

## Revisions to GDP Estimates in the US

Dennis Fixler\*, US Bureau of Economic Analysis  
Presentation to OECD Workshop on Revisions  
7 October 2004

### Analysis of revisions

BEA usually makes three successive "current quarterly" estimates of GDP, that are released near the end of each of the three months following the end of a quarter. These are labeled "advance," "preliminary," and "final." Annual revisions are released each July for the estimates of quarterly GDP for the three previous years are released; these annual-vintage estimates are labeled "first," "second," and "third" annual estimates. About every five years, instead of annual revisions, comprehensive revisions are made that are benchmarked to input-output tables that, in turn, incorporate information from quinquennial economic censuses. The comprehensive revisions are used to make definitional changes to keep economic measures abreast of a changing economy and to make improvements in the statistical methodology. BEA is currently reviewing its policies and schedule for revisions and may have a more flexible policy in the future.

There are a number of sources of revisions in addition to changes in definitions and methodology. They include the replacement of preliminary source data with revised or more comprehensive data, the replacement of judgmental estimates with those based on source data, the correction of errors in either source data or computations, revisions to seasonal adjustment factors, and—for real estimates—changes in the calculations of prices that support them. Because much of the source data is of annual frequency, changes from extrapolations to interpolations and the use of later-available indicator series also result in revisions to quarterly estimates. Changes in seasonal adjustment factors for given quarters result both from revisions to seasonally unadjusted data about the past relative to each quarter, and from the availability of data from the future relative to each quarter. Because of this, revisions to the seasonal adjustment factors occur with the passage time even if there are no revisions to the seasonally unadjusted estimates. BEA's methodology forces the net effects of seasonal adjustments for each year to sum to zero, so revisions to the seasonal adjustment factors have essentially no effect on mean revisions.

The focus of the first part this paper is on revisions from the three vintages of current quarterly estimates of real GDP to later-vintage estimates. The current quarterly estimates are generally the ones most closely followed by business analysts and

---

\* I am indebted to Bruce Grimm for his substantial contributions to this paper.

economic policy-makers. Although not presented here, revisions to current-dollar GDP have very similar patterns, but are of slightly smaller magnitude.

The results presented here are early versions of estimates being prepared for a new study of revisions that is scheduled for publication by yearend. (This study adds to a long tradition of revision studies beginning with Jaszi (1965).) Because this study is ongoing, some of the results here are from a previous study (Fixler and Grimm, 2002).

Table 1 shows the mean absolute revisions (MARs) of real GDP from each of the first six vintage estimates of estimates to the later-available vintages of estimates for the period 1983-2002. GDP is measured by its percent change, at annual rate, from the preceding quarter, and the MARs are in percentage points. Looking at the first row, the MAR from the advance to the preliminary estimates is about 0.5 percentage point, and to the final estimates about 0.6 percentage point. The MARs increase with later vintages of estimates, to about 1.1 percentage points to the first annual vintage, 1.2 percentage points to the second annual vintage, and 1.3 percentage points to both the third annual vintage and the latest-available estimates. The patterns of MARs for the other vintages show the same pattern of gradual increases as increasingly later vintages are used as the standards of comparison. Looking at the last column, which shows MARs to the latest-available estimates, they are about 1.3 percentage points for all three current quarterly vintages, 1.1 percentage points for the first and second annual vintages, and somewhat less than 1.0 percentage point for the third annual vintage.

Table 1. Mean Absolute Revisions to Successive Vintages of Estimates of Quarterly Changes in Real GDP to Later Vintages of Estimates, 1983-2002 /1/ [Percentage points]

Vintage of estimate	Vintage of revision used as standard					
	Preliminary	Final	1st annual	2nd annual	3rd annual	Latest
Advance	0.51	0.59	1.12	1.22	1.32	1.29
Preliminary		0.26	0.94	1.11	1.26	1.26
Final			0.94	1.13	1.27	1.32
1st annual				0.61	0.82	1.14
2nd annual					0.59	1.10
3rd annual						0.94

1. 2001 for 3rd annual

Table 2 shows the corresponding mean revisions (MRs) for real GDP for the period 1983-2002. The MRs are small in comparison to the MARs. The MRs from the advance to both the preliminary and final estimates are both about 0.1 percentage point, and the MR from the preliminary to the final estimates is a negligible negative

amount. Though these MRs are non-zero, one should not think of them as measures of bias because they are not statistically significant different from zero at a 1% confidence level.\*

Expanding the set of estimates used to compute revisions, the MR for the advance estimates to the latest estimates is 0.4 percentage point. The MRs from the preliminary and final estimates to the latest estimates are both somewhat more than 0.3 percentage point. The MRs from the three annual vintage estimates to the latest estimates are slightly larger. Looking at the last column, only the first revision, from the latest to the advance is statistically significant from zero, at the 5% level of confidence. At the 1% level of confidence none of the revisions from earlier to latest estimates is significantly different from zero.\*\*

Table 2. Mean Revisions to Successive Vintages of Estimates of Quarterly Changes in Real GDP to Later Vintages of Estimates, 1983-2002 /1/ [Percentage points]

Vintage of estimate	Vintage of revision used as standard					
	Preliminary	Final	1st annual	2nd annual	3rd annual	Latest
Advance	0.09	0.09	0.06	-0.01	0.13	0.42
Preliminary		-0.01	-0.03	-0.11	0.04	0.32
Final			-0.02	-0.10	0.06	0.33
1st annual				-0.08	0.06	0.35
2nd annual					0.12	0.45
3rd annual						0.37

1. 2001 for 3rd annual

Another reason to eschew concern about bias is the fact that the large bulk of the MRs are associated with definitional and statistical revisions at the time of comprehensive revisions and are thereby due to deliberate changes that are made to improve the estimates. BEA has previously reported that the changes at the times of comprehensive revisions have generally yielded higher levels and growth rates of GDP (Grimm and Parker 1998, Fixler and Grimm 2002). For example, Fixler and Grimm reported that the changes in the 1999 comprehensive revision—most prominently the recognition of software as investment rather than intermediate consumption—resulted in higher growth rates for current-dollar GDP (Table 3). Although real estimates for the impact of the change in the treatment of software are not avail-

\* The distribution of the revision of the current quarterly estimates do not pass tests for normality. However, by the Central Limit Theorem the test statistic for statistical significance has a t-distribution.

\*\* The six MRs in the last column are not statistically significantly different from one another.

able, the revisions in the real estimates were probably slightly larger (over time, software prices have declined relative to most other prices). Thus, for all but the advance estimates, MRs for the later vintages—both current quarterly and annual vintages—can largely be attributed to the effects of the comprehensive revisions and do not represent biases.

Table 3. Effects of the 1999 Comprehensive Revision on Growth Rates of Current-Dollar GDP  
[Percent]

	1982-95	1995-98
Total revision:	0.09	0.40
Definitional revisions	0.08	0.17
Statistical revisions	0.01	0.23

The absence of substantial biases, however, is in part the result of largely off-setting MRs to components of GDP. Table 4 shows the MRs for major GDP components from the three current quarterly vintages to the first and third annual vintage estimates, and to the latest-available estimates. The first annual vintage estimates incorporate substantial amounts of annual-frequency source data that augment the generally less-complete quarterly-frequency source data, and make a good standard of comparison for quickly evaluating reliability. The third annual estimates incorporate all annual-frequency source data and—due to the timing of revisions—more than half of the estimates incorporate definitional and methodological revisions made in comprehensive revisions subsequent to the corresponding current quarterly estimates. The latest estimates incorporate information from the quinquennial input-output tables (currently every five years through 1997) and all of the definitional and methodological revisions from all of the comprehensive revisions in the 1983-2002 period.

The MRs for personal consumption expenditures are generally similar to those for real GDP (not surprising because personal consumption expenditures are about two-thirds of GDP). Some other components, however, show early “biases” that grow in size with the later estimates. This is true, for example, in the case of real exports, which have fairly large MRs to the first annual estimates, and larger MRs to the latest estimates. Also, the MRs for the advance estimates are considerably larger than those for the preliminary and final estimates. The MRs for equipment and software investment, that are positive to the first annual estimates, but are large and negative to the third annual and latest estimates. Although not shown, the negatives first appear at the time of the second annual revision. These findings suggest that the annual frequency data available with a two year lag deviates systematically from information available earlier. Improvements to the estimates for equipment and software investment might result from further study of the source data and how it is used to make estimates.

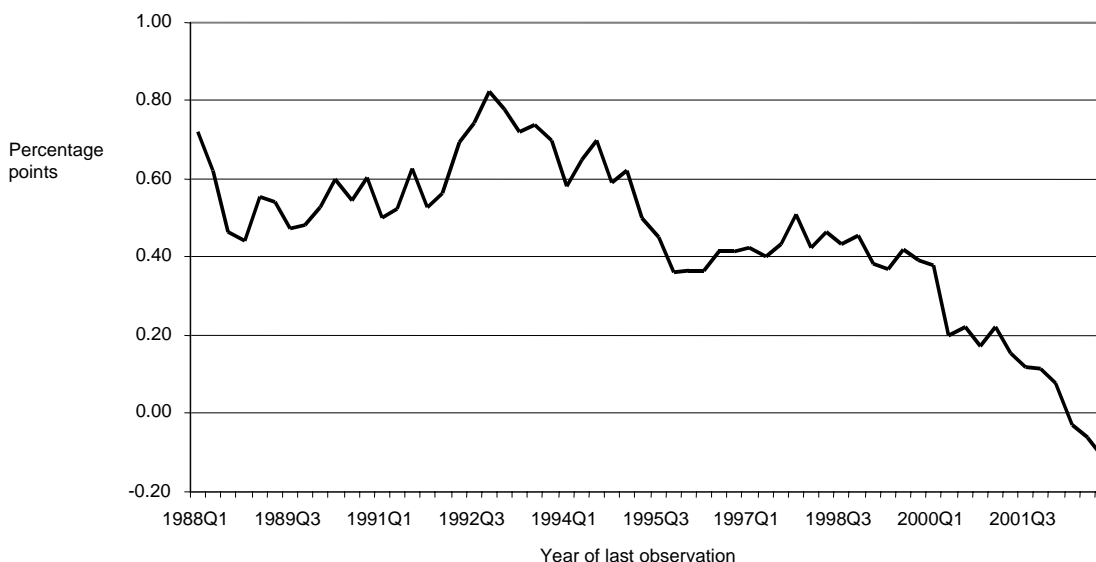
Table 4. Mean Revisions of Real GDP Components, 1983-2002  
[Percentage Points]

	Vintage of revised estimates		
	First annual	Third annual	Latest
Personal consumption expenditures			
Advance	-0.05	0.09	0.43
Preliminary	-0.17	-0.04	0.31
Final	-0.14	0.00	0.34
Nonresidential structures investment			
Advance	0.25	-0.27	0.29
Preliminary	0.02	-0.68	0.05
Final	0.17	-0.51	0.21
Equipment and software investment			
Advance	0.91	-0.69	-0.92
Preliminary	0.12	-1.52	-1.71
Final	-0.37	-2.01	-2.21
Residential investment			
Advance	0.20	-0.57	-0.08
Preliminary	0.61	-0.12	0.32
Final	0.45	-0.30	0.16
Exports			
Advance	1.56	2.40	1.75
Preliminary	0.51	1.26	0.70
Final	0.18	0.90	0.36
Imports			
Advance	0.12	0.08	-0.31
Preliminary	-0.74	-0.82	-1.17
Final	-1.03	-1.18	-1.46
Federal government expenditures ...			
Advance	0.26	0.00	0.21
Preliminary	-0.06	-0.31	-0.11
Final	0.39	0.15	0.34
State and local government expenditures ...			
Advance	0.35	0.66	0.85
Preliminary	0.15	0.48	0.68
Final	0.17	0.47	0.74

The mean revisions shown in the tables, however, do not provide useful guides for the introduction of systematic bias adjustments to the initial versions of the estimates. Even multiyear moving averages of revisions have substantial movements over time. This is illustrated in the Chart 1, which shows 10-year moving averages for the revisions in real GDP from the final to the latest estimates. For 10-year periods ending in 1988 through the mid 1990s, the 10-year average MRs fluctuate in the general vicinity of 0.6 percentage point. From then to the end of the 1990s the 10-year average MRs fluctuate in a narrower range near 0.4 percentage point. Beginning in 2000, the 10-year average MRs have become increasingly less

positive, and are increasingly negative for the 10-year periods ending in the last three quarters of 2002. Adjustments based on averages from previous periods would have missed shifts and trends, and would have been misleading.

Chart 1: Mean Revisions to Real GDP: 10-Year Moving Averages



Before drawing the discussion of the revision pattern to a close, the role of revisions to seasonal factors should be acknowledged. BEA seasonally adjusts some GDP components, but most source data are provided to it on a seasonally adjusted basis. Because of changing seasonal patterns, the seasonal factors used to adjust series are recomputed annually for several years after the time period for the estimate.

Seasonally unadjusted quarterly estimates of current-dollar GDP and its components are published about two months after annual or comprehensive revisions. Typically, the annual-revision estimates show quarterly estimates for the preceding four years, but only the later three years are revised. This means the seasonally unadjusted estimates correspond to first through third annual vintage revision estimates. The estimates do not give a full picture of the effects of the revisions to seasonal factors for two reasons. First, some source data are not available on a seasonally unadjusted basis, or the seasonally unadjusted data is constructed at a different level of detail than the seasonally adjusted estimates. Second, some seasonal factors change between the current quarterly estimates and the first annual revision estimates; these revisions are not captured. Nevertheless, it is possible to study the effects of revisions to seasonal factors between the first and third annual revision estimates.

Fixler and Grimm (2002) found that the revisions due to seasonal factors are at least as large as the revisions to the seasonally adjusted estimates but they tend to offset revisions to seasonally unadjusted estimates. In a sense, a finding of offsetting revisions is not surprising because the purpose of seasonal adjustment is to smooth out seasonal jumps in a series. For example, an upward revision in an estimate leads to a downward revision in the corresponding seasonal factor (however some jumps in estimates are determined to be outliers, and are not used in seasonal adjustment calculations). Because BEA seasonal factors are constructed to not affect annual sums of the quarterly estimates, they are not a principal source of volatility in the estimates. A more detailed analysis of the influence of revisions to seasonal factors can be found in Fixler, Grimm and Lee (2003), which examined the role of such revisions in the context of revisions to estimates of exports and imports.

In summary, there is a very small bias in the current quarterly estimates of real GDP, even smaller biases in the later-vintage estimates, and a larger bias with respect to the latest estimates. However, these biases are not significantly different from zero. Furthermore, the magnitude of the revisions with respect to the latest estimates are largely due to the deterministic changes that occur during a comprehensive revision and so that portion of the revision cannot be considered as bias.

#### Behavior of revisions around cyclical turning points

For economic policy-makers, accurate measurements in changes in real GDP are particularly important around cyclical peaks and troughs. A previous BEA study found that the advance, preliminary, and final current quarterly estimates had correctly captured the cyclical peaks in four of the five recessions between 1969 and 1991 (Grimm and Parker, 1998, p. 12). With the incorporation of the December 2003 comprehensive revisions, the current quarterly estimates are now formed to correctly capture the cyclical peaks in all five recessions. The same study found that about half of the five cyclical troughs were correctly captured by the current quarterly estimates; this finding was unchanged by the December 2003 comprehensive revision.

Table 5 shows that in general BEA has correctly identified peaks and troughs.

Table 5. Timing Accuracy of Real GDP Estimates and Troughs,  
1968-2000

Vintage of Estimate	Peaks				
	1969:III	1973:IV	1980:I	1981:I	1990:IV
Advance	X	X	X	X	X
Preliminary	X	X	X	X	X
Final	/1/	/1/	X	X	X
1st annual	X	/1/	/1/	/1/	X
2nd annual	X	X	X	Y	Y
3rd annual	X	X	X	X	Y

	Troughs				
	1970:IV	1975:I	1980:III	1982:III	1991:I
Advance	X	Y	Y	Y	X
Preliminary	X	X	Y	Y	X
Final	/1/	/1/	Y	Y	X
1st annual	X	X	/1/	Y	X
2nd annual	X	X	Y	X	X
3rd annual	X	X	Y	/1/	X

1. Estimate was not made  
X Peak or trough correctly identified  
Y Peak or trough not correctly identified.

Table 6 shows the mean absolute revisions and mean revisions around the peaks and troughs for the last five recessions, beginning with the 1969-70 recession. "Peak" identifies the last positive quarter before the onset of a recession, and "trough" identifies the last negative quarter before the beginning of a recovery. "Previous" identifies the quarter immediately preceding a peak or trough quarter, and "next" identifies the quarter immediately following a peak or trough quarter. It should be noted that the peak and trough designations are BEA's internal designation.



Table 6. Revisions to Changes in Real GDP at Cyclical Turning Points, November 2003 Estimates Less Current Quarterly Estimates (Excludes 2001 Recession)

[Percentage points]

Quarter	Mean absolute revisions		Mean revisions	
	Advance	Final	Advance	Final
Previous	2.16	2.51	-0.40	-0.10
Peak	0.98	0.50	0.59	0.23
Trough	1.56	1.80	0.16	0.62
Previous	2.31	2.26	1.74	1.82
Trough	2.29	2.70	0.02	0.31
Next	2.62	2.64	2.62	1.99
1983-92	1.28	1.38	0.70	0.69

The story about the 2001 recession is more complex. The NBER dating committee, using monthly-frequency data not including real GDP, has determined that the peak was in March 2001 and the trough was in November 2001. The final current quarterly estimates of real GDP all indicated only one quarter of decline in real GDP, 2001:3. Both the annual revision estimates of July 2002 and the December 2003 comprehensive revision estimates of real GDP indicated three quarters of decline in real GDP, beginning with 2001:1. The annual revisions of July 2004 (which are the latest estimates for 2001), however, indicate a complex pattern of movements in real GDP, with declines in 2000:Q3, 2001:Q1 and 2001:Q3, and increases in 2000:Q4 and 2001:Q2 (chart 1).

Given the NBER dating committee's determination of a November 2001 trough, it is likely that, on a quarterly basis, 2001:3 is indeed the quarterly-frequency trough for real GDP. It is, however, unclear which quarter is the peak. Even though, there are 2 declines in the 3 quarters prior to it, the level of real GDP 2001:Q2 is higher than in any previous quarter. If this quarter were indeed the peak, then the peak and trough quarters in the final current quarterly estimates agree with those of the latest. More generally, as seen in Chart 2, both the final and latest estimates indicate a retreat in growth rates of real GDP declining from high values in 2000:Q2 to lowest, and negative, values in 2001:Q3, followed by recoveries. The amplitude of quarter-to-quarter variations in growth rates is greater for the latest estimates prior to the trough, and greater for the final estimates after the trough. A second view of the general agreement in the pattern is seen by using three-quarter averages to smooth real GDP growth rates, as shown in Chart 3. Both the final and latest estimates show declines from high rates at the beginning of 2000 to low rates in mid-2001, followed by increasing growth rates in the first half of 2002, with some diminishing in growth in the second half of 2002. Thus, the final estimates of GDP around the 2001 recession may be considered as being largely successful in capturing it.

Because there will be further revisions to the estimates of real GDP in 2001 in future comprehensive NIPA revisions, these conclusions may have to be revised in the future.

Chart 2: Percent Changes in Real GDP

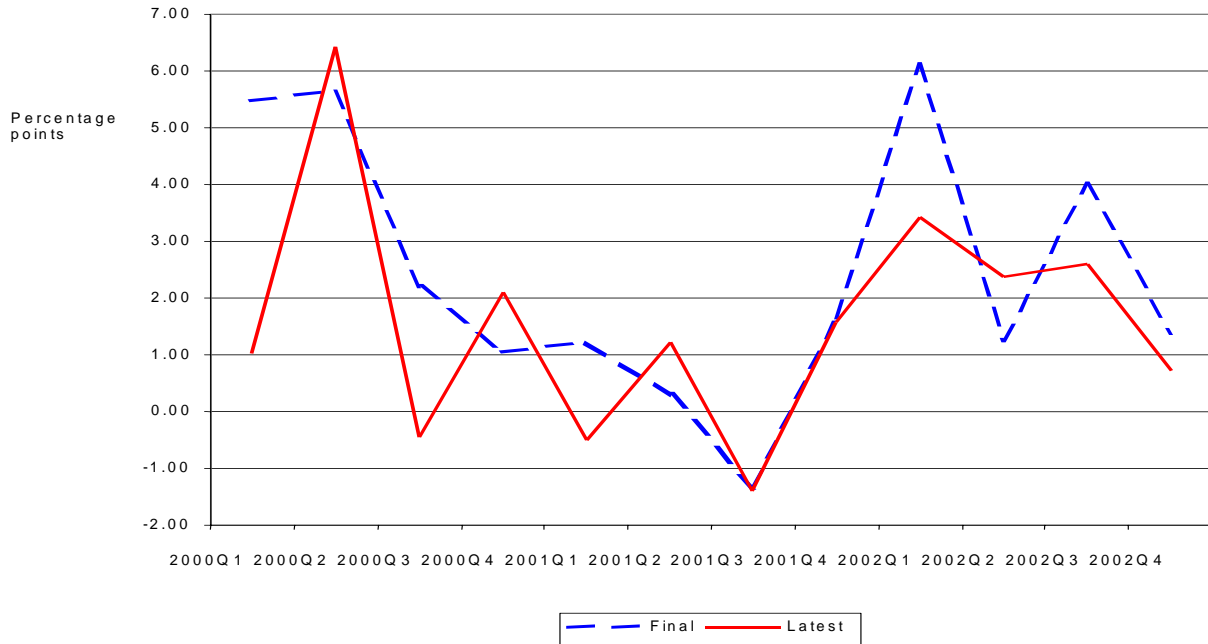
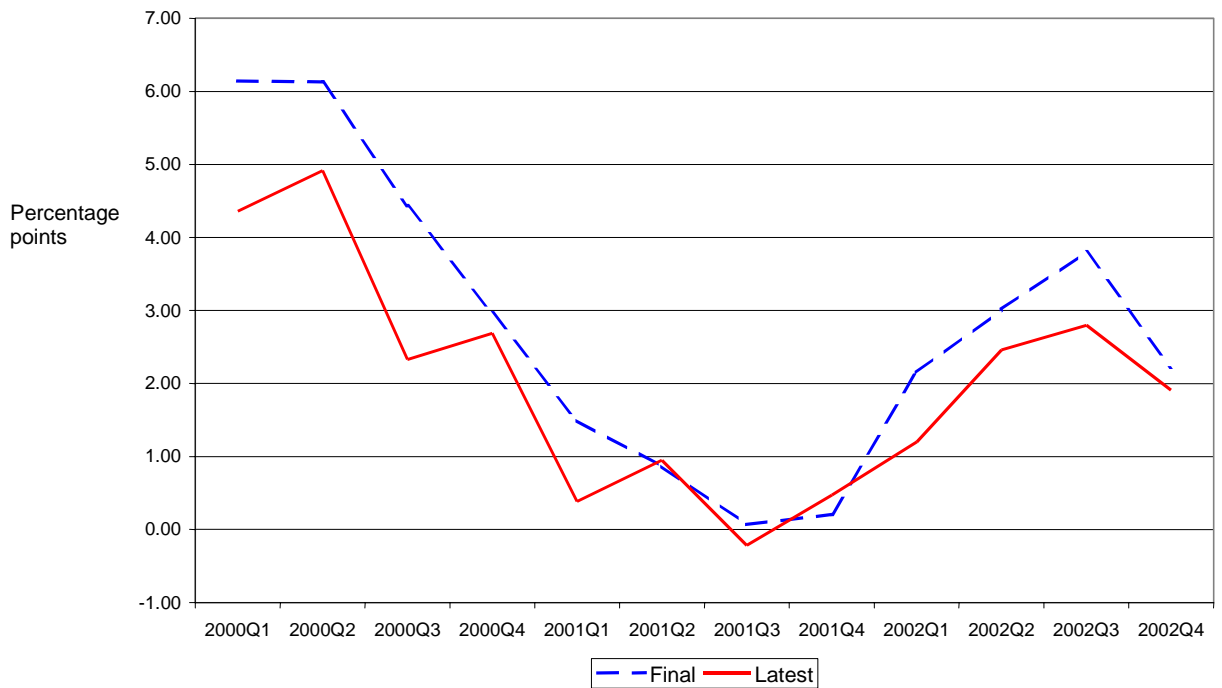


Chart 3: Percent Changes in Real GDP: 3QMA



## References

Jaszi, George. 1965. "The Quarterly National Income and Product Accounts of the United States: 1942-62." In *Short-Term National Accounts and Long-Term Economic Growth*. Studies in Income and Wealth, edited by Simon Goldberg and Phyllis Deane, 100-187. London: Bowes & Bowes for the International Association for Research in Income and Wealth.

Grimm, Bruce T. and Robert P. Parker. 1998. "Reliability of the Quarterly and Annual Estimates of GDP and Gross Domestic Income." Survey of Current Business 78 (December 1998): 12-21.

Fixler, Dennis J. and Bruce T. Grimm. 2002. "Reliability of GDP and Related NIPA Estimates." Survey of Current Business 82 (January 2002): 9-27.

Fixler, Dennis J, Bruce T. Grimm and Ann E. Lee, "The Effect of Revisions to Seasonal Factors on Revisions to Seasonally Adjusted Estimates: The Case of Exports and Imports." Survey of Current Business 83, (December 2003): 43-80.