

# **Digital Economy**

## **2002**

### ***Appendices***



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# Digital Economy 2002

## **METHODOLOGY, DATA SOURCES AND APPENDIX TABLES**

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## METHODOLOGY, DATA SOURCES AND APPENDIX TABLES

### APPENDIX TO CHAPTER III

<b>INFORMATION TECHNOLOGY INDUSTRIES IN THE NEW ECONOMY .....</b>	<b>1</b>
Defining Information Technology Producing Industries .....	1
Measuring Information Technology Producing Industries .....	3
Developing GPO Estimates for IT-Producing Industries .....	4
Real Dollar GPO of IT-Producing Industries .....	8
IT-Producing Industries: Contribution to Real Economic Growth .....	10
Industry Income Versus Product Demand: Alternative Measures of the Performance of IT-Producing Industries .....	10

### APPENDIX TO CHAPTER IV

<b>INDUSTRY-LEVEL EFFECTS OF INFORMATION TECHNOLOGY USE ON PRODUCTIVITY AND INFLATION .....</b>	<b>13</b>
Appendix A .....	14
Appendix B .....	35
Decomposing the Overall GDP per FTE Growth Rate .....	35
Comparing an Industry's Contribution to Overall Productivity Growth to Its Productivity Growth .....	37
Determining An Industry's Contribution to Overall Inflation .....	38

### APPENDIX TO CHAPTER V

<b>JOBS IN THE NEW ECONOMY .....</b>	<b>39</b>
IT Producing Industry Employment .....	39
IT Producing Industry Wages .....	41
IT Occupational Employment .....	41
Education and Training Requirements by Occupation .....	44
IT Occupational Wages .....	46

## APPENDIX TABLES

<b>Table A-3.1</b>	Information Technology Producing Industries - NAICS to SIC Concordance .....	2
<b>Table A-3.2</b>	IT-Producing Industries: Gross Product Originating .....	5
<b>Table A-3.3</b>	IT-Producing Industries: Real Gross Product Originating .....	9
<b>Table A-4.1a</b>	GDP Growth in All Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	15
<b>Table A-4.1b</b>	GDP Growth in Top-Half Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	16
<b>Table A-4.1c</b>	GDP Growth in Bottom-Half Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	17
<b>Table A-4.2a</b>	FTE Growth in All Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	18
<b>Table A-4.2b</b>	FTE Growth in Top-Half Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	19
<b>Table A-4.2c</b>	FTE Growth in Bottom-Half Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	20
<b>Table A-4.3a</b>	GDP per FTE Growth in All Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	21
<b>Table A-4.3b</b>	GDP per FTE Growth in Top-Half in All Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	22
<b>Table A-4.3c</b>	GDP per FTE Growth in Bottom-Half Industries and in All Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	23
<b>Table A-4.4</b>	Contributions to Overall GDP per FTE Growth by Top-Half and Bottom-Half Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	24
<b>Table A-4.5</b>	GDP per FTE Growth in Top-Half and Bottom-Half Industries and in All Industries of the U.S. Nonfarm Business Sector, 1989-1995 and 1995-2000 .....	25
<b>Table A-4.6</b>	Contributions to Overall GDP per FTE Growth Acceleration by Top-Half and Bottom-Half Industries of the U.S. Nonfarm Business Sector, 1995-2000 over 1989-1995 .....	26
<b>Table A-4.7</b>	GDP per FTE Growth in U.S. Nonfarm Business Sector by Major Industry Groups, 1989-2000 .....	27
<b>Table A-4.8</b>	Contributions to GDP per FTE Growth in U.S. Nonfarm Business Sector by Major Industry Groups, 1989-2000 .....	28
<b>Table A-4.9</b>	GDP per FTE Growth in U.S. Nonfarm Business Sector by Major Industry Groups, 1989-1995 and 1995-2000 .....	29
<b>Table A-4.10</b>	Contributions to GDP per FTE Growth Acceleration in U.S. Nonfarm Business Sector by Major Industry Groups, 1995-2000 over 1989-1995 .....	30
<b>Table A-4.11a</b>	Price Growth in All Industries of the U.S. Nonfarm Business Sector, 1989-2000 .....	31
<b>Table A-4.11b</b>	Price Growth in Top-Half Industries in the U.S. Nonfarm Business Sector, 1989-2000 .....	32
<b>Table A-4.11c</b>	Price Growth in Bottom-Half Industries in the U.S. Nonfarm Business Sector, 1989-2000 .....	33

<b>Table A-4.12</b>	Contributions to Overall Price Growth by Top-Half and Bottom-Half Industries in the U.S. Nonfarm Business Sector, 1989-2000 .....	34
<b>Table A-5.1</b>	Information Technology Producing Industries: Employment Trends, 1992 to 2000 .....	40
<b>Table A-5.2</b>	Information Technology Producing Industries: Annual Wages per Worker, 1992 to 2000 .....	42
<b>Table A-5.3</b>	Information Technology Producing Industries: Total Annual Wages, 1992 to 2000 .....	43
<b>Table A-5.4</b>	Employment and Wages, by Occupation, 2000 .....	45
<b>Table A-5.5</b>	Information Technology Occupations .....	47



## APPENDIX TO CHAPTER III

# Information Technology Producing Industries in the New Economy

This portion of the Appendix describes the sources of data and methods used to assess the economic impacts of Information Technology (IT) producing industries that were presented in Chapter III of the *Digital Economy 2002* (DE 2002) report.

### ***DEFINING INFORMATION TECHNOLOGY PRODUCING INDUSTRIES***

The IT-producing industries selected for the DE 2002 report are those industries that produce, process, or transmit information goods and services as either intermediate demand (inputs to production of other industries) or as final products (goods and services bought by consumers, business investors, government or for exports). The selected IT-producing industries also include those that supply the goods and services necessary for the Internet and electronic commerce (e-commerce) to operate—i.e., provide the products and services for the Internet infrastructure. IT-producing industries include manufacturers of some general and specialized electronic components, computers and peripheral equipment, specialized measuring and testing instruments, telecommunications equipment, and prepackaged software. IT-producing industries also include computer, software, and telecommunications service providers. (Table A-3.1)

In *Digital Economy 2000*<sup>1</sup> (DE 2000) and prior *Emerging Digital Economy*<sup>2</sup>(EDE) reports, radio and TV broadcasting industries were included as IT-producing industries, but in the DE 2002 report, these industries were not. After reevaluation, these industries were considered to be more oriented toward content, rather than products or processes that meet the criteria for IT-producing, and, therefore, were removed from the IT-producing list of industries. Content industries such as radio and TV broadcasting and printing and publishing provide the information, not the infrastructure, needed for the digital economy. Radio and TV broadcasting industries made up almost 5 percent of the total output, as measured by Gross Product Originating (GPO), of the IT-producing sector in the prior digital economy reports, mentioned above.

In DE 2002, the criteria for including the instruments industries as IT-producing were also re-evaluated, based on their importance to other IT-producing industries. The result was that these industries were retained since a majority of their production was purchased primarily by other IT-producing industries. For example, over 50 percent of all products produced within the Instruments for measuring electricity industry were purchased by other IT-producing industries—radio and TV communications industry, electronics industries, semiconductor industries, the other instrument industries, and the communications services industry. The same relationship held, to varying degrees for the Industrial instruments for measurement and the Laboratory analytical instruments industries.

**Table A-3.1**  
**Information Technology Producing Industries**  
**NAICS to SIC Concordance\***

<b>Hardware Industries</b>	<b><u>1997 NAICS</u></b>	<b><u>1987 SIC</u></b>
Computers and computer equipment and calculating and office machines	334111, 2, 3, 9, 334418pt 333311pt, 3pt	3571, 2, 5, 7pt 3578, 9pt
Wholesale trade of computers	421430pt, 3pt	5045pt
Retail trade of computers	443120pt	5734pt
Electron tubes	334411	3671
Printed circuit boards	334412	3672
Semiconductors	334413	3674
Passive electronic components	334414, 5, 6, 8pt, 9	3675, 6, 7, 8, 9pt, 3661pt
Industrial instruments for measurement	334513	3823
Instruments for measuring electricity	334514pt, 334515	3825pt
Laboratory analytical instruments	334516	3826
<b>Software/Service Industries</b>		
Computer programming services	541511	7371
Prepackaged software	511210, 334611	7372
Wholesale trade of software	421430pt	5045pt
Retail trade of software	443120pt	5734pt
Computer integrated system design	541512	7373
Computer processing, data preparation	514210	7374
Information retrieval services	514191, 9	7375
Computer services management	541513	7376
Computer renting and leasing	532420	7377
Computer maintenance and repair	811212	7378
Computer related services, nec	541519	7379
<b>Communications Services Industries</b>		
Telephone and telegraph communications	513310, 21, 22, 30, 40, 90	481, 4822, 4899
Cable and other pay TV services	513210, 20	4841
<b>Communications Equipment Industries</b>		
Household audio and video equipment	334310	3651, 3679pt
Telephone and telegraph equipment	334210, 334418pt	3661pt, 3577pt, 3679pt
Radio and TV communications equipment	334220, 334290	3663, 3679pt, 3699
Magnetic and optical recording media	334613	3695, 3577pt

\*1997 North American Industry Classification to 1987 Standard Industrial Classification concordance.



The IT-producing industries in this report are classified according to the Office of Management and Budget's (OMB's) 1997 *North American Industry Classification System* (NAICS). They are also cross-referenced to OMB's 1987 *Standard Industrial Classification* (SIC) manual since the data for the time-period considered in this report are published according to each industry classification system, depending on the year of the estimates. Annual estimates of GPO for the IT-producing sector by NAICS/SIC industries and portions of SIC industries were developed for the 1990 through 2000 period.

Although both industry classification systems were used in this report, the estimates of GPO by industry, reported here, are made consistent with the NAICS classification as shown in Table A-3.1. The development of the GPO time series for 1990 through 2000 meant taking all years for which only SIC data are available and translating these to GPO by NAICS industries. For example, data for estimating GPO of IT-producing manufacturing industries (hardware and communication equipment industries) are available by NAICS industries for 1992, 1997 (from the 1992 and 1997 *Economic Census* data), 1998, and 1999 (from the *Census' Annual Survey of Manufactures* data). However, data for 1990-91, 1993-96, and 2000 were published only in 1987 SIC codes. The estimates of GPO by industry for those years were converted to NAICS to be consistent with the latest industry classification system.

The differences in the classification of products between NAICS and SIC did raise some difficulties. For example, while 1997 industry shipments<sup>3</sup> for Other computer peripheral equipment manufacturing (NAICS 334119) includes shipments data for its counterpart industry under the SIC system (SIC 3577), it also includes shipments of products such as point of sales terminals and fund transfer devices, products produced under the Calculating and accounting equipment industry (SIC 3578). Thus, for the years that only SIC shipment data are available for these industries, estimates of product shipments for point of sales terminals and fund transfer devices were made and added to the shipments of the Other computer equipment industry, under the NAICS description of the industry, and subtracted from production in the Calculating and office equipment industry. There are other products under the SIC 3577 that are now part of the production of the Telephone and telegraph equipment industry and the Magnetic and optical recording equipment industry. These types of industry classification adjustments, from SIC to NAICS, were necessary to construct a consistent time series for the entire 1990 through 2000 period.

Table A-3.1 provides the complete listing of IT-producing industries according to the NAICS. A concordance of the NAICS to SIC industries is also provided. Six of the 27 IT-producing industries listed in the table had some reassignment of shipments as a result of SIC to NAICS classification changes. All of the industry reassignments of shipments resulting from the differences of NAICS and SIC occurred between IT-producing industries only that affected the composition, not the total, of GPO for IT-producing industries.

Finally, while the industries presented as IT-producing industries in the DE 2002 report do not reflect any official U.S. government list of such industries, the industries selected in Table A-3.1 meet the criteria, listed above, for IT-producing and, therefore, are considered to be IT-producing industries in this report.

## **MEASURING INFORMATION TECHNOLOGY PRODUCING INDUSTRIES**

As stated previously, the output of IT-producing industries was measured in terms of its Gross Product Originating. This is often referred to as an industry's "value added." GPO is defined as being equal to an industry's total revenue (measured by total shipments or receipts plus inventory change) less the cost of purchased goods and services used in production.<sup>4</sup> GPO and value added can be thought of more directly as the sum of the costs incurred by an industry including compensation of employees, net interest, indirect business taxes, capital investments, and profits earned in production.

GPO by industry is the contribution of each private industry and government to Gross Domestic Income (GDI). Theoretically, the nominal dollar value of GDI, the income associated with the output of industries, should equal total final demand on the economy, or Gross Domestic Product (GDP). In practice, however, GDI and GDP do not match precisely due to statistical differences.

The analysis of IT-producing industries used here is consistent with the definitions and conventions used in the Gross Product by Industry series published by the Bureau of Economic Analysis (BEA). Although the concept of GPO and value added are considered to be the same, value added data for manufacturing industries published by the Bureau of the Census do not match the GPO published by BEA. The difference between the two measures results from BEA subtracting industries' purchases of "Other services" (NAICS 71151, 51221, 54169, 51223, 541612, 514199, and 54162) from total revenue along with all other purchased goods and services. The Census does not subtract these other services to determine value added. The reason is that the Census collects manufacturing data on an establishment basis and most purchases of other services are at the corporate level. The BEA makes an adjustment for corporate to establishment estimates. The Census does not.<sup>5</sup>

The GPO estimates for the IT-producing industries are derived from revenue, receipts, and shipments, whether or not all of the industry's production was used as an IT good or service. For example, not all semiconductors are used by the computer industry or other industries considered to be IT-producing. Semiconductors are also used in automobiles, home appliances, and a variety of other consumer and industrial goods. However, to differentiate production into IT-producing and non IT-producing would be difficult, if not impossible. For this reason, the GPO of the semiconductor industry is based on its total annual shipments and costs of production.

By using GPO as the measure of industry performance for the IT-producing industries, double counting of the value of production is avoided when adding production across IT-producing industries. For example, the value of shipments of the computer industry includes the cost to the computer industry of their expenditures on semiconductors. The value of the semiconductor industry shipments includes its sales to the computer industry, as well as all other industry sales. Adding shipments of the semiconductor industry to the shipments of the computer industry double-counts the value of shipments of the semiconductor industry, i.e., once as the value of shipments of the semiconductor industry and once again as a cost of production of the computer industry. Other industries provide goods and services used in production in the computer industry as well. Adding the shipments of these industries to the shipments of the computer industry would similarly result in double counting due to mixing industry inputs and outputs.

For this reason, the costs of production of both for goods and services are subtracted from the industry shipments of all of the IT-producing industries.

## **Developing GPO Estimates For IT-Producing Industries**

The following is a description of the data and the methods used to derive GPO for IT-producing industries for 1990 through 2000. (Table A-3.2)

**GPO for Hardware and Communications equipment IT-producing industries**, all in manufacturing, were derived beginning with Census data on value of shipments for 1990 through 1999 and BEA estimates of shipments for 2000. GPO for 1990 through 1999 was derived by deducting the cost of materials and the value of purchased services used in production from the value of shipments and then adjusting

Table A-3.2  
Information Technology Producing Industries  
Gross Product Originating

Industries*	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Total Gross Domestic Income</b>	<b>5,772,700.0</b>	<b>5,966,600.0</b>	<b>6,275,200.0</b>	<b>6,578,600.0</b>	<b>6,995,600.0</b>	<b>7,374,000.0</b>	<b>7,780,300.0</b>	<b>8,288,600.0</b>	<b>8,812,500.0</b>	<b>9,341,300.0</b>	<b>10,003,400.0</b>
<b>Year-to-Year GDI Change (%)</b>	<b>3.4%</b>	<b>5.2%</b>	<b>5.2%</b>	<b>4.8%</b>	<b>6.3%</b>	<b>5.4%</b>	<b>5.5%</b>	<b>6.5%</b>	<b>6.3%</b>	<b>6.0%</b>	<b>7.1%</b>
<i>(Millions of \$, except as noted)</i>											
<b>Hardware Industries</b>											
Computers and equipment, calc. machines	27,091.0	23,144.8	24,101.7	23,495.0	26,330.1	31,036.0	32,927.6	36,139.0	39,210.8	38,583.4	46,222.9
Computers and equipment wholesale sales	33,835.9	35,999.0	39,743.2	42,573.0	43,553.9	51,113.8	61,559.9	70,270.7	75,084.2	81,015.8	87,675.5
Computer and equipment retail sales	1,870.3	1,887.8	1,914.9	2,293.3	2,720.8	2,860.5	2,797.0	3,188.8	3,407.3	3,676.4	3,985.3
Electron tubes	1,169.4	1,038.5	1,053.3	1,019.3	1,186.5	1,205.6	1,255.8	1,258.6	1,316.5	1,349.4	1,524.8
Printed circuit boards	4,407.7	3,143.3	3,555.7	3,710.8	4,380.9	4,406.2	5,056.3	5,070.3	5,526.7	5,908.0	5,984.8
Semiconductors	15,812.0	18,486.7	19,308.2	23,702.6	31,639.5	40,836.2	43,553.0	54,131.5	57,054.6	64,072.3	72,292.8
Passive electronic components	11,565.7	12,720.7	13,493.6	14,350.9	16,034.9	15,310.2	13,347.4	11,313.7	12,071.7	12,880.5	14,503.4
Industrial instruments for measurement	2,331.8	2,386.1	2,551.5	2,343.8	2,436.4	2,526.2	2,943.3	4,597.9	4,873.8	5,010.3	5,155.6
Instruments for measuring electricity	3,318.6	3,460.4	3,493.3	3,096.9	3,551.6	3,980.7	4,907.2	7,761.8	8,382.7	8,659.3	9,212.3
Laboratory analytical instruments	1,871.6	1,987.9	1,834.8	1,858.3	1,933.4	2,133.8	2,770.4	3,746.0	3,985.7	4,212.9	5,097.5
<b>Total Hardware</b>	<b>103,273.9</b>	<b>104,235.1</b>	<b>110,050.3</b>	<b>118,443.7</b>	<b>133,768.2</b>	<b>155,409.6</b>	<b>171,117.9</b>	<b>197,478.3</b>	<b>210,913.8</b>	<b>225,368.4</b>	<b>251,655.0</b>
<b>Software and Services</b>											
Computer programming services	15,896.5	17,442.5	18,624.4	20,399.0	23,162.9	26,119.5	31,370.1	37,295.3	47,796.1	55,013.3	62,715.2
Prepackaged software	11,322.9	12,552.9	14,554.5	17,263.4	19,775.9	22,768.3	26,926.5	29,511.7	34,496.8	40,016.2	46,418.8
Prepackaged software wholesale sales	1,810.1	1,927.7	2,127.2	2,278.0	2,330.2	2,733.0	3,291.7	3,607.7	4,217.1	4,891.9	5,674.6
Prepackaged software retail sales	99.8	100.9	102.3	122.5	145.3	152.6	149.2	163.6	191.2	221.8	257.3
Computer integrated system design	10,052.6	10,709.5	11,813.9	12,619.8	13,257.3	13,598.8	15,736.9	20,314.2	24,691.5	28,419.9	32,597.6
Computer processing, data preparation	10,939.9	11,563.8	12,554.2	14,561.7	17,908.4	21,843.6	25,181.1	26,592.1	28,062.2	32,299.5	37,047.6
Information retrieval services	2,597.6	2,704.8	2,879.2	3,132.7	3,338.0	3,910.0	5,058.5	6,637.4	8,977.4	10,333.0	11,852.0
Computer services management	1,460.3	1,616.6	1,910.2	1,872.9	1,941.8	2,090.0	2,134.1	2,478.6	2,942.1	3,386.3	3,884.1
Computer rental and leasing	1,693.8	1,535.9	1,528.0	1,590.2	1,702.4	1,880.1	2,125.4	2,463.0	2,944.3	3,388.9	3,887.1
Computer maintenance and repair	4,558.9	4,509.0	4,989.3	5,400.5	6,040.5	6,949.2	7,871.8	8,786.9	10,029.4	11,543.8	13,240.8
Computer related services, nec	3,206.5	3,461.0	4,406.4	5,545.2	7,267.3	9,305.2	11,644.3	16,023.4	21,261.1	24,471.5	28,081.2
<b>Total Software and Services</b>	<b>63,638.8</b>	<b>68,124.6</b>	<b>75,489.6</b>	<b>84,786.6</b>	<b>96,869.9</b>	<b>111,350.2</b>	<b>131,489.6</b>	<b>153,863.8</b>	<b>185,609.1</b>	<b>213,986.2</b>	<b>245,656.2</b>
<b>Communications Equipment</b>											
Household audio and video equipment	1,631.9	1,784.4	1,871.6	2,024.0	2,034.4	1,944.7	1,617.6	2,217.1	2,286.0	2,480.2	3,214.3
Telephone equipment, exc. ext. modems	8,313.5	8,005.2	10,250.9	10,734.9	10,949.7	12,138.7	15,034.4	21,069.1	21,806.5	24,968.4	29,712.4
Radio & TV communications equipment	9,806.1	8,763.0	10,134.2	9,480.7	13,020.2	14,309.8	13,839.4	18,646.4	20,641.6	22,251.6	26,524.3
Magnetic and optical and recording media	1,442.3	1,644.5	1,713.4	1,878.8	2,014.4	2,381.6	1,953.4	1,951.8	1,973.3	1,730.6	2,012.7
<b>Total Communications Hardware</b>	<b>21,193.8</b>	<b>20,197.2</b>	<b>23,970.1</b>	<b>24,118.3</b>	<b>28,018.6</b>	<b>30,774.8</b>	<b>32,444.7</b>	<b>43,884.5</b>	<b>46,709.5</b>	<b>51,430.8</b>	<b>61,463.7</b>
<b>Communications Services</b>											
Telephone and telegraph communications	119,400.0	124,000.0	128,700.0	139,000.0	148,000.0	151,600.0	163,900.0	166,700.0	173,900.0	195,100.0	204,074.6
Cable and other pay TV services	10,524.7	13,661.9	14,992.3	19,822.5	19,331.9	21,778.0	23,008.1	26,486.9	29,797.8	32,265.9	33,717.9
<b>Total Communications Services</b>	<b>129,924.7</b>	<b>137,661.9</b>	<b>143,692.3</b>	<b>158,822.5</b>	<b>167,331.9</b>	<b>173,378.0</b>	<b>186,908.1</b>	<b>193,186.9</b>	<b>203,697.8</b>	<b>227,365.9</b>	<b>237,792.5</b>
<b>Total IT-Producing Industries</b>	<b>318,031.2</b>	<b>330,218.8</b>	<b>353,202.3</b>	<b>386,171.2</b>	<b>425,988.6</b>	<b>470,912.7</b>	<b>521,960.3</b>	<b>588,413.5</b>	<b>646,930.2</b>	<b>718,151.4</b>	<b>796,567.3</b>
<b>Share of the Economy**</b>	<b>5.5%</b>	<b>5.5%</b>	<b>5.6%</b>	<b>5.9%</b>	<b>6.1%</b>	<b>6.4%</b>	<b>6.7%</b>	<b>7.1%</b>	<b>7.3%</b>	<b>7.7%</b>	<b>8.0%</b>

\* See industry classification in Table A-3.1

\*\*Share of the economy as measured by share of Gross Domestic Income

Source: ESA estimates derived from BEA and Census data

for inventory change. Cost of material and value of purchased services data for 2000 were not available so that GPO for 2000 is more generally estimated. GPO for 2000 was derived by using the average annual ratio, 1997 to 1999, of GPO to value of shipments for each of the IT producing industries and applying that ratio to the BEA estimates of shipments for 2000 to derive an estimate of GPO for 2000.

Beginning with BEA's Fall 1999 comprehensive revision of the national accounts, industry purchases of software and software services were considered as an investment, rather than as an expense of production.<sup>6</sup> Thus, industry spending on software and software services become a part of GPO, i.e., software is no longer considered as a cost of production. Therefore, the estimates of GPO for the IT-producing industries in Tables A-3.2 and A-3.3 include the purchase of software as a capital good and the value of the capital good purchases are included in its GPO.

In general, data used to estimate GPO for IT-producing industries in the manufacturing sector are from the *Annual Survey of Manufactures* for 1990-91, 1993-96, and 1998-99 and from the more detailed 1992 and 1997 *Economic Census of Manufactures*. The Economic Census reports contain more detailed data, particularly on the cost of materials and purchased services used in production, so that data for these two years are used to adjust the shipments data for the Annual Survey years where data are less detailed. Thus, for 1990-91, 1993-96, and 1998-99 GPO was estimated from the published shipments data in the Annual Surveys and then adjusted for inventory change and costs of materials and purchased services estimated from the average relationship of inventory change and materials costs to production in the 1992 and 1997 Economic Census years.

The more detailed data available in the Economic Census years (1992 and 1997) include costs of materials, beginning and end of year inventories, and costs of selected purchased services. Data on selected purchased services include software services, repair of buildings, repair of machinery, communications, legal services, accounting and bookkeeping, advertising, and refuse removal. Since IT-producing industry spending for these services only represent a portion of its purchased services, industry spending for all other services was estimated using the distribution of spending on services from BEA's 1992 Benchmark Input-Output (I-O) table. The distribution and the portion of the industry's output that was purchased services, from the I-O table, were then adjusted to accommodate the selected purchased services published in the 1992 and 1997 *Economic Census of Manufactures*. The "adjusted" ratio was applied to total annual industry shipments for the remaining years in the time period to estimate the cost of purchased services, not including software.

GPO for wholesale trade of computer equipment (part of NAICS 421430) was added to the category called IT-producing hardware industries since over half of wholesale trade of computers comes directly from computer manufacturers' branch offices. This was established based on the detailed data from the 1992 and 1997 Economic Census. Although counted by the Census as a wholesale sale and not a manufacturer's shipment, the actual sale is in practical terms a direct manufacturer's sale and, therefore, does not double-count the manufacturers sales. The nominal value of computer sales from branch offices of manufacturers has been twice that of computer sales directly from manufacturing facilities throughout the 1990s. If these wholesale sales were left out of GPO estimates for IT-producing industries, the overall value of GPO for the computer industry would be significantly under-represented.

Annual source data for 1990-91, 1993-96, and 1998-99 for wholesale trade of computers and equipment were available at the 3-digit SIC industry level in the Census Current Business Report called the *Annual Benchmark Report for Wholesale Trade*. In this report, the Census Bureau maintained time series of merchant wholesalers based on the SIC system through March 2001. In subsequent reports, data on merchant wholesalers will be on a NAICS basis. In the Annual Benchmark report for wholesale trade, gross margins (sales less costs of goods sold) by wholesale industries were reported under SIC

504, Wholesale sales of professional and commercial equipment and supplies.

Data for wholesale trade of computers and computer equipment in 1992 and 1997, at the 4-digit SIC industry level, are available from the Census *Economic Census of Wholesale Trade* and were used to derive the GPO for SIC 5045pt (NAICS 42143pt), Wholesale sales of computer equipment (and software). In the 1992 and 1997 reports, data for SIC 5045pt include sales and purchased operating expenses from merchant wholesalers, manufacturers' sales from branch offices, and sales from agents, brokers, and commission merchants. This Census report also separates sales and purchased operating expenses for computers, into both equipment and software.

The ratios of manufacturer's branch office sales to total wholesale sales of computer equipment (part of SIC 5045 for 1992 and 1997) and to the corresponding purchased operating expenses were used to distribute the gross margin data of the annual reports (SIC 504 for 1990-91, 1993-96, and 1998-99).

GPO for the retail trade of computer equipment and software (part of NAICS 443120) was derived in much the same way as the wholesale estimates described above. The Census *Annual Benchmark Report for Retail Trade* contains total sales and gross margins for the 3-digit SIC sector (SIC 573). Data on purchased operating expenses, as well as the distribution between equipment and software from the 1992 and 1997 *Census of Retail Trade*, were then used to disaggregate the 3-digit SIC sector to the 4-digit SIC 5734 for 1990-91, 1993-96, and 1998-99.

**GPO for the computer software and computer services IT-producing industries** for 1990-91, 1993-96, and 1998-00 was derived using the Census Current Business Reports and the *Service Annual Survey* and the 1992 and 1997 *Census of Service Industries* for 1992 and 1997. Similar to the derivation of GPO for the wholesale and retail trade of computer equipment and software, 4-digit SIC data on revenue and operating expenses from the 1992 and 1997 *Census of Service Industries* were used as a pattern to derive annual estimates from 3-digit SIC "controls" for 1990-91, 1993-96, and 1998. In 1997, the *Census of Service Industries* reported the industries on a NAICS basis. For 2000, the Census reported the service data on the NAICS basis and included data for 1998 and 1999.

The 1992 and 1997 *Census of Service Industries* includes a Subject Series report called *Sources of Receipts and Revenue* and were used to determine whether these industries sold only services, i.e., were used to determine whether these industries also sold goods where the cost of production of goods would have to be deducted from revenue to determine GPO. For most of the computer service industries, the cost of goods sold was less than 2 percent of total receipts so that the cost of production of goods sold for these industries were considered to be zero.

However, three of the computer service industries derived a significant portion of their revenue from the sale of goods. The Computer rental and leasing industry (NAICS 532420) derived almost 9 percent of its total revenue in 1997 from sales of goods. Computer maintenance and repair (NAICS 8112212) derived almost 8 percent of revenue from sales of goods and Computer services, not elsewhere classified (NAICS 541519), 2.4 percent. For these three computer services industries, therefore, it was necessary to account for the production of goods in its GPO estimate. The costs of these goods (computers and equipment sold from these industries) were deducted from the industry's total receipts to arrive at a gross margin (GPO) estimate.

The 1992 and 1997 *Census of Service Industry* reports also provide a Subject Series report called *Capital Expenditures, Depreciable Assets, and Operating Expenses*. This report lists operating expenses for these industries that were deducted from the remaining revenue to arrive at GPO estimates.

The distribution of goods sold and operating expenses for 1992 and 1997 is then applied to 4-digit SIC receipts data from the annual reports for these industries to obtain GPO estimates for 1990-91, 1993-96, and 1998-2000. GPO for Software wholesale sales (part of SIC 5045) and Retail sales (part of 5734) were derived using data from the *Census Annual Benchmark Reports for Wholesale Trade and for Retail Trade* for 1990-91, 1993-96, and 1998-2000 and the *Census 1992 Economic Census of Wholesale Trade and Census of Retail Trade*.

**GPO for the Communications Services IT-producing industries** was the BEA's published gross product by industry for communications services (NAICS 513310, 21, 22, 30, 40, and 90). This is the only IT-producing industry, listed in Table A-3.1, that is classified identically to the BEA published gross product by industry series<sup>7</sup>. BEA's estimates of GPO for Communications services were verified by using the same methods to estimate GPO of the rest of the IT-producing industries. In this case, the *1992 and 1997 Census of Transportation, Communications, and Utilities* and the 1990-91 and the 1993-98 *Annual Survey of Communications Services* reports were used. Revenue and cost of purchased services data from these reports, and the value and distribution of the costs of purchased services from BEA's 1992 Benchmark Input-Output table, were used to derive estimates of GPO adjusted for consistency with the new treatment for software purchases.

### Real Dollar GPO of IT-Producing Industries

GPO, in nominal dollars, for IT-producing goods industries was converted to real (chained 1996) dollars by using the industry price indexes associated with the industry sector from BEA's Gross Product by Industry series<sup>8</sup> in most cases. (Table A-3.2) A price index for the IT-producing industries was developed using an implicit<sup>9</sup> price index from an aggregate industry that included the IT-producing industries. For example, the price indexes used for the three IT-producing instruments industries were derived from the BEA aggregate industry implicit price index for all of instruments.

Price indexes for the computer and the semiconductor industries were handled differently. For the computer, computer equipment and calculating and office machine industry a composite price index was developed using BEA's quality-adjusted "hedonic" deflators for computers and computer equipment and an average product industry price index for calculating and office machines. The quality-adjusted deflators for computers relate prices of these products to their performance characteristics and their cost of production. The 1990 through 2000 composite price indexes used in this analysis of IT-producing industries for Computers and computer parts and Calculating and Office Machines were:

#### Computers and computer parts, Calculating and office machines

NAICS 334111, 2, 3, 334418pt., 9,  
333311pt, and 3pt

Year	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
Deflator	3.077	2.791	2.364	1.944	1.696	1.385	1.000	0.773	0.570	0.435	0.376

Total nominal dollar shipments of these sectors were divided by an aggregate real chain-weighted dollar value of shipments to produce the implicit deflator shown. The aggregation of the real chain-weighted dollar values of shipments was estimated by using a Fisher-Ideal quantity index formula.<sup>10</sup> These price indexes were also applied to wholesale sales of computers since these were mostly manufactures' sales.

**Table A-3.3**  
**Information Technology Producing Industries**  
**Real Gross Product Originating**

Industry*	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	(Millions of 1996\$, except as noted)										
<b>Total Gross Domestic Income</b>	6,672,300	6,659,600	6,832,700	6,994,800	7,286,800	7,516,700	7,780,300	8,130,200	8,538,900	8,926,000	9,345,700
Year-to-Year GDI Change (%)		-0.2%	2.6%	2.4%	4.2%	3.2%	3.5%	4.5%	5.0%	4.5%	4.7%
<b>Hardware Industries</b>											
Computers and equipment, calculating machines	8,804.4	8,292.7	10,195.3	12,085.9	15,524.8	22,408.7	32,927.6	46,751.6	68,790.8	88,291.5	122,933.2
Computers and equipment wholesale sales	10,996.4	12,898.2	16,811.8	21,899.7	25,680.4	36,905.3	61,559.9	90,906.5	131,726.6	186,243.3	233,179.6
Computer and equipment retail sales	607.8	676.4	810.0	1,179.7	1,604.3	2,065.4	2,797.0	4,125.3	5,977.6	8,451.5	10,599.3
Electron tubes	1,170.9	1,027.2	1,067.2	1,043.3	1,196.1	1,211.7	1,255.8	1,251.1	2,140.6	2,565.4	3,457.6
Printed circuit boards	3,812.9	2,750.0	3,166.2	3,420.1	4,156.4	4,286.2	5,056.3	5,080.5	9,075.0	11,296.4	13,695.0
Semiconductors	3,794.6	4,997.7	5,967.5	8,801.6	13,828.5	27,133.7	43,553.0	71,413.6	120,115.0	162,620.1	212,625.9
Passive electronic components	10,495.2	11,564.3	12,189.3	12,975.5	14,657.2	14,416.4	13,347.4	11,336.4	19,822.2	24,628.1	33,188.6
Industrial instruments for measurement	3,256.7	3,123.2	3,146.2	2,770.4	2,800.4	2,816.3	2,943.3	4,575.0	4,938.0	5,076.3	5,109.6
Instruments for measuring electricity	4,634.9	4,529.4	4,307.4	3,660.6	4,082.3	4,437.8	4,907.2	7,677.3	8,441.8	8,729.1	9,085.1
Laboratory analytical instruments	2,614.0	2,601.9	2,262.3	2,196.6	2,222.3	2,123.2	2,770.4	3,731.1	4,042.3	4,772.7	5,062.1
<b>Total Hardware**</b>	<b>39,848.6</b>	<b>43,297.6</b>	<b>51,832.9</b>	<b>63,980.3</b>	<b>80,852.3</b>	<b>116,522.8</b>	<b>171,117.8</b>	<b>245,373.0</b>	<b>368,982.6</b>	<b>488,710.0</b>	<b>625,915.2</b>
<b>Software and Services***</b>											
<b>Total Software and Services</b>	<b>75,312.1</b>	<b>78,214.3</b>	<b>83,784.3</b>	<b>92,360.1</b>	<b>104,611.1</b>	<b>115,736.7</b>	<b>131,489.6</b>	<b>139,495.8</b>	<b>173,304.5</b>	<b>194,179.9</b>	<b>220,319.5</b>
<b>Communications Equipment</b>											
Household audio and video equipment	2,065.7	2,139.6	1,997.5	2,026.0	1,846.1	1,511.1	1,617.6	2,109.5	2,636.0	3,035.7	4,179.8
Telephone equipment, exc. ext. modems	6,546.1	6,394.0	8,499.9	9,089.7	9,638.8	8,609.0	15,034.4	21,132.5	25,386.0	31,685.8	40,701.9
Radio & TV communications equipment	10,376.8	9,147.2	10,309.4	9,509.2	12,942.5	14,338.5	13,839.4	18,721.3	24,057.8	28,274.0	36,384.5
Magnetic and optical and recording media	2,236.2	2,243.5	2,306.0	2,366.2	2,156.7	2,334.9	1,953.4	1,938.3	2,042.8	1,860.9	2,274.2
<b>Total Communications Equipment**</b>	<b>20,590.5</b>	<b>19,339.7</b>	<b>22,806.7</b>	<b>22,793.0</b>	<b>26,278.5</b>	<b>26,162.7</b>	<b>32,444.7</b>	<b>43,896.0</b>	<b>54,092.4</b>	<b>64,729.2</b>	<b>83,365.0</b>
<b>Communication Services</b>											
Telephone and telegraph communications	117,100.0	120,800.0	125,500.0	135,800.0	142,200.0	147,600.0	163,900.0	167,900.0	180,900.0	215,100.0	243,708.3
Cable and other pay TV services	13,916.6	18,008.9	19,130.1	23,507.0	22,527.4	24,143.1	23,008.1	27,166.1	30,190.3	32,395.5	33,516.8
<b>Total Communications Services**</b>	<b>136,829.0</b>	<b>144,536.8</b>	<b>148,582.0</b>	<b>162,445.7</b>	<b>167,262.6</b>	<b>170,858.9</b>	<b>186,908.1</b>	<b>191,775.0</b>	<b>209,762.0</b>	<b>247,583.0</b>	<b>277,052.0</b>
<b>Total IT- Producing Industries**</b>	<b>247,736.8</b>	<b>261,195.9</b>	<b>286,657.6</b>	<b>324,114.5</b>	<b>365,972.8</b>	<b>425,258.8</b>	<b>521,960.3</b>	<b>626,289.0</b>	<b>780,945.0</b>	<b>942,981.7</b>	<b>1,117,792.3</b>

\*See industry classification in Table A-3.1

\*\*Real chain weighted 1996 dollars are not directly additive.

\*\*\*Detailed software and services price indexes are not available so that only aggregate real dollar value of software and services are provided.

Source: ESA estimates derived from BEA and Census data.

A hedonic deflator was also used to deflate semiconductors. The hedonic price indexes for semiconductors for 1990 through 2000 that were used to deflate nominal dollar GPO of the semiconductor industry were:

### **Semiconductors**

NAICS 334413

Year	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
Deflator	4.167	3.695	3.068	2.693	2.288	1.505	1.000	0.758	0.475	0.394	0.340

Real dollar estimates for telecommunications services were taken directly from BEA's gross product by industry series. Finally, chain-weighted dollars cannot be added directly. Instead, a Fisher-ideal quantity index formula (See footnote 5) was used.

### **IT-Producing Industries: Contribution to Real Economic Growth**

The contribution of IT-producing industries to overall real economic growth was calculated using the contributions formula published by the BEA.<sup>11</sup> The formula based contribution estimates take into account the chain weighting of the GPO estimates. It is also important to use a Fishers based residual formula when including the rest of the economy (real dollars) into the contribution calculation.

### **Industry Income Versus Product Demand: Alternative Measures of the Performance of IT-Producing Industries**

Up until Table 3.4 in Chapter III, the estimates of performance of IT-producing industries are based on income (production) side data and estimates, as measured by their GPO. As stated previously, GPO is used instead of an industry's shipments, revenues, or output to avoid double counting of the value of the industries. Estimates of GPO for each of these IT-producing industries for the 1990 through 2000 period were made. The sum of the individual industries GPO in current dollars is measured as a share of aggregate GPO for all industries. Aggregate GPO equates to the Gross Domestic Income of the U.S. Thus, IT-producing industries' relative size to the economy as a whole can be measured. In addition, the importance of these industries to the overall real, or inflation-adjusted, growth of the economy is calculated. The advantage of using income side (the income side of the national income and product accounts) is that all industries considered to be IT-producing can be incorporated into a performance measure.

On the other hand, one distinct disadvantage of using income side estimates is the lack of current data. In the DE 2002 report, the most recent estimates of the GPO for IT-producing industries that in "good conscience" could be made were for 2000. More current data for IT-producing industries are on the "product side." Product side data refer to final demands on the economy/industries. The sum of these demands for products is equal to the gross domestic product. Sources of final demand are from personal consumption expenditures, gross private fixed investments, government expenditures, and net international trade. These are all sources of demand (spending) for IT goods and services that have the distinct advantage of being more current, in most cases, than the production estimates.

We reported on demand for IT goods and services through the fourth quarter of 2001, as opposed to GPO (income or production side) estimates that stopped in 2000. Unfortunately, the product (demand or spending) side data are incomplete. Investment spending for IT goods and services provide the most complete and broadest measure of spending for IT goods and services, although this does not incorporate all final demand for these products.



While a significant portion of demand is generated by business investments, demand for IT goods and services should also include industry spending on currently expensed items and services such as spending on telecommunications and on IT goods used in their own production. In addition, personal consumption of IT goods and services, such as purchases of computers and communications, are significant. So are spending by the governments. Imports of IT goods and services exceed exports so that the demand placed on the domestic IT-producing industry from international trade is negative.

The net result is that a complete picture of business investments is available while data on demand on IT-industries from other sources is spotty and incomplete. While these other sources of demand are more difficult to gather, the data that are available and the estimates made show that sources of demand other than investments are significant.

**Industry investments**, in current and constant (chained 1996 dollars) dollars, in IT equipment and software are from BEA's published series on Private Fixed Investment by Type—Tables 5.4 and 5.5, respectively, in the *Survey of Current Business*. Four types of equipment and software are identified in these tables: (1) Information processing equipment and software, (2) Industrial equipment, (3) Transportation equipment, and (4) Other. Information equipment and software is further broken down into Computers and peripheral equipment, Software, and Other.

The contribution of IT equipment (Information processing and related equipment) to the growth in capital expenditures (investments) was derived from BEA's Table 8.2, Contributions to Percent Change in Real Gross Domestic Product.

**Demand for IT from other than industry investments** in capital IT goods and software were then estimated using (1) an interindustry (input-output) model<sup>12</sup> to estimate business spending on IT goods and services that is not considered capital (or investment) spending such as business spending on communication services, (2) BEA data for personal consumption of computers and communications services, and (3) BEA data for government spending on computers and estimates of government spending on communications services using BEA data on broad categories of government spending weighted by spending categories in BEA's methodology paper on government transactions<sup>13</sup>.

**Comprehensive estimates of all spending (final demand) for all IT goods and services are not readily available.** Published data are available for business spending on investments in information processing equipment and software and data are available for personal and government consumption of computers. Estimates, rather than published data, were made for business spending on IT goods and services that are not considered to be investments and for governments (communication spending). Other data or estimates need to be made. For example, some electronic products that are final demand goods, not intermediate products, such as communication equipment are purchased directly by consumers either from imports or from domestic production. These were not included in Table 3.9, Spending for IT Goods and Services, 2000, since the data were not available.

The unavailability of complete data for IT-producing industries on the demand side requires that the income (production) side approach continue in the measurement of performance of this important industry. On the other hand, reporting the current business spending on information processing equipment and software are a good indicator of how the IT-producing sector is doing.

## Endnotes

<sup>1</sup> Digital Economy 2000, *Economics and Statistics Administration, U.S. Department of Commerce, June 2000.*

<sup>2</sup> The Emerging Digital Economy, The Emerging Digital Economy II, *Economics and Statistics Administration, U.S. Department of Commerce, April 1998 and June 1999, respectively.*

<sup>3</sup>Shipments are the basis from which gross product originating is determined. See the next section called *Measuring Information Technology Producing Industries.*

<sup>4</sup> See page 133 of Yuskavage, "Improved Estimates of Gross Product by Industry, 1959-94," *Survey of Current Business, August 1996* for a more detailed description of GPO and its relationship to Gross Domestic Product and Gross Domestic Income.

<sup>5</sup>See page XI of the 1992 Census of Manufactures MC92-S-1, Subject Series General Summary, for a description of the difference between gross product originating and value added.

<sup>6</sup>See Seskin, "Improved Estimates of the National Income and Product Accounts for 1959-98, Results of the Comprehensive Revision," *Survey of Current Business, December 1999.*

<sup>7</sup> The remainder of the industries in Table A-3.1 are below the level of aggregation in the BEA published series.

<sup>8</sup>BEA's gross product by industry series are published on BEA's web site, <http://www.bea.doc.gov> . The series are included with their industry and wealth data.

<sup>9</sup> The implicit deflator equaled the current dollar price over the constant dollar price.

<sup>10</sup>See page 142 of Yuskavage, "Improved Estimates of Gross Product by Industry, 1959-94," *Survey of Current Business, August 1996* for a description of the Fisher-Ideal quantity index formula.

<sup>11</sup>See Moulton and Seskin, "A Preview of the 1999 Comprehensive Revision of the National Income and Product Accounts, Statistical Changes," *Survey of Current Business, October 1999.* The formula to calculate component contributions to economic growth is on page 16.

<sup>12</sup> INFORUM's (Interindustry Forecasting at the University of Maryland) LIFT (for Long-term Interindustry Forecasting Tool) model, (<http://inforumweb.umd.edu/>).

<sup>13</sup> U.S. Department of Commerce, Bureau of Economic Analysis. Government Transactions. Paper Series MP-5. Washington, DC, November 1988.

## APPENDIX TO CHAPTER IV

# Industry-Level Effects of Information Technology Use on Productivity and Inflation

The appendices to this chapter are in two parts. Appendix A provides the tables of results supporting the figures in the text. To facilitate the correspondence between them, the numbering system and titles are kept the same. For brevity, only the figure titles are typed out in the list below and the numbers of the supporting tables are listed after the title. In some cases, there are three tables supporting the specific figure. In the latter cases, the letters “a,” “b,” and “c” are added to the table number where “a” is the table for *all* industries, “b” for *top-half* industries, and “c” for *bottom-half* industries.

Appendix B is a mathematical presentation of this chapter’s methodology for decomposing aggregate productivity growth and overall inflation into industry-level contributions.

**APPENDIX A**

- Figure 4.1 GDP Growth in Top-Half and Bottom-Half Industries and in All Industries of the U.S. Nonfarm Business Sector, 1989-2000  
Table A-4.1a, Table A-4.1b, and Table A-4.1c
- Figure 4.2 FTE Growth in Top-Half and Bottom-Half Industries and in All Industries of the U.S. Nonfarm Business Sector, 1989-2000  
Table A-4.2a, Table A-4.2b, and Table A-4.2c
- Figure 4.3 GDP per FTE Growth in Top-Half and Bottom-Half Industries and in All Industries of the U.S. Nonfarm Business Sector, 1989-2000  
Table A-4.3a, Table A-4.3b, and Table A-4.3c
- Figure 4.4 Contributions to Overall GDP per FTE Growth by Top-Half and Bottom-Half Industries of the U.S. Nonfarm Business Sector, 1989-2000  
Table A-4.4
- Figure 4.5 GDP per FTE Growth in Top-Half and Bottom-Half Industries and in All Industries of the U.S. Nonfarm Business Sector, 1989-1995 and 1995-2000  
Table A-4.5
- Figure 4.6 Contributions to Overall GDP per FTE Growth Acceleration by Top-Half and Bottom-Half Industries of the U.S. Nonfarm Business Sector, 1995-2000 over 1989-1995  
Table A-4.6
- Figure 4.7 GDP per FTE Growth in U.S. Nonfarm Business Sector by Major Industry Groups, 1989-2000  
Table A-4.7
- Figure 4.8 Contributions to GDP per FTE Growth in U.S. Nonfarm Business Sector by Major Industry Groups, 1989-2000  
Table A-4.8
- Figure 4.9 GDP per FTE Growth in U.S. Nonfarm Business Sector by Major Industry Groups, 1989-1995 and 1995-2000  
Table A-4.9
- Figure 4.10 Contributions to GDP per FTE Growth Acceleration in U.S. Nonfarm Business Sector by Major Industry Groups, 1995-2000 over 1989-1995  
Table A-4.10
- Figure 4.11 Price Growth in Top-Half and Bottom-Half Industries and in All Industries of the U.S. Nonfarm Business Sector, 1989-2000  
Table A-4.11a, Table A-4.11b, and Table A-4.11c
- Figure 4.12 Contributions to Overall Price Growth by Top-Half and Bottom-Half Industries in the U.S. Nonfarm Business Sector, 1989-2000  
Table A-4.12



Table A-4.1b: GDP GROWTH IN TOP-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000

INDUSTRY	ITEQ/ITE	Rank	SIC	(Percentage Point)																	Average (Pct. Pt.) 1989-00
				1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1987-98	1988-89	1989-90	1990-00	1991-00	1992-00	1993-00	1994-00		
34 Telephone and telegraph	22.98		481	482	489	0.3592	0.1826	0.2272	0.4759	0.2822	0.2222	0.6240	0.1393	0.4357	0.7939	0.6430	0.3987				
32 Pipelines, except natural gas	14.25		46			-0.0362	0.0200	-0.0115	0.0044	-0.0209	-0.0210	0.0273	0.0164	0.0050	0.0009	0.0018	-0.0013				
40 Nondepository institutions	12.39		61			-0.0526	-0.0522	0.1814	0.2150	-0.1889	0.1418	0.2219	0.4873	0.1134	0.0906	0.1557	0.1194				
35 Radio and television	10.07		483	484		0.0753	0.1374	0.0977	0.0848	0.0897	0.2382	-0.1606	-0.0311	0.0159	-0.0022	0.1393	0.0622				
24 Petroleum and coal products	7.57		29			-0.3392	-0.1958	0.0652	0.0317	0.0254	0.2346	0.1308	-0.1797	0.0342	0.2604	-0.2932	-0.0205				
36 Electric, gas, and sanitary services	6.40		49			0.3301	0.2532	-0.1164	0.0050	0.1431	0.4207	0.0393	-0.2210	0.0814	0.6106	0.1475	0.1210				
3 Oil and gas extraction	4.02		13			0.0992	-0.2784	-0.3198	0.2300	0.1430	0.1505	-0.0848	0.1071	0.0079	-0.2615	-0.5865	-0.0721				
23 Chemicals and allied products	3.72		28			0.3379	-0.0891	0.1495	-0.0278	0.5399	0.1009	0.2141	0.3727	-0.3049	0.4361	0.4580	0.1894				
1 Metal mining	2.86		10			0.0380	0.0641	0.0161	-0.0035	-0.0078	-0.0055	0.0128	0.0140	0.0375	0.0092	-0.0130	0.0147				
18 Tobacco products	2.44		21			-0.1076	-0.1390	-0.1152	-0.0187	0.2223	0.0711	-0.0313	-0.0342	-0.0821	-0.3830	-0.0136	-0.0574				
33 Transportation services	2.38		47			0.0295	0.0101	-0.0054	0.0370	0.0729	0.0521	0.0885	0.0242	0.0453	0.0631	0.0230	0.0400				
50 Motion pictures	2.28		78			-0.0616	-0.0362	0.0026	0.1172	-0.0628	0.0734	0.0368	0.0396	0.0836	0.0318	0.0242	0.0226				
41 Security and commodity brokers	2.10		62			-0.1607	-0.0991	0.5304	0.5895	0.5753	0.0234	1.1994	0.6934	1.0379	1.1107	1.3351	0.6214				
39 Depository institutions	2.07		60			0.4603	0.0899	-0.4578	-0.0319	-0.2237	0.5271	-0.0505	0.1887	0.3875	0.4271	0.7120	0.1844				
42 Insurance carriers	1.94		63			-0.0701	0.7060	-0.4104	0.2699	-0.1282	0.0767	-0.2368	0.4440	-0.0168	0.0039	-0.1440	0.0449				
27 Railroad transportation	1.73		40			0.0467	0.1421	-0.0047	0.0086	0.0525	0.0243	0.0284	-0.0225	-0.0001	-0.0083	0.0190	0.0260				
44 Holding and other investment offices	1.65		67			0.1018	-0.0647	0.0767	0.1637	-0.2155	0.0426	-0.1788	0.0491	0.4453	-0.2348	-0.1720	0.0012				
15 Instruments and related products	1.59		38			0.0788	-0.0545	-0.1252	-0.2524	-0.1263	-0.0434	0.0422	-0.1453	-0.0267	-0.0327	-0.0007	-0.0624				
37 Wholesale trade	1.50		50	51		-0.1993	0.9906	1.2475	0.3168	1.2182	0.0593	1.7853	1.8881	2.4443	0.7213	0.5229	0.9996				
31 Transportation by air	1.45		45			0.2916	-0.0947	0.2039	0.1293	0.3515	0.1419	0.3080	0.1567	0.0576	0.1411	0.1288	0.1650				
12 Electronic and other electric equipment	1.27		36			0.1793	0.3038	0.0423	0.7580	1.0838	1.2688	0.9863	0.9733	0.7811	0.9683	1.2318	0.7798				
21 Paper and allied products	1.00		26			0.0251	0.0490	0.0583	0.1985	0.0228	-0.3546	0.1478	0.0806	-0.0663	0.0365	-0.2327	-0.0032				
22 Printing and publishing	0.84		27			-0.1617	-0.1781	-0.0481	-0.2309	0.0822	-0.1260	-0.0328	-0.0670	-0.0293	0.0876	-0.0482	-0.0684				
2 Coal mining	0.81		12			0.0223	0.0067	0.0541	0.0005	0.0628	0.0196	0.0427	0.0001	0.0227	0.0413	-0.0008	0.0247				
11 Industrial machinery and equipment	0.76		35			0.0598	-0.4616	0.3791	0.2377	0.4912	0.7905	0.4493	0.7380	1.0514	0.4407	0.4451	0.4201				
14 Other transportation equipment	0.74		37	exc371		0.0079	-0.0877	-0.3781	-0.2453	-0.2441	-0.1067	0.0741	0.1191	0.0621	0.1452	-0.1869	-0.0764				
4 Nonmetallic minerals, except fuels	0.64		14			-0.0069	-0.0210	0.0120	-0.0098	0.0588	-0.0012	0.0309	0.0179	0.0159	-0.0003	0.0444	0.0128				
47 Business services	0.64		73			0.6416	-0.2286	0.7864	0.6177	0.9930	0.7162	1.0500	1.4879	0.9163	1.4013	1.2484	0.8754				
49 Miscellaneous repair services	0.63		76			0.0036	-0.0782	-0.0520	-0.0032	-0.0091	0.0379	-0.0210	-0.0263	0.0188	-0.0538	-0.0207	-0.0186				
<b>Sum of Contributions (Pct.)</b>						<b>1.9930</b>	<b>0.8007</b>	<b>2.0857</b>	<b>3.6666</b>	<b>5.2831</b>	<b>4.7752</b>	<b>6.7432</b>	<b>7.3103</b>	<b>7.2118</b>	<b>6.8461</b>	<b>5.5679</b>	<b>4.7531</b>				

Source: ESA estimates derived from BEA data.

Table A-4.1c: GDP GROWTH IN BOTTOM-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000

INDUSTRY	SIC	Rank 1996	ITEQIFTE (Percentage Point)																	Average (Pct. Pt.) 1989-00
			1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1987-98	1998-99	1999-00							
17 Food and kindred products	20	0.59	0.0513	0.0888	-0.0113	0.1264	-0.0768	0.7318	-0.4959	-0.0206	-0.2039	0.1740	0.0264	0.0356						
9 Primary metal industries	33	0.57	-0.0017	-0.0358	0.0340	0.1828	0.0724	-0.0326	0.0451	0.0613	0.0575	0.0759	0.0039	0.0421						
13 Motor vehicles and equipment	371	0.56	-0.2778	-0.3280	0.3571	0.6147	0.5258	0.1444	-0.3793	0.1633	0.4620	0.0941	0.0614	0.1307						
53 Legal services	81	0.49	0.0119	-0.1026	0.0889	-0.1743	-0.0722	0.1247	-0.2499	0.2187	0.039	0.0991	0.1647	0.0194						
46 Personal services	72	0.43	-0.0390	-0.0514	0.0385	0.0748	-0.0083	0.1066	-0.0194	0.0573	0.1523	-0.0354	0.0275	0.0189						
52 Health services	80	0.42	0.0502	0.3419	0.3564	-0.1899	0.0302	0.2167	0.5205	0.0128	0.0466	0.3110	0.4596	0.2378						
8 Stone, clay, and glass products	32	0.42	0.0038	-0.1034	0.1093	-0.0186	0.1069	0.3007	0.0122	0.1188	-0.0012	0.0565	0.0415	0.0324						
30 Water transportation	44	0.42	0.0462	0.0163	-0.0087	0.0081	0.0324	-0.0018	0.0327	0.0347	-0.0016	-0.0436	-0.0025	0.0102						
43 Insurance agents, brokers, and service	64	0.41	-0.0046	0.0111	-0.1535	-0.1796	0.0218	-0.0960	-0.0368	0.0013	0.0988	0.2301	0.0384	-0.0026						
29 Trucking and warehousing	42	0.36	0.0386	0.1608	0.1807	0.1391	0.2501	0.0524	0.1969	-0.0561	0.1816	0.1736	0.1786	0.1360						
55 Other services, n.e.c.	34	0.34	-0.1185	-0.1858	0.0391	0.5142	0.2924	0.2570	0.3375	0.4456	0.6212	0.4342	0.6859	0.3580						
10 Fabricated metal products	34	0.32	-0.0079	-0.0504	0.0629	0.1449	0.4108	0.1968	0.0828	0.1034	0.0111	0.0604	0.0374	0.0858						
16 Miscellaneous manufacturing industries	29	0.29	-0.0079	-0.0504	-0.0423	0.0318	0.0488	0.0253	0.0152	0.0370	0.0008	0.0631	0.0242	0.0133						
28 Local and interurban passenger transit	41	0.28	-0.0150	-0.0100	-0.0015	0.0091	0.0052	0.0130	0.0080	0.0443	0.0263	0.0352	0.0470	0.0147						
19 Textile mill products	22	0.26	0.0342	0.0004	0.1228	0.0147	0.0375	-0.0331	-0.0220	-0.0132	-0.0275	-0.0170	0.0155	0.0102						
25 Rubber and miscellaneous plastics products	30	0.26	-0.0229	0.0508	0.1310	0.1382	0.1484	0.0794	0.0941	0.1186	0.0774	0.0772	0.0463	0.0853						
48 Auto repair, services, and parking	75	0.20	0.0829	-0.0676	-0.0612	0.0218	0.1404	0.1106	0.0906	0.0455	0.1783	0.1781	0.0972	0.0742						
6 Lumber and wood products	24	0.17	-0.0779	-0.1270	-0.0599	-0.0986	0.0779	0.1042	-0.0598	0.0187	0.0905	0.0337	-0.0101	0.0101						
38 Retail trade	52-59	0.17	-0.1270	-0.2101	0.6491	0.5007	1.4164	0.9132	1.6307	1.9686	1.7238	1.2832	1.7078	1.0415						
45 Hotels and other lodging places	70	0.16	0.0266	-0.0513	0.0465	0.0428	0.0840	0.1606	0.1249	-0.0541	-0.0523	0.0550	0.0894	0.0429						
26 Leather and leather products	31	0.16	-0.0048	0.0009	-0.0010	-0.0136	0.0095	0.0066	-0.0390	0.0016	-0.0130	-0.0051	0.0057	-0.0048						
7 Furniture and fixtures	25	0.16	-0.0455	-0.0432	0.0578	0.0624	0.0013	0.0203	-0.0011	0.0491	0.0259	0.0308	0.0164	0.0158						
20 Apparel and other textile products	23	0.13	-0.0320	-0.0134	0.0333	-0.0072	0.0345	-0.0152	-0.0372	-0.0169	-0.0397	-0.0832	-0.0036	-0.0164						
5 Construction	15,16,17	0.11	-0.2260	-0.8632	0.1152	0.2750	0.6557	0.0558	0.5884	0.2825	0.0252	0.7008	0.3073	0.2497						
51 Amusement and recreation services	79	0.10	0.1298	0.0437	0.2119	-0.0495	0.0846	0.1057	0.0958	0.1586	0.0723	0.1058	0.0375	0.0906						
54 Educational services	82	0.06	0.0119	0.0828	0.0311	0.0611	0.0604	0.0621	-0.0147	0.0227	0.0831	0.0421	0.0728	0.0468						
<b>Sum of Contributions (Pct.)</b>			<b>0.4138</b>	<b>-1.6737</b>	<b>2.3261</b>	<b>2.2312</b>	<b>4.3922</b>	<b>3.3033</b>	<b>2.5202</b>	<b>3.7715</b>	<b>4.4275</b>	<b>4.1865</b>	<b>4.2200</b>	<b>2.7381</b>						

Source: ESA estimates derived from BEA data.





Table A-4.2b: FTE GROWTH IN TOP-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000

Industry	Rank 1996	SIC	(Percentage Point)																	Average (Pct Pt.) 1989-00
			1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00							
34 Telephone and telegraph	22.98	481482489	0.1085	-0.0504	-0.0967	-0.0069	0.0309	0.0000	0.0519	0.1866	0.1126	0.1556	0.2271	0.0654						
32 Pipelines, except natural gas	14.25	46	0.0000	0.0034	0.0000	0.0000	-0.0069	-0.0032	0.0000	-0.0030	0.0000	0.0000	0.0000	-0.0015						
40 Nondepository institutions	12.39	61	0.0271	0.0134	0.0967	0.1804	0.0623	-0.0701	0.1459	0.2466	0.1174	-0.0661	0.0861	0.0861						
35 Radio and television	10.07	483484	0.0441	-0.0202	0.0000	0.0208	0.0343	0.0501	0.0519	0.1262	0.0365	0.0352	0.0632	0.0289						
24 Petroleum and coal products	7.57	29	0.0068	0.0034	-0.0069	-0.0173	-0.0137	-0.0100	-0.0130	-0.0095	-0.0061	-0.0088	-0.0144	-0.0081						
36 Electric, gas, and sanitary services	6.40	49	0.0712	0.0235	-0.0069	-0.0382	-0.0446	-0.0735	-0.0778	-0.0411	-0.0365	0.0059	-0.0172	-0.0214						
3 Oil and gas extraction	4.02	13	0.0475	0.0000	-0.1381	-0.0312	-0.0240	-0.0568	0.0000	0.0569	0.0000	-0.1262	0.0345	-0.0216						
23 Chemicals and allied products	3.72	28	0.0441	-0.0168	-0.0138	-0.0173	-0.0686	-0.0334	-0.0195	-0.0032	0.0030	0.0059	0.0057	-0.0103						
1 Metal mining	2.96	10	0.0068	-0.0101	-0.0069	-0.0104	-0.0069	0.0100	0.0065	0.0000	-0.0152	-0.0147	-0.0115	-0.0048						
18 Tobacco products	2.44	21	-0.0034	-0.0067	-0.0035	-0.0104	-0.0069	-0.0033	-0.0032	0.0000	-0.0030	-0.0038	-0.0057	-0.0050						
33 Transportation services	2.38	47	0.0102	-0.0067	0.0069	0.0625	0.0892	0.0568	0.0259	0.0632	0.0487	0.0147	0.0316	0.0366						
50 Motion pictures	2.28	78	0.0475	-0.0067	0.0000	0.0347	0.1063	0.1269	0.0876	0.0822	0.0609	0.0528	0.0000	0.0538						
41 Security and commodity brokers	2.10	62	-0.0102	-0.0168	0.0621	0.1145	0.1612	0.0367	0.0811	0.1391	0.1370	0.1204	0.1782	0.0912						
39 Depository institutions	2.07	60	-0.0136	-0.2558	-0.2209	-0.0520	-0.0549	-0.1236	-0.0466	0.0190	0.0091	-0.0205	-0.0546	-0.0770						
42 Insurance carriers	1.94	63	0.1526	0.0740	-0.0587	0.0139	0.0069	-0.0568	-0.0065	0.0411	0.1187	0.0734	-0.0747	0.0258						
27 Railroad transportation	1.73	40	-0.0543	-0.0303	-0.0276	-0.0104	-0.0206	0.0000	-0.0252	-0.0095	0.0091	0.0000	-0.0259	-0.0180						
44 Holding and other investment offices	1.65	67	0.0170	0.0336	-0.0276	0.0382	0.0034	-0.0234	0.0000	-0.0095	0.0061	0.0205	0.0115	0.0063						
15 Instruments and related products	1.59	38	-0.0984	-0.0941	-0.1450	-0.1145	-0.0892	-0.0634	0.0466	0.0285	0.0244	-0.0675	-0.0086	-0.0527						
37 Wholesale trade	1.50	50,51	-0.1730	-0.5446	0.0173	-0.2394	0.6312	0.7681	0.2562	0.5755	0.4870	0.3112	0.2846	0.2158						
31 Transportation by air	1.45	45	0.1628	-0.0336	-0.0069	0.1190	0.1088	0.1403	0.1557	0.0601	0.1674	0.1233	0.1351	0.1029						
12 Electronic and other electric equipment	1.27	36	-0.2238	-0.2790	-0.2175	-0.0208	0.1784	0.1436	0.1232	0.0949	0.0457	-0.1282	0.1495	-0.0120						
21 Paper and allied products	1.00	26	0.0102	-0.0235	-0.0069	0.0173	0.0069	0.0000	-0.0259	-0.0063	-0.0122	-0.0284	-0.0374	-0.0097						
22 Printing and publishing	0.84	27	0.0170	-0.1109	-0.1277	0.0243	0.1303	0.0033	-0.0195	0.0664	0.0365	-0.0352	-0.0057	-0.0019						
2 Coal mining	0.81	12	0.0034	-0.0370	-0.0311	-0.0486	0.0000	-0.0234	-0.0195	-0.0063	-0.0122	-0.0176	-0.0230	-0.0196						
11 Industrial machinery and equipment	0.76	35	-0.1289	-0.2522	-0.2831	0.0312	0.0204	0.2905	0.0746	0.1961	0.1218	-0.2143	-0.0575	-0.0018						
14 Other transportation equipment	0.74	37exc371	-0.0577	-0.2757	-0.2762	-0.3504	-0.2195	-0.1169	0.0195	0.1075	0.1309	-0.0763	-0.1082	-0.1113						
4 Nonmetallic minerals, except fuels	0.64	14	0.0000	-0.0235	-0.0104	0.0035	0.0034	0.0100	0.0000	0.0063	0.0061	0.0029	0.0029	0.0001						
47 Business services	0.64	73	0.8106	-0.4707	1.0080	1.4017	1.5642	1.9302	1.6343	2.0523	1.9573	1.8141	1.8400	1.4129						
49 Miscellaneous repair services	0.63	76	0.0509	-0.1614	0.0138	0.0555	-0.0686	0.0768	0.0466	0.0063	0.0244	-0.0059	-0.0201	0.0018						
<b>Sum of Contributions (Pct)</b>			<b>0.8750</b>	<b>-2.6056</b>	<b>-0.5074</b>	<b>1.1484</b>	<b>2.7167</b>	<b>2.9821</b>	<b>2.5456</b>	<b>3.8832</b>	<b>3.7016</b>	<b>2.1017</b>	<b>2.4322</b>	<b>1.7521</b>						

Source: ESA estimates derived from BEA data.

Table A-4.2c: FTE GROWTH IN BOTTOM-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000  
(Percentage Point)

Industry	Rank	SIC	ITOE/FTE																	Average (Pct. Pt.) 1989-00
			1996	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00						
17 Food and kindred products	0.59	20	0.0361	0.0150	-0.0210	0.0322	0.0423	0.0159	0.0205	-0.0050	-0.0033	0.0127	0.0046	0.0136						
9 Primary metal industries	0.57	33	-0.0285	-0.0619	-0.0867	-0.0170	0.0349	0.0106	0.0103	0.0033	0.0081	-0.0266	0.0031	-0.0120						
13 Motor vehicles and equipment	0.56	371	-0.0532	-0.0751	0.0705	0.0322	0.1140	0.1222	-0.0034	0.0251	0.0228	0.0445	-0.0031	0.0269						
53 Legal services	0.49	81	-0.0304	-0.0019	0.0172	0.0227	0.0018	-0.0053	0.0137	0.0301	0.0456	0.0397	0.0309	0.0149						
46 Personal services	0.43	72	0.0589	-0.0188	0.0343	0.0492	0.0441	0.0390	0.0394	-0.0033	0.0228	0.0461	0.0371	0.0317						
52 Health services	0.42	80	0.6020	0.5819	0.7128	0.4806	0.4559	0.3683	0.4825	0.3524	0.2446	0.2017	0.2086	0.4247						
8 Stone, clay, and glass products	0.42	32	-0.0228	-0.0695	-0.0229	0.0151	0.0331	0.0053	0.0034	0.0200	0.0228	0.0064	0.0155	0.0006						
30 Water transportation	0.42	44	0.0038	0.0113	-0.0152	-0.0019	0.0074	0.0000	-0.0017	0.0067	0.0049	0.0048	0.0077	0.0025						
43 Insurance agents, brokers, and service	0.41	64	0.0228	0.0169	-0.0305	0.0227	0.0386	0.0177	0.0171	0.0284	0.0048	0.0046	0.0046	0.0154						
29 Trucking and warehousing	0.36	42	-0.0133	-0.0375	0.0019	0.1400	0.1397	0.1027	0.0616	0.0768	0.025	0.1048	0.0525	0.0665						
55 Other services, n.e.c.	0.34	83,84,86,87,89	0.5222	0.3623	-0.0858	0.4938	0.4081	0.5153	0.4910	0.5411	0.825	0.4780	0.5986	0.4532						
10 Fabricated metal products	0.32	34	-0.0304	-0.1333	-0.0362	0.0170	0.0983	0.0885	0.0086	0.0685	0.0521	0.0238	0.0232	0.0155						
16 Miscellaneous manufacturing industries	0.29	39	-0.0380	-0.0075	0.0000	0.0170	0.0276	-0.0018	0.0086	-0.0033	0.0032	0.0032	-0.0015	0.0007						
28 Local and interurban passenger transit	0.28	41	0.0057	0.0131	0.0095	0.0341	0.0331	0.0230	0.0308	0.0267	0.0228	0.0238	0.0155	0.0216						
19 Textile mill products	0.26	22	-0.0437	-0.0563	0.0095	0.0132	0.0110	-0.0283	-0.0513	-0.0217	-0.0326	-0.0619	-0.0386	-0.0273						
25 Rubber and miscellaneous plastics products	0.26	30	0.0057	-0.0375	0.0286	0.0568	0.0809	0.0390	0.0034	0.0317	0.0244	-0.0064	0.0108	0.0216						
48 Auto repair, services, and parking	0.20	75	0.0627	-0.0864	0.0038	0.0985	0.0790	0.0992	0.1283	0.0768	0.488	0.9005	0.0711	0.0609						
6 Lumber and wood products	0.20	24	-0.0389	-0.0995	0.0114	0.0586	0.0901	0.0248	0.0171	0.0200	0.0374	0.0413	-0.0247	0.0124						
38 Retail trade	0.17	52-59	0.1671	-0.8185	0.2554	0.8211	1.1324	1.2784	0.6040	0.6280	0.785	0.830	0.9118	0.5765						
45 Hotels and other lodging places	0.16	70	0.0570	-0.0920	-0.0324	0.0285	0.0699	0.0761	0.0667	0.0701	0.0651	0.1048	0.0742	0.0442						
26 Leather and leather products	0.16	31	-0.0152	-0.0188	-0.0076	-0.0019	-0.0074	-0.0124	-0.0188	-0.0100	-0.0081	-0.0127	-0.0077	-0.0110						
7 Furniture and fixtures	0.16	25	-0.0342	-0.0676	0.0038	0.0265	0.0368	0.0159	-0.0086	0.0084	0.0326	0.0270	0.0124	0.0048						
20 Apparel and other textile products	0.13	23	-0.0798	-0.0619	-0.0114	-0.0170	0.0129	-0.0726	-0.1249	-0.0701	-0.0977	-0.1096	-0.1190	-0.0683						
5 Construction	0.11	15,16,17	-0.1006	-0.8673	-0.3297	0.2989	0.3683	0.5259	0.4517	0.5161	0.209	0.6273	0.4776	0.2463						
51 Amusement and recreation services	0.10	79	0.0987	0.0206	0.0801	0.1078	0.1655	0.1505	0.1129	0.1102	0.653	0.873	0.1283	0.1016						
54 Educational services	0.06	82	0.0456	0.0326	0.1620	0.0908	0.0846	0.0921	0.0770	0.0952	0.1465	0.1223	0.1298	0.1026						
Sum of Contributions (Pct.)			1.1384	-1.5074	0.7414	2.9155	3.8237	3.4899	2.4398	2.6722	2.4887	2.7586	2.6272	2.1402						

Source: ESA estimates derived from BEA data.



Table A-4.3b: GDP PER FTE GROWTH IN TOP-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000

Industry	TREQIFTE Rank 1996	SIC	(Percentage Point)																
			1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	1989-00	1989-95	1995-2000			
34 Telephone and telegraph	22.98	481,482,489	0.2485	0.2393	0.3255	0.4774	0.2447	0.2158	0.5579	-0.0455	0.3116	0.6532	0.4080	0.3279	0.2919	0.3710			
32 Pipelines except natural gas	14.25	46	-0.0359	0.0171	-0.0116	0.0044	-0.0137	-0.0139	0.0298	0.158	0.0078	-0.008	0.0018	0.0002	-0.0089	0.0112			
40 Nondepository institutions	12.39	61	-0.0790	-0.0674	0.0852	0.0342	-0.2641	0.2058	0.0741	0.3016	-0.1284	-0.0263	0.2166	0.0320	-0.0142	0.0875			
35 Radio and television	10.07	483,484	0.0310	0.1618	0.0982	0.0633	0.0539	0.1827	-0.2072	-0.0421	-0.0199	-0.0366	0.0743	0.0327	0.0985				
24 Petroleum and coal products	7.57	29	-0.3430	-0.2045	0.0724	0.0485	0.0381	0.2376	0.1402	-0.1639	0.0389	0.2837	-0.2722	-0.0151	-0.0251				
36 Electric, gas, and sanitary services	6.40	49	0.2586	0.2358	-0.1100	0.0427	0.1828	0.4798	0.1143	-0.1731	0.5922	0.1608	0.1405	0.1813	0.0916				
3 Oil and gas extraction	4.02	13	0.0513	-0.2658	-0.1826	0.2583	0.1626	0.2012	-0.0827	0.4683	0.0076	-0.1325	-0.6062	-0.0510	0.0342				
23 Chemicals and allied products	3.72	28	0.2912	-0.0681	0.1641	-0.0104	0.5924	0.1304	0.2277	0.3618	-0.2969	0.4214	0.4416	0.2050	0.1833				
1 Metal mining	2.96	10	0.0309	0.0762	0.0231	0.0068	-0.0009	-0.0151	0.0061	0.0135	0.0509	-0.0015	0.0194	0.0202	0.0185				
18 Tobacco products	2.44	21	-0.1034	-0.1388	-0.1123	-0.0082	0.2231	0.0723	-0.0274	-0.0329	-0.0762	-0.3664	-0.0077	-0.0523	-0.0107				
33 Transportation services	2.38	47	0.0191	0.0173	-0.0124	-0.0252	-0.0159	-0.0045	0.0610	-0.0375	-0.0033	0.0474	-0.0084	0.0034	-0.0036				
50 Motion pictures	2.28	78	-0.1081	-0.0302	0.0026	0.0915	-0.1647	-0.0495	-0.0411	0.0219	-0.0206	0.0237	-0.0306	-0.0306	-0.0451				
41 Security and commodity brokers	2.10	62	-0.1492	-0.0845	0.4706	0.4696	0.4032	-0.0129	1.0905	0.5395	0.8688	0.9700	1.1294	0.5172	0.1828				
39 Depository institutions	2.07	60	0.4697	0.3857	-0.2381	0.0199	-0.1643	0.6318	-0.0018	0.1634	0.3649	0.4385	0.7485	0.2562	0.1841				
42 Insurance carriers	1.94	63	-0.2208	0.6489	-0.3535	0.2531	-0.1314	0.1296	-0.2246	0.3678	-0.1307	-0.0681	-0.0676	0.0202	0.0543				
27 Railroad transportation	1.73	40	0.1001	0.1770	0.0230	0.0188	0.0711	0.0236	0.0562	-0.0126	-0.0089	-0.0082	0.0438	0.0440	0.0689				
44 Holding and other investment offices	1.65	67	0.0641	-0.1010	0.1049	0.1241	-0.2132	0.0640	-0.1744	0.0563	0.4235	-0.2501	-0.1791	-0.0055	0.1005				
15 Instruments and related products	1.59	38	0.1757	0.0406	0.0198	-0.1364	-0.0862	0.0195	-0.0063	-0.1673	-0.0492	0.0341	0.0077	-0.0089	0.0138				
37 Wholesale trade	1.50	5051	-0.0252	1.5764	1.2365	0.5499	0.5716	-0.6883	1.4912	1.2635	1.8873	0.4017	0.2326	0.7725	0.5366				
31 Transportation by air	1.45	45	0.1277	-0.0627	0.2119	0.1002	0.2353	0.0016	0.1486	0.0930	-0.1059	-0.0062	0.0610	0.0673	0.0294				
12 Electronic and other electric equipment	1.27	36	0.3996	0.5965	0.2611	0.7700	0.8815	1.0926	0.8416	0.8456	0.7092	1.0729	1.0586	0.7754	0.6672				
21 Paper and allied products	1.00	26	0.0148	0.0745	0.0655	0.1791	0.0155	-0.3443	0.1694	0.0836	-0.0522	0.0645	-0.1907	0.0073	0.0009				
22 Printing and publishing	0.84	27	-0.1771	-0.0690	0.0800	-0.2523	-0.0489	-0.1256	-0.0130	-0.1284	-0.0634	0.1203	-0.0444	-0.0682	-0.0985				
2 Coal mining	0.81	12	0.0187	0.0448	0.0856	0.0485	0.0417	0.0417	0.0606	0.0062	0.0336	0.0577	0.0217	0.0437	0.0501				
11 Industrial machinery and equipment	0.76	35	0.1870	-0.2150	0.6655	0.2041	0.2811	0.4855	0.3655	0.5217	0.8965	0.6415	0.4907	0.4113	0.2681				
14 Other transportation equipment	0.74	37exc371	0.0650	0.1930	-0.1024	0.1039	-0.0239	0.0099	0.0533	0.0111	0.0664	0.2170	-0.0758	0.0350	0.0409				
4 Nonmetallic minerals, except fuels	0.64	14	-0.0068	0.0026	0.0225	-0.0131	0.0539	-0.0109	0.0301	0.0112	0.0094	-0.0031	0.0406	0.0124	0.0080				
47 Business services	0.64	73	-0.1675	0.2476	-0.2227	-0.7751	-0.5561	-1.1789	-0.5898	-0.5453	-1.0039	-0.4043	-0.5775	-0.5229	-0.4421				
49 Miscellaneous repair services	0.63	76	-0.0469	0.0844	-0.0662	-0.0580	0.0560	-0.0377	-0.0879	-0.0314	-0.0054	-0.0469	-0.0006	-0.0199	-0.0305				
<b>Sum of Contributions (Pct.)</b>			<b>1.1083</b>	<b>3.4974</b>	<b>2.0064</b>	<b>2.4896</b>	<b>2.4986</b>	<b>1.7411</b>	<b>4.0534</b>	<b>3.2993</b>	<b>3.3849</b>	<b>4.6467</b>	<b>3.0612</b>	<b>2.3479</b>	<b>2.3236</b>				

Source: ESA estimates derived from BEA data.

Table A-4.3c: GDP PER FTE GROWTH IN BOTTOM-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000

Industry	FTE Rank 1996	SIC	(Percentage Point)																Average Contribution (Pct. Pt.) 1989-95	Average Contribution (Pct. Pt.) 1995-2000		
			1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	1989-90	1991-92	1993-94	1995-96	1997-98			1999-00	
17 Food and kindred products	0.59	20	0.0150	0.0749	0.0096	0.0915	-0.1137	0.6917	-0.5041	-0.0152	-0.1957	0.1570	0.0212	0.0211	0.0212	0.0211	0.0212	0.0211	0.0212	0.0211	0.1282	-0.1074
9 Primary metal industries	0.57	33	0.0265	0.0266	0.0999	0.1942	0.0361	-0.0418	0.0340	0.0565	0.0481	0.1070	0.0008	0.0530	0.0008	0.0530	0.0530	0.0530	0.0530	0.0530	0.0569	0.0482
13 Motor vehicles and equipment	0.56	371	-0.2220	-0.2568	0.2845	0.5861	0.3966	0.0215	-0.3869	0.1347	0.4286	0.0483	0.0629	0.0998	0.0483	0.0998	0.0483	0.0998	0.0483	0.0998	0.1316	0.0615
53 Legal services	0.49	81	0.0416	-0.1023	0.0713	-0.1914	-0.0713	0.1256	-0.2573	0.1638	0.0569	0.0578	0.1304	0.0041	-0.0210	0.0041	-0.0210	0.0041	-0.0210	0.0041	-0.0210	0.0343
46 Personal services	0.43	72	-0.0967	-0.0332	0.0042	0.0248	-0.0505	-0.0274	-0.0573	0.0591	0.1264	-0.0793	-0.0093	-0.0126	-0.0093	-0.0126	-0.0093	-0.0126	-0.0093	-0.0126	-0.0298	0.0079
52 Health services	0.42	80	-0.0907	-0.2437	-0.3538	-0.6514	-0.4100	-0.1465	0.0371	-0.3310	-0.1737	0.1064	0.2445	-0.1830	-0.3160	-0.1830	-0.3160	-0.1830	-0.3160	-0.1830	-0.0298	-0.0233
8 Stone, clay, and glass products	0.42	32	0.0263	-0.0345	0.1312	-0.0328	0.0711	0.0246	0.0086	0.0962	-0.0234	0.0488	0.0254	0.0310	0.0254	0.0310	0.0254	0.0310	0.0254	0.0310	0.0143	0.0311
30 Water transportation	0.42	44	0.0420	0.0051	0.0065	0.0097	0.0241	-0.0018	0.0336	0.0273	-0.0063	-0.0471	-0.0099	0.0076	-0.0099	0.0076	-0.0099	0.0076	-0.0099	0.0076	-0.0143	-0.0005
43 Insurance agents, brokers, and service	0.41	64	-0.0271	-0.0059	-0.1221	-0.1985	-0.0161	-0.0712	-0.0526	-0.0285	0.0710	0.2193	0.0329	-0.0177	0.0329	-0.0177	0.0329	-0.0177	0.0329	-0.0177	-0.0732	0.0488
29 Trucking and warehousing	0.36	42	0.0513	0.2014	0.1775	-0.0009	0.1064	-0.0486	0.1321	-0.1296	0.0771	0.0670	0.1228	0.0688	0.1228	0.0688	0.1228	0.0688	0.1228	0.0688	0.0612	0.0539
			83,84.86.																			
55 Other services, n.e.c.	0.34	87.89	-0.0545	-0.5565	0.1239	0.0198	-0.1115	-0.2206	-0.1498	-0.0331	-0.0403	-0.0427	0.0870	-0.0944	0.0870	-0.0944	0.0870	-0.0944	0.0870	-0.0944	-0.1332	-0.0478
10 Fabricated metal products	0.32	34	-0.0871	-0.0964	0.0984	0.1242	0.3000	0.0650	0.0725	0.0438	-0.0400	0.0356	0.1139	0.0483	0.1139	0.0483	0.1139	0.0483	0.1139	0.0483	0.0675	0.0252
16 Miscellaneous manufacturing industries	0.29	39	0.0297	-0.0436	-0.0420	0.0144	0.0214	0.0262	0.0065	0.0393	-0.0024	0.0563	0.0251	0.0121	0.0563	0.0251	0.0121	0.0563	0.0251	0.0121	0.0010	0.0254
28 Local and interurban passenger transit	0.28	41	-0.0204	-0.0235	-0.0110	-0.0242	-0.0269	-0.0087	-0.0223	0.0172	0.0034	0.0111	0.0307	-0.0069	0.0307	-0.0069	0.0307	-0.0069	0.0307	-0.0069	-0.0193	0.0080
19 Textile mill products	0.26	22	0.0770	0.0576	0.1124	0.0014	0.0255	-0.0046	0.0286	0.083	0.0049	0.0438	0.0527	0.0371	0.0527	0.0371	0.0527	0.0371	0.0527	0.0371	0.0449	0.0277
25 Rubber and miscellaneous plastics products	0.26	30	-0.0283	0.0897	0.1016	0.0791	0.0650	0.0391	0.0885	-0.0487	0.0517	0.0813	0.0346	0.0625	0.0346	0.0625	0.0346	0.0625	0.0346	0.0625	0.0577	0.0682
48 Auto repair, services, and parking	0.20	75	0.0200	0.0911	-0.0645	-0.0726	0.0591	0.0111	-0.0368	0.0305	0.1264	0.0852	0.0254	0.0129	0.0852	0.0254	0.0129	0.0852	0.0254	0.0129	-0.0047	0.0339
6 Lumber and wood products	0.20	24	-0.0376	-0.0279	-0.0708	-0.1528	-0.0117	0.0757	-0.0750	-0.0327	-0.0183	0.0479	0.0570	-0.0223	0.0570	-0.0223	0.0570	-0.0223	0.0570	-0.0223	-0.0373	-0.0042
38 Retail trade	0.17	52.59	-0.2907	0.6177	0.3908	-0.3113	0.2735	-0.3529	1.0023	1.3065	1.2150	0.3895	0.7756	0.4560	0.7756	0.4560	0.7756	0.4560	0.7756	0.4560	0.0545	0.3978
45 Hotels and other lodging places	0.16	70	-0.0301	0.0414	0.0783	0.0158	0.037	0.0816	0.0568	-0.1211	-0.1146	-0.0485	0.0148	-0.0011	0.0148	-0.0011	0.0148	-0.0011	0.0148	-0.0011	0.0334	-0.0425
26 Leather and leather products	0.16	31	0.0102	0.0200	0.0066	-0.0114	0.0162	0.0183	-0.0197	0.0113	-0.0048	0.0074	0.0131	0.0061	0.0131	0.0061	0.0131	0.0061	0.0131	0.0061	0.0100	0.0015
7 Furniture and fixtures	0.16	25	-0.0112	0.0248	0.0535	0.0349	-0.0341	0.0042	0.0072	0.0397	-0.0065	0.0037	0.0039	0.0109	0.0039	0.0109	0.0039	0.0109	0.0039	0.0109	0.0120	0.0086
20 Apparel and other textile products	0.13	23	0.0473	0.0483	0.0444	0.0095	0.0208	0.0555	0.0856	0.0519	0.0565	0.0257	0.1124	0.0508	0.1124	0.0508	0.1124	0.0508	0.1124	0.0508	0.0378	0.0664
5 Construction	0.11	15,16,17	-0.1239	0.0042	0.4417	-0.0232	0.0649	-0.4252	0.1335	-0.2276	0.2070	0.0715	-0.1659	0.0043	-0.1659	0.0043	-0.1659	0.0043	-0.1659	0.0043	-0.0103	0.0217
51 Amusement and recreation services	0.10	79	0.0307	0.0234	0.1309	-0.1529	-0.0779	-0.0433	-0.0167	0.0471	0.0166	0.0180	-0.0855	-0.0102	-0.0855	-0.0102	-0.0855	-0.0102	-0.0855	-0.0102	-0.0148	-0.0047
54 Educational services	0.06	82	-0.0333	0.0002	-0.1289	-0.0289	-0.0233	-0.0280	-0.0895	-0.0706	-0.0619	-0.0780	-0.0556	-0.0545	-0.0556	-0.0545	-0.0556	-0.0545	-0.0556	-0.0545	-0.0407	-0.0711
<b>Sum of Contributions (Pct.)</b>			<b>-0.7261</b>	<b>-0.1689</b>	<b>1.5731</b>	<b>-0.6649</b>	<b>0.5475</b>	<b>-1.1803</b>	<b>0.0786</b>	<b>1.1299</b>	<b>1.8917</b>	<b>1.3896</b>	<b>1.5580</b>	<b>0.5835</b>	<b>1.5580</b>	<b>0.5835</b>	<b>1.5580</b>	<b>0.5835</b>	<b>1.5580</b>	<b>0.5835</b>	<b>0.0618</b>	<b>1.2085</b>

Source: ESA estimates derived from BEA data.



**Table A-4.5: GDP PER FTE GROWTH IN TOP-HALF AND BOTTOM-HALF INDUSTRIES AND IN ALL INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-1995 AND 1995-2000**

	Average Contrib. (Pct.) 1989-1995	Average Contrib. (Pct.) 1995-2000
Top-Half Industries (see Table A-4.3b)	2.3236	3.6971
Bottom-Half Industries (see Table A-4.3c)	0.0618	1.2096
<b>All Industries (see Table A-4.3a)</b>	<b>1.0208</b>	<b>2.4806</b>

Source: ESA estimates derived from BEA data.





**Table A-4.7: GDP PER FTE GROWTH IN U.S. NONFARM BUSINESS SECTOR BY MAJOR INDUSTRY GROUPS, 1989-2000**  
(Percent)

Industry Group	Growth (Pct.)										GPO/FTE Growth (Pct.) 1989-00	
	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99		1999-00
Mining	0.4289	-1.4863	2.8025	10.0291	8.3880	7.7683	0.7680	0.3126	3.6042	2.8966	-15.2979	1.8376
Construction	-0.8570	1.7682	5.0801	-0.8231	-0.5233	-4.9669	0.4895	-2.9302	1.8252	-0.4380	-2.1608	-0.3197
Manufacturing, Durable Goods	1.7602	0.5601	4.5907	6.0454	6.6110	6.4019	3.5698	6.4189	7.5469	8.8874	6.9374	5.3936
Manufacturing, Nondurable Goods	-0.5869	-0.1361	2.4251	0.4606	3.6913	4.1094	1.1824	1.6183	-2.4737	5.1129	1.4383	1.5311
Transportation and Public Utilities	3.0124	4.2343	3.0906	1.2016	2.3096	2.4897	3.1018	-2.1663	-0.9854	4.5937	2.9059	2.1625
Wholesale trade	-0.2097	8.3755	6.7070	2.8882	3.1699	-3.4170	8.2531	7.1947	10.8067	2.2119	1.3533	4.3031
Retail trade	-1.0568	1.7932	1.8904	-0.5321	2.3069	-0.2394	5.0619	6.3008	5.6761	2.4734	4.2146	2.5354
Finance and Insurance	0.4167	4.3124	-0.1505	3.3693	-2.2605	5.1231	3.3806	6.5162	6.0366	5.3642	8.8545	3.7257
Services	-0.4857	-1.6535	-0.1442	-2.3792	-1.3960	-1.2109	-0.9161	-0.1774	-0.3761	0.5707	0.9788	-0.6536
<b>All Industries</b>	<b>0.1228</b>	<b>1.4580</b>	<b>1.9060</b>	<b>0.6196</b>	<b>1.3395</b>	<b>0.6790</b>	<b>2.0439</b>	<b>2.3857</b>	<b>2.8079</b>	<b>2.8931</b>	<b>2.2722</b>	<b>1.6844</b>

Source: ESA estimates derived from BEA data.



**Table A-4.9: GDP PER FTE GROWTH IN U.S. NONFARM BUSINESS SECTOR BY MAJOR INDUSTRY GROUPS  
1989-1995 AND 1995-2000  
(Percent)**

Industry Group	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	GPO/FTE Growth (Pct.) 1989-95	GPO/FTE Growth (Pct.) 1995-00
Mining	0.4289	-1.4863	2.8025	10.0291	8.3880	7.7683	0.7680	0.3126	3.6042	2.8966	-15.2979	4.6551	-1.5433
Construction	-0.8570	1.7882	5.0801	-0.8231	-0.5233	-4.9669	0.4895	-2.9302	1.8252	-0.4380	-2.1608	-0.0504	-0.6429
Manufacturing, Durable	1.7602	0.5601	4.5907	6.0454	6.6110	6.4019	3.5698	6.4189	7.5469	8.8874	6.9374	4.3282	6.6721
Manufacturing, Nondurables Goods	-0.5869	-0.1361	2.4251	0.4606	3.6913	4.1094	1.1824	1.6183	-2.4737	5.1129	1.4383	1.6606	1.3756
Transportation and Public Utilities	3.0124	4.2343	3.0906	1.2016	2.3096	2.4897	3.1018	-2.1663	-0.9854	4.5937	2.9059	2.7230	1.4899
Wholesale trade	-0.2097	8.3755	6.7070	2.8882	3.1699	-3.4170	8.2531	7.1947	10.8067	2.2119	1.3533	2.9190	5.9639
Retail trade	-1.0568	1.7932	1.8904	-0.5321	2.3069	-0.2394	5.0619	6.3008	5.6761	2.4734	4.2146	0.6937	4.7454
Finance and Insurance	0.4167	4.3124	-0.1505	3.3893	-2.2605	5.1231	3.3806	6.5162	6.0366	5.3642	8.8545	1.8051	6.0304
Services	-0.4857	-1.6535	-0.1442	-2.3792	-1.3960	-1.2109	-0.9161	-0.1774	-0.3761	0.5707	0.9788	-1.2116	0.0160
<b>All Industries</b>	<b>0.1228</b>	<b>1.4580</b>	<b>1.9060</b>	<b>0.6196</b>	<b>1.3395</b>	<b>0.6790</b>	<b>2.0439</b>	<b>2.3857</b>	<b>2.8079</b>	<b>2.8931</b>	<b>2.2722</b>	<b>1.0208</b>	<b>2.4806</b>

Source: ESA estimates derived from BEA data.





**Table A-4.11b: PRICE GROWTH IN TOP-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000**  
(Percentage Point)

Industry	ITEQ/ FTE Rank 1996	SIC	(Percentage Point)											Average (Pct. Pt.) 1989-00
			1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1987-98	1998-99	1999-00	1989-00
31 Telephone and telegraph	22.98	481,482,489	-0.0327	0.0465	-0.0069	-0.0154	0.1081	-0.0812	-0.1633	-0.0429	-0.0197	-0.2721	-0.2958	-0.0705
29 Pipelines, except natural gas	14.25	46	0.0403	-0.0247	0.0114	-0.0007	0.0185	0.0224	-0.0195	-0.0152	0.0062	-0.0006	0.0002	0.0035
36 Nondepository institutions	12.39	61	0.0342	0.0529	0.0062	0.0254	0.0586	0.0491	-0.0304	-0.1149	-0.0179	-0.0636	-0.0068	-0.0007
32 Radio and television	10.07	483,484	0.1478	0.0085	0.0708	0.1226	0.0480	0.0843	0.1656	0.1519	0.1512	0.0954	0.1540	0.1091
21 Chemicals and allied products	3.72	28	0.0021	0.3083	0.1005	0.2017	0.1545	0.4025	-0.1103	0.0181	0.3105	-0.1190	-0.0005	0.1153
1 Metal mining	2.96	10	-0.0432	-0.0472	-0.0179	-0.0328	0.0395	0.0474	-0.0401	-0.0228	-0.0460	-0.0207	0.0106	-0.0158
16 Tobacco products	2.44	21	0.1566	0.1993	0.1829	-0.0555	-0.1889	0.0027	0.0219	0.0576	0.1474	0.4384	0.1145	0.0979
30 Transportation services	2.38	47	0.0497	0.0613	0.0273	0.0023	0.0044	-0.0150	-0.0051	0.0230	-0.0146	-0.0044	0.0470	0.0160
46 Motion pictures	2.28	78	0.0558	0.0502	0.0129	0.0013	0.0284	0.0224	0.0503	0.0197	0.0088	0.0559	0.0623	0.0335
37 Security and commodity brokers	2.10	62	0.0118	0.0117	0.1396	-0.0011	-0.1432	-0.0289	-0.0592	-0.2513	-0.2849	-1.2766	-1.2061	-0.2808
35 Depository institutions	2.07	60	0.2842	1.1157	1.0891	-0.1777	0.2239	0.5674	0.5811	0.9976	0.4740	0.3620	0.4673	0.5441
38 Insurance carriers	1.94	63	0.3059	0.2201	0.3902	0.5629	0.3375	0.5861	0.3690	0.3657	0.1533	0.2473	0.4232	0.3601
24 Railroad transportation	1.73	40	-0.0539	-0.0428	-0.0148	0.0096	0.0053	-0.0135	-0.0349	0.0072	0.0423	-0.0249	-0.0293	-0.0136
40 Holding and other investment offices	1.65	67	0.0407	0.0048	0.0626	0.0147	-0.0065	0.0464	0.0535	0.0616	0.0678	0.0560	0.1149	0.0469
14 Instruments and related products	1.59	38	0.2329	0.1805	0.1556	0.1039	0.0626	0.0596	0.2118	0.1437	0.1592	0.0713	0.1602	0.1401
33 Wholesale trade	1.50	50,51	0.8564	-0.0544	-0.3925	0.5225	0.8191	0.8404	-0.7142	-0.5955	-1.1172	0.0695	0.6535	0.0807
28 Transportation by air	1.45	45	-0.2400	0.1947	-0.0522	0.1562	-0.0980	0.0699	-0.1950	0.1190	0.1810	-0.0032	-0.0521	0.0073
11 Electronic and other electric equipment	1.27	36	-0.1563	-0.0670	-0.2039	-0.1702	-0.3151	-1.0128	-0.7686	-0.5419	-1.0151	-0.7775	-0.8025	-0.5301
19 Paper and allied products	1.00	26	-0.0540	-0.0750	-0.0149	-0.1482	0.1187	0.7469	-0.2702	-0.1575	0.1305	0.0329	0.2975	0.0552
20 Printing and publishing	0.84	27	0.2682	0.3036	0.2538	0.2262	0.1374	0.0206	0.3227	0.1741	0.1776	0.1338	0.1297	0.1952
2 Coal mining	0.81	12	-0.0349	-0.0265	-0.0301	-0.0723	-0.0315	-0.0439	-0.0266	-0.0207	-0.0195	-0.0449	-0.0154	-0.0333
10 Industrial machinery and equipment	0.76	35	0.0097	0.0189	-0.1700	-0.2581	-0.1873	-0.3346	-0.3278	-0.5093	-0.5552	-0.4832	-0.1555	-0.2684
13 Other transportation equipment	0.74	37exc371	0.1927	0.2032	0.1906	0.0765	0.0518	0.0302	0.0694	0.0255	0.0314	0.0428	0.1408	0.0959
3 Nonmetallic minerals, except fuels	0.64	14	0.0082	0.0038	-0.0006	-0.0105	0.0114	0.0102	-0.0012	0.0148	0.0000	0.0056	-0.0128	0.0026
43 Business services	0.64	73	0.4263	0.3297	0.3755	0.2147	0.1063	0.4561	0.4853	0.3907	0.5403	0.5383	0.7426	0.4187
45 Miscellaneous repair services	0.63	76	0.0548	0.0533	0.0888	0.0785	0.0153	0.0174	0.0673	0.0428	0.0526	0.0779	0.0645	0.0557
8 Primary metal industries	0.57	33	-0.1146	-0.1362	-0.0564	-0.0410	0.1225	0.2647	-0.1325	-0.0031	-0.0417	-0.1708	0.0765	-0.0211
12 Motor vehicles and equipment	0.56	371	0.0257	0.2876	0.2729	0.2210	0.1826	-0.0340	0.1818	-0.0185	0.0154	0.1305	-0.0255	0.1127
<b>Sum of Contributions (Pct.)</b>			<b>2.4746</b>	<b>3.1806</b>	<b>2.4701</b>	<b>1.5567</b>	<b>1.6837</b>	<b>2.7828</b>	<b>-0.3193</b>	<b>0.3197</b>	<b>-0.4823</b>	<b>-0.9037</b>	<b>1.0570</b>	<b>1.2564</b>

Note: Table A-4.1 up to Table A-4.10 cover 55 industries. In contrast, Tables A-4.11a, 4.11b, 4.11c and Table A-4.12 cover 51 industries.

See footnote 5, p. 33, Table 4.1, p. 35, and footnote 13, p. 38, for the excluded industries and the reasons for their exclusion.

Source: ESA estimates derived from BEA data.

**Table A-4.11c: PRICE GROWTH IN BOTTOM-HALF INDUSTRIES OF THE U.S. NONFARM BUSINESS SECTOR, 1989-2000**

Industry	FTE Rank 1996	SIC	(Percentage Point)													Average (Pct. Pt.) 1989-00
			1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1987-98	1998-99	1999-00			
49 Legal services	0.49	81	0.3448	0.2679	0.2517	0.2087	0.1491	0.1305	0.1513	0.1693	0.1534	0.0972	0.1382	0.1875		
42 Personal services	0.43	72	0.1104	0.0991	0.0628	0.0707	0.0666	0.0373	0.0514	0.0670	0.0414	0.0508	0.0606	0.0653		
48 Health services	0.42	80	1.2355	1.2106	1.2089	0.9916	0.8180	0.5513	0.4439	0.4700	0.6037	0.4770	0.4201	0.7664		
7 Stone, clay, and glass products	0.42	32	0.0038	0.0392	-0.0014	0.0294	0.0553	0.0484	0.0173	0.0201	0.0529	0.0615	-0.0035	0.0294		
27 Water transportation	0.42	44	-0.0279	0.0340	-0.0104	-0.0048	-0.0042	0.0091	-0.0143	-0.0048	0.0210	0.0486	0.0371	0.0076		
39 Insurance agents, brokers, and service	0.41	64	0.1799	0.0039	0.2397	0.3118	0.1296	0.1400	0.1050	0.0887	0.0706	0.0400	0.0139	0.1203		
26 Trucking and warehousing	0.36	42	0.0678	-0.1058	-0.0190	0.0620	0.0413	0.0527	-0.0970	0.3313	0.3112	0.0652	-0.0709	0.0581		
			83,84,86,													
51 Other services, n.e.c.	0.34	87,89	0.5160	0.5633	0.7633	0.2117	0.2873	0.4925	0.3829	0.4790	0.4267	0.5033	0.5014	0.4661		
9 Fabricated metal products	0.32	34	0.1812	0.1474	0.0417	0.0209	-0.0187	-0.0100	0.1426	0.0523	0.1285	0.1244	-0.0053	0.0732		
15 Miscellaneous manufacturing industries	0.29	39	0.0418	0.0544	0.0364	0.0260	0.0056	-0.0110	0.0260	0.0735	0.0210	0.0099	-0.0014	0.0202		
25 Local and interurban passenger transit	0.28	41	0.0055	0.0697	0.0374	0.0088	0.0050	0.0211	0.0295	0.0066	0.0375	-0.0130	-0.0167	0.0174		
17 Textile mill products	0.26	22	0.0135	0.0230	0.0246	-0.0137	-0.0461	0.0042	0.0447	0.0295	0.0302	0.0104	-0.0402	0.0073		
22 Rubber and miscellaneous plastics products	0.26	30	0.0378	0.0422	-0.0174	-0.0026	-0.0185	-0.0369	0.0342	-0.0404	0.0810	-0.0054	-0.0223	0.0047		
44 Auto repair, services, and parking	0.20	75	0.1093	0.1301	0.1041	0.0972	0.0797	0.0899	0.0308	0.1095	0.0914	0.0332	0.0722	0.0861		
5 Lumber and wood products	0.20	24	0.0021	0.0485	0.1621	0.2694	0.0940	-0.0112	-0.0279	0.0612	0.0046	0.0428	-0.0914	0.0504		
34 Retail trade	0.17	52-59	0.9540	1.0603	0.6635	0.6737	0.3149	0.0772	-0.2177	-0.1712	-0.1485	0.0437	-0.0710	0.2890		
41 Hotels and other lodging places	0.16	70	0.0968	0.1574	0.0544	0.0751	0.0623	0.0368	0.0389	0.2152	0.1621	0.1634	0.0858	0.1044		
23 Leather and leather products	0.16	31	0.0098	0.0063	0.0036	0.0040	0.0025	0.0051	0.0001	0.0030	0.0054	0.0007	-0.0031	0.0034		
6 Furniture and fixtures	0.16	25	0.0376	0.0290	0.0038	0.0005	0.0346	0.0047	0.0472	0.0208	0.0268	0.0200	0.0041	0.0208		
18 Apparel and other textile products	0.13	23	0.0369	0.0492	0.0304	0.0189	0.0014	-0.0364	0.0291	0.0033	0.0243	0.0362	-0.0188	0.0159		
4 Construction	0.11	15,16,17	0.4083	0.1482	-0.0416	0.3714	0.4401	0.5235	0.3738	0.4961	0.5790	0.6797	0.8145	0.4357		
47 Amusement and recreation services	0.10	79	0.0948	0.1017	0.0538	0.0644	0.0746	0.0604	0.0810	0.0710	0.1023	0.0449	0.1310	0.0800		
50 Educational services	0.06	82	0.1192	0.1197	0.1031	0.0623	0.0783	0.0601	0.1086	0.0913	0.1300	0.1015	0.1151	0.0990		
<b>Sum of Contributions (Pct.)</b>			<b>4,5786</b>	<b>4,2991</b>	<b>3,7555</b>	<b>3,5574</b>	<b>2,6528</b>	<b>2,2394</b>	<b>1,7814</b>	<b>2,5826</b>	<b>2,9563</b>	<b>2,6359</b>	<b>2,0494</b>	<b>3,0080</b>		

Note: Table A-4.1 up to Table A-4.10 cover 55 industries. In contrast, Tables A-4.11a, 4.11b, 4.11c and Table A-4.12 cover 51 industries. See footnote 5, p. 33, Table 4.1, p. 35, and footnote 13, p. 38, for the excluded industries and the reasons for their exclusion.

Source: ESA estimates derived from BEA data.





## **APPENDIX B**

Let GDP be the aggregate (chained 1996 dollars) gross domestic product of industries in the U.S. nonfarm business sector and FTE be the total sum of workers in these industries in each year during 1989-2000. Also, let the subscripts  $t-1$  and  $t$  represent any two succeeding years during this period. Thus, the overall nonfarm business sector GDP per FTE annual growth rate is, by definition,

$$(1) \quad \frac{\frac{GDP_t}{FTE_t} - \frac{GDP_{t-1}}{FTE_{t-1}}}{\frac{GDP_{t-1}}{FTE_{t-1}}} = \frac{\left(\frac{GDP_t}{GDP_{t-1}} - 1\right) - \left(\frac{FTE_t}{FTE_{t-1}} - 1\right)}{\frac{FTE_t}{FTE_{t-1}}}.$$

where

$$(2) \quad \frac{GDP_t}{GDP_{t-1}} - 1 = \text{annual growth rate of aggregate GDP}$$

and

$$(3) \quad \frac{FTE_t}{FTE_{t-1}} - 1 = \text{annual growth rate of total FTE}.$$

### **Decomposing the Overall GDP Per FTE Growth Rate**

The overall GDP per FTE annual growth rate in equation (1) can be decomposed into the individual contributions of the 55 industries (see footnote 5, p. 33, and Table 4.1, page 35, in the text) by decomposing the annual growth rates of aggregate GDP in equation (2) and of total FTE workers in equation (3). Before decomposing the annual growth rate of aggregate GDP, the real aggregate levels in chained (1996) dollars must first be obtained from the nominal and (real) chained dollar GDP levels of each of the 55 industries following BEA's chained dollar aggregation procedure (see Seskin, Eugene P. and Robert P. Parker, "A Guide to the NIPA's," *Survey of Current Business*, Vol. 78, March 1998, pp. 26-68). Once the aggregate GDP levels are obtained, the decomposition of (2) is accomplished by BEA's formula for component (e.g., an industry) contributions to the growth rate of a chained dollar aggregate (see Moulton, Brent R. and Eugene P. Seskin, "A Preview of the 1999 Comprehensive Revision of the National Income and Product Accounts," *Survey of Current Business*, Vol. 79, October 1999, pp. 6-17.)

Following BEA's exact formula for a component's, e.g., an industry's, contribution to the aggregate GDP growth rate, equation (2) can be expressed as,

$$(4) \quad \frac{GDP_t}{GDP_{t-1}} - 1 = \sum_i^N w_{i,t}^q \left( \frac{q_{i,t} - q_{i,t-1}}{q_{i,t-1}} \right)$$

where  $w_{i,t}^q$  is the industry's "GDP growth weight" referred to in the text;  $q_{i,t-1}$  and  $q_{i,t}$  are the levels of the industry's chained dollar GDP in the two adjoining periods  $t-1$  and  $t$ ; and  $N$  is the total number of industries. The expression inside the parenthesis is the industry's chained dollar GDP growth rate.

The formula for the "GDP growth weight" is,

$$(5) \quad w_{i,t}^q = \frac{((p_{i,t} / P_t^F) + p_{i,t-1}) q_{i,t-1}}{\sum_i^N ((p_{i,t} / P_t^F) + p_{i,t-1}) q_{i,t-1}} ; \quad \sum_i^N w_{i,t}^q = 1$$

where  $p_{i,t-1}$  and  $p_{i,t}$  are the implicit price deflators or ratios (1996 = 1) of an industry's nominal GDP to its chained dollar GDP in each period. In (5),  $P_t^F$  is the chain-type Fisher ideal price index computed using  $q_{i,t-1}$ ,  $q_{i,t}$ ,  $p_{i,t-1}$  and  $p_{i,t}$ .

Letting  $l_{i,t-1}$  and  $l_{i,t}$  be an industry's FTE levels in the two adjoining periods, then the corresponding total FTEs for all  $N$  industries are,

$$(6) \quad FTE_{t-1} = \sum_i^N l_{i,t-1} \quad ; \quad FTE_t = \sum_i^N l_{i,t}$$

since total FTE in each period is the arithmetic sum of the FTE levels across industries. It follows from (6) that,

$$(7) \quad \frac{FTE_t}{FTE_{t-1}} - 1 = \sum_i^N w_{i,t}^l \left( \frac{l_{i,t} - l_{i,t-1}}{l_{i,t-1}} \right)$$

where  $w_{i,t}^l$  is the industry's "FTE growth weight" referred to in the text and the expression inside the parenthesis is the industry's FTE growth rate. It can be verified from (6) and (7) that

$$(8) \quad w_{i,t}^l = \frac{l_{i,t-1}}{FTE_{t-1}}$$

which means that the “FTE growth weight” of an industry from period  $t-1$  to period  $t$  is the industry’s share of total FTE in period  $t-1$ .

By substituting equations (4) and (7) into (1), it can be seen that,

$$(9) \quad \frac{\frac{GDP_t}{FTE_t} - \frac{GDP_{t-1}}{FTE_{t-1}}}{\frac{GDP_{t-1}}{FTE_{t-1}}} = \frac{\sum_i^N w_{i,t}^q \left( \frac{q_{i,t} - q_{i,t-1}}{q_{i,t-1}} \right) - \sum_i^N w_{i,t}^l \left( \frac{l_{i,t} - l_{i,t-1}}{l_{i,t-1}} \right)}{\frac{FTE_t}{FTE_{t-1}}}$$

### Comparing an Industry’s Contribution to Overall Productivity Growth to its Productivity Growth

By factoring out the summation sign, each component being summed in (9) is the individual *industry’s contribution to the overall productivity growth rate* that is given by,

$$(10) \quad \frac{w_{i,t}^q \left( \frac{q_{i,t} - q_{i,t-1}}{q_{i,t-1}} \right) - w_{i,t}^l \left( \frac{l_{i,t} - l_{i,t-1}}{l_{i,t-1}} \right)}{\frac{FTE_t}{FTE_{t-1}}}$$

In contrast, the expression for the *industry’s individual productivity growth rate* is similar to that in (1) and is given by,

$$(11) \quad \frac{\left( \frac{q_{i,t} - q_{i,t-1}}{q_{i,t-1}} \right) - \left( \frac{l_{i,t} - l_{i,t-1}}{l_{i,t-1}} \right)}{\frac{l_{i,t}}{l_{i,t-1}}}$$

It can be seen that the sign of the industry’s contribution to the overall productivity growth in (10) is *not* necessarily the same as the sign of its individual productivity growth rate in (11) unless the GDP growth weight,  $w_{i,t}^q$  equals the FTE growth weight,  $w_{i,t}^l$ .

There is no basis in economic theory for  $w_{i,t}^q$  to equal  $w_{i,t}^l$  and, empirically, the data show that they are not equal except by accident. Therefore, productivity growth trends in individual industries are *misleading* indicators of industry-level contributions to the overall productivity growth rate. Hence, this study computes the expression in (10) to determine *exactly* these industry-level contributions to overall productivity growth.

### Determining An Industry's Contribution to Overall Inflation

It can be verified that the growth rate of aggregate chained dollar GDP given by equation (4) exactly equals the growth rate of BEA's chain-type quantity index and the growth rate of the underlying chain-type Fisher quantity index. Because the roles of prices and quantities are symmetric in the definition of the Fisher index formula, simply switching quantities ( $q$ ) to prices ( $p$ ), vice versa, converts the formulas in (4) and (5) so as to yield an exact measure of a component's (e.g., an industry's) contribution to the growth rate of the chain-type Fisher ideal price index. This contribution is the component's contribution to the overall inflation rate, since it can also be verified that the growth rate of the chain-type Fisher ideal price index equals the growth rate of the aggregate GDP implicit price deflator, the ratio of total nominal GDP to aggregate chained dollar GDP for all 51 industries in each period (see footnote 5, p. 33, Table 4.1, page 35, and footnote 13, p. 38, in the text for the excluded industries and the reasons for their exclusion).

Following the above discussion, by simply switching notation, it follows from (4) that an industry's contribution to the overall GDP inflation rate is,

$$(12) \quad w_{i,t}^p \left( \frac{p_{i,t} - p_{i,t-1}}{p_{i,t-1}} \right)$$

where  $w_{i,t}^p$  is the industry's "price growth weight" defined by,

$$(13) \quad w_{i,t}^p = \frac{((q_{i,t} / Q_t^F) + q_{i,t-1}) p_{i,t-1}}{\sum_i ((q_{i,t} / Q_t^F) + q_{i,t-1}) p_{i,t-1}} ; \quad \sum_i w_{i,t}^p = 1 .$$

In (13),  $Q_t^F$  is the chain-type Fisher ideal quantity index computed using  $q_{i,t-1}$ ,  $q_{i,t}$ ,  $p_{i,t-1}$  and  $p_{i,t}$ . The sum of (12) across all industries equals the overall GDP inflation rate in this study.

## APPENDIX TO CHAPTER V

# Jobs in the New Economy

This appendix contains supplemental data, data sources and methodologies for estimating the employment effects of information technologies as described in Chapter V of *Digital Economy 2002*. (DE2002)

### **IT-PRODUCING INDUSTRY EMPLOYMENT**

Most of the employment estimates used in this analysis are from the Current Employment Statistics (CES) survey, conducted monthly on a sample of nonfarm establishments by the Bureau of Labor Statistics (BLS) in conjunction with state employment security agencies. (Table A-5.1) Private nonfarm employment includes all full and part-time employees except those in the agricultural and government sectors. These data are available monthly and annually via the BLS website for most three-digit and some four-digit SIC categories.

For some IT-producing industries, employment data were not available at the 4-digit SIC level, but instead at the 2- or 3-digit SIC level. In five cases, SIC 357 - Computer and office equipment, SIC 367 - Electronic components and accessories, SIC 737 - Computer and data processing services, SIC 481 - Telecommunications and SIC 483 - Cable and pay television, all of the 4-digit sub-industries were identified as IT-producing industries. Therefore, industries for which data were missing could be computed as a residual from the 2- or 3-digit aggregates. For example, most of SIC 48 (Communications services) have been defined as IT-producing industries, but CES data are only available for 481, 483, and 484. After subtracting employment levels in SICs 481, 483, and 484 from SIC 48, the residual was reported as employment in a combined industry including SICs 482 and 489.

In DE2002, SIC 483, Radio and television and broadcasting was removed from the list of IT-producing industries. The data in the following tables were revised historically, to 1992 to reflect this definitional change. Therefore, the aggregate estimates for "Communications" sector and the total for all IT-producing industries will not match those reported in *Digital Economy 2000*, *The Emerging Digital Economy II*, and *The Emerging Digital Economy*.

BLS also collects employment data through the Covered Employment and Wages (ES202) program, a Federal-State cooperative program that counts all employees covered by unemployment insurance programs. These data are published annually in *Employment and Wages, Annual Averages* and are available on the BLS website (<http://www.bls.gov/cew/home.htm>). When CES employment figures were not available at the necessary level of detail (4-digit SIC level) and a residual could not be calculated, employment levels were estimated by applying the 4-digit SIC level employment distribution of the ES202 numbers to the aggregate (3-digit SIC level) CES numbers. When CES employment numbers were not available at the 3-digit SIC level, ES202 employment numbers were used. The most recent ES202 estimates are for 2000. Therefore, estimates reported for 2001 (Figures 5.1 and 5.2 in DE2002), exclude industries SIC 3695, 3826, and 5734.

**Table A-5.1**  
**Information Technology Producing Industries: Employment Trends, 1992 to 2000**

(000s)

	SIC Code	1992	1993	1994	1995	1996	1997	1998	1999	2000	Change 92-00	AAG 92-00
<b>Total private employment</b>		<b>89,956</b>	<b>91,872</b>	<b>95,036</b>	<b>97,885</b>	<b>100,189</b>	<b>103,133</b>	<b>106,042</b>	<b>108,709</b>	<b>111,079</b>	<b>21,123</b>	<b>2.7</b>
Year to year percent change			2.1%	3.4%	3.0%	2.4%	2.9%	2.8%	2.5%	2.2%		
<b>Hardware</b>												
Computers	3571	241.9	216.1	201.1	190.0	189.3	197.2	203.6	195.7	198.0	-43.9	-2.5
Computers and equipment wholesalers	5045pt.	277.0	270.4	271.2	285.1	304.7	334.8	371.7	392.0	387.7	110.7	4.3
Computers and equipment retailers	5734pt.	75.3	78.2	84.5	93.7	102.4	115.7	125.5	136.8	142.5	67.2	8.3
Computer storage devices & peripheral equipment	3572,7	91.3	93.2	97.9	104.5	114.2	118.7	118.7	114.8	107.3	16.0	2.0
Computer terminals, office and accounting machines	3575,8,9	57.8	54.1	55.2	57.7	58.3	60.0	59.4	57.0	56.1	-1.7	-0.4
Electron tubes	3671	26.9	24.8	24.5	24.0	22.9	21.9	20.7	20.7	20.1	-6.8	-3.6
Semiconductors	3674	217.4	213.8	220.5	235.2	259.6	277.2	284.2	272.1	293.9	76.5	3.8
Printed circuit boards, electronic capacitors	3672,5-8	156.6	161.6	168.2	187.0	195.7	205.0	204.3	195.6	210.5	53.9	3.8
Electronic components, n.e.c.	3679	126.5	127.5	131.0	134.6	138.4	146.2	150.5	152.4	157.7	31.2	2.8
Industrial instruments for measurement	3823	61.0	60.5	62.0	64.2	66.2	66.5	68.1	69.9	72.6	11.6	2.2
Instruments for measuring electricity	3825	76.1	72.8	71.2	71.2	74.3	75.4	75.8	68.3	69.6	-6.5	-1.1
Analytical instruments	3826	28.1	28.1	26.9	28.1	29.7	31.3	32.0	31.9	32.7	4.6	1.9
<b>Total Hardware</b>		<b>1,435.9</b>	<b>1,401.1</b>	<b>1,414.3</b>	<b>1,475.3</b>	<b>1,555.6</b>	<b>1,649.9</b>	<b>1,714.5</b>	<b>1,707.2</b>	<b>1,748.7</b>	<b>312.7</b>	<b>2.5</b>
<b>Software and Computer Services</b>												
Computer programming services	7371	168.6	188.3	209.9	245.3	276.2	321.8	378.7	454.7	518.7	350.1	15.1
Prepackaged software wholesalers	5045pt.	14.6	14.2	14.3	15.0	16.0	17.6	19.6	20.6	20.4	5.8	4.3
Prepackaged software retailers	5734pt.	4.0	4.0	4.3	4.7	5.2	6.1	6.6	7.2	7.5	3.5	8.3
Prepackaged software	7372	130.8	144.8	157.4	180.8	201.0	224.5	247.0	270.1	299.9	169.1	10.9
Computer integrated systems design	7373	102.5	109.5	116.4	129.9	143.5	161.3	181.5	210.7	223.5	121.0	10.2
Computer processing and data preparation	7374	204.4	207.3	209.5	223.1	230.0	242.9	253.7	276.1	284.8	80.4	4.2
Information retrieval services	7375	45.2	46.2	48.0	56.9	70.2	83.1	102.5	158.4	243.0	197.8	23.4
Computer maintenance and repair	7378	42.8	41.8	44.5	48.6	53.3	57.9	58.4	58.2	53.7	10.9	2.9
Computer services management, rental and leasing	7376,7,9	141.2	154.9	172.9	205.3	253.5	317.9	393.2	447.2	471.3	330.1	16.3
<b>Total Software and Computer Services</b>		<b>853.9</b>	<b>911.0</b>	<b>977.1</b>	<b>1,109.6</b>	<b>1,248.9</b>	<b>1,433.1</b>	<b>1,641.2</b>	<b>1,903.2</b>	<b>2,122.8</b>	<b>1,268.9</b>	<b>12.1</b>
<b>Communications Equipment</b>												
Household audio and video equipment	3651	59.8	59.5	59.9	55.7	54.8	53.8	55.0	54.1	53.6	-6.2	-1.4
Telephone and telegraph equipment	3661	109.6	110.0	109.5	111.7	114.5	120.0	125.7	120.9	126.7	17.1	1.8
Radio and TV communications equipment n.e.c.	3663,9	128.9	129.0	138.3	153.2	155.8	157.3	154.0	147.6	149.5	20.6	1.9
Magnetic and optical recording media 1/	3695	18.3	18.2	18.8	16.7	16.8	17.9	16.1	11.9	11.7	-6.6	-5.4
<b>Total Communications Equipment</b>		<b>316.6</b>	<b>316.7</b>	<b>326.5</b>	<b>337.3</b>	<b>341.9</b>	<b>349.0</b>	<b>350.8</b>	<b>334.5</b>	<b>341.5</b>	<b>24.9</b>	<b>1.0</b>
<b>Communications Services</b>												
Telephone communications	481	885.2	879.0	893.4	899.7	911.4	970.9	1,012.8	1,078.7	1,133.9	248.7	3.1
Telephone and telegraph communications	482,489	25.6	24.4	24.7	26.7	28.4	31.2	33.4	33.2	33.9	8.3	3.6
Cable and other pay TV services	4841	130.6	136.2	144.5	155.5	170.0	174.2	183.9	199.2	215.8	85.2	6.5
<b>Total Communications Services</b>		<b>1,041.4</b>	<b>1,039.6</b>	<b>1,062.6</b>	<b>1,081.9</b>	<b>1,109.8</b>	<b>1,176.3</b>	<b>1,230.1</b>	<b>1,311.1</b>	<b>1,383.6</b>	<b>342.2</b>	<b>3.6</b>
<b>Total IT Producing Industries</b>		<b>3,647.9</b>	<b>3,668.4</b>	<b>3,780.6</b>	<b>4,004.2</b>	<b>4,256.2</b>	<b>4,608.3</b>	<b>4,936.6</b>	<b>5,256.0</b>	<b>5,596.6</b>	<b>1,948.7</b>	<b>5.5</b>
Year to year percent change			0.6%	3.1%	5.9%	6.3%	8.3%	7.1%	6.5%	6.5%		
<b>Share of total private employment</b>		<b>4.1%</b>	<b>4.0%</b>	<b>4.0%</b>	<b>4.1%</b>	<b>4.2%</b>	<b>4.5%</b>	<b>4.7%</b>	<b>4.8%</b>	<b>5.0%</b>		

Source: ESA estimates based on Bureau of Labor Statistics data.

AAG- average annual rate of growth

Estimates of employment by wholesale and retail sellers of computer equipment and software (SICs 5045 and 5734) were divided among the computer hardware and software and computer services categories using the same distribution as value added — 95 percent to computer hardware and 5 percent to software and computer services.

## **IT-PRODUCING INDUSTRY WAGES**

Industry level wage data are collected through the BLS ES202 program and include gross wages and salaries, bonuses, stock options, tips and other gratuities and in some cases the value of meals and lodging. These estimates along with CES industry employment were used to compute annual wages per worker shown in Figure 5.3 in *Digital Economy 2002*. (Tables A-5.2 and A-5.3)

Since employment estimates are from the CES survey and wages are from the ES202 survey, they do not exactly match employment per worker estimates using ES202 employment numbers (as published by BLS, the American Electronics Association and others). These simple averages are for purposes of comparing relative wages across industries and should not be interpreted as official BLS estimates of mean or median earnings. Estimates of wages per worker include all occupations in each industry and should not be confused with earnings for specific occupations which are discussed below.

## **IT OCCUPATIONAL EMPLOYMENT**

Occupations considered to be essential to IT and to electronic commerce were selected based on consultations with BLS and are the same as those used for the original *Emerging Digital Economy* report. Our definition of IT occupations is broader than the “core” IT occupations *i.e.*, computer scientists, engineers, programmers and systems analysts used by the Technology Administration, National Science Foundation, Information Technology Association of America and others. (See Box on right.) This is because the definition of IT occupations used in this analysis covers

### **IT Related Jobs**

*Engineering managers*  
*Computer and information systems managers*  
*Computer and information scientists, research*  
*Computer programmers*  
*Computer software engineers, applications*  
*Computer software engineers, systems software*  
*Computer support specialists*  
*Computer systems analysts*  
*Database administrators*  
*Network and computer systems administrators*  
*Network systems and data communications analysts*  
*Computer hardware engineers*  
*Electrical engineers*  
*Electronics engineers, except computer*  
*Electrical and electronic engineering technicians*  
*Data entry keyers*  
*Computer, ATM, and office machine repairers*  
*Telecommunications equipment installers and repairers*  
*Electrical and electronics repairers, commercial and industrial equipment*  
*Electrical power-line installers and repairers*  
*Telecommunications line installers and repairers*  
*Electrical and electronic equipment assemblers*  
*Electromechanical equipment assemblers*  
*Semiconductor processors*  
*Switchboard operators, including answering service*  
*Telephone operators*  
*Billing and posting clerks and machine operators*  
*Computer operators*  
*Mail and other office machine operators*

Source: ESA in consultation with BLS.

occupations not only involved in conducting electronic commerce, but in maintaining the infrastructure that enables it.

The occupations listed above do not match those published in earlier Digital Economy reports

Table A-5.2  
Information Technology Producing Industries: Annual Wages Per Worker, 1992 to 2000

	SIC	1992	1993	1994	1995	1996	1997	1998	1999	2000	Change 1992 to 2000	AAG% 1992 to 2000
<b>Average All Private Industries</b>		<b>\$25,400</b>	<b>\$25,700</b>	<b>\$26,200</b>	<b>\$27,200</b>	<b>\$28,300</b>	<b>\$29,800</b>	<b>\$31,500</b>	<b>\$32,900</b>	<b>\$35,000</b>	<b>\$9,600</b>	<b>4.1</b>
<b>Average IT-Producing Industries</b>		<b>\$41,800</b>	<b>\$43,100</b>	<b>\$44,500</b>	<b>\$46,900</b>	<b>\$49,700</b>	<b>\$53,500</b>	<b>\$58,500</b>	<b>\$65,600</b>	<b>\$73,800</b>	<b>\$32,000</b>	<b>7.4</b>
<b>Hardware</b>												
Computers	3571	\$52,400	\$54,700	\$55,600	\$59,600	\$62,400	\$69,800	\$82,200	\$98,000	\$124,300	\$71,900	11.4
Computer equipment wholesalers	5045pt.	\$52,500	\$52,900	\$52,900	\$54,300	\$56,700	\$62,100	\$69,200	\$80,400	\$88,200	\$35,700	6.7
Computer equipment retailers	5734pt.	\$32,200	\$30,500	\$32,000	\$33,700	\$34,900	\$37,300	\$40,900	\$43,300	\$47,900	\$15,700	5.1
Computer storage devices & peripheral equipment	3572,7	\$41,200	\$42,700	\$42,900	\$46,500	\$51,000	\$58,400	\$57,400	\$65,600	\$84,200	\$43,000	9.3
Computer terminals, office and accounting machines	3575,8,9	\$43,300	\$44,800	\$44,300	\$46,600	\$49,500	\$52,900	\$58,000	\$64,300	\$67,600	\$24,300	5.7
Electron tubes	3671	\$38,400	\$37,600	\$39,800	\$41,900	\$41,000	\$44,200	\$45,800	\$48,400	\$59,900	\$21,500	5.7
Semiconductors	3674	\$44,500	\$47,400	\$49,500	\$53,800	\$54,400	\$59,700	\$64,300	\$74,900	\$93,500	\$49,000	9.7
Printed circuit boards, electronic capacitors	3672,5-8	\$25,700	\$26,500	\$27,500	\$28,300	\$29,400	\$31,600	\$33,400	\$35,100	\$39,800	\$14,100	5.6
Electronic components, n.e.c.	3679	\$29,700	\$30,700	\$31,900	\$32,900	\$33,900	\$35,600	\$36,800	\$41,800	\$45,900	\$16,200	5.6
Industrial instruments for measurement	3823	\$35,100	\$35,800	\$37,000	\$38,400	\$40,500	\$43,200	\$45,700	\$48,500	\$54,300	\$19,200	5.6
Instruments for measuring electricity	3825	\$42,500	\$44,000	\$48,200	\$51,600	\$54,500	\$59,300	\$64,000	\$70,600	\$82,500	\$40,000	8.6
Laboratory analytical instruments	3826	\$38,700	\$39,200	\$42,600	\$44,200	\$50,100	\$49,900	\$54,600	\$58,700	\$75,400	\$36,700	8.7
<b>Hardware</b>		<b>\$42,400</b>	<b>\$43,300</b>	<b>\$44,200</b>	<b>\$46,300</b>	<b>\$48,300</b>	<b>\$52,800</b>	<b>\$57,800</b>	<b>\$65,900</b>	<b>\$77,200</b>	<b>\$34,800</b>	<b>7.8</b>
<b>Software and Computer Services</b>												
Computer programming services	7371	\$46,200	\$47,600	\$50,100	\$52,700	\$56,900	\$60,000	\$63,400	\$69,000	\$81,600	\$35,400	7.4
Prepackaged software wholesalers	5045pt.	\$52,500	\$52,900	\$52,900	\$54,300	\$56,700	\$62,100	\$69,200	\$80,500	\$88,300	\$35,800	6.7
Prepackaged software retailers	5734pt.	\$32,300	\$31,700	\$33,300	\$35,100	\$36,400	\$37,300	\$40,900	\$43,300	\$47,900	\$15,600	5.0
Prepackaged software	7372	\$57,000	\$54,500	\$57,000	\$63,700	\$70,100	\$79,200	\$96,100	\$115,400	\$117,400	\$60,400	9.5
Computer integrated systems design	7373	\$48,600	\$49,700	\$52,700	\$54,700	\$59,400	\$62,000	\$64,600	\$69,400	\$78,700	\$30,100	6.2
Computer processing and data preparation	7374	\$34,400	\$36,100	\$36,600	\$39,700	\$43,300	\$44,700	\$46,300	\$49,200	\$52,300	\$17,900	5.4
Information retrieval services	7375	\$36,700	\$38,900	\$38,600	\$42,200	\$45,300	\$48,500	\$61,400	\$73,200	\$89,500	\$52,800	11.8
Computer maintenance and repair	7378	\$36,600	\$37,500	\$37,200	\$37,800	\$39,500	\$40,100	\$42,700	\$42,700	\$44,800	\$8,200	2.6
Computer services management, rental and leasing	7376,7,9	\$46,000	\$46,800	\$48,900	\$51,800	\$54,600	\$58,700	\$63,700	\$68,400	\$74,900	\$28,900	6.3
<b>Software and Computer Services</b>		<b>\$44,300</b>	<b>\$45,300</b>	<b>\$47,200</b>	<b>\$50,700</b>	<b>\$54,800</b>	<b>\$58,800</b>	<b>\$65,000</b>	<b>\$72,200</b>	<b>\$80,900</b>	<b>\$36,600</b>	<b>7.8</b>
<b>Communications Equipment</b>												
Household audio and video equipment	3651	\$32,700	\$33,900	\$36,900	\$32,400	\$35,100	\$39,300	\$40,700	\$42,600	\$45,000	\$12,300	4.1
Telephone and telegraph equipment	3661	\$42,400	\$45,400	\$46,800	\$49,900	\$54,600	\$57,400	\$65,100	\$70,700	\$80,500	\$38,100	8.3
Radio and TV communications equipment n.e.c.	3663,9	\$39,100	\$40,300	\$40,100	\$42,700	\$44,400	\$48,000	\$52,200	\$57,200	\$68,200	\$29,100	7.2
Magnetic and optical imaging devices	3695	\$37,500	\$38,800	\$39,300	\$39,200	\$45,700	\$43,000	\$45,100	\$45,000	\$42,800	\$5,300	1.7
<b>Communications Equipment</b>		<b>\$38,900</b>	<b>\$40,800</b>	<b>\$41,700</b>	<b>\$43,200</b>	<b>\$46,400</b>	<b>\$49,700</b>	<b>\$54,700</b>	<b>\$59,200</b>	<b>\$68,300</b>	<b>\$29,400</b>	<b>7.3</b>
<b>Communications Services</b>												
Telephone communications	481	\$41,400	\$43,300	\$45,100	\$46,800	\$48,700	\$50,900	\$53,400	\$58,800	\$62,100	\$20,700	5.2
Telephone and telegraph communications	482,489	\$41,700	\$44,100	\$47,200	\$48,500	\$52,900	\$54,600	\$58,900	\$71,200	\$76,500	\$34,800	7.9
Cable and other pay TV services	4841	\$29,600	\$30,500	\$31,400	\$34,600	\$35,500	\$37,900	\$41,700	\$47,000	\$47,200	\$17,600	6.0
<b>Communications Services</b>		<b>\$39,900</b>	<b>\$41,600</b>	<b>\$43,200</b>	<b>\$45,100</b>	<b>\$46,700</b>	<b>\$49,100</b>	<b>\$51,800</b>	<b>\$57,300</b>	<b>\$60,100</b>	<b>\$20,200</b>	<b>5.3</b>

Source: ESA calculations based on BLS data.

AAG- average annual rate of growth



Table A-5.3  
Information Technology Producing Industries: Total Annual Wages, 1992 to 2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	Change 1992 to 2000	AAG% 1992 to 2000
<b>All Private Industries</b>	\$2,282,598	\$2,365,301	\$2,494,459	\$2,658,927	\$2,837,335	\$3,071,609	\$3,337,622	\$3,577,739	\$3,885,819	\$1,603,221	6.9
<b>IT-Producing Industries</b>	\$152,598	\$158,080	\$166,191	\$187,865	\$211,392	\$246,417	\$288,783	\$344,838	\$413,068	\$260,490	13.3
<b>Hardware</b>											
Computers	12,666	11,811	11,187	11,317	11,821	13,762	16,745	19,180	24,610	11,844	8.7
Computer and equipment wholesalers	14,543	14,315	14,344	15,482	17,284	20,786	25,716	31,526	34,210	19,667	11.3
Computer and equipment retailers	2,426	2,385	2,705	3,158	3,578	4,317	5,133	5,924	6,832	4,406	13.8
Computer storage devices & peripheral equipment	3,761	3,975	4,200	4,861	5,823	6,931	8,811	7,527	9,036	5,275	11.6
Computer terminals, office and accounting machines, and office machines, n.e.c.	2,500	2,424	2,447	2,687	2,883	3,174	3,447	3,665	3,791	1,291	5.3
Electron tubes	1,032	932	974	1,005	938	969	947	1,001	1,204	172	1.9
Semiconductors	9,670	10,126	10,923	12,654	14,124	16,549	18,287	20,383	27,490	17,820	14.0
Printed circuit boards, electronic capacitors, resistors, coils, transformers, and connectors	4,023	4,276	4,622	5,291	5,754	6,473	6,829	6,860	8,374	4,351	9.6
Electronic components, n.e.c.	3,759	3,908	4,185	4,430	4,695	5,210	5,536	6,364	7,241	3,482	8.5
Industrial instruments for measurement	2,140	2,168	2,297	2,467	2,679	2,873	3,112	3,388	3,946	1,806	7.9
Instruments for measuring electricity	3,234	3,202	3,431	3,671	4,052	4,468	4,822	4,852	5,745	2,511	7.4
Laboratory analytical instruments	1,088	1,102	1,147	1,243	1,484	1,563	1,745	1,872	2,466	1,378	10.8
<b>Total Hardware</b>	\$60,976	\$60,656	\$62,496	\$68,303	\$75,156	\$87,074	\$99,161	\$112,513	\$134,946	\$74,070	10.5
<b>Software/Services</b>											
Computer programming services	7,793	8,954	10,507	12,935	15,721	19,311	24,015	31,363	42,329	34,536	23.6
Prepackaged software wholesalers	765	753	755	815	910	1,094	1,353	1,659	1,801	1,035	11.3
Prepackaged software retailers	128	126	142	166	188	227	270	312	360	232	13.8
Prepackaged software	7,455	7,890	8,968	11,517	14,086	17,776	23,748	31,156	35,199	27,744	21.4
Computer integrated systems design	7372	4,977	6,140	7,107	8,517	10,007	11,729	14,630	17,591	12,614	17.1
Computer processing and data preparation	7374	7,026	7,673	8,868	9,968	10,854	11,751	13,588	14,900	7,874	9.9
Information retrieval services	1,659	1,797	1,852	2,401	3,181	4,031	6,297	11,590	21,747	20,068	37.9
Computer maintenance and repair	1,566	1,567	1,657	1,838	2,108	2,320	2,492	2,487	2,405	839	5.5
Computer services management, rental and leasing, and maintenance and repair	6,491	7,254	8,459	10,640	13,853	18,671	25,048	30,577	35,304	28,813	23.6
<b>Total Software/Services</b>	\$37,926	\$41,239	\$46,119	\$56,250	\$68,490	\$84,291	\$106,705	\$137,363	\$171,634	\$133,868	20.8
<b>Communications Equipment</b>											
Household audio and video equipment	1,955	2,015	2,210	1,803	1,924	2,117	2,240	2,302	2,413	458	2.7
Telephone and telegraph equipment	4,645	4,994	5,129	5,574	6,256	6,887	8,192	8,544	10,197	5,552	10.3
Radio and TV communications equipment and communications equipment, n.e.c.	5,037	5,202	5,541	6,547	6,917	7,555	8,044	8,437	10,189	5,162	9.2
Magnetic and optical recording media	685	706	741	656	770	769	728	536	501	-184	-3.8
<b>Total Communications Equipment</b>	\$12,322	\$12,917	\$13,621	\$14,580	\$15,867	\$17,328	\$19,194	\$19,819	\$23,310	\$10,988	8.3
<b>Communications Services</b>											
Telephone communications	36,641	38,037	40,248	42,083	44,347	49,421	54,081	63,418	70,418	33,777	8.5
Telephone and telegraph communications	1,068	1,076	1,166	1,296	1,503	1,705	1,966	2,362	2,594	1,526	11.7
Cable and other pay TV services	3,865	4,155	4,541	5,373	6,029	6,597	7,677	9,363	10,185	6,320	12.9
<b>Total Communications Services</b>	\$41,574	\$43,268	\$45,955	\$48,752	\$51,879	\$57,723	\$63,732	\$75,143.3	\$83,198	\$41,624	9.1

AAG - average annual rate of growth

Source: ESA calculations based on BLS data.

because in 1999, BLS started using the new Standard Occupational Classification (SOC) system. The new SOC system has expanded and combined some occupations and added some new ones. For example, computer engineers now have three separate occupations – computer hardware engineer, computer software engineer-applications, and computer software engineer-systems software. Network and computer systems administrators, network systems and data communications analysts, and computer and information scientists-research are newly classified occupations. Engineering managers were separated from computer and information systems managers. Billing, and calculating machine operators, however, were combined with billing rate clerks to create a new occupation called billing and posting clerks and machine operators.

Occupational employment is collected as part of the annual Occupational Employment Statistics (OES) survey. (<http://www.bls.gov/oes/home.htm>) The OES survey is conducted in a three year cycle, during which one-third of the sample is surveyed each year. Because changes in the SOC started in 1999, the 2000 data were computed from only a two-year cycle. Employees in IT occupations are counted across all industries, including government and agricultural services. Employment in IT occupations for 2000 are in Table A-5.4 and descriptions of duties are in Table A-5.5.

## **EDUCATION AND TRAINING REQUIREMENTS BY OCCUPATION**

The Bureau of Labor Statistics classifies occupations into 1 of 11 categories that describe the education and training needed by most workers to become fully qualified. *Note that these education and training categories were not intended to be measured as skills.* The eleven categories include occupations that require training ranging from short-term on-the-job training to a first professional degree. A concordance is provided in the box below that shows the 11 BLS categories and how they correspond to the three levels of training intensity presented in Appendix Table A-5.4 and Figure 5.4 in the *Digital Economy 2002* report.

<b>Concordance of BLS and ESA Education and Training Requirement Levels</b>	
<b>BLS Categories</b>	<b>ESA Intensity Levels</b>
First professional degree	High
Doctoral degree	High
Master's degree	High
Work experience, plus a bachelor's or higher degree	High
Bachelor's degree	High
Associate's degree	High
Post-secondary vocational training	Moderate
Work experience in a related occupation.	Moderate
Long-term on-the-job training	Moderate
Moderate-term on-the-job training	Low
Short-term on-the-job training	Low

**Table A-5.4**  
**Employment and Wages, by Occupation, 2000**  
 from OES survey

Occupation	Employment	Median Annual Wages	Education/ training requirement*
Engineering managers	242,280	\$84,070	High
Computer and information systems managers	283,480	\$78,830	High
Computer and information scientists, research	25,800	\$70,600	High
Computer programmers	530,730	\$57,600	High
Computer software engineers, applications	374,640	\$67,660	High
Computer software engineers, systems software	264,610	\$69,530	High
Computer support specialists	522,570	\$36,460	High
Computer systems analysts	463,300	\$59,340	High
Database administrators	108,000	\$51,980	High
Network and computer systems administrators	234,040	\$51,270	High
Network systems and data communications analysts	119,220	\$54,500	High
Computer hardware engineers	63,680	\$67,310	High
Electrical engineers	162,400	\$64,920	High
Electronics engineers, except computer	123,690	\$64,830	High
Electrical and electronic engineering technicians	244,570	\$40,020	High
Data entry keyers	458,720	\$21,300	Moderate
Computer, automated teller, and office machine repairers	142,390	\$31,370	Moderate
Telecommunications equipment installers and repairers, except line installers	192,470	\$44,030	Moderate
Electrical and electronics repairers, commercial and industrial equipment	81,760	\$36,920	Moderate
Electrical power-line installers and repairers	96,200	\$45,780	Moderate
Telecommunications line installers and repairers	168,480	\$38,110	Moderate
Electrical and electronic equipment assemblers	367,150	\$21,440	Moderate
Electromechanical equipment assemblers	72,550	\$23,210	Moderate
Semiconductor processors	67,000	\$25,440	Moderate
Switchboard operators, including answering service	243,100	\$20,200	Low
Telephone operators	52,150	\$28,000	Low
Billing and posting clerks and machine operators	492,040	\$24,560	Low
Computer operators	186,460	\$27,660	Low
Mail clerks and mail machine operators, except postal service	182,460	\$19,840	Low
Other office machine operators	86,380	\$20,800	Low
<b>Total</b>	<b>6,652,320</b>		

**High:** Associate degree, bachelor's degree or work experience plus a bachelor's degree or higher

**Moderate:** long-term on-the-job training, work experience in a related occupation or post secondary vocational training

**Low:** short to moderate-term on-the-job training

\*The grouping of education and training categories into high, moderate and low requirement levels reflects the author's interpretation of training intensity. BLS classifies occupations into 11 categories that describe education and training needed by most workers to become fully qualified. A description of these education and training categories can be found in the November 2001, Monthly Labor Review.

Source: Bureau of Labor Statistics.

## ***IT OCCUPATIONAL WAGES***

Median wages by occupation that are reported in Table A-5-4, are also from the OES survey and can be downloaded from the OES website. (<http://www.bls.gov/oes/home.htm>). Wages are straight time, gross pay and includes some types of bonuses and commissions. Like employment, wages are collected on a 3-year cycle, but the 2000 wages are based on only two years because of SOC changes.

For additional information on BLS surveys and related methodologies, see the *BLS Handbook of Methods*, April 1997. (<http://www.bls.gov/opub/hom/home.htm>)

**Table A-5.5  
Information Technology Occupations**

Occupation	Description of Duties
Engineering managers	Plan, direct, or coordinate activities in such fields as architecture and engineering or research and development in these fields.
Computer and information systems managers	Plan, direct, or coordinate activities in such fields as electronic data processing, information systems, systems analysis, and computer programming.
Computer and information scientists, research	Conduct research into fundamental computer and information science as theorists, designers, or inventors. Solve or develop solutions to problems in the field of computer hardware and software.
Computer programmers	Convert statements of problems and procedures to flow charts for coding into computer language. Develop and write programs to store, locate, and retrieve data and information. May program web sites.
Computer software engineers, applications	Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use. May analyze and design databases within an application area.
Computer software engineers, systems software	Research, design, develop, and test operating systems-level software, compilers, and network distribution software for a variety of computing applications. (medical, industrial, military, general) Set operational specifications and formulate and analyze software requirements.
Computer support specialists	Provide technical assistance to computer system users. Answer questions or resolve computer problems for clients in person or via telephone. May provide assistance in the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.
Computer systems analysts	Analyze science, engineering, business, and all other data processing problems for application to electronic data processing systems. Analyze user requirements, procedures, and problems to automate or improve existing systems. May analyze or recommend commercially available software.
Database administrators	Coordinate, test and implement changes to computer databases using database management systems. May plan, coordinate, and implement security measures to safeguard computer databases.
Network and computer systems administrators	Install, configure, support, monitor and maintain an organization's local area network (LAN), wide area network (WAN), and Internet system. May supervise network support and client server specialists and plan, coordinate, and implement network security measures.
Network systems and data communications analysts	Analyze, design, test, and evaluate network systems, such as local area networks (LAN), wide area networks (WAN), Internet, intranet, and other data communications systems. Research and recommend network and data communications hardware and software. Include telecommunications specialists who deal with the interfacing of computer and communications equipment. May supervise computer programmers.
Computer hardware engineers	Research, design, develop, and test computer or computer-related equipment for commercial, industrial, military, or scientific use. May supervise the manufacturing and installation of computer or computer-related equipment and components.
Electrical engineers	Design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use.
Electronics engineers, except computer	Research, design, develop, and test electronic components and systems for commercial, industrial, military, or scientific use. Design electronic circuits and components for use in fields such as telecommunications, aerospace guidance and propulsion control, acoustics, or instruments and controls.

**Table A-5.5  
Information Technology Occupations contd.**

Occupation	Description of Duties
Electrical and electronic engineering technicians	Apply electrical and electronic theory, usually under the direction of engineering staff, to design, build, repair, calibrate, and modify electrical components, circuitry, controls, and machinery for subsequent evaluation and use by engineering design staff.
Data entry keyers	Operate data entry device, such as keyboard or photo composing perforator. Duties may include verifying data and preparing materials for printing.
Computer, automated teller, and office machine repairers	Repair, maintain, or install computers, word processing systems, automated teller machines, and electronic office machines, such as duplicating and fax machines.
Telecommunications equipment installers and repairers, except line installers	Set-up, rearrange, or remove switching and dialing equipment used in central offices. Install and repair telephones and other communication equipment.
Electrical and electronics repairers, commercial and industrial equipment	Repair, test, adjust, or install electronic equipment, such as industrial controls, transmitters, and antennas.
Electrical power-line installers and repairers	Install or repair cables or wires used in electrical power or distribution systems. May erect poles and light or heavy duty transmission towers.
Telecommunications line installers and repairers	String and repair telephone and television cable, including fiber optics and other equipment for transmitting messages or television programming.
Electrical and electronic equipment assemblers	Assemble or modify electrical or electronic equipment, such as computers, test equipment telemetering systems, electric motors, and batteries.
Electromechanical equipment assemblers	Assemble or modify electromechanical equipment or devices, such as servomechanisms, gyros, dynamometers, magnetic drums, tape drives, brakes, control linkage, actuators, and appliances.
Semiconductor processors	Perform any or all of the functions in the manufacture of electronic semiconductors, including loading semiconductor material into furnace; sawing formed ingots into segments; cleaning, polishing, and loading wafers into series of special purpose furnaces, chemical baths, and equipment used to form circuitry.
Switchboard operators, including answering service	Operate telephone business systems equipment or switchboards to relay incoming, outgoing, and interoffice calls. May supply information to callers and record messages.
Telephone operators	Provide information by accessing alphabetical and geographical directories. Assist customers with special billing requests, such as charges to a third party and credits or refunds for incorrectly dialed numbers or bad connections. May handle emergency calls and assist children or people with physical disabilities to make telephone calls.
Billing and posting clerks and machine operators	Compile, compute, and record billing, accounting, statistical, and other numerical data for billing purposes. Prepare billing invoices for services rendered or for delivery or shipment of goods.
Computer operators	Monitor and control computer and peripheral electronic data processing equipment to process business, scientific, engineering, and other data according to operating instructions. May set controls on computer and peripheral devices. Monitor and respond to operating and error messages.

Source: Bureau of Labor Statistics.