

Evaluation of the GNP Estimates

Editor's Note—

Statistical Policy Directive No. 3, as revised by the Office of Management and Budget (OMB) in September 1985, requires that the performance of each Federal "principal economic indicator" be evaluated periodically by the agency compiling the indicator. The evaluation is to address the indicator's accuracy and reliability; the accuracy, completeness, and accessibility of documentation describing the methods used to prepare the indicator; the agency's performance in meeting the designated release schedule and the prompt release objective of the directive; and the agency's ability to avoid disclosure prior to the scheduled release time. In July of this year, BEA completed the first performance evaluation of the GNP estimates carried out under the directive.

This article presents the performance evaluation of GNP. Mr. Young, the Director of BEA, focuses on the quarterly GNP estimates. His comprehensive review of the accuracy and reliability of these estimates includes an evaluation of the status of the source data, which is the fundamental determinant of accuracy and reliability. The review draws on several BEA studies, including one in progress (a followup of the comprehensive revision released in December 1985), as well as on recent studies by university researchers. For this article, the only major modification made to the report submitted to OMB is the omission of an appendix containing information on BEA publications about GNP; this material was presented in the July issue of the SURVEY OF CURRENT BUSINESS as part of "GNP: An Overview of Source Data and Estimating Methods."

STATISTICAL Policy Directive No. 3 of the Office of Management and Budget (OMB) stipulates that the performance of each principal Federal economic indicator be evaluated by the compiling agency every 3 years. This report presents BEA's performance evaluation of the GNP estimates.

For some time there has been a heightened concern about the reliability of GNP. BEA, which estimates GNP, and OMB, which coordinates the Federal statistical programs that provide most of the source data used in estimating GNP, need to assess this heightened concern. To what extent does the heightened concern reflect a deterioration in the reliability of GNP, either because the existing source data has deteriorated or the structure of the economy has changed so that new and different source data are required? To what extent does the heightened concern reflect a need for increased reliability? If there is a need for reliability to be either restored or increased, can it be accomplished at reasonable cost? If there is no such need, or if improvement cannot be accomplished at rea-

sonable cost, can better communication with data users and the general public lead to more reasonable concerns? Unfortunately, the reliability of GNP cannot be dissected and analyzed as neatly as the above questions imply. However, it is necessary to make judgments about these matters.

Much of the concern with the reliability of GNP comes down to whether the early—that is, current—quarterly estimates of aggregate GNP provide a useful indication of the estimates that emerge when complete and final source data are available. This report is primarily concerned with that question.

As an introduction, chart 1 shows the quarterly changes in real GNP for the period 1968-86 as measured by the first and each successive current estimate and by the final estimate. (The GNP estimates in this report do not include the revisions for 1984-86 released in July 1987.) It is useful to examine the figures in the chart in light of the following questions.

- Do the early estimates usually provide a correct indication of the direction in which aggregate economic activity is moving?
- Do the early estimates usually provide a correct indication of whether the change in aggregate economic activity is large or small?

- Do the early estimates usually provide a correct indication of whether the change in aggregate economic activity will be larger or smaller than that in the previous quarter?

Tallies of the charted figures, summarized in table 1, show that the preliminary and first revised estimates correctly indicate direction of change more than 80 percent of the time. If small changes of 1 percent or less are disregarded, they correctly indicate direction more than 90 percent of the time. These early estimates correctly indicate large and small changes (defined as more than 4 percent and less than 1 percent, respectively) and acceleration or deceleration more than 70 percent of the time.

It is important to keep in mind that the size of quarterly revisions is only one of several determinants of the adequacy of the national income and product accounts (NIPA's). The design of the NIPA's—including definitions, component breakdowns, and supplementary information—is of prime importance in determining adequacy. Also of prime importance, and not so obvious at times, is the accuracy of the final estimates. Some aspects of these topics are also examined in this report.

The following sections of the report review BEA's role in the ongoing evo-

NOTE.—Carol S. Carson, Frank de Leeuw, and Robert P. Parker contributed to the development and preparation of the article. Tracy R. Tapscott provided editorial assistance. Teresa A. Williams provided secretarial assistance.

lution of the national income and product accounts; describe sources of error and types of statistical improvements; examine the reliability of the estimates; consider the status of efforts to improve source data and estimating procedures; and report on documentation of methodology, release schedules, and security procedures.

The major findings of the evaluation are:

- BEA is actively engaged in the continuing development of the national income and product accounts.
- The GNP estimates contain error. Part of the error in the early estimates is removed as the estimates are revised to incorporate more complete and accurate source data. Part of the error remains in the final estimates. All the estimates must be used with care.
- The reliability of the aggregate GNP estimates increased from the 1950's to the 1970's. Limited evidence provided by revisions suggests that reliability has neither increased nor decreased in recent years.
- Changes in the structure of the economy require new source data for GNP. There is concern that efforts to develop such data need to be stepped up.
- Cutbacks in two major bodies of existing source data used for final GNP estimates are also cause for concern. They are the tabulations of information from business tax returns and the survey of residential finance conducted in conjunction with the censuses of population and housing.
- In the preliminary and first revised estimates of GNP, there is

some evidence of bias and correlation with other information, which suggests that incorporation of econometric-type techniques in the estimating methodologies could lead to increased reliability.

- BEA is preparing and issuing documentation of the GNP methodology in installments.
- Release and security procedures are in good order.

The Evolution of the NIPA's

BEA (and predecessor agencies in Commerce) have been in the forefront of the development of the NIPA's since the late 1930's. ¹ Annual income estimates were prepared, in cooperation with the National Bureau of Economic Research (NBER), beginning in the 1930's. Product-side estimates, the accounting framework of the NIPA's, and the quarterly estimates of major series followed in the 1940's. The 1950's saw the addition of constant-dollar estimates and the integration of the NIPA's with BEA's input-output and balance of payments accounts (and partial integration of these accounts with the Federal Reserve Board's flow of funds accounts). The 1950's were also the starting point for a steady expansion of series detail, supplementary information, and extensions.

Four ways in which BEA, today, both exerts leadership and receives input from others are briefly described below.

(1) BEA participates in the Conference on Research in Income and Wealth, which is sponsored by NBER.

1. The evolution of the NIPA's through the 1960's is documented in Carol S. Carson, "The History of the U.S. National Income and Product Accounts: Development of an Analytical Tool," *Review of Income and Wealth*, June 1975.

This organization—which brings together those engaged in research on national economic accounts in Government, universities, and business—has contributed greatly to the development of the NIPA's. At present, BEA staff are serving on the Executive Committee and as organizers of conferences.

(2) BEA receives feedback from various types of users of GNP. Government users of GNP in Commerce, OMB, Council of Economic Advisers, etc., frequently contact BEA concerning the content and application of the GNP accounts. Out of these exchanges, BEA learns how to better meet the needs of Government users. Similar exchanges take place with the various private econometric modeling organizations and with research groups in business firms. More formal exchanges also occur. For example, the recently formed Statistics Committee of the National Association of Business Economists, which meets quarterly, is providing useful suggestions and criticisms.

(3) From time to time, BEA features in the SURVEY particularly relevant work of outside researchers. For example, two experimental sets of national economic accounts were presented in recent years to stimulate discussion of alternative and complementary approaches.²

(4) BEA is participating in the development of the revision to the United Nations System of National Accounts (SNA), which is expected to be completed in about 1990. The SNA provides guidelines for countries to follow in compiling national economic accounts. A BEA staff member is one of the group of six experts charged with preparing the new specifications.

A recent study by Carol Carson and George Jaszi of BEA examined BEA's "responsiveness to the needs of policymakers and their advisers for timely, usefully detailed estimates." They tabulated the recommendations for improvements in the NIPA's developed in four studies spanning the period since the mid-1950's and BEA's responses to each. Table 2 provides a summary of their findings. In the table the recommendations are shown

2. Richard Ruggles and Nancy D. Ruggles, "Integrated Economic Accounts for the United States, 1947-80," SURVEY, May 1982. Comments by users and estimators were also published in the May issue, and a reply by the Ruggles, in the November 1982 issue. Robert Eisner, "The Total Incomes System of Accounts," SURVEY, January 1985.

Table 1.—Accuracy of Preliminary and First Revised Estimates of Quarterly Changes in Real GNP, 1968-86

[Percentages providing correct indication]

	All quarters			Omitting quarters with changes /differences of 1 percent or less	
	Direction of change	Large/small ¹	Larger/smaller change than in previous quarter	Direction of change	Larger/smaller change than in previous quarter
	(71)	(52)	(70)	(60)	(64)
Preliminary estimate.....	82	73	71	92	73
First revised estimate.....	86	77	71	95	73

1. A large change is defined as more than 4 percent at an annual rate, and a small change is defined as less than 1 percent at an annual rate.

NOTE.—The number of comparisons is shown in parentheses.

Table 2.—Summary of Recommendations Related to the NIPA's Drawn From Four Representative Studies

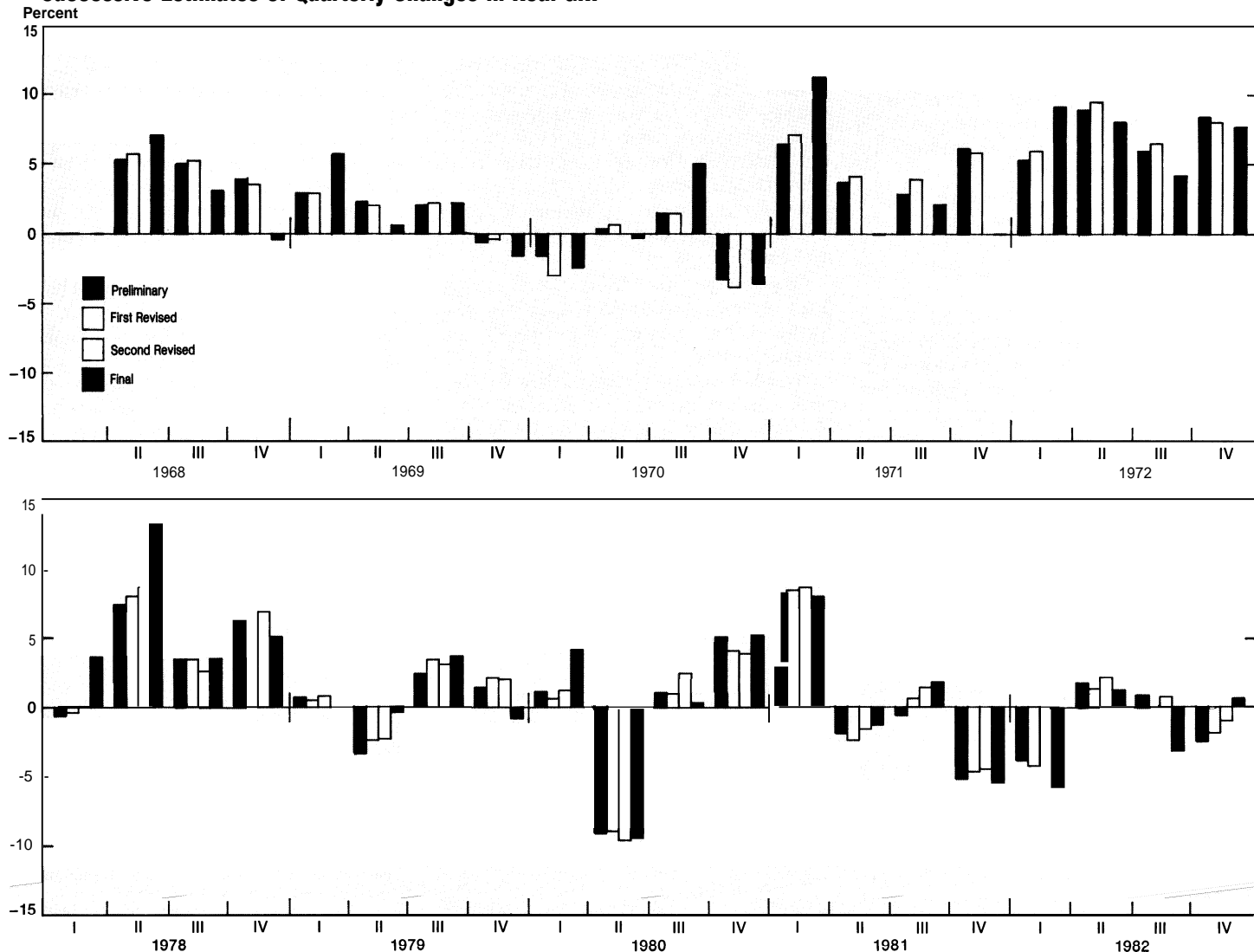
	A	B	C	D	E	All
	New series and more detail	Improved series	Periodicity, timeliness, and revision schedules	Concepts and structure	Other	
National Accounts Review Committee:						
Total.....	9		2	4		15
Implemented.....	8		2	2		12
Not implemented.....	1		0	2		3
Contributors to Retrospect and Prospect:						
Total.....	17	5		5	6	33
Implemented.....	11	3		2	6	22
Not implemented.....	6	2		3	0	11
GNP Data Improvement Project:						
Total.....	2	4	2		5	13
Implemented.....	1	2	2		5	10
Not implemented.....	1	2	0		0	3
Round Table of GNP Users:						
Total.....		6	1	5	2	14
Implemented.....		3	1	2	1	7
Not implemented.....		3	0	3	1	7
All:						
Total.....	28	15	5	14	13	75
Implemented.....	20	8	5	6	12	51
Not implemented.....	8	7	0	8	1	24

Source: Appendix A.

classified into five categories. The first column shows that there were 28 recommendations pertaining to the addition of new series and more detail in the NIPA's. Of these 28, 20 recommendations have been implemented. The next column indicates 15 recommendations for improved series, of which 8 have been implemented. The third column shows that all 5 recommendations pertaining to periodicity and timeliness were adopted. The fourth column shows that 6 of 14 recommendations of a conceptual or structural nature have been implemented. Altogether there were 75 recommendations, of which BEA has implemented 51. Appendix A lists the 75 recommendations and BEA's response in each case.³ It should be noted that

3. Carol S. Carson and George Jaszi, *The Use of National Income and Product Accounts for Public Policy*:

Successive Estimates of Quarterly Changes in Real GNP



Note.—Percent change in annual rates.

some of the 24 recommendations that were not implemented by 1984, the end of the period covered in the study, may be implemented in the future.

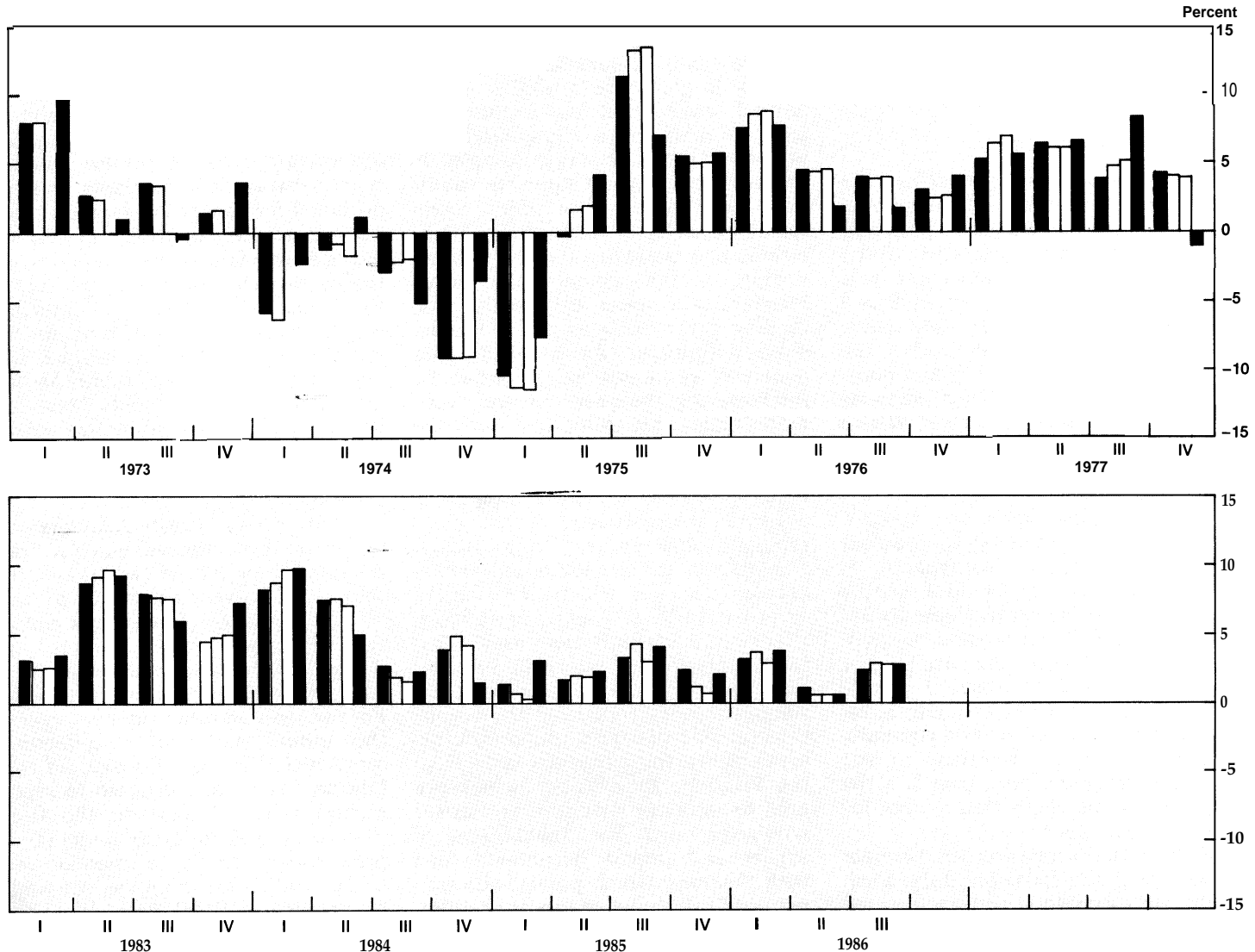
Our Successes and Failures. Bureau of Economic Analysis Staff Paper No. 43, January 1986. The citations for the four studies are (1) U.S. Congress, Joint Economic Committee, *National Economic Accounts of the United States: Review, Appraisal, and Recommendations*, in *The National Economic Accounts of the United States, Hearings*, 85th Congress, 1st Session, 1957; (2) U.S. Department of Commerce, Bureau of Economic Analysis, *The Economic Accounts of the United States: Retrospect and Prospect*, 50th anniversary issue of the SURVEY (SURVEY, July 1971, Part II); (3) Advisory Committee on Gross National Product Data Improvement, *Gross National Product Data Improvement Project Report*, issued by the Office of Federal Statistical Policy and Standards of the U.S. Department of Commerce (Washington, DC: U.S. Government Printing Office, 1977); and (4) "Round Table of GNP Users," in *The U.S. National Income and Product Accounts: Selected Topics, Studies in Income and Wealth*, Vol. 47, edited by Murray F. Foss (Chicago: University of Chicago Press for the National Bureau of Economic Research, 1983).

The evolution of the NIPA's will continue: Various modifications or extensions to the accounts are advocated. In general, they require more research at BEA or elsewhere and/or additional source data before their implementation would be possible. Most also would require additional resources at BEA. Several are listed below.

- (1) Addition of sectoral balance sheets integrated with the sectoral production and appropriation accounts that form the basis of the NIPA's.
- (2) A more comprehensive presentation of income to show capital gains more completely.

- (3) Integration of microdata in the business, household, and government sectors with aggregates in the NIPA's.
- (4) Separation of nonprofit institutions serving individuals from the household sector.
- (5) Extensions of the boundary of the NIPA's to include nonmarket activities such as household production.
- (6) Separation of market and imputed transactions to permit a focus on market transactions in the quarterly NIPA's.

CHART 1



In the late 1970's and early 1980's, BEA discontinued development of estimates of income-size distributions, which is part of (3), and discontinued research on (5). Budget stringency was the main factor in the discontinuance, although increased restrictions on access to microdata records was also a consideration in the work on income-size distributions. BEA is engaged in research with staff of the Center for Nonprofit Studies at Yale University on aspects of (4); a joint paper will be presented at the meeting of the International Association for Research in Income and Wealth this year.

Sources of Error and Types of Statistical Improvements

This part describes the schedule and the types of source data used in preparing each vintage of quarterly estimates. It provides background information needed to discuss the sources of error in this section and the measures of revisions of the estimates in the next section.

Vintage of the estimates

The schedule for preparing the quarterly GNP estimates is as follows: The preliminary estimate is prepared about 20 days after the end of the quarter. For most components, it is based on information for either 2 or 3 months of the quarter. In most cases, however, the source data for the second and third months of the quarter are not final and are subject to revision by the issuing agencies. Where source data are not available, the estimate is based primarily on the estimator's judgment.

About 1 month later, the preliminary estimate is replaced by the first revised estimate. In general, it is based on information for all 3 months of the quarter. However, there are instances in which source data, particularly for the third month, are subject to further revision. About 1 month later, the first revised estimate is replaced by the second revised estimate, which incorporates revisions in the source data for the third month of the quarter and quarterly source data for some components.

Usually the second revised estimate stands until the following July. Each quarterly estimate is subject to three successive July (annual) revisions. The first such revision is the occasion

for going back and picking up further revisions in the monthly (or quarterly) source data and a limited amount of information from annual data sources. More importantly, the second and third July revisions are the occasion for introducing a broad range of more detailed and reliable annual data. Each quarterly estimate is also subject to one or more comprehensive revisions, which incorporate the information obtained in the Nation's economic and demographic censuses.

An important exception to the timetable outlined above is that source data for corporate profits are not available as promptly as other information used in the quarterly estimates. They are not available until the time of the first revised estimate; as a result, the preliminary estimates are prepared without benefit of a complete income-side check against GNP. At yearend, corporate profits lag an additional month and are not available until the time of the second revised estimate.

More complete and accurate information is generally available on an annual basis than on a quarterly basis. In many cases, the annual data are either based on larger samples or represent a complete universe count. Also, the annual data often correspond more closely to the desired definitions and therefore require less adjusting, or the annual data source may contain more information for making adjustments to match the desired definitions. As a result, the quarterly estimates are obtained by interpolating between annual estimates and extrapolating from the most recent annual estimate.

Similarly, the annual estimates in many instances represent extrapolations or interpolations of the more complete and accurate information available in the economic and demographic censuses, which are conducted every 5 and 10 years, respectively.

The quarterly indicators used as extrapolators and interpolators are based largely on monthly or quarterly sample surveys conducted by various Government agencies. Important exceptions are the budgetary data from the Treasury Department, which are used to estimate Federal Government purchases, and the tabulations of export and import documents filed with Customs, which provide the estimates of merchandise exports and imports. Another type of exception occurs if no monthly or quarterly

data are available, such as for most consumer purchases of services and State and local government purchases. In such cases, the quarterly estimates are generally obtained by extrapolation and interpolation using projections based on annual data or on related information.

Sources of error

The GNP estimates contain several kinds of error. The most obvious kind of error arises either from preliminary and incomplete tabulations of the monthly source data or, where source data are not yet available, from BEA's judgments. The other kinds of errors, which are described below, are equally important.

Error arises because available source data do not meet the requirements of the NIPA's in terms of timing, coverage, and definitions. Even after various adjustments are made to bring the source data as close as possible to the desired basis, substantial errors may remain. In some cases, no source data are available, and either no estimate is attempted or very indirect and approximate techniques are used. A case in point are certain types of service transactions between U.S. residents and unaffiliated foreigners for which no estimate is attempted. BEA's new international services survey should eventually remove most of this error. Error also arises from the sampling errors, biases, etc., inherent in the monthly and quarterly sample surveys that provide source data for the quarterly estimates and from the biases and other nonsampling errors in the complete universe counts that provide source data for the annual estimates.

Often, when identified, errors can be removed or reduced, given a "reasonable" amount of additional resources. However, sometimes a "reasonable" amount of resources cannot reduce error because either the needed information is not available or the reporting burden is very large. For example, in some surveys, such as the annual survey of manufactures conducted by the Bureau of the Census, firms are permitted to report certain types of data on the fiscal year basis used for their financial reports rather than on a calendar year basis. While some improvement would be possible if fiscal year data were better identified and tabulated separately by ending month of the fiscal

year, the accuracy would still not be completely satisfactory. The way to gain in accuracy would be to require calendar year reporting. However, such data either do not exist or would be quite burdensome for firms to report. Consequently, the Government statistical system is content with a mixture of fiscal and calendar year reporting in which all parties involved in a given economic transaction may not report that transaction in the same period.

Seasonal adjustment is also a source of error. Even if the unadjusted source data were completely error free, the process of seasonally adjusting the figures would introduce errors. An examination of this question in the mid-1970's indicated that the revisions in the quarterly changes in the seasonal factors were of roughly the same magnitude as the revisions in the quarter-to-quarter changes in seasonally adjusted GNP. This does not mean that seasonal factor revisions account for all the revision in GNP, but it suggests that the seasonal factor revisions are a major contributor to the revisions in seasonally adjusted GNP. Further, it suggests that the error inherent in the seasonal adjustment process is a major contributor to the total error in the quarterly changes in GNP. Much effort, both before and after the mid-1970's, has been expended in developing methods of seasonal adjustment. Two developments since the mid-1970's (the linking of ARIMA methods with the Census X-11 ratio-to-moving average method and the use of concurrent seasonal adjustment) have reduced seasonal factor revisions. However, the effects of these improvements on quarterly GNP are not judged large; seasonal factor revisions are probably not reduced more than 10 or 20 percent. The prospects for further substantial improvement do not appear promising.

In considering sources of error, particularly those related to coverage and definitions, one cannot overlook the nature of the Government statistical system. The system was not designed to meet the needs of national income accountants. By and large, the statistics available have been designed over the years to meet a variety of needs. In many instances, the statistics are collected to carry out administrative programs, and the coverage and definitions are defined by law to serve specialized administrative

needs. As a result, the statistics coming out of the component parts of the statistical system are quite varied in coverage and definitions as well as in frequency and quality. Thus, the national income accountant must painstakingly piece together and adjust the statistics using carefully designed estimating procedures.

Types of statistical improvements

Statistical improvements are made in the NIPA's for several reasons. They may be categorized as those that (1) increase reliability, (2) prevent slippage, (3) reflect new developments, and (4) provide additional information. Each of these is described briefly

(1) Sometimes it is possible for statistical agencies to improve the source data used in the NIPA's. These improvements take various forms. For some, such as the development of an updated sample or a better editing procedure, the effect on the NIPA's is difficult to assess. For others, such as the collection of information for a previously uncovered industry or product or the collection of information on a more timely basis, the effect is more readily apparent. These improvements, which in some cases are initiated primarily to serve needs other than those of the NIPA's, have cumulated over time and, as this report indicates, appear to have increased the reliability of GNP.

(2) Sometimes source data need to be improved (or new data developed) to prevent slippage in the quality of the GNP estimates brought about by deterioration either in that same data or in other data. Such slippage can occur because of actions to reduce costs or reporting burden. For example, beginning in about 1978, the Statistics Division of the Internal Revenue Service (IRS) made several cost-cutting changes in its program for tabulating information from the corporate income tax returns. The preliminary tabulations were eliminated, the sample size reduced, and editing cut back. The elimination of the preliminary tabulations delayed the use of IRS information in the estimation of corporate profits, net interest, and depreciation from the second July revision until the third July revision, when the final tabulations are avail-

able. The other two changes reduced the quality of the final tabulations.

(3) Sometimes a development in the economy requires that BEA undertake research either to modify an estimating procedure or to develop a new one in order that the development not be a source of substantial error. Often such work draws on existing information. In other cases, new source data are also required. An example of a development in the economy that required substantial research by BEA was the preparation of a price index for electronic computers. In the 1970's, the increasing importance of computers and the accompanying price reductions in both existing models and new models clearly invalidated BEA's procedure of assuming no price change. To prepare a price index for deflating expenditures on computers, BEA undertook statistical work in cooperation with IBM that drew on both publicly available trade sources and the information and expertise of IBM. Further work to collect price information for computers, either by BEA or the Bureau of Labor Statistics (BLS), is needed to improve upon the trade information currently used.

(4) Sometimes, either because new source data have become available or research has shown how better to utilize existing source data, it is possible for BEA to provide additional information within the framework of the NIPA's at a cost that is judged reasonable. Such improvements can take the form of either providing more detailed breakdowns of entries in the accounts or providing additional supplementary information. Over the years, these types of improvements have been made frequently—often from within BEA's existing funding, sometimes with new funding. They have added much to the usefulness of the accounts. Two examples of such improvements are (1) the introduction and featuring of fixed-weighted GNP price indexes as a replacement for the implicit price deflators as a measure of price change, as inflation became an important factor in the 1970's and (2) the introduction and featuring of "gross domestic purchases" as a measure of demand, as imports became an increasingly important factor in the 1980's. The latter was accomplished with little expenditure of resources; the former required considerable resources initially and continues to use a significant amount each quarter.

Reliability of GNP

Reliability as used in this report refers to the accuracy of the estimates. It does not refer to revisions per se, which are only a partial indicator of accuracy. The reliability of GNP has been assessed in three ways: Revisions in preliminary estimates, statistical evidence internal to the accounts, and expert judgment. Expert judgment has included both judgments by policymakers and their advisers as to the usefulness and accuracy of the accounts and by the estimators as to the degree of error in the estimates that arises from the source data and estimating procedures. Certain of the criteria in Statistical Policy Directive No. 3, such as response rates, do not apply to the GNP estimates given their nature. They differ from most economic series to be evaluated under the directive in that they are not based on a survey. They are based on many types of information, both survey and nonsurvey.

BEA revision studies

BEA has conducted three major studies of reliability and a fourth is underway. The results of these studies, including preliminary results from the fourth study, are presented in table 3.

In table 3, six summary measures are used to describe the revisions. The measures are the dispersion, bias, relative dispersion, relative bias, upward revisions, and directional misses. They are calculated as follows. Let P represent the percentage change in the current estimates, F the percentage change in the final estimates, and n the number of quarterly changes.

Dispersion is the average of the absolute values of the revisions:

$$\sum |P - F| / n.$$

Bias is the average of the revisions:

$$\sum (P - F) / n.$$

Relative dispersion expresses the dispersion as a percentage of the av-

erage of the absolute values of the final quarterly changes:

$$\frac{100 \sum |P - F| / n}{\sum |F| / n}.$$

Relative bias expresses the bias as a percentage of the average of the final quarterly changes:

$$\frac{100 \sum (P - F) / n}{\sum F / n}.$$

Upward revisions expresses the number of times that the current estimate of the quarterly change was revised up by the final estimate, as a percentage of the number of quarterly changes.

Directional misses expresses the number of times that the sign of the current estimate of the quarterly change differed from that of the final estimate, as a percentage of the number of quarterly changes.

The performance criteria in Statistical Policy Directive No. 3 pertain to dispersion and bias. The dispersion criterion is in terms of relative dispersion. It is not clear whether the bias

Table 3.—Measures of Revisions in Quarterly Changes in GNP

	Percentage points ¹						Percent											
	Dispersion			Bias			Relative dispersion			Relative bias			Upward revisions			Directional misses		
	15-day	45-day	75-day	15-day	45-day	75-day	15-day	45-day	75-day	15-day	45-day	75-day	15-day	45-day	75-day	15-day	45-day	75-day
Current-dollar estimates																		
Study I:																		
1947-56 †	3.5			-1.0			45			-14							10	
1947-52		3.3			-1.2			34		-14								9
1953-56		2.1			-8			36		-19								12
1957-61		1.2			-1			18		-3								
Study II:																		
1947-63 †		3.1			-9			43		-15							12	
1958-63 †	1.5			-3			25		-5			50	60			4		
1964-71	1.2	1.0		-8	-6		16	13	-10	-8		69	72		0	0		
Study III:																		
1968-72 †	1.1	1.1		-7	-6		13	13	-9	-7		68	53		5	5		
1973-77	2.4	2.2		-1.0	-6		24	21	-10	-6		65	55		4	4		
1978-83	1.9	1.5	1.5	-8	-5	-2	20	15	-8	-5	-2	58	67	63	4	4	4	8
Study IV:																		
1968-77 †	2.1	1.8		-1.0	-7		22	19	-11	-8		67	62		3	3		
1978-86	1.7	1.5	1.5	-5	-3	-2	19	17	-6	-4	-2	54	57	51	3	3	3	6
Constant-dollar estimates																		
Study I:																		
1947-56 †																		
1947-52																		
1953-56																		
1957-61																		
Study II:																		
1947-63 †																		
1958-63 †																		
1964-71 ²	1.0	1.0		.7	-.2		27	24	2	-7		46	54		0	0		
Study III:																		
1968-72 †	1.4	1.3		-.2	-.2		32	32	-5	-5		42	53		11	5		
1973-77 †	2.0	1.8		-.6	-.4		41	38	-20	-14		65	65		10	5		
1978-83	1.5	1.3	1.2	-.7	-.5	-.1	38	31	-29	-22	-6	63	63	58	17	10	10	13
Study IV:																		
1968-77 †	2.4	2.4		0	.2		58	59	1	6		49	49		21	18		
1978-86	1.5	1.4	1.5	-.4	-.3	-.2	38	35	-17	-12	-7	57	54	57	14	10	10	9

† Estimates for this period incorporate one or more comprehensive revisions. Those for 1947-56 are estimated for this report from information contained in the study for 1947-61.

1. Calculated from quarterly percentage changes at seasonally adjusted annual rates. This required restating the revision measures shown in BEA's first two revision studies to annual rates.

2. For the constant-dollar estimates, revisions in the 15-day estimates are for the period 1966-71 and for the 45-day estimates, 1965-71.

NOTE.—See the text for sources and for definitions of the revision measures. Until recently, the terms "15-day," "45-day," and "75-day" were used to designate the successive current estimates. They correspond to the terms "preliminary," "first revised," and "second revised" that BEA now uses and that are used in the text.

criterion is in terms of relative bias, bias, or percent of upward or downward revisions.

The first set of measures in table 3 are from the study completed in 1965.⁴ The measures on the first line summarize the revisions in the initial quarterly estimates for 1947-56. The revisions are calculated as the difference between the quarterly percentage changes as initially published and those resulting from the comprehensive revision in 1958 that incorporated information from the 1954 economic censuses. The next three lines summarize the revisions for 1947-52, 1953-56, and 1957-61, using as "final" estimates those available as of July 1953, 1957, and 1963, respectively. In general, these "final" estimates had not undergone a comprehensive revision.

The second set are from the study completed in 1974.⁵ The first two lines summarize the revisions for the periods 1947-63 and 1958-63, using as "final" estimates those from the comprehensive revision in 1965, which incorporated information from the 1958 economic census. The 1958-63 period is included because the preliminary estimate was introduced in 1958. The third line summarizes the revisions for 1964-71, using as "final" estimates those from third July revisions.

The third set are from the study presented in 1984.⁶ The first line summarizes the revisions for 1968-72, using as "final" estimates those from the comprehensive revisions in 1976 and 1980, which incorporated information from the 1964 and 1972 economic censuses, respectively. The second line summarizes the revisions for 1973-77, using as "final" estimates those from the comprehensive revision in 1980, which do not fully incorporate economic census information in that the 1977 economic censuses had not yet been incorporated. The third line summarizes the revisions

for 1978-83, using as "final" estimates those from the July revisions in 1982 and 1984.

The fourth set are from the study now underway. The first line summarizes the revisions for 1968-77, using as "final" estimates those from the comprehensive revision in 1985, which incorporated information from the 1977 economic censuses. The second line summarizes the revisions for 1978-86. The estimates used as "final" estimates for 1978-82 are those from the comprehensive revision in 1985, which do not fully incorporate economic census information in that the 1982 economic censuses are not incorporated; the estimates for 1983-85 are those from the July revision in 1985; the estimates for 1986 are those available prior to the July revision in 1987.

It should be noted that the fourth set of measures do not incorporate two types of adjustments that were made in the previous studies. These adjustments removed the effect of the changes in definitions and of the change in base year in the constant-dollar estimates that were made in a comprehensive revision. Consequently, the contribution to the revision that comes from source data are not isolated as well in the fourth set of measures. To the extent possible, rough allowances for these two factors are made in the discussion of the results.

Two aspects of the estimation process need to be kept in mind to interpret properly the measures in table 3. First, within a given study, the reductions in the size of revisions over time cannot be taken as evidence that reliability is increasing. This type of reduction, which can be observed within each study, reflects the different vintages of the estimates used as "final." The revision between the initial estimates and those resulting from a July revision are not as large as those between the initial estimates and those resulting from a comprehensive revision.

Second, an increase in the size of revisions over time in estimates of a given vintage cannot be taken as evidence that reliability is decreasing. Revisions can also increase in size because improved source data and estimating procedures are introduced into the estimation process. Only if improvements are made to the source data or estimating procedure used for the early estimates, but not for the

final estimates, can a permanent decrease be expected in the size of revisions. If improvements are made for the final estimates but not for the early estimates, a permanent increase in the size of revisions can be expected. If improvements are made for both the early and final estimates, but they are introduced by BEA retrospectively into the final estimates, as is often the case, an increase in the size of revisions can be expected for a period of a few years until they also are reflected in the early estimates.

Findings from BEA revision studies

Dispersion in the GNP estimates.—As shown in table 3, the relative dispersion of the quarterly change of the current-dollar GNP estimates is fairly small. In the fourth set for the period 1968-77, it is about 20 percent. For the period 1978-86, for which the estimates will be revised in the comprehensive revisions in 1990 and 1995 to reflect the 1982 and 1987 economic censuses, it also is about 20 percent.

The relative dispersion of the constant-dollar estimates is much larger than that of the current-dollar estimates. For the period 1968-77, it is almost 60 percent. The main reason for the larger relative dispersion of the constant-dollar estimates than of the current-dollar estimates measure is not that the revisions in constant-dollar GNP are larger. The main reason is that the denominator of the constant-dollar relative dispersion ratio is smaller than that of the current-dollar ratio, and this is because the growth in constant-dollar GNP is less than that in current-dollar GNP. This "denominator effect" raises a caution about using relative dispersion as a measure of reliability. Constant-dollar relative dispersion can approach infinity in a period of no growth. Likewise, current-dollar relative dispersion can approach zero in a period of high inflation.

The difference in the relative size of the revisions in the current- and constant-dollar estimates is shown not by the relative dispersion, but by the dispersion, which is the numerator of the relative measure. The current- and constant-dollar dispersions of the preliminary estimates for the period 1968-77 as calculated in the fourth study are 2.1 and 2.4 percentage points, respectively; the constant-dollar dispersion is only 15 percent larger than the current-dollar dispersion.

4. George Jaszi, "The Quarterly National Income and Product Accounts of the United States, 1942-62," *Income and Wealth: Series XI, Studies in Short-Term National Accounts and Long-Term Economic Growth*, pp. 139-141.

5. Allan H. Young, *Reliability of the Quarterly National Income and Product Accounts of the United States, 1947-71*, Bureau of Economic Analysis Staff Paper No. 23, July 1974, pp. 6-10.

6. Robert P. Parker, "Revisions to the Initial Estimates of Quarterly Gross National Product of the United States, 1968-83," paper presented at Seminar on Provisional and Revised Estimates of Economic Data, University of Florence, Florence, Italy, November 1984. Available on request from the Bureau of Economic Analysis.

This difference is primarily due to improvements in source data and estimating procedures, which were introduced retrospectively into the final constant-dollar estimates (and which are now also incorporated in the current estimates). In the absence of such retrospective improvements, the constant-dollar dispersion will tend to be equal to the current-dollar dispersion. The reason for this is that the current-dollar dispersion essentially passes through on a one-for-one basis to the constant-dollar estimates, because the amount of revision to the price information used in deflation is

small and is such that it does not contribute much to dispersion.

The development of the retrospective improvements in deflation were initiated following the high levels of inflation and large drops in computer prices in the 1970's that revealed shortcomings in the source data and procedures used in the deflation of the current-dollar estimates. Table 4 lists the retrospective improvements in the constant-dollar estimates, which were introduced in the comprehensive revision in 1985 and in the annual July revision in 1986.

Table 4.—Improvements in Deflation Introduced in 1985 and 1986

Component	Description of improvement	Introduction date	Period covered
Personal consumption expenditures:			
Space rent.....	Price index revised to incorporate an estimate of the change in rent that occurs when a vacant unit is rented to a new tenant and an adjustment for the change in the quality of the stock of rental units.	1985	1974-80
Airline transportation	Price index revised to reflect fare discounting.	1986	1983-85
Electronic computers.....	Price index that incorporates detailed information on changes in prices and characteristics of computers introduced.	1986	1983-86
Nonresidential fixed investment:			
Nonresidential buildings..	One of the three price indexes averaged to derive the deflator, the Federal Highway Administration Index of Highway Structures, was dropped.	1985	1967-84
Electronic computers.....	Price index that incorporates detailed information on changes in prices and characteristics of computers replaced assumption of no price change.	1985	1959-85
Residential fixed investment:			
Additions and alterations	Price index for household maintenance replaced single-family home price index.	1985	1968-76
Net exports:			
Electronic computers (imports and exports).	Price index that incorporates detailed information on changes in prices and characteristics of computers introduced.	1985	1964-85
Petroleum imports	Separate deflation for petroleum imports.	1985	1929-67
Services (imports and exports).	Deflation carried out at more detailed level.	1985	1959-76
Federal Government:			
Commodity Credit Corporation.	Deflation carried out at more detailed level.	1985	1968-77
Electronic computers.....	Price index that incorporates detailed information on changes in prices and characteristics of computers introduced.	1985	1968-85
Defense purchases other than compensation.	Additional information on prices paid by Department of Defense introduced.	1985	1972-76
State and local governments:			
Electronic computers.....	Price index that incorporates detailed information on changes in prices and characteristics of computers introduced	1985	1968-85

Sources: SURVEY OF CURRENT BUSINESS articles presenting annual and comprehensive revisions (October and December 1985 and July 1986).

Tabulation A

[Percentage points]

	Dispersion	
	Current-dollar estimates	Constant-dollar estimates
Study III: 1968-77	1.8	1.8
Study IV: 1968-77	2.1	2.4

The figures in tabulation A show the current- and constant-dollar dispersion for the period 1968-77 as calculated in the third and fourth studies. (For the third study, the measures for 1968-72 and 1973-77 were averaged.) The increase from 1.8 percent to 2.1 percent in the current-dollar dispersion reflects the incorporation in the comprehensive revision of (1) economic census information and other source data and (2) retrospective improvements in source data and estimating procedures. (To a small extent, it also reflects the changes in definitions introduced in the comprehensive revision.) The increase from 1.8 percent to 2.4 percent in the constant-dollar estimates reflects both the increase in the current-dollar dispersion and retrospective improvements in the deflation discussed above. Thus, the increase in the constant-dollar dispersion can be roughly partitioned into two equal parts—that arising from the revisions of the current-dollar estimates and that from the retrospective improvements in deflation. (To a small extent, it also reflects the change in base year in the comprehensive revision.)

What can one say about the dispersion to be expected in future years? The historical record as shown in table 3 probably provides as good a guide as possible for current-dollar dispersion. Constant-dollar dispersion will depend on the current-dollar dispersion and on the extent of retrospective improvements in deflation. It seems likely that efforts to improve the constant-dollar estimates will continue for some time. Thus, one should not expect the constant-dollar dispersion to recede soon to the current-dollar level.

Bias in the GNP estimates.—The relative bias of the current-dollar GNP estimates is small. In the fourth set of revisions for the period 1968-77, it is about -10 percent. For the

Tabulation B

[Percentage points]

	Dispersion		
	Study		Differ- ence
	III	IV	
Preliminary estimate:			
Current dollars.....	-0.9	-1.0	-0.1
Implicit price deflator.....	-4	-1.1	-6
Constant dollars.....	-4	0	4
First revised estimate:			
Current dollars.....	-6	-7	-1
Implicit price deflator.....	-3	-8	-5
Constant dollars.....	-3	.2	.5

period 1978-86, it is about -5 percent. The relative bias of the constant-dollar estimates is small for the period 1968-77 and somewhat larger for the period 1978-86.

In the third set of revisions, the relative bias of the current-dollar estimates was also small. However, that of the constant-dollar estimates was considerably larger. For 1973-77, it was -15 to -20 percent and for 1978-83, -20 to -30 percent. In both periods, the bias was largest in the preliminary estimate.

As was the case with the dispersion measure, the bias of the constant-dollar estimates, when expressed in relative terms, is magnified in comparison to that in the current-dollar estimates. To abstract from the "denominator effect," the following analysis is in terms of bias rather than relative bias.

The figures in tabulation B show the bias for 1968-77 (in percentage points), as calculated in the third and fourth studies, in the current- and constant-dollar estimates of GNP and in the GNP implicit price deflator.

Several interesting points are apparent from these measures. First, unlike the dispersion, the bias is considerably larger in the current-dollar estimates than in the constant-dollar estimates. This comes about because there is a downward bias in the implicit price deflator that damps the current-dollar bias. Second, the bias in the preliminary estimate is larger than that in the first revised estimate in both current-dollar GNP and the implicit price deflator. This is an indication of a downward bias in BEA's projections of missing source data. Third, the bias in both the current-dollar GNP estimate and the implicit price deflator is larger in the fourth study than in the third study.

Tabulation C

[Percentage points]

	Dispersion		
	Preliminary estimate	First revised estimate	Second revised estimate
	Study III: 1978-83:		
Current dollars.....	-0.7	-0.5	-0.2
Implicit price deflator...	-1	.1	-1
Constant dollars.....	-7	-5	-1
Study IV: 1978-86:			
Current dollars.....	-5	-3	-2
Implicit price deflator...	-1	0	0
Constant dollars.....	-4	-3	-2

The increase in the size of the bias for the implicit price deflator, which more than offset the increase in the current-dollar bias, reflects both the change in base year and the improvements in deflation introduced retrospectively in the 1985 comprehensive revision. At this point, it is not possible to disentangle the separate effects, but it appears that the change in the base year accounts for most of the increase, with the effects of the various improvements in deflation being largely offsetting. Thus, it can be said that the reduction in the bias in the constant-dollar estimates resulted from the change in base year.

Tabulation C shows the biases as calculated in the third and fourth studies for the periods since 1977. In the estimates as they stand now (they are subject to comprehensive revisions in 1990 and 1995), the bias in the current-dollar estimates largely flows through to the constant-dollar estimates. It is possible, perhaps likely, that the bias in the implicit price deflator will become more negative when the base year is next updated and thus more or less offset the current-dollar bias.

Table 5 presents the results of statistical tests of significance of the biases in the current- and constant-dollar estimates in the third and fourth studies. The table also presents, for the 1968-83 period used in the third study, an additional set of estimates that did not contain the adjustments to remove the effect of changes in definitions and base year. For each set of current-dollar estimates, the biases in both the preliminary and first revised estimates are significant at either the 1-percent or 5-percent confidence level for the entire period tested. Many of the subperiods tested did not show a significant bias. This reflects lack of power of the test when there are few observations. For the constant-dollar estimates, only the bias in the preliminary estimates in the third study that did not include the adjustments for definitional and base year changes is significant at the 5-percent confidence level.

The findings from the third study raise the question of whether BEA should attempt explicit bias adjustments in future estimates. This is not an easy question to answer. Given that there is little evidence of significant bias in the constant-dollar estimates and that the periodic updating of the base year has worked to reduce the bias, one must be careful not to introduce bias into the constant-dollar estimates by removing it from the current-dollar estimates. Also, the relative number of upward revisions in current-dollar GNP is nearer to 50 percent than to 100 percent. Bias adjustments would make a substantial minority of the estimates worse rather than better. The question will be examined further by BEA.

Table 5.—Bias in Quarterly Changes in GNP

[Percentage points]

	Current-dollar estimates		Constant-dollar estimates	
	15-day	45-day	15-day	45-day
Study III:				
1968-77†.....	-0.9 (-2.6*)	-0.6 (-1.9)	-0.4 (-1.2)	-0.3 (-0.9)
1978-83.....	-8 (-1.5)	-5 (-1.5)	-7 (-1.7)	-5 (-1.6)
1968-83.....	-8 (-2.9**)	-6 (-2.4*)	-5 (-2.0)	-4 (-1.7)
Study IV:				
1968-77†.....	-1.0 (-2.7**)	-7 (-2.0*)	0 (0)	.2 (.3)
1978-86.....	-5 (-1.3)	-3 (-1.0)	-4 (-1.3)	-3 (-.9)
1968-86.....	-8 (-2.9**)	-5 (-2.2*)	-2 (-.7)	-1 (-.2)
Study III without adjustments:				
1968-77†.....	-9 (-2.7*)	-6 (-2.0)	-4 (-1.2)	-3 (-.2)
1978-83.....	-8 (-1.6)	-6 (-1.6)	-8 (-2.0)	-6 (-2.0)
1968-83.....	-9 (-3.1**)	-6 (-2.5**)	-5 (-2.1*)	-4 (-1.7)

† Estimates for this period incorporate one or more comprehensive revisions.

* Significant at the 5-percent confidence level.

** Significant at the 1-percent confidence level.

NOTES.—(1) The t-ratios are in parentheses. (2) See the text for a description of the revision studies III and IV. The terms "15-day" and "45-day" correspond to the terms "preliminary" and "first revised" that are used in the text.

Tabulation D

[Percentage points]

	Dispersion	Bias
Study II: 1947-63	3.1	-0.9
Study IV: 1968-77	1.8	-7

Improvement over time in the GNP estimates.—The revision studies suggest an increase in accuracy in the current estimates of current-dollar GNP over time. Tabulation D compares the dispersion and bias in the first revised estimates in the period 1947-63, as calculated in the second study, with that in the period 1968-77, as calculated in the fourth study. The dispersion shows a decrease of more than 40 percent. The bias also shows a decrease.

For the reduction in dispersion to be considered evidence of an increase in accuracy, it is necessary for the accuracy of the final estimates to have remained constant or improved. This question is examined later in the report.

Two caveats to the finding of a possible increase in accuracy are necessary. The evidence does not directly bear on the accuracy of the estimates since 1977, the last year covered in the studies. Second, the evidence does not indicate how the system would perform over time with respect to a given set of circumstances. For example, there were more frequent recessions in the period 1947 to 1963 than in the period 1968 to 1977, and such periods may strain the GNP system more than nonrecession periods. On the other hand, the period 1968 to 1977 had its own unique conditions that placed strains on the system. One also should note that the figures in table 3 suggest the improvement may have all come before 1958. The dispersion and bias measures for the preliminary estimate for 1958-63 are about the same size as or smaller than those for later periods.

GNP components.—The revision studies also indicate which components of GNP have been subject to large revisions and which have contributed the most to the revision in total GNP.

Table 6 shows the dispersion for the major components of GNP as calculated

in the fourth study. The components with the smallest dispersion—about the same as that for total GNP—are personal consumption expenditures (PCE) for nondurable goods and for services, and State and local government purchases. For all the other components, the dispersion is considerably larger than that for GNP. On a relative basis, as shown in table 7, the only components for which the dispersion is consistently below 50 percent, for both the current- and constant-dollar estimates in both the 1968-77 and 1978-86 periods, are PCE for durables and for services.

Table 8 shows the dispersion for the preliminary estimates of the components weighted by their dollar levels. One can infer from these figures that the most important contributions to the dispersion in GNP are the change in business inventories, imports, and exports. Also, the three components of PCE, even though their dispersion is

small, make important contributions because of their dollar size.

Table 9 shows the bias for the major components of GNP, as calculated for the preliminary estimates in the third and fourth studies. The current-dollar estimates of PCE contained a significant negative bias in both studies for the period 1968-77. Given the relative size of the components, it is clear that PCE accounted for much of the significant negative bias in current-dollar GNP in the third study and for all of it in the fourth study. Within PCE, the negative bias in services was significant in both studies and that in nondurables, in the fourth study. In constant dollars, for the period 1968-77, government purchases of goods and services contained a significant positive bias in the fourth study. While the positive bias was larger for Federal purchases, only that for State and local purchases was significant.

Table 6.—Dispersion in Quarterly Changes in GNP and its Components

[Percentage points]

	Current-dollar estimates			Constant-dollar estimates		
	15-day	45-day	75-day	15-day	45-day	75-day
Gross national product:						
1968-77	2.1	1.8	.....	2.4	2.4	.....
1968-77	1.7	1.5	1.5	1.5	1.4	1.5
1978-86						
Personal consumption expenditures:						
1968-77	2.6	1.7	.....	1.5	1.6	.....
1968-77	1.3	1.4	1.4	1.4	1.5	1.6
1978-86						
Durable goods:						
1968-77	6.9	5.0	.....	3.9	4.3	.....
1968-77	4.6	4.4	4.4	4.2	4.1	4.2
1978-86						
Nondurable goods:						
1968-77	3.0	1.8	.....	2.3	2.0	.....
1968-77	1.8	1.6	1.6	1.7	1.9	1.9
1978-86						
Services:						
1968-77	2.9	1.7	.....	1.5	1.3	.....
1968-77	1.5	1.7	1.8	1.3	1.4	1.3
1978-86						
Gross private domestic investment:						
1968-77	13.0	12.3	.....	11.0	12.2	.....
1968-77	11.2	9.8	9.2	10.4	9.2	9.0
1978-86						
Fixed investment:						
1968-77	5.2	4.5	.....	5.0	4.9	.....
1968-77	4.9	4.1	3.8	5.3	4.7	4.3
1978-86						
Nonresidential structures:						
1968-77	9.0	7.9	.....	9.7	8.2	.....
1968-77	7.5	6.0	5.9	7.1	5.7	5.9
1978-86						
Nonresidential producers' durable equipment:						
1968-77	6.3	5.8	.....	6.6	6.7	.....
1968-77	6.1	5.3	4.4	6.9	6.0	5.0
1978-86						
Residential:						
1968-77	13.3	12.7	.....	13.3	12.9	.....
1968-77	7.6	8.3	7.5	8.1	7.8	6.9
1978-86						
Change in business inventories:						
1968-77						
1968-77						
1978-86						
Net exports of goods and services:						
1968-77						
1968-77						
1978-86						
Exports:						
1968-77	8.9	7.0	.....	8.7	6.3	.....
1968-77	5.7	4.6	4.3	5.5	4.5	4.3
1978-86						
Imports:						
1968-77	8.0	6.4	.....	10.0	9.4	.....
1968-77	8.9	7.9	8.1	10.6	10.7	10.4
1978-86						
Government purchases of goods and services:						
1968-77	4.5	3.2	3.4	3.5	3.5	3.1
1968-77	2.8	3.0	2.6	2.8	2.9	2.6
1978-86						
Federal:						
1968-77	6.6	5.4	.....	6.2	6.4	.....
1968-77	6.8	7.3	6.7	6.8	6.9	6.4
1978-86						
State and local:						
1968-77	4.4	3.0	.....	3.3	3.3	.....
1968-77	1.4	1.4	1.5	1.0	1.3	1.3
1978-86						

NOTE.—The terms "15-day," "45-day," and "75-day" correspond to the terms "preliminary," "first revised," and "second revised" that are used in the text.

For the period since 1977, gross private domestic investment contained a large negative bias in both studies. All components, including business inventories, contributed to the bias. The bias for producers' durable equipment was significant in each case. The large negative bias in exports was significant in some cases and, as explained in the footnote to the table, appears to have resulted in a significant negative bias for net exports.

Critical periods.—The study by Carson and Jaszi reviewed revisions in GNP during critical periods, defined as "the quarter before a cyclical peak in real GNP, the peak-to-trough quarters, and the quarter after a cyclical trough in real GNP."⁷ The revisions were those between the preliminary estimates and the latest available estimates at the time of the

7. Carson and Jaszi

Table 7.—Relative Dispersion in Quarterly Changes in GNP and its Components

[Percent]

	Current-dollar estimates			Constant-dollar estimates		
	15-day	45-day	75-day	15-day	45-day	75-day
Gross national product:						
1968-77	21.8	19.2		57.7	58.6	
1978-86	18.9	17.0	16.9	38.2	34.9	37.2
Personal consumption expenditures:						
1968-77	26.5	17.3		35.0	39.4	
1978-86	14.6	14.8	15.5	39.3	41.0	43.7
Durable goods:						
1968-77	47.4	34.7		33.2	36.1	
1978-86	30.2	28.9	29.1	30.7	30.6	30.8
Nondurable goods:						
1968-77	34.3	20.8		66.6	57.2	
1978-86	23.8	21.4	22.2	64.4	71.8	74.9
Services:						
1968-77	27.6	15.5		37.3	33.6	
1978-86	14.5	16.1	16.8	39.4	41.8	41.0
Gross private domestic investment:						
1968-77	64.5	61.2		65.8	72.9	
1978-86	51.9	45.6	42.8	54.4	48.1	47.1
Fixed investment:						
1968-77	40.3	35.4		53.2	52.8	
1978-86	38.9	33.0	30.3	53.2	47.8	43.5
Nonresidential structures:						
1968-77	90.2	79.0		149.9	127.1	
1978-86	43.5	34.7	34.1	55.6	46.8	48.2
Nonresidential producers' durable equipment:						
1968-77	48.1	44.2		63.2	64.5	
1978-86	43.7	38.2	32.1	58.1	47.9	39.7
Residential:						
1968-77	59.4	56.8		67.1	65.3	
1978-86	34.3	37.7	34.1	55.1	38.2	33.8
Change in business inventories:¹						
1968-77	62.6	64.0				
1978-86	60.6	51.1	47.0			
Net exports of goods and services:¹						
1968-77	63.5	59.4				
1978-86	80.3	74.3	73.3			
Exports:						
1968-77	43.0	33.8		56.5	41.0	
1978-86	39.2	31.7	29.7	52.0	42.9	41.0
Imports:						
1968-77	33.1	26.7		56.2	52.7	
1978-86	49.6	44.3	45.1	74.4	75.2	73.6
Government purchases of goods and services:						
1968-77	56.9	40.5		112.8	112.7	
1978-86	27.2	28.9	25.5	55.7	57.6	51.6
Federal:						
1968-77	80.2	66.0		86.4	89.3	
1978-86	45.4	48.6	44.8	65.0	65.5	61.0
State and local:						
1968-77	42.2	29.2		104.5	103.7	
1978-86	15.7	15.9	16.9	38.8	50.7	48.9

1. Calculations based on dollar change.

NOTE.—The terms "15-day," "45-day," and "75-day" correspond to the terms "preliminary," "first revised," and "second revised" that are used in the text.

Tabulation E

	Dispersion	Bias	Percent	
			Relative dispersion	Relative bias
Carson/Jaszi: 1968-83:				
	(Billions of constant dollars)			
Based on dollar changes:				
All quarters	5.1	-1.6	37	-19
Critical quarters	4.9	-1.8	49	84
	(Percentage points)			
Based on percent changes:				
All quarters	1.6	-.5	37	-17
Critical quarters	1.6	-.6	51	134
Updated: 1968-86, based on percent changes:				
All quarters	2.0	-.2	50	-1
Critical quarters	2.2	-.7	68	113

study in 1985, before the comprehensive revision released in December of that year. Of the 63 quarters in the period 1968-83, 27 were defined as critical. As shown in tabulation E, they found little difference in the dispersion and bias for real GNP for the critical quarters as compared with all

quarters. There were differences in the relative dispersion and relative bias, which reflected the much lower growth of GNP during the critical periods. Also shown are revised calculations based on the estimates resulting from the comprehensive revision released in 1985. The measures for the critical quarters as compared with all quarters again showed little difference in the dispersion but a somewhat larger downward bias.

Although the critical quarters pass muster in comparison to all quarters, as indicated by the dispersion and bias, further examination revealed that in certain of the critical quarters "a competent economist might have been seriously misled had he relied on the NIPA's." In five quarters, the revisions were "large"—over 2½ percentage points—and the latest esti-

Table 8.—Dispersion in 15-day Estimates of GNP Components, Weighted by Dollar Levels

(Billions of dollars)

	Current-dollar estimates		Constant-dollar estimates	
	1968-77	1978-86	1968-77	1978-86
Gross national product				
Personal consumption expenditures:				
Durable goods	2.1	3.2	1.9	3.0
Nondurable goods	2.6	3.4	3.8	3.4
Services	2.7	3.8	2.9	3.4
Gross private domestic investment:				
Fixed investment:				
Nonresidential structures	1.1	2.4	2.7	2.4
Nonresidential producers' durable equipment	1.4	3.6	2.9	4.5
Residential	2.1	2.8	4.5	3.1
Change in business inventories ..	4.3	8.5	6.9	7.4
Net exports of goods and services:				
Exports	2.5	4.9	4.8	5.0
Imports	2.0	7.9	6.1	10.2
Government purchases of goods and services:				
Federal	1.9	4.4	3.9	4.6
State and local	1.8	1.3	2.7	.9

1. Equals the dispersion weighted by dollar level of gross private domestic investment less that of fixed investment.

NOTE.—The term "15-day" corresponds to the term "preliminary" that is used in the text.

mate showed the opposite direction of change to that of the preliminary estimate. These quarters were 1969:IV, 1975:II, 1981:III, 1983:II, and 1983:IV. Updating these calculations for the 1985 comprehensive revision shows that in four critical quarters the revisions were over 2½ percentage points and in the opposite direction of change. The quarters are 1973:III, 1975:II, 1982:III, and 1983:IV. (Several more quarters had revisions with these characteristics, but they were not critical quarters.)

Other revision studies

Studies of whether the revisions in the current GNP estimates behave like efficient forecasts have been carried out recently by investigators outside of BEA, using the data underlying BEA's third revision study. Gregory Mankiw and Matthew Shapiro found that the revisions in the pre-

liminary estimates behaved like efficient forecasts rather than measurement errors.⁸ The finding for GNP was the opposite of that for the revisions in the money supply, which in an earlier study Mankiw and Shapiro had found behaved like measurement errors. Thus, the authors concluded that, in effect, the revisions in the preliminary money supply series could be reduced by incorporating other information in the estimation process but that this was not the case for GNP.

Carl Walsh came up with findings similar to those of Mankiw and Shapiro. However, he also found that the

8. Gregory N. Mankiw and Matthew D. Shapiro, "News or Noise: An Analysis of GNP Revisions," *SURVEY*, May 1986. The idea underlying this finding is that revisions that are correlated with the preliminary estimate but not with the final estimate are characterized as measurement error, while revisions uncorrelated with the preliminary estimate but correlated with the final estimate are characterized as efficient.

size of the difference between the preliminary and first revised estimates could be used to improve the first revised and second revised estimates. Hence, in this sense, the estimates were inefficient.⁹

Knut Anton Mork found that the revisions of the preliminary and first revised estimates did not behave like either efficient forecasts or measurement errors.¹⁰ There was evidence of "ill-behavedness" in the form of downward biases. There also were some indications of correlations with other information—specifically the NBER/ASA forecasts of GNP—and of over-reliance in the estimation proce-

9. Carl E. Walsh, "Revisions in the 'Flash' Estimates of GNP Growth: Measurement Error or Forecast Error?," *Economic Review*, Federal Reserve Bank of San Francisco, Fall 1985.

10. Knut Anton Mork, "Ain't Behavin': Forecast Errors and Measurement Errors in Early GNP Estimates," *Journal of Business and Economic Statistics*, April 1987, Vol. 5, No. 2.

Table 9.—Bias in 15-day Estimates of Quarterly Changes in GNP and its Components

[Percentage points]

	Current-dollar estimates			Constant-dollar estimates		
	1968-77	1978-83	1968-83	1968-77	1978-83	1968-83
Study III						
Gross national product.....	-0.9 (-2.6*)	-0.8 (-1.5)	-0.8 (-2.9**)	-0.4 (-1.2)	-0.7 (-1.7)	-0.5 (-2.0)
Personal consumption expenditures.....	-7 (-2.5*)	.2 (.5)	-3 (-1.6)	-4 (-1.8)	0 (0)	-3 (-1.4)
Durable goods.....	-8 (-.8)	.3 (.2)	-4 (-.5)	-7 (-.8)	.1 (.1)	-4 (-.6)
Nondurable goods.....	-2 (-.5)	-2 (-.3)	-2 (-.6)	.1 (.1)	-2 (-.5)	0 (-.1)
Services.....	-9 (-3.3*)	.5 (1.5)	-4 (-1.7)	-7 (-2.8**)	.2 (.8)	-3 (-1.9)
Gross private domestic investment.....	-1.8 (-.8)	-2.5 (-.9)	-2.1 (-1.2)	-1.6 (-.9)	-3.5 (-1.6)	-2.3 (-1.6)
Fixed investment.....	-7 (-1.0)	-3.4 (-2.6*)	-1.7 (-2.5**)	-4 (-.6)	-3.7 (-3.4**)	-1.7 (-2.6*)
Nonresidential.....	-1 (-.1)	-4.3 (-3.3**)	-1.7 (-2.2*)	.1 (.1)	-4.5 (-4.1**)	-1.7 (-2.3*)
Structures.....	-4 (-.2)	-5.0 (-1.9)	-2.1 (-1.5)	.7 (.4)	-2.7 (-1.2)	-.6 (-.4)
Producers' durable equipment.....	.2 (.2)	-4.3 (-3.9**)	-1.5 (-1.6)	.1 (.1)	-5.3 (-4.4**)	-2.0 (-2.0)
Residential.....	-2.3 (-1.1)	-.7 (-.3)	-1.7 (-1.1)	-1.6 (-.7)	-1.6 (-.7)	-1.6 (-1.0)
Change in business inventories ¹						
Net exports of goods and services ¹						
Exports.....	-3.3 (-1.8)	-3.0 (-2.2*)	-3.2 (-2.6*)	-.8 (-.4)	-2.0 (-1.8)	-1.3 (-1.0)
Imports.....	-1.8 (-1.0)	1.6 (1.0)	-.5 (-.4)	.1 (.1)	-.1 (-.1)	.1 (0)
Government purchases of goods and services.....	.3 (.5)	-.1 (-.1)	.2 (.3)	1.3 (2.1*)	.1 (.2)	.8 (1.9)
Federal.....	1.2 (.9)	.9 (.5)	1.1 (1.0)	1.7 (1.4)	1.2 (.8)	1.5 (1.6)
State and local.....	-2 (-.4)	-.5 (-1.3)	-.3 (-.8)	1.2 (2.0*)	-.4 (-1.2)	.6 (1.4)
Study IV						
Gross national product.....	-1.0 (-2.7**)	-.5 (-1.3)	-.8 (-2.9**)	0 (0)	-.4 (-1.3)	-.2 (-.6)
Personal consumption expenditures.....	-2.1 (-3.3**)	.2 (.6)	-1.0 (-2.7**)	-.2 (-.6)	.4 (1.5)	.1 (.4)
Durable goods.....	-2.4 (-1.5)	-.3 (-.4)	-1.4 (-1.5)	-.8 (-1.0)	-.1 (-.1)	-.4 (-.8)
Nondurable goods.....	-1.6 (-2.3*)	.3 (.7)	-.7 (-1.7)	.3 (.6)	.7 (1.8)	.5 (1.6)
Services.....	-2.4 (-4.1**)	-.4 (-1.1)	-1.1 (-2.9**)	-.5 (-1.7)	.3 (1.1)	-.1 (-.6)
Gross private domestic investment.....	-2.0 (-.6)	-2.2 (-.9)	-2.1 (-1.1)	-.7 (-.3)	-2.7 (-1.3)	-1.6 (-1.0)
Fixed investment.....	-4 (-.4)	-1.9 (-1.8)	-1.1 (-1.5)	-.1 (-.1)	-1.9 (-1.8)	-1.0 (-1.3)
Nonresidential.....	0 (0)	-2.5 (-1.9)	-1.2 (-1.6)	.6 (.7)	-2.6 (-2.2*)	-.9 (-1.2)
Structures.....	-.1 (0)	-1.4 (-.8)	-.7 (-.6)	.4 (.2)	-.1 (-.1)	.1 (.1)
Producers' durable equipment.....	.1 (.1)	-3.4 (-2.9**)	-1.5 (-1.7)	.4 (.3)	-3.7 (-2.9**)	-1.6 (-1.6)
Residential.....	-2.1 (-.8)	-.6 (-.3)	-1.4 (-.8)	-2.4 (-.9)	-.9 (-.4)	-1.7 (-1.0)
Change in business inventories ¹						
Net exports of goods and services ¹						
Exports.....	-3.6 (-2.0)	-1.0 (-.9)	-2.4 (-2.2*)	-2.2 (-1.2)	-1.5 (-1.4)	-1.9 (-1.8)
Imports.....	-1.4 (-.9)	1.2 (.6)	-.2 (-.1)	-.7 (-.3)	2.2 (.9)	.7 (.4)
Government purchases of goods and services.....	-.7 (-.7)	-.1 (-.2)	-.4 (-.1)	1.8 (2.7**)	-.4 (-.8)	.8 (1.7)
Federal.....	-.1 (-.1)	.8 (.5)	.3 (.3)	2.4 (1.9)	.3 (.2)	1.4 (1.5)
State and local.....	-1.1 (-1.3)	-.3 (-1.0)	-.8 (-1.5)	1.5 (2.5*)	-.6 (-2.3*)	.5 (1.5)

* Significant at the 5-percent confidence level.

** Significant at the 1-percent confidence level.

1. Change in business inventories and net exports contain positive and negative values and consequently the bias cannot be expressed in terms of percentage changes. When expressed in dollars, the current-dollar bias for these components is negative except that for inventories for 1978-

83 in study III. When expressed as a percent of GNP, the bias in dollars in net exports is significant (at either the 5-percent or 1-percent level) in study III for 1978-83 and 1968-83 and in study IV for 1968-77 and 1968-86.

NOTES.—(1) The *t*-ratios are in parentheses. (2) See the text for a description of revision studies III and IV. The term "15-day" corresponds to the term "preliminary" that is used in the text.

ture on projection of the past trend as indicated by the preceding quarter's change. The second revised estimate performed better and qualified as "well-behaved," as defined in the study. Mork concluded by observing that the characteristics of the early estimates may denote a conservative policy on the part of BEA in an effort to avoid issuing false signals. (It should be noted that Mork's findings do not indicate that the NBER/ASA forecasts in themselves are more accurate than the preliminary estimates.)

If GNP revisions are correlated with recent growth rates and with other information, then it is possible that what one might call more sophisticated extrapolation methods would reduce revisions and should be developed and used by BEA. Because researchers disagree on whether these problems actually exist, it would be premature to modify estimation methods at present, although BEA is giving some consideration to this possibility. For example, the modeling procedure used by the Federal Reserve Board to forecast the preliminary GNP estimate from GNP source data and other data as they become available during and after the quarter appears to hold some promise of improving current procedures. While a blending of econometric-type techniques with current procedures might prove worthwhile, such a task would not be easy or inexpensive.

A study by Donald King is of interest in that it presented a survey of 33 business economists concerning the importance, given the revisions, that they placed on each of the successive current estimates. The study included the Flash estimate, even though at that time—1981—it was not being officially released (the Flash was released from September 1983 to January 1986, when it was discontinued.) The estimate on which the economists relied the most was the preliminary estimate. Thus, one can generalize that the first available estimate that contains substantial component detail will receive the most use, even if later ones are somewhat more accurate.¹¹

International comparisons of revisions

How does the size of revisions in the U.S. GNP estimates compare with

those of other industrialized countries? There appears to be only limited information available on GNP revisions in other countries. A study by the Organization for Economic Cooperation and Development covering roughly the decade 1965–75 found that revisions in the quarterly changes in real GNP from the earliest estimate to the first annual revision tended to be lower in the United States than in the other five countries studied (Australia, Canada, Japan, Great Britain, and West Germany). Comparisons covering the 1970's and the early 1980's, in which revisions are calculated from the earliest estimate to what is termed here a comprehensive revision, show revisions for the United States to be smaller than for Great Britain and Australia and to be about the same size as for Canada.

Statistical discrepancy

The statistical discrepancy is sometimes thought to provide an indication of the total error in current-dollar GNP. The statistical discrepancy is the difference between GNP estimated as the sum of final sales and inventory change (product side) and GNP estimated as the sum of the factor and nonfactor charges against GNP (income side). It reflects the errors in both sides of the GNP account. Two factors, however, tend to invalidate the statistical discrepancy as a measure of error. First, the errors on the income and product sides of the accounts are not completely independent, partly because some source data enter on both sides and partly because a common seasonal pattern that would give rise to similar errors may be assumed on the two sides. Second, in the process of preparing the estimates, BEA takes various actions that affect the statistical discrepancy. The actions consist of modifying estimates where there is a troublesome swing in the discrepancy and at times concentrating efforts to improve the estimates, i.e., uncover error, on one side of the account. Both these factors operate to reduce the size of the statistical discrepancy relative to the size of the total error. It seems likely, as noted in BEA's second revision study, that the total error is several times larger than the average change in the statistical discrepancy.¹² Thus, changes over time

Tabulation F

	Quarterly		Annual	
	Levels	Changes	Levels	Changes
Billions of dollars:				
1947-63.....	1.7	1.6	1.7	1.6
1968-77.....	3.5	4.6	2.5	2.9
Percentage of GNP:				
1947-63.....	.45	.33	.41	.37
1968-77.....	.27	.28	.13	.21

in the average size of the statistical discrepancy at best provide a partial indication of whether the total error is increasing or decreasing.

Four measures of the statistical discrepancy in the final estimates are shown in tabulation F. They are the averages without regard to sign of quarterly levels, quarterly changes, annual levels, and annual changes. The measures are computed from the statistical discrepancy both in terms of dollars and in terms of the percentage of GNP. The periods selected are the same as those that were featured in the revision studies. Of the four measures, the annual changes are least affected by actions BEA takes with respect to the discrepancy, because (a) annual estimates do not incorporate as many adjustments to control swings as do quarterly estimates and (b) changes do not reflect efforts to improve estimates on one side of the account as much as do levels.

As a percentage of GNP, each measure shows a decline over time. For the quarterly changes, the decline is small. This is probably largely a reflection of the part of the seasonal adjustment error that is not offsetting on the two sides of the account.

The behavior of the statistical discrepancy is consistent with what would result if the source data provided by the Government statistical system and/or BEA's estimating procedures had improved over time. It seems reasonable to conclude that such improvements have taken place and that the total error in the final estimates has declined over time. With respect to the question posed earlier of whether the reduction in dispersion in the preliminary estimates reflects an increase in accuracy, it is not necessary to accept fully the reasoning advanced here. It is only necessary to conclude that there has been no decrease in accuracy in the final estimates.

11. Donald A. King, "Accuracy of the Quarterly GNP Estimates," *Business Economics*, May 1982, Vol. 17, No. 3.

12. Young.

Table 10.—Cited Instances In Which Initial NIPA Estimates May Have Misled Analysts

Instances in which initial estimates may have misled analysts		Studies citing the instance ²	Source data underlying the revision
Period	Estimate ¹		
1948-49	These recessions were not reconstructed using the initial estimates. As of the comprehensive NIPA revision in January 1976	GNP DIP: Revised estimates showed much smaller decline than initial estimates.	BEA is aware that recessions tend to be shallower in revised estimates, but has not been able to identify a characteristic of recession estimates that would produce this result. It may be noted, however, that measures of bias for all periods indicate that revisions tend to be upward.
1953-54		GNP DIP: In early estimates, product declined more than income, and product was revised to show smaller decline during recession.	
1957-58		GNP DIP: Revised estimates showed smaller decline than initial estimates.	
1965		GNP DIP: Revised estimates showed stronger expansion than initial estimates.	
1969-70	Corporate profits before tax	GNP DIP: Revised estimates showed stronger decrease, so that initial estimates gave misleading view of the impact of the recession on business income. <i>Primer.</i> GAO.	Initial estimates of profits are based on stockholder reports; later estimates, on Internal Revenue Service tabulations. The revision arose from inability to adjust the initial estimates for the effect of a change in one or more of the items that reconcile the two sources.
1971	GNP	GNP DIP: Revised estimates showed smaller increase than initial estimates—a decidedly less buoyant recovery. <i>Primer.</i> GAO.	The revision reflected new Census Bureau estimates of construction activity and of retail sales and BEA estimates of retail inventories, all of which indicated less strength. The revision also incorporated retroactive aspects of the Revenue Act of 1971.
1973-74	Inventories	GNP DIP: Revised estimates showed more inventories than initial estimates—understating the seriousness of the coming recession. JEC: CBI estimates disguised the buildup at the onset of the 1974-75 recession. <i>Primer.</i> GAO.	The revisions reflected revised Census Bureau data on book values of manufacturing and trade inventories and Department of Agriculture data on farm inventories. The revision reflected revised Department of Agriculture data on farm income.
1975-76	GNP	<i>Primer:</i> Revised estimates of PCE for services, fixed investment, and CBI showed more strength in the recovery than the initial estimates. GAO.	The revision reflected new information on PCE for services, especially medical services, new Census Bureau data on shipments of producers' durable equipment and the book value of manufacturing and trade inventories, and revised Census Bureau data on construction.
Late 1970's	Nonresidential fixed investment	JEC: Revised estimates showed higher levels and rates of growth during a time when the need for more investment was at forefront of policy debate.	The revision largely reflected the incorporation of major benchmark sources—the 1972 input-output tables, for equipment and structures, and preliminary estimates of the input-output type prepared for 1977, for equipment.

GNP Gross national product
CBI Change in business inventories
PCE Personal consumption expenditures

1. Dollars in billions; GNP and product components in constant (1972) dollars; quarters at seasonally adjusted annual rates; and percent changes annualized.

2. For full citations, see footnote 14 in the text.

GNP DIP *GNP Data Improvement Project Report*
JEC *Maintaining the Quality of Economic Data*
GAO *The Bureau of Economic Analysis Should Lead Efforts to Improve GNP Estimates*
Primer A Primer on Gross National Product Concepts and Issues

3. Dated according to Arthur Okun's statement; see text of source.

4. This comparison is particularly difficult to date, because a comprehensive NIPA revision was published in January 1976; estimates as shown for the first three quarters reflect those revisions. As of November 1975, the estimates were: -11.4, 1.9, 13.2.

Source: *The Use of National Income and Product Accounts for Public Policy: Our Successes and Failures*. BEA Staff Paper No. 43, January 1986.

Expert judgment

Policy makers.—The study by Carson and Jaszi provides a summary of expert judgment concerning in-

stances in which preliminary GNP estimates may have misled analysts.¹³ It brings together the results of three

13. Carson and Jaszi.

Table 11.—Judgmental Evaluation of Reliability of National Income and Product Estimates, Prepared in 1974

[A rank of 1 indicates highest reliability, and a rank of 5, lowest]

	Quarterly changes		Annual levels			
	45-day	First July	First July	Second July	Third July	Benchmark
Gross national product						
Personal consumption expenditures:						
Durable goods.....	3	3	3	3	3	2
Nondurable goods.....	3	3	3	3	3	2
Services.....	5	5	4	3	3	3
Gross private domestic investment:						
Fixed investment:						
Nonresidential:						
Structures.....	5	4	4	3	3	3
Producers' durable equipment.....	4	4	3	3	3	2
Residential:						
Nonfarm.....	4	4	3	3	3	3
Farm.....	5	5	5	5	5	5
Change in business inventories:						
Nonfarm.....	5	5	5	5	5	5
Farm.....	5	5	4	4	4	4
Net exports of goods and services:						
Exports.....	4	3	2	2	2	2
Imports.....	4	3	2	2	2	2
Government purchases of goods and services:						
Federal:						
National defense.....	4	4	3	3	3	3
Other.....	3	2	3	2	2	2
State and local.....	4	4	3	3	3	3
Relation of GNP to national income						
Gross national product						
Less: Capital consumption allowances.....	5	5	4	3	2	2
Indirect business tax and nontax liability:						
Federal.....	3	2	2	1	1	1
State and local.....	3	3	2	2	2	2
Business transfer payments.....	5	5	4	3	2	2
Statistical discrepancy.....						
Plus: Subsidies less current surplus of government enterprises: Federal subsidies less current surplus of government enterprises.....	3	2	2	1	1	1
Less: State and local current surplus of government enterprises.....	5	5	4	3	3	3
Equals: National income						
National income by type of income						
Compensation of employees:						
Wages and salaries.....						
Private.....	3	3	2	1	1	1
Government.....	3	2	2	1	1	1
Supplements to wages and salaries.....	3	3	3	2	1	1
Proprietors' income:						
Business and professional.....	5	5	4	4	3	3
Farm.....	5	5	4	4	4	3
Rental income of persons.....	5	5	5	5	5	3
Corporate profits and inventory valuation adjustment:						
Profits before tax.....	5	5	4	3	2	2
Inventory valuation adjustment.....	5	5	5	5	5	5
Net interest.....	5	5	5	4	3	2
Personal income and related series						
National income						
Less: Corporate profits and inventory valuation adjustment.....						
Contributions for social insurance.....	3	3	2	1	1	1
Wage accruals less disbursements.....	4	4	4	4	4	4
Plus: Government transfer payments to persons.....	2	2	2	1	1	1
Interest paid by government (net) and consumers.....	4	4	3	3	3	2
Dividends.....	3	3	2	2	2	2
Business transfer payments.....						
Equals: Personal income						
Less: Personal tax and nontax payments:						
Federal.....	3	3	2	1	1	1
State and local.....	3	3	2	1	1	1
Equals: Disposable personal income						
Less: Personal outlays:						
Personal consumption expenditures.....						
Interest paid by consumers.....	5	5	3	3	3	3
Personal transfers to foreigners.....	3	3	2	2	2	2
Equals: Personal saving						

Source: *Reliability of the Quarterly National Income and Product Accounts of the United States, 1947-71*, BEA Staff Paper No. 23, July 1974.

studies in which policymakers and/or their advisers were interviewed about their experiences in using the preliminary estimates. The studies were those by the Advisory Committee on the Gross National Product Data Improvement Project, which issued its report in 1977, a private consultant for the Joint Economic Committee in 1981, and the General Accounting Office in 1982.¹⁴

Table 10 reproduces a table from the study that summarizes the findings. Carson and Jaszi reviewed the six instances in the 1960's and 1970's cited in the studies. They agreed that the revisions to GNP in 1965, to corporate profits in 1969-70, to inventories in 1973-74, and perhaps to nonresidential fixed investment in the late 1970's appeared to have misstated the picture as shown by the later estimates. In their opinion, there is not a strong case for misstatement concerning the revisions to GNP in 1971 and in 1975-76.

Estimators.—While expert judgment was used by Simon Kuznets at the outset of the development of GNP estimates to evaluate the total error arising from the source data and estimating procedures, it has been little used since in the United States in a formal way. The only other formal presentation of such judgments on a comprehensive basis appears to have been in the second revision study by BEA completed in 1974. The judgments—those of senior estimators in BEA—are reproduced here as table 11. The table is shown to illustrate this approach to reliability—the only one available other than those based on revisions and the statistical discrepancy.

Recent evidence

The previous parts of this section have examined reliability from various perspectives. However, much of the examination has focused on the period from 1947 to 1977, because the

14. The citations for these studies are (1) Advisory Committee on Gross National Product Data Improvement, *Gross National Product Data Improvement Project Report*, issued by the Office of Federal Statistical Policy and Standards of the U.S. Department of Commerce (Washington, DC: U.S. Government Printing Office, 1977); (2) U.S. Congress, Joint Economic Committee, *Maintaining the Quality of Economic Data*, a study prepared for the use of the Committee (Washington, DC: U.S. Government Printing Office, 1981); and (3) Comptroller General, *The Bureau of Economic Analysis Should Lead Efforts to Improve GNP Estimates* (Washington, DC: General Accounting Office, December 1982) and *A Primer on Gross National Product Concepts and Issues* (Washington, DC: General Accounting Office, 1981).

reliability of the more recent estimates cannot yet be assessed fully. For example, it will not be possible to get a reading on the total revision of the 1986 estimates until the comprehensive revision in 1995. Also, not enough time has elapsed for policymakers and their advisers to have written their memoirs concerning recent years.

The examination so far has indicated two causes for concern about the accuracy of the GNP estimates in the 1980's. First, there is evidence of bias in the current estimates of GNP, particularly in the preliminary estimate. Second, revisions in 1982 were of sufficient size that "a competent economist might have been seriously misled."

At this time, neither of these cases should be viewed as indicative of a deterioration in reliability, however. They appear to be a continuation of the level of reliability achieved earlier.

Table 12 examines revisions from 1978 to 1986 in greater detail—year by year—to see if there is any evidence of deterioration. The table shows the dispersion and the bias for each year, between the preliminary, first revised, and second revised quarterly estimates; it also shows the dispersion and the bias for each year, using the latest quarterly estimates as final.

There is no discernible trend in either the dispersion or the bias between the preliminary and first re-

vised or second revised estimates, or between the first revised and second revised estimates. With the exception of 1981–82, the figures from year to year are all about the same size. There also is no evidence of an increase or decrease in either the dispersion or the bias between the current and the latest estimates. (For this comparison it is necessary to disregard the entries for 1985–86 because of their more recent vintage.)

Status of Source Data

The late 1970's and 1980's represent a new era for government statistics. It is one of:

- Reduced real resources for data compilation, including that from administrative records.
- Heightened concern about reporting burden, leading to pressures to reduce survey size, etc.
- Reduced coordination of the statistical system.

These interrelated developments have given rise to the following concerns about the GNP estimates.

- Can the quality of the major bodies of source data, such as the consumer price index at BLS and sales of retail stores at the Census Bureau, be maintained?
- Can other source data be maintained or cutbacks identified early to allow development of substitutes?

- Can actions to improve source data and estimating procedures keep pace with underlying changes in the economy?

Existing data

With respect to the maintenance of existing source data, the evidence examined in this report is heartening. To date, there is no evidence of deterioration in the reliability of estimates of aggregate GNP, whether measured in terms of revisions or judged from the perspective of users. This suggests that the quality of major bodies of source data (and most other sources) used for the *current* GNP estimates have by and large been maintained. From the evidence considered, it is not possible to address whether or not the quality of the source data used for the *final* GNP estimates has also been maintained. However, such a conclusion by and large seems reasonable, although three exceptions must be noted. They are (1) the IRS tabulations of information from corporate tax returns, (2) the tabulations of merchandise imports, and (3) the survey of residential finance to be conducted in conjunction with the 1990 censuses of population and housing.

The cost-cutting changes made at IRS, as noted previously, eliminated the preliminary tabulations, reduced the sample size, and cut back on statistical editing. Eliminating the preliminary tabulations so that the introduction of IRS information is postponed until the third July revision results in larger interim revisions in corporate profits, net interest, and depreciation, but does not affect the reliability of the final estimates. There-duction in sample size weakened the representation of activities of small firms. This reduction affects the reliability of the final estimates for certain industries; the effect on the aggregates may not be large. The cut-back in editing potentially has serious effects on the reliability of the final aggregate estimates. (BEA undertakes a special review each year to detect and correct large errors due to lack of editing, but it probably will not succeed in all cases.)

The deterioration in the merchandise import tabulations was also due to resource problems. At Customs, the processing and forwarding of documents to the Census Bureau did not keep pace with the surge in imports in the 1980's. Consequently, timing errors became substantial; documents were being tabulated and placed in

Table 12.—Dispersion and Bias in Quarterly Changes in GNP

[Percentage points]

	Dispersion						Bias					
	15-to 45-day	45-to 75-day	15-to 75-day	15-day to latest	45-day to latest	75-day to latest	15-to 45-day	45-to 75-day	15-to 75-day	15-day to latest	45-day to latest	75-day to latest
Current-dollar estimates												
1978.....	0.5	0.8	1.2	2.6	2.3	2.3	-0.5	-0.3	-0.7	-2.4	-2.0	-1.7
1979.....	.5	.3	.5	1.8	1.7	1.6	-4	-1	-5	-2	.2	.3
1980.....	.8	.7	1.0	1.2	2.0	2.0	.4	-3	.1	-7	-1.0	-.8
1981.....	1.9	.6	2.4	2.3	1.2	1.0	-1.9	-5	-2.4	-1.9	-.1	.5
1982.....	.7	1.1	.5	1.8	1.4	1.5	.7	-9	-2	.5	-.3	.6
1983.....	.6	.2	.4	2.2	1.6	1.8	-3	-1	.2	.3	0	.1
1984.....	.6	.6	.7	1.6	2.1	1.6	-3	0	-2	.6	.8	.8
1985.....	.5	.6	.9	.4	.7	1.3	.4	.6	.9	-.3	-.7	-1.3
1986.....	.5	.3	.5	.6	.2	.2	-.3	.3	0	-.1	.1	-.1
1978-86.....	.7	.6	.9	1.7	1.5	1.5	-.2	-.2	-.2	-.5	-.3	-.2
1968-77 ¹.....	.5						-.3					
Constant-dollar estimates												
1978.....	.3	.6	.9	2.8	2.7	2.7	-.3	-.2	-.4	-.2.3	-.2.0	-1.8
1979.....	.7	.2	.6	1.3	1.4	1.5	-.6	0	-.6	-.3	-.3	-.3
1980.....	.4	.7	.8	1.0	1.4	1.7	-.4	-.3	-.1	-.6	-.7	-.7
1981.....	1.0	.5	1.3	1.2	.9	.6	-.8	-.5	-1.3	-1.1	-.3	-.2
1982.....	.6	.8	.6	2.4	1.9	2.2	.1	-.8	-.7	1.6	1.2	1.4
1983.....	.4	.2	.6	1.4	1.3	1.3	0	-.2	-.2	-.5	-.5	-.3
1984.....	.6	.6	.8	1.7	1.9	1.4	-.2	-.2	-.1	1.0	1.2	1.0
1985.....	.8	.6	.8	.9	1.0	1.4	-.2	.6	.7	-.7	-.9	-1.4
1986.....	.5	.3	.1	.5	.3	.2	-.2	-.3	-.1	-.2	0	-.2
1978-86.....	.6	.5	.8	1.5	1.4	1.5	-.1	-.1	-.3	-.4	-.3	-.2
1968-77 ¹.....	.5						-.1					

1. Measures based on the latest estimates as final are not shown for 1968-77 because they are not of the same vintage as those for 1978-86 that do not incorporate a comprehensive revision.

Note.—See the text for sources and for definitions of the revision measures. The terms "15-day," "45-day," and "75-day" correspond to the terms "preliminary," "first revised," and "second revised" that are used in the text.

the wrong month at Census. These timing errors had a substantial effect on current quarterly estimates for the period 1983-85. (It should be noted that effective actions have been taken to restore the quality of the import figures. BEA switched to using tabulations on a "revised statistical month" basis as soon as the problem was uncovered, and Census recently modified the timing of the "statistical month" tabulations to restore their accuracy.)

Planning funds for the survey of residential finance were deleted from the Census Bureau's FY 1988 budget. If this survey is not conducted, the estimates of space rent in personal consumption expenditures and of rental income will be substantially degraded.

Data improvement

A major effort to improve GNP source data was undertaken in the 1970's when OMB established the Advisory Committee on GNP Data Improvement. The committee's report,

published in 1977, contained 155 recommendations for improvement in the format of a 6-year program. It was recognized at the time that the recommendations would not all be implemented within 6 years. The schedule contained no estimates of the costs of implementation.

In a progress review, the General Accounting Office (GAO) found that by 1982, 49 of the 155 recommendations had been implemented.¹⁵ In general, those that were implemented were relatively cost free or were central to the missions of the collecting agency.

The GAO review was somewhat critical of the performance of OMB and BEA. As the title of the report indicates, GAO called on BEA, in place of OMB, to take more of a lead role in seeing that further improvements in source data were made. The review recommended that BEA develop a list

15. Comptroller General, General Accounting Office, *The Bureau of Economic Analysis Should Lead Efforts to Improve GNP Estimates*, December 1982.

of data improvements in priority order, with justification for each, and that OMB use BEA's results in reviewing the budget submissions of agencies that provide source data to BEA.

In May 1983, the Commerce Department's Under Secretary for Economic Affairs provided to OMB a list in priority order of 50 improvements in source data. In 1983, BEA also stepped up efforts to secure improved source data by working directly with other agencies and by making more effective use of the OMB forms review process. In several instances this approach has helped prevent cutbacks in source data for GNP.

The impetus given to data improvement from the Advisory Committee Report has run its course. Resource constraints have focused agencies on maintaining core programs. In addition, issues and problems that were not recognized as of major importance in the first half of the 1970's need attention. For example, because of changes in tax laws and the increased

Table 13.—Recommendations for GNP Source Data Improvements

Priority	Improvement description	Priority	Improvement description
1.	Maintain low level of, and eventually eliminate, carryover in merchandise export and import data without further delaying publication (Treasury).	13.	Improve measures of actual and expected investment by industry in the quarterly plant and equipment survey, including mandatory collection of annual data for all industries (BEA/Census).
2.	Improve the coverage of the monthly nonresidential construction survey, benchmark these estimates every 5 years by expanding the coverage of the census of construction, and prepare annual updates by initiating an annual survey of construction (Census Bureau).	14.	Provide comprehensive and edited quarterly tabulations of the "Reports of Condition and Income" 65 days after the end of the quarter (Federal Deposit Insurance Corporation, Federal Reserve Board).
3.	For the corporate <i>Statistics of Income</i> program, restore preliminary tabulations, sample size, and editing of detailed income and expense items (Treasury).	15.	Restore sample size and introduce other improvements into the <i>Quarterly Financial Report</i> (Census).
4.	For the noncorporate <i>Statistics of Income</i> program, provide comprehensive tabulations of partnership form K-1 (Treasury).	16.	Update progress patterns for single-family residential construction (Census).
5.	Improve nonresidential construction price indexes (BEA, Census).	17.	Improve annual collection of expenditures on legally required and voluntary nonwage compensation programs, including effective use of administrative records and new surveys (Bureau of Labor Statistics, Health Care Financing Administration, and Treasury).
6.	Expand balance of payments reconciliation program to Mexico, Japan, and other major U.S. trading partners (Census, BEA).	18.	Speed up availability to BEA of quarterly tabulations of selected items from the consumer expenditures survey (Bureau of Labor Statistics).
7.	Restore funding for the 1990 Survey of Residential Finance (Census).	19.	Introduce monthly collection for elements of import and export prices with extreme volatility (Bureau of Labor Statistics).
8.	Update estimates for the impact on GNP of the misreporting on tax returns used to estimate GNP (BEA).	20.	Collect quarterly data on crop inventories owned by farmers (Agriculture).
9.	Expand various annual surveys to provide data on nonfarm inventories not covered by Census surveys. Add inventories questions to the service annual survey, the plant and equipment expenditures survey (communications and public utilities), and the proposed annual construction survey. In addition, expand the coverage of the Census annual trade survey to cover nonmerchant wholesalers (Census).	21.	Initiate annual surveys of State government purchases of goods and services by type and corresponding price indexes (Census, Bureau of Labor Statistics).
10.	Improve the measurement of quality change in components of the Consumer and Producer Price Index programs used to estimate constant-dollar GNP (Bureau of Labor Statistics).	22.	Continue to expand coverage of service annual survey to include "Service-type" industries needed to estimate GNP (Census).
11.	Require mandatory reporting for the monthly manufacturers' shipments, orders, and inventories series (Census).	23.	Expand annual retail trade survey to collect merchandise line and operating expense data (Census).
12.	Speed up availability to BEA of preliminary tabulations of <i>Governmental Finances</i> (Census).	24.	Restore annual survey of production, disposition, and value of field crops (Agriculture).

use of partnerships as tax shelters, new types of tabulations by IRS of business income are necessary in order to measure income of partnerships correctly.

In 1986, the Economic Policy Council established the Working Group on the Quality of Economic Statistics. The Working Group was charged with reviewing the quality of economic statistics and developing recommendations and options for their improvement. The Working Group's report, issued in April 1987, focuses to a large extent on the need for the Government statistical system to adapt to changes as the economy evolves. It sets forth recommendations in five areas. The recommendations under the headings of GNP, merchandise trade statistics, and service sector statistics are important from the standpoint of the reliability of the GNP estimates; those for business lists used in economic surveys and for user charges are of less direct importance. Many of the recommendations in effect call for research by data collection agencies to develop new or improved source data and by BEA to develop new estimating procedures in order to keep pace with underlying changes in the economy.

Under the GNP heading, the report calls for reviews to set priorities for improving accuracy in the following areas: Merchandise trade, domestic and international services, business fixed investment, the underground economy, and price indexes that include improved treatment of quality change.

With respect to the merchandise trade statistics, the recommendations that are important to GNP are those pertaining to the accuracy of the import and export data. With respect to service sector statistics, the report calls for development of a plan that would lead to government-wide priorities for methodological development and data collection. From the standpoint of GNP, it is desirable that the information on services needed for the GNP estimates be assigned high priorities.

A list of BEA's recommendations for data improvement is shown in table 13. BEA provided the list to the Working Group's Subgroup on GNP Estimates and updated it to reflect developments since it was prepared in 1986. New items on the list are 4, 7, 10, 14, and parts of 2 and 9. The list provides a more detailed picture of BEA's priority concerns than the

broad recommendations of the Working Group.

Documentation of Methodology

BEA is engaged in an overdue effort to issue an up-to-date statement of the GNP methodology. The statement is being issued in increments. To date, four chapters have been issued. The first, completed in March 1985, lays out the conceptual basis of the NIPA's and their interrelationship with the input-output tables and flow of funds accounts. This was followed by chapters on corporate profits in May 1985 and on foreign transactions in May 1987. The latter relates the foreign transactions account of the NIPA's to the balance of payments accounts. The lapse between the second and third chapters reflects the fact that senior staff were fully occupied with the comprehensive GNP revision until the spring of 1986 and also spent much time overseeing the development of improved pre-release security procedures, which are described in the last part of this article.

The fourth chapter, "GNP: An Overview of Source Data and Estimating Methods," provides an abbreviated statement of methodology for each income- and product-side component. It also provides an annotated list of references to BEA publications since 1974 that contain methodological information about GNP. The chapter was first presented as an article in the July 1987 issue of the SURVEY; it will be available in the fall as a separate chapter in the methodology series.

The table of source data and assumptions used in preparing the preliminary quarterly estimates of GNP, which BEA provides on a subscription basis, is being redesigned and will be placed on the Commerce Department's electronic bulletin board in FY 1988. This table, used in conjunction with the information in the overview chapter, will make it much easier for users to evaluate BEA's current estimates and to assess the likely impact of new source data as they become available.

A chapter on government transactions is in progress. It has not been determined whether the remaining chapters on the product side of GNP—on consumption and investment—will be undertaken in FY 1988 or whether chapters on the income

side will be moved up for completion. The plan is to issue two or more chapters per year and complete the statement in 1990. This would be in accord with the position of the Working Group in its report that an incremental approach is sound and that BEA should complete the documentation promptly.

Schedule of Release

The schedule for the release of the quarterly GNP estimates is determined by the dates on which major source data are available. In most cases, GNP is released 6-8 working days after data on retail sales and inventories and on merchandise trade statistics are made available to BEA. The 6-8 days is the minimum time needed to process and review source data, prepare and review the GNP estimates, and prepare the release. BEA has met the release schedule provided to OMB.

Security Before Release

In July and September 1985, there were reports of leaks of GNP data. At the request of the Secretary of Commerce, the Department's Inspector General conducted a thorough investigation. No clear evidence of leaks was established in the investigation. However, the investigation disclosed that two BEA employees had used GNP information prior to release for personal gain. These employees were dismissed.

Beginning in October 1985, strengthened prerelease security measures for GNP have been put in place. Security measures include: Keeping component estimates under lock and key prior to the release of GNP; limiting discussion by employees of any GNP-related estimate, both inside and outside BEA; and restricting access to computer files that contain component information and closely monitoring file use.

The measures also include a lock-up for the preparation of the GNP release: The day before the release, 6-10 BEA employees establish the GNP aggregate using a stand-alone computer, review and approve the estimates, and prepare the news release. A copy of the news release is delivered by messenger to a designated person at the Council of Economic Advisers, and the lock-up ends at 6:00 PM or later. The figures are released to the public at 8:30 AM the next morning.

Appendix A.—Recommendations Related to the NIPA's Drawn From Four Representative Studies

Recommendation ¹	Comment ²
National Accounts Review Committee (NARC): Recommendations on the Structure of the National Economic Accounting System and on the NIPA Estimates	
A. New series and more detail for existing series 1. Emphasize development of constant-dollar estimates. a. Develop estimates of product by industry. b. Provide more detail on consumption, investment, and government expenditures. 2. Provide quarterly estimates in more detail. 3. Provide more estimates of government transactions: a. Provide reconciliations of NIPA government estimates with data from the budget and Census Bureau. b. Provide more detail on government and government enterprises. c. Separate the levels of government. 4. Capital stock: a. Provide integrated set of flows, stock, and depreciation for major consumer durables and for government structures and equipment so that users can treat the flows as investment. b. Provide depreciation allowances and stocks of reproducible durable assets at replacement as well as original cost. 5. Provide realized capital gains for main sectors, and extend soon to include unrealized capital gains.	<p>As of 1985, product flows were available in constant dollars. In addition, implicit price deflators, as byproducts of current- and constant-dollar estimates, were provided; <i>see also R & P A.13.</i></p> <p>Constant-dollar estimates of farm and nonfarm business product and of product originating in nonbusiness groups were introduced in 1958. Constant-dollar product by industry was introduced in the October 1962 SCB; estimates were provided annually beginning in 1967.</p> <p>Major expansions of annual constant-dollar estimates were: By 1958: Personal consumption expenditures by major type, construction by type, and producers' durable equipment by type. In addition, estimates were provided of GNP by major type, cross-classified by major type and purchaser, and by legal form of organization. By 1965: Personal consumption expenditures for almost 50 detailed categories. In addition, estimates were provided for gross auto product (introduced in the February 1963 SCB). By 1976: Government purchases by type; net and gross private domestic investment by major type, and business inventories. In addition, estimates were provided for net national product and national income by sector; for housing output, gross product, and income; and for change in business inventories by industry. By 1980: Federal national defense and nondefense purchases. In addition, estimates were provided for net exports, with data for merchandise trade, and for truck output. <i>See also NARC C.1.</i> for quarterly constant-dollar estimates.</p> <p>As of 1985, a large number of NIPA estimates were provided quarterly; the major exceptions were the estimates of fine component detail, estimates by industry, and estimates of relations and similar supplementary information. By 1958, quarterly estimates of Federal and of State and local receipts and expenditures, foreign transactions, and saving and investment had been introduced. Thereafter, when new and improved series (with the noted exceptions) were introduced, quarterly estimates usually accompanied annual estimates. <i>See also NARC C.1.</i></p> <p>By 1958, derivations were provided of Federal receipts and expenditures from budget data and of State and local receipts and expenditures from Census Bureau data. By 1976, derivations were provided of national defense purchases and Commodity Credit Corporation expenditures from budget data.</p> <p>By 1958, an expanded set of estimates of government transactions, including estimates of expenditures by type of function and an object breakdown, had been provided. Major expansions were: By 1976: Purchases by type in constant dollars, government gross fixed capital formation (see NARC A.4), and detail for subsidies less current surplus of government enterprises. By 1980: Detail on personal tax and nontax receipts and on indirect business taxes, and detail on national defense purchases in current and constant dollars.</p> <p>State and local government receipts and expenditures were shown separately in the October 1967 SCB. The estimates were updated in the May 1978 SCB and periodically thereafter. By 1980, expenditures by type and by function were provided for the Federal Government and for State and local governments.</p> <p>As of 1985, major parts of a project to measure the Nation's tangible wealth had been completed. Annual estimates of investment, depreciation, and stocks on a where-owned basis are consistent with the NIPA's and provide alternative assumptions about service lives, depreciation formulas, and valuations (including current replacement cost). Estimates of business fixed investment were introduced in the November 1962 SCB; major expansions were: 1966: Fixed business capital, updated and using several assumptions about - retirement patterns (December SCB). 1976: Residential capital (April SCB). 1979: Consumer durables (March SCB, supplemented in 1980 with estimates of services they provide; see R & P D.1). 1980: Government-owned fixed capital (March SCB). Estimates of government gross fixed capital formation had been introduced in the February 1973 SCB and updated for State and local government in the October 1975 SCB; <i>see also NARC A.3.</i> 1985: Fixed private capital stock, improved, with 60-industry detail (July SCB). In addition, for business inventories, annual estimates of stocks were introduced in the December 1972 SCB and quarterly estimates (in constant dollars), in the August 1974 SCB. Quarterly estimates of durables and nondurables cross-classified by manufacturing, wholesale trade, and retail trade were introduced in the May 1976 SCB; monthly estimates for manufacturing and trade, in the August 1979 SCB; and stage-of-fabrication estimates for manufacturing inventories, in the November 1981 SCB.</p> <p>Not implemented, although there is interest in estimating realized gains.</p>
See footnotes at end of table.	

Appendix A.—Recommendations Related to the NIPA's Drawn From Four Representative Studies— Continued

Recommendation ¹	Comment ²
National Accounts Review Committee (NARC)—Continued	
C. Periodicity, timeliness, and revision schedules	
1. Provide constant-dollar series quarterly.	<p>Quarterly constant-dollar GNP was introduced in the December 1958 SCB. Major expansions were:</p> <ul style="list-style-type: none"> By 1965: GNP by major type of product and by sector, and gross auto product. By 1976: Net national product and national income by sector, personal consumption expenditures by major type of product, government purchases by type, business inventories by industry, and nonfinancial corporate product. By 1980: Truck output, exports and imports (with detail for merchandise trade), business inventory change by industry, and national defense and nondefense Federal purchases.
2. Publish revisions of quarterly and annual estimates when new information makes significant changes in earlier estimates—probably quarterly—rather than being held until 6 months after yearend.	See GNP DIP C.1 .
D. Concepts and structure of economic accounts	
1. Integrate the five segments of national economic accounts—national income and product, flow of funds, input-output, balance sheets, and balance of payments—into a single structure.	<p>A. Flow of funds: With changes made in NIPA's in 1965 and in flow of funds over the years, progress has been made, but differences remain. Work sponsored by BEA explored a set of integrated accounts for income and product, saving and investment, and balance sheets (May and November 1982 SCB).</p> <p>B. As a result of a project begun in 1959, the 1958 input-output table, presented in the November 1964 SCB, was integrated with the NIPA's. GNP product components are "benchmarked" to the tables; see also GNP DIP C.2.</p> <p>C. BEA assumed focal responsibility for estimates of tangible wealth, which are conceptually and statistically integrated with the NIPA's. See NARC A.4.</p> <p>D. As of 1985, the NIPA's and the balance of payments are reconciled by tables published quarterly and annually.</p>
2. Change immediately to a five-account NIPA system.	The five-account system was introduced in 1958 and has been used since with only minor changes.
3. Disaggregate the "household" sector: Farm households and nonfarm households, nonprofit organizations, and welfare and trust funds; later, separate owners of unincorporated nonfarm business.	Not implemented, although there is interest in doing so, especially to separate nonprofit organizations and welfare and trust funds.
4. Provide change-in-asset and change-in-liability accounts for main sectors.	Not implemented, by direction of statistical coordinating office. See NARC D.1 .
Contributors to <i>The Economic Accounts of the United States: Retrospect and Prospect (R & P)</i>: Recommendations Related to the NIPA's	
A. New series and more detail for existing series	
1. Provide monthly estimates of GNP.	Not implemented; monthly estimates could not be prepared with acceptable accuracy. However, some monthly estimates are published; see GNP DIP A.1 .
2. Provide seasonally unadjusted series on a current basis and a description and appraisal of the seasonal adjustment methodology.	Seasonally unadjusted series for as many series as possible are provided annually, usually in the July SCB ; as of 1985, these were: GNP, personal consumption expenditures by major type of product, Federal Government receipts and expenditures, State and local government receipts and expenditures, foreign transactions in the NIPA's, and corporate profits.
3. Provide estimates of personal tax liabilities.	Estimates of Federal personal income tax liabilities were introduced in the May 1978 SCB .
4. Provide estimates of the services of the dwelling industry.	Estimates of housing output, gross housing product, and income originating in housing were introduced in 1976.
5. Provide estimates of economic depreciation and of capital stock on a where-used basis, with more industry detail, and with fuller coverage.	"Economic" depreciation—estimated using uniform service lives, straight-line depreciation, and current replacement cost—was introduced in the October 1975 SCB . See NARC A.4 .
6. Provide estimates of capital gains.	See NARC A.5 .
7. Provide more detail on government transactions.	See NARC A.3 .
8. Provide more detail on personal consumption expenditures.	See NARC A.1.b and NARC C.1 .
9. Provide change in business inventories cross-classified by product and industry.	Change in business inventories cross-classified by type of product (durable and nondurable) and by manufacturing, wholesale trade, and retail trade were introduced in 1976.
10. Provide gross product cross-classified by major industry and final demand.	Not implemented.

See footnotes at end of table

Appendix A.—Recommendations Related to the NIPA's Drawn From Four Representative Studies—Continued

Recommendation ¹	Comment ²
<i>Contributors to The Economic Accounts of the United States: Retrospect and Prospect (R & P)—Continued</i>	
11. Provide separate estimates of wages and salaries and of compensation for time not worked.	Not implemented.
12. Provide estimates of gross corporate product and of corporate unit costs by industry.	Not implemented.
13. Provide more fixed-weighted price indexes.	A GNP fixed-weighted (and a chain) price index was introduced in the March 1969 SCB . By 1976, it was provided quarterly for GNP components. By 1980, some additional detail was introduced.
14. Provide estimates of allocations between consumers and others for purchases such as automobiles.	Auto output (as product, introduced in the February 1963 SCB) and truck output (introduced in 1980) show allocations to final sales categories and to change in business inventories.
15. Provide other series: Stock options; national expenditures for medical care and for research and development; productivity in trade and services.	Not implemented.
16. Provide estimates of total factor productivity.	Assigned to the Bureau of Labor Statistics and implemented by that agency in 1983.
17. Provide estimates of the "environment."	Beginning with capital expenditures by business for air and water pollution abatement in the July 1974 SCB , estimates were provided as part of a program to estimate expenditures in a NIPA framework. Estimates were expanded in the February 1975 SCB to include expenditures of all sectors and for all types of pollution abatement and control and in the February 1979 SCB to include constant-dollar estimates.
B. Improved series	
1. Improve the methodology for estimating constant-dollar producers' durable equipment.	An improved methodology was introduced in the July 1975 SCB .
2. Improve the price and constant-dollar estimates for merchandise trade.	Price indexes for merchandise exports and imports, prepared by the Bureau of Labor Statistics, were substituted (with some exceptions) for unit-value indexes in 1983.
3. Introduce specification pricing for deflating purchases of labor services by government, households, and nonprofit institutions.	Beginning in 1976, an attempt was made to approximate specification pricing for purchases of labor services of government employees.
4. Improve the estimates of consumer interest.	Not implemented, although there is interest in doing so.
5. Improve income-size distribution estimates and supplement them with longitudinal income-size distributions and distributions of wealth.	Work on improved distributions was discontinued in 1981 (due to budget constraints). The other recommendations were not implemented.
D. Concepts and structure of economic accounts	
1. Provide estimates of "welfare."	Not implemented—at least as some proponents proposed. However work premised on the assumption that well-being is derived from more than the marketed goods and services in the NIPA's was initiated in 1977, but discontinued in 1981 (due to budget constraints). Estimates of services of consumer durables were presented in the July 1980 SCB ; other studies—for example, on the value of household work and on education and training costs—were published as working papers. <i>See also R & P D.4.</i>
2. Provide sector saving and investment accounts.	Not implemented, by direction of statistical coordinating office; <i>see also NARC D.1.</i>
3. Provide separate current and capital accounts for government.	By 1976, gross fixed capital formation for the Federal Government and for State and local governments was provided. <i>See also NARC A.4.a.</i>
4. Reassess the distinction between consumption and investment.	Although there are no plans to alter the NIPA definitions in a major way, work done outside BEA on alternative sets of accounts, including those that would redefine investment, appeared in the SCB in May and November 1982 and in January 1985 to encourage discussion of economic accounting concepts.
5. Modify the NIPA's to permit better integration with microdata.	Not implemented; however, work indicated in NARC D.3 on nonprofit institutions and trust funds and in R & P B.5 would have moved toward the needed modifications.

See footnotes at end of table.

Appendix A.—Recommendations Related to the NIPA's Drawn From Four Representative Studies—Continued

Recommendation ¹	Comment ²
Contributors to <i>The Economic Accounts of the United States: Retrospect and Prospect (R & P)</i>— Continued	
<p>E. Other</p> <p>1. Provide more analysis.</p> <p>2. Provide a statement of the methodology used to estimate the NIPA's.</p> <p>3. Provide statistical links to related data:</p> <p style="padding-left: 20px;">a. Provide derivations of NIPA components from source data.</p> <p style="padding-left: 20px;">b. Provide reconciliations with similarly defined estimates, such as the Index of Industrial Production and the BEA quarterly plant and equipment expenditures survey.</p> <p>4. Provide measures of error in NIPA estimates.</p> <p>5. Publish topical methodological notes.</p>	<p>Analyses in the <i>SCB</i> have dealt with NIPA components—for example, residential investment, farm output, national defense purchases, net exports, and corporate profits—as well as other topics, including productivity, saving measures, the underground economy, and cyclically adjusted Federal budget and debt.</p> <p>Implementation is to be by a series of papers; an introduction to national economic accounting was in the March 1985 <i>SCB</i>, and a paper on corporate profits was released in May 1985. Work is underway on papers on net exports and government transactions, to be completed in spring 1986.</p> <p>A table relating corporate profits to Internal Revenue Service (IRS) data predated the recommendation. In 1976, tables relating nonfarm proprietors' income and capital consumption to IRS totals were provided. In 1980, a table relating net farm income to farm operators' income from the Department of Agriculture was provided. <i>See also NARC A.3.a.</i></p> <p>Reconciliations of quarterly changes in compensation per hour with average hourly earnings and of the implicit price deflator for personal consumption expenditures with the Consumer Price Index (later discontinued) were introduced in the May 1974 <i>SCB</i>. A reconciliation of personal income with Internal Revenue Service adjusted gross income was introduced in the November 1981 <i>SCB</i>. Work continues on reconciliations with the Index of Industrial Production and with the BEA quarterly plant and equipment expenditures survey.</p> <p>Implementation is in the form of revision studies; the latest of these is Parker, "Revisions in the Initial Estimates . . .," referred to in the text.</p> <p>An <i>SCB</i> "Special Note" series initiated in September 1981 provides methodological and analytical discussions of components of special current interest. By 1985, personal interest income, Commodity Credit Corporation transactions, defense purchases, profits of financial corporations, and reinvested earnings of incorporated affiliates were discussed.</p>
Gross National Product Data Improvement Project Report (GNP DIP): Recommendations Directed to BEA and General Recommendations	
<p>A. New series and more detail for existing series</p> <p>1. Extend the monthly estimates of personal income to encompass the broad aggregates of its disposition—taxes, expenditures, and saving.</p> <p>2. Provide quarterly GNP estimates for the proposed 75-day release unadjusted for seasonal variation for as many components as feasible.</p> <p>B. Improved series</p> <p>1. Improve the services and income components of net exports.</p> <p style="padding-left: 20px;">a. Expand the program of bilateral reconciliation of balance of payments statistics with major trading partners.</p> <p style="padding-left: 20px;">b. Develop more direct measures for deflation.</p> <p>2. Put the project to develop quarterly constant-dollar estimates of defense purchases on a permanent basis.</p> <p>3. Reconsider use of productivity measures for deflating Federal Government employee compensation.</p> <p>See footnotes at end of table.</p>	<p>Monthly estimates of all components of the personal income and outlay account were introduced in the November 1979 <i>SCB</i>.</p> <p>See <i>R & P A.2</i>.</p> <p>By 1980, in addition to work described under b, several improvements, including the addition of reinvested earnings to receipts and payments of income on direct investment, were introduced, and work is currently underway to improve the source data for nonfactor services.</p> <p>Not implemented (although reconciliations with Canada continue).</p> <p>By 1980, the use of the implicit price deflator for net domestic purchases to deflate factor income was substituted for use of indexes related to commodities and selected services, and several specific price indexes were introduced for nonfactor services.</p> <p>Work on national defense purchases was made part of BEA's regular program.</p> <p>Not implemented; see <i>also R & P B.3</i>.</p>

Appendix A.—Recommendations Related to the NIPA's Drawn From Four Representative Studies—Continued

Recommendation ¹	Comment ²
Gross National Product Data Improvement Project Report (GNP DIP)—Continued	
<p>C. Periodicity, timeliness, and revision schedules</p> <p>1. Institute the preparation of a revised quarterly GNP estimate 75 days after the close of a quarter.</p> <p>2. Incorporate quinquennial benchmarks into annual and quarterly GNP 1 year after the relevant input-output table has been completed.</p>	<p>A 75-day estimate of GNP was published beginning in 1977</p> <p>The 1977 input-output table was published in the May 1984 <i>SCB</i>, along with preliminary revised estimates of GNP consistent with it. The comprehensive NIPA revision scheduled for December 1985 will incorporate the input-output table into the annual and quarterly series.</p>
<p>E. Other</p> <p>1. Publish a handbook on the NIPA's, detailing concepts, data sources, estimating methodology, and their limitations.</p> <p>2. Provide more complete and timely statement of major judgments used and their rationale for GNP estimates released 15 days after the reference quarter.</p> <p>3. Assess whether the published detailed components meet the reliability standards for publication, and indicate their recent estimating errors.</p> <p>4. Cross-check more product and income components with the quinquennial input-output tables.</p> <p>5. Conduct a comprehensive evaluation of the sampling procedures and statistical methodology of the quarterly plant and equipment expenditures survey.</p>	<p>See <i>R & P</i> E.2.</p> <p>A table showing key source data and projections of missing data for current-dollar GNP and for prices was introduced in the October 1978 <i>SCB</i> and continues to be available on request.</p> <p>See <i>R & P</i> E.4.</p> <p>See <i>GNP DIP</i> C.2.</p> <p>An evaluation was carried out and the results incorporated in the comprehensive revisions of plant and equipment expenditures series presented in the February 1985 <i>SCB</i>.</p>
"Round Table of GNP Users," 1979 Conference on Research in Income and Wealth ("Users")	
<p>B. Improved series</p> <p>1. Extend the estimates that now go back to 1929 to at least 1926.</p> <p>2. Improve the measurement and presentation of the inventory valuation and capital consumption adjustments, with the latter as an adjustment to combined corporate profits and net interest.</p> <p>3. Improve the measurement of government, including separate current and capital account spending.</p> <p>4. Improve the measurement of exports and imports by replacing unit values with price indexes.</p> <p>5. Pay increased attention to problems for the NIPA's brought about by inflation:</p> <p style="padding-left: 20px;">a. Develop more estimates based on physical volume data, especially for inventories and in "fringe" areas, to use as cross-checks on deflation methods.</p> <p style="padding-left: 20px;">b. Analyze the effects of using alternative base periods for measures of prices and volume.</p>	<p>Not implemented.</p> <p>Not implemented.</p> <p>See <i>R & P</i> D.3.</p> <p>See <i>R & P</i> B.2.</p> <p>Not implemented.</p> <p>Such studies are being conducted in preparation for the 1985 comprehensive NIPA revision, when the base period will be shifted from 1972 to 1982.</p>
<p>C. Periodicity, timeliness, and revision schedules</p> <p>1. Provide a broader and more comprehensive set of measures at more frequent intervals.</p>	<p>A "flash" estimate of GNP, limited to major aggregates, was published from September 1983 to January 1986. In addition, as of 1985, detailed sets of estimates were released 15 days after the close of a quarter beginning in 1965), 45 days after (beginning in 1958 for constant-dollar estimates), and 75 days after (beginning in 1977). See also <i>GNP DIP</i> A.1.</p>

See footnotes at end of table.

Appendix A.—Recommendations Related to the NIPA's Drawn From Four Representative Studies— Continued

Recommendation ¹	Comment ²
“Round Table of GNP Users,” 1979 Conference on Research in Income and Wealth (“Users”)— Continued	
<p>D. Concepts and structure of economic accounts</p> <ol style="list-style-type: none"> 1. Limit the NIPA's to components that can be “measured;” that is, eliminate components constructed to fill gaps in coverage or to implement the conceptual design. 2. Provide estimates and analyses of “welfare.” 3. Provide more complete reconciliation and integrated publication of the NIPA's with input-output and with the flow of funds. 4. Provide more regional estimates consistent with the NIPA's, including corporate profits and interregional trade flows. 5. Use gross domestic product, rather than gross national product, as the basic measure for analysis. <p>E. Other</p> <ol style="list-style-type: none"> 1. Provide more information about statistical discrepancies—size, stability, and allocation. 2. Expand the amount of information available about errors. 	<p>Not implemented.</p> <p>See R & P D.1.</p> <p>See NARC D.1.</p> <p>Experimental estimates of gross state product, consistent with the NIPA's, were completed in 1985, supplementing estimates of personal income for regions, States, counties, and metropolitan areas.</p> <p>Not implemented, but gross domestic product continues to be readily available in tables and has been supplemented by gross domestic purchases, another aggregate that helps in the analysis of international impacts, and by “command” measures of income and product, introduced in the May 1981 SCB.</p> <p>Not implemented</p> <p>See R & P E.4.</p>

NIPA National income and product accounts.

SCB Survey of Current Business.

1. For each study, recommendations have been placed in five groups: New series and more detail for existing series; improved series; periodicity, timeliness, and revision schedules; concepts and structure of economic accounts; and other.

2. Summaries in the “Comments” column are largely keyed to the comprehensive (benchmark) revisions of the NIPA's, which were published in 1954, 1958, 1965, 1976, and 1980. Major develop-

ments between their dates are noted by reference to specific **SCB** articles. Cross-references are to other recommendations; for example, “see also **R & P** A. 13” is to the 13th recommendation in group A for the **Retrospect and Prospect** study.

Source: *The Use of National Income and Product Accounts for Public Policy: Our Successes and Failures*, BEA Staff Paper No. 43, January 1986. For full citations for the four studies, see footnote 3 of text.