
INTRODUCTION:

INFORMATION TECHNOLOGIES IN THE U.S. ECONOMY

By Sabrina L. Montes*

In the late 1990s, the U.S. economy achieved performance levels unseen for a generation. Strong output and productivity growth accompanied low inflation and healthy employment growth. Then and now, economic research has suggested that investment in and use of information technologies (IT) played a role in bringing about that happy macroeconomic situation. Some observers, however, were skeptical of whether the observed changes would endure—and especially whether long-term trends in measures like labor productivity growth have indeed improved. They wanted, for instance, to see how the economy would fare as it moved through a business cycle.

The economy has passed through that test with a shallow, 8-month recession beginning in March 2001. However, the recession and post-recession period have been atypical. During the recession, real gross domestic product (GDP)—buoyed by consumer spending and a strong housing market—did not decline as much as during a typical recession. However, real business investment declined faster and more deeply and the job losses stayed higher longer than during an average recession. The job market has remained stubbornly weak in the post-recession period, and the U.S. economy has endured an extended period of modest output growth that only recently has begun to improve. On the other hand, throughout the recession and the post-recession period, inflation has remained low and labor productivity growth has been strong.

In addition, questions persist about the impact of IT on the U.S. economy. Do the economic forces that were at work during the latter half of the 1990s still resonate in our current economic situation? Three questions, in particular, stand out: What are the prospects for IT producers? How are IT workers faring in the current slack job market? And, do investment in and use of IT

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still play a commanding role in U.S. economic activity? The desire to illuminate these questions underlies this report.

IT Producers

Since the mid-1990s, the IT-producing sector has been vital to U.S. output growth. On average, between 1996 and 2000, IT producing industries, which represented between 8 and 9 percent of the economy, supplied an average annual 1.4 percentage points to the nation's 4–5 percent real annual output growth. We estimate IT producers' contribution to economic growth dropped to 0.1 percentage point of the estimated 2.3 percent growth rate in 2002. However, IT producers' contribution to economic growth revived in 2003, as growth in both the overall economy and in parts of the IT producing sector, improved. In 2003, IT producers contributed 0.8 percentage point to the estimated 2.9 percent growth rate. (Chapter 1.)

Since 2000, however, some IT producers have been struggling. IT manufacturing nominal output reached a peak in 2000. It began declining prior to the recession and has continued to decline through most of the post-recession period. Growth slowed dramatically in IT services industries—but did not actually decline.

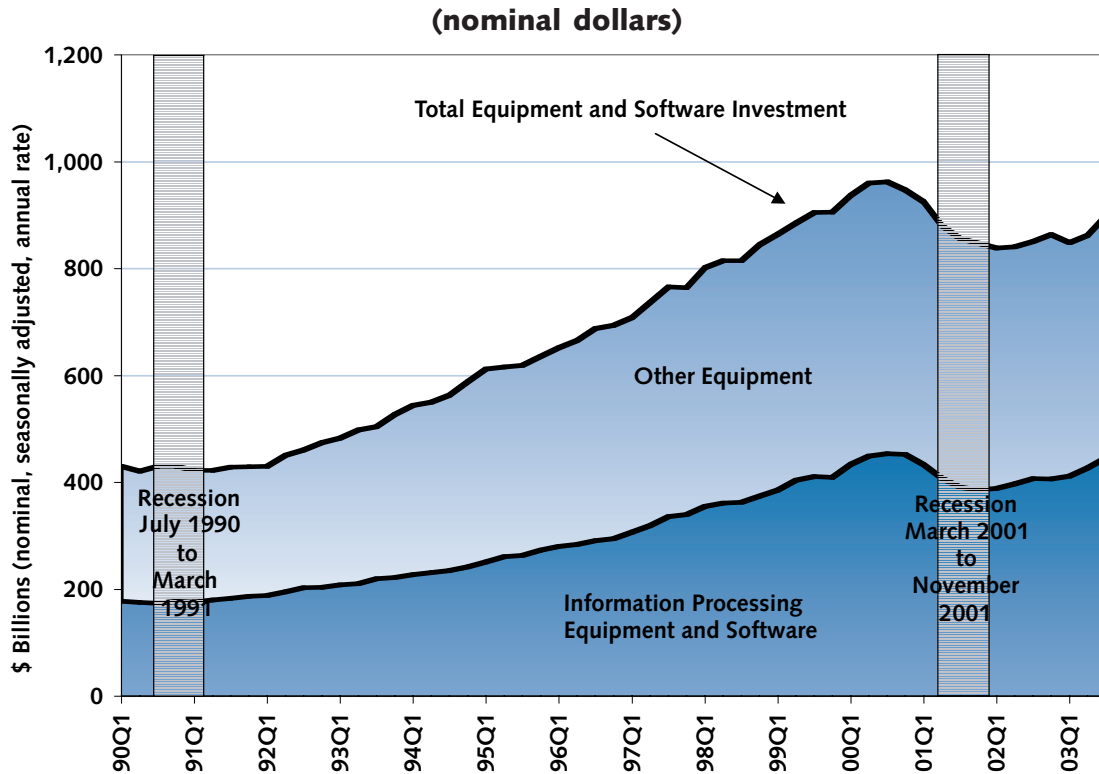
The situation for IT-producing industries also differed by market segment. The consumer market did not slow significantly, reflecting strong consumer spending throughout the recession and post-recession period. Indeed, while many firms in today's IT sector continue to struggle, corporate sales and profit reports suggest that companies selling consumer-oriented technologies are seeing strong sales and earnings growth.¹

The business market segment fared much worse. Products produced by IT firms make up a large and growing share of total business investment in equipment and software. While overall investment spending is still high relative to historic levels, spending has dropped off since 2000 and has only recently begun to recover. (Figure 1.)

Although current growth rates of business investment rival those that occurred during the latter half of the 1990s, it may take a while to see the levels reached during that period. Arguably, there were a number of one-time only factors driving investment during those years. For example, the investment associated with the year 2000 conversion, the initial build out of the Internet, and a post-deregulation surge in telecommunications spending will not occur again. On the other hand, it is impossible to foresee future events that might have the same positive effect on business IT spending.

Some observers have suggested that the high levels of overall business investment at the end of the 1990s and into 2000 reflect some over-investment in IT, or even an IT investment bubble. This resulted from the stock market bubble, which reduced the cost of capital to firms, and the initial exuberance associated with the Internet and dot.com companies, which encouraged

¹ Ken Belson, "Consumer Electronics Surge Ahead of Office Computers," *New York Times*, 1 Aug. 2003.

Figure 1. Private Fixed Investment in Equipment and Software

Source: Bureau of Economic Analysis, National Income and Product Accounts, Table 5.4.

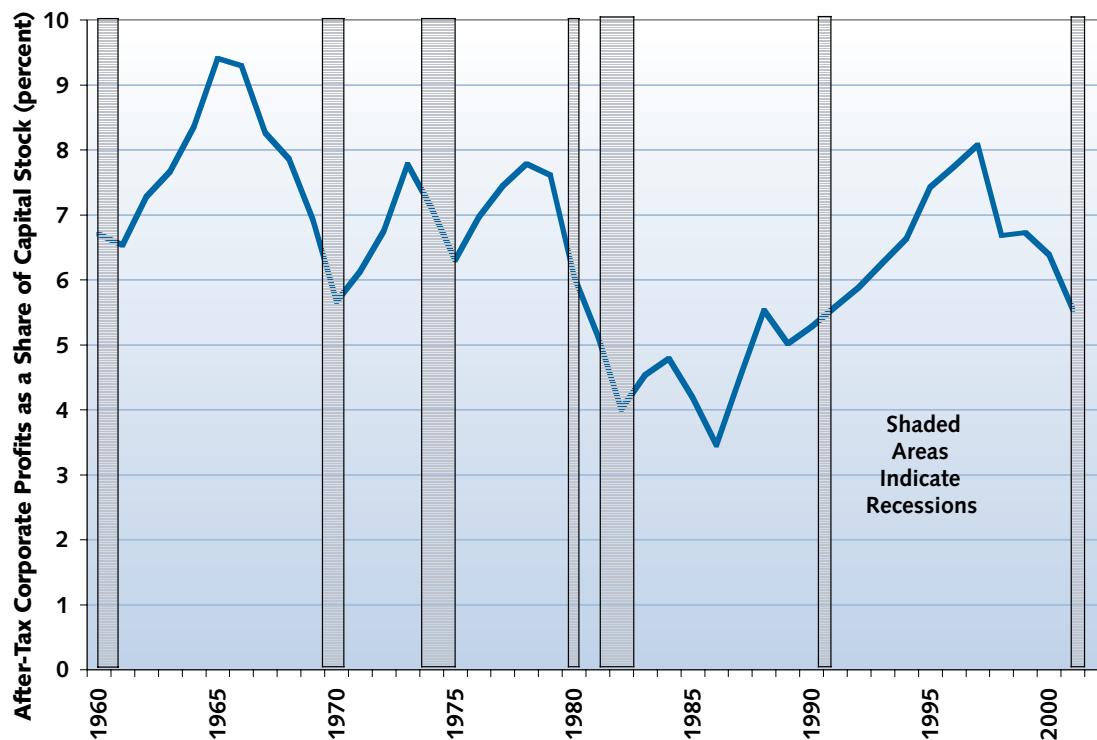
IT (Information processing equipment and software) represents a large (40–45 percent) and stable share (in nominal dollars) of business spending on equipment and software. Since IT equipment has seen rapid price declines relative to other equipment, IT's contribution to real business investment has grown. Overall investment spending—and consequently IT spending—peaked in 2000 and has only recently begun to recover.

investment in IT.² Such over-investment, if it indeed occurred, would foreshadow a longer recovery period for IT producers because businesses would need to work off the IT investment overhang before renewing IT investments.

Evidence of over-investment is mixed. For example, one would expect falling profits to accompany over-investment or an investment bubble because such retrospectively unwise investments would not earn returns at the same rate as more rational investments.

In fact, the profit data are ambiguous. After-tax returns to capital—a basic measure of profits peaked in 1997 at 8.1 percent and fell to 5.5 percent in 2001, which is consistent with some over-investment. However, the levels of after-tax return to profits are still higher than the level that prevailed during the mid-1980s. (Figure 2.) This overall increase is consistent with capital

² Kevin J. Lansing, "Growth in the Post-Bubble Economy," *Federal Reserve of San Francisco Economic Letter* 2003-17 (2003) (<http://www.frbsf.org/publications/economics/letter/index.html>).

Figure 2. After-Tax Return to Capital

Source: Bureau of Economic Analysis

After-tax return to capital—the ratio of after-tax corporate profits to the value of the corporate capital stock (current cost)—achieved a local peak of 8.1 percent in 1997. The measure has since declined. Levels remain higher than during the mid-1980s.

becoming more efficient (for example via technological change), and more profitable—i.e., consistent with the conclusion that IT investments in the 1997–2001 period were not excessive.

Declining IT investment and retrenchment among IT-producers were among the reasons for IT-related job losses throughout the economy. (Chapter 2.) In the IT producing sector itself, the number of jobs fell by 10.7 percent during 2002. Preliminary 2003 data suggest no improvement.

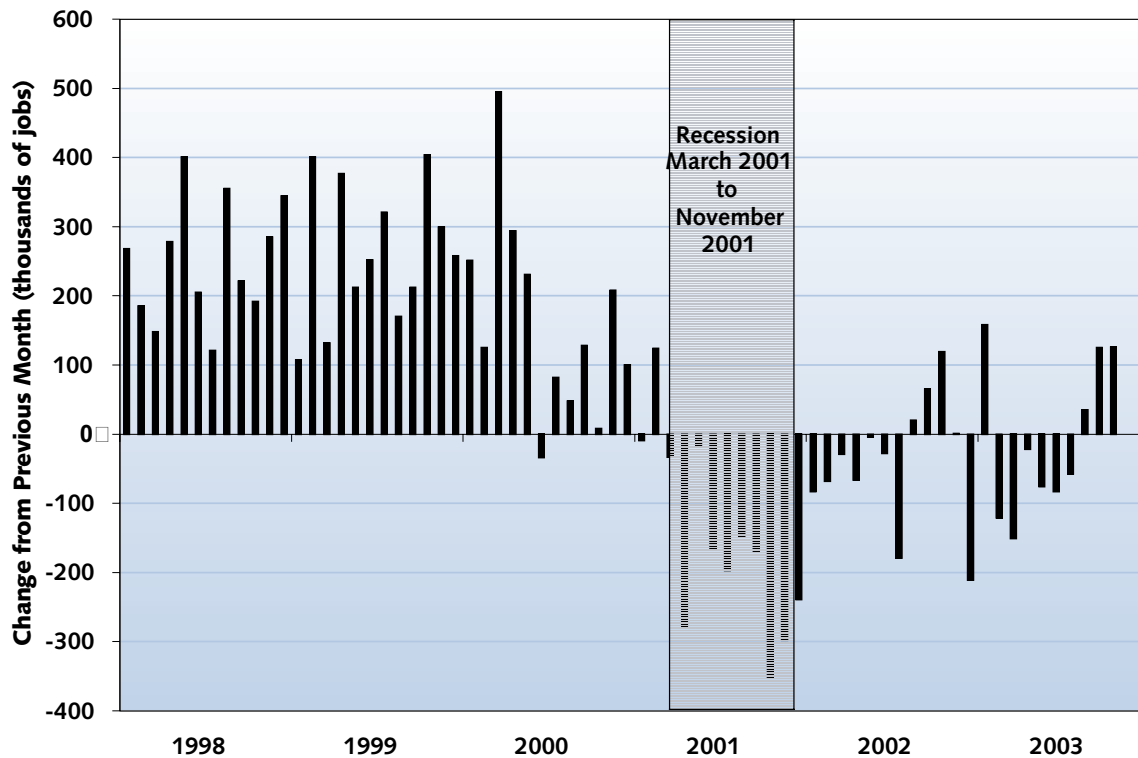
The Employment Situation

Job losses in the IT-producing sector are part of a larger picture of job losses and slow employment growth economy-wide that has been the conundrum of the post-recession period. (Figure 3.)

The current employment situation is complex. First, there is always churn in employment. Layoffs in one industry are often offset by new hires in another, and there are always people looking for work and firms seeking workers. Employment in the bioinformatics field is a case in point. (Chapter 6.) Even in the current, relatively slack job market, firms in this field—which merges IT capabilities with life science research and development—continue to seek workers.

Figure 3. Non-farm Payroll Employment

Change from previous month in thousands



Source: Bureau of Labor Statistics, Employment Situation, Table B.

Since the 2001 recession, U.S. workers have experienced a slack job market for an extended period. The employment picture has only recently begun to improve.

Second, there is some evidence that structural changes in employment may be occurring in the U.S. economy. A recent study by the Federal Reserve Bank of New York suggests that, during this recession and post-recession period, there have been permanent shifts in employment among various industries.³ Research presented in Chapter 4 suggests some possibility of IT-driven structural changes. Among industries that invest intensively in IT, employees in management and office administrative support occupations appear to account for most of the 2001 employment losses. Anecdotal evidence has long suggested that occupations such as these are vulnerable to elimination when routine tasks are automated. In addition, this and previous *Digital Economy* reports have found evidence that, in a number of occupations, the use of IT is associated with demand for workers with higher skill levels.

Third, some businesses have moved certain operations overseas. The practice, called offshoring, has long been associated with manufacturing firms. Anecdotal evidence now suggests that

³ Erica L. Groshen and Simon Potter, "Has Structural Changes Contributed to a Jobless Recovery?," *Current Issues in Economics and Finance*, Federal Reserve Bank of New York, 9-8 (2003) (http://www.newyorkfed.org/research/current_issues/ci9-8.html).

cheaper communications costs and increasing IT skills abroad enable the offshoring of some services. Many U.S. call centers, for example, are now located in countries like India that have a highly skilled, English-speaking labor pool. Although there are widely ranging private estimates of this phenomenon, hard statistical evidence is lacking.

U.S. foreign direct investment, which produces jobs in other countries, is part of a larger pattern of globalization. (Chapter 3.) The IT-producing sector, for example, is composed of firms that operate globally. The sector depends on a network of foreign affiliates to meet demand in both U.S. and foreign markets. It is clearly a vital and usually vibrant sector of the U.S. economy, yet it runs a large and increasing trade deficit.

Labor Productivity Growth and Firm Performance

A recent Bureau of Labor Statistics report indicates that overall layoffs peaked during 2001 and have since decreased. The current employment situation stems largely from slow job creation.⁴ Businesses are simply not hiring. One factor in businesses' ability to delay hiring and simultaneously increase output is the continued strong growth of labor productivity.

Labor productivity is the amount of output produced by the labor force in a period of time (e.g., one widget per worker per hour). For example, the labor productivity growth rate measures the increase in output achieved using the same number of workers over time (or a stable output achieved using fewer workers). The trend rate of labor productivity growth is also a key long-run measure of the improvement in people's standards of living.

Around 1995, the labor productivity growth rate accelerated (see Chapter 4, Figure 4.1). Economists are keenly interested in determining what caused this acceleration and whether this new, faster rate of labor productivity growth is sustainable. Insights into these questions are emerging as the research has expanded.

A growing body of evidence suggests that investment in and use of IT have played a role in the recent, strong labor productivity growth. Analysis in Chapter 4 shows that U.S. industries that have invested relatively more in IT equipment contribute more to productivity growth than those that are less IT-intensive in their investments.

In addition, since the mid-1990s, popular consensus has held that businesses that invest in IT are more productive and perform better than businesses that do not invest in IT. Economists, however, have argued that simply purchasing IT will not necessarily yield benefits; additional investments, such as the reorganization of workflow and re-training the labor force are also necessary.

To understand more clearly the role of IT in this phenomenon, we need a clearer understanding

⁴ U.S. Department of Labor, Bureau of Labor Statistics, *New Quarterly Data on Business Employment Dynamics from BLS* (Washington, DC, 30 Sept. 2003) (<http://www.bls.gov/news.release/cewbd.toc.htm>).

of how IT is being used within businesses. New micro-level research indicates that IT investments do contribute positively to firm performance in many, but not all, settings. They do so, however, in tandem with many other factors, such as firm ownership structure, management practices, worker training, and willingness to innovate. (Chapter 5.)

IT Continues to Transform the Economy

The lingering questions about long-term economic change and the difficulties that the IT-producing sector has faced since 2000 should not be confused with a decline in the importance of IT in the economy *today*. IT producers invest intensively in research and development (Chapter 1) and those investments have yielded dramatic advances in data processing, storage, and transmission capabilities. These IT-related innovations have and are diffusing through the U.S. economy in computers, communications equipment, software, and other products. Use of these technologies is transforming many aspects of our economy, our society, and our day-to-day lives.

Many of today's most important life sciences discoveries, such as the mapping of the human genome, can be traced back to the use of computers to process enormous quantities of data. The intersection of traditional life sciences with IT-enabled data processing capabilities has, in fact, spawned new fields, such as bioinformatics. This field is notable for the increasing number of collaborations between life science and IT researchers that seek to advance the frontier of IT capabilities in the interest of advancing life sciences research and development. (Chapter 6.)

Even in fields less closely wedded to IT capabilities, IT is widely used. For example, many businesses rely on IT equipment to support a substantial share of their transactions. In 2001, e-commerce shipments accounted for \$725 billion or 18.3 percent of manufacturers' shipments (i.e., the businesses relied on computer networks for the exchange of shipping and purchasing data). Similarly, in 2001, e-commerce sales represented 10 percent of sales by merchant wholesalers.⁵

Individuals rely on these technologies as well. Over 60 percent of the U.S. population uses computers and over 50 percent of the U.S. population uses the Internet at home, work, or both.⁶

Like any new technology, the capabilities made possible by IT are accompanied by challenges that must be resolved in order to fully realize its benefits. (Chapter 7.) As individuals, we are now able to access a vast amount of data. However, many issues remain with regard to searching, archiving, and controlling or limiting access to certain information. New management challenges accompany new means of interaction, such as e-commerce and e-business processes (e.g., business-to-business data exchange). And, finally, issues related to identity—from identity theft to privacy and rights to anonymity—intersect with almost all IT capabilities.

⁵ U.S. Bureau of the Census, *E-commerce 2001 Highlights*, 19 March 2003 (<http://www.census.gov/eos/www/papers/2001/2001estatstext.pdf>).

⁶ U.S. Department of Commerce, *A Nation Online, How Americans Are Expanding Their Use of the Internet*, Feb. 2002 (<http://www.ntia.doc.gov/ntiahome/dn/index.html>).

