

Remarks by Vice Chairman Roger W. Ferguson, Jr.

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Productivity: Past, Present, and Future

Thank you for the invitation to speak here today. In assessing the economic outlook, economists cannot avoid confronting the question of how fast the economy can expand without creating upward pressure on inflation. A fundamental determinant of the economy's potential growth is the sustainable rate of productivity expansion. Critical though this issue is, it does not by itself capture the importance of productivity. Besides influencing the near-term course of important economic variables, such as gross domestic product growth, inflation, and profits, productivity largely determines our society's long-term economic welfare. Productivity growth forms the foundation for improvements in living standards. And our ability to deal with budgetary challenges--such as funding the large future obligations of our Social Security and Medicare systems and, more generally, managing the nation's debt--depends critically on the future direction of productivity. Thus, knowing where productivity growth is headed is, in many respects, equivalent to foreseeing our economic destinies.

In thinking about productivity in the future, it is useful to first consider how it has behaved in the distant past and more recently. The past offers lessons about the kinds of economic and political environments that have proven most effective in fostering high rates of productivity growth. And a better understanding of the forces shaping recent developments in productivity--in particular, the causes of the pickup in labor productivity growth that began in the mid-1990s and the sources of the additional post-2000 surge--can help us put sensible bounds on possible future movements in productivity. In my discussion today, I will not attempt to predict these future movements, but with the knowledge gained from studying the past and the present, I will lay out some of the conditions--both favorable and unfavorable--that are likely to influence them. As usual, my remarks represent my own views, which are not necessarily shared by other members of the Board of Governors or of the Federal Open Market Committee.

The Past ¹

Over the past century and a half, three episodes stand out as especially relevant for assessing the sustainability of the current productivity boom: the late 1800s from roughly the end of the Civil War to around 1890; the decade or so between the end of World War I and the onset of the Great Depression; and the period from about 1950 to the early 1970s. In these boom periods, average labor productivity growth ranged from 2-1/2 to 3-3/4 percent, about double the average of growth rates during other periods. The striking similarities of these three episodes provide clues about the types of economic policies and other factors that have been important in promoting sustained productivity gains. Perhaps not surprisingly, all three periods were influenced heavily by the introduction of new technologies. But they were also characterized by important changes in the organization of production, in the means

of financing new enterprises, and in investment in human capital that facilitated the complex process of applying these new technologies to the creation of new goods and more-efficient production processes.

The productivity boom after the Civil War resulted from a variety of technological advances, including the expansion of and improvements in the use of steam power, railroad transportation, and communication by telegraph. By lowering the cost of transportation, railroad expansion allowed firms to take advantage of economies of scale in production and distribution. The telegraph's lowering of communication costs enabled firms to better coordinate movements in rail traffic and made possible more-informed and better decisions in many other industries. In the productivity boom that followed World War I, a chief technological innovation was the spread of electrification to the factory floor. By allowing each machine to be driven by its own power source, electric motors spurred the development of complex and more-productive configurations of machinery, such as the assembly line. Finally, the productivity gains of the 1950s and 1960s had their roots in a wide range of technological innovations made during the 1930s as well as in research sponsored by the military during World War II. For example, research advances in polymer chemistry, the development of new diesel and jet engine technologies, and the invention of the transistor and the integrated circuit facilitated productivity improvements in a wide range of industries and the creation of an array of highly useful consumer products.

In each episode, businesses found that changes to their organizational structures allowed them to take greater advantage of the new possibilities opened up by these technological innovations. In the productivity boom of the late nineteenth century, for example, the potential for economies of scale made possible by the new technologies led to dramatic increases in firm size in many industries. Their larger size, in turn, prompted firms to implement hierarchical management systems to coordinate their greater numbers of workers and machinery and to speed the flow of information between management and the factory floor. Shorter delivery times, reduced inventory holdings, and a better match between production and orders were the beneficial results. Similarly, to take advantage of the continuous-processing technologies of the early 1900s, firms increased the scope of their operations, integrating forward into distribution and retailing and backward into materials processing. This vertical integration reduced transaction costs but required the development of new units within the firm that were not directly tied to production, such as advertising, accounting, and research departments. In the third productivity boom, large multinational and multiproduct firms arose to take further advantage of economies of size and scope. In this episode, firms created multi-divisional organizations, with each product or geographic division having its own manufacturing and marketing departments. Such a structure was well suited to a firm with diverse activities as it allowed managers to respond to changes in preferences and technologies relevant to specific areas or products.

Because the implementation of new technologies often requires new capital, the productivity gains during these boom eras were also dependent on the development of efficient mechanisms to transfer capital to the entrepreneurs and firms best able to transform the potential of the new technologies into new goods and new production processes. In the productivity boom after the Civil War, for example, the increased use of secured debt and preferred stock reduced the transaction costs associated with borrowers having better information than lenders about the risks of bankruptcy and provided firms with the external funds needed to support a rapid buildup in the capital stock. In the second productivity boom, the introduction of regular audited financial statements, rating agencies, and newsletters covering firm and industry developments further reduced investors' costs of

acquiring information about firms' finances, which led to a sharp expansion in equity markets and the opening of a new channel of capital flows to that period's large-sized innovators. Similarly, the growth in pension funds, mutual funds, and brokerage houses during the productivity boom of the 1950s and 1960s reduced the costs of portfolio diversification and further increased the participation of individual investors and the flow of capital available to innovators.

A fourth ingredient contributing to the productivity booms of the past was the availability of a workforce capable of realizing the possibilities offered by technological innovations. In the late 1800s, new technologies increased the demand for unskilled production workers and skilled white-collar workers. Employers generally were able to satisfy these demands through existing domestic sources of such labor, augmented by substantial rates of immigration. In contrast, the complex continuous-processing technologies of the early 1900s increased the demand for skilled blue collar and white collar workers well above the available supply. But the new job opportunities and the wage premiums attached to them led to a significant increase in high-school graduation rates, which helped the supply of skills to catch up to the new demand. In much the same way, the new technologies and organizational structures of the post-World War II boom sharply increased the demand for workers in professional and technical occupations, which was quickly met by a corresponding increase in the percentage of young adults obtaining a college education.

The similarities of these previous productivity booms seem to offer some valuable lessons. The first concerns the importance of "general purpose technologies," or GPTs, in promoting long-run economic growth. Many of the technological innovations associated with past productivity booms--railroads and electric power, among others--were GPTs with widespread applicability. Because such GPTs raise efficiency not only in production but also in distribution and business practices, they offer the possibility of broad-based and long-lasting improvements in productivity. Second, the new capital investment and the organizational and financial innovations that helped to turn new technological possibilities into better and cheaper goods and services generally derived from the actions of individual economic agents and not from the directives of central planners. Of course, that doesn't mean that government has no role to play in fostering economic growth. Indeed, maintaining an economic, legal, and financial environment that provides individuals with the proper incentives to invest in new technologies is an important and often challenging responsibility of government policymakers. Also, government actions can help broaden opportunities for education and support the basic research that contributes to new technological breakthroughs.

Recent Developments

As I noted at the beginning of my remarks, it is also important to understand the forces shaping more recent developments in productivity. From 1995 through 2003, average annual productivity growth was 3 percent, double the 1-1/2 percent rate of growth that prevailed between 1973 and 1995. Although some observers initially questioned whether the pickup in productivity growth after 1995 represented a real increase in the underlying trend of productivity growth, the passage of time and the changes in cyclical conditions occasioned by the most recent recession have produced a general consensus that the trend growth rate did indeed increase.

From the fourth-quarter of 2001 through the fourth-quarter of 2003, the gains in productivity were particularly strong, at an annual average rate of growth of more than 4 percent; indeed, last year the rise in productivity was close to 5-1/2 percent. The increases in productivity

experienced during this period have been an important factor, perhaps the dominant factor, in the elevated profit margins that businesses have enjoyed in the past few years. Moreover, the strong performance of productivity relative to the more modest gains in labor compensation has helped to keep inflation low. Thus, a key question is whether this elevated pace of productivity growth can be sustained.

I see several reasons to believe that the additional pickup in productivity growth during the last couple of years is due primarily to cyclical factors and thus not likely to be sustained. First, the 2001 recession, by dramatically reducing profits, focused firms' attention on restructuring and cost-cutting rather than on business expansion and likely induced some one-time gains in efficiency. That firms could realize such large advances in productivity was perhaps due to their substantial, but underexploited, investments in high-tech equipment in the late 1990s; but at some point additional efficiencies from these earlier investments will be more difficult to achieve. Second, the threat of terrorist attacks, geopolitical risks, and corporate governance scandals led many employers to question the durability of the current recovery and thus made them hesitant to incur the costs of bringing on new employees. As firms chose instead to meet increases in their orders by using their existing workforces more intensively, measured productivity rose. The recovery in the labor market during the second half of 2003 and the first half of this year appears to be a sign that employers are now more confident about the economic outlook and are attempting to return workloads to a more-sustainable level.

Thus, I would not be surprised if measured productivity growth over the next few years falls below the rates of the fourth-quarter 2001 through fourth-quarter 2003 period or even, for a time, below the average growth rate from 1995 through 2003. Indeed, such a drop would be an expected consequence of the pickup in hiring that now seems to be under way. The average monthly increase in private payrolls of slightly more than 200,000 during the past six months appears to have coincided with an easing in labor productivity growth. Spending and hours data for the first half of this year point to a stepdown in productivity growth from last year's pace.

A second important question is whether trend productivity growth will slow as well. A pronounced deceleration in structural productivity could result in more rapidly accelerating labor costs and lower profit margins, which, in turn, could lead to a deteriorating outlook for inflation. Moreover, a deterioration in trend productivity growth would have adverse consequences for our ability to meet long-term economic challenges.

The Future

In my view, there are a number of reasons to expect that the stepped-up pace of underlying productivity growth that we have experienced since the mid-1990s can persist for a while longer. In particular, conditions similar to those that fostered previous productivity booms seem, on balance, to be in place today. General purpose technologies such as the personal computer, fiber optics, wireless communications, and the Internet--to give just a few examples--continue to present new avenues for raising productivity. Past deregulation should enable businesses to adapt their organizational structures in response to these new opportunities. Ongoing financial-market innovations have allowed financial intermediaries to expand the range of financing alternatives to businesses seeking external funds. And in response to the rising demand for skilled labor able to use new technologies, four-year colleges and community colleges are providing both experienced and inexperienced workers with opportunities to obtain new market-relevant skills.

Nevertheless, each of the previous productivity booms eventually ended, and thus one can reasonably ask whether any developments threaten the longevity of the current boom. One hypothesis along these lines is that periods of strong productivity growth come to an end when the productivity-increasing opportunities associated with new technologies are exhausted. I think that, at this point, such concerns are premature.

Sharp declines in the prices of high-tech capital equipment, spawned by the rapid rate of innovation in high-tech industries, were an important part of the productivity acceleration that began in the mid-1990s. As prices fell, firms used more high-tech capital to increase efficiencies in the production of other goods. Though productivity pessimists sometimes cite the absence of a "killer application" as an indication that the ability of high-tech capital to raise productivity in other industries is declining, the limited evidence available suggests that both the breadth and the depth of demand for new technologies remain substantial. With respect to breadth, research by Kevin Stiroh shows that the acceleration in productivity owing to investments in high-tech capital has been spread widely across industries.² Regarding depth, research coauthored by Jason Cummins of the Board's staff found that, despite the high investment rates of the late 1990s, a wide gap between the technology embodied in state-of-the-art capital equipment and the technology embodied in the existing stock of equipment remains across a broad set of industries. That gap implies continued incentives for capital investment.³

Although the exhaustion of technological possibilities seems unlikely to slow trend productivity growth, adverse changes in the economic, legal, and financial environment could threaten the longevity of the current productivity boom. For example, economists have long noted that free trade--and the specialization and economies of scale that it affords--fosters productivity increases. That our most recent productivity boom occurred against a backdrop of freer trade and increased globalization is likely no coincidence. However, the momentum for the liberalization of global trade now appears to be facing strong resistance. A halt in the movement toward freer trade or outright backsliding, such as the erection of new barriers to the trade of goods or services, would endanger the sustainability of the current productivity boom. Some observers believe that security-enhancing limitations on the international flow of capital, labor, and goods in response to an increased terrorist threat could have similar effects. In addition, a failure to continue to vigorously address the corporate governance issues of the past few years could also threaten the current boom. As I noted earlier, the efficient channeling of capital to innovators has been a critical component of past productivity booms. Fraud or dishonesty in corporate accounts increases investors' risk, raising the cost of capital and reducing incentives for investment. Large government borrowing to fund current consumption could also raise the cost of capital and crowd out the investment on which the current boom depends. The magnitude of future government obligations to fund Social Security payments for the retiring baby-boom generation and the growing costs of providing medical care to the elderly add to the urgency to put government debt on a sustainable long-term path. Doing so sooner rather than later would make the necessary adjustments easier and diminish the likelihood of significant future economic disruptions.

Some observers have also stressed the importance of large economic shocks, such as the oil price shock of the early 1970s, in bringing periods of rapid productivity growth to an end. It seems possible that the recent run-ups in energy prices, and the fact that markets expect much of them to be permanent, could reduce productivity growth by rendering energy-intensive technologies and capital obsolete. Without dismissing such concerns, one needs to

keep in mind that the recent shock to date has been significantly smaller than the oil shocks of the 1970s and that the economy today is far less energy intensive than it was then. Additionally, one can take some comfort from the economy's generally strong performance in the face of the numerous economic and geopolitical shocks that buffeted it over the past several years. Despite these shocks, the most recent recession, in terms of output decline, was one of the mildest on record. Our economy's ability to weather these shocks reflects well on the institutions we have established and on the hard work and determination of the American people. Nonetheless, developments in energy markets, and their potential effects on the U.S. economy, merit close and ongoing attention.

Finally, many observers have noted a positive relationship between macroeconomic stability and productivity growth. So let me here reaffirm the Federal Reserve's commitment to maintaining price stability, to promoting sustainable growth in output, and to safeguarding the stability of our financial system. I believe that by meeting these objectives, we can do our part to promote an economic environment that encourages the investment and innovation upon which all productivity booms have depended.

Conclusion

In conclusion, productivity growth--buoyed both by favorable cyclical and by structural factors--has greatly contributed to the recent benign coincidence of rising output, expanding profit margins, subdued unit labor costs, and low inflation. But because the future does not simply replicate the present, uncertainty surrounds the path that productivity will take from here. My sense is that cyclical factors likely contributed to the most recent advances and thus a slowing in productivity growth is likely. Such a cyclical slowing is not a concern in itself, but a simultaneous drop-off in the underlying trend rate of productivity growth could significantly impair our economic prospects. Certain circumstances argue against such an occurrence. History contains several precedents of sustained periods of elevated productivity growth, and, in general, the conditions prevailing during those periods appear to exist today. In addition, the technological underpinnings of the current boom appear secure. However, other forces bear close watching. Stagnation or regression in the movement toward free trade, continued large fiscal deficits, a failure to continue addressing problems in corporate governance, and elevated oil prices could all lessen the weight of conditions that have up to now tilted so favorably toward strong productivity advances.

End Notes

1. This discussion is based on Roger W. Ferguson, Jr., and William L. Wascher, "[Lessons from the Past Productivity Booms \(139 KB PDF\)](#)," *Journal of Economic Perspectives*, vol. 18, (Spring 2004). [Return to text](#)
2. See Kevin J. Stiroh, "Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say?" *American Economic Review*, vol. 92 (December 2002), pp. 1559-76. [Return to text](#)
3. See Jason Cummins and Giovanni Violante, "Investment-Specific Technical Change in the United States (1947-2000): Measurement and Macroeconomic Consequences," *Review of Economic Dynamics*, vol. 5 (April 2002), pp. 243-84. [Return to text](#)

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