Introduction to RATS

Outline

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4. Linear Regression and Statistical Test
5. Scatter Graph

1. Getting Started

Executing Instructions

Press "I|O" toolbar icon, which separates a window into the input {i} and the output {o} windows.

You need to command RATS to take certain actions.

(1) One the input window, type the line below:

```plaintext
display "Hello, Econ 715"
```

(2) Hit the <ENTER> key on your keyboard. Check what appears on the output window. A word which command RATS to take an action is called "instruction" (here, display).

(3) You can also execute a block of instruction by selecting (highlighting) the lines you want to execute using the mouse or the keyboard, and then hitting <Enter> or clicking on the "Run" icon (Runner).

Check whether you can get the same result as the above.

2. Data Import

One of the important features of RATS is that RATS has two approaches for the same command: wizard approach and programming approach. Let’s import data using two different approaches.

This data file includes 4 variables, years of experience (EXPER), gender (MALE), years of school (SCHOOL), and WAGE. The series MALE is equal to 1 for males, and 0 for females. (This type of variable is called “dummy variable”).

A. Wizard Approach

(1) Press “Data/Graphics” in the toolbar and then “Data (Other Formats)”.

(2) Select the Excel file "WAGES1" which you want to import into RATS.

(3) A window called “Spreadsheet Import” pops out. Press “OK”.

(4) Data import is done! Go to “View” in the toolbar and “Series Window”, where you can check the series you have imported. Conveniently, a wizard approach also produces the command lines used for a programming approach on the input window.

B. Programming Approach

(1) Hit “Clear Memory” (hand) icon on toolbar to delete the data series you imported in A.
(2) Select the command lines which left in the input window and run it. Check that data series has been imported.

3. Descriptive Statistics

Now, we have data series we want to analyze. Let's examine the descriptive Statistics for the series of WAGE (average, variance, and maximum/minimum values, etc.).

(1) Go to “Statistics” on the toolbar and select “univariate statistics”.

(2) Choose WAGE and check the boxes of “Basic Statistics” and “Extreme Values”. Then Press OK.

What appears on the output window?

(3) If you want to check the subset of the series, say, wages only for males or only for females, you can use the SMPL option, which allows you to make a sub-sample of a series. Check that you have the following command line in the input window:

```
STATS WAGE
```

Rewrite the above line as follows:

```
STATS (SMPL=MALE) WAGE
```

Executing the above line provides the descriptive statistics for males. If you want to see for females, type

```
SET FEMALE = .not.MALE
```

This creates a new variable FEMALE, and then type

```
STATS(SMPL=FEMALE) WAGE
```

(4) Compare the average wage for male and wage for female.

4. Linear Regression and Statistical Tests

Let's suppose that we have a regression model as follows:

```
WAGE = Constant + Beta1 * MALE + Beta2 * SCHOOL + Beta3 * EXPER + error
```

(1) On the input window, type and run the following two lines

```
linreg wage

# CONSTANT MALE SCHOOL EXPER
```

This regresses WAGE on the 3 explanatory variables with an intercept.

(2) You get the result table on the output window. See what kind of information is included. Check the p-values for T-test. Is the coefficient of each explanatory variable statistically significant?

(3) You may want to check whether SCHOOL and EXPER are “jointly” significant, that is a group of the variables has no effect on WAGE. Type in and execute

```
exclude

# SCHOOL EXPER
```
If the null is rejected, it suggests that the group of SCHOOL and EXPER should help explain WAGE.

(4) Let’s see how much your model can explain the actual data visually. Type in and execute:

```RATS
@regactfit
```

@ denotes a "procedure", which is a collection of RATS commands which is already saved in RATS. `@regactfit` generates a plot showing the residuals and actual and fitted values from the most recent regression.

(5) Let’s test the Heteroscedasticity in our model. We use the White Test for Heteroscedasticity (See textbook for the detail). Right after your regression (1), type in and run

```RATS
@RegWhiteTest
```

This procedure calculates the LM statistic which follows a chi-squared distribution, with degrees of freedom equal to the number of estimated parameters. If the p-value is sufficiently small, that is, below the chosen significance level, we reject the null hypothesis of homoskedasticity.

5. Scatter Graph with a Regression Line

You can graph one series against another, say WAGE and SCHOOL. Suppose your model is:

\[
Wage = \text{Constant} + \beta_1 \times \text{SCHOOL} + \text{error}
\]

(1) Type in and execute:

```RATS
Linreg WAGE
# constant school
PRJ WAGEFIT
```

The instruction “PRJ” computes and save the fitted values from the most recent regression, WAGEFIT, that is

\[
\text{WAGE}^\prime = \text{Constant}^\prime + \beta_2^\prime \times \text{SCHOOL}
\]

(2) Select “Scatter(X-Y) GRAPH” from the “DATA/Graphics” menu.

Select (highlight) both WAGE and SCHOOL from the list of series and add the pair to the list of series to be graphed. When prompted choose the combination with SCHOOL as the X-axis variable and click “OK”. Then Select “Symbols” as the ‘Style’.

(3) Now, select WAGEFIT and SCHOOL and add this pair to “Overlay Series” list. SCHOOL should again be on the X-axis. Select “Line” as the Style, and turn off the “Same Scale as Base?”

(4) You can see the scatterplot of WAGE and SCHOOL, and the fitted values from your regression.