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FOREWORD

THIS paper opens up the prospect that many of the valuable analytical measures that economists and statisticians rely upon for only the most current figures on national economic affairs can now be constructed on a practical, low-cost basis for a much wider variety of economic data, through the use of electronic computers. Monthly data for local areas or regions, separate industries, or individual business firms can be adjusted and analyzed by the same kinds of techniques that serve to improve our understanding of recent changes in the national economy. Business managements can be better and more promptly informed about current trends in their own firms' operations and related fields. One such improvement, for example, can give those using the technique something like a six-month lead in recognizing a new trend over those using the simple method that is now widely depended on.

Mr. Shiskin's report deals with a problem that has long perplexed observers of current business conditions—the diffi-

culty of separating more meaningful business trends from seasonal and irregular fluctuations. The problem is especially acute because, on a month-to-month basis, seasonal and irregular movements are usually much larger than changes in the underlying cyclical (or major) trend. The statistical adjustments required to handle this problem—correcting raw data for the number of working days per month, adjusting for seasonal variations, and smoothing irregular movements—involve large amounts of computation. Consequently, although their merits are well known to statisticians, they have in the past been carried out in a limited way or not at all. An electronic computer program which provides for all these adjustments systematically and extremely rapidly has been prepared and thoroughly tested. It is already being used by many government agencies and is available to the general public; several thousand monthly series have been analyzed by the method.

Business concerns can, therefore, now

have these adjustments made for their own figures and kept up to date; and business economists can have all important economic indicators in adjusted form. The computed seasonal factors themselves will be useful in forecasting seasonal load requirements and the like. Further applications of the power of electronic computers to handle complex analyses of economic data are now being developed and tested in a research program being conducted by the National Bureau of Economic Research. As these tools find their way into practical use, as they are modified in accordance with the lessons of experience, and as their merits and limitations become better understood, we may expect a general improvement in statistical intelligence at the level of individual company activities, as well as on the national level.

The electronic computer program described in this paper was started by Mr. Shiskin several years ago at the Bureau of the Census, where he is chief economic statistician. Mr. Shiskin received a Rockefeller Public Service Award for 1956-57 and has been devoting his efforts, while on leave from the Census Bureau, to the further exploration and testing of computer techniques, including the one described here. As a research associate of the National Bureau of Economic Research, he is directing, jointly with me, a study of the application of electronic computers to economic statistics. Several ways in which high-speed computers can be used to improve our understanding of current business trends are being investigated: (1) by faster application and fuller use of the most reliable statistical techniques employed by econ-

omists, (2) by the development of new and improved measures for current economic series, and (3) by more powerful analyses of historical business fluctuations. An advisory committee of distinguished economists and statisticians under the chairmanship of W. Allen Wallis, dean of the School of Business of the University of Chicago, is helping to guide the research. Substantial contributions of machine and programming time from equipment manufacturers and a grant from the National Science Foundation have made the study possible. The particular computer program described in the present report was developed with the aid of a contribution of Univac programming and machine time from the Sperry-Rand Corporation.

This paper is the first report on the National Bureau project. A second, more technical report, "Seasonal Adjustments by Electronic Computer Methods," will be published in the December issue of the *Journal of the American Statistical Association* and as "NBER Technical Paper" No. 12. It describes the seasonal adjustment method in full detail and analyzes the tests to which it has been subjected. Additional tests are reported by Mr. Shiskin in a paper presented at the September, 1957, meeting of the American Statistical Association. Other phases of the project are described briefly in the *Thirty-seventh Annual Report* of the National Bureau (May, 1957); full reports on these will be issued as completed.

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ELECTRONIC COMPUTERS AND BUSINESS INDICATORS

JULIUS SHISKIN*

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This paper has been approved for publication as a report of the National Bureau of Economic Research by the director of research and the Board of Directors of the National Bureau, in accordance with the resolution of the board governing National Bureau reports (see the *Annual Report* of the National Bureau of Economic Research). It is to be reprinted as No. 57 in the National Bureau's series of Occasional Papers.