

Harvey, Andrew C.

Forecasting, structural time series models, and the Kalman filter. Paperback ed. (English)

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Cambridge etc.: Cambridge University Press. xvi, 554 p. (1990).

This book contains 9 chapters: 1. Introduction, 2. Univariate time series models, 3. State space models and the Kalman filter, 4. Estimation, prediction and smoothing for univariate structural time series models, 5. Testing and model selection, 6. Extensions of the univariate model, 7. Explanatory variables, 8. Multivariate models, 9. Continuous time. Appendix 1 is devoted to principal structural time series and models, whereas Appendix 2 gives 10 data sets used for numerical illustrations throughout the text.

Some data have been already analyzed by many authors, e.g. mink and muskrat furs sold by the Hudson Bay Company, but most of them are not generally known and their presentation refreshes the mathematical description of the introduced statistical methods (e.g. purses snatched in the Hyde Park area of Chicago, or goals scored by England against Scotland in international football matches). Most of the calculations reported in the book can be carried out on an IBM PC using the program 'STAMP' (Structural Time series Analyser, Modeller and Predictor), which is a menu-driven program for fitting univariate structural time series models and models with intervention and explanatory variables. Also some series introduced in Appendix 2 can be found on the diskettes provided with STAMP.

Although some other methods for statistical analysis of time series are also reported, the main tool used here is the Kalman filter and its application to structural time series models. The author shows on the data that in many cases the 'best' models are those containing stochastic trend or stochastic cycle instead of deterministic components. It enables to avoid difficulties connected with complicated properties of residuals. An explicit hint is given on p. 289: "It is common practice, particularly in economics, to detrend a series before subjecting it to analysis. The best advice to anyone contemplating such a course of action is not to do it."

The book contains a lot of specific models and procedures. It is not written in the style Theorem-Proof-Remark-Application. The way of explanation can be described quoting a few words from the Introduction, although they were written in a different connection: "The technical details... are unimportant... The crucial point to understand is that the state space form opens up the possibility of setting up models in terms of components which have a direct interpretation." The reader is assumed to be familiar with linear algebra and calculus but not with more advanced techniques. "No attempt is made to provide rigorous proofs on topics such as the asymptotic properties of estimators. The emphasis is on the development of models which can be used in practice, and the way in which such models can be selected." (p. xii).

The publication provides a unified and comprehensive theory of structural time series models. It is concerned primarily with modelling economic and social time series, but the procedures can be successfully applied also to technical, biological and geophysical data. It can be recommended to students for seminary work as well as to people working in applications.

Reviewer: [J.Anděl \(Praha\)](#)

MSC:

- 62M20 Inference from stochastic processes and prediction
- 62M10 Time series, auto-correlation, regression, etc. in statistics (GARCH)
- 62-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to statistics
- 62-04 Software, source code, etc. for problems pertaining to statistics
- 62P20 Applications of statistics to economics

Cited in **3** Reviews
Cited in **50** Documents

Keywords:

STAMP-program; state space models; Kalman filter; estimation; prediction; smoothing; structural time series models; testing; model selection; explanatory variables; multivariate models; numerical illustrations; Structural Time series Analyser, Modeller and Predictor; stochastic trend; stochastic cycle; residuals;

