

# Chapter 22

## Overview of the Time Series Forecasting System

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## Chapter 22

# Overview of the Time Series Forecasting System

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## Introduction

The Time Series Forecasting system forecasts future values of time series variables by extrapolating trends and patterns in the past values of the series or by extrapolating the effect of other variables on the series. The system provides convenient point-and-click windows to drive the time series analysis and forecasting tools of SAS/ETS software.

You can use the system in a fully automatic mode, or you can use the system's diagnostic features and time series modeling tools interactively to develop forecasting models customized to best predict your time series. The system provides both graphical and statistical features to help you choose the best forecasting method for each series.

The following is a brief summary of the features of the Time Series Forecasting system. With the system you can

- use a wide variety of forecasting methods, including several kinds of exponential smoothing models, Winters method, and ARIMA (Box-Jenkins) models. You can also produce forecasts by combining the forecasts from several models.
- use predictor variables in forecasting models. Forecasting models can include time trend curves, regressors, intervention effects (dummy variables), adjustments you specify, and dynamic regression (transfer function) models.
- view plots of the data, predicted versus actual values, prediction errors, and forecasts with confidence limits, as well as autocorrelations and results of white noise and stationarity tests. Any of these plots can be zoomed and can represent raw or transformed series.
- use hold-out samples to select the best forecasting method
- compare goodness-of-fit measures for any two forecasting models side by side or list all models sorted by a particular fit statistic
- view the predictions and errors for each model in a spreadsheet or compare the fit of any two models in a spreadsheet
- examine the fitted parameters of each forecasting model and their statistical significance
- control the automatic model selection process: the set of forecasting models considered, the goodness-of-fit measure used to select the best model, and the time period used to fit and evaluate models

- customize the system by adding forecasting models for the automatic model selection process and for point-and-click manual selection
- save your work in a project catalog
- print an audit trail of the forecasting process
- show source statements for PROC ARIMA code
- save and print system output including spreadsheets and graphs

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## Using The Time Series Forecasting System

Chapters 23 through 27 contain a series of example sessions that show the major features of the system. Chapters 28 through 30 serve as reference chapters and provide more details on how the system operates. The reference chapters contain a complete list of Forecasting system features.

To get started using the Time Series Forecasting system, it is a good idea to work through a few of the example sessions. Start with Chapter 23, “Getting Started with Time Series Forecasting,” and use the system to reproduce the steps shown in the examples. Continue with the other chapters when you feel comfortable using the system.

The example sessions make use of time series data sets contained in the SASHELP library: `air`, `citimon`, `citiqtr`, `citiyr`, `citiwk`, `citiday`, `gnp`, `retail`, `usecon`, and `workers`. You can use these data sets to work through the example sessions or to experiment further with the Forecasting system.

Once you are familiar with how the system operates, start working with your own data to build your own forecasting models. When you have questions, consult the reference chapters mentioned above for more information about particular features.

The Time Series Forecasting system forecasts *time series*, that is, variables comprised of ordered observations taken at regular intervals over time. Since the Forecasting system is a part of the SAS software system, time series values must be stored as variables in a SAS data set or data view, with the observations representing the time periods. The data may also be stored in an external spreadsheet or data base if you license SAS/ACCESS software.

The Time Series Forecasting System chapters refer to *series* and *variables*. Since time series are stored as variables in SAS data sets or data views, these terms are used interchangeably. However, the term *series* is preferred when attention is focused on the sequence of data values, and the term *variable* is preferred when attention is focused on the data set.

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## Information Available on the World Wide Web

Visit the SAS World Wide Web site, [www.sas.com](http://www.sas.com), for information and download files related to forecasting. Follow the links for *forecasting*, *SAS/ETS*, and the *Time Series Forecasting System* for new feature descriptions and product overviews. SCL

source code is available for sample SAS/AF applications which provide customized interfaces and batch forecasting capabilities.

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## **SAS Software Products Needed**

The Time Series Forecasting system is part of SAS/ETS software. To use it, you must have a license for SAS/ETS. To use the graphical display features of the system, you must also license SAS/GRAPH software.