Measuring the New Economy

By J. Steven Landefeld and Barbara M. Fraumeni

THE "new economy" and the favorable economic conditions accompanying it have been the subject of considerable attention in the media, on Wall Street, among economists, at central banks, and in government agencies. Although some seem to take it on faith that there is a permanent change in the economy powering the strong performance of the U.S. economy over the last 5 years, many question this view and are scouring economic statistics for evidence on the importance of this new economy to economic performance and whether there really has been a fundamental and lasting change in the structure of the economy. This concern has been accentuated by the recent slowdown in the economy, leading many to ask if the change was simply cyclical; while others have speculated on the impact of just-in-time inventories and other aspects of the new economy on the depth and length of a possible downturn.

This paper provides background information on the new economy and how it relates to BEA's economic accounts. It is designed to answer the following questions:

- What structural changes have occurred that define the new economy?
- Why is it important that these changes in the economy be captured in gross domestic product (GDP) and BEA's other economic accounts estimates?
- What do we know now about the size and impact of these changes on the economy?
- Where does the new economy show up in the accounts?
- How well are the new aspects of the economy recorded in the accounts?
- What should be BEA's highest priority in improving the capacity of the accounts to measure the new changes in the economy?

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What is the new economy?

Many have hypothesized that we are in a new economy that is the product of various structural changes occurring in the last two decades and that has contributed to the recent improvement in economic performance. The expansion that began in 1991 is characterized by unprecedented length, strong growth in real GDP and real GDP per capita, a pickup in productivity, higher profitability, higher rates of investment, low inflation, low unemployment, and a somewhat more equitable distribution of the gains in income (charts 1–6).

The forces behind these changes include the effect of globalization and increased international competition on labor and management practices and the resulting reductions in costs and improvements in efficiency associated with these changes. But most prominently, the new economy is associated with the impact of technological innovation over the last several decades that appears to have begun to bear fruit by the mid-1990's. These include the impact of sharply lower prices and increased efficiency in computers, cell phones, and the Internet; a host of other new goods and services, innovation in financial markets, and new methods of payment; and reductions in costs and improvements in quality and efficiency associated with the use of these technologically based changes in other goods and services.

The new economy has been described by the media in such exuberant terms as the Internet age, the information technology (IT) revolution, and the digital economy. Estimates of the importance of the new economy vary widely, and a cottage industry seems to have sprung up in estimating the size of the high-tech economy and its impact on growth, productivity, and other aspects of economic activity—including exports, investment, and retail sales. The wide variations in such estimates stem from the absence of common definitions for the new economy or its subcomponents—including high-tech products, IT goods and services, E-business, business-to-business E-commerce, and retail E-commerce.

Why is it important?

Among the central questions being asked about the new economy are: Is it real, or is it an illusion of measurement?; Does it represent a fundamental and lasting change in the structure of the economy, or is it the result of a number of temporary phenomena?; Can we accurately measure the new economy? The answers to these questions are important because if it is real, structural, and likely to last, then there are major implications for:

- Tax and spending projections;
- The funding and allocation of Federal and State and local programs;
- Technology policy; regulations, laws, and tax rules affecting saving; investment in physical and human capital, R&D, financial markets, and the Internet;

CHART 1

Growth Rate of Real GDP Per Capita

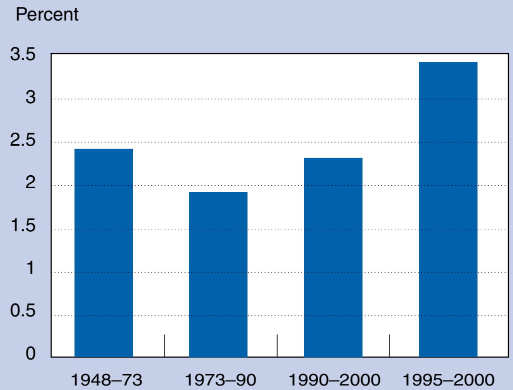

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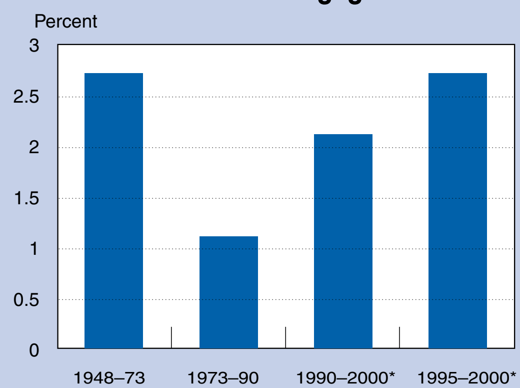
CHART 2

Growth Rate of Real Gross Business Product Per Person Engaged



Data: U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics
*Estimates for per person engaged in production for the year 2000 is extrapolated based on the number of employees on nonfarm payrolls and on total civilian employment.

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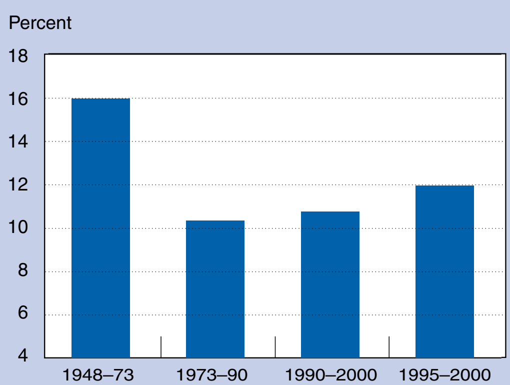
CHART 3

Average Profit Margin



Note.–Estimates of the profit margin for the year 2000 are based on averages of the estimates for the first, second, and third quarters for corporate profits with inventory valuation and capital consumption adjustments (unit profits from current production) and for price per unit of real gross product of nonfinancial corporate business.

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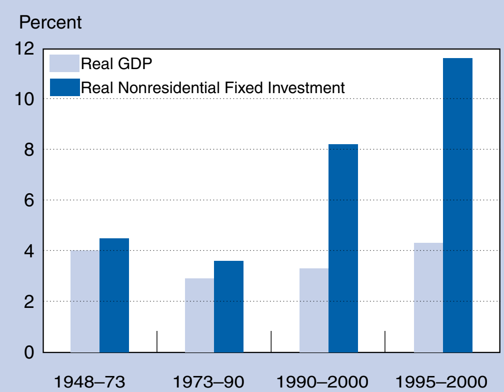
CHART 4

Growth Rate of Real GDP and Real Nonresidential Fixed Investment



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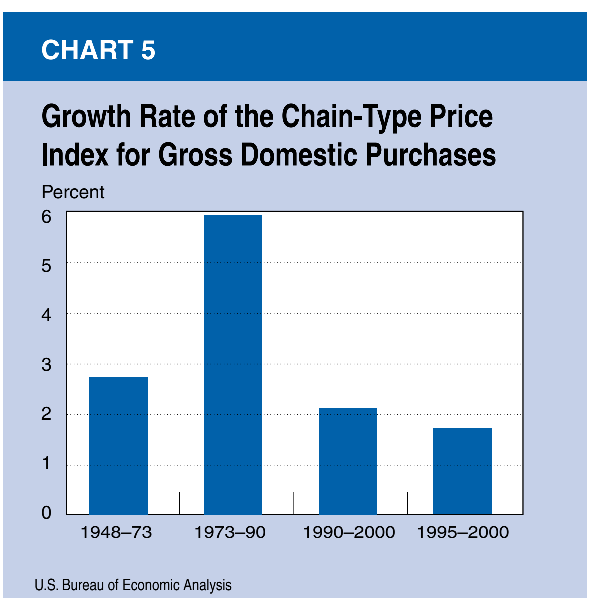
- Understanding of long-term growth and productivity.

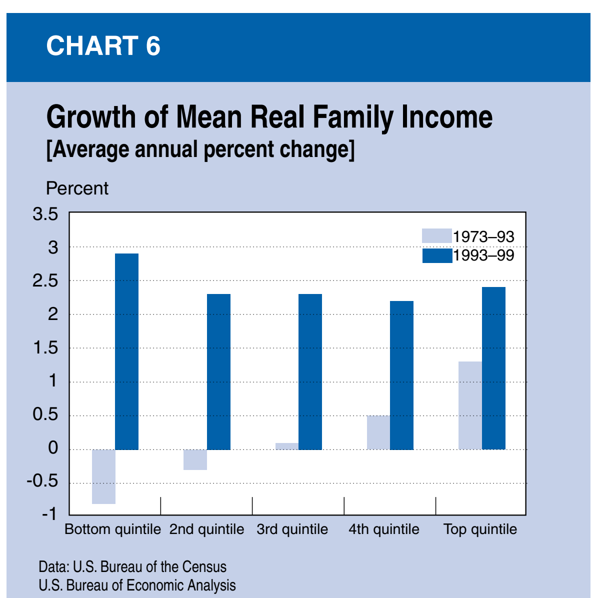
Conversely, if the new economy isn't real and isn't likely to last, there are major implications for Federal budget projections. According to the Office of Management and Budget, a sustained 1-percent decrease in real GDP growth could lower the projected surplus over the usual 5-year planning horizon (2001–05) by as much as $518 billion, from $965 billion to $447 billion. Similarly, a 1-percent decrease in long-term real GDP growth could raise the long-term Social Security deficit (in 2025) by two-thirds. As Chairman Greenspan has pointed out, such large uncertainty about the ability to sustain growth and about the likely long-term growth rate has—or should have—a large impact on current debates and proposals regarding tax cuts and spending. Undoubtedly, it also has an impact on the conduct of monetary policy (see the next section on the uncertainty and problems in capturing the impact of the new economy on GDP).

Changes in the economy can have a significant, variable, and sometimes distorting impact on BEA's measures of economic activity across different geographic areas and regions (see the next section). It is critical that BEA's regional estimates be as accurate as possible because they are used to allocate over $120 billion in funds for programs ranging from Medicaid to Appalachian Development Assistance to State and local governments. Seventeen large States that account for almost half the U.S. population are required by statute or State constitution to use BEA's regional income and product data in establishing limits for tax receipts and expenditures. In addition to the mandatory use of BEA data by these States, almost all the States use BEA data in their tax projections, infrastructure planning, and allocation of funds to counties.

Accurate and up-to-date measurement of the economy is essential to providing an objective baseline for assessing the effects of a wide range of policies, regulations, laws, and tax rules; for assessing the relative contributions of various factors to economic growth; and for assessing the means by which technology is transmitted and appropriated by various industries. For example, one of the major issues highlighted by recent studies is the impact on economic growth of innovations in the computer, software, and telecommunications industries and in other high-tech industries. In particular, do the benefits extend beyond the computer, software, and telecommunications industries making the new technology? Are there spillover effects to industries using the new technologies beyond those associated with direct returns from increased investment in these technologies?

Other issues relate to changes in the form of compensation and profitability of new technologies. That is, how are tax policies and changes in tax policies affecting, or likely to affect, the use of stock options? How widespread is the use of stock options? Are stock options moderating wage de-





mands? What is the impact of changes in equity values on household consumption and saving behavior?

What do we know now about the size and impact of the new economy?

Recent press attention has focused on the E-business aspects of the new economy. Two estimates released in recent years illustrate the range of estimates on the size of Internet business. One of the first comprehensive estimates of the E-business sector was provided by a study by the University of Texas at Austin that was funded by Cisco Systems, the largest manufacturer of routers and other networking hardware and software. Based on data collected from 2,830 firms, total sales by the "Internet economy" were initially estimated at $331 billion in 1998, which was then adjusted down to $301 billion; this 9-percent downward adjustment was for double-counted sales between the Internet layers (column 1, table 1). For many purposes, such a sales-based estimate may be appropriate. However, in order to compare the size of this estimate, or its growth rate, with GDP (rather than total sales in the economy), it must be adjusted to reflect intermediate sales to all firms and not just the intercompany sales between these Internet economy firms. Table 1 illustrates what the impact might be on the Texas Internet economy estimates of counting just final sales. Although the match between the firms reporting in the University of Texas study and the 1996 input-output (I-O) categories is somewhat arbitrary, sorting the types of companies in each of the Internet layers used in the study into relevant 1996 I-O categories, shows (column 2, table 1) the high proportion of intermediate sales relative to final sales for these firms (or gross output, in I-O terminology). Weighting by gross output from the Cisco study produces an overall contribution to GDP of $159 billion. Thus, an adjustment for intermediate product results in a total that is roughly 1.8 percent of GDP, rather than the 3.8 percent implied by the $331 billion Internet economy sales figure.

Table 1.—Estimates of the Internet Economy

[Adjusted to GDP concepts]

Layer	Description	Estimates for 1998		
		Estimated Internet revenues [1] (billions)	GDP share [2]	Contribution to GDP [3] (billions)
One	Internet infrastructure	115.0	0.37	43.1
Two	Internet applications	56.3	.60	34.0
Three	Internet intermediary	58.2	.18	10.3
Four	Internet commerce	101.9	.70	71.4
	Total	331.4	....	158.8

1. Values are from text and table in Whinston (1999).
2. GDP shares are calculated by BEA from the 1996 annual input-output accounts. For each layer, commodities were selected from the 1996 input-output accounts and an average share of the final expenditure of the commodities to GDP was calculated.
3. The share of the Internet revenues in GDP is calculated by BEA as Internet revenues times the GDP share.

The second recent set of estimates of the size of the Internet economy is the estimate of retail Internet sales by the Bureau of the Census. This estimate was based on a supplemental question on the Census Bureau's retail survey, which measures sales of goods from businesses directly to consumers, whether through brick and mortar outlets or by mail order, phone, or Internet. It does not include sales of services to consumers. According to this estimate, 1.01 percent of retail sales are E-commerce sales.[1]

The estimates, particularly the Census Bureau's estimates, provide important insight into various aspects of the new economy, but a comprehensive examination of the major issues requires further information on the overall volume of E-business, as well as its impact on GDP, across products, industries, and regions, and on incomes and prices. In a budget proposal now before the U.S. Congress, BEA is proposing a comprehensive measure of E-business and high-tech that would measure the new economy in a comprehensive and consistent fashion through the lens of BEA's national, industry, international, and regional accounts.

However, absent such E-business measures, researchers have attempted to measure the impact of the new economy using existing BEA estimates—mainly information from BEA's national income and product account (NIPA) estimates, its wealth accounts, its international transactions accounts, and its I-O and GDP-by-industry accounts—supplemented with other information and estimates from the Bureau of Labor Statistics (BLS), the Census Bureau, and other sources.

The simplest estimates of the impact of changes in the economy are those that compute the contribution of high-tech goods and services to real GDP growth and to inflation as measured by the chain-price index for gross domestic purchases. The difficulties with this approach include the computational complexities of estimating contributions to growth in Fisher chain indexes, the lack of detailed product categories for high-tech goods and services, and the absence of measures of the impact of the IT revolution on the non-high-tech

1. Table 1 of a recent paper by Fraumeni (2001) provides a range of estimates and forecasts for business-to-business and business-to-consumer E-commerce.

goods and services that are included in the final demand measure of GDP. As a result of these limitations, product-side measures focus on the direct contribution of broad groupings of high-tech goods and services included in GDP—such as computers, peripherals, and software—but do not capture the indirect contribution. These include the impact of computers and software used in designing, ordering, and manufacturing on the price (and output) of clothing, furniture, and other goods and services. Nor does it capture the relatively low-tech goods not included in broader high-tech categories or the high-tech goods included in low-tech categories. On the whole, such estimates of the impact of high-tech goods would seem to represent a lower bound estimate of the impact of the new economy. Based on BEA data, the direct contributions of high-tech products—such as computers, software, and telecommunications—to real GDP growth in 1995–2000 averaged 29 percent or 1.20 percentage point of the 4.1-percent growth in real GDP (table 2).

Because of the limited nature of this "product-side" approach, other researchers interested in the impact of technical change—including Corrado and Slifman (1999), Gullickson and Harper (2000), Jorgenson and Stiroh (2000), and Department of Commerce (1999)—have used GDP-by-industry and gross output-by-industry data to analyze technical change. Corrado and Slifman and Gullickson and Harper used this industry data to focus on the implausibly low and negative rates of output and productivity growth in IT-using service industries and the potential impact of measurement problems on real GDP and productivity growth. Corrado and Slifman used real GDP-by-industry data, which are value-added, income-side estimates of industries' contributions to real GDP and labor productivity. They show that if all industries with negative productivity growth instead had zero productivity growth, productivity growth would be raised by 0.3 percentage point per year over the 1977 to 1997 period. Gullickson and Harper and Jorgenson and Stiroh used Domar weights to calculate the contributions of industry gross output (final and intermediate output) on real GDP and on labor and multi-factor productivity. Gullickson and Harper estimate that if all industries with negative productivity growth had zero productivity growth, annual productivity growth would be raised 0.38 percentage point over the 1977 to 1997 period; Jorgenson and Stiroh, using similar gross output data and weights but somewhat different adjustments, find a somewhat smaller increase in multi-factor productivity growth of 0.22 percentage point. All of these estimates found that those broad groupings of industries that were most closely associated with high-tech—with the exception of high-tech using industries—had above-average productivity growth. It should also be noted that all but the Gullickson and Harper estimates were made using at least some pre-1999 benchmark data and thus would be larger using post-benchmark data.

The Department of Commerce industry estimates used Census Bureau sales and BEA GDP-by-industry data to produce more detailed industry breakdowns to better assess the impact of high-tech industries on real GDP and productivity growth. Based on these breakdowns, they estimated that high-tech industries accounted for more than one-third of real GDP growth in 1995–98.

Aggregate estimates by Gordon (1999), Whelan (2000), Macroeconomic Advisors (1999), Oliner and Sichel (2000), Jorgenson and Stiroh (2000), and others use variants of growth-accounting models to measure the direct contributions of high-tech to real GDP growth and the indirect contributions of high-tech to growth. The indirect contributions are measured by the capital services/rental value of investments in high-tech equipment. All of the authors find that the increase in trend growth in real GDP and productivity is

Table 2.—Final Sales of Computers, Software, and Telecommunications

	Contributions to real gross domestic product growth						
	1995	1996	1997	1998	1999	2000	Average 1995–00
Percent change at annual rate:							
Gross domestic product	**2.7**	**3.6**	**4.4**	**4.4**	**4.2**	**5.0**	**4.1**
Contributions in percentage points:							
Computers and software [1]	.62	.74	.90	.94	1.04	1.10	.89
Telecommunications services [2]	.10	.14	.11	.13	.14	.13	.13
Communication equipment [3]	.19	.15	.17	.10	.24	.25	.18
Total	.91	1.03	1.18	1.17	1.42	1.48	1.20
	Contributions to gross domestic purchases prices growth						
Percent change at annual rate:							
Gross domestic purchases prices	**2.2**	**1.8**	**1.6**	**0.8**	**1.6**	**2.4**	**1.7**
Contributions in percentage points:							
Computers and software [1]	–.24	–.44	–.45	–.53	–.44	–.18	–.38
Telecommunications services [2]	.00	.02	.03	.01	–.02	–.03	.00
Communication equipment [4]	–.05	–.05	–.03	–.05	–.07	–.08	–.06
Total	–.29	–.47	–.45	–.57	–.53	–.29	–.43

1. Includes computers, software, and audio and video products.
2. Includes cable TV and local and long distance telephone.
3. Includes PCE, GPDI, net exports, and government.
4. Includes PCE, GPDI, and government.

largely due to IT. Table 3 summarizes the computer hardware findings of all but Gordon, whose analysis emphasizes departures from the trend growth rate. In all cases, the 1996–98 or 1996–99 contribution of computer hardware is at least twice the contribution of the earlier period. Gordon's results suggest that the impact is mainly through the direct impact of high-tech products on GDP, rather than through an indirect effect. Jorgenson and Stiroh also do not find any empirical evidence of a significant indirect effect, but note that measurement difficulties may cloud the picture.

The most recent results are consistent with those of the previously cited studies. Nordhaus (2001c) and Baily and Lawrence (2001) find significant acceleration in productivity growth in both new economy and other sectors; Gordon (2001) finds less acceleration outside new economy sectors and continues to emphasize the cyclical effect. Nordhaus, in a series of papers, utilized BEA income-side GDP-by-industry data to examine productivity for 1996–98 for three aggregates: Total output, business sector output, and well-measured output. Regardless of the aggregate considered, the increase in labor productivity growth in the most recent period over the period 1978–95 was significant in both new economy and other sectors. Labor productivity growth in 1996–98 ranges from 1.2 percentage point to 2.1 percentage point. Use of income-side data during the second half of the 1990's raises output and productivity estimates; for example, Nordhaus' estimate of labor productivity growth in the business sector in 1996–98 is 0.65 percentage point higher than the comparable BLS product-side estimate. Baily and Lawrence and Gordon recently debated whether there is a new economy, both using the recently released BEA GDP-by-industry data through 1999. The Baily and Lawrence estimate of the post-1995 labor productivity revival at 1.43 percentage point is one-third higher than the Gordon estimate of 1.08 percentage point. Gordon attributes the differences to methodology, for example, use of income-side estimates instead of product-side estimates and employees in the denominator instead of hours, and the comparison for a shorter historical time period, but he agrees that there are remaining differences in their findings regarding the extent of the cyclical effect and the contribution of non-IT-producing sectors.[2]

Table 3.—Contribution of Computer Hardware to Annual Real Output or GDP Growth

Study	Previous period		Current period	
	Years covered	Annual real contribution	Years covered	Annual real contribution
Jorgenson and Stiroh (2000)	1991–95	.19	1996–99 1996–98	.49 .46
Macroeconomic Advisers (1999)	1994–95	.2–.3	1996–99 1996–98	.5–.7 .5–.6
Oliner and Sichel (2000)	1991–95	.25	1996–99 1996–98	.63 .59
Whelan (2000)	1990–95	.33	1996–98	.82

Sources: Jorgenson and Stiroh, table 2, page 143; estimates reflect the use of a broader definition of output than that used by the other researchers.
Macroeconomic Advisers, table 4, page 85; annual numbers based on conditional projections of growth in potential GDP.
Oliner and Sichel, table 3, page 31 for Oliner and Sichel and also for Whelan.

Where does the new economy show up in the accounts and how well is it recorded?

Gross Domestic Product:

Consumer spending.—The main impact of the new economy on consumer spending probably shows up in spending on computers and equipment, telecommunications services, software, and other high-tech goods. The accounts capture nominal spending on computers, peripherals, and software (NIPA table 2.6) fairly well. These products are deflated using hedonic indexes that adjust for the rapid technical change in those products.[3]

Nominal spending on telecommunications equipment and services—including Internet services—appears to be adequately covered, and BEA uses an index developed by Hausman (1999) to deflate cellular services, but there are other areas where the price indexes used for deflation do not fully capture the advances in quality, speed, convenience and the reductions in cost per minute associated with a number of communications products. Similarly, nominal spending on video and audio goods is relatively well represented, but the price indexes used are not hedonic indexes. However, recent research by Liegey and Shepler (1999) at BLS suggests that the use of a hedonic index for VCR's may have little impact.

The largest difficulties in measuring the impact of changes in the economy are probably in consumer spending for services. For both goods and services, the problem with the digital economy, including E-business, is that it is mainly business-to-business, or intermediate transactions, with only a small share of it, such as household payments to Internet service providers, showing up as final demand. As a result, if you want to know E-busi-

2. Elsewhere, such as in the 2001 *Economic Report of the President*, the Council of Economic Advisors used an average of the income-side and product-side estimates of labor productivity.

3. The consumption component of software is prepackaged software, which is deflated using a combination of hedonic and matched-model indexes through 1997 and the consumer price index for "computer software and accessories" thereafter.

nesses of high-tech's net effect—not just substitution of sales from brick and mortar retailers to E-business firms (and much of E-business is accounted for by brick and mortar firms)—you need to measure its impact on real final product and productivity. Are the prices of the consumer goods and services using E-business and high-tech falling, and are we seeing greater efficiencies, for example, increases in real output per unit of input in production? For goods, many of the efficiencies of the new economy are likely to be captured in the estimates. However, for services, the absence of adequate price data makes it difficult, if not impossible, for measures to reflect higher measured output and productivity arising from new technologies.

This is a significant problem because owing to the absence of price indexes 23 percent of GDP is measured using either physical inputs as extrapolators (mainly labor hours) or as input-cost indexes, which produce zero or low growth in labor productivity and often negative growth in multifactor productivity because of the rapid rate of growth in investment and capital stocks. Input-type deflation of personal consumption expenditures (PCE)—mainly of spending on services such as insurance, education, and medical care—alone represent 7 percent of GDP. Many of these services are major users of IT products and services. These include financial services such as insurance, as well as nonprofit hospitals, private education, and other services that are, or would be expected to be, beneficiaries of IT advances (table 4, table 5, table 6, and table 7). In addition to these categories of PCE and other components of GDP estimated using input or cost-based indexes, there are other components, such as brokerage services, where real output is estimated using partial output measures that probably do not capture improvements in service quality associated with IT innovations. As Jorgenson and Stiroh observed:

> Many of the goods and services produced using high-tech capital may not be adequately measured, as suggested in the already classic paper of Griliches (1994). This may help to explain the surprisingly low productivity growth in many of the high-tech intensive, service industries. If the official data are understating both real investment in high-tech assets and the real consumption of commodities produced from these assets, the under-estimation of U.S. economic performance may be far more serious than we have suggested. Only as the statistical agencies continue their slow progress towards improved data and implementation of state-of-the-art methodology will this murky picture become more transparent. (Jorgenson and Stiroh 2000, 186–187)

The last benchmark revision of the NIPA's made some progress on these issues through the replacement of a labor-hours extrapolator with a transactions-based measure of banking output and with the treatment of purchases of computer software as investment, both of which contributed to a 0.42-percentage-point upward revision in private nonfarm business real GDP over the 1992–98 period. While it is not clear that the introduction of

Table 4.—Use of Input Cost Deflators and Quantity Extrapolation and Percent Share of GDP in 1999

	Billions of dollars	Percent share
Gross domestic product	**9,299.2**	
Input-type deflation	**2,134.7**	**23**
Input-cost deflation	**1,289.0**	**14**
Input-based quantity extrapolation	**845.7**	**9**
Personal consumption expenditures	693.1	7
Input-cost deflation	693.1	7
Input-based quantity extrapolation		
Gross private domestic investment	330.7	4
Input-cost deflation	330.7	4
Input-based quantity extrapolation		
Net exports of goods and services	.0	0
Input-cost deflation		
Input-based quantity extrapolation		
Federal Government consumption expenditures and gross investment	325.9	4
Input-cost deflation	105.5	1
Input-based quantity extrapolation	220.4	2
State and local government consumption expenditures and gross investment	785.0	8
Input-cost deflation	159.7	2
Input-based quantity extrapolation	625.3	7
Addenda:		
Compensation of general government employees	844.5	9

Table 5.—Personal Consumption Expenditures and Gross Private Domestic Investment: Components Measured by Input Cost and Percent Share of GDP in 1999

	Billions of dollars	Percent share
Gross domestic product	**9,299.2**	
Components of personal consumption expenditures	**693.1**	**7.45**
Nonprofit hospitals	245.5	2.64
Expense of handling life insurance and pension plans	98.0	1.05
Labor unions	9.6	.10
Professional association expenses	5.1	.06
Clubs and fraternal organizations	15.8	.17
Religious and welfare activities	170.2	1.83
Education and research	148.9	1.60
Gross domestic product	**9,299.2**	
Components of gross private domestic investment	**330.7**	**3.56**
Components of nonresidential structures	237.8	2.56
Telecommunication	15.1	.16
Electric light and power	14.2	.15
Nonresidential buildings, excluding farm	204.0	2.19
Farm buildings	4.5	.05
Residential improvements	93.0	1.00

hedonic or other output-based deflators would produce similar increases in productivity growth in other poorly measured goods and services, if one assumes an increase in output similar to that in banking services for these industries, the growth rate of real GDP for private business could be increased by as much as 0.3 percentage point for the 1990–99 period.[4]

Medical services is another product affected by technology, but the effects are more complex. There have been significant improvements in the producer and consumer price indexes used in deflating several components of medical services, including public hospitals. These new BLS indexes track the price of treatment and presumably reflect the value of improvements in technology that reduce cost or the reduce the length of treatment. However, as pointed out by Shapiro and Wilcox (1997) in their study of cataract surgery, by Cutler, McClellan, and Newhouse (1999) in their study of heart attacks, and by Berndt, Busch, and Frank (1998) in their study of depression, there are significant benefits in terms of quality of life and length of life that are not reflected in these indexes.

The difficulty with measuring the economic value quality of life aspects of medical interventions is that in addition to the problems in objectively measuring the value of life, use of measures such as quality-adjusted life years from medical interventions would require an expansion of the production boundary for the accounts to include time-use and other willingness-to-pay estimates. This would be a useful exercise but one better suited to a set of satellite accounts. This would not be the case if the value was associated with a hedonic index that was based on market-clearing prices. However, the prevalence of third-party payments, physician-directed demand, administered prices, and other problems with medical markets suggest that the results of hedonic work may not represent the market value that consumers place on the various quality changes associated with advances in medical care.

Fixed investment.—The main impact of high-tech within investment is on computers, peripherals equipment, and software. While computers and peripheral equipment use hedonic indexes for all components, only approximately one-half of computer software uses such indexes. As noted above, prepackaged software is deflated with a hedonic index. However, in-house software is deflated with an input-cost index, and custom software is deflated with a price index that is a weighted average of the prepackaged index and a cost-based price index. Although advances in technology have undoubtedly affected a broad range of types of equipment and structures in a manner that is unlikely to be picked up by conventional price indexes, the largest probably relate to investments in telecommunications and imbedded chips and other technology embodied in equipment and structures. Other than switching equipment, there are no quality-adjusted indexes used for telecommunications. In addition to the evidence on cell phones, advances in telecommunications equip-

4. For a review of the impact of hedonic indexes currently used in measuring real GDP, see J. Steven Landefeld and Bruce T. Grimm, "A Note on the Impact of Hedonics on Real GDP," SURVEY OF CURRENT BUSINESS 80 (December 2000): 17–22.

Table 6.—Federal Government Consumption Expenditures and Gross Investment: Components Measured by Input Cost or Quantity Extrapolator and Percent Share of GDP in 1999

	Billions of dollars	Percent share
Gross domestic product	**9,299.2**	
Components of Federal Government	**325.9**	**3.50**
Input-cost deflation	**105.5**	**1.13**
Components of national defense installation support services	20.1	.22
National defense weapons support services	8.7	.09
National defense personnel support services	24.1	.26
Components of national defense "other services"	17.3	.19
National defense buildings, residential and industrial	1.9	.02
Components of nondefense "other services"	22.4	.24
Nondefense structures	11.0	.12
Input-based quantity extrapolation	**220.4**	**2.37**
National defense compensation of general government employees except own-account investment	133.2	1.43
Nondefense compensation of general government employees except own-account investment	87.2	.94

Table 7.—State and Local Government Consumption Expenditures and Gross Investment: Components Measured by Input Cost or Quantity Extrapolator and Percent Share of GDP in 1999

	Billions of dollars	Percent share
Gross domestic product	**9,299.2**	
Components of State and local	**785.0**	**8.44**
Input-cost deflation	**159.7**	**1.72**
Components of "other services"	2.2	.02
Residential buildings	4.3	.05
Educational buildings	38.3	.41
Hospital buildings	2.8	.03
Other buildings	24.4	.26
Highways and streets	53.6	.58
Conservation and development	2.3	.03
Sewer systems	10.3	.11
Water systems	7.4	.08
Other structures	10.5	.11
Net purchases of used structures	3.7	.04
Input-based quantity extrapolation	**625.3**	**6.73**
Compensation of general government employees, except own-account investment	624.1	6.71
Components of "other services"	1.2	.01

ment that significantly expand the carrying capacity of fiber optic cables suggest rapid declines in other areas of telecommunications. As Jorgenson and Stiroh note, if the price deflators currently used for the other components of telecommunications were replaced by indexes that showed moderate-to-rapid price declines, real product and productivity growth could be raised between 0.16 and 0.34 percentage points.

An interesting and related issue is the impact of the increasingly short-lived high-tech equipment and software on real GDP growth verses net domestic product (NDP) growth. NDP is often used as a measure of sustainable growth, in the sense that it subtracts depreciation from GDP to indicate the amount of current product/income that should be set aside for the using up of capital stock in production during the current period. Over the 1947–73 period, both real GDP and real NPD grew at an annual rate of 4.0 percent. In contrast, with a pickup in investment and shorter lived investment, including software, over the 1973–2000 period, real GDP grew 3.1 percent, verses 2.8 percent for NDP, and over the 1995–2000 period, real GDP grew 4.3 percent, verses 4.0 percent for NDP. This is important because as Gordon has pointed out, continuation of the current pickup in real GDP and productivity growth may require sustained high rates of real investment.[5]

Inventory investment.—Although advances in technology have been essential to "just-in-time" inventory-control methods, to increased direct sale by manufacturers to the public, to the use of courier services, and to other changes in the distribution system, most of these will be captured by the existing data-collection system. One area where changes are not well captured is the inventories of "nonmerchant" wholesalers. These are essentially non-brick-and-mortar wholesalers that do not take physical possession of goods and essentially act as agents or intermediaries who put together buyers and sellers and arrange for shipment, temporary storage, financing, and billing. In some respects, the Internet may be reducing use of these intermediaries, but in other respects, it may be increasing them. Unfortunately, information on these intermediaries is collected only once every 5 years in the quinquennial census.

Exports and imports.—The largest impacts of high-tech and E-business are likely to be in low-value exports of computers, peripherals, software, semiconductors, and aircraft. Further enhancements in price indexes for software and communications equipment will probably raise the measured impact of high-tech on trade in goods, as will replacement of cost-based deflators for services trade components.

The largest impact, however, may be omitted from the estimates. According to the Census Bureau, total exports may be underestimated by between 3 and 7 percent. A significant share of this understatement may be in low-value exports, which are exempt from direct reporting and are indirectly estimated using out-of-date information. The increase in direct transactions between overseas customers and U.S. companies associated with globalization and the IT revolution has presumably contributed to the undercount of exports.

Government.—The largest impact of IT in government shows up in purchases of computer equipment and software and of telecommunications equipment, which are treated symmetrically with consumer spending and private investment for these products. The overall impact of IT on government, however, is limited by the long-standing national accounts treatment of real output by government. Government output is measured by costs, and real output for a significant share of government is extrapolated by employee hours. Investment and other expenditures for goods and services are deflated by output price indexes, but for high-tech military and other noncomputer hardware, hedonic indexes are not employed. The services of government capital are partial cost-based estimates that use the value of depreciation to estimate the rental value of the capital rather than depreciation plus an imputed return to the asset (a treatment that BEA hopes to address in the future).

IT and other technological innovations, therefore, will show up in measured government output and real GDP through a) government investment in computers and other high-tech equipment; b) government purchases of goods; c) government's use of banking and other services not extrapolated by inputs or cost indexes; and d) the depreciation on high-tech equipment that it owns. However, for the 12 percent of government output measured by

5. High rates of real investment will be required if, as Gordon suggests, most of the pickup is attributable to the increased rate of real investment in IT. However, if—as suggested above—the contribution to real GDP growth by IT-using industries is understated because of measurement problems, then higher real GDP growth—appropriately measured—might be possible with a lower rate of investment. Alternatively, if there is a lagged increase in productivity from the IT investment, higher real GDP growth may be possible, at least in the intermediate term, even if the rate of investment slows.

either output extrapolated using employee hours or purchased real services estimated by input extrapolation of cost deflation, there will be no increase in measured output from IT. In addition, to the extent that the full service value of government IT assets exceeds the depreciation on those assets, the capital services of government IT assets will be understated (which, based on Jorgenson and Stiroh and other estimates, is likely to be large).

Gross Domestic Income:

Compensation of employees.—A significant share of the compensation paid by high-tech companies is in difficult to measure components of national (and personal) income. BEA's estimates of wages and salaries for the monthly and quarterly NIPA estimates of personal income are mainly based on the BLS monthly payroll survey of employers. Although the monthly survey collects employment data on all employees, the information on wages and salaries is collected only for production and nonsupervisory workers, thereby omitting nearly 50 percent of employee compensation. BEA estimates the wages and salaries of nonproduction and supervisory workers for its quarterly estimates, as well as bonuses, stock options, and other irregular forms of compensation. However, the volatility of some of these components makes estimation difficult, and there are often significant revisions when complete data on wages and salaries from the unemployment insurance system become available and are incorporated in the annual and benchmark revisions of the NIPA's.

In addition to the absence of current data on wages and salaries for many of the professional and supervisory workers in the high-tech industries, the reporting of bonuses, stock options, and other forms of compensation appears to be quite uneven across and within States in the unemployment insurance (UI) data. Although coverage in the UI reports is quite comprehensive, one of the difficulties with the data is that they are collected for purposes of administering the UI system. Thus, while employers are usually instructed to report total wages (including gross wages and salaries, bonuses, and stock options), employers only pay UI taxes on the first $7,000 of employee wages in most States. As a result, the accuracy of the data on total wages may not be as great as it would be if the entire amount were taxable. Also, the requirements for reporting stock options, 401k plans, and other income are based on State law rather than on Federal law. However, it is likely—given the incentives for employers to report total wages from all sources and the UI reporting instructions—that most stock options and bonuses are usually included.

There are two ways stock options can overstate BEA estimates of income earned in the current period from production. First, if the stock options are nonqualified options, which are the majority of employee stock options, they are taxable under Federal law and should be included in employees reported income; they are deductible expenses for employers and hence will be deducted from profits for tax purposes, but they do not have to be deducted from profits reported on financial reports to stockholders. Although the exercise of stock options may overstate income earned in the current period from production activities, there is an offsetting reduction in profits as firms deduct the cost of these options. A problem arises, however, because—as noted above—UI estimates of total wages may contain most if not all of the exercised stock options in the current period, but firms may have an incentive to boost reported profits to stockholders by not deducting exercised stock options from quarterly profit reports (although they most certainly deduct them from IRS profits). As a result, there may be no offsetting deduction in profits until BEA replaces the profits reported on financial reports with IRS data, which normally occurs with a lag of 2 years.

Second, if the stock options are qualified options, they are not taxable as ordinary income (but are taxable as capital gains), should not be included in employees' reported incomes, and cannot be deducted from profits for tax purposes. The problem is that if all labor income (including both qualified and nonqualified stock options) is included in total wages, there will be no offsetting reduction in profits, either in the current period or when IRS data become available.

This latter phenomenon may help explain the increasing gap in recent years between adjusted gross income (AGI) for wage and salary income as reported to the IRS and BEA estimates of wage and salary income adjusted to the IRS definition (chart 7). The AGI gap as a share of BEA wages and salaries, which had reached a postwar low of 1.0 percent in 1982, began rising along with the stock market in the late 1980's and reached a postwar high of 5.5 percent in 1998, the most recent year for which IRS data are available.

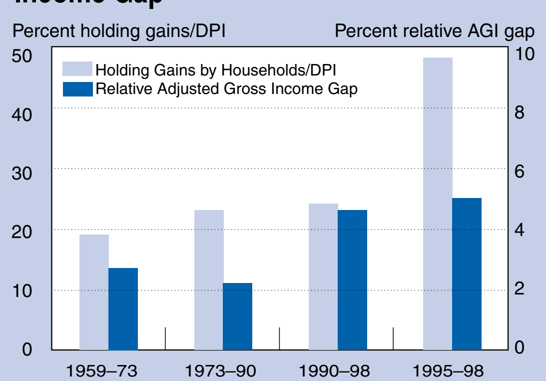
Finally, there is the broader issue that companies and stockholders may "accept" operating losses, or below-normal returns on tax-reported profits if they are making large capital gains. As a result, rates of return to capital and wages during a period of large capital gains may be a misleading measure of “sustainable” wages (wage pressure) and profits.

Profits.—Profits have always been one of the most difficult components of national income to measure, and the high-tech, E-business world of stock options, capital gains, mergers and acquisitions, intellectual property, writeoffs, and changing tax laws just makes it that much more difficult. BEA’s goal is to measure operating profits, or what we call profits from current production. BEA must therefore adjust reported profits to exclude capital gains and losses, restate profits to reflect economic depreciation rather than accelerated-tax depreciation or historical-cost depreciation, capitalize and depreciate various items that are expensed, and adjust for misreporting to tax authorities. The upward spiral in high-tech and other stocks and the associated pressure to report strong profits has, along with financial innovation, made the interpretation and adjustment of profits more difficult.

For financial reports, the focus on growth in profits may cause an upward bias in profits reported to stockholders, but there is clearly an incentive for firms to minimize profits reported to the IRS and hence taxes paid to the IRS. The key questions are whether this differential has gotten larger and how well BEA has been able to keep up in adjusting for this differential. One example of the changing dynamics is the treatment of the substantial capital gains earned by firms in the 1990's. Large corporations can face a 3-percentage-point higher tax rate on operating profits than on capital gains and thus have an incentive to shift as many costs as possible to operations and to shift operating profits to capital gains. On the other hand, changes in tax laws and the resurgence in income from foreign subsidiaries of U.S. corporations appear to have contributed to an overstatement of domestic income in the NIPA estimates, though this may have been addressed in the recent NIPA benchmark. The net result of these forces is unclear.

CHART 7

Holding Gains and Adjusted Gross Income Gap



Data: U.S. Board of Governors of the Federal Reserve System
U.S. Bureau of Economic Analysis

Proprietors’ income.—BEA estimates proprietors’ income using IRS data adjusted for misreporting adjustments. Estimates for the current period are extrapolated using indicators of activity, such as the value of new construction put in place and judgmental extrapolation. Such income is consistently underreported to the IRS. In 1988, the date of the last taxpayer compliance measurement program estimates (before the program—popularly known as the “tax audits from hell”—was eliminated by the Congress), proprietors’ actual income was estimated to be more than twice as large as that reported to the IRS. Since then, it is difficult to know what has happened in terms of compliance. Increased use of computers and recording of transactions from the video store to the local restaurant suggests better compliance in the retail sector, whereas higher tax rates, which result in a somewhat higher return to noncompliance, suggest worse compliance. Although little is known about changes in taxpayer compliance by entrepreneurs over the last decade, the problem appears to have gotten somewhat smaller, largely because of a slight decline in self-employed persons during this expansion. This experience is contrary to the experience in the 1970’s and 1980’s expansions when self-employment rose. This falling self-employment may be associated with the increasing use of S-corporations. Form 1040 data show net income of S-corporations increasing from $7.6 billion in 1987 to $100.7 billion in 1997.

Rental income, dividends, interest, and other property income.—Aside from the licensing and leasing of computer software and other intellectual property, which should be picked up in the source data, there are no major or obvious new economy measurement issues related to these types of income. To the extent the new economy is raising productivity and increasing wealth and returns to wealth, these types of income will be affected as follows: Higher productivity of capital raises the returns to capital, but it also lowers inflation and the nominal return to capital; and increased wealth and returns to wealth raise these types of income, but the tax structure and the focus on capital gains may act to lower dividends.

On net, the new economy is likely to exacerbate the tendency for BEA, as Boskin pointed out in his recent paper on the NIPA's (Boskin 2000), to underestimate the size and strength of growth both in nominal GDP and gross domestic income (GDI) by a small but persistent margin. This tendency probably relates to the fact that BEA concepts, estimating methods, and source data tend to lag somewhat in adapting to changes in the structure of the economy, including new suppliers, changes in sources of demand, technical change, changes in business and accounting practices, changes in the prices and characteristics of products, and changes in tax laws affecting the source data. BEA has worked hard to adapt to changes in the economy and is proud of its record in updating the accounts, but the time and resources necessary to develop new surveys, new methodologies, and new classification systems—and the need to develop a consensus regarding these changes—make it difficult to appreciably accelerate this process. The increased rate of change and growth in the new economy just make the task that much more difficult.

Wealth Stocks:

The IT revolution has raised the productivity, rate of return, and value of capital investments; raised the rate of investment in the economy; and dramatically increased the net worth of households. The increase in the value of tangible wealth associated with the new economy shows up in the form of increases in the overall size of the capital stock. The declining prices of computers and other equipment and their short service lives have meant that the largest impact on net stocks of capital equipment is through the increased rate of investment and hence an increased (albeit less dramatic) rate of growth in the capital stock for nonresidential equipment and software from 3.9 percent in 1973–92 to 5.4 percent in 1992–99. The real rate of increase in investment is probably somewhat understated because of the absence of quality-adjusted price indexes for investment in certain types of telecommunications and other high-tech equipment.

The rise in household wealth associated with the new economy is unprecedented. Led by IT company stocks, household net worth has more than doubled in the 1990's, increasing from $20.6 trillion in 1990 to $42.0 trillion in 1999. According to the Federal Reserve Board's balance sheets, nominal holding gains, primarily related to changes in stock prices, increased household net worth $1,099.2 billion in 1991, or one-fourth of disposable personal income (DPI). These gains relative to DPI particularly rose during the second half of the 1990's (chart 7). In 1999, these gains increased household net worth by $4,447.9 billion, an amount equal to two-thirds of DPI. If these gains are compared with personal saving, the potential impact of the wealth effect is even more dramatic. The ratio of nominal holding gains to NIPA personal saving grew from a negative in 1991 to 28½ in 1999, dwarfing the post-World War II high of 8½ in 1947.[6] The ratio of nominal holding gains to DPI in 1999 is the highest since this measure became available in 1946.

These large gains along with steady growth in income and high levels of consumer confidence have contributed to a decline in personal savings that began in the 1980's and accelerated in the 1990's (chart 8). The NIPA personal saving rate declined to –0.8 percent in the fourth quarter of 2000, the lowest rate since 1933. This phenomenon has put renewed attention on the wealth effect and the importance of looking at both financial and tangible wealth in an integrated fashion. BEA has begun work on developing an integrated set of income and wealth accounts for the household and nonprofit sector that should address the need for an integrated picture of household saving and wealth.

The new economy has also focused attention on the importance of intangibles. In addition to the computer software that BEA capitalized in the last benchmark revision, there is renewed interest in measures of the stock of R&D capital, the returns to investment in R&D capital, and the cross-industry effects of such investment. BEA developed prototype estimates of R&D capital in 1994 but has not been able to update or expand that earlier effort. The Office of Management and Budget, however, as part of their efforts to encourage construction of a national balance sheet, has updated and maintained a set of estimates of real R&D capital that show growth at an annual rate of 3.5 percent since 1990; in 1999, these estimates would add roughly 8 percent to the stock of fixed

6. The increases in the value of asset holdings may not result in increases in consumer spending in the same period that the value increases, because the increases may not be realized in that period and because the gains may not be spent in the same period they are realized. Comprehensive data on "realizations" of asset gains are not available, but it is likely that the gains realized in 1997 reflected value increases in earlier periods as well as in 1997.

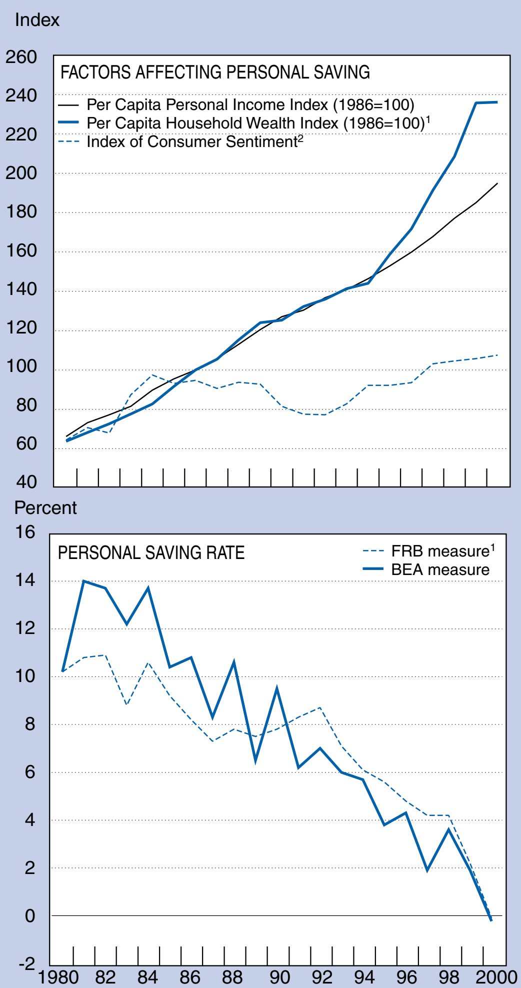
assets in BEA's estimates of tangible wealth.

Personal Income and Saving:

Many of the new economy issues raised with respect to the NIPA's also carry through to the personal income, expenditures, and saving estimates. These include the impact of the statistical discrepancy on personal saving, which is the residual between personal income and spending, the measurement and treatment of capital gains, and the need to measure personal saving out of current income in the context of an integrated set of income and wealth accounts. Finally, there are issues specific to personal income and saving, including the treatment of capital gains taxes as a transaction tax that is deducted in computing DPI (rather than as a capital transfer tax, such as inheritance taxes, that is not deducted from personal income).

CHART 8

Perspectives on Personal Saving



Note.—The estimates of the Federal Reserve Board's measures of household wealth and the personal saving rate for the year 2000 are averages of the estimates for the first, second, and third quarters.
1. U.S. Board of Governors of the Federal Reserve System
2. University of Michigan's Survey Research Center

U.S. Bureau of Economic Analysis

Regional Income:

Although the regional accounts must face many of the same issues confronting the NIPA's, the major new economy issue for the regional accounts is the further weakening of the physical links between consumers and the location of production, workers and the location of production, and pensions and the location of production. Much of the source data used in the regional accounts, such as sales and earnings (including pensions), are based on the physical location of business firms. To the extent that the Internet age increases the volume and lowers the cost of on-line shopping, banking, investment trading, and E-mail communications, it increases the mobility of the population and makes BEA's task of allocating pension and other earnings across the Nation more difficult. Also, to the extent that the increase in household net worth is a result of the new economy, the new economy hastens retirement and therefore will accelerate and exacerbate the measurement problems associated with the retirement of baby-boomers.

Input-Output Accounts:

In terms of completeness of information, the I-O accounts are the place one should look to examine changes in the structure of the economy. With data on nearly 500 industries at the I-O six-digit level, the I-O accounts provide a much more detailed look at high-tech goods and services than the relatively broad final demand categories in GDP or the two- and three-digit industry categories in BEA's GDP-by-industry or gross output-by-industry estimates. The industries in the GDP and gross output estimates are so broad that many contain a mix of high-tech and low-tech industries that may make interpretation difficult.

The I-O accounts can provide useful information on the new economy in that they provide a means of measuring the impact of shifts in final demand associated with technology, the effect of changes in technology on intermediate purchases as well as on final demand, and the effect of technology on incomes. When paired with BEA's regional accounts, they can also provide information on the effect of technology across States and regions of the country.

The drawback in using the benchmark and the annual I-O accounts is the lag in availability of current data. The benchmark U.S. I-O accounts are based on the quinquennial economic censuses and are produced within 5 years after the reference year (BEA's 1992 I-O accounts were released in 1997). The lag in production has been reduced from 9 years to 5 years through estimation of still-to-be-released source data. The reestablished annual I-O tables (BEA's 1997 I-O accounts were released in late 2000) can answer a number of questions about the new economy. They can tell us about changes in input use, but only to the extent that they involve shifts in final demand for goods and services with a different mix of input requirements. (At the detailed level, the technical coefficients still reflect 1992 I-O relationships.)

For example, to the extent that changes in the new economy are reflected in components of final demand, such as the impact of direct sales to consumers on wholesale inventories and the associated increase in deliveries to consumers by couriers, the impact on other industries and commodities can be assessed using the 1997 I-O tables. What will not be captured are changes such as the reduction in the use of wiring harnesses and other gauges in automobile production as a result of the use of microchips.

In this context, the I-O tables can also be quite helpful in trying to trace through the impact of shifts in final demand associated with technological innovations or to estimate the likely impact, or pass-through, of technologically based cost savings in an industry on the users of its products. Another use suggested by Scherer (1984) is to use an augmented set of I-O accounts to estimate the upstream returns to R&D in an industry.

GDP and Gross Output by Industry:

Because much of E-business and other IT innovations affect business-to-business transactions, or intermediate product, BEA's gross output measures of industry production are quite important in assessing the cross-industry impact of the new economy. This is because gross output reflects the effects of both intermediate inputs and value-added—gross product—inputs on industry production. The largest impact of the new economy on industry output and productivity, as measured using either the published BEA gross output data or its close relative the BLS sectoral output data, is in durable-goods manufacturing, mainly in computers with contributions from other manufacturing industries that appear to be either producers of other high-tech equipment or users of computers and other high-tech equipment. Another industry that is affected substantially is trade, mainly wholesale trade, which may be a beneficiary—directly or indirectly—of computer and other innovations in purchasing, inventory control, and distribution systems.[7] However, as a number of researchers have pointed out, the construction and service industries show low-to-negative contributions to multi-factor productivity growth. As noted above, this is in great part due to the use of either input extrapolators or input-cost deflators in measuring output. Indeed, many of these industries—if measured using output price deflators—would be expected to show a significant contribution to multi-factor productivity growth. Construction is the beneficiary of innovations in energy efficiency, new design techniques, and new materials, and services-producing industries, such as banking and insurance, are the beneficiary of ATM's, electronic funds transfers, on-line banking, and automated clearance, billing, and customer service systems.

The extension of double-deflation to the remaining 12 industries in the recent GDP-by-industry comprehensive revision addressed at least some of the likely underestimation of services output and productivity and helped in the assessment of the contribution of new technology to economic growth. However, further progress will require the development of additional output-based price indexes.

International and Balance of Payments Accounts:

The IT revolution and the globalization that has accompanied it have had a large impact on both the current and capital accounts and on the direct investment accounts. In the current account, the IT revolution and globalization have contributed to a significant increase in trade in goods and services—especially in computers, semiconductors, and other high-tech products and in financial and other services that are major users of the new technology. The quantitative impact on real exports and imports is largest in computers and peripheral equipment, semiconductors, digital telecommunications switching equipment, and software, where BEA uses quality-adjusted or partial quality-adjusted price indexes.[8] As suggested in the NIPA

7. Wholesale and retail trade are margin industries and are measured by the margin between sales/receipts and the cost of goods sold plus any commissions received. These industries may therefore benefit from changes in input costs associated with cost-saving innovations by suppliers that the wholesale and retail firms may not fully pass on to their customers.

8. BEA's hedonic indexes for semiconductors and switching equipment are used only for 1996 and earlier years; estimates beginning with 1997 use BLS price indexes that have a flatter price profile. As noted earlier, BEA's hedonic index for computer software is used only for prepackaged software; custom and in-house software are deflated using cost-based indexes.

section above, more extensive use of quality-adjusted or output-based price indexes for services and other high-tech equipment would likely raise the measured contribution of IT to real GDP and productivity growth.

The impact of IT may also be understated to the extent that the portion of the understatement in exports associated with an increase in low-value shipments is driven by direct transactions related to "just-in-time" inventories, IT, and globalization. The resulting understatement in nominal exports will probably raise nominal and real GDP growth (and productivity) in IT and non-IT industries.

In the financial accounts, there has been a large increase in the volume of U.S. investment abroad and foreign investment in the United States. Electronic banking, new intermediaries, and the increasing globalization of financial markets has been accompanied by enormous growth, much of it in direct securities transactions—that is, transactions that are not channeled through U.S. brokers, banks, and other financial intermediaries—and in new financial instruments, such as derivatives. BEA has worked with the U.S. Treasury and the Federal Reserve Board to address the measurement gaps associated with this globalization through data exchanges with foreign central banks, internationally coordinated benchmark surveys of portfolio investment, improved coverage of pension and other funds, expanded surveys of short-term instruments, and methodological innovations; however, the large and persistent errors and omissions in the balance of payments estimates suggest that further work is needed.

Toward improved measures of the new economy

Although BEA received initial funding to begin work on a number of initiatives to update its GDP and related statistics and to update its IT systems, additional funding will be required to carry on the work outlined below:

Measuring E-Business and High-Tech in the GDP Accounts:

In order to address the need for better data, BEA—working with BLS and the Census Bureau—is seeking additional financial resources to develop the following new and revised measures of E-business-related and high-tech economic activity:

Index of investment in E-business/high-tech.

- This would be a new index of quarterly investment in E-business-related and high-tech equipment and associated measures of its contribution to real GDP growth and inflation. These data would include:
  - E-business-related/high-tech investment index;
  - Current-dollar and chain-dollar estimates of E-business-related/high-tech investment;
  - Contribution to growth and inflation of E-business-related/high-tech investment.

Revised and new output and price indexes for E-business-intensive/high-tech industries.

- BEA would attempt to develop revised quarterly price and real GDP indexes for the following major E-business/high-tech-using products/sectors:
  - Insurance;
  - Banking and other financial services;
  - Computer and related business services;
  - Engineering, design, management consulting, and related services.
- BEA would work to develop revised estimates of employee compensation, personal income, wealth, and saving that better reflect the impact of stock options and capital gains of workers in E-business-related and other high-tech industries.
- BEA would revise and expand its surveys of international trade in services and of direct investment to fill gaps in the coverage of E-business/high-tech-related transactions and to identify E-business-related direct investment in the United States and abroad.
- BEA would work to develop new aggregations using earnings by place of work for E-business/high-tech-related industries.
- BEA would attempt to develop updated and revised "input-output" and GDP-by-industry estimates to help disentangle the effects of E-business and high-tech on final demand versus on intermediate product.

Updating the GDP Accounts to Keep Up with the Changing Economy:

Reduction in persistent measurement error in GDP and GDI.—There are two major focuses in the attempt to reduce persistent measurement error: Updated measures of services and other product-side components, and updated measures of compensation and other key income-side components.

- BEA will conduct research on expanding the use of supplemental measures that use more up-to-date public and private source data to update BEA's estimates for the inaccuracies that result from the lags between when economic activity occurs and when the data on that activity is provided to BEA.

- BEA will attempt to develop new estimating methods that use more up-to-date public and private source data to correct the GDI estimates for lags in the availability of BLS, IRS, and other source data on the incomes earned by individuals and businesses. New supplemental income estimates will be developed for:
  - Wages and salaries for nonproduction and supervisory workers;
  - Bonuses and stock options for all employees;
  - Employer-provided fringe benefits;
  - Profits, proprietors' income, interest, and rent.

Development of improved measures of the 20 percent of GDP that is deflated using physical-input extrapolators and cost-based deflators.—Telecommunications equipment installation (fiber optic cable and infrastructure), as well as other goods and services identified by the Advisory Commission to Study the CPI ("Boskin Commission"), present special problems for the quality-adjustment necessary for GDP estimation.

- BEA will work with BLS on the development and incorporation of quality-adjusted price indexes and real GDP indexes for the following components of GDP that have significant measurement problems:
  - Telecommunication services;
  - Insurance and other financial services;
  - Selected medical services;
  - Private education services;
  - Selected personal business services;
  - Telecommunication equipment;
  - Nonresidential construction.

Development of new measures of saving, wealth, and international trade and finance.

- BEA will work to develop and incorporate the following measures to better understand the interaction between the large changes in wealth and productive stocks on the one hand, and investment, saving, consumption, capital flows, trade, and productivity on the other:
  - Comprehensive income and wealth accounts for the U.S. economy that integrate the Federal Reserve Board's "Financial Accounts" with BEA's tangible wealth, international investment position, GDP, national income, national investment, and balance of payments accounts; and
  - New output-based price indexes for components of investment in computer software. At present, those indexes are estimated using inferior cost-based indexes that impair measurement of productivity in the U.S. economy, one of the most-often-cited weaknesses in the present GDP accounts.
- BEA would develop and incorporate the following to update and improve BEA's estimates of new and rapidly growing services, financial instruments, and direct transactions across U.S. borders:
  - An expanded quarterly survey of international trade in services to cover computer services, legal services, data base services, and financial services; and
  - A new set of quarterly and annual estimates of U.S. international assets and liabilities in financial derivatives and other short-term instruments, and selected data on transactions in those instruments.

Other Work:

- *Satellite Accounts.* Although BEA currently has no budget initiatives related to satellite accounts, the Bureau has on occasion received resources from other government agencies for such accounts. If there were other interested agencies, BEA would be able to develop a set of R&D satellite accounts that would build upon BEA's preliminary work on these accounts.
- *Contribution to Growth Software.* BEA's chain indexes provide more accurate estimates of real GDP growth, but they are computationally more difficult to manipulate. BEA hopes to be able to develop an on-line piece of software that would allow users interested in the new economy and contributions to growth to specify aggregates of their own choosing from detailed NIPA data and to compute growth rates over periods specified by the user.
- *Implementation of the North American Industry Classification System (NAICS).* NAICS is an updated industrial classification system that is replacing the old Standard Industrial Classification system. This new system gives an updated view of new and emerging industries, service industries, and industries engaged in the production of advanced technologies. Incorporating this new classification system will be a major effort for the Bureau but will provide a significantly updated view of economic activity.

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