

OR and mathematics through calculus is assumed. The text is well written and valuable to anyone interested in military OR.

*Reviewed by Dean S. Hartley III, Center for Modeling, Simulation & Gaming, Oak Ridge Federal Facilities, 1099 Commerce Park, Oak Ridge, TN 37830, USA*

## Forecasting: Methods and Applications

Spyros Makridakis, Steven C. Wheelwright and Rob J. Hyndman

John Wiley & Sons, 1998, 642 pp., third edition, ISBN 0-471-53233-9

This is a new edition of a highly regarded text on business and economic forecasting. It retains two former authors, one of whom has had a considerable influence on a generation of researchers with his views on the conduct of practical research in forecasting. The new edition still covers old standards such as time series decomposition, exponential smoothing, regression analysis, and ARIMA models in chapters that are reminiscent of the old. Yet it also contains considerable new material. Its chapter on time series decomposition has been extended to include local regression smoothing, X-12-ARIMA and the STL methods. The regression chapter now contains best subset regression. Model selection with Akaike's Information Criterion (AIC) is considered in a number of places including the chapter on ARIMA models. There is a chapter on advanced forecasting models, which includes regression with time series errors, dynamic regression models, intervention analysis, multivariate autoregressive models, neural networks, nonlinear forecasting, and state space modeling. Modern approaches to long term forecasting based on mega-trends, analogies and scenarios are considered. The book also looks at new ideas for combining statistical and judgemental forecasts, covers experience gained from forecasting competitions including the latest M3-IJF competition explores recent research on forecast accuracy, examines the features of major forecasting packages, and outlines forecasting resources that are currently available on the Internet. Quite remarkably the book has been reduced by about one-third with no obvious decrease in coverage or quality.

It is claimed that a major strength of the book is its practical orientation. In most ways this claim is well founded but there are some omissions. How do we forecast the usage of slow moving items that are so prevalent in many businesses? Are the conventional techniques such as exponential smoothing appropriate in these circumstances? Is Theil's U-statistic always useable in practice with the widespread prevalence of business time series containing zeros? How is the variance of lead-time demand properly calculated for inventory control applications, particularly when the exponential smoothing methods are used? What is done when inventories consist of products with relatively short life cycles and where sufficient data is not available to get reliable results from the standard techniques?

What does one do when the extrapolation of a downward local trend from trend corrected exponential smoothing yields negative sales forecasts? These and similar issues that I have encountered in practice seem to be ignored.

The book has addressed some approaches to forecasting that have come of age since the publication of the second edition. There is now a cursory discussion of the Dicky-Fuller test for unit roots. Given the importance of this test, however, a more thorough elaboration of its logic together with an illustration of its use would have been most helpful. Structural time series models are mentioned briefly but a more detailed exposition without the complexities of the Kalman filter would have been possible and most illuminating. The issue of cointegration and its importance in economic forecasting has been overlooked. And given the growing importance of finance applications with their emphasis on the measurement of volatility, an introduction to ARCH and GARCH models would have been sensible. The book is still geared to a first course in business and economic time series analysis and is admirably suited for this purpose. Explanations are still simple and comprehensible. The use of graphical methods has been increased. And more real examples, many based on consulting experiences, are used to illustrate the methods. Again extensive exercises follow each chapter. The data for these exercises can be downloaded from a web site maintained by the third author.

The mathematical prerequisites for understanding the new edition have not changed much. Matrix algebra is now used in a few technical sections of the chapter on advanced forecasting models. Students without matrix algebra, however, should continue to feel comfortable with most of the text.

The earlier edition of the book was always a winner with students and was sorely missed when it went out of print. The current enhanced edition will almost certainly achieve the same standing with a new generation of students. I commend it most highly as an introductory text on business and economic forecasting.

*Reviewed by Ralph D. Snyder, Department of Econometrics and Business Statistics, Monash University, Clayton, Victoria 3185, Australia*