The RATS letter

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RATS 10.10c

We have just released a "c' build of RATS 10.10 for all platforms. The principal changes are the addition of the OS instruction, for cooperating with external programs, and improvements in accessibility. Other changes include substantial improvements to programs, procedures and documentation as described elsewhere in this newsletter.

10.1 is free for anyone with a full version 10 license. If you have 10.00f or later, the software should offer an automatic update when you run it. With an earlier v10, you would need to do a re-install. Contact **sales@estima.com** for instructions.

If you have an older version of RATS that you would like to update, the link (for single user licenses) is

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

If you need to update a multiple user/network license, contact **sales@estima.com** or your reseller.

Accessibility Settings

The newest build of RATS has several changes which can be helpful to users who would prefer interface elements to appear larger. Some of these apply to all versions, some to Windows specifically (at this point).

First, in addition to the existing ability to adjust the font and size for the editor windows, we have added the ability to change the font size for the text in other windows (report windows, series list windows and series editing windows). This is the "Display Font Size" on the Preferences dialog.

We also have added to the same dialog a checkbox to "Use Accessibility Adjustment". This applies only to Windows. Since Windows 10, there has been an "Text Size" slider including in the Windows Accessbility features. This requests that interface elements be scaled up by the value you choose in the slider. This applies to anything controlled by Windows (such as menus and window titles). Each application can then decide what to do with this information. For RATS, we scale up the fonts on the text windows, all the other "interface" windows and in dialogs. We do not rescale fonts within graphs (which already rescale automatically based upon the size of the window to keep them proportional to the graph itself.)

Note that this interacts with the text and display font sizes so you might need to adjust *down* your current text font size if you use the accessibility adjustment.

OS Instruction

The latest build of RATS 10.1 adds the **OS** instruction. This interrupts the execution of a RATS program to execute some other operating system command (typically running a different program). This can be used to (for instance) run a Python program to fetch a data set, which can then be brought into RATS using the **DATA** instruction. You can also use **OS** to pass data to another program to, for instance,do specialized graphics.

Other Additions to 10.1

Improved Data Wizard

Version 10 added the ability to use "mapped" dates which allow you to analyze daily data with skipped observations for holidays without losing the relationship between entries and dates. 10.1 now adds to the Data Wizard the option to set up the date mapping. (Previously, you had to do that manually).

Edit Menu Operations

Go To operations have been added to the **Edit** menu to navigate to a line based either upon an absolute line number, or a relative line number. To prevent the menu from getting too long, we've switched to hierarchical menus for **Markers**, **Indenting** and **Comments**,

Line Numbers Made Optional

10.10 added marginal line numbers in the edit windows. While these can often be useful (for instance, some error messages would give a specific line number as the source), some users would prefer it to be optional, so we added a preference item to control it.

ACCUMULATE option

An ACCUMULATE option has been added to the IMPULSE and ERRORS instructions to include an accumulation of the impulse responses for certain variables in the model. This is helpful when variables need to be differenced to estimate a particular model (such as in long- and short-run restrictions in a VAR). The ACCUMULATE option has been included in several procedures (such as @VARIRF), but this allows it to be done at the initial calculation.

Binomial Distribution Functions

Functions %BINOMIALK and %BINOMIALCDF have been added to give the exact probability function and CDF for the binomial for an arbitrary number of trials.

New/Updated Examples

The following examples are either new, or substantially updated either by improved coding, improved documentation or both.

Blanchard-Quah

This is a replication for Blanchard and Quah(1989), which introduced the Blanchard-Quah structural model for identification of shocks by long-run restrictions. The Faust-Leeper replication (see below) uses the same basic model applied with a different choice for the second variable to examine how well the model identifies the long-run zero shock.

BONDS.RPF
BONDSPLINE.RPF

This is a pair of programs which estimate a yield curve based upon a set of data on bond prices. BONDS.RPF uses a non-linear discount function, while BONDSPLINE.RPF uses a cubic spline.

CHOWTEST.RPF

The CHOWTEST.RPF example demonstrates a number of forms of "Chow" tests.

COINTTST.RPF

COINTTST.RPF provides an example of tests for cointegration, demonstrating the procedures @EGTEST and @JOHMLE.

CONDITION.RPF

CONDITION.RPF demonstrates conditional forecasting for a VAR, that is, forecasting under the constraint that certain series hit certain values during the forecast period. Unlike the SHUTDOWN.RPF example (which finds the unique series of shocks to a single variable to achieve a particular result), this allows shocks to all variables to be involved, and finds the most likely set to achieve the result.

CONSTANT.RPF

CONSTANT.RPF demonstrates several tests for structural stability in a linear model for time series data. It uses the instruction RLS, and procedures @STABTEST and @CUSUMTESTS. With time series data, it's quite possible that the model simply breaks down part way through the sample, due to changes in laws, technology, etc.

ECT.RPF

ECT.RPF demonstrates the analysis of a Vector Error Correction model. It analyzes a set of three interest rate yields, first testing for cointegration, then imposing it.

Faust-Leeper

These are replication files for Faust and Leeper(1997), which looks at a pair of two-variable models with structural VAR's with long- and short-run restrictions (basically, the Blanchard-Quah model applied to different data sets). The object of the paper is to examine how well the "long-run" restriction identifies "supply" and "demand" shocks.

GIBBSVAR.RPF
GIBBSVARBUILD.RPF

This is a pair of virtually identical programs for doing Gibbs sampling analysis of a Bayesian VAR (BVAR). The newer and simpler one (GIBBVARBUILD.RPF) uses **@BVARBuildPriorMN** to construct the mean and precision matrices for the prior, while GIBBSVAR.RPF includes the full set of calculations for creating those.

HISTORY.RPF

This is our standard example of a historical decompostion in a VAR, examining several different ways of displaying the information generated by the **HISTORY** instruction.

IMPULSES.RPF

IMPULSES.RPF is our standard example which computes and graphs impulse response functions is a VAR (to Cholesky shocks) in several different formats, including basic error bands.

SCTEST.RPF

This provides examples of several different tests for (univariate) serial correlation.

SHUTDOWN.RPF

SHUTDOWN.RPF is an example of calculating a variant of impulse response in a VAR which shuts down the dynamic response of a variable. This differs from historical decomposition (see HISTORY.RPF) which shuts down (in turn) each shock (not response), or conditional forecasting (see CONDITION.RPF), which allows all shocks to be used in htting the target.

VARLAG.RPF

VARLAG.RPF is an example of lag length selection in a VAR. It shows several different ways to approach the choice of lag length in a VAR, including a formal test of one lag length vs another longer one, and use of information criteria for automatic lag length selection.

Updated Help

We have switched to a new help authoring tool which will allow us to more easily add topics (particularly graphical how-to's) and anything with math.

The help is structured differently (there is a "topics" directory inserted between the root and most of the content) and is posted on our web site at estima.com/webhelp. However, any old references to the previous "ratshelp" will now be rerouted to the proper address on the new one.

The help is still incorporated into the software, but the help on the web is always our most recent.

New/Updated Procedures

The following procedures are substantially updated either by improved coding, improved documentation or both.

bqdodraws.src

This is a specialized procedure for (carefully) doing Monte Carlo integration of impulse responses in a two-variable Blanchard-Quah model. (The Blanchard-Quah factorization creates "demand" shocks with an impact sign that is not directly controlled by the calculation. This ensures that the impact sign is consistently positive).

bvarbuildprior.src
bvarbuildpriormn.src

These are a pair of procedures for creating the matrices used for the prior for Gibbs sampling in a Bayesian VAR. The first procedure does a single element of the prior, while the latter does a full "Minnesota" prior, similar to what is done by the SPECIFY instruction for point estimates for a BVAR within RATS, except with the information in the form required for Gibbs sampling.

exactinverse.src

This computes an exact "limit" inverse for a matrix when it is composed of "finite" and "infinite" components. It's heavily used internally by the RATS DLM instruction to handle mixed stationary-non-stationary models but has other uses as well.

impactsignflip.src

@IMPACTSIGNFLIP is used to correct the signs of columns in a factor of a covariance matrix when the signs themselves may not be identified by the process of computing the factor (such as long-run restrictions) where either a positive or negative shock can yield a long-run zero.

johmle.src

@JOHMLE is the workhorse procedure for doing basic maximum likelihood analysis of cointegration in a var. The output has been changed to be more similar to that produced by CATS.

mcmcpostproc.src

This s a "post-processor" for Markov Chain Monte Carlo (MCMC) statistics, which is used in almost every example we have for the various types of MCMC (such as Gibbs sampling and Metropolis-Hastings). It can generate both summary statistics of the draws and chain diagnostics.

structresids.src

@StructResids converts standard VAR residuals into the equivalent structural innovations.

Bayesian Econometrics E-Course

The RATS e-course on Bayesian Econometrics was first offered in spring 2009 and updated to a 2nd edition in 2013. It covers most of the most important methods now used in Bayesian analysis in econometrics, including Gibbs sampling, Metropolis-Hastings and importance sampling. The applications are to a broad range of topics, including time series, cross-section and panel data.

The presentation is based largely on Gary Koop's Bayesian Econometrics(2003). It starts with the closed-form analyses which are possible for linear models with convenient choice of priors before moving on to simulation methods for models for which that isn't available. To this, we've added coverage in several areas, with a chapter on vector autoregressions, and examples from the literature for panel, cross-sectional data and state-space models. In most cases, we've included much of the statistical derivations from the book, presented in a way to highlight the calculations as they are done with RATS.

We're now including this at no charge with the RATS distribution. The advanced simulation-based techniques are used in the contents of many of the other e-courses, particularly the Vector Autoregression and and Switching and Breaks course, where the use of modern Bayesian techniques is a common choice for state-of-the-art analysis. By starting with relatively simple types of models (such as single equation non-linear least squares), it's possible to learn how to use methods such as Metropolis-Hastings before applying them in more complex multivariate settings.

E-Course Materials

We also have e-courses available on several important topics. All of these include a workbook, with the example programs and data. Through all of these, we offer a mix of the general theory, with descriptions of how models can be analyzed with RATS.

The price for the course materials is $50 for each topic. Those are "Vector Autoregressions", "arch/garch and Volatility Models", "State-Space and DSGE Models", "Structural Breaks and Switching Models" and "Panel Data". For more information on any of these

https://estima.com/courses_completed.shtml

SEIR Model

Several years ago, we posted a zip which includes RATS programs for simulation and estimation of various forms of the commonly used SEIR (Susceptible Exposed Infected Recovered) dynamic model for infections, applied to COVID data. We've put this under the GNU Free Document License and are including it in the distributions of RATS.

This has a series of (increasingly complicated) linear and non-linear dynamic models. There are actually quite a few interesting parallels with dynamic models for economic data:

- What the model really wants for data is often unobservable. (Instead of the unobservable "real rate of interest", the SEIR model lacks "number of people who are infectious.")
- Key parameters are poorly estimated from time series data.
- As with micro-level economic data (or data in countries with less developed statistics bureaus), what data can be observed may have some odd properties.

Because of those similarities, the methods employed may have parallels to economic analysis.

The first chapter works only with pure simulations. It first shows a deterministic model, a model with errors implied by the process and another deterministic model with an assumed model of changing behavior. In the simulation section, it shows a "shotgun" graph which shows various random simulations of the model and (in this case) demonstrates that a wide range of values is mainly due to differences in timing rather than actually differences in the ultimate effect. (Shotgun graphs have become increasingly popular in the VAR literature for showing impulse responses.)

The second chapter looks at the behavior of actual data (in this case from the state of Illinois in the U.S.). U.S. data has some rather strong day-of-the-week effects (which often differ from state to state); this looks at different ways to extract the signal out of observed data.

The third chapter looks at actually estimating a dynamic SEIR model given the data. This does four increasingly complex models: first with a transmission rate which is fixed across the sample; the second with an exogenously input change in the transmission rate, the third with an endogenously determined transmission rate, then finally a more complicated model that allows for a multiplicative day-of-the-week effect in the observed data.

The SEIR model is fundamentally non-linear, though not in a particularly complex way. The basic simulation models can be handled relatively easily with **FORECAST** or **SIMULATE** instructions. When attempting to fit them to actual data, however, one needs to use the non-linear (extended) Kalman filter to deal with multiplicative interactions among the states. The non-linear Kalman filter is covered in greater detail as part of the State Space Models/DSGE e-course.

Numerical integrals

RATS has several functions and procedures for doing different types of numerical integration. For definite integrals, there are %ITRAPEZOID and %ISIMPSON which do the trapezoid rule and Simpson's rule. The **@GaussHermite** procedure can generate weights for Gauss-Hermite integration for indefinite integrals with a function times a Normal density, which is needed in, for instance, Random Effects probit models. We've added a topic to the help (linked in the title of this section) which discusses how these (and other methods) can be used.

Updated Forum

As part of a recent upgrade of our web site, we were able to update the RATS support forum. (The old forum software was around 15 years old). This corrected some issues (such as Select All on code blocks not working). The newer interface is cleaner, but some of the operations have been moved do different locations, or have been moved into pull down menus. The link above includes a detailed help on how to use the new forum.

The forum is often the first location in which new and improved programs are posted, and we encourage users to register. This is particularly helpful for customers with multiple user licenses, where your end users can register directly.

If you run across any errors in the new forum (a few attachments seemed to have been inexplicably dropped), please let us know.

The RATSletter

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