

## Reliability of the NIPA Estimates of U.S. Economic Activity

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THE goal of BEA's national income and product accounts (NIPAs) is to provide timely, comprehensive, and reliable descriptions of the condition of the U.S. economy. Two featured measures—gross domestic product (GDP) and gross domestic income (GDI)—aim to provide snapshots of the economy at specified times.

This study analyzes the reliability of BEA's quarterly and annual estimates of GDP, of GDI, and of their components for 1983–2002. In this article, “reliability” refers to the magnitudes of the revisions to the estimates of these measures.<sup>1</sup> The revisions are defined as the changes from an earlier vintage of estimates to a later vintage (see the box “Vintages and Timing of Revisions”). The latest available estimates are presumed to be the best estimates and are used as the standards for reliability.

Confirming previous research, the study concludes that BEA's estimates are generally reliable and that these estimates thus present a useful picture of the Nation's output of goods and services. Specifically, successive revisions to these estimates were usually able to indicate whether growth was positive or negative, whether growth was accelerating or decelerating, whether growth was high or low relative to trend, and where the economy was in relation to the business cycle.

In order to present timely estimates of GDP, BEA prepares quarterly estimates that are based on preliminary data from Census Bureau surveys, such as those for retail sales and manufacturers' shipments, and on extrapolated estimates, such as those for international trade and for consumer spending on domestic services. The estimates are revised to incorporate more comprehensive and more up-to-date data from surveys, tax records, and other administrative records when the data become available. The latest available estimates typically reflect not only updated source data but also changes in various definitions and statistical

conventions.

Because these data come from a wide range of sources—including random and nonrandom surveys, administrative records, and extrapolated and interpolated estimates—the construction of confidence intervals and standard errors is not strictly possible. Accordingly, the only way to measure the accuracy of the estimates is to compare them with later estimates; for example, the advance estimates are compared with the final estimates.

The data show that since the early 1980s, the revisions to the annual rates of change—without regard to sign—from the current quarterly estimates to the latest estimates of current-dollar and real GDP have averaged slightly more than 1 percentage point. Substantial portions of these revisions result from the introduction of new concepts and new methods as part of the annual and comprehensive revisions of the NIPAs. For example, in the 2003 comprehensive revision, a new measure of banking services identified services received by borrowers as well as by depositors, and as a result, the cumulative growth of current-dollar GDP in 1992–2002 was reduced 0.4 percentage point.

The revisions—without regard to sign—from an early vintage of current quarterly estimates to a later vintage of quarterly estimates tend to be smaller; the average revision from the advance estimates of real GDP to the preliminary estimates is 0.5 percentage point. The average revision from the advance estimates to the final estimates is 0.6 percentage point, and the average revision from the preliminary estimates to the final estimates is 0.3 percentage point.

Further, many of the quarterly, annual, and comprehensive revisions are offsetting. The mean revision, which accounts for whether the revisions are positive or negative, from the advance estimates of real GDP to both the preliminary and final estimates is 0.1 percentage point; the mean revision from the advance estimates to the latest estimates is 0.4 percentage point.

1. This definition of reliability differs from that used in statistics to analyze survey results and quality control, and in statistical work, the term “accuracy” refers to the total measurement error, which in the NIPAs is never observed.

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The mean revision from both the preliminary and final estimates to the latest estimates is 0.3 percentage point.

For 1983–2002, the average growth rate for the quarterly estimates of real GDP was 3.4 percent. The growth rates ranged from –3.0 to 9.3 percent, with a standard deviation of 2.4 percentage points. The quarterly estimates of real GDP successfully indicated the following:

- The direction of change in real GDP 98 percent of the time.
- Whether real GDP was accelerating or decelerating 74 percent of the time.
- Whether real GDP growth was high relative to trend about two-thirds of the time and whether it was low relative to trend about three-fifths of the time.
- The cyclical peaks in all five of the recessions in 1969–2000. (The quarterly movements of real GDP around the 2001 recession are complex, and the peak quarter has not been clearly identified; see the next section.)
- The cyclical troughs in three of the five recessions; both the missed troughs were within a quarter of the latest estimates of the troughs for both quarters.

The remainder of this article discusses (1) revisions to quarterly estimates of GDP, (2) revisions to annual estimates of GDP, (3) revisions to the estimates of GDI, (4) revisions and the relationship between GDP and GDI, (5) the statistical discrepancy (the difference between GDP and GDI), and (6) the conclusions of this study.

## 1. Revisions to Quarterly Estimates of GDP

The measures of reliability featured in this evaluation are mean revisions and mean absolute revisions from the earlier estimates to the latest available estimates (see the box on page 10). The mean absolute revisions and the mean revisions for the three quarterly estimates of current-dollar and real GDP and their major components for 1983–2002 are evaluated.<sup>2</sup>

### Mean absolute revisions

For both current-dollar and real GDP, the mean absolute revisions from the advance estimates to the preliminary estimates decreased slightly. The mean absolute revisions from the preliminary estimates to the final estimates increased slightly (table 1). The mean absolute revisions for both current-dollar GDP and real GDP are slightly more than 1.0 percentage point, and the revisions for real GDP are about 0.1 to 0.2 percentage point higher than those for the current-dollar GDP.

The pattern of the mean absolute revisions for the 17 components of GDP vary:

- From the advance estimates to the preliminary estimates of current-dollar GDP, the mean absolute

2. Current-dollar GDP is adjusted for the changes in prices over time in order to prepare real GDP. At the most detailed level, the components of real GDP are calculated by dividing the current-dollar estimates by price indexes. Both real GDP and its components are estimated by using a Fisher index chain formula, so the components in chained dollars do not sum to GDP.

### Vintages and Timing of the Revisions

The Bureau of Economic Analysis (BEA) prepares quarterly and annual estimates of gross domestic product (GDP) in the national income and product accounts (NIPAs). It prepares three vintages of quarterly GDP estimates—advance, preliminary, and final estimates. The advance estimates for a quarter are released near the end of the first month after the end of the quarter; the preliminary estimates for the quarter are released 2 months after the end of the quarter, and the final estimates are released 3 months after the end of the quarter. In addition, as part of the annual NIPA revision, the quarterly estimates for the 3 preceding years are revised.

BEA prepares four vintages of annual estimates for a year—the “sum of finals,” the first annual estimates, the second annual estimates, and the third annual estimates. The “sum of finals” is an average of the final estimates for each quarter of a year that is prepared when the final estimate for the fourth quarter of a year is available; these estimates are released in March with the release of the final fourth-quarter estimates. The annual estimates for 3

preceding years are revised as part of the annual NIPA revision; these revised estimates are the first, second, and third annual estimates. The most recent annual NIPA revision was released in July 2004, and it presented revised annual and quarterly estimates for 2000–2003. After the third annual revision of the estimates for a year is released, these estimates are not revised or released again until the next comprehensive NIPA revision.

Annual NIPA revisions are superseded by comprehensive NIPA revisions, which historically occurred about every 5 years. These revisions incorporate changes in definitions and classifications and statistical changes. The most recent comprehensive revision was released in December 2003, and it featured revised annual estimates for 1929–2002 and revised quarterly estimates for 1947–2003.

BEA also prepares revised quarterly estimates of gross domestic income (GDI). The revised final estimates for a quarter are now released with the preliminary estimates of GDP for the succeeding quarter.

revisions for 11 components decreased. For real GDP, these revisions for only 8 components decreased.

- From the preliminary estimates to the final estimates of current-dollar GDP, the mean absolute revisions for only 8 components decreased. For real GDP, these revisions for 10 components decreased.

The mean absolute revisions for the major components tended neither to increase nor to decrease with the subsequent estimates. However, except for the mean absolute revisions for personal consumption expenditures, the revisions for the other components of GDP are considerably larger than the ones for current-dollar GDP and for real GDP.

Comparing the mean absolute revisions for the major components of GDP with their subcomponents yields a mixed picture.

**Personal consumption expenditures (PCE).** The mean absolute revisions for current-dollar and real PCE for durable goods and nondurable goods and current-dollar PCE for services are larger than those for total PCE. The revisions for real PCE for services

### Mean Revisions and Mean Absolute Revisions

The mean revision is calculated as the average of the revisions in the relevant period:

$$MR = \Sigma(L - E)/n$$

E is the percent change in the earlier quarterly or annual estimate, L is the percent change in the later estimate, and n is the number of observations in the sample period. Percent changes in quarterly estimates are at quarterly rates, which corresponds to the convention generally used for the estimates.

The revisions can be positive or negative, so they may be offsetting. As a result, it is useful to look at the mean absolute revision:

$$MAR = \Sigma|L - E|/n$$

The mean absolute revision is the average of the absolute values of the revisions.

For most of the analyses in this study, the latest estimates are used as the standards for the sizes of the revisions.

**Table 1. Averages of Revisions to Quarterly Estimates of GDP and Its Major Components in 1983–2002**

[Percentage points]

	Mean absolute revisions		Mean revisions			Mean absolute revisions		Mean revisions	
	Current-dollar GDP	Real GDP	Current-dollar GDP	Real GDP		Current-dollar GDP	Real GDP	Current-dollar GDP	Real GDP
<b>Gross domestic product</b>									
Advance .....	1.18	1.29	0.40	0.42	Preliminary .....	4.41	4.81	-1.31	-1.71
Preliminary .....	1.12	1.26	0.25	0.32	Final .....	4.46	4.95	-1.78	-2.21
Final .....	1.15	1.32	0.25	0.33	<b>Residential</b>				
<b>Personal consumption expenditures</b>									
Advance .....	1.29	1.27	0.47	0.43	Advance .....	4.89	4.73	0.49	-0.08
Preliminary .....	1.22	1.19	0.34	0.31	Preliminary .....	4.73	5.12	0.51	0.32
Final .....	1.21	1.22	0.36	0.34	Final .....	4.59	4.97	0.32	0.16
<b>Durable goods</b>									
Advance .....	4.46	4.44	0.70	0.61	Change in private inventories <sup>1</sup> .....				
Preliminary .....	4.47	4.49	0.62	0.49	<b>Net exports of goods and services <sup>1</sup></b>				
Final .....	4.46	4.45	0.57	0.41	<b>Exports</b>				
<b>Nondurable goods</b>									
Advance .....	1.86	2.22	0.64	0.84	Advance .....	4.53	4.40	2.07	1.75
Preliminary .....	1.45	1.89	0.35	0.55	Preliminary .....	3.92	3.72	0.78	0.70
Final .....	1.47	1.88	0.37	0.58	Final .....	4.03	3.80	0.44	0.36
<b>Services</b>									
Advance .....	1.30	1.01	-0.51	0.22	<b>Imports</b>				
Preliminary .....	1.27	1.02	-0.57	0.15	Advance .....	6.26	6.81	0.70	-0.31
Final .....	1.21	1.07	-0.53	0.25	Preliminary .....	5.13	6.21	0.05	-1.17
<b>Gross private domestic investment</b>									
Advance .....	7.61	7.52	-0.88	-1.10	Final .....	5.19	6.21	-0.35	-1.46
Preliminary .....	7.82	7.71	-0.67	-0.85	<b>Government consumption expenditures and gross investment</b>				
Final .....	7.92	7.55	-1.00	-1.29	Advance .....	2.74	3.49	0.40	0.69
<b>Fixed investment</b>									
Advance .....	3.00	3.26	-0.06	-0.65	Preliminary .....	2.67	4.02	0.17	0.42
Preliminary .....	2.76	3.06	-0.49	-0.93	Final .....	2.73	3.99	0.28	0.66
Final .....	2.71	3.23	-0.71	-1.23	<b>Federal</b>				
<b>Nonresidential</b>									
Advance .....	3.60	3.97	-0.26	-0.85	Advance .....	5.78	6.39	0.23	0.21
Preliminary .....	3.62	4.24	-0.88	-1.02	Preliminary .....	5.89	6.49	-0.14	-0.11
Final .....	3.47	3.97	-1.13	-1.74	Final .....	5.88	6.48	0.17	0.34
<b>Structures</b>									
Advance .....	6.12	5.75	0.86	0.29	<b>Defense</b>				
Preliminary .....	5.79	5.63	0.31	0.05	Advance .....	3.86	3.88	0.17	0.15
Final .....	5.81	5.32	0.33	0.21	Preliminary .....	3.60	3.21	0.16	0.23
<b>Equipment and software</b>									
Advance .....	4.21	4.76	-0.49	-0.92	Final .....	3.64	3.29	0.18	0.33
<b>State and local</b>									
Advance .....					Advance .....	19.80	22.98	-6.35	-5.51
					Preliminary .....	20.46	23.42	-7.88	-7.11
					Final .....	20.01	22.94	-6.53	-5.54
					<b>Commodity Credit Corporation affected nondefense revisions, but not GDP revisions.</b>				
					Advance .....	1.85	1.46	0.44	0.85
					Preliminary .....	1.71	1.45	0.29	0.68
					Final .....	1.75	1.46	0.32	0.74

1. Negative values in some quarters make the calculation of percentage changes impossible.

2. A 1991 change in the accounting treatment of purchases and sales of agricultural goods by the

are smaller than those for total real PCE.

**Gross private domestic investment.** The mean absolute revisions for the components of fixed investment are all larger than those for total fixed investment.

**Government consumption expenditures and gross investment.** In contrast, the mean absolute revisions for state and local government expenditures are much smaller than those for total government expenditures. The large mean absolute revisions for current-dollar and real Federal Government nondefense expenditures reflect a 1991 change in the treatment of the Commodity Credit Corporation's commodity loan program; after this change, the revisions for these expenditures have been about an eighth of the size of the previous revisions.<sup>3</sup>

**Change in private inventories.** The change in this component is frequently negative, so mean absolute revisions and mean revisions cannot be calculated. However, the effects of revisions to this component can be approximated by comparing the revisions for gross private domestic investment (GPDI) with those for fixed investment.<sup>4</sup> The mean absolute revisions for GPDI are more than double those for fixed investment, indicating that the revisions to inventories contribute significantly to the revisions to the estimates of GPDI.<sup>5</sup>

### Mean revisions

The mean revisions for the advance estimates of both current-dollar GDP and real GDP are about 0.4 percentage point, much smaller than the mean absolute revisions. The mean revisions for the preliminary and final estimates are about 0.3 percentage point.

These mean revisions are not indications of bias. Most of these revisions reflect definitional and statistical changes that are part of comprehensive revisions in order to improve the estimates (see Fixler 2004).

By component, the mean revisions for personal consumption expenditures and expenditures for durable goods and nondurable goods are all positive. The mean revisions for current-dollar expenditures for services are negative, but the revisions for real expenditures for services are positive.

The mean revisions for gross private domestic investment and for fixed investment are negative, but the revisions for nonresidential structures and residential investment are positive.<sup>6</sup> The mean revisions for total

government expenditures and for most of its components are positive. However, the mean revisions for nondefense expenditures are large and negative. These mean revisions, however, are small and negative in the period beginning with 1992, as a result of the revised treatment of the purchases and sales by the Commodity Credit Corporation (CCC).

### Revisions relative to the trend rate of GDP growth

In 1983–2002, the trend rate of real GDP growth was 3.4 percent. “Near” trend growth is defined as growth within one standard deviation of the trend—between 2.1 and 4.7 percent (table 2). Each row in table 2 sums to the percent share of all the final estimates that were below, near, or above trend, and each column sums to the percent share of all the latest estimates that were below, near, or above trend. For example, 38 percent of the final estimates indicated below-trend growth, and 28 percent of the latest estimates indicated below-trend growth; 23 percent of both the final estimates and latest estimates indicated below-trend growth.

**Table 2. Final Current Quarterly and Latest Estimates of GDP and Growth Rates Relative to Trends in Growth, 1983–2002**  
[Percent of total]

Final estimate	Latest estimate			Row total
	Below trend	Near trend	Above trend	
Below trend.....	23	15	0	38
Near trend.....	4	24	12	40
Above trend.....	1	7	14	22
Column total.....	28	46	26	100

NOTE: Below trend is a change at annual rate of less than 2.1 percent, near trend is from 2.1 to 4.7 percent, and above trend is more than 4.7 percent.

Three-fifths of the estimates remain below, near, or above trend. Of the estimates that changed categories, more than two-thirds were revised to a more rapid growth category.

### Distribution of mean revisions

The distribution of the mean revisions from the final quarterly estimates to the latest estimates of current-dollar and real GDP and their major components are shown in table 3.

The standard deviations for the revisions are the distributions of the revisions that are approximately normally distributed. About two-thirds of these revisions are within one standard deviation of the mean.

The mean revisions of current-dollar and real GDP are not statistically significantly different from zero, and seven of the current-dollar components and nine

3. This changed treatment primarily affected the timing of Federal non-defense purchases and change in farm inventories, but not GDP.

4. Gross private domestic investment is the sum of change in private inventories and fixed investment.

5. However, in previous studies, mean absolute revisions for final sales (GDP less change in private inventories) were slightly smaller than those for GDP; thus, revisions to inventories tend to be offset by revisions to the other components of GDP.

6. The mean revisions for equipment and software, the other component of fixed investment, are positive the second and third annual revision estimates and later estimates are used. The change from negative to positive suggests that the annual source data that are available with a 2-year lag differ from the earlier source data.

of the real components are not statistically significantly different from zero. Because of the change in the treatment of CCC purchases and sales in 1991, the significance of the revisions for total government expenditures, for Federal Government expenditures, and for nondefense expenditures cannot be tested. For 1992–2002, all these components may be tested, and none are statistically different from zero.

For the other components of GDP, four of the current-dollar components are not testable, but all of the real components are testable; three current-dollar mean revisions and five real mean revisions are significantly different from zero.<sup>7</sup>

### Smoothness of GDP estimates

Some analysts have discerned that the volatility of real GDP estimates dropped sharply around 1984; since then, volatility has remained relatively low. Volatility is typically measured as the standard deviation of percent changes at an annual rate.<sup>8</sup>

The smoothness or standard deviations of four vintages of quarterly estimates of real GDP for 1978–84 and 1985–2002 are analyzed.<sup>9</sup> For all four vintages, the

7. Although the revisions for some of the nongovernment components do not pass tests for normality, with a sample size of 80 observations, t-test statistics are reasonably robust even in the absence of normality. For the four current-dollar components that were not tested, none had t-statistics as large as 1.99, the critical value for statistically significant values that differ from 0 with  $p = .05$ . Thus, it may be reasonably concluded that their means are not statistically significantly different from zero.

8. For example, see Howrey (2003), Kahn, McConnell, and Perez-Quiros (2003), Kim, Nelson, and Piger (2001), and Stock and Watson (2002).

standard deviations in 1985–2002 are only about two-fifths as large as those in 1978–84 (table 4). In both periods, the standard deviations from the advance estimates to the latest estimates increase; the increases reflect the use of more and better source data to prepare the later vintages of the estimates.

The coefficients of variation give a sense of the “tightness” of the distributions.<sup>10</sup> The coefficients of all four vintages are smaller in 1985–2002 than in

9. The earliest year for which BEA has found it feasible to reconstruct the vintages of the quarterly estimates of GDP, GDI, and their major components is 1978.

10. The coefficients of variation are defined as the standard deviations divided by the mean percent changes in real GDP.

**Table 4. Estimates of the Smoothness of Real GDP Estimates**

	1978:I–1984:IV	1985:I–2002:IV
Standard deviations of estimates; percentage points		
Advance.....	4.425	1.771
Preliminary.....	4.521	1.937
Final.....	4.583	2.019
Latest.....	5.302	2.098
Coefficients of variation		
Advance.....	1.104	0.626
Preliminary.....	1.124	0.659
Final.....	1.104	0.687
Latest.....	1.099	0.641
Standard deviations of revisions; percentage points		
Latest less advance.....	2.525	1.593
Latest less preliminary.....	2.384	1.528
Latest less final.....	2.510	1.593
Ratios of standard deviations of revisions to those of estimates		
Advance.....	0.571	0.899
Preliminary.....	0.527	0.789
Final.....	0.548	0.787

**Table 3. Revisions to Quarterly Current-Dollar and Real Estimates of GDP in 1983–2002**

[Percentage points]

	Current-dollar GDP					Real GDP				
	Mean revision	Minimum revision <sup>1</sup>	Maximum revision <sup>2</sup>	Standard deviation	Statistical significance	Mean revision	Minimum revision <sup>1</sup>	Maximum revision <sup>2</sup>	Standard deviation	Statistical significance
<b>Gross domestic product</b> .....	<b>0.25</b>	<b>-3.94</b>	<b>3.09</b>	<b>1.43</b>	NS	<b>0.33</b>	<b>-4.45</b>	<b>3.25</b>	<b>1.62</b>	NS
<b>Personal consumption expenditures</b> .....	<b>0.36</b>	<b>-2.93</b>	<b>6.56</b>	<b>1.60</b>	<b>S</b>	<b>0.34</b>	<b>-2.90</b>	<b>5.14</b>	<b>1.52</b>	NS
Durable goods.....	0.56	-14.11	11.71	5.55	NS	0.41	-14.42	13.06	5.61	NS
Nondurable goods.....	0.37	-6.00	3.41	1.81	NT	0.58	-5.53	5.52	2.18	S
Services.....	0.28	-3.47	9.16	1.88	NT	0.25	-2.50	1.39	1.49	NS
<b>Gross private domestic investment</b> .....	<b>-1.00</b>	<b>-24.75</b>	<b>23.77</b>	<b>9.99</b>	NS	<b>-1.29</b>	<b>-31.43</b>	<b>20.84</b>	<b>9.95</b>	NS
Fixed investment.....	-0.71	-10.62	8.70	3.57	NS	-1.29	-12.01	8.16	0.88	S
Nonresidential.....	-1.13	-9.93	8.58	4.31	S	-1.74	-17.90	8.18	4.92	S
Structures.....	0.33	-25.54	21.05	7.68	NS	0.21	-13.34	19.06	6.77	NS
Equipment and software.....	-1.78	-10.05	9.82	5.06	S	-2.21	-20.11	10.36	5.80	S
Residential.....	0.26	-19.53	29.77	6.61	NT	-22.11	-24.85	0.16	6.69	NS
Change in private inventories <sup>3</sup> .....										
<b>Net exports of goods and services</b> <sup>3</sup> .....										
Exports.....	0.44	-12.51	14.07	5.07	NS	0.36	-10.86	17.16	5.13	NS
Imports.....	-0.35	-41.34	35.84	9.17	NT	-1.46	-54.28	41.68	11.65	NS
<b>Government consumption expenditures and gross investment</b> .....	<b>0.28</b>	<b>-11.09</b>	<b>14.56</b>	<b>3.79</b>	<b>NT</b>	<b>0.63</b>	<b>-12.67</b>	<b>18.21</b>	<b>4.40</b>	<b>NT</b>
Federal.....	0.17	-33.11	24.28	8.58	NT	0.43	-32.24	28.05	9.79	NT
Defense.....	0.18	-13.55	10.15	4.55	NS	0.47	-10.07	11.54	4.30	NS
Nondefense <sup>4</sup> .....	-4.04	-227.88	64.36	39.25	NT	-5.52	-216.03	69.06	43.10	NT
State and local.....	0.32	-3.96	7.03	2.28	NS	0.64	-4.70	7.54	2.40	S

NS Not statistically significant at 5 percent.

NT No test; revisions not normally distributed at a 5-percent or lower level.

S Statistical significance of at least 5 percent.

1. The minimum revision is the largest negative revision.

2. The maximum revision is the largest positive revision.

3. Negative values in some quarters make the calculation of percentage changes impossible.

4. A 1991 change in the accounting treatment of purchases and sales of agricultural goods by the Commodity Credit Corporation affected nondefense revisions, but not GDP revisions.

1978–84, and they are about three-fifths as large as in 1985–2002. Thus, the coefficients of variation in 1978–84 show less improvement in smoothness than in 1985–2002.

The ratio of standard deviations of the revisions of the four vintages of real GDP estimates in 1985–2002 are smaller than those in 1978–84. In line with the findings on mean absolute revisions shown in table 1, no particular trends in the standard deviations are shown when the vintages of the estimates progress from advance estimates to final estimates.

If the volatility of the revisions declines in line with the volatility of the estimates, the ratios of the standard deviations of the revisions to the standard deviation of the estimates would be about the same in both periods. Instead, the ratios in 1985–2002 are considerably higher than in 1978–84. Thus, the reductions in the volatility of the estimates are not fully mirrored in the reductions in the revisions.

In sum, the volatility of real GDP has been lower since 1984, regardless of the vintage of the estimates. The volatility of the revisions has also been lower, but not by nearly as much, and the declines in volatility are roughly in line with those found for the coefficients of variation. Because all of the latest estimates through 1997 have been benchmarked to the benchmark input-output accounts, future revisions are unlikely to reverse this finding.

**Reliability at cyclical turning points**

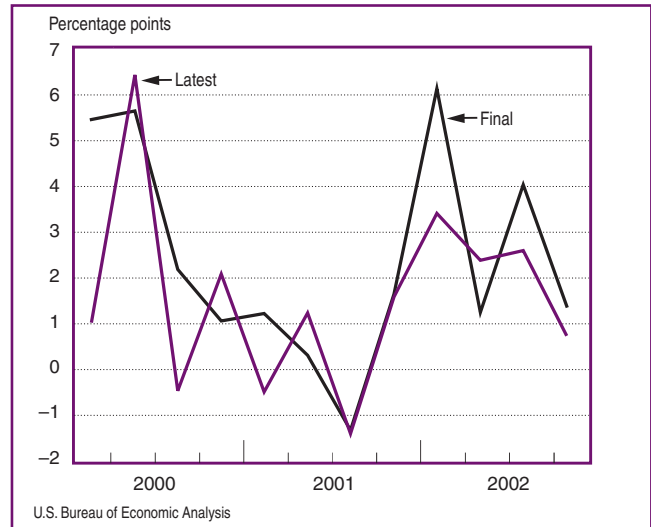
For economic policymakers and business analysts, accurate measurements of the changes in real GDP are particularly important around cyclical peaks and troughs.

A previous BEA study found that the advance, preliminary, and final quarterly estimates have correctly captured the cyclical peaks in four of the five recessions in 1969–91 (Grimm and Parker 1998, 12). As a result of the 2003 comprehensive NIPA revision, the quarterly estimates are now found to correctly capture the cyclical peaks in all five recessions (table 5). This study also found that about half of the five cyclical troughs were correctly captured by the quarterly estimates, and this finding was unchanged by the comprehensive revision.

Determining the peaks and troughs of the 2001 recession is more complex. The dating committee at the National Bureau of Economic Research (NBER), using monthly data that differ from the data used in the estimates of real GDP, has determined that the peak was in March 2001 and that the trough was in November 2001. However, the final quarterly estimates of real GDP indicated that real GDP declined only in the third quarter of 2001.

The latest estimates, which include the 2003 comprehensive NIPA revision and the 2004 annual revision, indicate a more complex pattern of movements: Real GDP decreased in the third quarter of 2000 and in the first and third quarters of 2001, and it increased in the fourth quarter of 2000 and in the second quarter of 2001 (chart 1). The NBER dating committee

**Chart 1. Percent Change in Real GDP**



determined that the trough was in November 2001, so on a quarterly basis, the third quarter of 2001 is indeed the quarterly trough of real GDP. However, it is unclear in which quarter GDP peaked. Even though real GDP decreased in two of the three quarters before the second quarter of 2001, it is higher in the second quarter than in any previous quarter.

If the peak were in the second quarter of 2001, then the peak and trough quarters shown in the final estimates are the same as those in the latest estimates. The

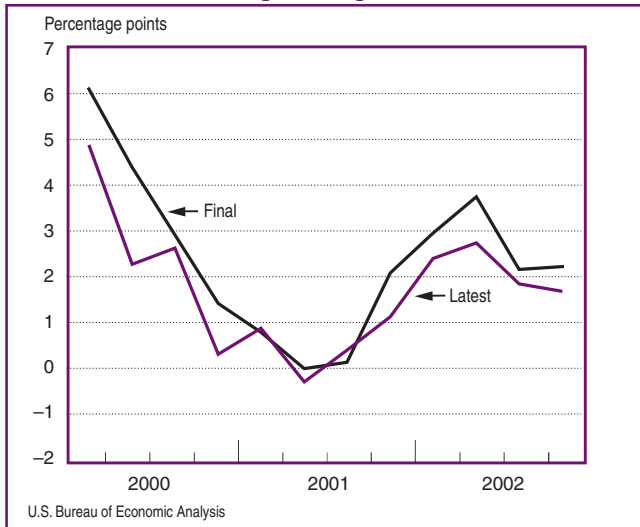
**Table 5. Timing Accuracy of Real GDP Estimates at Peaks and Troughs**

Vintage of estimate	Peaks				
	1969:III	1973:IV	1980:I	1981:I	1990:IV
Advance.....	C	C	C	C	C
Preliminary.....	C	C	C	C	C
Final.....	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	C
First annual.....	C	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	C
Second annual.....	C	C	I	I	I
Third annual.....	C	C	C	C	I
Vintage of estimate	Troughs				
	1970:IV	1975:I	1980:III	1982:III	1991:I
Advance.....	C	I	I	I	C
Preliminary.....	C	C	I	I	C
Final.....	( <sup>1</sup> )	( <sup>1</sup> )	I	I	C
First annual.....	C	C	( <sup>1</sup> )	I	C
Second annual.....	C	C	I	C	C
Third annual.....	C	C	I	( <sup>1</sup> )	C

C Correctly identified.  
 I Incorrectly identified.  
 1. No estimate was prepared.

shape of the trajectory of the economy is more easily observed by taking three-quarter centered, moving averages. Both the final estimates and latest estimates indicate a retreat in the growth rates of real GDP from high values in the second quarter of 2000 to lowest and negative values in the third quarter of 2001, and the retreat was followed by a recovery (chart 2). The ampli-

**Chart 2. Percent Changes in Real GDP: Three-Quarter Moving Average**



tude of quarter-to-quarter variations in growth rates is greater for the latest estimates before the trough, and the amplitude is greater for the final estimates after the trough. Both the final estimates and latest estimates show declines from high rates near the beginning of 2000 to low rates in mid-2001; growth rates increased in the first half of 2002, and then in the second half of 2002, growth rates diminished.

The final estimates of GDP for the quarters around the 2001 recession may be considered as being successful in capturing the general movements in real GDP.

## 2. Revisions to Annual Estimates of GDP

The revisions to the annual estimates of current-dollar and real GDP and their major components that are shown in table 6 are much smaller than those to the quarterly estimates of GDP in table 2. The size of the mean absolute revisions tend to decrease as the annual estimates are revised. For current-dollar and real GDP, the largest decreases occur between the second and third annual estimates; the next largest decreases are those between the “sum of finals” and first annual revisions.

These results partly reflect that annual estimates are unaffected by revisions to seasonal adjustments that affect the quarterly estimates or other allocations of ex-

penditures among the quarters of the years.

Like the mean absolute revisions for the quarterly estimates, the mean absolute revisions for the annual estimates of real GDP and most of its major components are slightly larger than those for current-dollar GDP and its major components.

Except for the mean absolute revisions for PCE, the revisions for current-dollar and real GDP are smaller than those for their major components. Among the components, PCE has the smallest mean absolute revisions, and Federal nondefense expenditures has the largest (reflecting the changes in treatment of the CCC commodity loan program).

The mean revisions for current-dollar and real GDP and for most of their major components are similar to those for the current quarterly estimates. The mean revisions for some of the annual vintages of investment and for real imports are negative. Most of the other mean revisions are positive, including those for the second and third annual estimates of fixed investment and its components.

## 3. Revisions to Estimates of GDI

### The quarterly estimates

As part of the 2003 comprehensive revision, a number of revisions reflect new definitions and classifications that affected income components; in particular, the concept of national income was redefined. Net national factor income is essentially the same as the previous national income component.<sup>11</sup>

Advance estimates of GDI, net national factor income, and some of its components are not published. Additionally, preliminary estimates of net national factor income and most of its components for the fourth quarters of each year have not been published since 1994, and as a result, the revisions for their preliminary estimates are not shown in table 7.

The mean absolute revisions for the final estimates of GDI and net national factor income are similar to those for current-dollar GDP (table 7). Among the components of net national factor income, only compensation of employees has mean absolute revisions that are similar to those for most of the major components of GDP. For the other components, the mean absolute revisions are much larger, primarily reflecting the limited availability of quarterly source data. For example, corporate profits are estimated using sources such as corporate financial statements; beginning with the second annual revision estimates, tax return data

11. Net national factor income equals the new definition of national income plus subsidies, less taxes on production and imports, “business current transfer payments (net),” and current surplus of government enterprises. National income is now net national product less the statistical discrepancy.

are used for the estimates. The second annual revisions of the quarterly estimates of the components incorporate the final revisions of some annual data. The large mean absolute revisions for proprietors' income reflect typically large revisions to farm proprietors' income; the mean absolute revisions for nonfarm proprietors' income are less than half as large as those for total proprietors' income.

Mean revisions for GDI, for net national factor income, and for most vintages of compensation of employees are all positive, but less than 0.1 percentage point. The revisions for most other GDI components are similar to those for current-dollar major GDP components; thus, the larger mean absolute revisions do not translate into larger mean revisions.

**Table 7. Averages of Revisions to Quarterly Estimates of GDI and of Selected Components in 1983–2002**

[Percentage points]

	Mean absolute revision			Mean revision		
	Advance	Preliminary	Final	Advance	Preliminary	Final
<b>Gross domestic income</b> .....			<b>1.28</b>			<b>0.08</b>
Consumption of fixed capital .....	3.62	3.40	3.41	1.03	0.83	0.83
Taxes on production and imports .....	3.21	3.20	3.31	0.18	-0.03	0.02
<b>Net national factor income</b> <sup>1</sup> .....			<b>1.47</b>			<b>0.09</b>
Compensation of employees .....	1.58	1.43	1.40	0.28	0.09	0.09
Proprietors' income with IVA and CCAAdj .....	11.45	11.16	10.58	-1.29	-0.77	-0.66
Nonfarm .....	5.52	4.87	5.00	-1.02	-0.48	-0.39
Rental income of persons with CCAAdj <sup>2</sup> .....						
Corporate profits with IVA and CCAAdj .....			12.13			-1.19
Net interest and miscellaneous payments .....			7.98			0.31

IVA Inventory valuation adjustment.

CCAAdj Capital consumption adjustment.

1. Equals the new definition of national income plus subsidies, less taxes on production and imports, business current transfer payments (net), and current surplus of government enterprises.

2. Negative values in some quarters make the calculation of percent changes impossible.

**Table 6. Averages of Revisions to Annual Estimates of GDP and Its Major Components in 1983–2002<sup>1</sup>**

[Percentage points]

	Mean absolute revisions		Mean revisions			Mean absolute revisions		Mean revisions	
	Current-dollar GDP	Real GDP	Current-dollar GDP	Real GDP		Current-dollar GDP	Real GDP	Current-dollar GDP	Real GDP
<b>Gross domestic product</b>					Second annual .....	1.71	1.95	0.42	0.23
Sum of finals .....	0.48	0.65	0.27	0.38	Third annual .....	1.41	1.51	0.24	0.17
First annual .....	0.41	0.57	0.18	0.39	<b>Residential</b>				
Second annual .....	0.37	0.52	0.21	0.42	Sum of finals .....	1.44	1.42	0.52	0.34
Third annual .....	0.29	0.41	0.12	0.37	First annual .....	0.94	1.03	0.10	-0.04
<b>Personal consumption expenditures</b> .....					Second annual .....	0.96	0.85	0.19	0.17
Sum of finals .....	0.59	0.61	0.45	0.47	Third annual .....	0.98	0.82	0.26	0.18
First annual .....	0.46	0.58	0.32	0.50	Change in private inventories <sup>2</sup> .....				
Second annual .....	0.38	0.49	0.26	0.47	<b>Net exports of goods and services</b> <sup>2</sup>				
Third annual .....	0.29	0.44	0.19	0.44	<b>Exports</b>				
<b>Durable goods</b>					Sum of finals .....	0.87	1.38	0.42	0.39
Sum of finals .....	1.37	1.26	0.67	0.62	First annual .....	0.73	1.16	0.50	0.32
First annual .....	1.27	1.11	0.38	0.46	Second annual .....	0.63	0.97	0.23	-0.01
Second annual .....	1.08	1.00	0.32	0.41	Third annual .....	0.72	0.99	-0.10	-0.27
Third annual .....	1.03	0.91	0.30	0.44	<b>Imports</b>				
<b>Nondurable goods</b>					Sum of finals .....	0.66	1.22	0.32	-0.46
Sum of finals .....	0.58	0.85	0.23	0.50	First annual .....	0.49	0.87	0.26	-0.21
First annual .....	0.52	0.75	0.15	0.46	Second annual .....	0.41	0.73	0.13	-0.14
Second annual .....	0.30	0.56	0.12	0.41	Third annual .....	0.42	0.69	0.03	-0.14
Third annual .....	0.25	0.51	0.05	0.35	<b>Government consumption expenditures and gross investment</b>				
<b>Services</b>					Sum of finals .....	0.65	0.78	0.19	0.71
Sum of finals .....	0.76	0.68	0.54	0.47	First annual .....	0.58	0.66	0.09	0.44
First annual .....	0.63	0.63	0.39	0.55	Second annual .....	0.62	0.74	0.15	0.37
Second annual .....	0.63	0.57	0.34	0.53	Third annual .....	0.55	0.58	0.01	0.18
Third annual .....	0.48	0.51	0.27	0.51	<b>Federal</b>				
<b>Gross private domestic investment</b>					Sum of finals .....	1.08	1.40	0.18	0.51
Sum of finals .....	2.18	2.05	-0.55	-0.72	First annual .....	1.03	1.44	0.09	0.40
First annual .....	1.93	1.92	-0.47	-0.59	Second annual .....	1.04	1.47	0.22	0.38
Second annual .....	1.52	1.53	-0.02	0.04	Third annual .....	1.15	1.41	0.22	0.26
Third annual .....	1.23	1.25	-0.04	0.07	<b>Defense</b> <sup>3</sup>				
<b>Fixed investment</b>					Sum of finals .....	0.66	0.96	0.01	0.24
Sum of finals .....	1.25	1.48	-0.45	-0.76	First annual .....	0.57	0.77	-0.03	0.16
First annual .....	1.20	1.28	-0.47	-0.64	Second annual .....	0.51	0.58	0.04	0.20
Second annual .....	0.89	1.03	0.30	0.24	Third annual .....	0.53	0.46	0.09	0.07
Third annual .....	0.88	0.82	0.17	0.18	<b>Nondefense</b> <sup>4</sup>				
<b>Nonresidential</b>					Sum of finals .....	4.28	3.03	0.33	0.61
Sum of finals .....	1.84	2.13	-0.81	-1.16	First annual .....	4.21	2.22	0.16	0.26
First annual .....	1.48	1.64	-0.67	-0.91	Second annual .....	4.04	2.02	0.62	0.93
Second annual .....	1.24	1.71	0.44	0.88	Third annual .....	4.46	2.00	0.45	0.54
Third annual .....	1.11	2.19	0.27	0.21	<b>State and local</b>				
<b>Structures</b>					Sum of finals .....	0.92	1.06	0.26	0.64
Sum of finals .....	2.48	2.19	0.51	0.27	First annual .....	0.66	0.77	0.12	0.48
First annual .....	1.28	0.90	0.21	0.31	Second annual .....	0.67	0.72	0.13	0.33
Second annual .....	1.00	1.33	0.63	0.82	Third annual .....	0.50	0.48	-0.12	0.11
Third annual .....	1.09	1.26	0.37	0.49					
<b>Equipment and software</b>									
Sum of finals .....	2.20	2.36	-1.30	-1.47					
First annual .....	2.01	2.16	-0.98	-1.22					

1. Second annual estimates are for 1983–2001, and third annual estimates are for 1983–99.

2. Negative values in some years make the calculation of percentage changes impossible.

3. Estimates for 1983 and 1984 were not prepared.

4. A 1991 change in the accounting treatment of purchases and sales of agricultural goods by the Commodity Credit Corporation affected nondefense revisions, but not GDP revisions.



### Annual estimates

Like the quarterly estimates, the mean absolute revisions for GDI and net national factor income are similar to those for current-dollar GDP (table 8). The mean absolute revisions for compensation of employees are somewhat smaller than those for GDI and net national factor income. The mean absolute revisions for GDI and net national factor income are successively smaller from the "sum of finals" estimates to the first annual revision estimates and then to the second annual revision estimates. However, the mean absolute revisions increase somewhat to the third annual revision estimates.

The mean revisions for GDI, net national factor income, and their components are generally quite small and are generally similar to the mean revisions for the major components of GDP. Like GDP, the mean revisions for all vintages of GDI and net national factor income are positive.

### 4. Revisions, GDP, and GDI

GDP and GDI may be viewed as two less-than-perfect measures of "true" U.S. economic activity. GDP measures activity as the sum of final sales and change in private inventories. GDI measures activity as the sum of income generated in the production process.<sup>12</sup>

To explore whether contemporaneously available information helps explain revisions from the final current quarterly estimates to the latest estimates, the revisions for current-dollar GDP were regressed on the following: The median forecast of GDP by the Society of Professional Forecasters was used as a proxy for non-NIPA information; the final quarterly GDP estimates, which summarize the available information

12. BEA views GDP as a more reliable measure of output than GDI because it considers the source data underlying the estimates of GDP to be more accurate. For example, most of the annual source data used for estimating GDP are based on complete enumerations, such as Federal Government budget data or are regularly adjusted to complete enumerations, such as the quinquennial economic censuses and census of governments.

about the product side of the NIPAs; and the final estimates of net national factor income, which summarize the available information about the income side of the NIPAs.<sup>13</sup>

The coefficients for all three variables are statistically significant, and the equations explain about one-fifth of the variance of the revisions (table 9). The positive coefficient on the median forecast variable suggests that professional forecasters used information that is related to economic activity but that was not

13. The Survey of Professional Forecasters, which is the oldest quarterly survey of macroeconomic forecasts in the United States, was begun in 1968 by the American Statistical Association and the National Bureau of Economic Research. The survey has been conducted by the Federal Reserve Bank of Philadelphia since 1990. The forecasts underlying the survey estimates are typically made following the release of advance estimates for the preceding quarter; thus, they incorporate information available at about the middle of the initial quarter being forecasted.

**Table 9. Regression Equations Explaining Revisions in Income and Product Estimates in 1983:I–2002:IV**

Explanatory variable	Dependent variable			
	Gross domestic product	Final sales	Gross domestic income	Net national factor income <sup>1</sup>
Constant .....	0.171	-0.234	-0.239	-0.736
T-test statistics .....	(0.372)	(0.613)	(0.500)	(1.315)
Gross domestic product (GDP)				
Median SPF GDP forecast.....	0.362			
T-test statistics .....	** (3.363)			
Final estimate .....	-0.498			
T-test statistics .....	** (4.488)			
Final sales				
Final estimate .....		0.227	0.271	0.275
T-test statistics .....		** (2.871)	** (2.939)	** (2.787)
Gross domestic income				
Final estimate .....			-0.218	
T-test statistics .....			* (2.609)	
Net national factor income				
Final estimate .....	0.164	-0.146		-0.136
T-test statistics .....	* (2.001)	** (2.701)		(1.914)
First order autoregressive term .....			-0.415	
T-test statistics .....		** (2.701)		
R-bar square .....	0.216	0.243	0.089	0.072
Standard error .....	1.265	1.488	1.545	1.784
F-statistic .....	** 8.242	** 9.327	* 4.877	* 4.061

\* Significant at a 5-percent level.  
\*\* Significant at a 1-percent level.

**Table 8. Averages of Revisions to Annual Changes in GDI and Selected Components**  
[Percentage points]

	Mean absolute revision				Mean revision			
	Sum of finals <sup>1</sup>	First annual <sup>1</sup>	Second annual <sup>2</sup>	Third annual <sup>3</sup>	Sum of finals <sup>1</sup>	First annual <sup>1</sup>	Second annual <sup>2</sup>	Third annual <sup>3</sup>
<b>Gross domestic income</b> .....	<b>0.85</b>	<b>0.41</b>	<b>0.28</b>	<b>0.36</b>	<b>0.25</b>	<b>0.08</b>	<b>0.04</b>	<b>0.13</b>
Consumption of fixed capital .....	1.59	1.16	1.23	1.35	0.37	0.74	0.85	0.11
Taxes on production and imports .....	0.72	0.96	1.14	0.88	0.26	0.30	0.21	0.09
<b>Net national factor income</b> <sup>4</sup> .....	<b>0.86</b>	<b>0.47</b>	<b>0.34</b>	<b>0.44</b>	<b>0.28</b>	<b>0.07</b>	<b>0.03</b>	<b>0.10</b>
Compensation of employees .....	0.97	0.33	0.19	0.22	0.18	0.10	0.06	0.12
Proprietors' income with IVA and CCAj <sup>5</sup> .....	4.05	2.72	1.99	2.46	0.37	0.64	-0.05	0.30
Nonfarm .....	4.13	3.21	2.47	2.91	0.57	0.40	0.00	0.22
Rental income of persons with CCAj <sup>5</sup> .....								
Corporate profits with IVA and CCAj .....	7.20	6.11	4.05	3.36	-0.25	-0.64	-0.43	-1.16
Net interest and miscellaneous payments .....	5.68	5.07	3.47	2.23	0.43	-0.13	-0.26	-0.28

IVA Inventory valuation adjustment.

CCAj Capital consumption adjustment.

1. Sum of final and first annual estimates are for 1983–2002.

2. Second annual estimates are for 1983–2001.

3. Third annual estimates are for 1983–99.

4. Equals the new definition of national income plus subsidies, less taxes on production and imports, business current transfer payments (net), and current surplus of government enterprises.

5. Negative values in some years make the calculation of percent changes impossible.

used in the preparation of the final estimates. The negative coefficient on the final GDP estimate is consistent with a tendency to revise early estimates toward average values.<sup>14</sup> The positive coefficient on the final estimate of net national factor income is consistent with the hypothesis that the income-side estimates contain information that is significant in explaining revisions to GDP.<sup>15</sup>

The results of a regression that estimates revisions from the final estimates to the latest estimates of final sales, which is defined as GDP less change in private inventories, are also shown in table 9. Nearly one-fourth of the variance of the revisions is explained by the equation. Both the estimates of final sales and of net national factor income are significant, but the signs of their coefficients are the opposite of those expected. The negative coefficient for net national factor income appears to capture the impact of revisions to change in private inventories, which is not included in final sales. In addition, a first order autoregressive correction is significant, at a *p* value of .01; its negative sign indicates that it is correcting for negative serial correlation.

The regressions equations that estimate revisions from the final estimates to the latest estimates of gross domestic income and of net national factor income find that final estimates of final sales are statistically significant, but they explain less than one-tenth of the variances. In both equations, the coefficient of the final estimate of final sales is statistically significant, with positive coefficients that indicate that the product-side estimate contains information that is significant in explaining revisions to the income-side measures. The final estimate of GDI has a negative coefficient in the GDI revisions equation, which is consistent with a tendency to revise early estimates toward average values. The final estimate of net national factor income has a negative coefficient in the equation, but its *t*-test statistic falls a bit short of statistical significance at the *p* = .05 level. Alternative versions of the first, third, and fourth equations—that include first-order autoregressive corrections—found that the corrections were not statistically significant.

Thus, the regressions show two general tendencies. First, early-vintage estimates tend to be revised toward long-run averages. Second, the estimates of income-side economic activity contain information about the product side that is not embodied in the product-side

14. It is consistent because the equation can be renormalized to include the difference between the final GDP estimate and the long-run average of GDP; only the constant term is affected. If GDP is higher than its long-term average, the negative coefficient will lower the estimated value of the revision, and conversely.

15. GDI was not significant, presumably because the information on net national factor income was masked by the other components that are added to net national factor income to obtain GDI.

estimates; the same is true about information in the product-side estimates versus the contemporaneously available income-side estimates, but less strongly so.

## 5. The Statistical Discrepancy

In principle, GDP and GDI should be equal. However, they usually differ because they rely on different source data that are not necessarily compatible. The statistical discrepancy is defined as the difference between GDP and GDI. The statistical discrepancy may be regarded as the net sum of offsetting, unknown, measurement errors. For example, if the output of drycleaning and laundry services is measured in a Census Bureau survey, and the income for this activity is measured in IRS income tax documents, a discrepancy might arise. This is true of many income-side and product-side measures.<sup>16</sup>

In theory, an econometric analysis should be able to determine which income-side and product-side measures have the greatest ability to explain the statistical discrepancy. In practice, most major GDP components are highly correlated with one another, and most major GDI components are only slightly less highly correlated with one another. All of the measures are considerably less correlated with the statistical discrepancy.<sup>17</sup>

As a result of the correlations among GDP and GDI components, the principal contributors to the statistical discrepancy are difficult to identify. Revisions to each component of GDP and of GDI will pass through one-for-one to the statistical discrepancy, but the effects of the revisions partly offset one another, and multicollinearity is again a substantial problem.

BEA's statistical findings about the relationships between the movements in the statistical discrepancy and those in GDP and GDI components have been inconclusive. Research on the statistical discrepancy and related topics is continuing at BEA.

For the latest annual estimates, the statistical discrepancy has large positive values in 1989–97; it dips

16. Some analysts have advocated using weighted averages of GDP and GDI to approximate the true size of economic activity; see Weale (1992), Howrey (2003), and Fixler and Nalewaik (2004). The first two papers implicitly assume that the differences between the two measures and the true size of economic activity is “noise,” or completely uncorrelated with the true state of the economy. The third paper assumes that the differences are “news,” or perfectly correlated with the true state of the economy.

17. According to a study of the statistical discrepancy in 1947–97 by Klein and Makino (2000), the discrepancy was statistically significant in explaining its values four quarters later, and after the discrepancy was adjusted to remove trends, the sum of corporate profits and proprietors' income, exports, and government consumption expenditures were statistically significant in explaining the statistical discrepancy. Replication of their work by BEA for 1983–2002 and using data from the 2003 comprehensive NIPA revision found that none of the explanatory measures were statistically significant and that the four-quarter-lag effects of the discrepancy were also not significant.

sharply to negative values in 1998, and then it recovers to a near-zero value in 2002 (chart 3).

Annual data should be used to study the statistical discrepancy and revisions to it; if quarterly data are used, two factors act to obscure the relationships between the statistical discrepancy and the income-side and product-side components:

- **Seasonal adjustments.** Although these adjustments remove regular fluctuations from seasonally unadjusted source data, the adjustments are not made in lockstep, and the adjustment process includes some judgments that might not be the same for related income-side and product-side measures.
- **Interpolation and extrapolation.** The use of methodologies to interpolate or to extrapolate quarterly estimates by less-than-perfect indicator series may lead to incompatible quarterly estimates for income-side and product-side components. In addition, revisions to the indicator series or the use of different indicator series in later estimates may lead to revisions to the estimates of the statistical discrepancy.

### Comprehensive revisions and statistical discrepancies

The comprehensive revisions to the NIPAs feature two types of revisions: Revisions that reflect new definitions or classifications and revisions that reflect new statistical methodologies. In addition, new or newly available source data are incorporated into the estimates when possible, and the estimates are benchmarked to the most recent benchmark input-output accounts.

The revisions due to new definitions are designed to

contain offsetting amounts on the income side and the product side, and these revisions do not affect the statistical discrepancy. For example, the changed treatments of banking and insurance services as part of the 2003 comprehensive revision had offsetting effects on GDP and GDI (Seskin and Larkins 2004, 9).

The changes in statistical methodology and the incorporation of newly available data can have substantial and differing effects on GDP and GDI.

The total revisions to GDP are relatively small, but they contain substantial year-to-year variation (chart 4). The total changes to GDI are generally negative, and they are relatively large in the middle of the period. The revisions to the statistical discrepancy are equal to the revisions to GDP less those to GDI; these revisions are relatively small near the end of the period, and they are large and positive in the middle of the period.

## 6. Conclusions

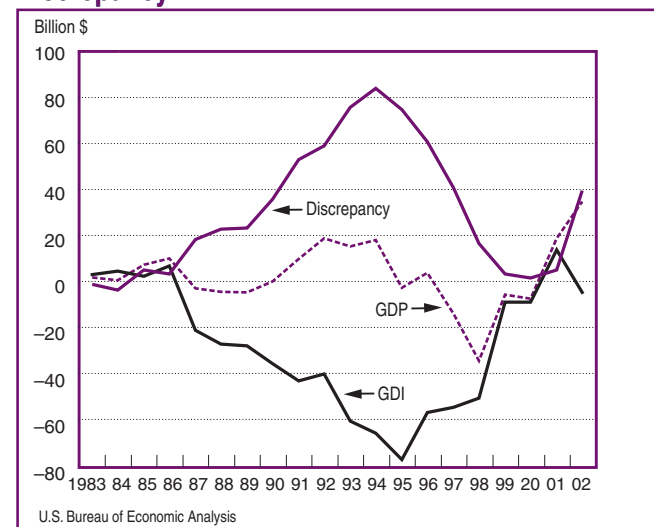
The results of this study are generally consistent with those of previous BEA studies:

- The estimates of GDP and GDI are reliable; the mean absolute revisions for the quarterly estimates of both measures are slightly more than 1 percentage point, and the mean absolute revisions for the annual estimates are about half the size of those for the quarterly estimates.
- The mean revisions for GDP and GDI are positive, primarily as a result of improvements in the measures of economic activity and expansions of the definition of economic activity that have been introduced in comprehensive NIPA revisions in

Chart 3. Statistical Discrepancy



Chart 4. Revisions to GDP, GDI, and the Statistical Discrepancy



order to adapt GDP and GDI to a changing economy.

- The quarterly estimates are reliable indicators of whether the economy is growing at rates above, near, or below the long-term trend.
- For the annual estimates, the mean absolute revisions from the “sum of finals” estimates to the first annual revisions are substantially reduced. The mean absolute revisions are also substantially reduced between the first and second annual revision estimates and between the second and third annual revision estimates.
- The quarterly estimates of real GDP have accurately portrayed the peaks in five of the last six recessions. They also accurately portrayed the troughs of four of the last six recessions, but they were late by one quarter for the other two recessions.
- The mean revisions for the quarterly estimates of current-dollar and real GDP are not statistically significant; similarly, where it is possible to test, the

mean revisions for most of the major components are not statistically significant. The revisions from the final quarterly estimates to the latest estimates of current-dollar GDP, of final sales, of GDI, and of net national factor income are partly explained by contemporaneously available information. In addition, for net national factor income, the final quarterly estimates contain significant information about revisions to the final estimates of GDP and of final sales.

Changes in statistical methodologies as part of comprehensive NIPA revisions and source data can significantly affect the estimates of the statistical discrepancy. Changes in definitions, however, do not result in changes, because these revisions are designed to have the same effects on both the income-side estimates and the product-side estimates of economic activity. Revisions to the estimates of the components of GDP and GDI significantly affect the statistical discrepancy, but multicollinearity obscures the information that can be gleaned from statistical studies.

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