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RELATED STUDIES AND PLANS

THIS is a progress report on one part of the National Bureau study of short-term economic forecasting. It should be useful to give some indications about the work being done in other related areas of the project.

While the present analysis deals with forecasts made without a formal specification of the underlying model or method, another paper in progress covers forecasts which have an explicit basis in econometric models, i.e., in sets of mathematical equations designed to represent the interrelations among economic variables operating over time. Both studies are concerned mainly with accuracy of numerical forecasts. Preliminary results obtained by Jon Cunnyngham suggest that econometric models have been on the average about as accurate as the better general business forecasts in predicting the annual changes of GNP during the period 1953–63.[1]

Rendigs Fels has examined reports on the business outlook in a collection of influential business and financial periodicals with a view to evaluating their record on the recognition of cyclical turning points. He finds that warnings that proved right come typically late and that false signals have been frequent on some occasions. To recognize contemporaneously a peak or a trough (that is, to predict turning points with a zero lead) would be to perform better than the average of the publications reviewed.[2] This is consistent with our finding that "the record of the numerical forecasts of GNP . . . does not indicate an ability to forecast the turn several months ahead."

[1] See Forty-Fifth Annual Report, New York, National Bureau of Economic Research, 1965, p. 60. The econometric models are expressed in terms of changes in constant dollars and the comparisons assume error-free price predictions in all forecasts involved.

[2] *Ibid.*, p. 64.

Jacob Mincer and myself have worked on the methodology of forecast evaluation with the aim of formulating and applying in an exploratory manner some criteria for analyzing aspects of predictive performances.[3] The approach developed in this study is also used in other parts of our project which are concerned with the quality of numerical forecasts. Some of the results are seen as pertinent to the general subject of economics of expectations, beyond the narrower question of how to appraise forecasting accuracy.

Errors in the data used by the forecaster account for nearly all of the error in the forecast base, according to Rosanne Cole's study of GNP revisions and their relation to forecasting accuracy. Predictions of changes are affected significantly by such errors in those cases where projection of past values of the series is an important ingredient of the forecast. For some of the forecast sets covered by the present report, very little of the error in predicted change could be traced to errors in the GNP figures as estimated from data revisions; for other sets, it appears that as much as 20 per cent of the error in change forecasts was induced by the thus measured errors of observation.[4]

Less closely related to this study is the research conducted by Geoffrey H. Moore and Julius Shiskin, which is concerned with improvement of forecasting tools rather than with evaluation of any recorded forecasts. Moore and Shiskin have completed a comprehensive review of the National Bureau cyclical indicators and compiled a revised list based on several objective criteria and an explicit and inclusive scoring system. The result should be a better selection, classification, and description of business cycle indicators.

FURTHER RESEARCH

An inventory of findings usually reveals gaps to be filled as well as doubts to be resolved. Some observations are, therefore, in order about a few other topics that either are under study or deserve future attention.

The comparative merits and shortcomings of different forecasting methods and procedures are, of course, matters of central interest, but

[3] Forty-Sixth Annual Report, New York, National Bureau of Economic Research, 1966, pp. 53–54.

[4] See also the reports by Rosanne Cole in the National Bureau Annual Reports for 1965 and 1966.

direct information on the methods used is largely lacking and would be difficult and costly to collect. Most forecasters use various techniques (extrapolations, relationships among economic variables, business surveys) in combination, tempering the results by judgment. They themselves may not be able, therefore, to determine retrospectively the precise relative importance of these ingredients. A more promising approach to the problem of evaluating forecasting methods is an indirect one, based on comparisons of summary error measures for different types of predictions of the same variable. Some of the following suggestions for research illustrate possible applications of this approach.

1. Comparisons of actual forecasts with various types of extrapolations, such as those introduced in Chapter 6 of the present study, can be extended to provide relative measures of predictive accuracy which distinguish between the systematic (bias) and the random parts of the errors. This analysis also results in estimates of the "autonomous" and "extrapolative" components of forecasts, or how much forecasts and extrapolations have in common and how large are the net predictive contributions of each. The methodology for these measurements has already been developed (see Chapter 6, note 2).

2. Comparisons could be made between econometric model forecasts and more informal forecasts, and between the recorded forecasts and predictions that could be obtained from anticipations data and leading indicators. This work would also produce measures of relative over-all accuracy, bias, and efficiency, formally analogous to those generated by comparisons of forecasts with extrapolations. Some tentative results on econometric model forecasts have already been obtained, as noted before. The sum of these efforts should result in some tested quantitative estimates of the contributions to effective forecasting of techniques such as econometric relations, anticipations and indicator data, extrapolation procedures, and (as a residual) "judgment."

3. Analysis of the structure of forecasts from a given source, that is, relations between the predicted values of such elements of the economic system as aggregate income, consumption, investment, government expenditures, etc., would be useful. For example, one may ask what "consumption function" is implied in a forecast, or, specifically, what the coefficients of a regression of predicted consumption on predicted income are. These relations would then be compared with their counterparts for the actual values. Such analysis can provide important

clues on how a forecast was constructed in those cases where the forecaster's model is not specified (and this category includes the majority of all business conditions forecasts).

4. Appraisals of the general business outlook nowadays most often take the form of forecasts of the size and structure of GNP *in current dollars*. On the other hand, economic theory suggests that some relations of concern to the forecaster apply to quantities or constant-dollar values, and the latter are used by some forecasters, notably those working with econometric models. It is of considerable interest to examine two questions: How accurate have the price forecasts been? How did the errors of these forecasts affect the forecasts of GNP? Preliminary results indicate that price level predictions in recent years have been on the whole unsatisfactory. Price changes were often understated when they were large and overstated when they were small. However, the effects of the price errors on the GNP forecasts have not always been adverse because of elements of negative correlation between these errors and those in the implicit quantity component of GNP.

5. Aggregation of forecasts may obscure some interesting aspects of forecasting. Additional materials now available represent a substantial extension of our collection of individual forecasts and will permit us to study the latter more intensively. It will be possible to examine the distributions of predicted changes and compare them with those of actual changes for several different variables and subperiods. Evidence on how the errors of individuals are structured and how they are associated with each other at different times will be considerably increased, which may improve understanding of how forecasts are formed and how forecasters interact.

6. Further insights into how to improve the use of available information for purposes of forecasting can be gained from assessments of the quality of forecast revisions. Our compilation contains materials that are uniquely suited for such an investigation, namely, forecasts for overlapping sequences of short periods (e.g., predictions for each of several quarters ahead, revised and extended quarterly). Do revisions improve the forecasts significantly and systematically? If improvements are achieved, as seems to be the case, how are they related to the characteristics of the forecasts, of the series being predicted, of the period covered? These questions illustrate what we expect to learn from this

part of the study. More ambitiously, we might be able to formulate a useful "learning function"—one that would enable forecasters to learn efficiently from their past errors and that may therefore be expected to help forecasters in the future.

7. The availability and quality of data needed by forecasters are important subjects for study. As already noted, a paper on revisions in the GNP accounts is concerned with some major questions in this field. How large are the errors of observation relative to the errors of forecasts for the same series? Do the revisions of the data reveal systematic measurement errors? If so, are the latter related to the systematic components of forecast errors? Further work in this general area should progress from an analysis of data quality to that of data requirements. Series with anticipatory properties, such as the leading cyclical indicators, the indexes based on surveys of businessmen's plans and consumer intentions, government budget projections, and the so-called diffusion data are of special interest here. Past efforts on this front were rewarded by some significant extensions and improvements in statistical materials. These may prove to be one way of getting better forecasts, and further explorations of this subject are planned.