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## Introduction

Gross national product has become one of the most widely used indicators of the nation's economic performance. Most evaluations of current business conditions and predictions of the future course of the economy rely in part on recent levels and changes in GNP. Movements in GNP are often used to assess the magnitude of short-term cyclical fluctuations and to measure secular trends in the economy's growth.

These uses of the product estimates require up-to-date and dependable figures. As so often the case with economic statistics, however, there is likely to be a trade-off between the accuracy and the currency of the estimates. An aggregate such as GNP is built up from detailed component estimates and much of the comprehensive data underlying the components is available only periodically or with reporting lags. As a result, the GNP estimates that are published on a current basis must be based on less comprehensive and complete data. These estimates are therefore provisional; they are periodically revised as more complete data become available. Typically, at least six estimates are made of the value of GNP for a given period.

This report explores the nature of the differences between the provisional and the revised estimates of GNP and its major components. Since the revised estimates are presumably more accurate, the differences (i.e., the revisions) may be considered a measure of the price, in terms of accuracy, of up-to-date GNP statistics.

A narrow view of GNP error is thus taken for the purpose of this study. The errors considered are measurement errors, given the particular definitions and scope of the present accounts. No attention is given to errors created by limitations of concepts, definitions, and coverage.<sup>1</sup>

Some of the sources of measurement errors and the potential of the revisions for reducing these errors are reviewed in Chapter I. Most ap-

<sup>1</sup> Recent work suggests that such errors may be large and that GNP in 1966 may have been understated by as much as 20 per cent. See Nancy and Richard Ruggles, *The Design of Economic Accounts*, New York, NBER, 1970.

praisals of the accuracy of the provisional estimates use the revisions as a measure of error.<sup>2</sup> No one, of course, in reviewing the record of revisions supposes that they measure the total error in the initial estimates. Instead, they are generally thought to provide an indication of the uncertainty attached to the initial estimates, as well as a rough index of the reliability of the component estimates. For example, the studies by Jaszi and by Nassimbene and Teeter find some correspondence between the size of the revisions and the reliability that would be accorded the components by those most familiar with the estimating procedures and the underlying data: The GNP components which undergo the largest revisions turn out to be the ones considered least reliable, while the components which show the smallest revisions are considered most reliable. There are of course exceptions, and the fact that a component is not revised is no indication that it is more accurate than other components. It may simply mean that more reliable data have not become available.

On the other hand, the fact that a component is revised is no guarantee that it is more accurate. Indeed, one of the questions not explicitly considered in the earlier studies is whether or not the revisions actually improve the accuracy of the estimates. Though unlikely, it is nevertheless possible, as Morgenstern has emphasized, for the revisions to be perverse and augment measurement error.<sup>3</sup>

A direct answer to the question of whether the revised or the provisional figures are the more accurate would require estimates of the measurement errors in each set of figures—and it is well known that such estimates are exceedingly difficult to construct. As we shall see,

<sup>2</sup> For example, see Arnold Zellner, "A Statistical Analysis of Provisional Estimates of Gross National Product and Its Components, of Selected National Income Components, and of Personal Saving," *Journal of the American Statistical Association*, March 1958; Raymond Nassimbene and Benjamin T. Teeter, "Revisions of First Estimates of Quarter-to-Quarter Movement in Selected National Income Series, 1947-58," *Statistical Evaluation Reports, Report No. 2*, Office of Statistical Standards, Bureau of the Budget, Washington, D.C., 1960; Peter E. DeJanosi, "A Note on Provisional Estimates of the Gross National Product and Its Major Components," *Journal of Business*, October 1962; George Jaszi, "The Quarterly National Income and Product Accounts of the United States, 1942-62," in Simon Goldberg and Phyllis Deane, ed. *Studies in Short-Term National Accounts and Long-Term Economic Growth*, Income and Wealth: Series XI, London, 1965; and H. O. Stekler, "Data Revisions and Economic Forecasting," *Journal of the American Statistical Association*, June 1967.

<sup>3</sup> Oskar Morgenstern, *On the Accuracy of Economic Observations*, Princeton, 1963, pp. 261-272.

however, it is possible to infer at least the types of measurement errors that GNP may contain and some of the properties of these errors from the data and the methods used in GNP estimation. Even though this indirect approach does not yield estimates of the magnitude of the errors, it can nevertheless be used to show the rather special conditions that would have to obtain if the revisions were to augment error. The analysis in Chapter I concludes that in general the revisions could be expected to improve the accuracy of the estimates and, more specifically, to do so by eliminating extrapolation errors.

It is shown in Chapter II that the revisions are largest for those series which show considerable variability and weak serial correlation (i.e. correlation of an observation at one point in time with previous observations on the same series) and which would therefore be the most difficult to extrapolate accurately. Revisions therefore seem most common where extrapolation errors are most likely. Chapter III compares the magnitude of these "revision errors" with that of other forecast and extrapolation errors. Chapter IV considers how rapidly errors are reduced by revision and whether the accuracy of the provisional estimates has increased over the years. The results have some implications for the question of whether fewer revisions would suffice.

Earlier studies have given little attention to the whole sequence of estimates and revisions, or put differently, to the question of how rapidly the error in the initial estimates is reduced. Though Stekler's results suggest that the revisions after one month produce only a small reduction in error,<sup>4</sup> the effect of revisions thereafter has not been previously studied. Moreover, the earlier studies have not emphasized the similarities between provisional estimates and forecasts. The finding, however, that the revisions can be considered akin to extrapolation errors is relevant to the question of whether the provisional estimates have improved over the years. For example, Stekler found that the magnitude of the revisions has declined over time and concluded that the estimates have improved. Whether this apparent gain in accuracy occurred merely because the series were smoother in the later than in the early part of the postwar period and could therefore have been extrapolated more accurately is a question considered in Chapter IV.

Alternative estimates of GNP based on the income side of the ac-

<sup>4</sup> Stekler, *op. cit.*, Table 4 compared with Table 2.

counts can be derived (GNP, exclusive of the statistical discrepancy) and their accuracy is compared with that of the product, or expenditures, estimates in Chapter V. Following that, the revisions together with the statistical discrepancy are used to obtain very crude estimates of the error that may remain in GNP estimates.

The revisions of major patterns of change in GNP are reviewed in Chapter VI. It is generally, though mistakenly, supposed that the revisions mainly alter the level of the estimates and have little systematic effect on the changes. However, it is shown in Chapter VI that the initial estimates have tended to overestimate cyclical and underestimate trend movements in GNP throughout the postwar period. The cyclical errors were primarily the result of overestimating changes in gross private domestic investment; underestimating changes in personal consumption expenditures was the major source of the trend errors. During periods of business cycle contraction the two kinds of error reinforced each other and caused the initial estimates to exaggerate substantially the severity of peak to trough decline in GNP. The errors tend to offset one another during periods of expansion.

The revisions not only affected the amplitudes of cyclical changes; they also affected the dates of major turns. Peaks were not altered, but the dates of three of the four postwar lows in GNP were changed by a minimum of one quarter. Some evidence is presented that revisions in the seasonal factors were primarily responsible for the changes in turning point dates.

For the benefit of the impatient reader, the last chapter contains a fairly detailed summary of findings. The period covered by this report is the postwar years, 1947-63, although data compiled through the major revision of 1965 are used to appraise the earlier figures.