Gross Domestic Product by Industry

A Progress Report on Accelerated Estimates

By Robert E. Yuskavage

IN this article, the Bureau of Economic Analysis (BEA) reports on its research to develop estimates of gross domestic product (GDP) by industry on an accelerated schedule. In its Strategic Plan released last month, BEA stated that its priorities for the industry accounts include speeding up the release of the input-output (I-O), GDP-by-industry, and capital-flow accounts.[1] Developing a prototype methodology for preparing accelerated estimates of GDP by industry is one of the first major steps in testing the feasibility of the acceleration initiatives. To help shape future work, BEA is soliciting your comments on the proposed methodology, on the scope of industry detail, and on the tradeoff between accuracy and timeliness.

While BEA is investigating ways of speeding up the availability of the GDP-by-industry estimates, work continues on improving their quality and accuracy. BEA is working closely with the Bureau of the Census on new initiatives to improve the quality of the source data used to measure the output of services industries for both the national income and product accounts (NIPA's) and GDP by industry. In addition, BEA is reviewing initiatives to further integrate the GDP-by-industry accounts with the benchmark and annual I-O accounts in order to increase the accuracy and consistency of the measures of industry output.

The research reported in this article was conducted using experimental accelerated estimates of GDP by industry for 1998–2000. Compared with the "latest" current-dollar GDP-by-industry estimates, the accelerated current-dollar estimates:

- Successfully indicated the direction of change 100 percent of the time for broad industry groups and 85 to 90 percent of the time for detailed industries.
- Successfully indicated whether an industry group's GDP was accelerating or decelerating about three-fourths of the time.
- Successfully indicated whether an industry group's GDP growth was high, medium, or low in comparison with that of other industry groups about 70 percent of the time.
- Showed that the range of revisions to the growth rates for the major industry groups was not significantly different from that for the major expenditure components of GDP.
- Showed that many of the revisions to the growth rates for detailed industries were offsetting at the industry-group level.

As part of reporting the research results, this article also provides, on an expedited schedule, illustrative estimates for 2001 of current-dollar GDP by industry for 10 broad industry groups and 5 industry subgroups. These estimates are more limited in scope than the full set of GDP-by-industry estimates that are released in November, which present detail for 66 industries, real (inflation-adjusted) measures, components of current-dollar GDP by industry, gross output, and intermediate inputs.[2] Nonetheless, these illustrative estimates provide a first look at the effect on industries of last year's economic slowdown and the events of September 11th.

Given the experimental nature of these estimates and the need for more research, BEA would like your feedback on the importance of continuing work in this area and whether the scope of the accelerated estimates should be broadened to include more industry detail and more data items. The research conducted so far has been designed primarily to assess the feasibility of providing industry estimates shortly after the release of the final fourth-quarter GDP estimate in late March, because users of the industry accounts have expressed a need for earlier information on the direction and scale of industry growth. The research suggests that reasonably reliable current-dollar estimates can be prepared for industry groups and major aggregates but that the reliability of the real estimates is sensitive to economic developments, such as business cycle fluctuations and changes in relative prices.

This article is presented in three parts. The first part presents a summary of the research conducted to de-

1. See "BEA's Strategic Plan for 2001–2005," SURVEY OF CURRENT BUSINESS 82 (May 2002): 23.

2. New GDP-by-industry estimates for 2001 and revised estimates for 1999–2000 will be released in November 2002. For the most recently published estimates, see Sherlene K.S. Lum and Brian C. Moyer, "Gross Domestic Product by Industry for 1998–2000," SURVEY 81 (November 2001): 17–33.

termine the feasibility of preparing accelerated GDP-by-industry estimates, including some of the limitations revealed by the research. The second part uses the illustrative current-dollar estimates for industry groups for 2001 to examine the industry effects of the economic slowdown and the events of September 11th, and it briefly discusses methodological issues in the measurement of real estimates. The third part describes the kind of feedback that BEA is seeking and explains how to provide comments and suggestions.

Summary of Research

The research into developing a prototype methodology for preparing accelerated GDP-by-industry estimates started in the fall of 2000, several months after the release of the most recent comprehensive revision of the GDP-by-industry accounts. A major element of the comprehensive revision was the development of an integrated set of estimates of gross output, intermediate inputs, and value added—which is the same as GDP by industry—for all industries.[3] These improvements enabled BEA to extend the double-deflation method for computing industry real value added to all industries and resulted in a consistent set of industry production accounts that are more closely integrated with the NIPA's. These integrated accounts are now widely used to study productivity growth and structural change in the economy. BEA then turned its attention to improving the timeliness of the GDP-by-industry estimates as the next major step in expanding their value and raising their visibility.

The methodology used to prepare the regular estimates of current-dollar GDP by industry differs significantly from that used to prepare the regular estimates of real GDP by industry. The current-dollar estimates are based on industry distributions of components from the income-side of the NIPA's. The real estimates are computed as the difference between real gross output and real intermediate inputs, which are largely based on data from the product-side of the NIPA's and from the I-O accounts. For this research, new methodologies were proposed, developed, and tested for preparing accelerated estimates of current-dollar GDP by industry and real GDP by industry.

One of the guiding principles in developing the new methodologies was to maintain consistency with the NIPA's by making maximum use of NIPA data for both the current-dollar and real estimates. In addition, the new methodologies could not follow the same procedures used for the November estimates for 66 industries, because much of the industry source data are not available by the end of March or are not available at the required level of industry detail. These considerations, among others, resulted in the decision to provide illustrative estimates only in current dollars and only for industry groups.

Current-dollar estimates

Current-dollar GDP-by-industry estimates, as noted above, are based on income-side measures from the NIPA's. In the regular methodology, detailed industry distributions of the 16 components of gross domestic income from the annual NIPA revision are prepared, and then—for each detailed industry—the components are summed to obtain GDP by industry.[4] NIPA estimates for corporate profits before tax, corporate capital consumption allowances, and corporate net interest are converted from a company basis to an establishment basis. The statistical discrepancy is included as a separate "industry," which ensures that the industry estimates sum to the NIPA estimate of current-dollar GDP.

For the experimental accelerated estimates for the 66 detailed industries, only the three major components of industry GDP—compensation of employees, property-type income (PTI), and indirect business tax and nontax liability (IBT)—were extrapolated from the published levels for the preceding year. The estimates for farms, nonfarm housing services, private households, and general government were obtained directly from the NIPA's. For the remaining industries, the major income components were extrapolated using industry source data from the NIPA's.

Compensation of employees, which consists of wage and salary accruals and supplements to wages and salaries, was extrapolated by wage and salary accruals, a procedure that assumes that supplements are a fixed share of compensation. PTI was extrapolated by the sum of corporate profits, proprietors' income, capital consumption allowances, and net interest. For most industries, these components account for nearly all of PTI. (Company-establishment adjustments were not made in order to minimize complexity.)

Research showed that using separate extrapolators for compensation and for PTI achieved better results than simply extrapolating industry GDP by wage and salary accruals, because the composition of GDP by industry can change significantly from year to year. For

3. See Sherlene K.S. Lum, Brian C. Moyer, and Robert E. Yuskavage, "Improved Estimates of Gross Product by Industry for 1947–98," SURVEY 80 (June 2000): 24–54.

4. The 16 components of gross domestic income consist of wage and salary accruals, supplements to wages and salaries, corporate profits before tax, corporate capital consumption allowances (CCA), corporate net interest, corporate inventory valuation adjustment (IVA), rental income of persons, farm proprietors' income, nonfarm proprietors' income, nonfarm proprietors' IVA, noncorporate CCA, noncorporate net interest, government consumption of fixed capital, surplus of government enterprises, subsidies, and indirect business tax and nontax liability.

IBT, the industry distribution from the prior year was held constant, except for those industries whose estimates were obtained directly from the NIPA's.

After extrapolating estimates of each of the three major income components for each detailed industry, the extrapolated estimates were summed over all industries to obtain a preliminary aggregate estimate of each major income component for all industries. For the detailed industries whose estimates were not obtained directly from the NIPA's, the preliminary GDP-by-industry estimates were proportionately scaled by major income component to match the corresponding all-industry NIPA aggregates. The scaled income components were then summed to obtain GDP by industry at the detailed industry level. The estimates for the detailed industries were summed to obtain estimates for industry groups and for aggregates, such as "private industries."

Real estimates

In the regular methodology of double deflation, both gross output and intermediate inputs for each of the 66 detailed industries are deflated to obtain real GDP by industry as the difference between the two in a Fisher index formula.[5] Double deflation is the preferred method because it requires few assumptions about the relationships between gross output and intermediate inputs. Using this method would have required the development of accelerated current-dollar estimates and price indexes for gross output and intermediate inputs. Reasonably reliable estimates of current-dollar gross output and gross output price indexes could be prepared by the end of March, but estimates for inputs price indexes are not possible due to the lack of sufficiently detailed source data.

As a result, the research tested two alternative methods that international statistical organizations, such as the Organisation for Economic Co-operation and Development and the United Nations, recommend when the data needed for double deflation are not available. These methods are (1) single deflation of current-dollar GDP by industry, using the industry's gross output price index and (2) extrapolation of real GDP by industry, using the industry's gross output quantity index. Single deflation approximates the results obtained by double deflation when the prices of an industry's intermediate inputs (or "purchases") increase at about the same rate as the prices of its gross output (or "sales"). The results obtained by extrapolation approximate those obtained by double deflation when real intermediate inputs change at about the same rate as real gross output.[6]

Research has demonstrated that the single-deflation method's assumption of equal changes in gross output and intermediate input prices holds for many industries in many years, but it may break down during periods of business cycle fluctuations or of sharp changes in raw materials prices. The gross-output-extrapolation method's assumption of equal changes in real gross output and real intermediate inputs implies little, if any, substitution between value-added inputs and intermediate inputs in the production process, but this assumption is generally not supported by the data. In testing, the extrapolation method did not perform as well as the single-deflation method (see the next section on evaluating the results). In particular, the revisions for the mining industry group were much larger for the extrapolation method because relatively large changes in gross output for some of the detailed mining industries were not accompanied by similar changes in intermediate inputs.

Therefore, the single-deflation method was used at the detailed-industry level, and estimates for industry groups and for aggregates were obtained using Fisher aggregation techniques that approximate the procedures used for the November estimates.[7] Gross output price indexes for most of the detailed industries were implicit price deflators computed as current-dollar gross output divided by real (chained-dollar) gross output. For detailed industries, both current-dollar and real gross output were extrapolated from the preceding year's levels using a variety of source data from the NIPA's, from other Federal Government agencies, and from private organizations.

Evaluating the results

The statistical criteria for evaluating the methods proposed for the accelerated GDP-by-industry estimates were the mean absolute revision (MAR) in annual percent changes for each industry group and the simple average MAR for all the industry groups. Other statistics were also computed to test the reliability of the direction of change, of the acceleration or deceleration in growth rates, and of the ranking of growth rates. The

5. See the box "Computation of the Chain-Type Quantity Indexes for Double-Deflated Industries" in Robert E. Yuskavage, "Improved Estimates of Gross Product by Industry," SURVEY 76 (August 1996): 142.

6. The alternative methods yield the same result when the industry's current-dollar gross output and intermediate inputs both increase at about the same rate, which implies a constant nominal input-output ratio. For most industries, this ratio fluctuates from year to year.

7. The aggregation techniques are similar to the procedures used for the November estimates, but they are based on considerably less component detail. Research has demonstrated that these techniques yield results that are very similar to those from the more detailed procedures.

MAR is one of several error measures featured in a recent BEA study of revisions to GDP.[8] In this study, the mean revision (MR) is defined as the average of all revisions, and it is calculated as follows:

$$MR = \frac{\sum (L - E)}{n}$$

where E is the percentage change in the earlier annual estimate, L is the percentage change in the later annual estimate, and n is the number of observations in the sample period over which the summation is calculated. The MAR is defined as the average of the absolute values of all revisions:

$$MAR = \frac{\sum |L - E|}{n}$$

For GDP by industry, accelerated estimates could only be prepared for the years 1998–2000 because of limited availability of earlier vintages of advance source data. For each year, experimental accelerated GDP-by-industry estimates were prepared using as much as possible of the early vintages of source data that were available when these estimates would have been prepared in late March. The evaluation focused on industry groups because of relatively large, offsetting errors for the detailed industries.

The evaluation compared annual changes in the experimental accelerated GDP-by-industry estimates with actual changes obtained from several vintages of the published GDP-by-industry accounts for 1998–2000. For each year, the published GDP-by-industry accounts provide three vintages of annual estimates that correspond to the three vintages of estimates from the annual NIPA revision. For this study, changes in the accelerated estimates were compared with changes in as many of the first, second, and third annual revision estimates as were available.[9] In addition, simple average MARs for 13 GDP-by-industry groups were compared with simple average MARs for 10 major expenditure components of GDP from the NIPA's.

MARs for industry groups. Table A presents MARs for industry groups for current-dollar estimates, for real estimates using the single-deflation method, and for real estimates using the gross-output-extrapolation method. For each measure, the accelerated estimate is compared with both the first and the "latest" regular estimates; for perspective, the first regular estimate is also compared with the latest estimate. For current-dollar estimates, the average MAR for the 13 industry groups for the accelerated estimate relative to the first estimate was 1.61 percentage points, and the average MAR for the accelerated estimate relative to the latest estimate was 2.04 percentage points. By comparison, the MAR for the first estimate relative to the latest estimate was 1.39 percentage points. The MARs for the accelerated estimates relative to the latest estimate ranged from 0.40 percentage point for durable-goods manufacturing to 5.25 percentage points for mining. In this period, current-dollar GDP-by-industry growth rates

8. See Dennis J. Fixler and Bruce T. Grimm, "Reliability of GDP and Related NIPA Estimates," SURVEY 82 (January 2002): 9–27.

9. The first estimate for 1998 was obtained from the comprehensive GDP-by-industry revision released in June 2000. The second estimate for 1998 and the first estimate for 1999 were released in December 2000. The third estimate for 1998, the second estimate for 1999, and the first estimate for 2000 were released in November 2001.

Table A. Mean Absolute Revisions to Annual Percent Changes in GDP by Industry for Industry Groups, 1998–2000

[Percentage points]

	Current-dollar estimates			Real estimates				
				Single-deflation method		Gross-output-extrapolation method		Latest less first
	First less accelerated	Latest less accelerated	Latest less first	First less accelerated	Latest less accelerated	First less accelerated	Latest less accelerated	
Agriculture, forestry, and fishing	1.97	2.87	1.35	4.51	4.97	4.63	4.41	1.02
Mining	5.11	5.25	3.00	3.68	3.90	9.00	7.76	3.28
Construction	0.50	2.31	2.72	2.19	1.61	1.00	1.08	2.48
Manufacturing	0.72	0.65	0.16	1.34	1.60	0.55	0.81	0.40
Durable goods	0.76	0.40	0.80	3.26	2.80	1.68	1.22	0.69
Nondurable goods	0.83	1.39	0.86	2.35	2.88	1.98	2.35	0.91
Transportation and public utilities	1.86	2.15	0.55	1.96	1.92	2.51	2.46	1.61
Transportation	2.92	3.48	1.41	1.83	0.78	2.06	1.07	1.80
Communications	2.66	2.25	2.20	2.74	1.73	3.35	2.51	1.91
Electric, gas, and sanitary services	2.20	3.55	2.70	2.82	5.07	3.23	5.06	3.38
Wholesale trade	1.24	1.60	0.55	1.46	2.36	3.15	4.37	1.82
Retail trade	0.39	0.67	1.03	1.00	1.01	1.87	1.68	0.29
Finance, insurance, and real estate	0.86	1.43	0.85	1.68	1.86	0.91	1.09	0.27
Services	0.88	0.71	0.35	1.46	1.45	2.07	2.05	0.44
Government	0.59	0.64	0.30	0.33	0.54	0.33	0.25	0.36
Average for 13 industry groups [1]	**1.61**	**2.04**	**1.39**	**2.25**	**2.38**	**2.71**	**2.68**	**1.43**

1. Includes all industry groups listed above except for the aggregates "manufacturing" and "transportation and public utilities."

ranged from a low of –15.7 percent for mining in 1998 to a high of 23.0 percent for mining in 2000. These ranges indicate that the MARs—especially those for mining—are not unusually large relative to the size of the underlying percent changes.

The industry groups with the largest revisions to the accelerated current-dollar estimate relative to the latest estimate—mining, transportation, and electric, gas, and sanitary services—have larger proportions of property-type income in their industry GDP. The revisions to the estimates for these industry groups partly reflect the relatively large revisions to the annual estimates of corporate profits, net interest, and proprietors' income in the NIPA's.

On average, the MARs for the accelerated real estimates were larger than those for the accelerated current-dollar estimates. For the single-deflation method, the average MAR was 2.25 percentage points relative to the first estimate and 2.38 percentage points relative to the latest estimate. The revisions to the real estimates using the gross-output-extrapolation method were larger on average than those using the single-deflation method. The MARs for the extrapolated estimate relative to the first estimate (2.71 points) and relative to the latest estimate (2.68 points) were both larger than those for the single-deflation estimate. Most of the difference was due to a very large revision for mining; however, even after excluding mining, the single-deflation method performed slightly better.[10]

Comparison with GDP revisions. Because of the relatively small sample size used for computing MARs for industry groups, these MARs are compared with MARs from the NIPA revision study in order to provide perspective on the industry results. This comparison indicates that the revisions to the accelerated GDP-by-industry estimates are slightly larger than, but still comparable with, the revisions to the early estimates of the major expenditure components of GDP. Using data compiled by Fixler and Grimm, table B presents MARs for the current-dollar and real estimates of the major components of GDP for 1998–2000.[11]

The revisions to the current-dollar NIPA estimates tend to be similar to the revisions to the current-dollar GDP-by-industry estimates, and the revisions to the real NIPA estimates tend to be smaller than those to the real GDP-by-industry estimates. The range of the MARs for the 10 major GDP components is similar to the range reported above for the 13 industry groups. For the current-dollar estimates, the simple average MAR relative to the latest estimate for the 10 detailed GDP components was 1.07 percentage points, ranging from 0.21 percentage point for personal consumption expenditures for services to 3.56 percentage points for nonresidential fixed investment in structures. The current-dollar growth rates of these GDP components ranged from –0.2 percent for exports in 1998 to 18.4 percent for imports in 2000. The range of the MARs for the real NIPA estimates is similar to that for the real GDP-by-industry estimates derived using the single-deflation method.

Other indicators of change. The evaluation criteria for the accelerated estimates of GDP by industry in-

Table B. Mean Absolute Revisions to Annual Percent Changes in Major Components of GDP, 1998–2000

[Percentage points]

	Current-dollar estimates		Real estimates	
	First annual revision less sum of finals [1]	Latest estimate less sum of finals [1]	First annual revision less sum of finals [1]	Latest estimate less sum of finals [1]
Personal consumption expenditures	**0.15**	**0.20**	**0.15**	**0.27**
Durable goods	0.67	0.45	0.67	0.47
Nondurable goods	0.24	0.38	0.23	0.39
Services	0.04	0.21	0.36	0.40
Gross private domestic investment	**1.79**	**1.76**	**1.84**	**1.89**
Fixed investment	1.26	0.85	1.08	0.66
Nonresidential	2.17	1.52	1.80	4.07
Structures	2.70	3.56	2.70	3.41
Equipment and software	1.92	1.61	1.81	1.59
Residential	1.37	1.61	1.15	1.48
Change in private inventories [2]				
Net exports of goods and services [2]				
Exports	0.63	0.62	0.65	0.53
Imports	0.64	1.13	0.75	0.87
Government consumption expenditures and gross investment	**0.53**	**0.66**	**1.29**	**1.37**
Federal	0.29	0.49	0.40	0.38
State and local	0.68	0.63	0.66	0.71
Average for 10 components [3]	**0.92**	**1.07**	**0.94**	**1.02**

1. Consists of the final current quarterly estimates for the second, third, and fourth quarters, and a post-final estimate—published in late July—for the first quarter.
2. Negative values in some years make the calculation of percent changes impossible.
3. Consists of durable goods, nondurable goods, services, structures, equipment and software, residential, exports, imports, Federal, and State and local.

10. The results for the first estimate relative to the latest estimate are not strictly comparable with the results in the other columns because both the first estimate and the latest estimate are based on the double-deflation method.

11. Fixler and Grimm reported MARs for annual estimates for broader GDP categories and for the period 1983–98 in table 11 of their article.

Acknowledgments

Research and development for the prototype methodologies used for the accelerated GDP-by-industry estimates was conducted by Robert E. Yuskavage, senior economist in the Office of the Associate Director for Industry Accounts, under the guidance of Sumiye Okubo, Associate Director for Industry Accounts. Kali K. Kong of the Industry Economics Division (IED), assisted by Michelle L. LaLonde and Felicia V. Candela of IED, prepared the estimates for 2001 and the tables. Ann M. Lawson, Chief of IED, and Brian C. Moyer, Chief of the GDP by Industry Branch of IED, reviewed the estimates and provided valuable suggestions. Staff members from the National Income and Wealth Division and the Government Division also contributed significantly to the preparation of the estimates.

clude their reliability to successfully indicate the direction of change (positive or negative), the acceleration or deceleration of an industry's growth rate, and the rank of an industry in terms of its growth rate. Table C presents these results for the 10 major industry groups.

The direction of change was always correctly indicated for the current-dollar estimates, and it was correctly indicated at least 90 percent of the time for the real estimates using either the single-deflation method or the extrapolation method. The acceleration or deceleration of the growth rate was successfully indicated about three-fourths of the time for the current-dollar estimates and about two-thirds of the time for the real estimates using the single-deflation method. The ranking of industry groups by high, medium, or low growth was successfully indicated about two-thirds of the time for the current-dollar estimates and for the real estimates using the single-deflation method.

Detailed industries. In general, the revisions to current-dollar GDP-by-industry growth rates for the detailed industries were two to three times as large as those for the industry groups. The MARs for industry groups were smaller because of frequent offsetting of large positive and negative revisions within the industry groups. Because of the larger revisions for detailed industries and the uncertainty about the choice of methods for real estimates, the analysis of the revisions for detailed industries was not as extensive as that for industry groups.

Table D provides some insight into the relative magnitudes of the revisions to the current-dollar GDP-by-industry estimates for detailed industries and the nature of the offsetting revisions. For both the first and the latest regular estimates, table D presents the MR (where sign matters) and the MAR (where sign does not matter). The bottom two rows of table D present the simple average MRs and MARs for 65 detailed in-

Table C. Reliability of Accelerated Annual Estimates of GDP by Industry for Industry Groups, 1998–2000

[Percent]

Vintage and type of estimate	Percentage of estimates that correctly indicated: [1]		
	Direction of change	Acceleration or deceleration	Growth-rate rank [2]
First estimate			
Current-dollar	100	77	63
Real:			
Single deflation	93	63	70
Extrapolation	90	67	47
Latest estimate			
Current-dollar	100	73	70
Real:			
Single deflation	97	67	63
Extrapolation	93	77	43
Number of industry group observations	**30**	**30**	**30**

1. For each of the 10 major industry groups for each of the 3 years, the accelerated estimate is compared with the later estimate to determine if the accelerated estimate provided a correct indication.
2. High, medium, or low growth based on the ordinal rank of the 10 major industry groups. High growth are ranks 1 through 3, medium growth are ranks 4 through 7, and low growth are ranks 8 through 10.

Table D. Mean Revisions and Mean Absolute Revisions to Annual Percent Changes in Current-Dollar GDP by Industry, 1998–2000

[Percentage points]

	First estimate less accelerated estimate		Latest estimate less accelerated estimate	
	Mean revision	Mean absolute revision	Mean revision	Mean absolute revision
Agriculture, forestry, and fishing	1.97	1.97	2.87	2.87
Farms	3.02	3.48	3.20	3.46
Agricultural services, forestry, and fishing	0.16	0.62	2.42	2.61
Mining	–2.82	5.11	–4.81	5.25
Metal mining	–0.52	8.57	–2.49	7.88
Coal mining	–0.31	1.65	–1.68	1.76
Oil and gas extraction	–3.88	7.04	–5.88	7.22
Nonmetallic minerals, except fuels	2.41	5.23	0.41	7.22
Construction	0.06	0.50	1.88	2.31
Manufacturing	0.72	0.72	0.65	0.65
Durable goods	0.63	0.76	0.10	0.40
Lumber and wood products	–0.22	2.04	0.04	1.78
Furniture and fixtures	1.32	1.80	0.02	2.88
Stone, clay, and glass products	0.15	3.77	–1.38	4.84
Primary metal industries	3.20	4.98	–0.71	1.85
Fabricated metal products	–0.66	1.42	–0.12	0.27
Industrial machinery and equipment	1.27	1.27	0.77	3.99
Electronic and other electric equipment	–0.15	1.44	–3.27	4.05
Motor vehicles and equipment	–0.35	2.55	2.93	5.97
Other transportation equipment	–0.70	2.58	1.81	3.83
Instruments and related products	4.58	4.58	3.37	3.37
Miscellaneous manufacturing industries	4.20	5.77	4.53	6.09
Nondurable goods	0.82	0.83	1.39	1.39
Food and kindred products	2.81	2.81	2.96	3.78
Tobacco products	6.11	10.36	3.36	7.61
Textile mill products	2.84	2.88	2.67	2.67
Apparel and other textile products	–3.59	4.03	–5.27	5.92
Paper and allied products	–2.41	2.70	–1.91	2.49
Printing and publishing	0.44	1.51	0.58	0.69
Chemicals and allied products	0.73	0.74	1.29	1.30
Petroleum and coal products	–0.52	3.86	4.42	5.37
Rubber and miscellaneous plastics products	0.77	0.77	3.48	3.48
Leather and leather products	3.64	12.27	1.68	11.97
Transportation and public utilities	–1.11	1.86	–1.48	2.15
Transportation	–0.03	2.92	0.53	3.48
Railroad transportation	–3.64	8.97	–2.15	8.28
Local and interurban passenger transit	1.03	2.79	2.29	4.05
Trucking and warehousing	–2.41	3.30	0.21	3.43
Water transportation	1.25	2.07	0.43	1.24
Transportation by air	3.18	6.33	1.83	5.85
Pipelines, except natural gas	0.96	7.14	–3.32	3.96
Transportation services	0.98	2.98	–0.18	2.79
Communications	–1.51	2.66	–1.87	2.25
Telephone and telegraph	–2.93	4.46	–3.43	3.43
Radio and television	2.98	2.98	3.00	4.80
Electric, gas, and sanitary services	–2.00	2.20	–3.55	3.55
Wholesale trade	–0.65	1.24	–1.01	1.60
Retail trade	–0.11	0.39	–0.64	0.67
Finance, insurance, and real estate	0.46	0.86	0.97	1.43
Depository institutions	1.45	2.39	3.75	3.75
Nondepository institutions	10.00	21.50	–2.81	8.49
Security and commodity brokers	–6.55	6.55	–5.42	12.07
Insurance carriers	0.95	2.76	0.97	2.33
Insurance agents, brokers, and service	–1.04	1.34	3.34	4.21
Real estate	1.44	1.44	2.04	2.04
Nonfarm housing services	1.39	1.79	1.94	2.06
Other real estate	1.29	1.98	2.02	2.02
Holding and other investment offices	.....	.....	.....	.....
Services	0.88	0.88	0.71	0.71
Hotels and other lodging places	2.98	3.31	1.59	3.56
Personal services	–1.82	1.82	–1.28	4.96
Business services	3.24	3.24	2.05	2.91
Auto repair, services, and parking	–1.35	2.31	0.28	3.03
Miscellaneous repair services	–0.09	3.22	–1.02	3.74
Motion pictures	–0.61	5.12	2.50	2.89
Amusement and recreation services	–0.86	0.86	–1.73	1.73
Health services	–0.20	0.56	0.04	0.66
Legal services	–0.47	0.63	–1.26	1.42
Educational services	0.45	3.40	1.09	3.92
Social services	0.35	1.26	0.60	1.61
Membership organizations	2.30	2.38	2.80	3.58
Other services	0.13	2.38	0.14	2.45
Private households	13.75	13.75	16.72	16.72
Statistical discrepancy	.....	.....	.....	.....
Government	–0.06	0.59	–0.26	0.64
Federal	–1.08	1.08	–1.59	1.59
General government	–0.12	0.70	–0.29	0.84
Government enterprises	–5.72	5.72	–7.86	7.86
State and local	0.43	0.97	0.38	0.85
General government	0.19	0.74	0.24	0.73
Government enterprises	3.03	3.44	1.91	2.08
Average for 65 detailed industries [1]	**0.70**	**3.68**	**0.51**	**4.00**
Average for 13 industry groups [2]	**–0.18**	**1.61**	**–0.29**	**2.04**

1. Excludes holding and other investment offices, which is included in the industry group of finance, insurance, and real estate.
2. See footnote 1 to table A.

dustries and for 13 industry groups.[12] Relative to the first estimate, the MAR for 65 detailed industries was 3.68 percentage points, compared with 1.61 percentage points for the 13 industry groups. Relative to the latest estimate, the average MAR was 4.00 percentage points, compared with 2.04 percentage points for the industry groups. Durable-goods manufacturing provides an example of the impact of offsetting revisions: Relative to the latest estimate, the MAR was 0.40 percentage point, but the simple average MAR for the 11 detailed industries in the group was 3.54 percentage points.

Results for 2001

The illustrative GDP-by-industry estimates for 2001 are limited to current-dollar GDP by industry for broad industry groups (table E). Nevertheless, these estimates provide perspective on the effects on industries of the economic slowdown and the events of September 11th.

In the NIPA estimates, growth in current-dollar GDP fell sharply to 3.4 percent in 2001 from 6.5 percent in 2000. (Real GDP growth also decelerated sharply, to 1.2 percent from 4.1 percent.) In terms of final expenditures, the major contributors to the slowdown in current-dollar GDP were gross private domestic investment, which declined 7.6 percent after increasing 8.0 percent, and exports of goods and services, which declined 4.8 percent after increasing 11.4 percent.

In the illustrative estimates, current-dollar GDP for private industries increased 3.2 percent in 2001, slightly less than the increase in the NIPA estimate of GDP (table F). Growth slowed in both private goods-producing industries and private services-producing industries; the slowdown was more pronounced in the goods-producing industries, in which growth essentially stalled in 2001 after increasing 6.5 percent in 2000. Government increased 4.6 percent, more than GDP but still slower than in 2000. Reflecting these differing growth rates, the share of GDP accounted for by private industries declined slightly to 87.5 percent, while government's share increased slightly to 12.5 percent (table G). A decline in the share of private goods-producing industries, from 23.2 percent to 22.5 percent, was offset by a comparable increase in the share of private services-producing industries, from 65.8 percent to 66.5 percent.

The pattern of changes for the private industry groups reflects both a continuing decline in durable-goods manufacturing and in goods-distribution industries due to the downturn in business fixed investment in the second half of 2000 and a slowdown in personal consumption expenditures for nondurable goods and for travel and tourism-related services after the September 11th terrorist attacks.[13]

12. Because of unusual volatility, the results for holding and other investment offices are not shown separately and are not included in the averages for the detailed industries. However, these results are included in the results for finance, insurance, and real estate.

13. Goods-distribution industries include wholesale trade, retail trade, and parts of transportation. Retail trade primarily involves the distribution of goods to households rather than to business and government.

Table E. GDP by Industry Group in Current Dollars, 1998–2001

[Billions of dollars]

	1998	1999	2000	Illustrative 2001
Gross domestic product	**8,781.5**	**9,268.6**	**9,872.9**	**10,208.1***
Private industries	**7,678.2**	**8,116.9**	**8,656.5**	**8,935.5**
Private goods-producing industries	**2,040.6**	**2,152.9**	**2,293.0**	**2,292.0**
Agriculture, forestry, and fishing	128.0	127.2	135.8	144.2
Mining	100.2	103.3	127.1	137.9
Construction	380.8	425.5	463.6	491.4
Manufacturing	1,431.5	1,496.8	1,566.6	1,518.5
Durable goods	830.7	865.7	901.7	861.3
Nondurable goods	600.8	631.0	664.8	657.1
Private services-producing industries	**5,668.6**	**6,036.7**	**6,493.9**	**6,793.4**
Transportation and public utilities	732.0	776.8	825.0	853.3
Transportation	288.7	302.7	313.9	305.7
Communications	238.5	258.5	281.1	301.0
Electric, gas, and sanitary services	204.8	215.6	230.0	246.6
Wholesale trade	607.9	633.5	674.1	684.8
Retail trade	790.4	834.9	893.9	942.2
Finance, insurance, and real estate	1,708.5	1,810.6	1,936.2	2,006.4
Services	1,829.9	1,980.9	2,164.6	2,306.8
Statistical discrepancy [1]	–31.0	–72.7	–130.4	–149.8*
Government	**1,103.3**	**1,151.7**	**1,216.4**	**1,272.6**

* The estimates of GDP and the statistical discrepancy for 2001 are from the published NIPA's.
1. Equals gross domestic product measured as the sum of expenditures less gross domestic income.

Table F. Percent Changes in Current-Dollar GDP by Industry Group

	1999	2000	Illustrative 2001	Illustrative average annual rate of change 1998–2001
Gross domestic product	**5.5**	**6.5**	**3.4***	**5.1***
Private industries	**5.7**	**6.6**	**3.2**	**5.2**
Private goods-producing industries	**5.5**	**6.5**	**0.0**	**3.9**
Agriculture, forestry, and fishing	–0.6	6.7	6.2	4.0
Mining	3.1	23.0	8.5	11.2
Construction	11.7	9.0	6.0	8.9
Manufacturing	4.6	4.7	–3.1	2.0
Durable goods	4.2	4.2	–4.5	1.2
Nondurable goods	5.0	5.4	–1.2	3.0
Private services-producing industries	**6.5**	**7.6**	**4.6**	**6.2**
Transportation and public utilities	6.1	6.2	3.4	5.2
Transportation	4.9	3.7	–2.6	1.9
Communications	8.4	8.7	7.1	8.1
Electric, gas, and sanitary services	5.2	6.7	7.2	6.4
Wholesale trade	4.2	6.4	1.6	4.0
Retail trade	5.6	7.1	5.4	6.0
Finance, insurance, and real estate	6.0	6.9	3.6	5.5
Services	8.2	9.3	6.6	8.0
Government	**4.4**	**5.6**	**4.6**	**4.9**

* The estimate of GDP for 2001 is from the published NIPA's.

The illustrative accelerated GDP-by-industry estimates for 2001 show the following:

- Manufacturing declined 3.1 percent after increasing 4.7 percent in 2000, and its share of GDP declined a full percentage point to 14.9 percent. The decline was concentrated in durable goods, which includes industries that produce information and communications technology equipment.
- Transportation declined 2.6 percent after increasing 3.7 percent. This decline mostly reflected sharp reductions in tourism-related and business air travel after September 11th, but it also reflected declines in the transport of goods to the wholesale trade and retail trade industries by truck, rail, and water.
- Services and retail trade both grew relatively rapidly. Services increased 6.6 percent despite declines in hotels and lodging places and in other travel-related services. Retail trade increased 5.4 percent, partly reflecting a large increase in sales of automobiles.
- Several of the smaller industry groups also posted relatively large increases—including agriculture, forestry, and fishing; mining; construction; communications; and electric, gas, and sanitary services. Nonetheless, except for electric, gas, and sanitary services, growth in these industry groups was slower than in 2000.

Measurement issues for real estimates

Experimental accelerated estimates of real GDP by industry for 2001 were also prepared, but they are not presented in this article. For most of the detailed industries, the estimates were prepared using the single-deflation method. For farms, nonfarm housing services, private households, and general government, chain-type quantity indexes were obtained directly from the NIPA's. For all the other detailed industries, chain-type quantity indexes were calculated by dividing an index of current-dollar GDP by industry by the industry's gross output price index. Chain-type quantity indexes for industry groups were obtained by Fisher aggregation over the detailed industries.

Unlike the experimental current-dollar estimates of GDP by industry that were constrained to match the level, and thus the growth rate, of NIPA current-dollar GDP, the experimental real estimates were not constrained to match the growth rate of NIPA real GDP. As a result, the growth rate of real GDP by industry for "all industries" (private industries plus government) differed by nearly a full percentage point from the growth rate of NIPA real GDP. However, proportional scaling of detailed GDP-by-industry price or quantity indexes is not appropriate, because differences in the composition of gross output and intermediate inputs across industry groups suggest that the effects on accuracy of using the single-deflation method instead of the double-deflation method are not uniform across industry groups.

Using the single-deflation method assumes that price index growth rates for industry gross output equal those for intermediate inputs. Research has demonstrated that when these two measures diverge substantially for large industries or for a large number of industries, the GDP-by-industry (value-added) price index for all industries differs significantly from the gross output price index for all industries. As a result, aggregate real growth rates based on the single-deflation method may differ significantly from those based on the double-deflation method. Large differences in aggregate price index growth rates have coincided either with a business cycle downturn (1991) or with a large increase in crude oil prices (1998). For 2001, the substantial slowdown in real GDP growth, combined with declines in the prices of a wide variety of manufactured goods relative to the prices of other commodities, provides some reasons to suspect a similar divergence may have occurred.

Table G. GDP by Industry Group in Current Dollars as a Percentage of GDP, 1998–2001

[Percent]

	1998	1999	2000	Illustrative 2001
Gross domestic product	**100.0**	**100.0**	**100.0**	**100.0***
Private industries	**87.4**	**87.6**	**87.7**	**87.5**
Private goods-producing industries	**23.2**	**23.2**	**23.2**	**22.5**
Agriculture, forestry, and fishing	1.5	1.4	1.4	1.4
Mining	1.1	1.1	1.3	1.4
Construction	4.3	4.6	4.7	4.8
Manufacturing	16.3	16.1	15.9	14.9
Durable goods	9.5	9.3	9.1	8.4
Nondurable goods	6.8	6.8	6.7	6.4
Private services-producing industries	**64.6**	**65.1**	**65.8**	**66.5**
Transportation and public utilities	8.3	8.4	8.4	8.4
Transportation	3.3	3.3	3.2	3.0
Communications	2.7	2.8	2.8	2.9
Electric, gas, and sanitary services	2.3	2.3	2.3	2.4
Wholesale trade	6.9	6.8	6.8	6.7
Retail trade	9.0	9.0	9.1	9.2
Finance, insurance, and real estate	19.5	19.5	19.6	19.7
Services	20.8	21.4	21.9	22.6
Statistical discrepancy [1]	–0.4	–0.8	–1.3	–1.5*
Government	**12.6**	**12.4**	**12.3**	**12.5**

* The estimates of GDP and the statistical discrepancy for 2001 are from the published NIPA's.
1. Equals gross domestic product measured as the sum of expenditures less gross domestic income.

Future Initiatives

The experimental accelerated GDP-by-industry estimates were prepared using a prototype methodology that takes the first steps toward regularly providing more timely estimates of GDP by industry. Given the experimental nature of the estimates, BEA is interested

in your views on the proposed methodologies for current-dollar and real estimates, the appropriate level of industry detail, and the tradeoff between accuracy and timeliness. We encourage your feedback on the value of this initiative and of other initiatives described in BEA's Strategic Plan to speed-up the availability of estimates from the industry accounts.

BEA is especially interested in learning (1) if the potential magnitude of the revisions to current-dollar and real estimates for industry groups are acceptable for your uses, (2) if having the real estimates available in April is as important to you as having the current-dollar estimates available, (3) if the real estimates are important, whether differences between the growth rate of real GDP from the NIPA's and that of "all industries" from the accelerated estimates that significantly exceed the differences in the November estimates should be a factor in deciding whether to release the real estimates, (4) if additional industry detail for current-dollar estimates in April would be useful despite the prospect of substantial revisions in November, and (5) if having estimates for the three major income components by industry group available in April is important for your uses.

Given additional resources for preparing accelerated estimates of GDP by industry, BEA would consider the following:

- Increasing the amount of industry detail beyond the 13 industry groups to include many of the detailed industries in the November release,
- Providing additional estimates, such as gross output and the shares of labor and capital income,
- Developing more robust estimating methodologies, such as double deflation, that would improve the reliability of the real estimates,
- Expediting the conversion of the estimates to the new North American Industry Classification System, and
- Expediting the development of new software applications for the accelerated estimates.

Please e-mail your comments regarding these issues to Sumiye Okubo, BEA's Associate Director for Industry Accounts, at industryaccts@bea.gov.