RATS 9

Fast, Easy, Flexible, and Reliable Time Series and Cross-Sectional Data Analysis

RATS provides all the basics, including linear and non-linear least squares, forecasting, and ARIMA models, but goes far beyond that with support for techniques like GMM, ARCH and GARCH, vector autoregressions (VARs), spectral analysis, state space models and DSGEs, and much more.

It can handle time series of virtually any frequency, including daily and weekly, as well as panel data, and produces publication-quality graphs for printing or importing directly into word processors.
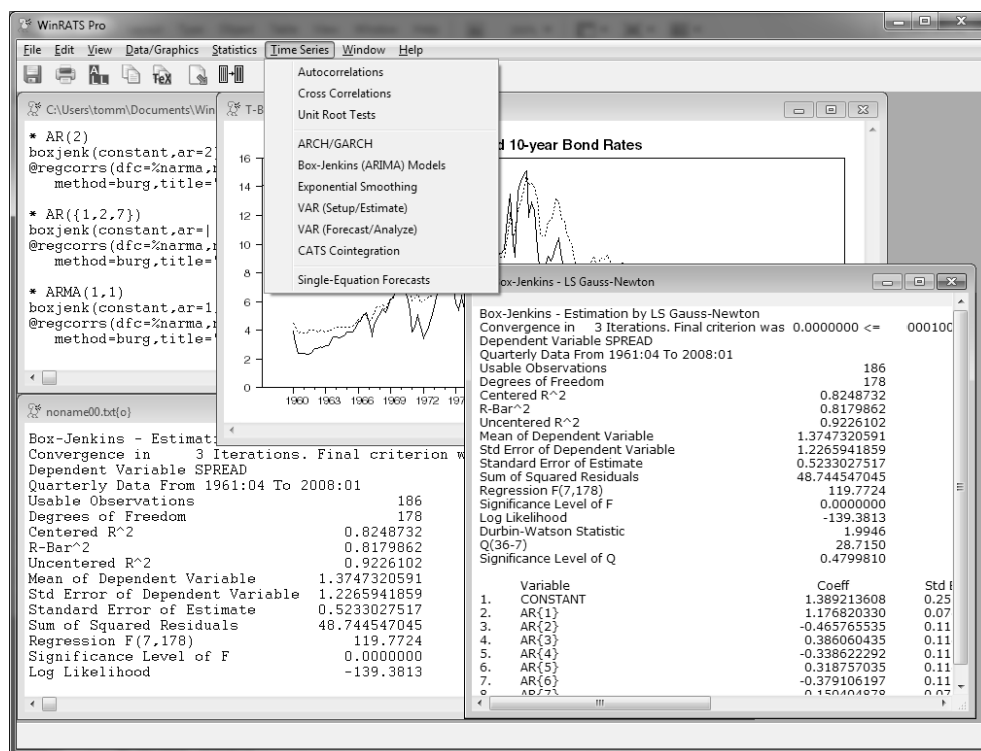
Menu-driven "Wizards" provide a point-and-click interface for many common tasks, making RATS an ideal tool for new users and for educational settings.

Meanwhile, the powerful command-driven language at the heart of the program remains easy to learn and use for simple jobs, while also allowing users to automate complex or repetitive tasks and even write sophisticated menu- and dialog-driven end-user applications.

RATS is available for Windows, Macintosh, UNIX, with complete compatibility across platforms.

The RATS v.9 interface. Here, the sequence of commands appear in one text window, with the output directed to another window. This makes it easy to save commands as a complete program, which you can rerun later with a couple of mouse clicks. Also visible are a report window showing the output from a Box-Jenkins estimation, a graph window, and a look at the wizards on the Time Series menu.

Major Improvements Since Version 8.0 Include:

❑ Revised and expanded manuals.

❑ Multi-threaded execution for better performance.

❑ New editor with many new features.

❑ "Find in Files" operations locates useful examples.

❑ More point-and-click Wizards.

❑ Many new built-in functions.

❑ Option to compute more accurate numerical derivatives.

❑ Estimates of completion time for long operations.

❑ HASH and LIST types for flexible handling of "vector" information.

❑ Ability to pass functions to procedures.

For More Information, or to Place an Order:

RATS is available directly from Estima, and from resellers around the world. We offer single-user, multi-user and network licenses, as well as several options for using RATS in instructional settings, including discounts for full-time students.

For more information, please visit our web site at:

https://www.estima.com

or contact us by phone, fax, mail, or email:

Toll free: 800–822–8038
General: 847–864-8772
Fax: 847-864-6221
Email: sales@estima.com

Estima
1560 Sherman Ave, Suite 510
Evanston, IL 60201 USA

RATS Version 9 Features

Statistical Methods

Estimation Techniques

- ❐ Multiple regressions including stepwise
- ❐ Regression with autoregressive errors
- ❐ Heteroscedasticity/serial-correlation correction, including Newey-West
- ❐ Non-linear least squares
- ❐ Two-stage least squares for linear, non-linear, & autocorrelated models
- ❐ Seemingly unrelated regressions and three-stage least squares
- ❐ Non-linear systems estimation
- ❐ Generalized Method of Moments
- ❐ Maximum likelihood estimation
- ❐ Constrained optimization
- ❐ Extensive built-in hypothesis testing, with procedures for a huge variety of unit-root, stability, and other tests
- ❐ Limited and discrete dependent variable models: logit, probit, censored/truncated data (Tobit), count models
- ❐ Panel data support, including fixed and random effects estimators
- ❐ Non-parametric regressions
- ❐ Kernel density estimation
- ❐ Robust estimation
- ❐ Recursive least squares
- ❐ State-space models, including Kalman filtering and smoothing, simulations, and optimal control models
- ❐ DSGE models
- ❐ Neural network models
- ❐ Linear and quadratic programming

Time Series Procedures

- ❐ Easy to specify lags and leads for time-series model estimation and analysis
- ❐ ARIMA and ARMAX models including multiplicative seasonal models; support for arbitrary lag structures
- ❐ Transfer function/intervention models
- ❐ Error correction models
- ❐ Kalman filter
- ❐ Spectral analysis

Forecasting

- ❐ Time series models
- ❐ Regression models
- ❐ Exponential smoothing
- ❐ Static or dynamic forecasts
- ❐ Simultaneous equation models (unlimited number of equations)
- ❐ Simulations with random or user-supplied shocks
- ❐ Forecast performance statistics, including Theil U statistics

Vector Autoregressions (VARs)

- ❐ Unmatched support for VAR models
- ❐ Error Correction models
- ❐ Structural VARs. Choice of factorizations, including estimation of a factor matrix from a covariance matrix model
- ❐ Impulse responses, with Monte Carlo and Importance Sampling techniques for standard error bands.
- ❐ Forecasting
- ❐ Variance decomposition
- ❐ Historical decomposition
- ❐ Extensive hypothesis testing tools
- ❐ CATS 2.0 add-on provides industry-leading cointegration analysis

ARCH and GARCH Models

- ❐ Univariate and multivariate, including BEKK, diagonal, CC, DCC, and VECH multivariate models
- ❐ Support for GARCH-in-mean models
- ❐ Additional exogenous variables in mean and/or variance equations
- ❐ Normal, t and GED distributions
- ❐ Exponential and Asymmetric models
- ❐ Robust standard errors

Working With Data

Data Entry

- ❐ Menu-driven Data Wizards for reading in data
- ❐ Reads and writes Excel files, text files, EViews®, Stata®, and other formats
- ❐ Pro version supports SQL/ODBC
- ❐ On-screen data viewer and editor, with point-and-click graphing and statistics tools
- ❐ Can handle virtually any data frequency, including daily, weekly, intra-day, and panel data
- ❐ Can automatically convert data to different frequencies
- ❐ RATS data file format is fast and easy, supports all frequencies, and allows you to store series of different frequencies on the same file

Data Transformations

- ❐ Flexible transformations with algebraic formulas
- ❐ Easy to create trend series, seasonal, and time period dummies
- ❐ Extensive filtering operations, including Hodrick-Prescott, Henderson, Spencer, and custom filters
- ❐ Supports regular, seasonal, and fractional differencing

Graphics

- ❐ High-quality time series graphics
- ❐ High-resolution X-Y scatter plots
- ❐ Dual-scale graphs
- ❐ Contour graphs
- ❐ Copy-and-paste graphs into other applications
- ❐ Export graphs to many formats, including PostScript and Windows Metafile
- ❐ User can customize attributes such as line thickness, colors and grayscale levels, and fill patterns

Interface

Interactive Mode Environment

- ❐ Text-editor based
- ❐ Point-and-click "wizards" for many tasks, greatly enhancing ease-of-use
- ❐ Saved programs can be re-run with just a few mouse clicks
- ❐ Designed so that you can reproduce results, output, and graphs easily *and* accurately—a critical but often overlooked requirement for producing reliable, publication-quality results
- ❐ True multiple window support. Simultaneously view your input commands and output, spreadsheet-style "report" windows, graphs, and more

Programmability

- ❐ Extensive looping capabilities and support for applying operations to lists of variables make it possible to automate many repetitive tasks
- ❐ You can write *procedures*, which can perform complex tasks with a single instruction, and write your own callable functions.
- ❐ A library of procedures written by RATS users from around the world is available free of charge on our web site
- ❐ A variety of interface-related instructions allow you to create your own drop-down menus, custom dialog boxes, and more

RATS Professional

The Professional versions of RATS add the following features not found in the Standard version:

- ❐ 64-bit version
- ❐ Support for CRSP and FRED databases
- ❐ ODBC/SQL database support
- ❐ Census Bureau X12 seasonal adjustment routine
- ❐ Support for FAME data files (for Windows and UNIX/LINUX)

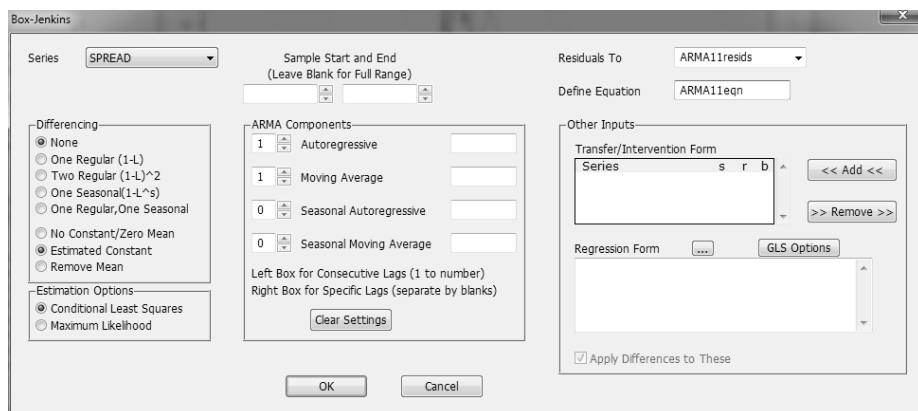## Free Technical Support, No Required Maintenance Fees

Estima supplies expert technical support at no additional charge for as long as you own the software. Most questions are answered within one day. Users can also participate a web-based forum with RATS users from around the world.

And your license to use RATS will never expire—there are never any required maintenance or licensing fees to continue using the software.

Flexible Update Policies

Minor updates are made available by CD or download for a small fee, while more significant updates are offered at very reasonable prices. Updates are always optional.

For users who want to stay up to date automatically, we also offer **Update Subscription** programs, which make it easy to budget software purchases and provide you with all updates, shipped to you on CD or provided by download as soon as they are released.

Supported Platforms

RATS for Windows

WinRATS runs on Windows XP, Vista, Windows 7, and 8. Pro versions include 64-bit version. Requires a Pentium or better processor, and a hard drive with at least 200MB free.

RATS for Macintosh

MacRATS is a "Universal" application and runs on any Intel or PowerPC-based Mac, running OS X 10.5 or later. It requires a hard drive with at least 200MB of free space.

RATS for UNIX and Linux

RATS is available for almost all UNIX and Linux systems, and now includes the same interactive-mode environment previously available only for Windows and Macintosh.

The Linux and UNIX versions require a hard drive with at least 200MB free. The Motif X11 windowing libraries are required for interactive mode use. The UNIX version requires that you have a C compiler to compile the source code.

Pricing

Please refer to our website or your local reseller for prices for the new Version 9.0 of RATS.

https://estima.com/ratsprices.shtml

The Box-Jenkins/ARIMA Wizard provides an easy way to estimate ARIMA and ARMAX models, including models with transfer function or intervention terms.
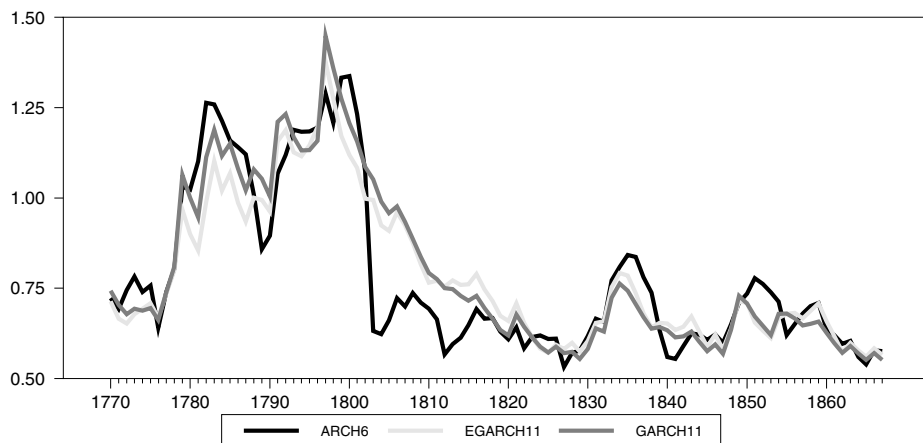
A sample time-series graph. Here, we've used the graphics style sheet feature in RATS to select thicker lines in shades of gray to represent the three series. Because the series cross each other so frequently, the dash patterns that are the standard for black and white lines wouldn't look as good. We've used another option to place a key at the bottom of the graph.

CATS 2.0 Cointegration Analysis Procedure

CATS (Cointegration Analysis of Time Series) is a sophisticated set of RATS procedures which implement the popular Johansen and Juselius cointegration analysis techniques.

Version 2.0 was written by Jonathan Dennis, Katarina Juselius, Soren Johansen, and Henrik Hansen of the University of Copenhagen, and is distributed and supported by Estima.

CATS is almost entirely a menu and dialog-driven procedure. You use standard RATS instructions to define the frequency, read in data, and do any necessary transformations. You then "source" in and execute the CATS procedures. From there, the rest of the analysis is done by selecting operations from the CATS pull-down menus, and entering information in pop-up dialog boxes.

The Johansen–Juselius approach to cointegration is based on the error-correction form of a Gaussian vector autoregression. In particular, they analyze the decomposition of the matrix of error-correction coefficients Π into $\alpha\beta'$. The I(1) procedure supports partial systems, and makes it easy to specify weakly exogenous variables. You can also include dummy variables, or stationary dummy-type variables.

To help you choose a model, CATS provides eigenvalues and trace test statistics for reduced rank (as well as 90% critical values if requested) and unrestricted estimates of α, β, and Π. You can check the model by calculating multivariate test statistics for residual autocorrelation, normality, and ARCH. Version 2 even provides an automated model selection routine.

Additional features include:

- Auxiliary procedures for multivariate tests of long-run exclusion, weak exogeneity and stationarity, and for calculating eigenvalues and trace statistics for five different hypotheses.

- Ability to set and reset the rank of Π throughout the analysis, and a variety of tests to help you determine the "correct" rank order.

- Graphical analysis tools, including plots of the β-vectors to check stationarity, and of residuals to locate possible problems with the Gaussian assumption, plus correlograms and autocorrelograms.
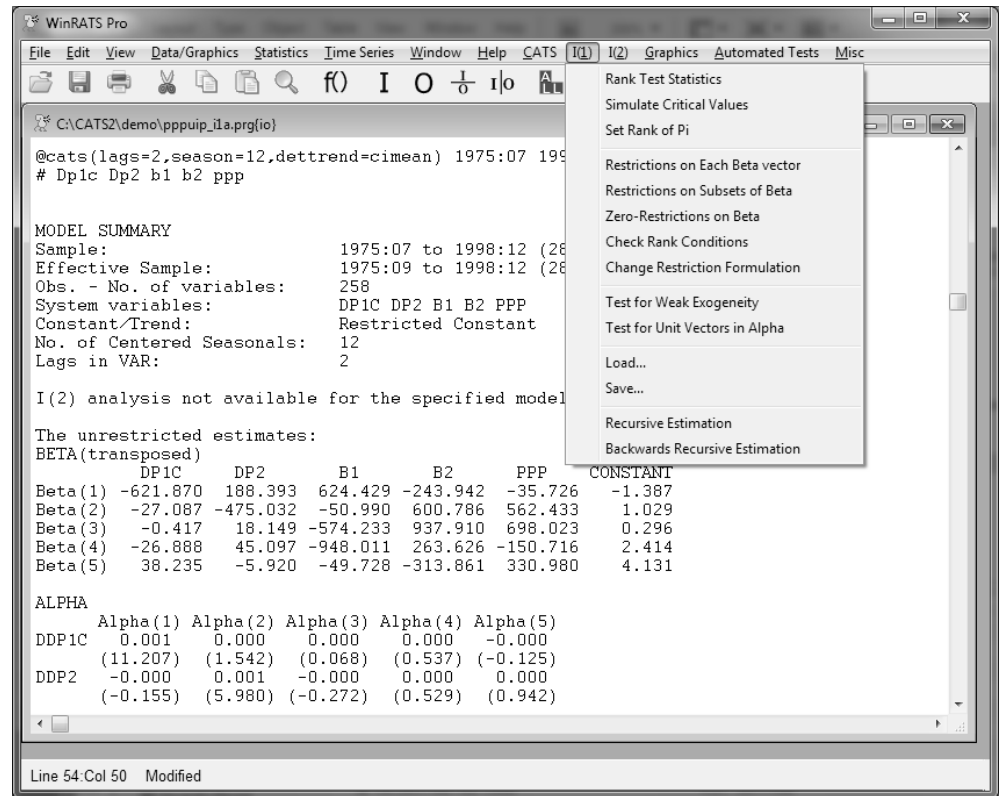
- Descriptive statistics include: residual correlation matrices, the short-run parameters and associated t-values, estimates of the **C**-matrix (with asymptotic t-values) in the common trends representation, and the long-run covariance matrix.

- Structural tests, including non-identifying restrictions on β, identifying restrictions on β, and weak-exogeneity hypotheses on α.

- Supports recursive cointegration analysis, with tests for the constancy of the eigenvalues, stability of the estimated cointegration space and the estimated parameters, and the adequacy of the predictions from the model.

The CATS package includes the CATS procedures on CD (or by download), a 200-page user's manual, and sample data and program files.

CATS requires Version 6.2 or later of RATS, and is available for Windows, Macintosh, UNIX, and Linux. Please contact us if you have any questions about CATS or RATS, or check out our website to order online.

https://estima.com/shopcart/webordercart.shtml

Also available: *The Cointegrated VAR Model: Methodology and Applications*, by Katarina Juselius. Written in conjunction with the development of CATS 2.0, this book provides a comprehensive look at both the theory and practice of cointegration analysis. It is highly recommended for anyone using CATS.

Online Courses and Resources

Over the past few years, we have provided several popular online courses focused on particular topics in econometrics. These courses are delivered via the discussion forum on our website, and include PDF handbooks, example programs, and procedures specific to the course, along with interactive discussions on the lessons and related topics. Most courses last about two months, although we continue to field questions from course participants indefinitely.

Materials From Previous Courses

The following sets of course materials, developed from our web-based courses, are now available for sale. Each package includes the PDF handbook containing the lecture materials, as well as all of the example programs, data sets, and RATS procedures used in the course and are delivered by e-mail download.

Please see https://www.estima.com/courses.shtml to order any of these materials.

ARCH/GARCH and Stochastic Volatility Models

This examines the practical and theoretical issues with estimating and using ARCH, GARCH, and stochastic volatility models. It covers many variants of univariate and multivariate GARCH estimation, including specification of the variance and mean models, overcoming numerical issues, and diagnostic checking.

The course also explains the workings of the Gibbs sampling and bootstrap examples that are provided with RATS, both for inference on the model parameters and for inference on out-of-sample behavior (such as calculation of Value at Risk).

Bayesian Econometrics

The course wookbork is based upon the content of the RATS e-course on Bayesian Econometrics. It covers most of the most important methods now used in Bayesian analysis in econometrics, including Gibbs sampling, Metropolis-Hastings and importance sampling. The applications are to a broad range of topics, include time series, cross-section and panel data. It assumes that the user is comfortable with such basic instructions as **COMPUTE**, **DISPLAY**, **GRAPH**, **SCATTER** and **LINREG**, and can use simple programming techniques such as **DO** loops. In each chapter, there is a "Tips and Tricks" section which covers in greater detail any functions or instructions that might be unfamiliar.

The presentation is based largely on Gary Koop's *Bayesian Econometrics(2003)*. We've added to that in several areas, with a chapter on vector autoregressions, and examples from the literature for panel, cross-sectional data and state-space models. In most cases, we've included much of the statistical derivations from the book, presented in a way to highlight the calculations as they are done with RATS, so even those without the book can benefit.

Panel and Grouped Data

The course covers the techniques of panel data econometrics, with an emphasis on the "time-series" aspects, including Dynamic Panels, Unit Root Tests, Cointegration, and VAR's. We also demonstrate the use of Gibbs sampling for panel data, including linear and non-linear random effects, random coefficients models, and applied to VAR's.

We make use of several new features that were added with RATS versions 8 and 8.1, including improvements to the core instructions **PREGRESS**, **PANEL**, and **PFORM** to provide greater flexibility for dealing with both panel and general grouped data.

State Space and DSGE Models

The "State Space" part of this course is based largely on Durbin and Koopman's *Time Series Analysis by State Space Methods* book, supplemented by material from Harvey's *Forecasting, Structural Time Series Models and the Kalman Filter*, and from West and Harrison's *Bayesian Forecasting and Dynamic Models*. Roughly two-thirds of the course is devoted to State Space models, with the remainder focusing on DSGE models.

We recommend that anyone purchasing the course materials also have a copy of the Durbin and Koopman book, which is available for purchase through Estima. The example programs require version 7.0 or later of RATS.

Structural Breaks and Switching Models

This course deals with a range of topics including outlier detection, intervention modeling in various models, tests for structural breaks and threshold effects, estimation of threshold and smooth transition models and endogenous Markov switching models. It covers both maximum likelihood and Bayesian estimation techniques.

VAR Models

The course covers identifying and estimating VAR models, computing impulse responses and variance decompositions, historical decomposition and counterfactual simulations, structural and semi-structural VARs, and sign restrictions.

The Vector Autoregression (VAR) was introduced to the economics literature in the famous paper "Macroeconomics and Reality". Since then it, and its close relatives, have become the standard for analyzing multiple time series. Even when more complicated and tightly parameterized models are used, it's the stylized facts gleaned from VAR analysis that they are expected to explain.

In this course, we examine techniques that use "flat priors"; that is, the techniques designed to elicit information from the data without the use of informative Bayesian priors. Strongly informative priors (such as the so-called Minnesota prior) are widely used for building forecasting models, but they tend to improve forecasts by shutting down much of the cross-variable interaction. The techniques we examine are designed primarily to analyze precisely that type of interaction.

Econometrics Texts

Applied Econometric Time Series, 3rd edition, by Walter Enders
Applied Econometric Time Series, now in its third edition, provides a lucid introduction to, and discussion of, most of the key topics in modern time series econometrics, including stationarity and unit roots, ARIMA models, volatility (ARCH/GARCH) models, cointegration, and more. Geared towards Masters and PhD students in time series analysis or advanced econometrics courses, as well as professionals wishing to learn more about time series techniques.

Econometric Analysis of Panel Data, 4th Edition, by Badi Baltagi
Badi Baltagi's *Econometric Analysis of Panel Data* is one of the leading textbooks for postgraduate courses in panel data. The 4th edition features recent developments in the field, and covers recent empirical examples from the literature. It also examines dynamic panel data models, non-linear panel models, and limited dependent variables panel data models.

Introductory Econometrics for Finance, 2nd Edition
RATS Handbook for Intro. Econ. for Finance, by Chris Brooks
Introductory Econometrics for Finance is aimed at teaching introductory econometrics to finance majors. It assumes no prior knowledge of econometrics, and covers important modern topics such as time-series forecasting, volatility modelling, switching models and simulation methods. The book includes numerous examples and case studies, making it particularly accessible for non-specialists. The second edition contains new chapters on limited dependent variables and panel methods, as well as new case studies from the finance literature. Supporting materials are available on the web.

Brooks' *RATS Handbook*, written to complement *Introductory Econometrics for Finance*, provides a comprehensive introduction to the use of RATS for modelling in finance and beyond. It includes numerous worked examples with carefully annotated code. Detailed explanations of the outputs are also presented, giving readers the knowledge and confidence to use the software for their own research and to interpret their own results.

An Introduction to State Space Time Series Analysis,
by Commandeur and Koopman
This text offers a step by step approach to the analysis of the salient features in time series such as the trend, seasonal, and irregular components. Practical problems such as forecasting and missing values are treated in some detail. This useful book will appeal to practitioners and researchers who use time series on a daily basis in areas such as the social sciences, quantitative history, biology and medicine. It also serves as an accompanying textbook for a basic time series course in econometrics and statistics, typically at an advanced undergraduate level or graduate level.

Time Series Analysis by State Space Methods, 2nd Edition
by Durbin and Koopman
This is an excellent choice for RATS users interested in pursuing state space modelling techniques. Many of the enhancements to the DLM instruction introduced in recent versions of RATS were developed in the process of writing RATS code for the examples in this book.

The Cointegrated VAR Model: Methodology & Applications,
by Katarina Juselius.
This book is highly recommended for anyone using Version 2 of the "CATS in RATS" cointegration analysis software, but it will be of interest to anyone interested in Vector Autoregression models and cointegration analysis. The book was written in conjunction with the development of CATS 2.0, and provides a comprehensive look at both the theory and practice of cointegration analysis.

Analysis of Financial Time Series, 3nd edition, by Ruey Tsay
Based on an MBA course taught by the author, this covers a wide range of topics, from Box-Jenkins modeling, through ARCH and its relatives, duration models, continuous time models, value at risk calculations, and multivariate time series and volatility analysis. It includes RATS programs for ARCH, non-linear volatility models and duration models. (SCA is used for basic time series methods.)

A Guide to Modern Econometrics, 4th Edition, by Marno Verbeek
Verbeek notes that modern software tools have made it relatively easy for researchers to apply the latest techniques without necessarily understanding them well enough to be aware of potential problems inherent in these techniques. This book is designed to help fill the gap between introductory econometrics texts, which tend not cover these techniques at all (or only deal with idealized cases), and more advanced texts, which are often too advanced to be useful to many practitioners. It aims to familiarize the reader with a wide range of topics in modern econometrics, focusing on what is important for doing and understanding empirical work.

Econometric Analysis of Cross Section and Panel Data
2nd Edition, by Jeffrey Wooldridge
Intended as a second semester graduate text, this book examines the special problems that the econometrician must face in applying linear regression, instrumental variables/GMM and SUR estimators to cross section and panel data. Also covers a wide range of non-linear models: probit, logit, censoring and sample selection, count data and duration models. This includes almost all techniques covered in Chapter 14 of the *RATS User's Guide* plus many more.

For more information on purchasing these textbooks through our website visit:

https://estima.com/textbooks.shtml

Databases

US Economic Data from Haver Analytics

In partnership with Haver Analytics, we are pleased to provide our customers with high quality U.S. economic database services at very reasonable prices. There are three packages from which to choose:

USECON Database

USECON (U.S. Economic Statistics) is Haver's primary database of U.S. economic and financial data. It includes approximately 12,000 series, including national accounts, prices, housing, construction, industrial production, interest rates, money supply, and much more.

USECON Plus USNA Databases

Purchasers of the USECON database have the option of also subscribing to the USNA (U.S. National Accounts) database, which offers an additional 20,000 series with complete national income and product accounts data from the Bureau of Economic Analysis. These provide detailed information such as monthly personal consumption expenditures and personal income.

US1 Database

The US1 database is a subset of the USECON database, containing approximately 750 of the most commonly-used data series.

Distribution Details

The data are supplied via FTP download, both in RATS format, and in Haver's DLX (Data Link Express) format. RATS users can access the RATS files directly using RATS or the RATSDATA utility program. Customers with Version 5 or later of WinRATS can also read data directly from the DLX versions of the data files.

The databases are offered as a one-year subscription. Commercial institutions will receive updates every month. Academic institutions can choose monthly updates, quarterly updates, or just a single copy of the database (the "Annual" subscription).

OECD Main Economic Indicators Database

The OECD MEI database is available in "Full" and "Seven Country" versions. The Full version includes data on more than 30 countries, including Western Europe, the U.S., Canada, Japan, Turkey, Australia, New Zealand, Mexico, Russia, and the former Soviet republics. The seven country version includes only the G7 countries.

The data for most countries include GDP and its major components, producer and consumer price indexes, money stock and related measures, major interest rates, industrial production indexes, unemployment rates, exchange rate vs. the dollar, and the general stock market index. For larger countries, you will also find data on orders, shipments, and inventory stocks, plus greater disaggregation on the price and industrial production indexes. Many of the monthly series are available in both seasonally adjusted and unadjusted forms.

You can purchase a single copy of the OECD database, or you can purchase quarterly or monthly subscriptions. The data are supplied via FTP download, in our convenient RATS data file format, with one file per country. You can read the data directly into RATS, or use the included RATSDATA utility program to view, print, or graph data, or export data into text files, Excel spreadsheets, and other formats. Academic institutions qualify for discounted pricing, visit our website for more information.