Econ 120C, Fall 2003, Homework #2, Due November 17, 2003

This assignment is due at the beginning of class.   Papers turned in at the end of the class will have a 10% percent penalty. No papers will be accepted after class.

As before, form a team of no more than three people and submit a paper jointly. However, each of you should do the exercise and then compare notes. If you divide it up, you will not learn the methodology very well. *Also, be very careful in carrying out the step*s. Remember the cliché "garbage in, garbage out." If you got the model wrong or the computer methodology wrong, you will lose a lot of points. If you need help, we are here. But you have to do your part first. Bring relevant printouts. Also copy all the files saved in the user directory and bring it so that we can troubleshoot.

We will be using Data7-19 in this computer assignment (see Page 659 for a description of this data set). Note that D82 and D86 are dummy variables. Review Chapter 7 on how dummy variables affect slope coefficients and also how interaction terms are treated.

Consider the basic model (for simplicity, I have replaced Greek symbols for coefficients with English letters)

Model 0: $\ln(Q_t) = a + b\,D82 + c\,D86 + d\,ED1 + e\,ED2 + f\,\ln(Y_t) + g\,\ln(P_t) + u_t$

The coefficients f and g are elasticities (review double log model of Chapter 6). Assume that the elasticities are not fixed but depend on D82, D86, ED1, and ED2. Thus, we have,

$$f = f_0 + f_1\,D82 + f_2\,D86 + f_3\,ED1 + f_4\,ED2$$

$$g = g_0 + g_1\,D82 + g_2\,D86 + g_3\,ED1 + g_4\,ED2$$

Substitute these in Model 0, expand the terms and rearrange them to obtain the "kitchen sink" model expressed in the standard way. Thus, you should have,

Model 1: $\ln(Q_t) = \boldsymbol{b}_1 + \boldsymbol{b}_2\,D82 + \ldots + \boldsymbol{b}_{15}\,ED2 \times \ln(P_t) + u_t$

If you haven't already done so, download the latest version of GRETL. Click GRETL to download the new version to your personal computer. Click the link to gretl_install.exe for the program and data files and the link to manual.pdf for the complete manual. Choose any location in the USA from which to download and click the appropriate box. Keep all default settings. You will be doing the empirical work in several sessions.

Session 1
Run GRETL, and select FILE, OPEN DATA, SAMPLE FILE, *data7-19*, and click OPEN. You will get a list of variables.   To avoid mistakes, carry out the following steps slowly and patiently.

1. Hold down the left mouse, point it at Q, drag down to P, and highlight the three variables Q, Y, and P.
2. From the menu list on the top row, click DATA, ADD VARIABLES, and LOGS OF SELECTED VARIABLES. Note from the main GRETL window that three new variables have been added; $l\_Q = \ln(Q_t)$ and similarly for the other two variables. Each log variable will have the lower case l following by the underscore _.

   If you made a mistake in any of the following steps, skip to Step 5, close window, and follow directions given there, but use temp for name. Then print out that file and bring to me. I will show you how to fix it. You can, of course, start over again and do it correctly. It doesn't take that long.

3. From the menu list, select VARIABLE and DEFINE NEW VARIABLE. In the box, type D82lnY = D82*l_Y, <u>exactly as I have it here</u> and click OK. This will create the dummy shift of the income elasticity for the variable D82. Repeat this for l_P to get D82lnP. Similarly generate two new variables using D86. DO NOT USE l_Q in any of these.
4. Use the same method to generate interaction terms with ED1 and ED2 for both income and price. Thus, generate ED1lnY = ED1*l_Y, and so on. You will have four new variables in this part.
5. Close the main window now. You will be asked whether you want to save the commands and output from this GRETL session. Answer YES and choose a suitable name (for example, *hw2inp1*). Next close the GRETL window again. You will now be asked whether you want to save changes made to the data set. Say YES, select ALL, and click OK. Give it the name *data7-19a*. After you close GRETL, use Windows Explorer and move the file *data7-19a.gdt* from the *gretl\data* directory to the *gretl\user* directly. This way, it will stay in the user directory and not be mixed up with the data in the book. For the remaining empirical works you will use the data file *data7-19a*.

The next step is to write down in your write-up the steps you carried out above to derive Model 1, and also write down the auxiliary equation (in symbols) for testing whether the model has AR(2) residuals. In it state the null hypothesis of no serial correlation. Specify this using Equation 9.11 as a guide. Also write down what your Step 2 from Page 399 is for the above model. This will be your Model 2. *Give a great deal of thought to this step because the success of your next computer session will crucially depend on doing it right.*

Session 2
Run GRETL, and select FILE, OPEN DATA, USER FILE, *data7-19a*, and click OPEN. You will get a list of variables including the ones you generated in the first session.

6. You are first going to estimate Model 1 by OLS. To do this, from the top menu list, select MODEL, OLS, choose l_Q as the dependent variable. For the list of independent variables, besides the constant term, add all the relevant independent variables from the original list and the new list you created in Session 1. *Select the variables carefully because mistakes will be very costly.* You should have a total of 15 independent variables including the constant term. Click OK to obtain the estimates. Then select FILE, SAVE AS TEXT, and save this window as *model1*. Close this window.

7. Next carry out the LM test for AR(2).   To do this, first go to the main window and select VARIABLE and DEFINE NEW VARIABLE. In the box, type *ut = uhat*. Next generate *ut1 = ut(-1)* and *ut2 = ut(-2)*. Next go back to the main menu list and select, MODEL, OLS, choose *ut* as the dependent variable, and the appropriate independent variables from Model 2 that you derived above. Click OK to run this regression. Save the output window as *model2*.
8. Close all windows and follow directions similar to Step 5 above.

In your write up, actually carry out the Breush-Godfrey LM test for AR(2) at the 1 percent level of significance (study Page 399 first). State the null hypothesis, the test statistic, and its distribution and d.f. under the null. What do you conclude? In the light of your conclusion what can you say about OLS estimators and hypothesis tests based on them?

Session 3
Regardless of your conclusion above, I want you to apply the Generalized Cochran-Orcutt (GCORC) Procedure for AR(2). GRETL has an easy way to do this.

9. Load the data set *data7-19a* that you created. From the main menu list, select MODEL, AUTOREGRESSIVE ESTIMATION, and l_Q as the dependent variable. In the box for LIST OF AR LAGS, enter 1 2 (that is 1, space, and 2).   Select each of the independent variables in Model 1 above and click OK to estimate this model by GCORC.
10. Study the p-values and identify the variable whose coefficient is least significant (your output gives it to you *but never omit the constant term*). To omit this, click TESTS, OMIT VARIABLES, select this variable, and OK. Repeat this procedure and omit variables *one by one* until all coefficients (ignore the constant term) are significant at the 10 percent level (that is, have at least one * in the last column). If you like you can save each window as a separate file, with different names, just in case.
11. Close window and save commands and output by giving suitable names.
12. Go to MS Word and cut and paste the outputs for the sessions using COURIER NEW, font size 10, and margins 1" inch left and right.

Interpret the results of your final model by carrying out the following steps:

a) First write down the full estimated model <u>separately for the three periods</u> (you can round off numbers to three decimals); (1) control period 1960-1981 when D82 and D86 are both zero, (2) 1982-1985 when D82 is 1 and D86 is zero, and (3) 1986-1988 when both D82 and D86 are 1. For (2) and (3) combine the terms for all the l_Y that might appear. Similarly for l_P. In doing this, use the example on Page 316 as a guide. Note that your expression should not contain the dummy variables.

b) Separately for each period, examine the impact of ED1 and ED2 on the elasticities. In this, use the example in pages 310-311. For instance, write down the partial derivative of lnQ with respect to lnY as
$l_0 + l_1 ED1 + l_2 ED2$. Then describe *in words* what happens to the elasticity as ED1 or ED2 increases. Do the same thing for lnP.

c) Write down the numerical values of the elasticities for each of the three periods in a table such as the following. For ED1, use the average value of 0.27 and for ED2 use 0.06. Is demand price and/or income elastic or inelastic in the three periods?

Period	Income Elasticity	Price Elasticity
1960-1981		
1982-1985		
1986-1988		

Submit your report along with the relevant computer output.