The RATSletter

Reminder: We Moved!

On January 15th, Estima moved into new office space, a few blocks down the street from our old location. Our new address is shown below.

Phone and fax numbers and all other contact information remain the same.

We are now in a much larger building with more amenities, including meeting room facilities and a cafeteria. These amenities will make it much easier for us to offer in-house training sessions.

Watch for announcements on these in coming months.

Announcing RATS 6.1

We are pleased to announce RATS Version 6.1. As with other recent updates, this release offers improvements in all areas, including econometric capabilities, programmability, and the user-interface.

New Instruction Options

GARCH:
- The XREG option for supplying additional regressors can now be used with multivariate models.

- The ASYMMETRY option can now be used with all supported multivariate models (BEKK, diagonal, CC, and DCC). Formerly, this option could only be used with the standard multivariate model.

- The VARIANCES option allows the user to specify the form of the variances used for diagonal, CC, and DCC models. The choices are SIMPLE, VARMA, and EXPONENTIAL.

BOXJENK:
- **BOXJENK** now offers a MAXL option, for doing maximum likelihood rather than conditional least squares, and METHOD and PMETHOD options, to allow estimation algorithms other than Gauss–Newton. With MAXL, **BOXJENK** can now handle missing data within the estimation range.

FORECAST:
  Now has an option for computing/saving standard errors which previously required doing a separate **ERRORS** command. We have also added an option for doing static forecasts, rather than dynamic forecasting. Previously, this required the use of the **STEPS** instruction.

FILTER:
- Adds the option EXTEND for doing "end effects"— adjusting weights near the ends of the sample.

- Adds TYPE=SPENCER for the Spencer moving average, and TYPE=LAGGING for convenient specification of filters which use current and past values.

NLSYSTEM and NLLS:
- Offer a new option JACOBIAN=*FRML for the Jacobian*, which makes it easier to do Full-Information Maximum Likelihood.

- As noted in our previous newsletter, **NLSYSTEM** also now offers a FRMLVEC option, which you can use to supply your model as a FRML of VECTORS, for cases where this is easier than defining the model using separate FRMLs.

ESTIMATE:
- Now has a MODEL option, making it easier to work with multiple VAR specifications.

New Procedures and Examples

RATS Version 6.1 ships with many new procedures and examples, some of which we describe below. Note that these are in addition to the more than 150 other procedures and examples, and more than 400 example programs drawn from a dozen popular econometrics textbooks, already included in earlier releases.

Many of these procedures and examples originally appeared (sometimes in a more primitive form) on the RATS email discussion list in response to queries from users. If you would like to join the discussion list, see **www.estima.com/maillist.shtml.**

These will also be available for downloading from the "Procedures and Examples" section of our website.

General Examples

GARCHMVDCC2.PRG — Multivariate GARCH with two-step DCC estimator.

REPROBIT.PRG — Panel data probit model with random effects.

SWARCH.PRG — Exogenous Markov Regime Switching ARCH, including cleaner code for computing smoothed properties, and a demonstration of computing time-varying probabilities.

Procedures/Functions

BJAutoFit — determines the best (non-seasonal) ARMA(p,q) model according to AIC or BIC.

CFEAT — determines the turning points of a time series and calculating the duration and amplitude of expansions and recessions. Originally written by K.A. Kholodilin, with some modifications.

MVJB — does a multivariate Jarque–Bera test for normality (includes code for transforming raw multivariate residuals into standardized components).

StepProbit — performs a backwards selection process for probit models.

GraphMatrix — graphs a RECTANGULAR array of SERIES on separate graphs (using **SPGRAPH** to display all graphs on one page).

HinichTest — performs the Hinich bispectrum test for linearity and Gaussianity.

PrinFactors — does principal components-based factor analysis of an input covariance or correlation matrix.

SPLOM — generates a scatter plot matrix, an NxN matrix of bivariate scatter plots for an input set of variables.

TAR — estimates a SETAR model, choosing the lag delay and threshold value, and tests for the presence of a threshold effect. See "Programs Replicating

Paper Results" below, and "Threshold Autoregressions" on page 3, for more.

VARIRF — organizes graphs for the impulse response functions of a VAR.

VARLagSELECT — chooses the lag length for a standard VAR using AIC, BIC or HQ.

VRatio — Revised version of the VRATIO test as described in Campbell, Lo, and MacKinlay, *The Econometrics of Financial Markets*, section 2.4

Programs Replicating Paper Results

We have posted several more example programs on our web site for replicating results from some significant econometrics papers. To access Zip files containing the program files, data files, and (in some cases) required procedure files, please visit this page on our website:

www.estima.com/PaperResults.shtml

The recent additions include:

Inclan and Tiao's ICSS (iterated cumulative sums of squares) algorithm, from "Use of Cumulative Sums of Squares for Retrospective Detection of Changes in Variance", *Journal of the American Statistical Association*, 1994, Vol. 89, pp. 913–923.

Regime Switching GARCH, from Stephen Gray, "Modeling the Conditional Distribution of Interest Rates as a Regime-Switching Process", *Journal of Financial Economics*, 1996, Vol. 42, pp. 27–62.

Fractionally Integrated GARCH (FIGARCH), from Baillie, Bollerslev, Wilkinson, "Fractionally Integrated Generalized Autoregressive Conditional Heteroskedasticity", *Journal of Econometrics*, 1996, Vol. 74, pp. 3–30.

Use of updated VRATIO procedure, from Wright, "Alternative Variance-Ratio Tests Using Ranks and Signs", *Journal of Business and Economic Statistics*, 2000, vol 18, pp 1-9.

And two papers dealing with Threshold Autoregression models (see page 3 for more on these):

SETAR model with threshold variable estimated, including a test for threshold effect, from Bruce Hansen, "Inference When a Nuisance Parameter is Not Identified Under the Null Hypothesis", *Econometrica*, 1996, Vol. 64, No. 2, pp. 413–430.

LSTAR or ESTAR (smooth transition autoregression) model, from Timo Teräsvirta "Specification, Estimation and Evaluation of Smooth Transition Autoregressive Models", *Journal of the American Statistical Association* 1994, Vol. 89, pp 208–218.

Transition Autoregression Models

We've had quite a few questions recently regarding various forms of transition autoregression models (TAR's). Some recently posted procedures and examples include:

TAR.SRC estimates a self-exciting threshold autoregression (SETAR), and computes asymptotic *p*-values for tests for the threshold effect; from Bruce Hansen's 1996 *Econometrica* article (see "Programs Replicating Paper Results" on page 2 for the full reference, and information on an example program using the procedure).

STARTEST.SRC does the test for linearity vs. an alternative of LSTAR or ESTAR (smooth transition autoregression) described in Timo Teräsvirta's 1994 *JASA* article. We've written replication programs for two of the examples in that paper, using the test and also estimating the selected models (again, see page 2 for details).

There is also a section on TAR models in Enders' RATS *Programming Manual* (included with RATS, also available at **www.estima.com/enders**). The Tsay textbook also includes several examples—you can find RATS code for these on our website, at: **www.estima.com/procs_tsay.shtml**.

The TAR and STAR models need to be approached quite differently. TAR has a discontinuous sum of squares function and so its cutoff point must be estimated using a grid search. The TAR.SRC procedure, in fact, searches over both the transition lag and cutoff point.

STAR models, on the other hand, at least theoretically can be approached using non-linear least squares. This, however, requires a bit of finesse: under the default initial values of zero for all parameters that RATS uses for **NLLS**, both the parameters in the transition function and the autoregressive coefficients that they control have zero derivatives.

As a result, TAR can never move them away from zero if you do **NLLS** with the default METHOD=GAUSS. Use of PMETHOD=SIMPLEX might help a bit, but a better way to handle this is to split the parameter set into the transition parameters and the autoregressive parameters, and first estimate the second set conditional on a pegged set of values for the transition parameters.

The following is a snippet out of one of the examples from the Teräsvirta paper. Note that this uses the author's suggestion of standardizing the logistic exponent by dividing by (roughly) the sample standard deviation ($1.8 \approx 1/\sigma$). Also note that it uses the new %logistic function, which is does the calculation of the logistic CDF "safeguarded" against overflows.

```
stats x
compute scalef=1.0/sqrt(%variance)
nonlin(parmset=starparms) gamma c
frml flstar = $
    %logistic(1.8*gamma*(x{3}-c),1.0)
compute c=%mean,gamma=2.0
equation standard x
# constant x{1 to 11}
equation transit x
# constant x{1 to 11}
frml(equation=standard,vector=phi1) phi1f
frml(equation=transit,vector=phi2) phi2f
frml star x = f=flstar,phi1f+f*phi2f
nonlin(parmset=regparms) phi1 phi2
nonlin(parmset=starparms) gamma c
nlls(parmset=regparms,frml=star) x
nlls(parmset=regparms+starparms,$
    frml=star) x
```

New Textbook Examples

We've added more example programs taken from popular textbooks. These are all introductory forecasting and time-series books. While their coverage overlaps quite a bit, there are some significant differences.

For instance, the Brockwell and Davis book, while primarily about ARIMA modeling, also includes a chapter on spectral analysis, and covers more advanced techniques such as fractional differencing and dynamic models for discrete data.

Makridakis, Wheelwright and Hyndman put a greater emphasis on dynamic regression models, while DeLurgio is one of the few authors to devote several chapters to intervention and transfer function models.

The example files are included with RATS 6.1, and will also be available for downloading from our website. The new additions are:

Brockwell and Davis, *Introduction to Time Series and Forecasting*, 2nd ed., Springer–Verlag, 2002.

Makridakis, Wheelwright and Hyndman, *Forecasting: Methods and Applications*, 3rd ed., Wiley, 1998.

DeLurgio, *Forecasting Principles and Applications* (Irwin/McGraw–Hill, 1998). This book has an accompanying instructor's manual with RATS programs for some of the additional problems found in the text.

We have also updated the examples for Diebold's *Elements of Forecasting* (Thomson/South-Western, 2004) to the 3rd edition, and added still more examples from Tsay's, *Analysis of Financial Time Series* (Wiley, 2002). Finally, Chris Brooks' *Introductory Econometrics for Finance* (Cambridge, 2002) includes RATS code as an integral part of the text, and may be of interest to many RATS users.

RATS Version 6.1, *continued*

DIFFERENCE:
- Now supports fractional differencing with the options `FRACTION=`*d* and `PADDING=`*out-of-sample padding value*.

GRAPH:
- Has a new `OVRANGE` option allowing you to do "overlay" graphs with split vertical ranges

- Has a new `STYLE=FAN` (or `OVERLAY=FAN`), which does a "fan" chart, filling the gaps between series with a set of shaded fills, getting lighter towards the outside.

New Functions

RATS 6.1 offers the following new functions, with `%PSUBMAT` and `%PSUBVEC` probably being the two most important additions.

`%CHISQRNC,%CHISQRNCDENSITY,%INVCHISQRNC` — Computes the CDF, density, and inverse CDF for a non-central Chi-squared.

`%LOGDENSITYCV` — Returns the log of multivariate normal density as a function of Σ, $\hat{\Sigma}$, and the number of observations.

`%LOGCONCDENSITY` — Returns the log concentrated multivariate normal density as a function of $\hat{\Sigma}$ and the number of observations.

`%LOGISTIC` — Logistic Function: $1/(1 + b\ \exp(-x))$. This is "safeguarded" to avoid overflows.

`%MAXINDEX` — Returns the element number at which the maximum value of a `VECTOR` is attained.

`%MININDEX` — Returns the element number at which the minimum value of a `VECTOR` is attained.

`%MODELGETVCV` — Gets the covariance matrix from a `MODEL`.

`%MODELSETVCV` — Sets the covariance matrix for a `MODEL`.

`%NEGBIN` — Computes the negative dinomial density (x | r,p).

`%PSUBMAT` — Copies info into a specified portion of an existing `RECTANGULAR` or `SYMMETRIC` array.

`%PSUBVEC` — Copies info into a specified portion of an existing `VECTOR`.

Other New Features

We've added five new menu-driven *Wizards*, for generating various dummy variables, for doing regular, seasonal, and fractional differencing, for filtering and smoothing series, for Box–Jenkins ARIMA estimation, and for exponential smoothing.

There is also a new preference item for a Procedures directory, which is where RATS will look for a procedure if you just do "@procedure" without doing a **SOURCE** instruction first. For example, if you do:

`@uradf`

RATS will automatically search the "Procedures" directory for a file called `URADF.SRC`.

RATS 6.1: How to Get Your Copy

The easiest way to get updates is to purchase a **Maintenance Contract**—you'll automatically receive each update up to and including Version 7 shipped to you on CD. See below for details.

If you would prefer to order just the update to Version 6.1, the cost is $15 for users updating from Version 6, or $150 for users updating from Version 5 or older (these prices are for single-user licenses —if you have a multi-user license, please contact Estima for a price quote). Users paying by credit card can order via our secure on-line ordering system. We also accept orders by phone, fax, mail, and email.

Users with licensed copies of WinRATS 6.0 will also have the option of updating their RATS executable file to Version 6.1 free of charge by downloading a "patch" file from our website. *You will need to have your serial number to download the patch.* Also, the free download only updates the RATS program file. It does not include the revised PDF–format fdocumentation and Help files describing the new features, which are included on the CD.

Maintenance Contracts

We're again offering "maintenance contracts" for those who wish to receive their updates to RATS automatically.

For single-user licenses that have already been updated to Version 6, the cost is $200 for the standard version or $250 for the Pro (plus a shipping charge for those outside the continental U.S.). This provides all updates up to and including Version 7. You can obtain information about ordering this on the web site.

Need to Budget on an Annual Basis?

We've heard from quite a few of our customers at larger institutions that they would prefer to have maintenance contracts priced on an annual basis, as they would find that easier for budgetary purposes.

If you have a network license or large groupings of single licenses that you would like to keep up-to-date, please contact us for pricing.