

# FRBSF ECONOMIC LETTER

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## The Productivity and Jobs Connection: The Long and the Short Run of It

Ask any economist and he or she will tell you that faster productivity growth leads to higher real wages and improved living standards. So, from those perspectives, the recent evidence of strong productivity growth in the U.S. is good news. Figure 1 shows, by decade, the relationship between productivity growth and the growth rate of real labor compensation per hour. The decades of slow productivity growth have been decades of slow growth in real wages; decades of faster productivity growth have been decades of faster growth in real wages.

Yet a quite different picture of productivity growth dominates the news. Numerous newspaper articles blame strong productivity growth for a “jobless recovery,” as economic output grows yet employment does not. Faster productivity growth, according to this view, allows firms to increase production without increasing employment. While recent employment figures suggest that job growth may finally be accelerating, the slow growth in new jobs during the past two years has raised doubts about the benefits of faster productivity growth.

These two views of productivity growth seem dramatically inconsistent. If higher productivity allows firms to shed workers, how can it raise wages and living standards? If productivity does lead to improved wages and living standards, why do so many feel the recent productivity growth has left workers behind?

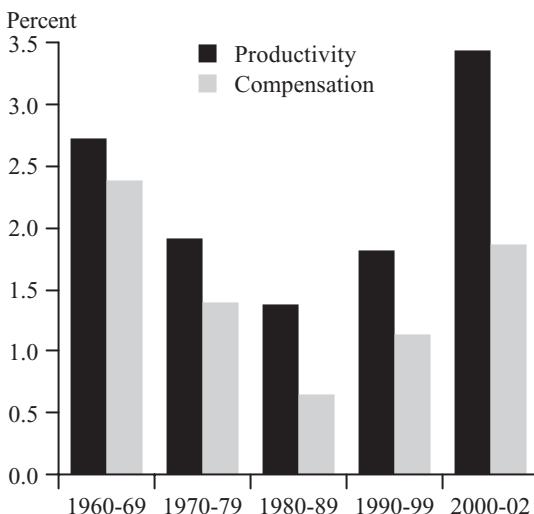
To answer these questions, and to understand how both views contain part of the truth about productivity, we need to distinguish both between a microeconomic and a macroeconomic perspective on productivity and between the short-run and long-run effects of changes in productivity. This *Letter* discusses these different perspectives on the productivity-jobs connection.

### The macro versus micro perspective

Variations in productivity growth have both microeconomic and macroeconomic effects. Microeconomics

Figure 1

Productivity growth rate and growth in real compensation per hour



investigates the structure of individual industries and markets, and the behavior of individual firms and consumers. From a micro perspective, productivity growth and new technological innovations are constantly leading to structural changes in the economy, causing one industry to expand in terms of both production and employment, while other industries shrink. The rapid growth of the high-tech industry during the 1990s and the effects of research in biochemistry on the pharmaceutical industry are just two recent examples of such changes. At the same time, technological changes can cause other industries to contract. The introduction of word processors and personal computers had a devastating effect on firms producing electric typewriters, for example. These micro factors produce an enormous amount of change each year in the American labor market. As a consequence, small changes in overall employment can mask the quite large numbers of jobs that disappear and are created every year. For example, according to Pivetz et al. (2001), in the fourth quarter of 1999, the net gain in employment



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of 1 million was the result of the loss of just over 8 million jobs and the creation of over 9 million new jobs.

Similar phenomena can be observed when looking across industries. For example, while the share of manufacturing in total U.S. GDP has remained roughly constant over the past 50 years, rising productivity in manufacturing means that this level of production can be achieved with fewer and fewer workers. Thus, employment in manufacturing as a share of total employment has declined over the past 50 years. In contrast, employment and output in areas such as the computer industry, areas of economic activity that did not exist 50 years ago, have grown rapidly. These shifts in the economy cause jobs to disappear in some sectors while jobs are created in others.

Rather than focusing on specific industries or sectors of the economy, macroeconomics focuses on the overall behavior of the economy (e.g., overall levels of income, production, employment, inflation). Thus, while important issues of public policy are involved in deciding how best to assist workers displaced by these changes, the question from the macroeconomic perspective is whether faster productivity growth does more than simply shift the types of jobs available in the economy: Does it alter the total level of employment and wages? And to address this issue, it is useful to distinguish between the short run and the long run.

### The short run

If firms see the demand for their products rise, they respond by expanding production. And if labor productivity is unchanged, then typically they need to hire more workers to do this. But if labor productivity is increasing, then it has the potential to reduce employment growth, because the firm will be able to satisfy demand using fewer workers. Likewise, if overall demand in the economy has not expanded, then an increase in labor productivity could lead to a fall in employment in the short run. In this case, faster productivity growth might lead to an increase in job loss without a corresponding increase in job creation in new and expanding industries.

### The long run

Economics teaches us that, in the long run, income and employment depend not on demand but instead on supply factors—the economy's stock of capital, its labor force (measured in terms of both the quantity of labor as well as its quality as reflected, for example, in educational levels), and its technology. At the macro level, the level of income that results when the economy's factors of production are fully and efficiently utilized is often called potential GDP.

While the short-run perspective emphasizes the impact of productivity on the number of workers needed to

produce a *given* level of output, the long-run perspective emphasizes that an increase in labor productivity increases potential GDP. It does so directly by allowing more output to be produced with the same level of employment, but it also increases employment because it *decreases* the cost of labor to firms and promotes the creation of new industries. For firms, the relevant cost of labor is not measured simply by the wages and benefits paid to the workers. Rather, it is measured by the costs of these wages and benefits relative to the output the workers are able to produce. Just as a rise in wages increases labor costs if worker productivity remains constant, a rise in labor productivity lowers the cost of labor at a given level of wages and benefits. And if higher productivity makes labor less costly, firms will find it profitable to expand employment. As the new technological innovations that boost productivity occur, new industries arise, along with the creation of new jobs. The increased demand for labor will tend to boost wages, as firms compete to hire additional workers, and raise total employment. With higher employment and productivity, potential GDP increases.

### Getting from here to there

The short-run and long-run effects of productivity growth may appear contradictory. How can faster productivity growth depress job creation in the short-run but increase wages and employment in the long-run? In the short-run, productivity growth increases the economy's potential GDP, but if actual GDP does not rise in tandem, actual GDP will fall short of potential, a situation described as a "negative output gap." Expanding investment and consumption spending serve to close the negative output gap. Often, taking advantage of new technological innovations requires that firms increase investment spending to purchase new equipment, and lower labor costs boost profits and the stock market. This increase in overall wealth contributes to a rise in consumption spending. Critically, wages and prices also adjust to restore equilibrium in the economy. These adjustments reduce the output gap until actual GDP rises to match the new level of potential GDP.

Monetary policy plays an important role in this adjustment process. The Fed, like many other central banks, is concerned with keeping inflation low and stable and with promoting macroeconomic stability. Promoting macroeconomic stability normally means the Fed focuses on the output gap as well as on inflation. If inflation is under control, a negative output gap is a signal that policy should be more expansionary, thereby speeding the elimination of the output gap and returning actual GDP to potential GDP. For example, the Fed's policy of maintaining its policy interest rate at low levels for the past three years was designed to help eliminate any negative output gap. Of course,

Fed policy actions affect the economy with a lag, so it is not today's output gap that must be the focus of policy, but rather the outlook for the gap in the future.

### The evidence

Several economists have tried to estimate the short-run and long-run impacts of productivity shocks on employment. In one of the first papers to investigate this issue, Galí (1999) found that an increase in productivity growth initially reduced overall employment in the economy. The effects on employment, however, were found to be temporary. Thus, his results were consistent with the short-run and long-run effects discussed above.

While the negative impact of faster productivity growth on employment eventually disappears, leaving only the positive impact on incomes, the period of adjustment may be slow and drawn out. Galí, for example, estimated that it would take about seven quarters for total hours worked to return to their initial level after a productivity innovation.

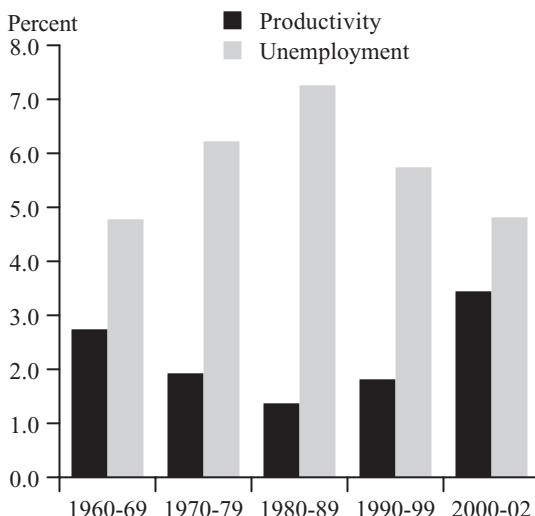
While most subsequent research has confirmed Galí's basic conclusions, some researchers have disputed his findings. For example, Christiano et al. (2003) argue that productivity raises total hours worked even in the short-run. The different findings are attributed to two sources. First, different methods for estimating productivity shocks seem to account for some of the differences. Second, the results are sensitive to the researchers' assumptions about the long-run behavior of hours worked and whether one assumes hours per capita have fluctuated around a constant level during the past 50 years. While this may seem to be purely a technical statistical issue, it does seem to matter for the empirical results.

In any event, there is little debate among economists about the long-run effect of productivity on employment. And this effect is evident in some simple measures of the relationship among productivity, wages, and unemployment. In the long run, faster productivity growth should translate into an increase in the overall demand for labor in the economy. This, in turn, will lead real wages to rise, just as an increase in the demand for a typical good or service acts to bid its price up. Figure 1 showed that this positive relationship between productivity growth and real wage growth holds across decades.

Figure 2 shows the relationship by decades between productivity growth and the unemployment rate. Consistent with the longer-run perspective, periods of faster productivity growth are not associated with higher average unemployment rates.

**Figure 2**

### Productivity growth rate and unemployment rate



### Conclusions

Innovation and technological change bring benefits to the economy and contribute to rising standards of living. But such changes inevitably require that resources, including labor resources, be shifted from shrinking industries to expanding industries. This process can be costly and painful for the workers whose skills are no longer in demand. A macroeconomic perspective helps to highlight the contrasting short-run and long-run impacts of productivity growth on employment. While faster productivity growth may reduce employment in the short run, it promotes employment and higher wages in the long run.

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