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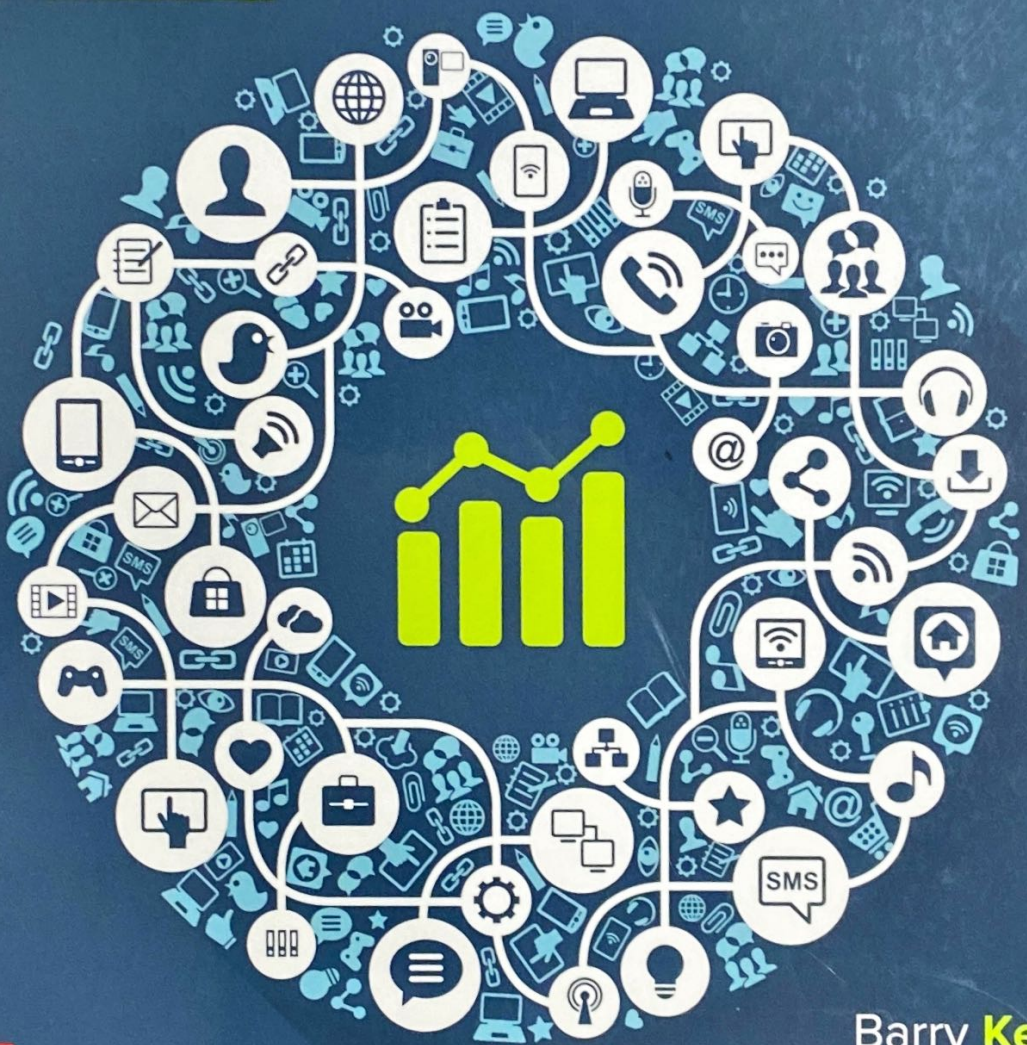
SEVENTH EDITION

Forecasting and Predictive Analytics

with ForecastX™



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Forecasting & Predictive Analytics with ForecastX™

Seventh Edition

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Preface

The seventh edition of *Forecasting and Predictive Analytics with ForecastX™* builds on the success of the first six editions. While a number of significant changes have been made in this seventh edition, it remains a book about prediction methods for managers, forecasting practitioners, data scientists, and students who will one day become business professionals and have a need to understand practical issues related to prediction in all its forms. Our emphasis is on authentic learning of the forecasting and analytics methods that practitioners have found most useful. *Forecasting and Predictive Analytics with ForecastX™* is written for students and others who want to know how forecasting is really done.

Content Updates

Major overall updates for this edition include:

- Four new chapters on predictive analytics
- The addition of Learning Objectives to all chapters
- Updated data throughout the book
- Updated and clarified ForecastX™ software sections

Today, most business planning routinely begins with a sales forecast. Whether you are an accountant, a marketer, a human resources manager, a data scientist, or a financial analyst, you will have to predict something sooner or later. This book is designed to lead you through the most helpful techniques to use in any prediction effort.

The analytics materials included in the sixth edition have been expanded to include four full chapters in the seventh edition; this is a recognition of the importance of these tools in today's prediction efforts. The examples we offer are, for the most part, based on actual historical data, much like that you may encounter in your own forecasts. The techniques themselves are explained as procedures that you may replicate with your own data.

Specific chapter updates include:

Chapter 1. Introduction to Business Forecasting and Predictive Analytics

- Added Stages in the development of business forecasting are added.
- Steps to obtain better forecasts are added.
- A discussion of survey results is added showing what functional areas in an organization contribute to a forecast and which area owns the forecast.

Chapter 2. The Forecast Process, Data Considerations, and Model Selection

- New exercises and updated data in others are added.
- Discussion of trend, seasonal, and cyclical components of a time series, including new data, is added.

Chapter 3. Extrapolation 1. Moving Averages and Exponential Smoothing

- Sections on Simple, Holt's and Winters' exponential smoothing models are completely rewritten to clarify how they work and how to interpret the results.
- The use of all methods for dealing with seasonal data is discussed, including the deseasonalizing of data, making the forecast, then putting the seasonality back into the forecast.
- "Event Modeling" section is expanded to include a complete example.
- New exercises and updated data in others are added.

Chapter 4. Extrapolation 2. Introduction to Forecasting with Regression Trend Models

- A comparison of the look of regression results from Excel and from ForecastX™ is added to show that they are equivalent, even if the formatting is different.
- An explanation of seasonal indices and how to get seasonal indices using ForecastX™ is added.
- A complete explanation of calculating the mean absolute percent error (MAPE) is added, including a table with an example.
- An example of cross sectional forecasting is added.
- The steps to use when evaluating a regression model are clarified.

Chapter 5. Explanatory Models 1. Forecasting with Multiple Regression Causal Models

- The discussion of steps to use when evaluating regression models is expanded and clarified.
- An example of accounting for a recession in a multiple regression model with an introduction to business cycle information from FRED is added.
- Discussion of how missing variables may affect serial correlation is clarified, with an example.
- Discussion of the use of a seasonal Durbin-Watson statistic DW_4 versus DW_1 is added.
- An appendix concerning forecast combinations (ensembles) with a full discussion of detecting bias is added.

Chapter 6. Explanatory Models 2. Time-Series Decomposition

- Discussion of ways to estimate cycle turning points using actual private housing starts data with detailed graphics is added.

Chapter 7. Explanatory Models 3. ARIMA (Box-Jenkins)–Type Forecasting Models

- The ARIMA philosophy of modelling is introduced.
- An intuitive approach to explaining ARIMA is used to reduce complexity.
- The individual components of ARIMA (autoregressive models and moving average models) are explained.
- Stationarity is explained and the handling of nonstationarity is demonstrated.

- Numerous examples are included.
- The application of ARIMA to time-series data is detailed.
- "Overfitting" is explained along with detection and correction.

Chapter 8. Predictive Analytics: Helping to Make Sense of Big Data

- Entirely new chapter.
- The field of predictive analytics as an extension of forecasting is introduced.
- The three primary tools of analytics are defined.
- The new vocabulary and terminology used in analytics are listed.
- The importance of correlation is stressed.
- The "steps" in any data mining/analytics process are described.
- The data used in analytics is differentiated from the data commonly used in forecasting.
- The new diagnostic statistics used by data scientists are described.

Chapter 9. Classification Models: The Most Used Models in Analytics

- Entirely new chapter.
- The most used technique in analytics, classification algorithms, is introduced.
- The use of the kNN algorithm is taught.
- CART models (a second type of classification algorithm) is demonstrated.
- A third classification algorithm is introduced: the Naive Bayes algorithm.
- The final classification technique, Logit, is detailed.
- Actual examples of each technique are covered in detail.

Chapter 10. Ensemble Models and Clustering

- Entirely new chapter.
- Ensemble models are introduced with the rationale for their use in analytics.
- Two important ensemble techniques are discussed and demonstrated: bagging and boosting.
- A third, newer ensemble is detailed: random forests.
- Clustering is introduced as a completely different class of analytics technique.
- Each of the techniques in the chapter is demonstrated step-by-step with actual examples.

Chapter 11. Text Mining

- Entirely new chapter.
- Text mining (and all its variants) is introduced first in a general manner.
- The concept of data reduction is demonstrated, and its importance is demonstrated in the context of text mining.
- The "bag of words" approach to text mining is used with examples and software.
- "Bag of words" analysis is detailed in an extended example involving newsgroups.
- The newer approach to text mining involves "natural language processing;" this is shown with an extended example.
- Text mining and the more traditional data mining are combined through example to demonstrate the power of using both together.

Chapter 12. Forecast/Analytics Implementation

- Graphics related to the forecasting process are added.

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- As Word files, with both question-only and answer files.
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edition. Comments from students at other universities in the United States and elsewhere have also been appreciated. It has been particularly gratifying to hear from students who have found what they learned from a course using this text to be useful in their professional careers. We are accessible; drop us an email if you have a comment.

The final product owes a great debt to the inspiration and comments of our colleagues, especially Professors Thomas Bundt of Hillsdale College and Tunga Kiyak at Michigan State University. In addition, we would like to thank the staff at John Galt Solutions for facilitating our use of the ForecastX™ software. We also thank Professor Eamonn Keogh at the University of California, Riverside, for sharing with you his illuminating examples of data mining techniques.

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We hope that all of the above, as well as all new faculty, students, and business professionals who use the text, will be pleased with the seventh edition.

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