The RATSletter

Estima

RATS 6.2

In conjunction with CATS 2.0, we are releasing version 6.2 of RATS. Improvements in this version include:

- New GARCH capabilities
- Expanded Excel support
- Many new functions and instruction options.
- Revised *User's Guide* and *Reference Manual.*

and more!

Note that CATS 2.0 requires version 6.2 of RATS. Users who have version 6 and purchase CATS 2.0 will receive a free update to RATS 6.2.

See page 2 for more on 6.2. See page 4 for pricing information.

CATS Version 2.0!

We are very pleased to introduce version 2.0 of CATS (Cointegration Analysis of Time Series) written and developed by Jonathan G. Dennis, Katarina Juselius, Søren Johansen and Henrik Hansen of the University of Copenhagen.

Version 2.0 is a major update to CATS that introduces many significant new econometrics capabilities, features a re-designed user interface, and includes an all-new, expanded user's manual.

The CATS 2.0 package includes a CD with CATS procedures and sample program and data files, plus an all-new 200-page user's manual describing the econometrics of the cointegrated VAR model and how to interpret the output. All features of the program are illustrated by a worked example. The manual also includes a technical appendix describing the mathematics of CATS.

The cost for a new single-user copy of CATS is $175. The price for an update from CATS 1.0 is $100. The student price for CATS is $125 with verification of student status. Multi-user licence prices are also available—contact Estima for a quote.

CATS 2.0 requires version 6.2 or later of RATS, and is available for Windows and Macintosh platforms. Users with version 6.1 or 6.0 of RATS can receive a free update to 6.2 with an order for CATS 2.0. Please see the CATS Order Form, or visit our web site for complete pricing and ordering information.

New Econometric Features

- Bartlett small-sample correction of the tests for the cointegrating rank and hypotheses on β.
- A new "CATSmining" automated model-selection procedure.
- Estimation and hypothesis testing of the I(2) model, including testing hypotheses on the multi-cointegrating relations and the I(1) relations among the system variables.
- Estimation of structural moving average models.
- System reduction tests for determining lag length.
- Missing observations in data allowed.
- Updated recursive estimation routine includes new tests for eigenvalue fluctuation, constancy of the cointegrating space and the log-likelihood function.
- Allows for "backwards" recursion for investigating parameter constancy over the beginning of the sample.
- For most model specifications, CATS now reports the correct critical values and p-values for the rank test. For other models, you can simulate the critical values using a built-in procedure.
- Includes a procedure for estimation and identification of structural moving average models.

RATS 6.2, *continued*

Here are the most significant changes in RATS 6.2. See page 4 for prices and ordering information.

GARCH Instruction

- Now supports IGARCH, both for univariate and (where appropriate) multivariate models.

- Extends support for GARCH-M and asymmetry models to multivariate cases. Previously, these were only supported for univariate models.

Excel Spreadsheets

- You can now read data from any of the worksheets on an Excel workbook file. Prior versions could only read data from the first sheet in a workbook.

- Recent versions of Excel would sometimes produce files that RATS could not process properly. We have revised our code so that it should now handle any Excel workbook.

New Wizards/Interface Features

- A new *VAR Wizard* provides a dialog-driven interface for defining and estimating VAR models.

- The new *RATS Variable Wizard* provides easy access to all of the "reserved" variables defined by various RATS instructions.

With these two additions, RATS now includes nineteen menu-driven Wizards (twenty in the "Pro" version, which also includes the *X11 Wizard*).

- The *Restore Report* operation on the *Window* menu allows you to re-display text "reports" generated by instructions like **IMPULSES**, **FORECAST**, **PRINT**, **STATISTICS**, **TABLE**, or **REPORT**. For example, if you've done a **STATISTICS** command, and decide that you would like to go back and see the output displayed in a spreadsheet-style window, you can do that using *Window—Restore Report*.

Other Improvements

- Many new functions, including: %GINV for doing generalized inverses, and %PERP, which are used extensively in CATS 2.0 (see page 4).

- **NLSYSTEM** now has a DERIVES option for saving the partial derivatives.

- The *User's Guide* and *Reference Manual* have been fully revised and updated to document the new features and changes made since the release of 6.0. (PDF versions of the revised manuals are included on every CD—contact Estima for availability of hard copies of the revised manuals).

New Procedures

The following new procedures are included with RATS 6.2, and will also be available on our web site:

BICORRTEST calculates Hinich bicorrelations tests for autocorrelation and 3rd order dependence.

BLOCKBOOT is an alternative to the **BOOT** instruction which does block draws (with and without allowing overlaps).

CVSTABTEST performs a fluctuations test on a covariance matrix of a set of series.

ELFCALC computes the empirical likelihood for a set of moment conditions, that is, it finds the maximum of $\sum_i \log w_i$ subject to

(a) $\sum_i w_i = 1$

(b) $\sum_i w_i f_i$

where f are the moment conditions input as a set of series.

FM estimates a cointegrating vector using fully modified LS.

LOGSKEWTDENSITY is a function returning the log density of the skew-t distribution from Bruce Hansen (1994), "Autoregressive Conditional Density Estimation", *International Economic Review*, vol. 35, no. 3, pp. 705-730.

MODELCOMPANION is a function returning the companion matrix for a dynamic model with states added to allow it to be written as a one lag VAR.

MVGARCHFORE forecasts many of the multivariate GARCH models.

SWTRENDS tests cointegration rank using common trends analysis from Stock and Watson (1988), "Testing for Common Trends", *JASA*, vol. 83, pp. 1097-1107.

SWDOLS estimates cointegration vectors using dynamic OLS as described in Stock and Watson (1993), "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems", *Econometrica*, vol. 83, pp. 1097-1107.

VARCALC does a direct calculation of a simple OLS VAR.

SHORTANDLONGRUN computes a factorization of a covariance matrix subject to a (just-identifying) collection of short and long-run zero restrictions.

Several other important procedures have seen some improvements including JOHMLE, FORCEDFACTOR and PRINCOMP.

CATS 2.0, *continued*

New Interface Features

- All-new user interface, with separate menus for various categories of operations. User input and program control is now much easier, thanks to extensive use of custom dialog boxes (created with the **DBOX** instruction).

- All model settings, including the deterministic terms and lag structure, are menu-controlled, so you can now change the underlying VAR model without quitting and re-starting CATS.

- All procedure settings, such as maximum number of iterations and convergence criteria for the switching algorithms, screen output format, and more, can be set via a dialog box.

- The estimated model can now be exported as a RATS "MODEL" making it much easier to compute forecasts and impulse responses.

- Graphs created by CATS can be customized.

- Output can be exported in TeX or CSV formats.

- Restrictions can be saved and re-loaded, making it easier to replicate analyses or continue your work at a later time.

- CATS can now be run in a true batch mode that does not require user interaction to generate basic output. This allows it to be used in loop.

Other Features

The following features carry over from Version 1:

- Support for partial systems, models with structural breaks, and various dummy variables.

- Multivariate and univariate tests on residuals.

- "Batch" tests for long-run exclusion, weak exogeneity, and stationarity on all variables (now available from the CATS menu). Also tests for unit vectors in a, which corresponds to testing if the cumulated disturbances of any of the variables do not enter the common trends.

- Recursive estimation for assessing constancy of the model parameters, including tests for constancy of the estimated eigenvalues, the cointegrating space, the log-likelihood function, the parameters of an identified system, and the adequacy of one-step-ahead predictions.

- Options for testing hypothesis on the long-run relations in β as well as on the adjustment coefficients in α.

- Choice of normalization for each cointegrating vector (CATS 2 simplifies this by suggesting default choices).

- Estimation of the parameters of the moving average model, e.g., the long-run impact matrix C and the loadings to the common trends $\alpha_\perp$ (with asymptotic t-values).

- A large variety of preset graphics illustrating various key aspects of the estimated model.

New Network\Multi-User Policy

We have recently made some changes to our multi-user licensing scheme, which we hope will simplify purchasing and managing such licenses.

Previously, we distinguished between "Cluster" licenses (for installing on individual machines) and "Network" licenses (for installation on a network). We have now combined these into a single plan, and have added additional flexibility.

If you purchase a Multi-User license for N users, you can either install the software on up to N individual computers, or install the software on a single network server, as long as the software is limited to N or fewer simultaneous users. We also offer an "unlimited user" license, which allows you to install the software on institutional networks *and* on individual computers.

In all cases, the software must be reserved solely for the use of employees (and students, where applicable) of the institution purchasing the license.

In situations where managing licenses installed on individual machines may be difficult (as with students at a university), we can provide versions of the software that will expire after a period of time.

If you are interested in obtaining a quote for a new or updated Multi-User license, please contact us at 800-822-8038 or *sales@estima.com*.

German-Language RATS Textbook

Alexander Prinz informs us that a new German-language introduction to RATS, entitled *Angewandte Statistik und Ökonometrie mit WinRATS*, is due to be published in April.

The book will help beginners learn WinRATS using economic examples. It also covers more advanced topics, including VARs and panel data analysis.

The authors are Peter M. Schulze and Alexander Prinz of the Institut für Statistik & Ökonometrie, Universität Mainz, and Andreas Schweinberger of HfB—Business School of Finance & Management, Frankfurt.

The book will be published by Oldenbourg Verlag, in Munich.

Singular Value Decomposition and Related Functions

The function `%SVDECOMP` was introduced with version 6 of RATS. In 6.2, we have improved its capabilities and added several useful functions which are based upon it.

The singular value decomposition of an $m \times n$ matrix $\mathbf{A}$ ($m \geq n$) is a triple of matrices $\mathbf{U}$, $\mathbf{W}$ and $\mathbf{V}$ where $\mathbf{A} = \mathbf{UWV}'$, $\mathbf{U}$ ($m \times n$) and $\mathbf{V}$ ($n \times n$) are column orthonormal (that is, $\mathbf{U}'\mathbf{U} = \mathbf{I}$, $\mathbf{V}'\mathbf{V} = \mathbf{I}$), and $\mathbf{W}$ ($n \times n$) is diagonal. This looks something like a eigen decomposition of $\mathbf{A}$, and, in fact, if $\mathbf{A}$ is a positive semi-definite symmetric matrix, $\mathbf{U}=\mathbf{V}$ and $\mathbf{W}$ is a diagonal matrix of eigenvalues.

However, the SVD can be computed for any matrix with at least as many rows as columns, and the singular values (the diagonal elements of $\mathbf{W}$) are always real and non-negative.

The RATS function `%SVDECOMP` returns a `VECTOR[RECT]` with three elements: $\mathbf{U}$, $\mathbf{W}$ (diagonal only) and $\mathbf{V}$ respectively. RATS also has the function `%CXSVD` which computes a singular value decomposition for complex matrices. With a complex matrix as input, $\mathbf{U}$ and $\mathbf{V}$ satisfy $\mathbf{U}^*\mathbf{U} = \mathbf{I}$ and $\mathbf{V}^*\mathbf{V} = \mathbf{I}$, where $*$ denotes conjugate transpose. $\mathbf{W}$, however, remains real and non-negative.

One change that was made with version 6.2 is that the SVD is arranged so that the singular values are in decreasing order. (Prior to this, there was no predictable order to the singular values). This is very useful because it is often important to isolate the zero singular values as we'll see below. The other change to `%SVDECOMP` was to allow for the input matrix to have dimensions $m < n$. In that case, the component matrices will have dimensions $\mathbf{U}$ ($m \times m$), $\mathbf{W}$ ($m \times m$) and $\mathbf{V}$ ($n \times m$).

The new functions based upon the SVD are:

`%GINV(A)` (for Generalized INVerse) computes $\mathbf{A}^\dagger = \mathbf{VW}^\dagger\mathbf{U}'$, where $\mathbf{W}^\dagger$ is a diagonal matrix with the non-zero singular values replaced by their reciprocals, and the zero (or effectively zero) singular values replaced by zero.

`%PERP(A)` returns an orthonormal matrix $\mathbf{A}^\perp$ which forms a basis for the null space of $\mathbf{A}$. If $m > n$ (that is, $\mathbf{A}$ has more rows than columns), this is a basis for the left null space, so $\left(\mathbf{A}^\perp\right)'\mathbf{A} = \mathbf{0}$. $\mathbf{A}^\perp$ is $m \times (m-n)$. If $m < n$, it will be a basis for the right null space, with $\mathbf{A}\left(\mathbf{A}^\perp\right) = \mathbf{0}$, $\mathbf{A}^\perp$ being $n \times (n-m)$.

One use for `%PERP` is in reparameterizing a restricted model. If, for instance, you are estimating β subject to the restrictions $\mathbf{R}\beta = 0$, this can be reparameterized to the unrestricted vector θ with $\mathbf{R}^\perp\beta = \theta$. This is computed by padding out the matrix with zero columns or rows to make a square matrix, then extracting the columns of $\mathbf{U}$ or $\mathbf{V}$ corresponding to the zero singular values.

`%NULLSPACE(A)` is similar to `%PERP`, but it does not assume that the input matrix has full rank in its smaller dimension. As a result, the dimensions of the output matrix will depend upon the rank of $\mathbf{A}$, not just upon its dimensions.

New Replication Files

We've added several new sets of replication files for important papers on VAR methodology. The Gali program has only been slightly altered from the version sent us by Jordi Gali. Mark Watson provided RATS version 2 code for much of the analysis done in their paper; however, that will not work in current versions without considerable updating, so the programs provided on our web site are completely rewritten to use all the current capabilities of RATS. Our thanks to Jordi, Mark and Harald for their help with these.

Gali, "Technology, Employment and the Business Cycle: Do Technology Shocks Explain Aggregate Fluctuations", *American Economic Review*, 1999, vol 89, pp 249-271.

King, Plosser, Stock and Watson, "Stochastic Trends and Economic Fluctuations", *American Economic Review*, 1991, vol 81, pp 819-840.

Uhlig, "What are the effects of monetary policy on output? Results from an agnostic identification procedure." *Journal of Monetary Economics*, 2005, 52, pp 381-419.

Prices for CATS and RATS

As noted on page 1, the price for a new copy of CATS is $175. The cost to update from CATS 1.0 is $100. Students can purchase CATS for $125.

Basic pricing for the Macintosh and Windows versions of RATS are shown below. Please see our website or contact our sales department for additional information, including shipping costs for orders going outside the continental U.S., and for Multi-User license pricing.

Product	New	Update from 6.0/6.1	Older
RATS 6.2	$500	$25*	$150
RATS Pro 6.2	$650	$25*	$150

*Users with RATS 6.0 or 6.1 who purchase CATS 2.0 (new license or update) will receive the update to 6.2 at no charge.