The RATSletter

Estima

RATS Version 9.1!!

We're pleased to announce that version 9.1 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 9.1 (versus 9.0) are

FRED® data

The ability to read data from the St. Louis Federal Reserve Bank's FRED database is now included in all levels of the software, not just Pro, and there's also a separate browser for the wide range of other databases (besides the main U.S. macro databank) included on the FRED web site. See page 3 for more.

PDF graphics

PDF is now available as an export format for graphics which can be used on the *Save As...* or *Export...* menu operations, or as a format in **GSAVE**. You can export into either portrait or landscape. PDF is built in to the Macintosh and UNIX. On Windows, you need to have GhostScript installed.

Command Line Definitions

If you run RATS from the command line, you can use the command line switches

`/Dvariable=value` or `/Dvariable`

under Windows and

`-Dvariable=value` or `-Dvariable`

for the Mac or UNIX to define a variable for use in the program being run. The second form of each defines a value of 1. These create an `INTEGER`, `REAL` or `STRING`, depending upon the form of `value`.

Reading from URL's

For files that read data or text, you can now use URL's (beginning with HTTP or HTTPS) to access data directly from websites. This can either be a fixed file on a web site or a data set created by a "query" to a data site. For instance,

```
open data $
https://quandl.com/api/v3/datasets/WIKI/AAPL.csv
cal(d) 1990:1:12
data(format=prn,org=col) / open high low close
```

pulls stock market price data for Apple stock.

Series List Windows

These are the windows created to display the current working series, the contents of a RATS format file, or the series in a FRED browser. They now have a *Copy Names Only* operation (both on the *Edit* menu and the contextual menu) which copies to the clipboard as text the list of selected series names.

BOXJENK instruction (SV option)

This is a minor change, but makes it much simpler to do certain types of Gibbs sampling operations that involve ARIMA models (particularly low order AR's). It allows the variance, which is usually sampled separately, to be input to **BOXJENK**. When combined with the `INITIAL` and `METHOD=EVALUATE` options, you can easily compute the exact full-sample likelihood for ARIMA models with known variance.

DATA(CALENDAR option)

In general, **DATA** does a fairly good job of detecting the frequency and dates of the information on a data file which has date information. However, if you have a very short data set, or a data set with large gaps, it might fail to determine the date scheme that you intend. The `CALENDAR` option allows you to force a particular (encoded) date scheme.

DATA(REVERSE option)

If your data are in time-reversed order (starting with the most recent at the top or left), you can use `REVERSE` to have it switched to the standard time series order when read in. Note that if the file has usable dates which run in the reversed order, **DATA** will automatically detect that and correct the ordering, so this is only necessary if you have a data set with reversed sequence and no usable dates.

Data (Other Formats) Wizard

This has been improved in many ways. First, it now detects and handles properly dates in reversed order (see the preceding paragraph). It warns about skipped data points which might cause problems in doing GARCH modeling. And it has a *Copy Headers* button which copies header information to the clipboard so you can paste it into the dialog for entering series names (if the header information on the file isn't directly usable as labels).

DLM instruction (SAVE/GET options)

The new `SAVE` saves the information about the inputs to the model (basic input options `A`, `C`, `Y`, `F`, `SW`, `SV`, `MU`, `Z` and less standard ones `SX0`, `X0`, `Q`, `R`, `SH0` and `DISCOUNT`). You can then use `GET` on a later **DLM** instruction to re-use those inputs. Since the covered set of options can often take up to two lines of code in a complicated model, this can make it quite a bit simpler to use **DLM**.

GRAPH/SCATTER instructions

There is no longer a limit on the number of series graphed. The `SERIES` option that was added to **GRAPH** with version 9.0 is particularly handy when

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 9.1 of RATS.

balcilarguptamiller_ee2015.zip

This is a replication of Balcilar, Gupta, Miller(2015), "Regime switching model of US crude oil and stock market prices: 1859 to 2013", *Energy Economics*, vol 49, 317-327. This estimates a Markov Switching VECM, with the cointegrating vector fixed between regimes, but different VECM coefficients and covariance matrices.

Our program deals with a technical issue which is specific to this data set. US crude oil prices were price controlled for many years. As a result, the change in the oil price is often zero, sometimes for many years in a row. Because of this, the MS model can achieve an infinite log likelihood by zeroing out the coefficients on everything other than the lagged oil price change in one regime to achieve a perfect fit there. To avoid this problem, we "fuzz" the zero values by adding a small random number. This doesn't really change the results in any meaningful way, but avoids numerical problems. This is only necessary for EM or maximum likelihood estimation—Bayesian estimation has a prior which prevents the variances from going all the way to zero.

Note that these types of models are *very* technically demanding. If you would like to work with Markov switching VAR's or VECM's, we would strongly recommend that you get the *Structural Breaks and Switching Models* e-course (page 3).

kilian_restat1998.zip

This does replications of the bootstrap-within-bootstrap for analyzing impulse responses for a VAR from Kilian(1998), "Small-Sample Confidence Intervals for Impulse Response Functions", *Review of Economics and Statistics*, vol 80, no 2, 218-230. The bootstrap-within-bootstrap aims to correct for the bias in the initial VAR estimates when they are used to generate bootstrapped data.

kilianvigfusson_qe2011.zip

This is a replication file for Kilian and Vigfusson (2011). "Are the Responses of the U.S. Economy Asymmetric in Energy Price Increases and Decreases?" *Quantitative Economics*, 2: 419–453. This does an asymmetric VAR (allowing for different lag coefficients on positive and negative values, analyzing the impulses using a variety of bootstrap procedures.

sadorsky_ee2012.zip

This is a replication file for Sadorsky(2012), "Correlations and volatility spillovers between oil prices and the stock prices of clean energy and technology companies", *Energy Economics*, vol 34, pp 248-255. This analyses a three variable VAR-GARCH model with (returns on) oil, "clean" energy stocks and general technology stocks. Using a DCC-VARMA model for the variance, it computes time-varying hedge ratios and portfolio weights.

dieboldyilmaz_ijf2012.zip

This is the replication file for Diebold and Yilmaz(2012), "Better to give than to receive: Predictive directional measurement of volatility spillovers," *International Journal of Forecasting*, vol. 28, no 1, 57-66. It is a companion piece to Diebold and Yilmaz(2009), "Measuring Financial Asset Return and Volatility Spillovers, with Application to Global Equity Markets," *Economic Journal*, vol. 119, 158-171. The 2012 article uses "generalized" IRF's. The 2012 paper also uses a much smaller set of series which makes several other types of measures feasible, such as rolling "net pairwise spillovers". (Those *could* be computed in the 2009 data set, but there would be 171 pairs for that rather than 6 for the small set.)

The DY papers have proven very popular, which has generated quite a few questions about extensions of the technique. It's important to understand what this can and can't do. If one looks at the original DY 2009 paper, it repackaged standard decompositions of variance for a very large set of (similar) series. If, instead, you have a more modest-sized *structural* model, you can just use the standard FEVD's directly—aggregating into "from" and "to" doesn't even make sense when the shocks don't correspond one-to-one with the variables.

The principal innovation in the DY 2012 is the use of "generalized impulse responses" rather than conventional Choleski shocks. To demonstrate, suppose the covariance matrix in a two-variable VAR is

$$\begin{bmatrix} 4.0 & 1.6 \\ 1.6 & 1.0 \end{bmatrix}$$

which has a high positive correlation (.8). If these were two relatively "equal" countries, and one did not want to try to come up with a structural model to explain the high correlation, it would be difficult to justify choosing one country to be "first". The standard Choleski factors in the two orders are

$$\begin{bmatrix} 2.0 & 0.0 \\ 0.8 & 0.6 \end{bmatrix}, \begin{bmatrix} 1.2 & 1.6 \\ 0.0 & 1.0 \end{bmatrix}$$

With order 1-2, the first step variance for variable 1 is 100% assigned to its own shock, while in the order

2-1,it's 2.56/4.00 (or 64%) assigned to the second variable and 36% to the first. The DY generalized spillover calculation is to (in effect), use column 1 from the matrix on the left and column 2 from the matrix on the right and compute the share of variable 2 for variable 1 as

$$\frac{1.6^2}{2.0^2 + 1.6^2} \approx 39\%$$

While this is a relatively straightforward calculation, it's not clear what the denominator in this means—it pulls numbers out of two only loosely related matrices. An alternative computation which is similarly not sensitive to ordering (but, unfortunately is not feasible above about five variables) would be to average the decompositions across all possible Choleski factors. That would give you a 68%-32% breakdown. In the two-variable case, the difference between the two calculations is that averaging would include 1.2^2 as an additional term in the denominator (so the denominator would have two full variance calculations). The DY calculation will be biased upwards on the "other" variables,

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 updated to a 2nd edition. In particular,

- Chapter 3 on "Error Bands" adds a discussion of Kilian (1998)'s bias-corrected bootstrap, and the newer **@MCPROCESSIRF** procedure, and updates the descriptions to use features added to RATS with version 9.

- Chapter 5 on "Structural VARs" has been greatly expanded to include detailed discussion of methods of computing error bands for impulse responses in structural models.

- Chapter 6 on "Semi-Structural VARs" describes procedures for incorporating "medium-run" constraints in addition to impact (short-run) and long-run constraints.

- Chapter 7 on "Sign Restrictions" has been expanded to include coverage of zero constraints (in addition to the sign constraints) and calculation of the Fry-Pagan median target responses.

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

RATS Help

With version 9, we completely reworked the help so it includes the full content of the Reference Manual (and more). Since then, we've started adding detailed descriptions of the workings of some of the most important example programs. Plus, we now have the help files loaded onto our web site at

http://estima.com/ratshelp

This considerably simplifies the task of technical support, since we can just provide a direct link to a description of an instruction or option, rather than referring to a page in a PDF manual.

You can see an example of the help for a specific paper at

http://estima.com/ratshelp/mountforduhligjae2009.html

At the end of this, you'll note a section on "Common Errors". With many of these topical papers, users have been tempted to push a technique beyond the limits that it can handle (either theoretically or practically). We hope that this type of warning will help steer people away from "overpromising" results for their empirical work.

FRED Databases

As described earlier, with 9.1 support for FRED is now included in the Standard as well as Pro levels of RATS. And the *Data/Graphics* menu adds a second "browser" for the more than sixty data sources available on FRED:

https://research.stlouisfed.org/fred2/sources

FORMAT=FRED will read data from *any* of the databases that can be accessed using either of the FRED browsers. For instance,

```
cal(q) 1952:1
data(format=fred) / CRDQUSAPABIS
```

reads quarterly data from 1952:1 to present (which will change as data are added) for the "Total Credit to Private Non-Financial Sector, Adjusted For Breaks, for United States" series from the Bank for International Settlements sourced-data on FRED.

Because the on-line data are frequently updated, if you are writing a paper, you probably will want to get a "snapshot" of one set of data rather than using FORMAT=FRED directly in your program. That way, you'll be able to reproduce the results since you have a static set of data. FORMAT=FRED would be best used when you want real-time data for (for instance) forecasting or updating a monthly analysis.

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you have a large number of series to graph (such as separate response functions for different data points).

GRPARM (custom month labels)

New options allow you to override the standard English names and abbrevations for months with a different set. CMLABELS is for one-character, SMLABELS for short (roughly three character) and LMLABELS for full month names. For instance,

```
grparm(cmlabels=||"E","F","M","A","M","J",$
    "J","A","S","O","N","D"||)
grparm(smlabels=||"enero","feb","marzo",$
 "abr","mayo","jun","jul","agosto","set",$
 "oct","nov","dec"||)
grparm(lmlabels=||"enero","febrero",$
  "marzo","abril","mayo","junio","julio",$
  "agosto","septiembre","octubre",$
  "noviembre","diciembre"||)
```

would use Spanish month names and abbrevations instead. Note that the graphs themselves don't have the labels built in—instead, they save the raw date information. The substitution is done whenever any graph is displayed, printed or exported after the **GRPARM** instruction.

REPORT (PREFIX/SUFFIX options)

PREFIX="*prefix formatting string*"
SUFFIX="*suffix formatting string*"

These can be used as an alternative to the SPECIAL option if you need some other form of tagging for eventual use in TeX. You can use these alone or together. SUFFIX="^{**}" will add ** as a super-script (ordinarily ** is on the same line at normal text size), and PREFIX="\lbrace",SUFFIX="\rbrace" will enclose the element in { }.

STORE (REQUEST option)

The REQUEST option provides a VECT[STRINGS] with the database names to include. This applies to the CONVERT option and is mainly designed for data formats such as FRED, FAME or HAVER that have too many series to import in their entirety (or may have no option to run through the entire catalog anyway). You create a VECT[STRINGS] with the names that you want, and **STORE** will pull them off the data base (if they're present) and add them to the file being edited.

Prices and Ordering

Users with current update subscriptions will automatically receive version 9.1. Users with single-user licenses for versions 9.0 who *don't* have update subscriptions can update to 9.1 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* or 800-822-8038 before placing your order. You can get the update either with or without printed manuals—the latter avoids shipping charges. The software includes PDF versions of all of the manuals.

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:	9.1 Std	9.1 Pro
RATS Pro v. 9.0	—	$25
RATS Standard v. 9.0	$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 or are updating to 9.1, 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 and you're outside the U.S.)