Homework

Econometrics

January 21, 2003

1 General Instructions

The purpose of these exercises is to help you become more comfortable with the tools of econometrics. To accomplish this, you are to write IML programs to obtain the results for the problems found below. Doing these exercises will contribute to your matrix algebra, computing, and overall econometric skills. The data for these exercises can be found in *Econometric Analysis* (Greene 2003) or at the web site:

`http://pages.stern.nyu.edu/~wgreene/Text/econometricanalysis.htm`

or on the CD-rom that comes with the book.

Most of these exercises can be found in Greene's book which also includes the numerical results for some of the problems found below. Feel free to use the book to provide check figures for key results. An additional source of check figures is the use of the canned SAS procedures AUTOREG and MODEL.

You may turn in your answers in the form of annotated notes made on your SAS output. Otherwise, make sure your results and answers are easy to identify and supported by relevant IML programs and SAS output. In order to obtain credit for the exercises you must turn in both the IML programs and output. Each of the hypothesis tests need to be carried out fully, meaning that you should state the null and alternative hypotheses, the distribution of your test statistic under the null hypothesis, your decision criterion, and your decision. Unless otherwise stated, conduct all hypothesis tests at the 5% level.

Problem 1

Data on gasoline consumption in the United States from years 1960-1995 appear in Table F2.2 of (Greene 2003). The variables are:

- G = total gasoline consumption
- P_g = the price of gasoline
- Y = per capita disposable income
- P_{nc} = price index of new cars
- P_{uc} = price index of use cars
- P_{pt} = price index of public transportation
- P_d = price index of durable goods
- P_n = aggregate price index of nondurable goods
- P_s = aggregate price index of consumer services

$$\ln G = \beta_1 + \beta_{P_g} \ln P_g + \beta_Y \ln Y + \beta_{nc} \ln P_{nc} + \beta_{uc} \ln P_{uc} + \beta_{pt} \ln P_{pt} + \beta_d \ln P_d + \beta_n \ln P_n + \beta_s \ln P_s + e \quad (1)$$

Using the data provided on the CD-rom or from the website, use IML and SAS Proc Autoreg to answer the following.

1. Estimate the model using least squares. Compute and report coefficient estimates, their standard errors, t-ratios, and their p-values.
2. Compute R^2.
3. Perform the overall F-test for regression significance.
4. Report your estimate of the scale parameter, σ^2.

Problem 2

Using the same model and data do the following:

1. Test the following hypotheses at the 5% level using a Wald test (i.e., equation (6-5) and (6-6):
   (a) $\beta_{pt} = 0$ and $\beta_Y = 1$. Own price elasticity of demand is one and the income elasticity is zero.
   (b) $\beta_{nc} = \beta_{uc}$ and $\beta_Y = 1$.
   (c) $\beta_{nc} = \beta_{uc}$, $\beta_n = \beta_d$, and $\beta_Y = 1$.
2. Find the p-values associated with the Wald tests.
3. Find the 3 sets of restricted estimates using the RLS estimator
$$b^* = b - (X'X)^{-1}R'[R(X'X)^{-1}R']^{-1}(Rb - q) \tag{2}$$
as discussed in class. Compute and report standard errors, t-ratios, and p-values.
4. Repeat the tests using the other forms of the statistics λ_2 and λ_3 discussed in class.
5. Find the restricted estimates and repeat the hypothesis tests using the RESTRICT and TEST statements in SAS's PROC AUTOREG.

Important Note: Whenever you do a hypothesis test, be sure to state the null and alternative hypotheses, the distribution of your test statistic under the null hypothesis, your decision criterion, and your decision.

Problem 3

Write an IML module that computes the RESET test. Perform the RESET with powers 2 and 3 on the gasoline demand model above. Based on the outcome of this test, is your model misspecified? If so, reestimate the model in level form and repeat the RESET test.

Remember: Whenever you do a hypothesis test, be sure to state the null and alternative hypotheses, the distribution of your test statistic under the null hypothesis, your decision criterion, and your decision.

Problem 4

Data on U.S. consumption and GDP for the years 1950I-2000IV appear in Table F5.1 of Greene. Consider the following model:
$$C_t = \alpha + \beta Y_t + \gamma C_{t-1} + e_t \tag{3}$$

In this model the short-run MPC is β and the long-run MPC is $\delta = \beta/(1-\gamma)$.

1. Test the null hypothesis that $\delta = 1$ against the alternative that it is not at the 5% level.
2. Test the (joint) null hypothesis that $\delta = 1$ and $\beta = .5$ against the alternative $\delta \neq 1$ or $\beta \neq .5$ at the 5% level

Problem 5

Using the gasoline data from Table F2.2 and model (1) to investigate the parameter stability using the CUSUM test.

1. Reproduce the results in Table 7.6 of Greene.
2. Perform the Chow test for parameter stability at the 5% level under the assumption that the subset equation variances are the same.
3. Perform the Chow test for parameter stability at the 5% level under the assumption that the subset equation variances are not the same.
4. Compute the CUSUM and its upper and lower bounds using IML. You may confirm your results using PROC AUTOREG which permits you to output these statistics into a data set which can in turn be printed. There is an example of the SAS statements needed to accomplish this posted at the end of these exercises.

Problem 6

Gaver and Geisel (1974) propose two forms of a consumption function:

$$Ho: \qquad C_t = \alpha + \beta Y_t + \gamma C_{t-1} + e_t \tag{4}$$

and

$$Ha: \qquad C_t = \alpha + \beta Y_t + \gamma Y_{t-1} + e_t \tag{5}$$

The first model states that consumption responds to changes in income over many periods (infinite distributed lag model) and the second states that it responds to changes in income over only two periods.

1. Using the data from the above problem, determine which of the above hypotheses are supported by the data using the J test and the Cox test. (Set the level of the test at 5%).

2. Compute the AIC and BIC statistics for each model.

Problem 7

Estimate the model in equation (3) using least squares and compute standard errors, t-ratios, and p-values using White's heteroscedasticity covariance matrix.

Problem 8

1. Test for the presence of heterosedasticity in model (3)using White's test.
2. Test for its presence again using the Breusch-Pagan test assuming that heteroscedasticity is a function of $z_{t2} = C_t/GNP_t$ and a constant. First perform the test under the assumption of normality, then repeat the test under the assumption that the errors are not normally distributed.

Problem 9

Use PROC AUTOREG to determine whether the model in equation (3) is autocorrelated of order 1.

Problem 10

Using IML, estimate the model in equation (3) under the assumption that it is first order autocorrelated. Report your estimates, standard errors, t-values, and p-values. Verify your results using PROC AUTOREG.

Problem 11

Write an IML program to reproduce the results found in Tables 14.1 and 14.2 of Greene. The tables includes the SUR estimates of a system of 5 equations, the pooled estimate, and an OLS estimates. The data are in Table F13.1 on the CD-rom that goes with your book.

Programming Examples

```
DATA ONE;                              * creates a data set called ONE ;
INFILE 'c:\ex6_22.dat' firstobs=2;  * reads data, skip line 1;
input Y x2 x3 x4;                      * INPUT ;
    lx2=log(x2);                       * take natural logs of variables ;
    lx3=log(x3);
    lx4=log(x4);
    x4_lag=lag(x4);
    ly=log(y);
    int=1;

Proc AutoReg;
  model y = x2 x3 x4/reset;
  Test x2=x4,x3=0;
  output out=two recres=recur cusum=c1 cusumlb=lb cusumub=ub;
proc print data=two;

Proc Autoreg;
  model y = x2 x3 x4;
  restrict x2=x4,x3=0;

Proc IML;
  vname= {  const, GasPrice, Income, NewCar};
  use one;
  read all var{y} into y;
  read all var{ int x2 x3 x4 } into x;
  read all var{ int x2 x3 x4 } into x where(x4 > 1963);

  t=nrow(x);
  k=ncol(x);
  b=inv(x'*x)*x'*y;
```

References

Gaver, K. and M. Geisel, "Discriminating Among Alternative Models: Bayesian and Non-Bayesian Methods," *Frontiers in Econometrics*, 1974.

Greene, William H., *Econometric Analysis*, 5th ed., Prentice-Hall, 2003.