

# The RATSletter



Volume 29, No. 1

May, 2017

## RATS Version 9.2!!

We're pleased to announce that version 9.2 of RATS is now available for all three platforms (Windows, Macintosh, UNIX/Linux). See

<https://estima.com/ratslatest.shtml>

for a fuller list of changes over the past few updates. The main improvements in 9.2 (versus 9.1) are

### OECD MEI data

You can now download the entire Main Economic Indicators from the OECD directly from RATS. See page 4 for more. (This was added in a late build of 9.1)

### New Optimization Methods

Simulated Annealing and Genetic Annealing have been added. These are methods which provide even broader searches than the current GENETIC method and can be very helpful in handling a potentially multi-modal surface (as is common in Markov Switching models). Unlike all the other non-linear optimization methods provided by RATS, these can move both "down" and "up" hill, rather than only climbing, so have a much better chance of moving off one mode to another.

In addition, inequality constraints in the parameter set will now be respected for simplex, genetic and the two new methods (by rejecting values outside the bounds).

### Pseudo-code Generators

We've added two new "wizards" to generate "pseudo-code" to help organize Monte Carlo/Gibbs Samplers and Rolling Windows analysis.

### New Project Wizard

A new wizard which does some basic setup for new program files has been added.

### Rich Text Format

RTF is now available as an output format on COPY, WRITE, REPORT, PRTPDATA and file export operations.

### Edit-Prettify operation

This new operation indents DO and DOFOR loops to make a program more readable.

### DATA instruction

You can use `series<<fileservicename` parameter fields to map a series/column name on an original file to a (valid) RATS name. This can be used to handle source file names which are too long, improperly formatted (for instance, having spaces), conflict with RATS reserved names (such as INV or T), or simply not easily understood.

### DSGE instruction

The FRML's in the MODEL can now be written in the more natural form of

```
frml frmlname depvar = right-side-formula
```

if that's appropriate, rather than having to be written as the "implicit"

```
frml frmlname = depvar-(right-side-formula)
```

Also, a model can be forced to be solved backwards for all roots (even explosive ones), by using `CUTOFF=%NA`.

### ECT instruction

MODELS created using SYSTEM with ECT (VECM's) can be used more flexibly than before. In particular, you can use them for the mean model on GARCH, and can make draws from their distribution similar to VAR's without error correction.

### GARCH instruction

The GARCH instruction has seen quite a bit of work. The new DENSITY function allows you to override the standard Normal and *t* densities with something else, while maintaining the rest of the structure of the model (for computing the covariance matrix and residuals). For instance, the Bauwens and Laurent (2005) DCC model with a multivariate skew-*t* density can now be done with GARCH by defining a short FUNCTION that returns the log density.

The XBEEKK option controls how the "X" regressors are handled in a BEKK model (as there are several plausible ways to do that).

You can now estimate directly GARCH models with VECM mean models defined using the SYSTEM instructions with ECT. And non-trivial mean models are now first estimated by OLS to give better guess values both to the parameters and to the pre-sample covariance matrix.

### GROUP instruction

You can use a VECT[FRML] or VECT[EQUATION] as the part or all of the list of components in the MODEL.

### GRPARM instruction

The new SHADING and GRID options allow override of the default styles for user-controlled shading and grid lines.

### NEWTYP instruction

This new instruction allows you to define your own abbreviations for complicated data types.

(continued on page 4)

## 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 9.2 of RATS. For many of these, there are fairly detailed descriptions as part of the RATS help.

Note that some of these use features added with 9.2. We also reworked the Markov Switching support procedures (such as `@MSVARSSETUP`) to more easily handle time-varying transitions (TVTP), and to simplify other uses, and all existing examples of MS models have been rewritten to use those.

### argarchsim.rpf

Simulates a univariate (conditionally Normal) AR-GARCH model

### bauwens\_laurent\_jbes2005.zip

This is a revision of the program for Bauwens and Laurent(2005), "A New Class of Multivariate Skew Densities, With Application to Generalized Autoregressive Conditional Heteroscedasticity Models," *JBES*, vol 23, 346-354. This uses new features of the `GARCH` instruction to dramatically simplify the estimation of a DCC model with multivariate skew- $t$  density.

### cecchetirich\_jbes2001.zip

This is a replication file for Cecchetti and Rich (2001), "Structural Estimates of the U.S. Sacrifice Ratio," *JBES*, vol. 19, no 4, 416-427. It does bootstrapped estimates of three different structural VAR's. (Note that the paper demonstrates that the "sacrifice ratio" is poorly determined once you allow for the uncertainty in the coefficients of the VAR.)

### chanmcaleer\_afe2003.zip

This is a replication file for Chan & McAleer(2003), "Estimating smooth transition autoregressive models with GARCH errors in the presence of extreme observations and outliers," *Applied Financial Economics*, vol. 13, no 8, 581-592. As is clear from the title, this is about estimation of a STAR-GARCH model (star in the mean model, fixed GARCH error process), and specifically about how difficult it is to make a model like that actually work.

### copula.rpf

Demonstrates use of a copula as an alternative to a multivariate GARCH model.

### filardojbes1994.zip

This is based upon an example from Kim and Nelson's textbook of a Markov Switching model with Time Varying Transition Probabilities model (MS-TVTP). It is based upon Filardo(1994), "Business Cycle Phases and Their Transitional Dynamics", *JBES*, vol 12, no 3, 299-308; however, the data set

provided for the original paper was badly flawed and can't reproduce the published results. This uses a reconstructed data set instead.

### garchmvsimulate.rpf

Simulates a multivariate (DVECH) GARCH process.

### garchm\_uv\_dummy.rpf

This shows estimation of a univariate GARCH-M model with dummy shift in the "M" effect and variance. It is based upon a model from Sun and Tong(2010), "Risk and the January effect", *Journal of Banking and Finance*, vol 34, no 5, 965-974.

### garchvirfdiag.rpf

This shows how to compute Volatility Impulse Response Functions (VIRF's) for a model that has a recursion which only directly generates the variances themselves (such as with a CC model). The Hafner-Herwartz(2006) VIRF uses a model which admits a VEC representation and can generate VIRF's for the full covariance matrix, not just the variances. Most models for the variance recursions in CC or DCC models *do* allow for impulse response calculations of the variances only and that's what this demonstrates.

### gonzales-rivera\_nd1998.zip

This is a replication file for González-Rivera(1998), "Smooth-Transition GARCH Models," *Studies in Nonlinear Dynamics & Econometrics*, vol. 3, no 2, 1-20 which estimates STGARCH models (that is models with a smooth transition in the GARCH variance process).

### lee\_jimf\_1994.zip

This is a replication for Lee(1994), "Spread and volatility in spot and forward exchange rates," *Journal of International Money and Finance*, vol. 13, no 3, 375-383. This estimates a BEKK-GARCH-X model with a VECM mean model on the spot and forward exchange rates for several countries. This uses two new features of the `GARCH` instruction: the ability to directly estimate a model with a VECM mean and the `XBEKK` option to control how "X" regressors are included in the variance recursion. (One should note that the default method in RATS of handling those actually fits better, often quite a bit better, than the model used in the paper).

### montevecm.rpf

This demonstrates Monte Carlo integration for a Vector Error Correction Model (with fixed cointegrating vector). This requires 9.2.

### vargarchsimulate.rpf

This simulates a VAR GARCH model (VAR with multivariate GARCH distributed error process)

### varmagarch.rpf

This estimates a GARCH model with a VARMA mean

process (not to be confused with a GARCH model with a VARMA variance process). Note that these are *notoriously* difficult to fit—the identification and cancellation problems that plague VARMA models in standard time series analysis are still present when they’re used in GARCH models.

#### **vecmgarch.rpf**

This uses a new capability of the **GARCH** instruction to estimate a GARCH model with a VECM mean process.

#### **watsonaer1994.zip**

This is a replication file for Bry-Boschan business cycle dating from Watson(1994), “Business Cycle Durations and Postwar Stabilization of the U.S. Economy”, *American Economic Review*, vol 84, no 1, 24-46.

#### **wzsampler.rpf**

This uses the Waggoner-Zha(2003) sampler, “A Gibbs sampler for structural vector autoregressions,” *Journal of Economic Dynamics and Control*, 28(2), 349–366 to analyze an “A” form structural VAR.

## **Enders, 4th Edition Examples**

Version 9.2 includes the examples and data files from Enders, *Applied Econometric Time Series*, 4th ed, Wiley 2015 and this is also available from our web site. This includes a number of topics which are seen in few, if any, of the other textbook examples, such as seasonal ARMA models, transfer function models, ARMA-GARCH, bootstrapping and threshold models. The examples rely fairly heavily on RATS procedures such as **@BJIDENT**, **@VARLAGSELECT**, **@DFUNIT** and **@JOHMLE**. (And, sorry, no, we are not selling it—unfortunately, Amazon makes it impossible for us to continue to offer textbooks).

## **E-Course Materials**

There are now six e-courses on sale. These go into considerably greater detail on specific subjects than we can provide in the main documentation.

The very popular VAR course was recently updated to a 2nd edition. The other subjects for e-courses are *ARCH/GARCH and Volatility Models*, *Panel Data, Structural Breaks and Switching Models*, *State-Space and DSGE Models* and *Bayesian Econometrics*. For more information, see

[https://estima.com/courses\\_completed.shtml](https://estima.com/courses_completed.shtml)

## **New Functions**

Version 9.2 adds a set of “mapping” functions which can be useful in doing derivatives of complicated functions of matrices. Note that none of these actually *do* the indicated mapping—they just create a matrix which changes one matrix form to another.

**%dnn(n)** returns the “duplication matrix” which maps a vech (lower triangle) of symmetric matrix to the equivalent vec of a full matrix by duplicating the lower triangle elements to the above diagonal locations.

**%dnninv(n)** returns the (generalized) inverse of the duplication matrix.

**%knn(n)** returns the transposition operator which maps a vec of a matrix to the vec of its transpose.

**%l1nn(n)** returns the “elimination matrix” which maps a vec of a square matrix to the equivalent vech (lower triangle) by eliminating the above diagonal elements.

**%l1nnx(n)** returns the “elimination matrix” which maps a vec of an  $n \times n$  matrix to the equivalent vech (lower triangle) by eliminating the elements at *and above* the diagonal.

**%skewnn(n)** returns a matrix operator which will map the vech of an  $(n-1) \times (n-1)$  lower triangle to the vec of an  $n \times n$  matrix skew-symmetric matrix which has the lower triangle below its diagonal, and minus the transpose of the lower triangle above its diagonal.

## **Special Topics Page**

We’ve added a new page to the “Resources” on our web site:

[https://estima.com/resources\\_topics.shtml](https://estima.com/resources_topics.shtml)

This will be used for short essays on topics that aren’t specific to a single example. The first topic posted on that is “Causality Tests”, which covers a wide range of issues in causality testing, such as how to handle the presence of  $I(1)$  variables, and the meaning of causality tests with more than two variables. This pulls together information from discussion list, forum posts and technical support questions and expands upon those. It includes links to quite a few examples, some of which have been around for years, some of them new. Two new ones are

#### **rollingcausality.rpf**

demonstrates how to do a “rolling sample” causality test, and how the results are easy to misinterpret.

#### **vecmcause.rpf**

does testing for causality and long-run causality in a VECM.

## RATS Version 9.2, contd from page 1.

### SPGRAPH instruction

The new YROTATE option allows the row labels (YLABELS option) to be rotated 90 degrees. While it makes them harder to read, the rotated text takes up quite a bit less room on the page if the labels are more than a few characters long.

### %NFREE variable

This is now defined by all estimation instructions. This counts the total number of freely estimated parameters, including variances or covariances, which will make it easier to compare information criteria for models which have different ways of handling those. For instance, the typical formulas for AIC and BIC for a least-squares model generally don't count the variance, which is fine if you're comparing least-squares models with each other, but not if you're comparing least squares with GARCH (which explicitly models the variance). The @REGCRITS procedure distributed with 9.2 now uses %NFREE (rather than %NREG) and so can be used to compare models with very different parameter structures

---

## OECD MEI Database

For many years, we, at Estima, have provided the OECD MEI database as a separate product, taking the raw data (which years ago was distributed in a in a box with 40 floppy disks) and converting it into RATS format files.

The full MEI has now been put onto the OECD's website and is also included in FRED, so there was no longer a good reason to continue to provide this as a separate service. So with RATS 9.2, you now can download the full data base free of charge. This new operation (on the Data/Graphics Menu) downloads the current release of all the data for all countries. It creates (in the chosen directory), separate RATS format files for the individual countries named for instance USAOECD.RAT, FINOECD.RAT, where the three letter prefix is usually the country's ISO code. The amount of data varies considerably from country to country. The larger economies may have up to 1000 series, some dating back to 1960 (which is the earliest data point in the database), while some smaller ones may have only exchange rates.

---

*The RATSletter*

© 2017 Estima

1560 Sherman Ave, Suite 1029  
Evanston, IL 60201 USA  
[www.estima.com](http://www.estima.com)  
[sales@estima.com](mailto:sales@estima.com)  
874-864-8772

## Prices and Ordering

Users with current update subscriptions will automatically receive version 9.2. Users with single-user licenses for versions 9.0 or 9.1 who *don't* have update subscriptions can update to 9.2 for just \$25.

If you have a single-user version 8.3 or older, you can update it for just \$150. You don't have to have the older software installed. You *do* need to have the serial number. If you cannot find your serial number, contact us at [sales@estima.com](mailto:sales@estima.com) or 847-864-8772 before placing your order. You can get the update either with or without printed manuals—the latter avoids shipping charges. Note that the software includes PDF versions of all of the manuals and PDF's are also included on the web site.

If you have the standard version of RATS, you can upgrade to the Professional version for an additional \$150. The Pro version gives you the X12 seasonal adjustment capability, a 64-bit executable (to allow use of much larger data sets), is somewhat faster, and also includes support for reading ODBC/SQL, FAME, and CRSP databases.

The prices for updating a single-user license for Windows, Macintosh or UNIX are shown below. If you are doing any update except the \$25 ones, you can switch between platforms (for instance, Windows to Mac or UNIX). Please contact us if you have questions.

	What you want:	
What you have:	9.2 Std	9.2 Pro
RATS Pro v. 9.0/9.1	—	\$25
RATS Standard v. 9.0/9.1	\$25	\$150
RATS Pro (8.3 or earlier)	—	\$150
RATS Std. (8.3 or earlier)	\$150	\$300

## Update Subscriptions

Update subscriptions provide a convenient way to budget your software expenditures, and are the easiest way to ensure that you receive all updates to RATS as soon as they are released. We offer two forms of update subscriptions: Version and Annual.

Most (current) multi-user licenses are on annual subscriptions. These provide all updates for one year. The expiration date is shown on the license agreement. If you (think you) need to renew yours, please contact us for pricing.

Single-user licenses are generally handled using Version subscriptions, which provide all updates up to and including the next major release.

If you have version 9.0 or 9.1 or are updating to 9.2, a version update subscription is just \$150 and would give you all updates up to and including version 10.0. (There's an added charge for shipping if you want printed manuals when version 10 is released .