

Springer Series in Statistics

Rob J. Hyndman · Anne B. Koehler  
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# Forecasting with Exponential Smoothing

The State Space Approach



Springer

**Forecasting With Exponential Smoothing The State  
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2008 Paperback**

**Rob Hyndman, Anne B. Koehler, J. Keith  
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*Forecasting with Exponential Smoothing* Rob Hyndman, Anne B. Koehler, J. Keith Ord, Ralph D. Snyder, 2008-06-19 Exponential smoothing methods have been around since the 1950s and are still the most popular forecasting methods used in business and industry. However, a modeling framework incorporating stochastic models, likelihood calculation, prediction intervals, and procedures for model selection was not developed until recently. This book brings together all of the important new results on the state space framework for exponential smoothing. It will be of interest to people wanting to apply the methods in their own area of interest as well as for researchers wanting to take the ideas in new directions. Part 1 provides an introduction to exponential smoothing and the underlying models. The essential details are given in Part 2, which also provide links to the most important papers in the literature. More advanced topics are covered in Part 3, including the mathematical properties of the models and extensions of the models for specific problems. Applications to particular domains are discussed in Part 4.

**A State Space Model for Exponential Smoothing with Group Seasonality** Karl H. van Donselaar, Pim Ouweland, Rob J. Hyndman, Ton G. de Kok, 2007

[Incorporating a Tracking Signal Into State Space Models for Exponential Smoothing](#) Ralph Snyder, Anne Koehler, 2006

**Introduction to Time Series and Forecasting** Peter J. Brockwell, Richard A. Davis, 2006-04-10 Some of the key mathematical results are stated without proof in order to make the underlying theory accessible to a wider audience. The book assumes a knowledge only of basic calculus, matrix algebra, and elementary statistics. The emphasis is on methods and the analysis of data sets. The logic and tools of model building for stationary and nonstationary time series are developed in detail, and numerous exercises, many of which make use of the included computer package, provide the reader with ample opportunity to develop skills in this area. The core of the book covers stationary processes, ARMA and ARIMA processes, multivariate time series, and state space models, with an optional chapter on spectral analysis. Additional topics include harmonic regression, the Burg and Hannan-Rissanen algorithms, unit roots, regression with ARMA errors, structural models, the EM algorithm, generalized state space models, with applications to time series of count data, exponential smoothing, the Holt-Winters and ARAR forecasting algorithms, transfer function models, and intervention analysis. Brief introductions are also given to cointegration and to nonlinear continuous time and long memory models. The time series package included in the back of the book is a slightly modified version of the package ITSM, published separately as ITSM for Windows by Springer-Verlag, 1994. It does not handle such large data sets as ITSM for Windows, but like the latter, runs on IBM PC compatible computers under either DOS or Windows version 3.1 or later. The programs are all menu-driven so that the reader can immediately apply the techniques in the book to time series data with a minimal investment of time in the computational and algorithmic aspects of the analysis.

**Time Series Analysis by State Space Methods** James Durbin, Siem Jan Koopman, 2012-05-03 This new edition updates Durbin-Koopman's important text on

the state space approach to time series analysis The distinguishing feature of state space time series models is that observations are regarded as made up of distinct components such as trend seasonal regression elements and disturbance terms each of which is modelled separately The techniques that emerge from this approach are very flexible and are capable of handling a much wider range of problems than the main analytical system currently in use for time series analysis the Box Jenkins ARIMA system Additions to this second edition include the filtering of nonlinear and non Gaussian series Part I of the book obtains the mean and variance of the state of a variable intended to measure the effect of an interaction and of regression coefficients in terms of the observations Part II extends the treatment to nonlinear and non normal models For these analytical solutions are not available so methods are based on simulation

*Smoothing, Forecasting and Prediction of Discrete Time Series* Robert Goodell Brown, 2004-01-01 Computer application techniques are applied to routine short term forecasting and prediction in this classic of operations research The text begins with a consideration of data sources and sampling intervals progressing to discussions of time series models and probability models An extensive overview of smoothing techniques surveys the mathematical techniques for periodically raising the estimates of coefficients in forecasting problems Sections on forecasting and error measurement and analysis are followed by an exploration of alternatives and the applications of the forecast to specific problems and a treatment of the handling of systems design problems ranges from observed data to decision rules 1963 ed

**Exponential Smoothing Methods of Forecasting and General ARMA Time Series Representations** Roland G. Shami, R. D. Snyder, 1998

*Student Solutions Manual to Accompany Introduction to Time Series Analysis and Forecasting* Douglas C. Montgomery, Cheryl L. Jennings, Murat Kulahci, James R. Broyles, Christopher J. Rigdon, 2009-03-23 An accessible introduction to the most current thinking in and practicality of forecasting techniques in the context of time oriented data Analyzing time oriented data and forecasting are among the most important problems that analysts face across many fields ranging from finance and economics to production operations and the natural sciences As a result there is a widespread need for large groups of people in a variety of fields to understand the basic concepts of time series analysis and forecasting Introduction to Time Series Analysis and Forecasting presents the time series analysis branch of applied statistics as the underlying methodology for developing practical forecasts and it also bridges the gap between theory and practice by equipping readers with the tools needed to analyze time oriented data and construct useful short to medium term statistically based forecasts Seven easy to follow chapters provide intuitive explanations and in depth coverage of key forecasting topics including Regression based methods heuristic smoothing methods and general time series models Basic statistical tools used in analyzing time series data Metrics for evaluating forecast errors and methods for evaluating and tracking forecasting performance over time Cross section and time series regression data least squares and maximum likelihood model fitting model adequacy checking prediction intervals and weighted and generalized least squares Exponential smoothing techniques for time series with polynomial components and

seasonal data Forecasting and prediction interval construction with a discussion on transfer function models as well as intervention modeling and analysis Multivariate time series problems ARCH and GARCH models and combinations of forecasts The ARIMA model approach with a discussion on how to identify and fit these models for non seasonal and seasonal time series The intricate role of computer software in successful time series analysis is acknowledged with the use of Minitab JMP and SAS software applications which illustrate how the methods are implemented in practice An extensive FTP site is available for readers to obtain data sets Microsoft Office PowerPoint slides and selected answers to problems in the book Requiring only a basic working knowledge of statistics and complete with exercises at the end of each chapter as well as examples from a wide array of fields Introduction to Time Series Analysis and Forecasting is an ideal text for forecasting and time series courses at the advanced undergraduate and beginning graduate levels The book also serves as an indispensable reference for practitioners in business economics engineering statistics mathematics and the social environmental and life sciences

State Space Modeling of Time Series Masanao Aoki, 1987 Model's predictive capability These are some of the questions that need to be answered in proposing any time series model construction method This book addresses these questions in Part II Briefly the covariance matrices between past data and future realizations of time series are used to build a matrix called the Hankel matrix Information needed for constructing models is extracted from the Hankel matrix For example its numerically determined rank will be the dimension of the state model Thus the model dimension is determined by the data after balancing several sources of error for such model construction The covariance matrix of the model forecasting error vector is determined by solving a certain matrix Riccati equation This matrix is also the covariance matrix of the innovation process which drives the model in generating model forecasts In these model construction steps a particular model representation here referred to as balanced is used extensively This mode of model representation facilitates error analysis such as assessing the error of using a lower dimensional model than that indicated by the rank of the Hankel matrix The well known Akaike's canonical correlation method for model construction is similar to the one used in this book There are some important differences however Akaike uses the normalized Hankel matrix to extract canonical vectors while the method used in this book does not normalize the Hankel matrix

*State-Space Methods for Time Series Analysis* Jose Casals, Alfredo Garcia-Hiernaux, Miguel Jerez, Sonia Sotoca, A. Alexandre Trindade, 2018-09-03 The state space approach provides a formal framework where any result or procedure developed for a basic model can be seamlessly applied to a standard formulation written in state space form Moreover it can accommodate with a reasonable effort nonstandard situations such as observation errors aggregation constraints or missing in sample values Exploring the advantages of this approach State Space Methods for Time Series Analysis Theory Applications and Software presents many computational procedures that can be applied to a previously specified linear model in state space form After discussing the formulation of the state space model the book illustrates the flexibility of the state space representation and covers the main state

estimation algorithms filtering and smoothing It then shows how to compute the Gaussian likelihood for unknown coefficients in the state space matrices of a given model before introducing subspace methods and their application It also discusses signal extraction describes two algorithms to obtain the VARMAX matrices corresponding to any linear state space model and addresses several issues relating to the aggregation and disaggregation of time series The book concludes with a cross sectional extension to the classical state space formulation in order to accommodate longitudinal or panel data Missing data is a common occurrence here and the book explains imputation procedures necessary to treat missingness in both exogenous and endogenous variables Web Resource The authors E4 MATLAB toolbox offers all the computational procedures administrative and analytical functions and related materials for time series analysis This flexible powerful and free software tool enables readers to replicate the practical examples in the text and apply the procedures to their own work

*Time Series: Theory and Methods* Peter J. Brockwell, Richard A. Davis, 1991 This paperback edition is a reprint of the 1991 edition Time Series Theory and Methods is a systematic account of linear time series models and their application to the modeling and prediction of data collected sequentially in time The aim is to provide specific techniques for handling data and at the same time to provide a thorough understanding of the mathematical basis for the techniques Both time and frequency domain methods are discussed but the book is written in such a way that either approach could be emphasized The book is intended to be a text for graduate students in statistics mathematics engineering and the natural or social sciences It contains substantial chapters on multivariate series and state space models including applications of the Kalman recursions to missing value problems and shorter accounts of special topics including long range dependence infinite variance processes and nonlinear models Most of the programs used in the book are available in the modeling package ITSM2000 the student version of which can be downloaded from <http://www.stat.colostate.edu/pjbrock/student06>

An Introduction to Time Series Analysis and Forecasting Robert A. Yaffee, Monnie McGee, 2000-04-27 A time series is a set of repeated measurements of the same phenomenon taken sequentially over time Capturing the data creates a time series memory to document correlations or lack and to help them make decisions based on this data

**A State Space Framework for Automatic Forecasting Using Exponential Smoothing Methods**, 2000

**Introduction To Time Series And Forecasting, 2E (With Cd)** Peter J. Brockwell, 2006-01-01

*Time Series and Forecasting* Bruce L. Bowerman, Richard T. O'Connell, 1979 Forecasting and multiple regression analysis Forecasting time series described by trend and irregular components Forecasting seasonal time series The box jenkins methodology

Prediction Intervals for Exponential Smoothing State Space Models Rob J. Hyndman, Monash University. Department of Econometrics and Business Statistics, 2001

**Introduction to Time Series and Forecasting** Peter J. Brockwell, Richard A. Davis, 2014-01-15

*Stability Properties of State Space Models for Exponential Smoothing* Muhammad Akram, 2005

The Vector Innovation Structural Time Series Framework Ashton De Silva, 2007

**Bagging Exponential Smoothing Methods Using STL Decomposition and Box-Cox Transformation**

Christoph Bergmeir, Rob Hyndman, José M. Benítez Sánchez, 2014

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