output and quarterly labor hours. The key to analyzing short-term movements in labor productivity is to also look at the accompanying changes in the output and labor hours series.

When analyzing changes in output and labor hours, one should pay close attention to both the size and direction of these movements. For instance, are output and hours both increasing, but one faster than the other? Are they both relatively flat? Or, are they moving in opposite directions? Examining output and labor hours in this way can provide a numerical explanation for movements in productivity, while also providing a deeper understanding of the current state of the economy. Output and labor hours are both macroeconomic indicators in their own right, and stacking up labor hours beside the corresponding output gives us the ability to see how macroeconomic inputs and outputs fared on their own, as well as how they moved relative to each other during a given period.

Also, taking into account the position in the business cycle can provide useful context when one looks at recent productivity estimates. When analyzing how output and hours each fared during a recession or expansion, one should pay close attention to both the timing and the magnitude of the movements in these variables. With regard to timing, one should determine whether output and hours each made their moves at the same time or with a lead or lag of several quarters, and whether their ascent or descent was compressed or gradual. And, with regard to magnitude, one should determine whether one variable gained ground or fell behind relative to the other, both during each quarter and by the end of the business cycle period. Analyzing recessions and expansions in this way can provide a better understanding of how labor varied as a productive input while its corresponding output rose or fell.

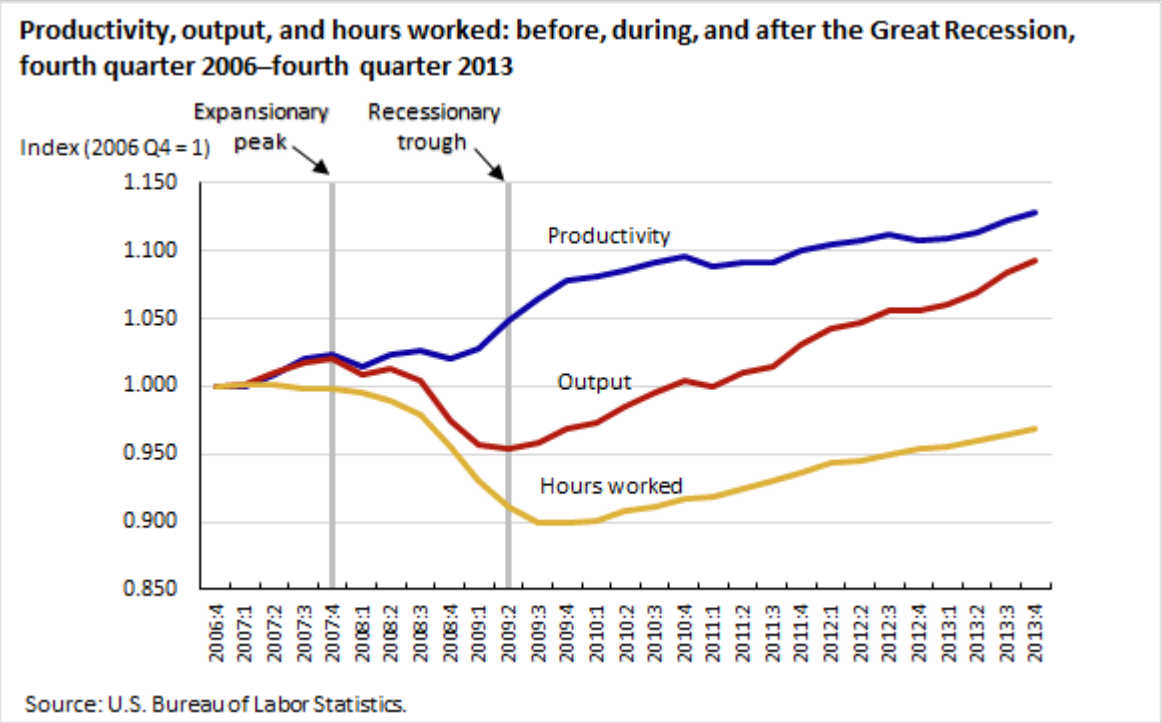
Labor productivity and the Great Recession

A key example in recent history that merits this sort of analysis is the Great Recession of 2007 to 2009. One can gain a fuller understanding of how this recession began, progressed, and ended by looking at movements in labor productivity and the underlying changes in its output and hours components before, during, and after this period.

The National Bureau of Economic Research declared the official start date of the recession to be December 2007 and the end date to be June 2009. For the purposes of our analysis—in which quarterly data will be used rather than monthly data—the fourth quarter of 2007 will be used as the start date and the second quarter of 2009 will be used as end date. Please note that the start date is often referred to as the "peak," because it represents the high point of the previous expansion just before the economy fell into recession; similarly, the end date is often referred to as the "trough," because it represents the point at which the economy hit bottom, just before beginning to improve.

Chart 3 shows the paths of output, labor hours, and productivity before, during, and after the Great Recession. All three of these variables have been reindexed to equal "1" in the fourth quarter of 2006; this sets this point in time as the starting line for our analysis, after which we can track exactly how these variables outpaced or fell behind each other during every phase of the period. The first thing we notice is that hours actually began to decline earlier than output did: hours began to fall slightly in the third quarter of 2007. Then, as the recession took hold and progressed, the fall in hours accelerated and they began to plummet, continuing to fall even after the recession was over. Hours were virtually flat for three additional quarters and did not begin to rise substantially until a full year after the trough. So, one could say that hours suffered more than output did during the recession: hours fell earlier, fell by more, and did not emerge until later. As the chart illustrates, output rose during the quarters before the peak, and though it did fall substantially during the recession—mostly during the second half of it—output did begin to show some solid growth just a couple of quarters after the trough. So, overall, output did not fare as poorly as hours did during the recession.

Chart 3



These movements in output and hours are reflected in the movements of productivity during this period. Before the recession began, productivity had been increasing, as output was still growing at that point while hours had already begun to decline slightly. Then, as the recession began, productivity flattened out as output and hours both fell approximately in concert with one another. Output and hours continued to fall together until the latter part of the recession, when the fall in output ceased but hours continued to decline. During this period there was substantial productivity growth: from the fourth quarter of 2008 through the fourth quarter of 2009, productivity grew 5.6 percent. In fact, this was the highest four-quarter rate of productivity growth recorded in more than 35 years.[5]

One particularly interesting thing to note about this period during 2009 is that although productivity growth was tremendous during this time, the economy was still in the doldrums. Unemployment was nearing 10 percent, and the United States had lost hundreds of billions of dollars in potential national output,[6] still languishing in an economy that was underutilized. This is a clear example of the fact that although productivity is very useful in analyzing the economy in the ways which have been discussed up to this point, it should not be viewed as an unambiguous indicator of the current health of the economy at a given point in time. As the recessionary period shows, it is possible to have a situation where output and hours are *both dropping*, while productivity remains positive, and even grows substantially. Because gains in productivity can occur both in recessions and in expansions (such as the one seen in the late 1990s), it is critically important to not look at a gain in productivity as a clear and absolute indicator that the economy is doing well. It simply means that output is growing faster—*or not falling as fast*—as hours at a given point in time. The main point here is that it is vitally important to understand context when looking at productivity data, and to always also inspect how output and hours are themselves moving in order to more fully understand the overall health of the economy at a given point in time.

Looking at the recovery period will illustrate this point in another way: as the recovery took hold and both output and hours began to recover, productivity itself began an extended period of meager growth. In fact, productivity only grew at an annual rate of 1.1 percent during this period (from fourth quarter 2009 to fourth quarter 2013), which is well below the 2.7-percent rate of growth during the previous 10 years (from fourth quarter 1999 to fourth quarter 2009). It might seem counterintuitive that productivity slowed to a crawl while the economy gained steam, but it actually makes sense when one considers how output and hours were moving during this period. An important story of this period is that labor hours finally began to show steady growth after languishing for so long, and this—when combined with relatively moderate output growth—led to the overall slow productivity. So, in this case, slow productivity went hand-in-hand with a steadily improving economy.

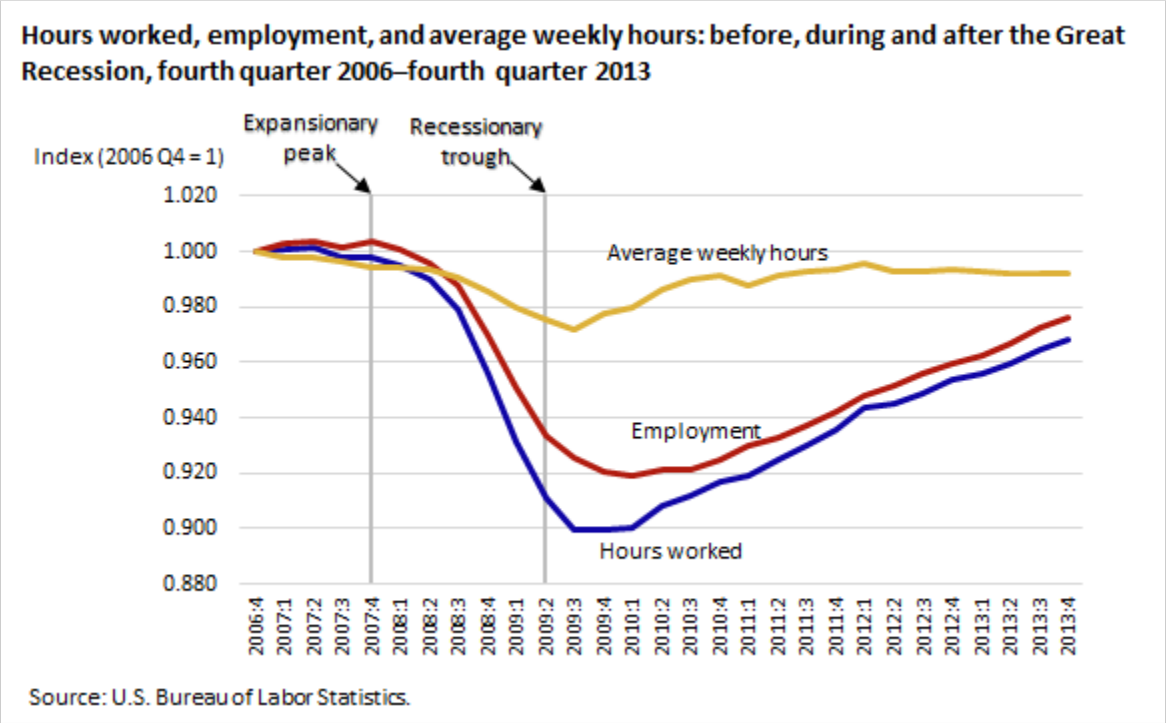
Labor hours and the Great Recession

In addition to the analyses up to this point, labor productivity data can help in looking at cyclical shifts in the economy in another way, by looking more closely at the sources of growth in the labor hours themselves. The labor hours series utilized in productivity analysis is itself a particularly useful measure for analyzing how the labor supply fared over a given period, because this series is the most all-encompassing measure of labor input available; the series is used in productivity analysis for this reason.[7] In analyzing these labor hours data, the following questions can be addressed: during a recession, did employers shed labor hours more by laying off workers or by dropping their weekly hours, and conversely, in an expansion, did employers add labor hours more by hiring workers or by augmenting their weekly hours?

Chart 4 displays the case of the most recent recession. The chart shows that both employment and average weekly hours began to decrease as the recession began—as did overall labor hours. However, as the recession wore on, the majority of the fall in labor hours was due to layoffs. Average weekly hours did not fall by nearly as much during this period, and in fact began to increase just one quarter after the end of the recession, while employment continued to decline for nearly a full year after the recession ended. This continued drop in employment kept labor hours in the doldrums until 2010—at which point average weekly hours were posting solid gains and employment was flattening out and then beginning to trend positive. From 2010 onward, the gains in labor hours came virtually completely from growth in employment—which began

a period of steady growth during this time—with average weekly hours remaining stable and nearing their prerecession levels.

Chart 4



Conclusion

Labor productivity and its underlying series can complement other macroeconomic indicators and provide a deeper understanding of changes in the economy, in particular the growth rates in economic output and the corresponding labor inputs over short-term and longer-term historical periods. Conceptually, labor productivity measures how much *more* workers can produce for a given amount of labor—and how much more can ultimately be consumed—over a period of time.

For more information on labor productivity, visit the BLS Labor Productivity and Costs webpage, at www.bls.gov/lpc.

*This **Beyond the Numbers** summary was prepared by Shawn Sprague, economist in the Office of Productivity and Technology, U.S. Bureau of Labor Statistics. Email: Sprague.Shawn@bls.gov. Telephone: (202) 691-5612.*

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NOTES

[1] Source: Division of Major Sector Productivity, BLS, March 6, 2014. The business sector is a subset of the domestic economy and excludes the economic activities of the following: general government, private households, and nonprofit

organizations serving individuals. The business sector accounted for about 76 percent of the value of gross domestic product (GDP) in 2013. Labor hours are defined as the aggregate number of hours-worked within the sector during a period of time. Please note that all labor hours (both quarterly and annual) levels are expressed as annualized levels, and are defined as the product of employment and average weekly hours.

[2] Specifically, the potential sources of productivity growth include (a) all of the technological advances in production which were introduced during the period, (b) increases in the quality and quantity of physical capital and equipment which businesses purchased and utilized, (c) the institution of more streamlined industrial organization, (d) increases in worker skill due to the attainment of experience and education, (e) better utilization of capacity, energy, and materials, (f) relative shifts of inputs from low- to high-productivity industries, (g) increased efforts of the workforce, and (h) improvements in managerial efficiency.

[3] BLS also produces labor productivity data by industry. BLS labor productivity databases—for both major sector productivity and industry productivity estimates—are available via this link: http://www.bls.gov/lpc/data.htm.

[4] While this is possible, it is not always the case that growth in labor income keeps pace with growth in labor productivity. For instance, over the past 30 years, gains in real worker compensation per hour have fallen behind gains in output per hour. This reveals another reason why it is important to measure labor productivity—because it is the yardstick with which we can measure the extent to which additional production per hour of work ultimately ends up translating into additional income per hour of work. (For more information on this topic, see http://www.bls.gov/opub/mlr/2011/01/art3full.pdf.)

[5] Output per hour had increased at a 5.7-percent rate from the first quarter of 1972 to the first quarter of 1973.

[6] The Congressional Budget Office publishes estimates of potential GDP, here: http://www.cbo.gov/publication/45068.

[7] Labor hours data not only incorporate both employment and average weekly hours data for a given sector, but they also include data for all worker categories (including employees, proprietors, and unpaid family workers), and utilize data from both the Current Establishment Statistics program as well as the Current Population Survey, in addition to other sources.

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