The RATSletter

Estima

RATS Version 9.0!!

We're pleased to announce that version 9 of RATS is now available. This is the end of a multi-year update cycle which has included the many additions that came with versions 8.1, 8.2 and 8.3. Below, we list primarily what's new with 9 (versus 8.3), but if you're only familiar with an earlier version of RATS, there is much more that's not described here. You can check https://estima.com/ratslatest.shtml for a fuller list of changes over the past several updates.

Updated Manuals

With each new major version, we need to decide what's new and needs to be explained, what's important and needs greater emphasis, and what's no longer topical and can be moved out of the main documentation. For Version 9, the chapters in the *User's Guide* that received the most attention were "ARCH/GARCH and related models", "Threshold, Breaks and Switching" and "Cross Section and Panel Data". This partly reflects the fact that these were the topics of our three most recent e-courses (see page 4), and the GARCH and panel data instructions saw quite a bit of change as a result. Also GARCH and the regime-switching models can often require a bit of care to get reasonable results (or results at all), which has produced many of our technical questions in recent years. As much as possible, we try to address those issues in the revised documentation.

Interface Improvements

Version 9.0 adds the following:

- The on-line help that we used in prior versions has been completely redone. It now has pretty much the full content of the *Reference Manual*, with some important extras: there are pages describing over 100 of the most important procedures, most with a full description of the syntax, plus examples, similar to what we've had all along with the regular instructions. There are also pages with the main examples. In all, it has the equivalent of about 2000 pages of printed documentation. And this is all linked up with cross-references for ease of use.

- The GARCH wizard has been split into separate wizards for univariate and multivariate models. A new wizard for handling estimation of cointegration models provides easy-to-use access to the `@JOHMLE`, `@FM` and `@SWDOLS` procedures.

- *File-Properties* shows the full file name of an open file (in a form where you can easily copy and paste). This can be handy when you have long paths so the name gets truncated.

- *Help-News...* gets a "news feed" off our web site with links to updated information.

- With version 8.3, we replaced the editor which actually runs most of the program with a new public domain editor called Scintilla. This adds the ability to put markers at locations in your program and includes "regular expressions" for more sophisticated searches. A few oddities in its operation (particularly skipping lines if you hold down the Enter key) have been corrected with version 9.

- Another important change with v8.3 that's even better with v9 is *Find in Files*. This allows you to search for a string (or "regular expression") across the full set of example programs so you can quickly locate example programs that use `DLM` or do a BEKK GARCH or an `SPGRAPH`, etc. It gives a huge boost to your productivity.

Programming

The most important change to the program itself is that you can now pass functions as parameters and options. This was a big hole in the RATS programming language—we haven't even begun to figure out all the things that will be made easier or (even) possible using this. Just as an example, we have revised the commonly used `@MONTEVAR` and `@MCVARDODRAWS` procedures to allow a `FUNCTION` to be used to provide a non-standard factorization. In the past, you would have to create a custom version of the full procedure do that.

We introduced the `HASH` and `LIST` aggregators with version 8.2, but with version 9, we've added enough support to these to make them truly useful. These have been added to the documentation and examples of their use is now included.

The diagnostics for attempts to access out-of-range array elements have been improved, pointing you towards the likely source. You also now get better information about mistyped identifiers, as the program will list possible near-matches.

New and Updated Programs

The files below contain example programs and (in most cases) data files replicating results from significant econometrics papers or demonstrating other useful techniques. These are available on our web site, and are included with version 9.0 of RATS.

balke_restat2000.zip
This is a replication file for Balke(2000), "Credit and Economic Activity: Credit Regimes and Nonlinear Propagation of Shocks," *Review of Economics and Statistics*, vol 82, pp 344-349. This includes both a search for the optimal threshold and computes the generalized IRF's as described in the paper, averaging responses across all observed periods in a given regime.

grier_henry_etal_jae2004.zip
This is a replication file for Grier, Henry, Olekalns & Shields(2004), "The Asymmetric Effects of Uncertainty on Inflation and Output Growth," *Journal of Applied Econometrics*, vol 19, no. 5, pp 551-565. This does a VARMA(2,1)-GARCHM mean model with an asymmetric BEKK GARCH on inflation and growth. Because the BEKK asymmetry in this model is sign-dependent, this uses a feature added with RATS 8.2 to allow an adjustment to the sign of the asymmetric effect.

laubach_williams_restat2003.zip
This estimates the two-observable models (real GDP and inflation) from Laubach and Williams(2003), "Measuring the Natural Rate of Interest", *Review of Economics and Statistics*, vol. 85, no 4, pp 1063-1070. This is a state-space model with a combination of regression equations and latent variables.

west_cho_joe1995.zip
This is from West and Cho(1995), "The Predictive Ability of Several Models of Exchange Rate Volatility," *Journal of Econometrics*, vol. 69, no 2, 367-391. It does descriptive analysis of volatility and estimates and does diagnostics on univariate GARCH models. This is covered in some detail in the "ARCH/GARCH and Volatility Models" e-course (see page 4).

With version 9, we've revised many of the standard examples that are discussed in the documentation. And we've also added quite a few new ones. The most important of these are:

autobox.rpf
This demonstrates how to use the **@GMAUTOFIT** procedure and the automatic outlier detection of the **BOXJENK** instruction to fit (automatically) fit a complicated seasonal ARIMA model to a series.

bivariatehp.rpf
Fits a state-space model with a common "local trend" (the trend model underlying the HP filter) to a pair of series.

dlmcycle.rpf
Demonstrates the process of fitting a state-space model to a set of time series using a common cycle (with varying loadings) plus variable-specific noise.

garchbacktest.rpf
This fits a "rolling" GARCH model and uses it to "back test" a simple calculation of VaR.

garchflux.rpf
Uses the **@FLUX** procedure to identity stability problems in a univariate GARCH model. **@FLUX** is a very handy but underutilitized procedure for checking for stability issues in models where simple sample split calculations won't work.

hasbrouck.rpf
This provides an example of the calculation of decomposition of long-run variance using the techniques from Hasbrouck(1995) "One Security, Many Markets: Determining the Contribution to Price Discovery", *Journal of Finance*, vol 50, no 4, pp 1175-1199.

regarima.rpf
This demonstrates estimation of a "RegARIMA model" which is a regression with an ARIMA error process. This uses quite a few specialized features of the **BOXJENK** instruction to identify pre-adjustment trading day factors for seasonal adjustment.

shortandlongvecm.rpf
This is an example of estimation of a structural VECM with short-and-long run restrictions for structural model. This is more complicated in several ways from a similar model for a regular VAR: first, the calculation of the long-run matrix can't be done by simply inverting the lag sum matrix, because the lag sum matrix is singular by construction. Second, the existence of the long-run restrictions imposed by the VECM structure changes the set of non-trivial restrictions.

unitrootbreak.rpf
This demonstrates several of the procedures for testing for unit roots allowing for breaks.

varstability.rpf
This does a fluctuations test for stability on a full VAR. This is an alternative to a test like that in Bai, Lumsdaine and Stock(1998), "Testing For and Dating Common Breaks in Multivariate Time Series", *Review of Economic Studies*, vol 65, no 3, 395-432, which looks for common breaks. The fluctuations test provides for a less-structured alternative.

New Textbook Examples

We have three new sets of textbook examples, plus one set of updates for a new edition.

Martin, Hurn and Harris(2013)

Econometric Modelling with Time Series: Specification, Estimation and Testing, Cambridge Univ Press is a relatively advanced text which covers a wide range of subjects, and includes some often quite sophisticated models taken from the literature. At this point, we've focused mainly on their examples with real-world data.

While the econometrics sometimes isn't simple, in most cases, the RATS code itself is fairly straightforward, by making use of procedures like **@SHORTANDLONG** and **@ADFAUTOSELECT**. The most interesting examples are likely to be:

- mhhp342.rpf and mhhp381.rpf, which estimate the CKLS model using maximum likelihood and GMM respectively.

- mhhp528.rpf, mhhp535.rpf and mhhp537.rpf, which estimate various structural VAR's with short-and-long run constraints

- mhhp563.rpf and mhhp564.rpf, which estimate dynamic factors models, the first by maximum likelihood, and second by principal components

- mhhp744.rpf and mhhp745.rpf, which estimate univariate and bivariate STAR models respectively.

- mhhp798.rpf which estimates DCC and DECO GARCH models.

- mhhp799.rpf which estimates an SVAR-GARCH model (that is, a model with an SVAR which is assumed to produce independent univariate GARCH components). This is covered in considerable detail as part of the *ARCH, GARCH and Volatility Course* (see page 4).

Dougherty(2011)

Introduction to Econometrics, 4th ed, Oxford University Press, is an introductory book with a general emphasis on cross section data. It's not clear whether it was intended that the students be able to do these, but we've included the programs for doing the Monte Carlo experiments in the book. None of these are particularly difficult and can serve as an introduction to simulation methods in RATS.

Novales, Fernandez & Ruiz(2009)

Economic Growth: Theory and Numerical Solution Methods, 1st ed, Springer-Verlag. The examples all use the **DSGE** instruction for solving small macroeconomic models. About half are comparisons of steady-state solutions with changes to exogenous processes and about half are simulations of the economies with a given structure. The second group typically use **DLM** with TYPE=SIMULATE to simulate the linearized or log-linearized economy.

Durbin and Koopman(2012)

Time Series Analysis by State Space Methods, 2nd ed, Oxford University Press, is an updated edition of a book for which we have had worked examples for several years. Most of the examples are carried over from the 1st edition.; the new ones are durkp202.rpf (dynamic factor model), durkp284.rpf and durkp288.rpf (particle filters, the only examples which don't use the **DLM** instruction).

RATS Programming Manual

We're in the process of writing a 2nd edition of the very popular *RATS Programming Manual*. Like the 1st edition, this will be a freely available "e-book" designed to help you learn how to use the "programming language" features of RATS— loops, procedures, functions, matrix calculations, etc.

While only partially done, at almost 250 full-sized pages, there's already quite a bit of information available. This is included both with version 9, and you can also find it on our web site at

https://estima.com/forum/viewforum.php?f=41

Some of the topics that would likely be of greatest interest are:

- Chapter 3 on "Non-Linear Least Squares" is devoted mainly to the estimation of Smooth Transition Autoregression (STAR) models, which, theoretically, have a differentiable explanatory function, and, in practice, can be very tricky to estimate.

- Chapter 4 on "Maximum Likelihood" goes into detail about the workings of the simplex and BFGS algorithms generally used for likelihood maximization.

- Chapter 5 on "Standard Programming Structures" uses a threshold autoregression as the main application of the programming structures (particularly **DO** and **IF**). It shows how to start with a relatively crude program which won't easily adapt to other data and transform it into a polished piece of code.

- Chapter 7 on "Nonstationary Variables" goes through the use of the main unit root testing procedures (with and without breaks) and includes a detailed example of how to create a REPORT (in this case for the unit root tests for a set of countries).

RATS Version 9.0, contd.
Changes to Instructions

• You can now write data to XLSX and not just XLS. This applies to any instruction which writes data and to the export operations from **REPORT** windows.

• **SPGRAPH** can now put keys out the outside of a matrix of graphs.

• The **GARCH** instruction adds the new option VARIANCES=KOUTMOS to compute the univariate variances for CC and DCC models using the EGARCH formulation from Koutmos(1996) "Modeling the Dynamic Interdependence of Major European Stock Markets", *Journal of Business Finance and Accounting*, vol 23, 975-988. It also adds the STDRESIDS option for computing standardized residuals (univariate or jointly standardized multivariate).

• **IMPULSE** has a new FLATTEN option for more easily saving into %%RESPONSES in Monte Carlo methods. Its FACTOR option can accept reduced numbers of columns (shocks), which makes it easier to handle situations where you are particularly interested in only a subset of the structural shocks.

• HEIGHT and WIDTH have been added to **GRPARM** to allow standardized sizing of graphs.

• **GRAPH** has a new SERIES option which can take a VECTOR of SERIES or a VECT[INTEGER] with series handles as input. This is particularly handy for doing graphics in Vector Autoregressions, where the number of graphs needed can change from application to application.

• **DATA** adds the option ORG=MULTILINE, which allows you to pull data out of a spreadsheet file when a particular series occupies a block of rows.

E-Course Materials

The workbook, example programs, and procedures from our recent e-course on *ARCH/GARCH and Stochastic Volatility Models* are now available for sale. The price for the course materials is $50. The package includes the 291-page PDF workbook, thirty example programs plus programs replicating examples from several textbooks.

This is the sixth in our series of e-courses, with the other five being *Bayesian Econometrics*, *Vector Autoregressions*, *State-Space and DSGE Models*, *Structural Breaks and Switching Models* and *Panel Data*. For more information on any of the courses, see:

https://estima.com/courses_completed.shtml

Prices and Ordering

Users with update subscriptions through version 9.0 (or through July 31, 2014 or later if it's on an annual contract) will automatically receive version 9.0. Note that the downloadable software will be available several weeks before the printed manuals, so if you have arranged for full documentation, you may still want to get the download first.

You can update any single user license version 8.3 or earlier to version 9 for just $150. You don't need the older software to be installed in order to get an update. You *do* need to have the serial number. If you cannot find your serial number, contact us at *sales@estima.com* or 800-822-8038 before placing your order. You can get the update either with or without printed manuals—the latter avoids shipping charges. In either case, the software ships with PDF versions of all of the manuals.

If you have the standard version of RATS (a WE or MP serial number) you can upgrade to the Professional version for an additional $150. The Pro version gives you the X12 seasonal adjustment capability, the ability to access the online FRED database, as well as support for reading ODBC/SQL, FAME, and CRSP databases. Under Windows, the Pro version also includes a 64-bit executable in addition to the 32-bit.

If you would like to switch from Windows to Macintosh (or vice versa), there's no additional charge when you are doing a major update like this.

The prices for updating a single-user license for Windows or Macintosh are shown below. Please contact us if you have questions, or need to update multi-user or UNIX/Linux licenses.

	What you want:	
What you have:	9.0 Std	9.0 Pro
RATS Pro (8.3 or earlier)	—	$150
RATS Std (8.3 or earlier)	$150	$300

The direct link for ordering a single user update is

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

While you're placing your order, you might want to look into ordering one or more of the "e-courses" (story at left). All of these have proven to be very popular and can be a great help in understanding both the theory and practice of the covered subjects.