

**Lab 8:**  
**Multiple Regression: Excel and Minitab**

**Objectives:**

We all agree that most economic models would require estimation of a multiple regression. The objective of today's lab is to estimate multiple regression models in *Excel* and introduce you to data analysis in *Minitab*.

**Key Terms:**

1. **Multiple Regression**
2. **Partial Effects (Partial Derivatives)**

**Readings:** *Specification Bias* (Handout available on the course website.)

**Data:** *Lab 8 Exercises.xls.*; *Roses.dat* (an ASCII data set)

**Exercises:**

◆ Open *Excel* and *Minitab*. If you want us to review your results, open *Word* as well.

◆ **Multiple Regression in Excel.**

1. Open the spreadsheet *du jour*. First, estimate the following **simple regression**:

$$Sales_t = \alpha_0 + \alpha_1 Prose_t + v_t.$$

Review the results. Interpret the parameter estimate  $\hat{\alpha}_1$ . The units for *Sales* are dozens of roses sold and *Prose* is measured in \$/dozen. This model represents the demand for roses in Detroit.

2. Estimate the following **multiple regression** and place the results in a separate worksheet:

$$Sales_t = \beta_0 + \beta_1 Prose_t + \beta_2 Pearn_t + \beta_3 Dinc_t + u_t.$$

How do you interpret the three parameter estimates:  $\hat{\beta}_1$ ,  $\hat{\beta}_2$ , and  $\hat{\beta}_3$ ? *Pearn* is also measured in \$/dozen; *Dinc* is weekly disposable income in dollars.

3. Compare the estimated values:  $\hat{\alpha}_1$  and  $\hat{\beta}_1$ . How would you explain the observed difference?
4. Using your multiple regression results, formulate and complete hypothesis tests for the three population parameters,  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$

◆ **Multiple Regression in Minitab**

1. You first need to open both *Minitab* and *Word* so that we can have the word processor available to organize your results. When you have opened *Minitab*, you should see two windows: one titled **Session** and one titled **Worksheet**.
2. Before we can do anything, we need data. The file *roses.dat* is available on the course website. It is an ASCII (text) file. The file contains the same variables listed in the Excel spreadsheet. You need to have a physical copy of this data set available on, eg., your flash drive, the desktop, etc. In lab, we'll use the data in the ResEc 312 folder: *roses.dat*.
3. To read the data into *Minitab*:

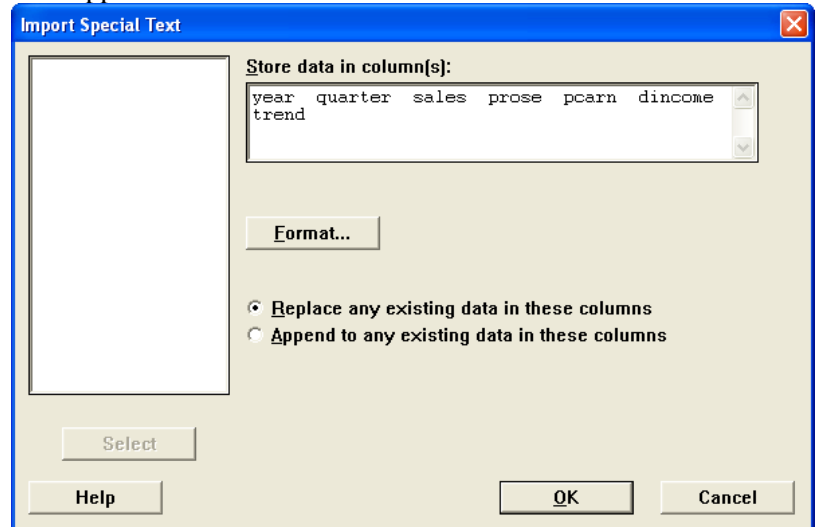
◆ Click on an empty cell in the *Minitab* worksheet.

◆ Choose **F**ile from the *Minitab* main menu, then **O**ther **F**iles, and **I**mport **S**pecial **T**ext. You will find yourself in a window that asks you to describe the data you are about to import.

- ◆ In the box labeled, **Store data in column(s)**, you need to list names for the variables *Minitab* will encounter when reading the data file on your disk. So, whenever importing data into *Minitab*, you need to know the format of the data you are importing. You can choose any names you wish (no more than 8 characters) **BUT, you must list the variables in the correct order!**

- ◆ For the roses data set, the window should appear as follows:

- ◆ Once you've entered the list of variable names, click **OK**. *Minitab* will then open a window titled: **Import Text From File**. *Minitab* is now asking you to tell it where to find the data file. Make sure you saved the file to a physical location (our data are in the ResEc 312 folder), get into the correct directory and then choose the *roses.dat* data set from the list that appears at the left and click the **OK** button at the right.

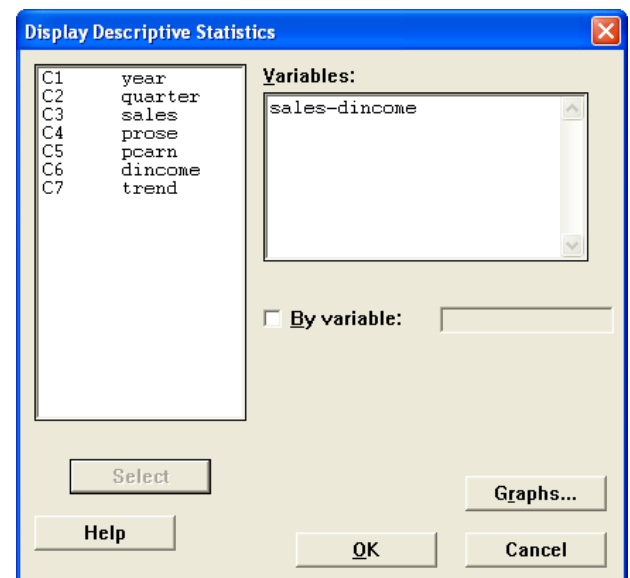


- ◆ In the blink of an eye, the data appear in the columns C1-C7 with the names you chose for the variables as column headings. You can observe all the data by using the scroll bar or by maximizing the **Data** window. You're ready to estimate!

4. First calculate some basic statistics (estimates of population parameters) for these data. This is material you learned in ResEc 211/212 and then again early this semester in this course. To do basic statistical analyses:

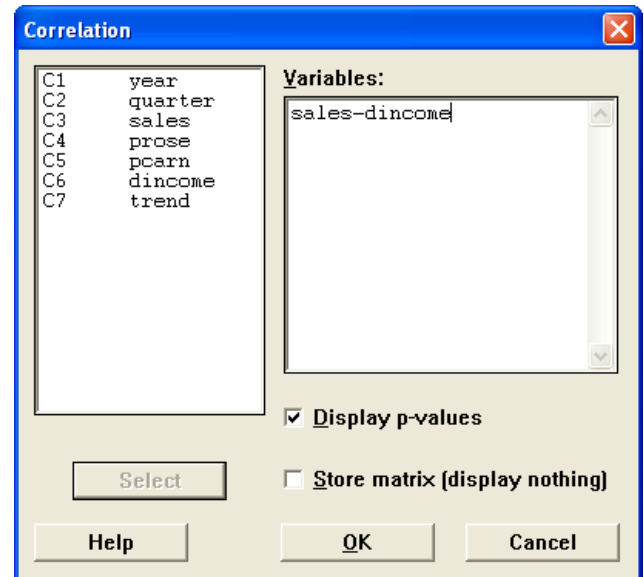
- ◆ Choose (amazingly!) **Stat** from the main menu. You will see a number of options.
- ◆ Choose **Basic Statistics** and you will again see a number of options.
- ◆ Choose **Display Descriptive Statistics**. We know that distributions of random variables are *described* by their mean and variance, so we should expect to find estimators of the population means and variances in here.

- ◆ *Minitab* will send you to a window where you need to select the variables for which descriptive statistics will be calculated. You can use the mouse to highlight the variables. Block or highlight - then click **Select** at the bottom of the window; or you can double-click each variable one at a time. You can also click inside the box for **Variables:** and type the names of the variables. After choosing the variables, click the **OK** button at the bottom and in a blink or two, *Minitab* reports the descriptive statistics in the **Session** window. *Minitab* reports the Mean, Median, Standard Deviation, quartiles and more for each of the variables selected.



5. We also discussed measures of linear association. The one that we decided was useful was the *Correlation Coefficient*.

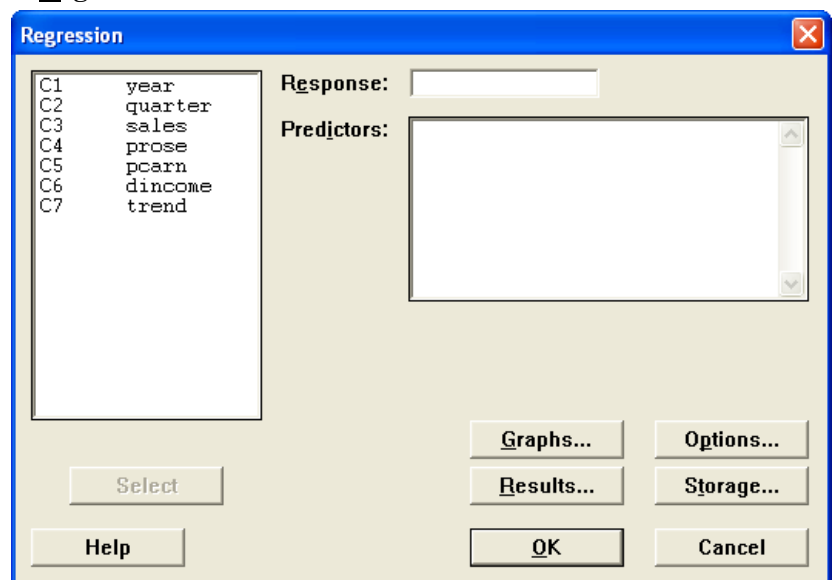
- ◆ Choose **Stat** from the main menu.
- ◆ Return to the **Basic Statistics** menu and you will see that *Minitab* will also compute correlation coefficients.
- ◆ Select the variables: *sales*, *prose*, *pcarn*, and *dincome*. Click **OK** and *Minitab* creates the same type of correlation matrix that we created in Excel using the Data Analysis tools. Doing this task in Minitab just seems a bit easier. The correlation coefficients between the variables are listed. Which variables are most closely linearly associated? Which are positively or negatively associated?



5. Histograms: Minitab is great for getting a quick histogram. Go to the **Graph** menu. In there, you'll find **Histogram**, then choose **Simple**. Select the variable *sales* and create a histogram – just click OK. (There are lots of options, but don't worry about being fancy.) The histogram appears with the midpoints as labels. Change the labels to "cutpoints" by doing the following. Right-click on the histogram bars. Then select **Edit Bars**, and **Binning**. Once in that menu, you'll see **Interval Type**: change this from Midpoint to Cutpoint. You can also define the intervals.
6. Our main objective is to estimate the population regression function specified on the first page of these lab exercises.

- ◆ In the **Stat** menu, you will find **Regression**. Within **Regression** you will find several different types of analysis, choose **Regression**.

- ◆ You will find yourself in a window where you are again confronted with choices. You need to tell *Minitab* what model you wish to estimate. *Minitab* calls the dependent variable the **Response**. The independent variables are referred to as **Predictors**. Choose the appropriate variable for the **Response** and the appropriate variable for the **Predictor**. To estimate the simple regression model, you then click on the **OK** button, but *Wait!*



- ◆ Before clicking **OK**, look at the items included under **Storage**. *Minitab* will save the errors (**Residuals**) and the predicted or fitted values (**Fits**) for you if you click on the little boxes. Click on those two boxes, just for the experience. It'll be great! Then, click on the **Options...** box. One of the options is **Prediction intervals for new observations**: What might this thing be and what value(s) should be placed in the box?? If you have answers to these questions,

one of the TAs or I can give you the values to place in the box. If not, discuss the options with one of us before proceeding.

- ◆ Click the **OK** box to estimate the regression model, store residuals, fitted values and create a prediction interval (be sure you've gotten values from one of us). In a couple of blinks, your estimated regression will appear in the **Session** window and the Residuals and Fits will appear in your **Data** window. Now all you need to do is figure out what the stuff is that appears as your results. You should be able to sort everything out.
7. Before exiting *Minitab*, **C**opy and **P**aste the multiple regression results to *Word*. You can edit the results as needed in *Word* eliminating duplications, miscues, etc. If you want us to review your work, print **your descriptive statistics and multiple regression results – they should fit on one page**. Check with us, we have examples.
  8. Save all your *Minitab* data, including variable names, as well as your Minitab results. To do this save the project as a *Minitab Project* to a physical location – your folder in the ResEc 312 folder or your flash drive. Choose **F**ile from the main menu in *Minitab*, then choose **S**ave **P**roject and select a location for the file. Then, after you've saved and closed the file, be sure you've printed your two pages (one Excel regression output and one page of Minitab results). Bingo! You're a trained professional! (Well, you're getting there!)