RELIABILITY OF THE QUARTERLY NATIONAL INCOME AND PRODUCT ACCOUNTS OF THE UNITED STATES, 1947–71*

BY ALLAN H. YOUNG

U.S. Department of Commerce

The reliability of the quarterly national income and product (NIP) accounts of the United States is examined from several standpoints. First, possible sources of error in the quarterly NIP accounts are explored, the most important being the lack of appropriate data, seasonal adjustment errors, sampling errors and biases, and the nature of the U.S. statistical system. Next, four ways of assessing the reliability of the accounts are considered. The most weight is given to measures of revisions in early estimates of the quarterly NIP aggregates. Results of previous studies of revisions are reviewed, and a summary of a major study of revisions for the period 1947–71 is given. The other ways of assessing reliability which are examined are the effect of errors on economic policy making, analysis of the statistical discrepancy, and expert judgment on sources and methodology.

The degree of accuracy is judged to be generally sufficient for the policy decisions for which the NIP estimates are used. The early estimates of a quarter's change in GNP almost always distinguish whether the ultimate estimate will be large or small and will usually distinguish whether the ultimate estimate will be larger or smaller than the preceding quarter. While the accuracy of the estimates has generally been sufficient, the accuracy for 1965 was judged insufficient by policymakers. There is some evidence that errors have been reduced over time.

INTRODUCTION

Summary and Conclusions

Quarterly estimates of the national income and product (NIP) accounts of the United States have become an indispensable tool for formulating and evaluating economic policy since they were first published 31 years ago. This has resulted in an ever present demand for more accurate estimates and for more timely estimates.[1] The latter demand, which is to a significant extent inconsistent with the former, has resulted in the creation of earlier estimates of GNP; these are, of course, subject to revision as later data become available. This paper examines the reliability of these quarterly estimates. The main focus is on the size of the revisions, but it also considers other ways in which reliability may be examined.

It is difficult to assess the reliability of the NIP estimates. Two quantitative measures are available: revisions in successive estimates and the statistical discrepancy. These measures can be supplemented with expert judgment as to data sources and methodologies and with experience in using the estimates in policy making.

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[1]Recently, the demand for more accuracy has been expressed in the establishment of a GNP Data Improvement Committee by the Office of Statistical Policy in the Office of Management and Budget. This committee is charged with planning improvements in the basic data used in preparing the NIP estimates.

The statistical discrepancy provides some crude indications as to the total error in the quarterly changes in total GNP. It suggests that a large part of the total error in the early estimates remains in the revised estimates.

The average revisions of the quarterly changes in GNP in the 1964–71 period have been small. The revisions between the first published estimates prepared 15 days after the close of the quarter and the latest available estimates have averaged 16 percent of the quarterly change in GNP. The revisions in the projections prepared 15 days before the close of the quarter are not much larger than those in the first published estimates. With average revisions of this size, the early estimates almost always provide an accurate indication of whether the ultimate estimate of a quarter's change (as measured by the latest available estimate) will be large or small and will usually distinguish whether the ultimate estimate will be larger or smaller than the preceding quarter. This degree of accuracy is generally sufficient for the policy decisions for which the numbers are used. However, it is incumbent on the national income accountant to prepare numbers that are more accurate than the minimum needs for today's policy making. Without this extra accuracy, future improvements in policy making and in economic theories are hampered.

The available evidence suggests that the error in the NIP estimates has been reduced over time. The revisions between the early estimates of the quarterly GNP change and those made in the following July in the 1964–71 period are roughly one half the size of those in earlier years. The statistical discrepancy also suggests that the total error in the quarterly changes had been reduced. However, the later period is yet to be benchmarked, and the size of the error that will be disclosed by the revision is unknown.

While the accuracy of the estimates generally has been sufficient, the quality of the numbers for the year 1965 was judged inadequate by policy makers. Errors the size of those in 1965 could occur again in a crucial period when economic policies are being designed.

The current concern with accuracy has been highlighted by two recent revisions which were "front page news," especially for Government policy makers and economists. A review of the nature and causes of these revisions will serve as an introduction to our consideration of the reliability of the U.S. NIP accounts.

July 1971 Revision of Corporate Profits

The first of the two revisions occurred in July 1971, when estimates of corporate profits were revised downward very sharply for 1969 and 1970. Table 1 shows the annual estimates of corporate profits before and after the July 1971 revision.

This revision "rewrote history" by changing the increase of $2.5 billion in 1969 to a decrease of $3.4 billion. The size of the revision and the clear difference in the direction of change was unprecedented in our past measurements of corporate profits. The implication of the revision for policy makers was that the factual underpinnings of this part of the NIP accounts are subject to major uncertainties at the time policies have to be formulated.

TABLE 1

CORPORATE PROFITS BEFORE TAXES, 1967 TO 1970
(BILLIONS OF DOLLARS)

	Annual Totals				Change from Previous Year		
	1967	1968	1969	1970	1968	1969	1970
Before July 1971	79.8	88.7	91.2	81.3	8.9	2.5	−9.9
Revised July 1971	79.8	87.6	84.2	75.4	7.8	−3.4	−8.8
Revision	—	−1.1	−7.0	−5.9	−1.1	−5.9	1.1

How did the revision arise? The revision was largely in the profits of manufacturing corporations and, like most revisions, it arose from replacing an early estimate with a later estimate based on more adequate information. In the case of manufacturing, the early and revised estimates were based on information from two separate programs for the collection of profits data—programs with substantial differences in definitions and coverage. The revision arose because of a failure to adjust the early estimates for the effect of a change in the importance of one or more of the reconciliation items between the two sources.[2] This failure was the result of a lack of statistical information concerning the reconciliation items which would have permitted an adjustment to the early estimate.

The basis for the early estimate of profits of manufacturing corporations was the sample of shareholder reports on book profits as compiled by the Federal Trade Commission and the Securities and Exchange Commission, while the revised estimate was based on tabulations by the Internal Revenue Service of taxable income as reported on corporate income tax returns. The use of shareholder reports for the early estimates was based on the premise that the tax return profit measure and the book profit measure, after certain adjustments, would show fairly parallel movements, as had been the case through 1968. However, in 1969 the two measures diverged markedly as adjusted book profits increased and taxable income declined.

In obtaining the NIP estimates, both book profits and taxable income were adjusted so as to exclude foreign earnings (remitted earnings are included in the rest of world industry). In addition, book profits were adjusted for the difference for many corporations between straight-line depreciation used in arriving at book profits and accelerated depreciation used in determining taxable income. In obtaining the revised estimates of profits, taxable income was adjusted so as to exclude capital gains. Two types of differences between book profits and taxable income for which adjustments were not possible were differences in the reporting corporate unit (e.g., the extent of consolidation) and differences in accounting conventions.

Since there is little evidence that the effects of changes in consolidation were important, differences in accounting conventions emerges as the most likely culprit. At present, we can do little more than identify various conventions

[2]An alternative explanation that there was a serious processing error or a large sampling error in one of the two programs seems less likely.

which differ and speculate that corporations made unusual use of one or more such conventions in 1969. Among the differences are the following: (1) receipts from installment sales may be included in taxable income as the installments are received, while they are commonly recorded on the books when sales are made; (2) under deferred compensation plans, only actual payments are reported as tax deductions, but the amounts earned are commonly book expenses; (3) expenditures on intangibles are expensed on tax returns and capitalized on books; (4) tax and interest expense incurred on projects under construction are expensed on tax returns and capitalized on books; (5) expenses associated with facility shutdowns are taken when paid on tax returns and when the decision is made to shut down the facilities on some companies' books; and (6) receipts from the sale of oil rights can enter tax and company books in different years.[3]

The July 1971 revision of corporate profits demonstrated that data which do not become available for some time (in this case, two years) after the first estimates of a NIP component are published can necessitate drastic changes in earlier estimates. An instance in which important changes were caused by new data which become available fairly soon after the first estimates were published was the general revision in January 1972 of the 1971 NIP estimates.

January 1972 Revision of GNP

In January 1972, while GNP users were still recovering from the revision in profits, BEA revised downward the estimates of growth in GNP for the first three quarters of 1971. The timing was unusual in that, under the normal schedule, these quarterly estimates were not due to be revised again until July 1972. On only one other recent occasion, in 1966, had such a revision of the previous year's quarters been made in January. Table 2 shows the January 1972 revisions of GNP and its major components.

The revision was made because the Census Bureau had developed new estimates of construction activity and retail sales and the Bureau of Economic Analysis (BEA) had revised its estimates of retail inventories, all of which indicated less strength in the economy during 1971 than had the previous figures. Introducing this new information resulted in downward revisions to GNP of $3.0 billion in the second quarter and $6.2 billion in the third. The revision also was the occasion to bring the 1971 estimates of the NIP accounts into line with the retroactive aspects of the Revenue Act of 1971.[4]

Unlike the revision in corporate profits described in the preceding section, which arose because of differences between two data sources, these revisions arose from improved estimates from the same sources. The improvement in the retail sales data eliminated a serious bias which had developed in the monthly sample of retail stores. The new estimates of construction were based on improved data sources and estimating techniques.

The magnitude of the revisions was such that a decision was made to incorporate the new data in January rather than waiting until July. The revisions

[3]For a more detailed discussion, see "Aggregate Profit Measures, or Where Have All the Profits Gone?" by John A. Gorman, *Business Economics*, January 1972.

[4]The effect of the terroactive features of the Revenue Act on the NIP estimates is described on p.4 of the January 1972 issue of the *Survey of Current Business*.

TABLE 2

GROSS NATIONAL PRODUCT AND MAJOR COMPONENTS, 1971(1) TO 1971(3)

	Billions of Dollars, Seasonally Adjusted at Annual Rates			Quarter-to-Quarter Percentage Changes*	
	1971 (1)	1971 (2)	1971 (3)	1971 (2)	1971 (3)
Gross national product					
Before January 1972	1020.8	1043.1	1060.8	2.18	1.70
Revised January 1972	1020.8	1040.0	1053.4	1.88	1.29
Revision	0.0	−3.1	−7.4	−0.30	−0.41
Personal consumption expenditures					
Before January 1972	644.6	660.9	672.5	2.53	1.76
Revised January 1972	644.9	657.4	668.8	1.94	1.73
Revision	0.3	−3.5	−3.7	−0.59	−0.03
Gross private domestic investment					
Before January 1972	143.8	152.4	153.6	5.98	0.79
Revised January 1972	143.3	152.9	150.8	6.70	−1.37
Revision	−0.5	0.5	−2.8	0.72	−2.16
Net exports of goods and services					
Before January 1972	4.2	−0.5	0.5	−4.7	1.0
Revised January 1972	4.7	0.1	0.0	−4.6	−0.1
Revision	0.5	0.6	−0.5	0.1	−1.1
Government purchases of goods and services					
Before January 1972	228.2	230.2	234.2	0.88	1.74
Revised January 1972	227.9	229.6	233.8	0.75	1.83
Revision	−0.3	−0.6	−0.4	−0.13	0.09

*Except net exports, where measures of quarterly changes are shown in billions of dollars, seasonally adjusted at annual rates.

resulting from the new information were large, although not outside the range of past experience. For total GNP, the revision in the percentage change from the first to second quarter (including a small adjustment for the Revenue Act) amounted to −0.30 percentage points, about two times the average revision between the estimate made 45 days after the end of the quarter and that made in the following July over the past few years. The revision in the percentage change from the second to the third quarter amounted to −0.41 percentage points, about three times the average.[5]

While the revisions in corporate profits and GNP cited above were unusual, they were not unprecedented. In the past 30 years, there have been several (perhaps 4 or 5) such "surprises."

With the present state of the art, basic data sources can deteriorate, as was the case with retail sales. Similarly, methodologies which, for want of better information, rely on constant relationships between two variables can mislead us, as was the case with corporate profits. Constant monitoring and evaluation

[5]Quarterly percentage changes in the U.S. NIP accounts are customarily expressed at annual rates. The percentage changes and the revisions in the percentage changes presented in this paper are *not* expressed at annual rates and are thus about one-fourth the size one is accustomed to with annual rates.

of data sources and methodologies are required simply to stay even with respect to reliability.

Improvements in reliability have not come easily in the past. The basic reason for this is that, compared to many countries, the information provided by the statistical system in the U.S. was quite extensive and of relatively high quality at the time the first official NIP estimates were prepared in the Department of Commerce. This implies that improvements will not come easily in the future, either.

I. Factors Affecting Reliability

How the Estimates are Prepared

Like wine, one must pay attention to the vintage of the estimates of the NIP accounts. One must also be aware of the blending of various types of information in a given estimate. In general, there is more complete information available on an annual basis than on a quarterly basis for use in constructing the estimates. As a result, the quarterly estimates are obtained by interpolating between annual estimates and extrapolating from the most recent annual estimate.[6] Similarly, the annual estimates in many instances represent extrapolations or interpolations of information available in great detail in the economic and demographic censuses, which are conducted every five and ten years, respectively.

The annual information generally provides a more accurate reading than the quarterly for several reasons. In some cases, the annual data are based on larger samples. In others, they 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.

The quarterly indicators used as extrapolators and interpolators are based largely on monthly or quarterly sample surveys conducted by various Government agencies. The most important exception to the use of sample surveys as the source of quarterly information is the budgetary data from the Treasury Department, which are used to estimate Federal government purchases. Another type of exception is areas such as proprietors' and rental income, where only annual information is available. In such areas, the current quarterly estimates are generally obtained by extrapolating past trends.

The schedule for preparing the quarterly estimates of the NIP accounts is as follows: The first estimate is prepared 15 days before the end of the quarter. This estimate, referred to as the "projection," is unpublished and is supplied to several government policy making agencies. For most components, the projection is based on information for one or two months of the quarter. The missing months are obtained on the basis of either a simple projection technique such as repeating the previous month's change or on the basis of the estimator's judgement.

The projection is replaced by a "preliminary" estimate about 15 days after the end of the quarter, which is the first published estimate for that quarter.

[6]The procedure used in most instances to interpolate between annual estimates is an adaptation of that described by V. Lewis Bassie in his *Economic Forecasting* (McGraw-Hill Book Company, New York, 1958), Appendix A.

We shall refer to this estimate as the "15-day estimate." For most components, the 15-day estimate is based on information for two or three months of the quarter. However, in most cases the source data for the second and third months of the quarter are not final and are subject to revision by the issuing agencies.

About 45 days after the end of the quarter, the preliminary estimate is replaced by a "final" estimate. We shall refer to this estimate as the "45-day estimate." In general the 45-day estimate is based on information for all three months of the quarter. However, there are instances in which source data, particularly for the third month, are subject to further revision.

Usually the 45-day estimate of the quarter 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) surveys, especially for the third month of each quarter. More importantly, the July revisions are the occasion for introducing the more detailed and reliable annual data sources.

Following the July revisions, each quarterly estimate is subject to one or more benchmark revisions which incorporate the information obtained in the Nation's economic and demographic censuses. To date, the NIP accounts have undergone five benchmark revisions which were published in 1947, 1951, 1954, 1958, and 1965. Work is currently underway on another benchmark revision which will probably result in a reworking of all the estimates back to 1959.

The above description is simplified in that it glosses over certain details. One important exception to the timetable outlined above is that quarterly data on corporate profits are not available as promptly as other information used in the quarterly estimates. As a result, the projection and 15-day estimates are prepared without benefit of a complete income side check against gross national product. At yearend, corporate profits lag an additional month or more and profits are unavailable at the time of the 45-day estimate as well. Thus, estimates of corporate profits and national income are prepared 45 and 75 days after the close of each of the first three quarters. Fourth quarter estimates are prepared 75 and 105 days after the close of the quarter.

The description also takes no note of the revisions in source information that occur when an agency prepares new seasonal adjustment factors or develops new or improved ways of obtaining information. The Census Bureau's revisions of the retail trade and construction estimates published in the fourth quarter of 1971, which were described earlier, are examples of such revisions.

Appendix A summarizes the data sources used in the current quarterly estimates and in the July revisions.

Sources of Error in the National Income and Product Estimates

One source of error, as illustrated by the revision of the 1969 corporate profits estimate, is that in some cases the coverage and definitions of the available data do not meet the requirements of the NIP accounts. Even if adjustments are made in an attempt to achieve the desired definitions, errors result.

Another source of error is the sampling errors, biases, etc., inherent in the monthly and quarterly sample surveys used for the NIP quarterly estimates.

The complete universe counts used annually and for the benchmarks also contain biases and other non-sampling errors.

In considering sources of error, particularly those related to coverage and definitions, one should not overlook the nature of the U.S. statistical system. The system was not designed to meet the needs of national income accountants. The statistics available to national income accountants in the U.S. are, by and large, data that, over the years, have been designed to meet a variety of needs. The statistics have grown out of different traditions in different government departments. In many instances, the statistics are collected to carry out administrative programs, so that the coverage and definitions are designed to serve specialized administrative needs. As a result, 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 in the U.S. is faced with the need for much painstaking piecing together and adjusting of numbers.

Certain types of errors, when identified, can be removed or reduced, given a "reasonable" amount of additional resources. Sampling errors and some non-sampling errors can often be reduced. Some errors related to the coverage and definitions of the source data can also be reduced or eliminated through extensions of existing data collection programs or with the advent of new programs.

However, prospects for reducing certain errors do not appear promising. For example, in some areas, further improvement in reliability almost immediately encounters a lack of the needed information in the records of the persons or businesses who would be called on to supply the information. To move ahead requires that a level of resources many times greater than that now employed be devoted to supplying and collecting information. This addition to present resources would be so large as to make substantial progress in certain areas difficult, expensive, and perhaps quite impractical. Three examples of this type of constraint are discussed here.

One example is in the collection of better inventory statistics on a more frequent than annual basis, especially at the retail and wholesale levels. This constraint arises because many firms do not keep track of total inventories during the year. Some do not even take a physical count once a year.

Surveys conducted by the Bureau of the Census show that many respondents in the monthly sample of retail firms do not keep inventory records on a less than annual basis and so report guesses as to the level of their monthly inventories. Possibly only the record-keeping reporters should be tabulated, but there is also reason to suspect the quality of some of these reports, and there is no basis for assuming that they are a representative sample of all firms.

The change in business inventories component is presently one of the least reliable components of GNP. Unfortunately, it is not clear that any substantial improvement is feasible in the trade sub-component.

Another example is in the mixing of calendar year and fiscal year data. 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 used for their financial reports rather than a calendar year. While some improvement would be possible if fiscal year data were better identified and tabulated separately, the accuracy of the numbers for use in the NIP accounts

would still not be completely satisfactory. The way to gain in accuracy would be to require calendar year reporting. Such a requirement would be a major reporting burden. 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 do not report that transaction at the same time.

The third example is another where there is a lack of synchronization of the data used to estimate the various flows in the NIP accounts. Once again, one of the affected components of GNP is change in business inventories. At a given moment, there are goods in transit between a buyer and seller which are often, at that point, recorded in neither the buyer's nor the seller's books. As long as this "float" remains constant, the accuracy of the estimates of inventory investment is little affected. However, our judgement is that this float varies substantially, especially in periods of major strikes.

While inventory float has probably been a major source of error, it may not be as resistant to improvement as are some other factors. It would seem to be possible to estimate inventory float by means of special studies of accounting practices and surveys of goods in transit and thereby correct the estimates for timing differences.

Another constraint on improving the reliability of the estimate is the error inherent in seasonal adjustment methods. Even if the basic, unadjusted data were completely error free, the process of seasonally adjusting the figures would impose errors on the seasonally adjusted data.[7] Some idea as to the size of the errors can be gained by examining the revisions in the seasonal factors.

The available evidence indicates that the revisions in the quarter-to-quarter changes in the seasonal factors are of roughly the same magnitude as the revisions in the quarter-to-quarter changes in seasonally adjusted GNP.[8] This is not to say that seasonal factor revisions account for all the revision in GNP, but it does suggest that the seasonal factor revisions are a major contributor to the

[7]Sometimes econometricians suggest that BEA should place more emphasis on the preparation of seasonally unadjusted estimates. At present, only the product side components of GNP are prepared in seasonally unadjusted form. The income side components are not so prepared. The reason for the suggestion is the notion that it is preferable to use unadjusted data in an econometric model and incorporate any necessary seasonal allowances in the model. The desirability of this approach to model building depends basically on whether suitable seasonal allowances can be specified in an econometric model. Putting this question aside, a basic difficulty remains which prevents BEA from readily responding to the request. At present it is not possible to prepare several income side components in unadjusted form given the available source data. For example, much of proprietors' income is estimated on the basis of trend lines through annual numbers. Such a procedure probably provides a satisfactory approximation on a seasonally adjusted basis. However, in the absence of a quarterly survey of proprietors' income, there is little basis for estimating the seasonal variation required for an unadjusted series.

[8]It is next to impossible to isolate the exact amount of revision which arises from replacing preliminary seasonal factors with revised estimates. The difficulty arises because the seasonal adjustments are made to detailed components, mainly by the agencies which provide the source data to BEA. One shortcut is to examine the revisions in the seasonal factors from two direct adjustments of total GNP where one adjustment contains, say, two additional years of data. The seasonal factor revisions in this case are somewhat larger than the revisions between the seasonally adjusted GNP as published in July of the succeeding year and that published two years later. Another approach is to examine the revisions in the seasonal factors implicit between GNP as published in seasonally adjusted and unadjusted form. Such revisions tend to be larger than those obtained with the first approach.

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 has been expended in developing methods of seasonal adjustment. The prospects for substantial improvement do not appear promising. Thus, seasonal adjustment error will remain as a reliability constraint.

II. Ways to Assess Reliability

The reliability of the NIP estimates can be assessed in several ways. Among the various approaches are consideration of the nature of revisions in early estimates, the extent to which inadequacies in the estimates affect economic policy making, analysis of the statistical discrepancy, and expert judgment of the adequacy of the data sources and methodology. None of these provide a complete assessment and they must be combined judiciously in any attempt at an overall view.

Revisions—Previous Studies

The amount of revision between an early estimate and a later estimate provides a partial measurement of the error in the early estimate (provided that the later estimate is more accurate). The revision is only a partial measure of error because an element of error which cannot be measured remains in the later or final estimate. Because the amount of error in the final estimate is not uniform across components, one cannot rank components as to their reliability solely on the basis of revisions. The extreme case is that of a highly unreliable component that is never revised because no additional information is available later. Similarly, because the amount of error in the later estimates may not be constant over time, one cannot obtain an unambiguous measure of improvement over time in the early estimate.

When combined with other approaches, revisions are useful in arriving at an overall assessment of reliability. Used alone, they are useful as an indicator of the range of revision expected in the estimate of the current quarter. They also point to particular components (but not all components) in which the early estimates stand in need of improvement.

The two most thorough studies of revisions in the U.S. income and product accounts have been those by George Jaszi and Rosanne Cole.[9] These two studies are described briefly below.

[9]"The Quarterly National Income and Product Accounts of the United States, 1942–62" by George Jaszi, paper presented at the 1963 meetings of the International Association for Research in Income and Wealth, published in *Studies in Short-Term National Accounts and Long-Term Economic Growth*, Simon Goldberg and Phyllis Deane, ed., Income and Wealth: Series XI, 1965; and *Errors in Provisional Estimates of Gross National Product* by Rosanne Cole, National Bureau of Economic Research Studies in Business Cycles No. 21, 1969. Other studies include "Data Revisions and Economic Forecasting" by H. O. Stekler, *Journal of the American Statistical Association*, June 1967; "A Note on Provisional Estimates of the Gross National Product and Its Major Components" by Peter E. DeJanosi, *Journal of Business*, October 1961; and "A Statistical Analysis of Provisional Estimates of Gross National Product and Its Components, of Selected National Income Components, and of Personal Saving" by Arnold Zellner, *Journal of the American Statistical Association*, March 1958.

George Jaszi compared quarterly changes in the estimates prepared 45 days after the end of the quarter with the latest available estimates for the period 1947–61. Combining this information with his expert judgment as to data sources and use of the NIP figures in policy making, he concluded that "the entries into the system, even though they lack precision, are usually solid enough to give a correct indication of the direction in which aggregate economic activity is moving and of whether the change is large or small." He also stressed that the "most important function of NIP statistics is not the exact measurement of the ups and downs of aggregate income and production or their components, but the provision of empirical material for the study of the cause-and-effect relationships that determine the economic process."

Jaszi's measures of the revisions in total GNP for the period 1947–61 are shown in Table 3. He also computed similar measures for the components of GNP and for national income and its components. It is well to keep in mind that the size of the revisions in many of the components is much larger than that in total GNP.

Jaszi computed five summary measures of revisions in quarterly percent changes:[10]

Bias was computed as the average of the differences between the initial measure of percentage change and the final measure. Let P represent the preliminary percentage change, F the final percentage change, and n the number of quarterly changes involved. Then bias is $\Sigma(P - F)/n$.

Relative bias was obtained by taking the ratio of the bias to the average of the final percent changes

$$100\left(\frac{\Sigma(P-F)/n}{\Sigma F/n}\right) = 100\left(\frac{\Sigma(P-F)}{\Sigma F}\right).$$

Dispersion was calculated as the average of the absolute differences $\Sigma|P - F|/n$.

Relative dispersion was calculated as

$$100\left(\frac{\Sigma|P-F|/n}{\Sigma|F|/n}\right) = 100\left(\frac{\Sigma|P-F|}{\Sigma|F|}\right).$$

In addition, the number of quarters in which the *direction* of the preliminary change was different than the final change was tallied and expressed as a percentage of the total number of changes.

On average for 1947–61, the 45-day estimates of quarterly percent changes in GNP were 0.17 percentage points low in comparison to the percent changes in the latest available estimates. This understatement was 11 percent of the average quarterly change of 1.50 percent in the latest available estimates. The average absolute error amounted to 0.68 percentage points, which was 35 percent of the average absolute change of 1.92 percent in the latest available estimates.

[10]These measures were first developed by Raymond Nassimbene and Benjamin T. Teeter in *Revisions of First Estimates of Quarter-to-Quarter Movement in Selected National Income Series, 1947–1958 (Seasonally Adjusted Data)*, Statistical Evaluation Report No. 2, U.S. Bureau of the Budget, February 1960.

TABLE 3

REVISIONS IN QUARTERLY CHANGES OF GROSS NATIONAL PRODUCT (JASZI)

	Bias (percentage points)	Relative Bias (percent)	Dispersion (percentage points)	Relative Dispersion (percent)	Directional Misses (percent)
1947–61	−0.17	−11	0.68	35	8
1947–52	−0.29	−14	0.84	34	9
1953–56	−0.21	−19	0.52	36	12
1957–61	−0.03	− 3	0.31	18	0

Source: Tables 3 and 5 in Jaszi (see reference, footnote 9).

The measures shown in Table 3 suggest an improvement in accuracy over time. However, at the time the study was conducted, the latest benchmark was for 1954. Subsequently, the 1958 benchmark was completed with the later years of the period being subject to more revision than the earlier years. As a result, the measures reflect different vintages of latest available estimates and do not necessarily indicate improvement.

In 1969, Rosanne Cole published a study of revisions in the changes and levels of quarterly GNP for the period 1947 to 1963.[11] Her study was conducted after the major revision of 1965, which introduced the 1958 benchmark estimates and which revised the quarterly series back to 1947. As a result, particularly for the post-1954 period, Cole had a "more final" standard for comparison than did Jaszi. Cole examined revisions in the 15- and 45-day estimates, the first, second and third July estimates, and the benchmark estimates.

Cole used as a standard of accuracy against which the size of revisions might be compared the errors arising from naive projections of no change (i.e. same as last quarter's change) and extrapolations based on first order autoregressions. Table 4 shows Cole's summary measures of the revisions between the 45-day estimates and the benchmark estimates of the quarterly change in total GNP and compares the revisions with the errors obtained by extrapolation for the period 1947–61 and two sub-periods, 1947–54 and 1955–61.

TABLE 4

REVISIONS IN QUARTERLY CHANGES OF GROSS NATIONAL PRODUCT (COLE)

	Average Absolute Change (billion $)	Mean Error (billion $)	Standard Deviation of Error (billion $)	Ratio of Revision to Error in Extrapolation	
				Last Quarter's Change	First Order Autoregressive
1947–61	6.7	−0.6	3.2	0.40	0.57
1947–54	N.A.	−1.0	3.8	N.A.	0.85
1955–61	N.A.	−0.4	2.9	N.A.	0.48

Source: Tables 1, 7, and 11 in Cole (see reference, footnote 9).

[11]This review omits several topics included in Cole's report, including revisions in GNP levels and cyclical patterns.

The types of measures used by Cole are not the same as those used by Jaszi. While Jaszi considered revisions in quarterly percentage changes, Cole's revisions are computed in absolute terms in dollars. The difference in technique prevents a direct comparison of the two studies. However, if Cole's mean error and standard deviation of error are expressed as percentages of the average absolute change, which is also shown on the table, one obtains rough measures of relative error which are of about the same magnitude as Jaszi's. The mean error of −$0.6 billion becomes −9 percent as against Jaszi's relative bias of −11 percent and the standard deviation of error of $3.2 billion becomes 48 percent as against Jaszi's relative dispersion of 35 percent for the period 1947–61.

For the entire period, Cole found that the revisions were 40 percent as large as the errors that would result from the assumption that the quarter's change is the same as the previous quarter's. Compared with the more stringent autoregressive standard, the revisions were 57 percent as large as would be obtained with the extrapolation. Cole also found improvement over time, but it was less marked than that in Jaszi's pre-benchmark measures, especially when compared against the extrapolations, which also performed better in the second sub-period than in the first.

While the accuracy of the 45-day estimates of total GNP compares favorably with the extrapolations, the comparisons are less favorable for some components. For the entire period and for the first sub-period, revisions in consumer purchases of services, purchases of State and local governments, and net exports are as large or larger than the errors which would be obtained by using a first order autoregressive extrapolation to obtain the 45-day estimates. In the second sub-period, the extrapolation performed as well or better than the 45-day estimate for consumer purchases of nondurables and services and purchases of State and local governments.

Cole compared the size of the successive revisions in the estimates of a quarterly change. Of the total revision between the 45-day estimate and the benchmark estimate for total GNP, the three successive July revisions removed less than 40 percent. Over 60 percent remained until the benchmark revision. In addition, she examined the direction of each revision to determine if it was a success; i.e., moved the estimate closer to the final benchmark estimate. The 45-day estimate of total GNP was closer to the final than was the 15-day in 52 percent of the cases. The first July revision scored an improvement in 56 percent of the cases, the second July in 75 percent of the cases, and the third July in 68 percent. In view of this record, Cole suggested that perhaps the 45-day estimate could be eliminated.

Revisions—Present Study

This section presents results of a study of the revisions in the quarterly percent changes in the NIP estimates for the period 1947–71. The estimates examined were the projection, 15-day, 45-day, first July and latest available estimates. The second and third July estimates were not considered. Each set of early estimates was compared against each set of later estimates for the longest period for which continuous series are available for both sets—1947–71 where possible for estimates in current dollars and 1965–71 for estimates in constant

1958 dollars. Current-dollar comparisons were also made for two sub-periods 1947–63 and 1964–71. The first sub-period is the longest period for which the first July estimates can be compared with data adjusted to the 1965 benchmark. In the second sub-period, the latest available estimates are for most years the third July estimates. The July 1972 revision was the latest annual revision included.

Because several definitional revisions were introduced in the 1965 benchmark, it was necessary to adjust the early estimates through the first quarter of

TABLE 5

DISPERSION IN REVISIONS IN QUARTERLY PERCENTAGE CHANGES FOR SEASONALLY ADJUSTED GROSS NATIONAL PRODUCT AND ITS COMPONENTS, 1964 (1) TO 1971 (4)

GROSS NATIONAL PRODUCT	Latest Available Estimates Compared with: Projection Estimates*	15-day Estimates	45-day Estimates	First July Estimates
Gross national product	0.33	0.30	0.24	0.15
Personal consumption expenditures	0.27	0.32	0.24	0.15
Durable goods	1.21	1.00	0.87	0.71
Nondurable goods	0.61	0.57	0.43	0.29
Services	0.35	0.32	0.30	0.19
Gross private domestic investment	1.82	1.53	1.31	0.91
Fixed investment	1.10	1.02	0.94	0.62
Nonresidential	1.12	1.20	1.06	0.60
Structures	2.55	2.08	1.83	1.25
Producers' durable equipment	1.56	1.87	1.54	0.93
Residential structures	2.85	2.62	2.48	1.71
Change in business inventories†	2.50	1.73	1.77	1.30
Net exports of goods and services†	0.99	0.72	0.80	0.28
Exports	1.89	1.57	1.48	0.46
Imports	2.02	1.38	0.80	0.32
Government purchases of goods and services	0.65	0.59	0.50	0.30
Federal	0.87	0.93	0.78	0.37
National defense	0.96	1.06	0.88	0.55
Other	3.12	2.94	2.88	1.48
State and local	0.81	0.96	0.73	0.49
RELATION OF GNP TO NATIONAL INCOME				
Gross national product	—	—	—	—
Less: Capital consumption allowances	0.51	0.56	0.60	0.43
Indirect business tax and nontax liability	0.69	0.56	0.52	0.44
Business transfer payments	—	—	—	—
Statistical discrepancy†	N.A.	N.A.	1.18	0.87
Plus: Subsidies less current surplus of government enterprises	0.35	0.35	0.30	0.37
Equals: National income	N.A.	N.A.	0.31	0.15

*Projection comparisons are for 1965 (1) to 1971 (4).

†Measures for change in business inventories, net exports, and statistical discrepancy are based on billions of dollars, seasonally adjusted at annual rates.

1965 for the effects of these revisions, the largest of which involved the deletion of interest paid by consumers from the personal consumption expenditures component of GNP and the net interest component of charges against GNP. A summary of these revisions is given on page 12 of the August 1965 *Survey of Current Business.*

TABLE 6

DISPERSION IN REVISIONS IN QUARTERLY PERCENTAGE CHANGES FOR SEASONALLY ADJUSTED NATIONAL INCOME AND RELATED MEASURES 1964 (1) TO 1971 (4)

NATIONAL INCOME BY TYPE OF INCOME	Latest Available Estimates Compared with: Projection Estimates*	15-day Estimates	45-day Estimates	First July Estimates
National income	N.A.	N.A.	0.31	0.15
Compensation of employees	0.29	0.29	0.28	0.28
Wages and salaries	0.31	0.32	0.30	0.17
Private	0.37	0.35	0.34	0.19
Government	0.45	0.42	0.35	0.21
Supplements to wages and salaries	0.66	0.69	0.70	0.40
Proprietors' income	1.28	1.13	1.20	0.64
Business and professional	0.93	0.96	0.91	0.67
Farm	4.11	4.07	4.29	2.68
Rental income of persons	0.71	0.85	0.79	0.54
Corporate profits and inventory valuation adjustment	N.A.	N.A.	1.51	0.97
Profits before tax	N.A.	N.A.	1.36	0.98
Inventory valuation adjustment†	1.63	0.69	0.71	0.58
Net interest	1.05	1.28	1.23	0.87
PERSONAL INCOME AND RELATED SERIES				
National income	—	—	—	—
Less: Corporate profits and inventory valuation adjustment	—	—	—	—
Contributions for social insurance	0.69	0.69	0.67	0.41
Wage accruals less disbursements	—	—	—	—
Plus: Government transfer payments to persons	0.93	0.81	0.80	0.28
Interest paid by govt. (net) and consumers	—	—	—	—
Dividends	0.93	0.86	0.85	0.58
Business transfer payments	—	—	—	—
Equals: Personal income	0.26	0.22	0.19	0.18
Less: Personal tax and nontax payments	0.82	0.88	0.77	0.31
Equals: Disposable personal income	0.29	0.25	0.25	0.29
Less: Personal outlays	—	—	—	—
Equals: Personal saving	4.36	3.83	4.01	1.90
Addendum: Personal saving as a percent of disposable personal income	0.29	0.31	0.25	0.15

*Projection comparisons are for 1965 (1) to 1971 (4).

†Measures for inventory valuation adjustment are based on billions of dollars, seasonally adjusted at annual rates.

The five measures used by Jaszi—bias, relative bias, dispersion, relative dispersion, and relative number of directional misses—were computed. In addition, three measures of the range of revisions were added—the standard deviation of the revisions, the largest positive (upward) revision, and the largest negative (downward) revision. Also, the relative number of upward, downward, and "no change" revisions were added. The results are summarized below. The full set of tables of revisions is contained in appendix B.

Dispersion, 1964–71

In comparison to the latest available estimates, the revisions in the early estimates of the quarterly changes in current-dollar GNP, on average, have been fairly small in the period 1964–71. The dispersion in percentage points for the projection estimates was 0.33; for the 15-day estimates, 0.30; for the 45-day estimates, 0.24; and for the first July estimates 0.15 (see Table 5). On a relative basis, these measures were 17, 16, 13, and 8 percent, respectively, of the average absolute quarterly change. The corresponding measures for national income were somewhat larger than for GNP for the 45-day estimates and the same size as for GNP for the first July estimates (see Table 6). (National income is not prepared in the projection and 15-day estimates.)

TABLE 7

DISPERSION IN REVISIONS WEIGHTED BY DOLLAR LEVELS, GROSS NATIONAL PRODUCT, 1964 (1) TO 1971 (4)

(Billions of dollars)

GROSS NATIONAL PRODUCT	Latest Available Estimates Compared with:			
	Projection Estimates*	15-day Estimates	45-day Estimates	First July Estimates
Gross national product	—	—	—	—
Personal consumption expenditures	—	—	—	—
Durable goods	1.0	0.8	0.7	0.6
Nondurable goods	1.4	1.3	1.0	0.7
Services	0.8	0.7	0.7	0.4
Gross private domestic investment	—	—	—	—
Fixed investment	—	—	—	—
Nonresidential	—	—	—	—
Structures	0.8	0.6	0.6	0.4
Producers' durable equipment	0.9	1.0	0.9	0.5
Residential structures	0.9	0.8	0.7	0.5
Change in business inventories	2.5	1.7	1.8	1.3
Net exports of goods and services	1.0	0.7	0.8	0.3
Exports	—	—	—	—
Imports	—	—	—	—
Government purchases of goods and services	—	—	—	—
Federal	0.7	0.8	0.7	0.3
National defense	—	—	—	—
Other	—	—	—	—
State and local	0.8	0.9	0.7	0.5

*Projection comparisons are for 1965 (1) to 1971 (4).

This study, which is the first to include the projection estimates, shows that they perform quite well in comparison to the 15-day estimates. The difference in the dispersion for the projection and 15-day estimates when compared with the latest available estimates was quite small for total GNP.

For several components of GNP, the projection estimates performed as well or better than the 15-day estimates. This was the case for personal consumption expenditures (although not for the three sub-components), producers' durable equipment, and Federal and State and local government purchases.

Among the components of national income the projection estimates performed as well or better than the 15-day estimates for wages and salaries (although not for the two sub-components) supplements to wages and salaries, business and professional income, rental income of persons, and net interest.

Table 7 shows the measures of dispersion for the GNP components expressed in terms of dollars. Shown in this form, the measures indicate the average contribution of each component to the revision in the changes in total GNP. The procedure used was to weight the dispersion for each component by the average dollar level of that component in the period 1964–71 (except for change in business inventories and net exports, where the measure of dispersion was already expressed in dollars).

For each of the successive estimates, the largest contributor on average to the revision in the GNP change is the change in business inventories. The next largest is personal consumption expenditures for nondurable goods. If the calculations are performed at the level of the major components (not shown in

TABLE 8

DISPERSION IN REVISIONS WEIGHTED BY DOLLAR LEVELS, NATIONAL INCOME, 1964 (1) TO 1971 (4)

(Billions of dollars)

NATIONAL INCOME BY TYPE OF INCOME	Latest Available Estimates Compared with:			
	Projection Estimates*	15-day Estimates	45-day Estimates	First July Estimates
National income	N.A.	N.A.	—	—
Compensation of employees	—	—	—	—
Wages and salaries	—	—	—	—
Private	1.3	1.2	1.2	0.7
Government	0.4	0.4	0.3	0.2
Supplement to wages and salaries	0.3	0.3	0.3	0.2
Proprietors' income	—	—	—	—
Business and professional	0.4	0.5	0.4	0.3
Farm	0.6	0.6	0.7	0.4
Rental income of persons	0.1	0.2	0.2	0.1
Corporate profits and inventory valuation adjustment	N.A.	N.A.	—	—
Profits before tax	N.A.	N.A.	1.1	0.8
Inventory valuation adjustment	1.6	0.7	0.7	0.6
Net interest	0.3	0.3	0.3	0.2

*Projection comparisons are for 1965 (1) to 1971 (4).

TABLE 9

LARGEST REVISIONS WEIGHTED BY DOLLAR LEVELS, GROSS NATIONAL PRODUCT, 1964 (1) TO 1971 (4)
(Billions of dollars)

GROSS NATIONAL PRODUCT	Latest Available Estimates Compared with:							
	Projection Estimates*		15-day Estimates		45-day Estimates		First July Estimates	
	Upward	Downward	Upward	Downward	Upward	Downward	Upward	Downward
Gross national product	—	—	—	—	—	—	—	—
Personal consumption expenditures	—	—	—	—	—	—	—	—
Durable goods	2.6	−2.0	2.5	−1.2	1.6	−2.8	1.3	−2.1
Nondurable goods	2.0	−3.4	2.7	−3.0	1.7	−3.3	1.6	−1.7
Services	1.3	−1.4	1.3	−1.4	1.0	−1.2	1.0	−1.2
Gross private domestic investment	—	—	—	—	—	—	—	—
Fixed investment	—	—	—	—	—	—	—	—
Nonresidential	—	—	—	—	—	—	—	—
Structures	2.1	−2.2	2.1	−1.5	2.0	−1.2	1.2	−1.7
Producers' durable equipment	2.7	−3.0	2.7	−2.8	2.8	−2.6	1.1	−1.8
Residential structures	1.9	−2.0	1.6	−2.1	1.9	−2.1	1.8	−1.9
Change in business inventories	5.7	−5.9	5.7	−3.9	6.9	−4.1	3.1	−3.1
Net exports of goods and services	1.3	−3.3	1.5	−3.3	2.1	−1.9	0.8	−2.4
Exports	—	—	—	—	—	—	—	—
Imports	—	—	—	—	—	—	—	—
Government purchases of goods and services	—	—	—	—	—	—	—	—
Federal	2.4	−2.1	2.4	−2.4	1.2	−2.5	1.6	−1.3
National defense	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	—	—
State and local	1.7	−1.0	2.3	−1.4	1.7	−1.6	1.7	−0.5

*Projection comparisons are for 1965 (1) to 1971 (4).

TABLE 10

LARGEST REVISIONS WEIGHTED BY DOLLAR LEVELS, NATIONAL INCOME, 1964 (1) to 1971 (4)
(Billions of dollars)

NATIONAL INCOME BY TYPE OF INCOME	Latest Available Estimates Compared with:							
	Projection Estimates*		15-day Estimates		45-day Estimates		First July Estimates	
	Upward	Downward	Upward	Downward	Upward	Downward	Upward	Downward
National income	N.A.	N.A.	N.A.	N.A.	—	—	—	—
Compensation of employees	—	—	—	—	—	—	—	—
Wages and salaries	—	—	—	—	—	—	—	—
Private	2.6	−2.5	2.9	−3.2	2.8	−3.2	2.0	−1.9
Government	2.2	−1.1	2.2	−1.0	0.8	−1.0	1.0	−0.4
Supplements to wages and salaries	0.8	−1.1	0.7	−1.3	0.7	−1.3	0.7	−0.4
Proprietors' income	—	—	—	—	—	—	—	—
Business and professional	1.1	−0.8	1.1	−1.1	1.1	−0.7	0.9	−0.7
Farm	1.9	−1.2	1.8	−1.4	1.8	−1.8	1.4	−1.7
Rental income of persons	0.5	−0.3	0.5	−0.3	0.5	−0.3	0.4	−0.2
Corporate profits and inventory valuation adjustment	N.A.	N.A.	N.A.	N.A.	—	—	—	—
Profits before tax	N.A.	N.A.	N.A.	N.A.	2.8	−3.0	1.0	−1.4
Inventory valuation adjustment	1.9	−1.2	0.5	−1.9	1.7	−2.0	1.1	−1.5
Net interest	0.8	−0.3	0.8	−1.5	0.8	−1.1	0.8	−0.4

*Projection comparisons are for 1965 (1) to 1971 (4).

the table), gross private domestic investment is the largest contributor, followed by personal consumption expenditures.

The largest contributor to the revision in the 45-day estimate of the change in national income is private wages and salaries. The next largest contributor is corporate profits before tax (Table 8). In the revision in the first July estimate, the contributions of private wages and salaries and corporate profits are about the same.

Tables 9 and 10 provide measures of the maximum contribution rather than the average contribution each component might be expected to make to the revision in the total. These measures were obtained by identifying the largest upward and downward revisions in each component and then weighting these two revisions in absolute value by the dollar level of the series.

In terms of the maximum contributions, the largest contributor to the GNP revision is change in business inventories followed by personal consumption

TABLE 11.

RELATIVE NUMBER OF REVISIONS IN CORRECT DIRECTION, SUCCESSIVE ESTIMATES AND SELECTED PERIODS

(Percent)

GROSS NATIONAL PRODUCT	15-day Estimates, 1965–71	45-day Estimates, 1964–71	First July Estimates, 1964–71
Gross national product	64	66	75
Personal consumption expenditures	39	66	69
Durable goods	57	59	66
Nondurable goods	50	66	56
Services	64	66	69
Gross private domestic investment	57	53	69
Fixed investment	61	50	63
Nonresidential	46	72	69
Structures	61	75	63
Producers' durable equipment	43	72	78
Residential structures	57	66	66
Change in business inventories	71	53	66
Net exports of goods and services	63	50	77
Exports	61	50	88
Imports	89	63	75
Government purchases of goods and services	68	59	66
Federal	61	66	75
National defense	68	72	78
Other	75	66	81
State and local	61	69	66
RELATION OF GNP TO NATIONAL INCOME			
Gross national product	—	—	—
Less: Capital consumption allowances	86	81	56
Indirect business tax and nontax liability	71	78	56
Business transfer payments	—	—	—
Statistical discrepancy	N.A.	N.A.	60
Plus: Subsidies less current surplus of government enterprises	75	66	66
Equals: National income	N.A.	N.A.	69

expenditures for nondurable goods. Among the national income components, private wages and salaries and corporate profits before taxes are the largest in terms of maximum contributions.

As discussed earlier, another measure of the quality of a particular estimate is the percent of times it represents a "successful" revision of the earlier estimate; i.e., the number of times the revision moves the earlier estimate of quarter-to-quarter change closer to the "best" measure of change, which is represented by the latest available estimate. Such measures are shown in Tables 11 and 12 for 15-day, 45-day, and first July estimates. If a particular revision is successful for a certain component more than 50 percent of the time, we may conclude that the revision has added to our knowledge in this sense. If it is successful less than 50

TABLE 12

RELATIVE NUMBER OF REVISIONS IN CORRECT DIRECTION, SUCCESSIVE ESTIMATES AND SELECTED PERIODS

(Percent)

NATIONAL INCOME BY TYPE OF INCOME	15-day Estimates, 1965–71	45-day Estimates, 1964–71	First July Estimates, 1964–71
National income	N.A.	N.A.	69
Compensation of employees	54	88	94
Wages and salaries	54	88	84
Private	63	77	84
Government	66	88	82
Supplements to wages and salaries	82	91	56
Proprietors' income	64	78	69
Business and professional	79	88	66
Farm	57	91	66
Rental income of persons	82	100	78
Corporate profits and inventory valuation adjustment	N.A.	N.A.	69
Profits before tax	N.A.	N.A.	69
Inventory valuation adjustment	56	58	82
Net interest	86	91	66
PERSONAL INCOME AND RELATED SERIES			
National income	—	—	—
Less: Corporate profits and inventory valuation adjustment	—	—	—
Contributions for social insurance	71	91	66
Wage accruals less disbursements	—	—	—
Plus: Government transfer payments to persons	79	88	84
Interest paid by govt. (net) and consumers	—	—	—
Dividends	79	97	66
Business transfer payments	—	—	—
Equals: Personal income	75	75	69
Less: Personal tax and nontax payments	57	69	72
Equals: Disposable personal income	57	59	69
Less: Personal outlays	—	—	—
Equals: Personal saving	61	56	75
Addendum: Personal saving as percent of disposable personal income	57	59	69

percent of the time, the revision has a negative impact on our economic intelligence. In terms of the resources involved in producing each different revision, we should expect a success factor of considerably greater than 50 percent to justify the revision.

For GNP, the 15-day, 45-day, and first July revisions were successful 64 percent, 66 percent, and 75 percent of the time, respectively. For national income, the first July revision was successful 69 percent of the time.

Among the components of GNP, the 15-day estimates of personal consumption expenditures and producers' durable equipment were successful less than

TABLE 13

BIAS IN REVISIONS IN QUARTERLY PERCENTAGE CHANGES FOR SEASONALLY ADJUSTED GROSS NATIONAL PRODUCT AND ITS COMPONENTS, 1964 (1) to 1971 (4)

	Latest Available Estimates Compared with:			
GROSS NATIONAL PRODUCT	Projection Estimates*	15-day Estimates	45-day Estimates	First July Estimates
Gross national product	−0.18	−0.19	−0.15	−0.07
Personal consumption expenditures	−0.09	−0.12	−0.08	−0.04
Durable goods	−0.58	−0.47	−0.20	−0.22
Nondurable goods	0.10	0.00	0.00	−0.00
Services	−0.10	−0.07	−0.06	0.02
Gross private domestic investment	−0.72	−0.45	−0.18	−0.03
Fixed investment	−0.26	−0.24	−0.11	−0.03
Nonresidential	−0.18	−0.11	−0.03	−0.02
Structures	−1.52	−0.77	−0.55	−0.28
Producers' durable equipment	0.46	0.40	0.25	0.18
Residential structures	−0.53	−0.62	−0.32	−0.05
Change in business inventories†	−0.74	−0.44	−0.31	−0.25
Net exports of goods and services†	0.59	0.17	−0.17	0.05
Exports	−0.05	−0.05	−0.47	−0.10
Imports	−1.23	−0.34	−0.05	−0.07
Government purchases of goods and services	−0.22	−0.16	−0.11	−0.08
Federal	−0.08	0.14	0.11	0.12
National defense	−0.21	0.10	0.14	0.07
Other	0.48	0.22	−0.53	0.32
State and local	−0.35	−0.61	−0.33	−0.28
RELATION OF GNP TO NATIONAL INCOME				
Gross national product	—	—	—	—
Less: Capital consumption allowances	−0.32	−0.20	−0.22	−0.24
Indirect business tax and nontax liability	−0.06	0.00	0.02	−0.06
Business transfer payments	—	—	—	—
Statistical discrepancy†	N.A.	N.A.	0.10	−0.03
Plus: Subsidies less current surplus of government enterprises	−0.03	−0.04	−0.03	0.09
Equals: National income	N.A.	N.A.	−0.15	−0.02

*Projection comparisons are for 1965 (1) to 1971 (4).

†Measures for change in business inventories, net exports, and statistical discrepancy are based on billions of dollars, seasonally adjusted at annual rates.

50 percent of the time. The 45-day estimate of net exports was successful 50 percent of the time. On the income side, all components scored above 50 percent, although the 15-day estimate of compensation of employees scored only 54 percent.

Bias, 1964–71

The early estimates of the quarterly changes in GNP and in national income and in most of their components have been subject to downward biases for the

TABLE 14

BIAS IN REVISIONS IN QUARTERLY PERCENTAGE CHANGES FOR SEASONALLY ADJUSTED NATIONAL INCOME AND RELATED MEASURES 1964 (1) TO 1971 (1)

NATIONAL INCOME BY TYPE OF INCOME	Latest Available Estimates Compared with: Projection Estimates*	15-day Estimates	45-day Estimates	First July Estimates
National income	N.A.	N.A.	−0.15	−0.02
Compensation of employees	−0.14	−0.12	−0.09	−0.13
Wages and salaries	−0.14	−0.08	−0.08	0.01
Private	−0.15	−0.13	−0.10	0.02
Government	−0.06	−0.12	−0.04	−0.10
Supplements to wages and salaries	−0.18	−0.09	−0.09	−0.17
Proprietors' income	−0.72	−0.31	−0.31	−0.23
Business and professional	−0.43	−0.21	−0.38	−0.11
Farm	−0.40	0.35	0.45	−0.73
Rental income of persons	−0.30	−0.54	−0.45	−0.37
Corporate profits and inventory valuation adjustment	N.A.	N.A.	0.40	0.48
Profits before tax	N.A.	N.A.	0.14	0.46
Inventory valuation adjustment†	1.28	−0.10	0.06	0.06
Net interest	−0.67	−0.48	−0.64	−0.49
PERSONAL INCOME AND RELATED SERIES				
National income	—	—	—	—
Less: Corporate profits and inventory valuation adjustment	—	—	—	—
Contributions for social insurance	0.06	0.13	0.14	−0.13
Wage accruals less disbursements	—	—	—	—
Plus: Government transfer payments to persons	−0.14	−0.17	−0.18	−0.10
Interest paid by govt. (net) and consumers	—	—	—	—
Dividends	0.16	0.09	0.10	0.23
Business transfer payments	—	—	—	—
Equals: Personal income	−0.20	−0.17	−0.14	0.10
Less: Personal tax and nontax payments	−0.25	−0.23	−0.03	0.04
Equals: Disposable personal income	−0.19	−0.16	−0.16	0.09
Less: Personal outlays	—	—	—	—
Equals: Personal saving	−1.45	−0.94	−1.62	−0.52
Addendum: Personal saving as percent of disposable personal income	−0.10	0.04	−0.10	−0.04

*Projection comparisons are for 1965 (1) to 1971 (4).

†Measures for inventory valuation adjustment are based on billions of dollars, seasonally adjusted at annual rates.

period 1964–71 (Tables 13 and 14). The two components which contribute the most to the bias in GNP are change in business inventories and State and local government purchases. On the income side, private wages and salaries and net interest contribute the most to the bias in the 45-day estimates of national income.

Given the size of the biases relative to the total revisions and the tendency for almost as many downward as upward revisions in GNP and its components, one hesitates in suggesting that bias adjustments (in addition to any that are already incorporated in the early estimates) be introduced on the basis of the information presented here. In general, among GNP and its components, the relative number of upward revisions is less than 60 or 70 percent. However, the bias is a large part of the total revision in personal income and the projection, 15-day and 45-day estimates of the quarterly changes were revised upward over 80 percent of the time. It would seem advisable to investigate further the need for bias adjustments on the income side.

Improvement over Time

This study provides comparisons of the revisions between the 15-day and 45-day estimates and the first July estimates for the 1964–71 period with those

TABLE 15

RELATIVE DISPERSION IN REVISIONS IN QUARTERLY PERCENTAGE CHANGES FOR SEASONALLY ADJUSTED GROSS NATIONAL PRODUCT AND ITS COMPONENTS, SELECTED PERIODS

	First July Estimates Compared with:			
	15-day Estimates		45-day Estimates	
GROSS NATIONAL PRODUCT	1958–63	1964–71	1947–63	1964–71
Gross national product	17	11	27	8
Personal consumption expenditures	22	15	27	12
Durable goods	40	24	32	19
Nondurable goods	30	26	28	19
Services	24	16	36	14
Gross private domestic investment	25	33	29	23
Fixed investment	24	40	38	37
Nonresidential	52	47	83	38
Structures	114	62	169	47
Producers' durable equipment	72	60	55	52
Residential structures	48	44	102	44
Change in business inventories	44	42	54	28
Net exports of goods and services*	66	60	48	61
Exports	N.A.	—	68	31
Imports	N.A.	—	65	28
Government purchases of goods and services	49	29	40	23
Federal	70	40	45	32
National defense	73	39	53	27
Other	86	72	98	68
State and local	33	34	40	26

*Measures for change in business inventories, net exports, and statistical discrepancy are based on billions of dollars, seasonally adjusted at annual rates.

for earlier periods. The 45-day estimates are available for the period 1947–63. The 15-day estimates are available for 1958–63.

Until the 1964–71 period is subject to benchmarking we cannot make a final judgment as to the accuracy of the early estimates. At this point by examining the revisions between the 15-day and 45-day estimates and the first July estimates we are considering what in the past has amounted to considerably less than half of the total revision.

In general the revisions were smaller in the 1964–71 period than in the earlier periods. Tables 15 and 16 show the revisions in terms of the relative dispersion.

TABLE 16

RELATIVE DISPERSION IN REVISIONS IN QUARTERLY PERCENTAGE CHANGES FOR SEASONALLY ADJUSTED NATIONAL INCOME AND RELATED MEASURES, SELECTED PERIODS

	First July Estimates Compared with:			
	15-day Estimates		45-day Estimates	
NATIONAL INCOME BY TYPE OF INCOME	1958–63	1964–71	1947–63	1964–71
National income	N.A.		29	12
Compensation of employees	48	17	33	16
Wages and salaries	45	12	29	10
Private	N.A.		29	12
Government	N.A.		35	17
Supplements to wages and salaries	N.A.		57	22
Proprietors' income	148	75	98	80
Business and professional	N.A.		65	60
Farm	N.A.		73	108
Rental income of persons	84	53	96	58
Corporate profits and inventory valuation adjustment	N.A.		43	36
Profits before tax	N.A.		39	33
Inventory valuation adjustment	N.A.		30	25
Net interest	N.A.		91	28

*Measures for inventory valuation adjustment are based on billions of dollars, seasonally adjusted at annual rates.

In total GNP and national income the revisions were reduced from one-third to two-thirds. Among the components the only exceptions to the general rule that revisions have been reduced were the 15-day estimates of fixed investment and State and local government purchases and the 45-day estimates of net exports and farm income.

While these results are encouraging to the data compiler and to the user, it should be recognized that they may overstate the improvement somewhat. The pre-1964 period encompassed more cyclical variability than the later period. As a result it would have been more difficult to project missing months of data in the earlier period. Expressing the revisions in relative terms tends to standardize for this but probably not completely.

OMB Guidelines

The Office of Statistical Policy in the U.S. Office of Management and Budget in 1971 established guidelines for the preparation of current economic indicators which among other things set a standard for the size of revisions in preliminary figures. Guideline III stated that: (1) the differences between preliminary and revised figures should average less than half the average month-to-month change in the revised figures; (2) differences greater than half the average month-to-month change should not occur more than 25 percent of the time; and (3) differences greater than the average change should not occur more than 5 percent of the time.[12] In terms of the measures presented here, (1) may be restated that relative dispersion should be less than 50 percent.

These criteria were developed primarily for monthly series and may be too lenient for quarterly series. On the other hand, they refer to revisions between estimates released within 60 days after the close of the period while we have been considering the first July and the latest available estimates as standards. Given these qualifications, it is interesting to note that relative dispersion is well below 50 for GNP and national income and most of the components for the projection, 15-day and 45-day estimates when compared with the latest available estimates for the period 1964–71. Components which do not meet this criterion include nonresidential and residential structures, producers' durable equipment, net exports, other Federal purchases, proprietors' income, and rental income of persons. If the guideline is applied to the 15-day estimate with the 45-day estimate as the standard, the only components with a relative dispersion above 50 percent are net exports and other Federal purchases.

It is also interesting to examine the distribution of revisions in early estimates compared with the latest available estimates in terms of (2) and (3) in the OMB guideline. There were no revisions in the projection estimate of GNP greater than the average change in the latest available estimate, and only 1 revision in the 28 quarters (or 3 percent of the total) was greater than half the average change. There were no revisions in the 15-day, 45-day, or first July estimates greater than half the average change.

Constant-dollar Estimates

So far the discussion has been in terms of the current-dollar estimates. Much the same picture emerges when revisions in constant-dollar estimates are considered.

There is a tendency in the constant-dollar estimates towards a larger relative dispersion (the dispersion remains about the same while the average change is reduced) with more components showing a relative dispersion above 50 percent in the early estimates. There is also less tendency towards negative biases in the estimates.

Effect of Errors on Economic Policy Making

There are no studies on the extent to which errors in the U.S. estimates have affected national economic policy making (or policy making at other levels such

[12]See Julius Shiskin, "Measuring Current Economic Fluctuations," *Annals of Economic and Social Measurement*, 2/1, 1973, p. 6.

as the individual business firm). If such a study were to be conducted, it would of necessity focus on that part of the error which is revealed by revisions.

Would different policies have been followed if the revised estimates of GNP issued in January 1972 had been available 45 days after the close of each quarter in 1971? My judgment (and I am not a policy maker) is that probably about the same policies would have been followed if the revised estimates had been available 45 days after the close of each quarter. Both the 45-day estimates and the revised estimates showed a sluggishly expanding economy. Either set of estimates indicated that the real growth was not sufficient to soak up much if any of the unemployed resources which were present in 1971. However, one cannot be certain that the same policies would have been followed. The errors as revealed by the revisions were large, and if it is true that policy was not affected by errors, it is also true that there was not much margin of safety.

In 1965, the quarterly estimates of GNP apparently did contain sufficient error to mislead policy makers. Arthur Okun, former Chairman of the Council of Economic Advisers, faulted the GNP statistics for understating the strength of the economy in 1965; he stated:

> "Our intelligence system for tracking current movements did not perform well. This was the only period in my experience during which the preliminary estimates of economic activity qualitatively misrepresented the true situation. As of November 1965, official estimates of GNP showed a rise of $36 billion and a real growth rate of 5½ percent for the first three quarters of the year—essentially a continuation of the brisk growth of 1964. The estimates today for that same period show a gain of $46 billion and an enormous 8 percent rate of real growth."[13]

Arthur Burns, another former Chairman of the Council of Economic Advisers (who was not in a policy making role in 1965), sounded the same theme:

> "Faulty statistics compounded the difficulties of the policy makers. . . . As originally calculated by the Department of Commerce, the annual rate of increase in the gross national product during 1965 was consistently too low, quarter after quarter, by amounts varying from about $2 to $5 billion. This cumulation of errors left its mark on economic thinking by underestimating the growth that was taking place, and therefore also exaggerating whatever gap may have still existed between actual and potential output."[14]

Can we set a standard for identifying errors that would affect policy making and those that would not? Consider for example the revisions in the quarter-to-quarter percent changes in current and constant dollar GNP in the first three quarters of 1965 and 1971 as shown in Table 17. If my judgment is correct that

[13]Arthur M. Okun, *The Political Economy of Prosperity* (The Brookings Institution, Washington, D.C., 1970), p. 68.

[14]Arthur F. Burns and Paul A. Samuelson, *Full Employment Guideposts and Economic Stability* (American Enterprise Institute for Public Policy Research, Washington, D.C., 1967), p. 34.

TABLE 17

REVISIONS IN QUARTERLY CHANGES IN GROSS NATIONAL PRODUCT, 1965 (1) TO 1965 (3) AND 1971 (1) TO 1971 (3)

	Quarter to Quarter Percentage Changes					
	Current dollars			Constant dollars		
1965	1965 (1)	1965 (2)	1965 (3)	1965 (1)	1965 (2)	1965 (3)
Before November 1965	2.39	1.45	1.65	2.19	0.65	1.28
Most recent estimates	2.74	1.95	2.28	2.23	1.46	1.98
Revision	0.35	0.50	0.63	0.04	0.81	0.70
1971	1971 (1)	1971 (2)	1971 (3)	1971 (1)	1971 (2)	1971 (3)
Before January 1972	3.28	2.18	1.70	1.93	1.19	0.96
Revised January 1972	3.28	1.88	1.29	1.93	0.84	0.67
Revision	—	−0.30	−0.41	—	−0.35	−0.29

errors in the 1971 estimates did not affect policy making, then one might be tempted to place the critical point at or above the revisions of roughly 0.3 percentage points in 1971, but certainly below the revisions in 1965 of 0.5 to 0.6 percentage points in current dollars and 0.7 to 0.8 percentage points in constant dollars. Perhaps one might even conclude that early estimates need not be corrected for errors below limits established in such a manner.

However, it is risky business for the data compiler to impose such judgements. Of crucial importance is whether an error falls in a quarter in which policies are being formulated. An error that might have no effect midway through the early recovery phase of a business cycle as in 1971 could mislead policy makers in another instance.

Another factor is that such judgments would have to be made in terms of the components. The interrelations in policy making of such key variables as consumer spending and saving, corporate profits, business investment, and government purchases are complex. It becomes an almost impossible task to identify the degree of error in each component that would mislead policy makers in each particular type of situation. The difficulty, even perverseness, of such a task becomes apparent when one considers the revision of corporate profits in July 1971 which was described earlier. This particular error had little if any effect on policymaking. One would be foolhardy to count on such good luck if a rerun of the situation develops.

While there certainly is a level below which the degree of error is inconsequential, it is not easily identified, certainly not by examining the effect of data errors on policy making. The data compiler must proceed with extreme caution in any scheme to limit revisions because the errors appear insignificant. In other words, policy makers in Government and business should receive, within practical limits, the latest, most accurate estimates.

Econometric Models

Examination of the effect which errors in the NIP estimates have on econometric models would seem to be a useful approach in assessing the reliability of GNP. This approach would provide a systematic way of considering the effect of revisions on economic forecasts which in turn are basic input to economic policy making. As of now, apparently no full-scale study has been made of the effect of errors in the NIP estimates on econometric models.

The subject has received some attention, however, and there are a few results which may be cited.[15]

Cole estimated the effect of errors in early estimates by comparing forecasts from two consumption functions using data available before and after the 1965 benchmark revision of GNP. The functions used were that of Zellner, in which data available in July 1955 were compared against the 1965 revised data, and that of Griliches, in which data available in August 1961 were compared against the 1965 revised data. Cole found that the use of the preliminary rather than the 1965 revised data led to a doubling of forecast errors, of which 70 percent was due to direct effects of data errors and 30 percent to indirect effects of these errors on the parameters of the model. However, her findings refer to forecasts of levels. Equations based on quarterly changes might indicate that the impact of preliminary data on the forecast error is less than that for levels.

Denton and Oksanen fitted a small annual econometric model to NIP estimates of 21 countries. They concluded that the effects of data revisions were rather modest.

Statistical Discrepancy

Unlike measures of revisions, the statistical discrepancy reflects not only that part of the error which is revealed by revisions but also that which remains in the final estimates. The nature of the statistical discrepancy in the U.S. NIP accounts has been described in the following passage from pages 64–65 of *National Income, 1954 Edition* (see reference, footnote 16):

> "The 'statistical discrepancy' measures the excess of the gross national product as estimated by summing its component product flows over the gross national product as estimated by summing components of the national income and all other charges against the total value of gross national product. It arises because of errors in the component estimates, and hence is relevant to the problem of reliability.
>
> "In the national income and product account the statistical discrepancy is entered on the debit side, as an item reconciling national income with charges against national product. This manner of entering the statistical discrepancy is purely a matter of convenience. It permits the two most widely used aggregates—national income and gross national product—to be broken down into component items which do not include the 'statistical discrepancy.'

[15]"Data Errors and Forecasting Accuracy" by Rosanne Cole in *Economic Forecasts and Expectations*, Jacob Mincer, ed., NBER, 1969 and "Multi-Country Analysis of Effects of Data Revisions on an Econometric Model" by Frank T. Denton and E. H. Oksanen, *Journal of the American Statistical Association*, June 1972.

It does not signify that the national income and the gross national product have been correctly estimated, and that the error has been made in the estimation of one or more of the items reconciling the two. Quite to the contrary, it is likely that the aggregates are affected whenever a statistical discrepancy appears. . . .

"The adjustment for statistical discrepancies appears also in the gross saving and investment account. It signifies an error either in total saving and/or total investment and in one or more of their components.

"The statistical discrepancy is a measure of the difference in error between the two estimates of the total gross national product. While its presence is conclusive evidence that errors have been committed, a zero discrepancy does not constitute proof to the contrary. Strictly speaking, the discrepancy measures lack of consistency, and it does not register absolute errors which compensate in the accounts. To the extent, however, that the sources and methods of estimating the components of the credit and debit sides of the national income and product accounts are independent—in the sense that errors committed in estimating components on the one side do not involve corresponding errors on the other—it is reasonable to give some weight to the statistical discrepancy in evaluating the reliability of the totals. In these circumstances, greater confidence can be attached to the value of the national income and product totals if the size of the discrepancy is small than if it is large. . . .

"The statistical discrepancy measures the net residual of error which remains after the best possible estimates of the various components of the income and product flow have been made. If initial estimates of the components lead to a sizeable statistical discrepancy or to erratic movements in it, they are reexamined and an effort is made to trace the source of the discrepancy and to eliminate it as far as possible. This reexamination of the initial estimates consists mainly of a critical comparison of the methodology of the component estimates for error and inconsistency. This is an essential step of the estimating procedure which cannot be taken by the individual estimators responsible for the preparation of the component series, but must be reserved until initial estimates of all the components have been prepared. While significant improvements can sometimes be made in this manner, a residual discrepancy will remain.

"The suggestion has been made that this residual discrepancy should be eliminated, either by the exercise of further judgmental decisions of the type used in reducing it from its initial size, or by the application of more formal mathematical procedures that tend in the direction of greater objectivity. Superficially, complete elimination of the statistical discrepancy would be desirable, from the standpoint of convenience to the users of the data. Basically, however, it would be harmful. A statistical discrepancy of substantial size or irregular movement reflects troublesome errors in the estimates. If this is the situation, the users of the data should be aware of it so that they can exercise due caution in the application of the estimates in economic analysis."

The total error in the quarterly change in GNP cannot be estimated from the statistical discrepancy with any degree of accuracy. The two major problems are: (1) the errors on each side of the NIP accounts are not completely independent because some source data enter on both sides; and (2) no doubt in some instances the modifications made to the initial estimates when there is a troublesome swing in the statistical discrepancy are in error in that they are made on the wrong side of the accounts. Both (1) and (2) operate so as to reduce the size of the quarterly change in the statistical discrepancy relative to the size of the total error in the change in GNP. It is clear that the total error in the quarterly change in GNP is several times larger than the average change in the statistical discrepancy.

Nevertheless, it is tempting to try to use the statistical discrepancy as evidence concerning the total error. To this end, Table 18 shows the average

TABLE 18

AVERAGE AND LARGEST QUARTER-TO-QUARTER CHANGES WITHOUT REGARD TO SIGN IN SUCCESSIVE ESTIMATES OF THE STATISTICAL DISCREPANCY, SELECTED PERIODS
(Billions of dollars, seasonally adjusted at annual rates)

	45-day Estimates		First July Estimates		Latest Available Estimates	
Period	Average	Largest	Average	Largest	Average	Largest
1947–63	1.7	6.8	1.7	6.8	1.1	3.4
1964–71	1.1	2.8	1.1	2.6	1.1	3.1

quarter-to-quarter change without regard to sign and the largest change in the statistical discrepancy for the 45-day estimates, the first July estimates, and the latest available estimates. Comparing the average change in the statistical discrepancy in successive estimates shows that there is no reduction in the first July revision. The only reduction is in the benchmark revision for the 1947–63 period. Comparing the average change in the 1947–63 and 1964–71 periods shows that there has been a reduction in the size of the statistical discrepancy. The reduction is particularly pronounced if the average change is considered relative to the level of GNP.

Subject to the qualification that we cannot establish a precise relationship between the statistical discrepancy and the total error, the figures in Table 18 suggest the following: (1) a large part of the total error in the early estimates remains in the final estimates; (2) the relative degree of error in the quarterly change in GNP has probably been reduced over time.

Expert Judgment on Sources and Methodology

Expert evaluation of the source data and methodology provides a way to consider the total error in each component. However, it is quite subjective and

imprecise. From the outset, the compilers of the U.S. estimates have attempted to provide a judgmental assessment of reliability. This sort of approach in the U.S. can be traced back to Simon Kuznets' evaluation of his estimates in chapter 12 of his *National Income and Its Composition, 1919–1938* (2 volumes), 1941.

No better statement of the role of judgment can be found than that contained on pages 62–63 of *National Income, 1954 Edition* (see reference, footnote 16):

> "Consideration of four major factors should prove helpful in forming a judgment about the reliability of estimates of the various components of the income and product flow.
>
> "In the first place, one must consider whether the economic units (such as businesses, governmental agencies, or individuals) are reporting on an item which is represented by straightforward transactions of simple definition, or on an item which requires complex calculations on their part or is somewhat vague in definition. In practice, the former case is likely to be associated with the occurrence of monetary transactions.
>
> "The second factor to be considered is the quality of the records kept by the economic units whose transactions are being measured. Lack of adequate records leads to less reliable reporting or to an absence of reported data. In either case, the reliability of the resulting estimates is impaired.
>
> "The third factor which should be given weight is the reporting system—its character and the quantity of data it produces. The obvious distinction here, as to the former, is between complete census-type coverage and sampling. However, this distinction in itself does not throw much light on the problem of reliability. While, other things being equal, complete enumerations are more reliable than samples—and, for that matter, large samples are more reliable than small ones—the *ceteris paribus* qualification in this instance deprives the statement of much of its practical significance.
>
> "So much depends on the quality of the censuses and of the samples—including the skill and training of enumerators—that only a detailed investigation of all the relevant characteristics can yield well founded conclusions regarding reliability. Needless to say, such investigations are difficult undertakings and often may not prove conclusive. In particular, recent advances in sampling techniques have considerably narrowed the area over which a flat claim of superiority for the results of census-type reporting can be made.
>
> "With respect to the quantity of information yielded by a reporting system. it is first to be observed that large and frequent quantity does not necessarily, of course, make for reliable estimates. But smallness of quantity, even of high quality, results in data gaps impairing the adequacy of an income or product series.
>
> "The final point to be considered is to what extent the items that enter the income and product accounts differ from those that are actually reported. Such differences almost always imply that estimating procedures have been introduced. This means an impairment of reliability of the final figures which can be evaluated only by an examination of the procedures. In

TABLE 19

RANKINGS OF RELIABILITY OF NIP ESTIMATES

GROSS NATIONAL PRODUCT	Quarterly Changes		Annual Levels			
	45-day	First July	First July	Second July	Third July	Bench-mark
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 govt. enterprises	—	—	—	—	—	—
Federal subsidies less CSE.	3	2	2	1	1	1
Less: State and local CSE.	5	5	4	3	3	3
Equals: National income	—	—	—	—	—	—

TABLE 19

RANKINGS OF RELIABILITY OF NIP ESTIMATES
(Continued)

NATIONAL INCOME BY TYPE OF INCOME	Quarterly Changes		Annual Levels			
	45-day	First July	First July	Second July	Third July	Bench-mark
National 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 govt. (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	—	—	—	—	—	—

general, a long and involved estimating chain can be taken as a sign of statistical weakness, although this rule must be qualified in the light of the adequacy of the supplementary data introduced and of the cogency of the procedures adopted. Simplicity of procedure, however, cannot be taken as evidence of absence of statistical weakness. It may only mean that reliable data for making necessary adjustments are not available, and that summary, arbitrary assumptions have been used instead."

The user of NIP estimates is hampered in judging their reliability because of a lack of an up-to-date statement on sources and methodology. The last complete statement was in 1954, with updatings in 1958 and 1965.[16] In view of this, a simple and rough evaluation of the reliability of the estimates is presented here.

Ranks were assigned subjectively to quarterly changes as they are measured 45 days after the close of the quarter and as they stand after the first July revision. Since some components provide a more accurate measurement of annual level than of the pattern of quarter-to-quarter changes, ranks were also assigned to annual levels as they stand after each July revision and after a benchmark revision. The results of this exercise are shown in Table 19. A rank of 1 indicates highest reliability and a rank of 5 the lowest.

The criteria applied in ranking the components were those set forth in the above passage from *National Income, 1954 Edition.* It is not clear that any formalized scheme for assigning such ranks would be unambiguous and objective. Accordingly, no formalized scheme was attempted, rather several estimators simply assigned the ranks on the basis of their judgment. The rankings should be of use to persons who desire some guidelines as to the reliability of the NIP components. Clearly, differences of 1 between two ranks should not be considered of great significance.

Appendixes A and B

For reasons of space only a sample page from each appendix is reproduced here. The complete sets are available on request from the author.

[16] *National Income*, 1954 *Edition* (A Supplement to the *Survey of Current Business*), 1954; *U.S. Income and Output* (A Supplement to the *Survey of Current Business*), November 1958; "The National Income and Product Accounts of the United States: Revised Estimates, 1929–64," *Survey of Current Business*, August 1965. These publications are out of print, but their methodological sections are reproduced in *Readings in Concepts and Methods of National Income Statistics*, a reprint volume published for OBE in 1970 by the National Technical Information Service, U.S. Department of Commerce.

APPENDIX A

DATA SOURCES FOR NATIONAL INCOME AND PRODUCT ESTIMATES

Component	Quarterly	Annual
I. Gross National Product		
A. Personal consumption expenditures (664.9)		
1. Goods (381.6)		
a. Automobiles, new (33.6)	Unit sales by nameplate from trade sources for three months and average unit prices for two months for 15-day estimate; 3 months of prices for 45-day estimate. Average unit price by nameplate based on trade source list prices and BLS data on discounts. Sales to government and to businesses are estimated separately and subtracted to obtain sales to consumers.	Average unit prices revised to reflect unit sales and prices for the complete range of models and options for the model year.
b. Net purchases of used automobiles (1.8)	Unit sales and inventories of franchised dealers from trade source; sales and inventories of nonfranchised dealers from Census retail trade data; wholesale and retail prices based on FRB data. Two months of franchised dealer data and 3 months of Census data for 15-day estimate; 3 months of franchised dealer data for 45-day estimate. When annual estimates are prepared, quarterly wholesale and retail used car prices from trade sources replace FRB data.	Same as quarterly.
c. Automobile accessories and parts, including tires and tubes (6.5)	Census retail sales of tire, battery, and accessory stores; 3 months for the 15-day estimate and revised data for the 45-day estimate.	Unit manufacturers' shipments and price data for tires and tubes from trade source and related CPI and USDA price data are used to prepare separate estimates of tires and tubes.

d. Mobile homes and recreational vehicles (6.5)	Unit manufacturers' shipments and price data from trade source; 2 months for 15-day estimate and 3 months for the 45-day estimate.	More detailed annual shipments and price data from trade source.
e. Gasoline and oil (23.5)	Census retail sales of gasoline service stations for 3 months for 15-day estimate; U.S. Department of Interior quantity and BLS price data for the 45-day estimate.	Passenger car consumption of gasoline from government and trade sources.
f. Tobacco products (11.7)	IRS excise tax collections and BLS price data; 2 months for the 15-day estimate and 3 months for the 45-day estimate.	Sales by type from government and trade sources.

APPENDIX B

Measures of Revisions in National Income and Product Estimates, 1947–71

TABLE 9A

Measures of Revisions in Quarterly Percentage Changes for Seasonally Adjusted Gross National Product and its Components, 1964 (1) to 1971 (4)

15-Day Estimates Compared with Latest Estimates

Gross National Product	Bias	Relative Bias	Standard Deviation of Revisions	Largest revisions		Dispersion	Relative Dispersion	Relative Number of Directional Misses	Relative Number of revisions		
				Positive	Negative				Upward	Downward	No Change
Gross national product	−0.187	−10	0.375	0.592	−0.328	0.299	16	0	69	31	0
Personal consumption expenditures	−0.121	−7	0.363	0.787	−0.402	0.315	17	0	56	44	0
Durable goods	−0.471	−23	1.111	3.150	−1.478	1.000	31	13	56	44	0
Nondurable goods	0.003	0	0.665	1.202	−1.331	0.572	35	3	50	50	0
Services	−0.074	−4	0.361	0.588	−0.674	0.316	16	0	66	34	0
Gross private domestic investment	−0.447	−25	1.838	3.161	−3.866	1.526	42	13	63	37	0
Fixed investment	−0.240	−12	1.259	2.259	−2.185	1.023	44	16	55	44	1
Nonresidential	−0.112	−5	1.460	2.286	−2.615	1.202	45	3	53	47	0
Structures	−0.773	−36	2.608	6.916	−4.896	2.083	69	34	66	34	0
Producers' durable equipment	0.400	19	2.276	4.840	−4.965	1.869	62	16	53	47	0
Residential structures	−0.616	−34	2.936	5.318	−7.001	2.617	57	22	59	41	0
Change in business inventories*	−0.441	320	2.155	5.700	−3.900	1.734	55	16	59	38	3
Net exports of goods and services*	0.169	−46	0.969	1.500	−3.300	0.719	69	22	44	53	3
Exports	−0.053	−3	1.994	2.930	−4.529	1.571	41	13	50	50	0
Imports	−0.341	−12	1.776	4.448	−3.034	1.376	36	3	56	44	0
Government purchases of goods and services	−0.159	−8	0.767	2.351	−1.370	0.589	28	3	53	47	0
Federal	0.144	10	1.182	2.924	−2.763	0.928	45	19	47	53	0
National defense	0.101	9	1.417	5.787	−4.624	1.056	45	3	53	47	0
Other	0.216	9	3.564	6.729	−7.322	2.939	93	28	47	53	0
State and local	−0.609	−23	1.225	2.448	−1.412	0.957	35	3	69	31	0

RELATION OF GNP TO NATIONAL INCOME											
Gross national product	—	—	—	—	—	—	—	—	—	—	—
Less: Capital consumption allowances	−0.203	−11	0.741	1.037	−3.045	0.562	29	0	78	22	0
Indirect business tax and nontax liability	0.001	0	0.779	1.737	−2.122	0.558	28	0	56	44	0
Business transfer payments	—	—	—	—	—	—	—	—	—	—	—
Statistical discrepancy*	N.A.										
Plus: Subsidies less current surplus of government enterprises	−0.035	110	0.432	0.800	−1.000	0.345	123	45	52	45	3
Equals: National income	N.A.										

*Measures for change in business inventories, net exports, and statistical discrepancy are based on billions of dollars, seasonally adjusted at annual rates.