

GRET FOR TODDLERS!!

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U.P.V.

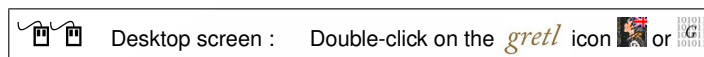
E.H.U.

1. ACCESS TO THE ECONOMETRIC SOFTWARE


In this primer we'll use program *gretl* (Gnu Regression, Econometrics and Time-series Library ) to introduce the General Linear Regression Model (GLRM). Therefore, it is assumed that *gretl*'s software has already been downloaded from its official site at gretl.sourceforge.net and that all necessary steps to install the software in your computer have been successfully carried out.

Please note: This guide refers to *gretl* version 1.7.9 as of Sep 28, 2008.

In order to access *gretl* :



or...

Start ⇒ All Programs ►  *gretl*

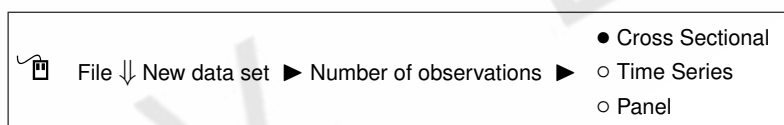
2. LOADING AND SAVING DATA: THE FILE MENU

In order to estimate a model you need data stored in a file. There are several methods in *gretl* to create and handle this data file:

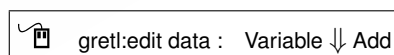
2.1. A new data set: If the data are simply on paper, you'll have to type them into a *gretl* file. Let us consider the following data set obtained from the *strawberry production data* experiment:

Obs	1	2	3	4	5	6	7
<i>Y</i>	40	60	50	70	90	80	100
<i>X</i>	10	25	40	45	60	80	90

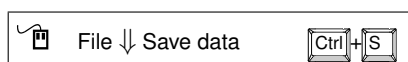
You must introduce data by hand for the variables of interest: the dependent variable *Y* as well as the explanatory variable *X* (you may add more variables later on if you like):



After entering data values for the first variable using *gretl*'s spreadsheet you may add a new variable and carry on entering data for the second variable:



Once the data are introduced you should save them in a *gretl* file:



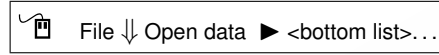
If the data have not been saved yet, a new pop-up window will open where you will be asked to provide a file name (something like `MyDataFileName.gdt` for instance) and location within your directory structure. Next time, the data will just be saved in the current file overwriting its previous contents.

2.2. An existent data set: Otherwise, if the data are already in a *gretl* file:



You must browse through the hard disk's directories for the file you want and open it by clicking on it.

Note that if the data file has been used recently, you can also find it in a short list at the bottom of the options:

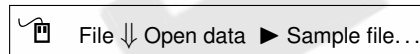


2.3. Importing from non-gretl data sets: If your data are filed in a different format, like a plain and readable CSV file or an Excel spreadsheet file for instance, you can import them into *gretl*:

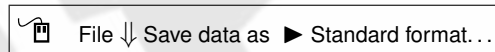


You select the format type and browse for the file of your choice.

2.4. Textbook data sets: Also, *gretl* includes data files from some textbooks:

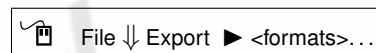


For example, you may open data file 7.12 of Ramanathan's book¹. This file contains 11 variables. If you are interested in some of them only, you can generate a new data file containing just the variables of interest:



Now you can select the variables you want to keep (say *price*, *length*, *weight*) and you save the file with a new name like say *Ram712.gdt* or any other of your choice. In the remainder of this guide we will be working with the file you have just created.

2.5. Exporting to other formats: Note that, instead of saving your current data set to a *gretl* file type (*.gdt), you can also export the data to a different format:



As with the import option you select the format type and a file name. Later on you may work with the new file with other software like, for instance, Excel.

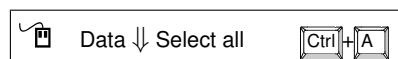
3. MANIPULATING DATA: THE DATA MENU

3.1. Data selection:

You can select the variable(s) with a single mouse click on *gretl*'s central panel.

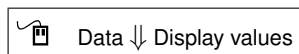
If you want to select more than one variable hold the **Ctrl** key down while selecting them.

Also, if you want to select all the variables in the data set at once:



¹Additional collections can be downloaded from *gretl*'s site.

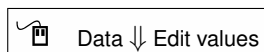
3.2. **Reviewing the data:** To see the data entered into the current data set, first select the variables of interest and:



You may check this with the file you created in the previous chapter by selecting some variables from Ramanathan's data file 7.12.

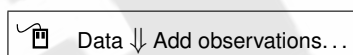
( Short cut: just double-click the variable name on the central panel to review a single variable.)

3.3. **Data correction:** If you made mistake when entering some value...



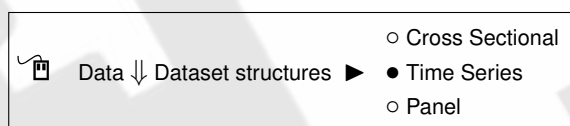
... will open *gretl*'s spreadsheet where you may replace the wrong values with the new ones.

3.4. **More values:** If later on you have more observations for some (or all) of your variables...

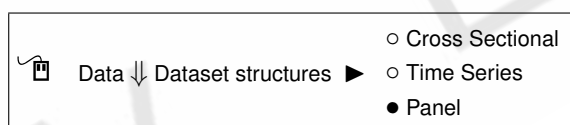


... will ask you for the number of observations that should be added to the bottom of your data set. Of course you'll need now to open the *gretl*'s spreadsheet to enter the new values as for data correction.

3.5. **Changing the structure:** By default data are assumed to have a cross-sectional structure. To change it:



After this *gretl* will allow you access to new commands specific for time-series data like time-series plots, seasonal dummies, time-series models, etc. (they appear written with dimmed gray letters otherwise). Similarly,

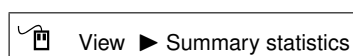


will grant you access to specific panel data commands.

4. STATISTICS & GRAPHS: THE VIEW MENU

4.1. **Main statistics:**

a) Descriptive statistics:



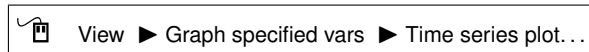
displays mean, median, minimum, maximum, standard deviation, etc. for the selected variables in the central panel.

b) Correlations:



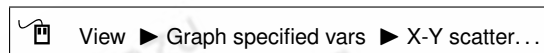
opens a popup window to display correlation coefficients of the variables of interest.

4.2. **One-dimensional time-series plots:** If the current data set has a time-series structure you may visualise the evolution of one or more variables along time:



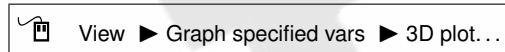
By clicking on the graph a pop-up menu appears that allows you to do several things like saving your plot in different formats or copying the plot to *Windows clipboard* for later use in, say, a *Word* file where it can be pasted (with **Ctrl+V**). For example, if you want to save the graph within the current session, select “Save to session as icon”.

4.3. **Two-dimensional scatter plots:** More generally, you may want to plot pairs of variables, one against the other, to visualise how they are related:



Clicking on the graph lets you save the plot, etc. exactly as before.

4.4. **Three-dimensional graphs:** A more complex type of graph lets you visualise how one variable may be related to a combination of two other variables:



Note that, for obvious reasons, it is usually convenient to choose the dependent variable as the Z-axis variable. The 3D graph can be rotated by clicking on it, which is nice, but it cannot be saved like the previous one. It can nevertheless be printed or copied to the *clipboard* (with **Ctrl+C**) so that it can be pasted (with **Ctrl+V**) to a *Word* file for example (right-click on window’s blue top to see *gnuplot options*).

4.5. **The icon view:** All these results saved in your session can be visualised as follows:

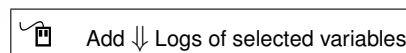


Note that most results (like summary statistics, etc.) are saved by *gretl* automatically, while a few (like graphs) will need an specific action by the user.

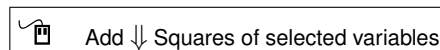
5. DEFINING NEW VARIABLES: THE **ADD** MENU

Some simple but important transformations of existing variables can be easily obtained within *gretl* itself, for example

a) the natural logarithms:

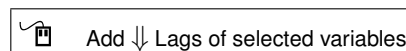


b) or the squares:

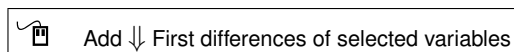


For time-series data there are some specific time-related transforms like:

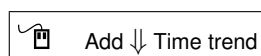
a) the first lags (that is, the previous value of each period):



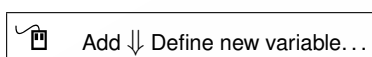
b) the first differences (i.e., the change between one period and the next):



c) or a secular trend (that is, like time itself):



More generally, you may construct a new variable as a mathematical function of the ones already present in the current data set:



... opens a dialogue in which to enter a formula for the new variable. For example, if you type ...

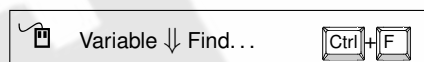


... a new variable (`length_m`) will appear in the central panel corresponding to the car length in cm (instead of inches).

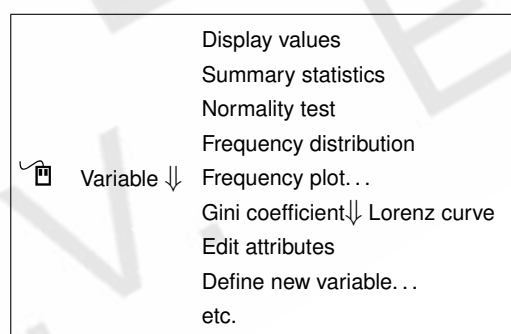
The new variables thus created can be visualised by any of the means described above.

6. SINGLE VARIABLE RESULTS: THE `VARIABLE` MENU

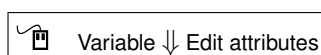
This menu offers short cuts to all the commands that are relevant to single variables. The first one simply lets you find and select a variable by name, which can be useful if your data set contains many variables:



As for the rest, most of them have been already mentioned above whilst others have an obvious meaning:



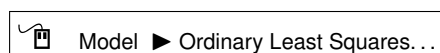
For example,...



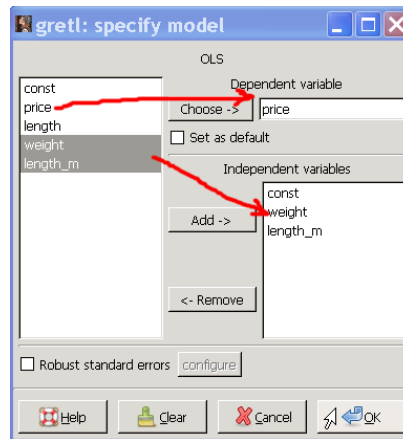
... lets you modify the name of the variable, its description or its display name that appears in graphs.


7. ESTIMATING A REGRESSION MODEL: THE `MODEL` MENU

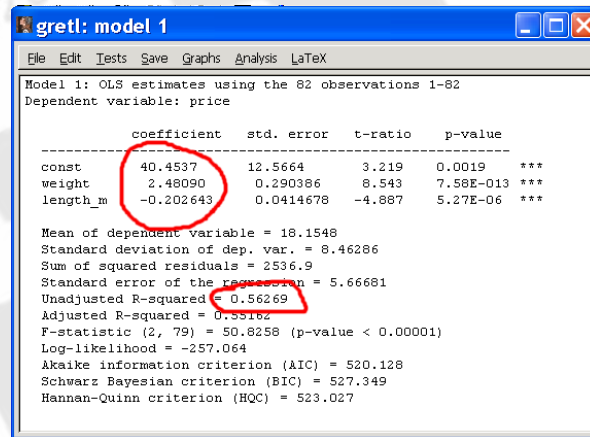
Estimation of a regression model is extremely easy with *gretl*:



... opens a menu where we can select the dependent and the explanatory variables from the current set:



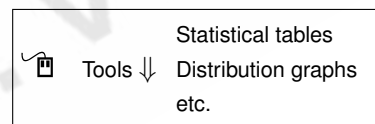
Clicking the  button will produce a new window with all the relevant results:



which will be explained in greater detail in chapter 11.

8. USING THE TOOLS

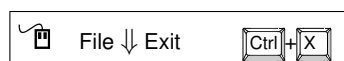
Here we can find critical values from tables of the most common statistical distributions like the normal dn., the t-student dn. etc., with which to carry out some statistical hypothesis testing, as well as some pretty graphs of their corresponding density functions:



Their use should be self-explanatory.

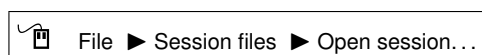
9. SAVING THE SESSION & EXITING GRETL

Finally, when you have finished:



You will be given the option to save the *gretl* session and, if the current data set has not been save yet, to save the unsaved changes you may have made to it.

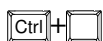
Next time you want to carry on with your work from where you left it, you only have to



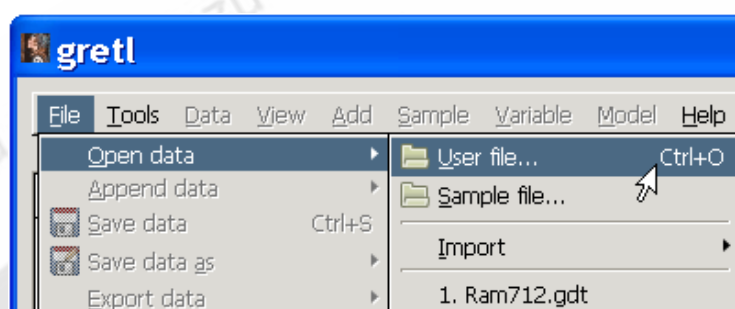
... and select the one you want.


10. THE SHORT-CUTS

10.1. **The Ctrl key:** You probably have noticed that some of the commands described above have something like

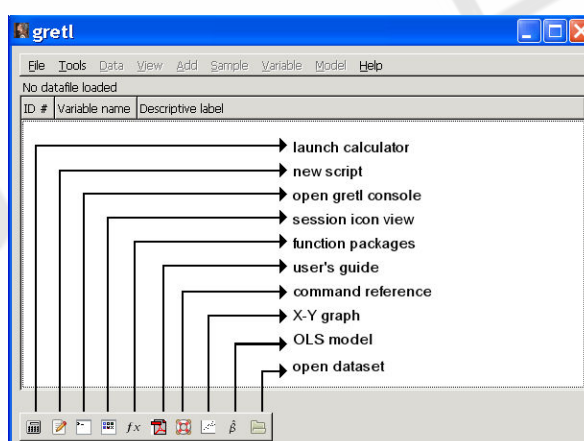


written at the end of its selection tab:





These are keyboard short-cut combinations: you press and hold the  key down while pressing also the second key. By pressing them you reach the command destination much quicker and without the use of the mouse.

10.2. **The bottom icons:** Also, you may have noticed by now that *gretl* shows some of the most useful commands as icons at the bottom of the window:



With them you may also reach some useful commands with a single click of your mouse.

10.3. **A right-click of your mouse:**  Finally, clicking with the right button of your mouse on a variable name or on a selection of variables (remember you can select more than one variable by holding  while selecting), *gretl*'s panel will open a context window with commands like:

- Display values
- Descriptive statistics
- Time series plot
- Frequency plot
- ...
- Edit attributes
- Edit values
- Copy to the clipboard
- Delete
- Define new variable...

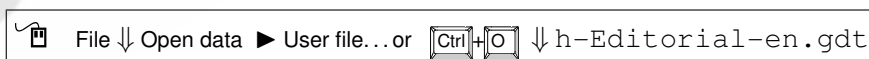
Clicking normally on any of them will give you the expected action.

11. OLS WITH GRETL...

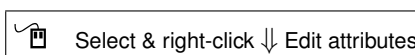
Gretl data file h-Editorial-en.gdt contains 40 quarterly observations from four variables: S (book Sales in thousands of euros), P (average Price in euros), C (average price of the Competition in euros) and A (Advertising expenditure in euros)²:

	Book sales (S_t)	Average price (P_t)	Average price of the com- petition (C_t)	Advertising expen- diture (A_t)		Book sales (S_t)	Average price (P_t)	Average price of the com- petition (C_t)	Advertising expen- diture (A_t)
1992:1	275.5	98.6	105.5	1868	1997:1	229.9	99.2	108.5	1903
1992:2	285.6	96.6	104.4	2157	1997:2	342.9	86.4	98.10	2489
1992:3	336.8	102.0	115.6	2541	1997:3	361.9	92.7	122.8	2770
1992:4	333.4	91.9	102.7	2561	1997:4	301.3	100.9	106.9	2493
1993:1	357.0	105.6	106.1	3103	1998:1	332.5	101.7	108.3	2701
1993:2	325.2	102.8	100.2	2661	1998:2	343.2	95.3	114.4	2497
1993:3	362.2	102.1	97.2	2757	1998:3	421.9	98.6	114.9	3192
1993:4	232.0	99.1	93.3	1403	1998:4	401.9	102.5	107.5	3086
1994:1	252.2	100.3	94.6	1856	1999:1	421.8	101.0	108.5	3533
1994:2	322.1	104.8	109.4	2123	1999:2	361.7	96.9	109.4	2864
1994:3	297.3	85.6	94.7	2181	1999:3	393.6	98.3	114.6	3181
1994:4	298.9	103.0	111.4	2520	1999:4	287.6	91.8	118.2	1855
1995:1	246.8	100.4	105.0	2134	2000:1	380.0	77.8	106.8	2575
1995:2	322.4	93.8	118.3	2473	2000:2	495.6	81.6	131.4	3723
1995:3	383.5	99.7	102.1	3125	2000:3	452.6	86.6	101.5	3268
1995:4	321.8	104.6	110.6	2753	2000:4	404.9	93.0	146.2	3025
1996:1	351.5	100.0	97.3	2869	2001:1	421.3	83.7	114.2	3173
1996:2	381.1	103.7	91.8	3301	2001:2	333.7	93.7	119.3	2387
1996:3	412.5	96.7	96.8	3043	2001:3	379.1	94.5	116.5	2839
1996:4	217.5	105.5	102.2	1538	2001:4	407.0	97.7	113.5	3352


You must open the data file in the usual way:



If you want, you can change the names and other attributes of the variables:



²As in Alonso, Fernández & Gallastegui's book *Econometría* (ISBN:84-205-4460-4), pp. 14 & 42. Appendix B of this book, p.383, shows full resolution of many questions related to this course that are illustrated with this data set, including the ones that follow here.

 Then you can change the variable name, the description, the display name (as shown in graphs), the compaction method (for reducing frequency using sums, averages or just a single observation per year) and the graph line width.

11.1. Estimating a SLRM (Single Linear Regression Model).

11.1.1. Regress Sales on Price only:

$$S_t = \beta_0 + \beta_1 P_t + u_t$$

- (1) What sign do you expect for β_1 ?
- (2) Plot a scatter graph of S against P and comment
- (3) Run the OLS regression: do the results agree with your expectations?
- (4) interpret the estimated coefficients
- (5) Show that the regression line crosses the point (\bar{X}, \bar{Y})
- (6) What is the value of the coefficient of determination?. Interpret this value.

11.1.2. Regress Sales on Advertising expenditure only:

$$S_t = \beta_0 + \beta_2 A_t + u_t$$

- (1) Repeat the process for this model, and interpret the results, etc.

11.2. Estimating the GLRM (General Linear Regression Model).

$$S_t = \beta_0 + \beta_1 P_t + \beta_2 A_t + \beta_3 C_t + u_t$$

- (1) Repeat the process for the full GLR Model, and interpret the results, etc.
- (2) Compare the results obtained to those from the previous SLR Models. Are they the same? Why?
- (3) Obtain an estimate for the variance of the error term
- (4) Table of observed values, fitted vales and residuals
- (5) Estimate the variances of the estimators of the coefficients β_1 and β_2
- (6) Estimate the covariance of $\hat{\beta}_1$ and $\hat{\beta}_2$
- (7) Plot of Sales observations against fitted values
- (8) Plot of OLS residuals
- (9) Plot of residuals against Price

12. CARRY ON GRETL!!...

As a young toddler I don't think you need to know more *gretl* stuff but as, alas, you grow older you will probably want to proceed to further levels of knowledge 😊. In that case *gretl*'s own reference guide is conveniently provided with your *gretl* distribution (click on Help ► User's guide). If that proves too dense for you (it does for most of us 😊) you will be happy to learn that there are several resources available in the Internet. A search for "gretl primer" with your favourite search engine produces as a first entry an anonymous but useful visual guide to *gretl*.

If you prefer something more "textbook-like" you may visit Lee Adkins' *gretl* page and try some of his ebooks *Undergraduate Econometrics* and *Using gretl for Principles of Econometrics, 3rd edition*. His page contains some additional *gretl* resources. Have fun! 😊

END OF THE PRIMER