Professor R.L. Oaxaca | Assignment #4
Econ 522a | Spring 2015

Due Wednesday, April 22
(40 points)

This assignment is on heteroscedasticity and autocorrelation problems. The necessary data come from two sources: the Excel files hprice_1.xls and traffic_2.xls available at http://u.arizona.edu/~rlo/ under econ 522a. Be sure to use matrix commands and attach the supporting computer print out to the completed assignment and make clear where your answers are shown.

1. Consider the following model of residential property assessments based on the hprice_1 data set containing a random sample of 88 homes:

   $assess_t = \beta_0 + \beta_1 sqrft_t + \beta_2 (sqrft_t)^2 + \beta_3 bdrms_t + \beta_4 lotsize_t + \beta_5 (lotsize_t)^2 + u_t,$
   $t = 1, ..., 88$

   where $assess$ is assessed value in $1,000s, $sqrft$ is the size of house in square feet, $bdrms$ is the number of bedrooms, and $lotsize$ is the size of the lot in square feet. You may assume that u_t is serially uncorrelated, follows a normal distribution, and is independent of the regressors.

   a. Compute the White heteroscedasticity consistent (robust) variance/covariance matrix for the OLS estimator of the model's coefficients.

   Suppose a researcher suspects that $var(u_t) = h(Z_t)$,

   where $Z_t = \alpha_0 + \alpha_1\ sqrft_t + \alpha_2\ (sqrft_t)^2 + \alpha_3 bdrms_t + \alpha_4 lotsize_t + \alpha_5 (lotsize_t)^2$.

   b. Use a LM test to test for homoscedasticity at the 5% level of significance.

   c. Assume that $var(u_t) = exp(Z_t)$

      (1) Use $FGLS$ to estimate the parameters of the assessment model.

      (2) Use the F test as an asymptotic test for homoscedasticity at the 5% level of significance.

   d. If it were true that $var(u_t) = exp(Z_t)$, compare and contrast the statistical properties of OLS using the White correction procedure with those of the $FGLS$ estimator of the assessment model.

2. Consider the following model of traffic accidents based on the traffic_2 data set that contains monthly time series data for the State of California over the period 1981-89:

$$\begin{aligned} totacc_t &= \beta_0 + \beta_1\ feb_t\ + \beta_2\ mar_t + \beta_3\ apr_t + \beta_4 may_t + \beta_5 jun_t + \beta_6 jul_t + \beta_7 aug_t \\ &+ \beta_8 sep_t + \beta_9 oct_t + \beta_{10} nov_t + \beta_{11} dec_t + \beta_{12} spdlaw_t + \beta_{13} beltlaw_t + \beta_{14} time_t + u_t, \\ t &= 1, ..., 108 \end{aligned}$$

where the variables of interest for this exercise are *totacc* (total number of statewide automobile accidents), *feb* - *dec* (dummy variables for each month), *spdlaw* (dummy variable =1 for each month after the 65 mph speed limit took effect), *beltlaw* (dummy variable = 1 for each month after the seatbelt law took effect), and *time* (linear time trend for each month starting with 1 and ending in 108). Assume that the error term is a normally distributed random variable with mean zero and constant variance and is independent of the regressors.

   a. Suppose one suspects that $u_t = \rho u_{t-1} + \varepsilon_t$, where ε_t satisfies all of the standard assumptions and $\mid \rho \mid < 1$. Use any appropriate test to test H_0: $\rho = 0$, H_1: $\rho \neq 0$ at the 5% level of significance. What can you conclude about the properties of OLS applied to the traffic accident model?

   b. Assume $\rho \neq 0$, and use both the iterated Prais-Winsten and Cochrane-Orcutt $FGLS$ procedures to estimate the traffic model.

3. Now consider the following alternative model of traffic accidents:

$$\begin{aligned} totacc_t &= \beta_0 + \beta_1\ feb_t\ + \beta_2\ mar_t + \beta_3\ apr_t + \beta_4 may_t + \beta_5 jun_t + \beta_6 jul_t + \beta_7 aug_t \\ &+ \beta_8 sep_t + \beta_9 oct_t + \beta_{10} nov_t + \beta_{11} dec_t + \beta_{12} spdlaw_t + \beta_{13} beltlaw_t \\ &+ \beta_{14} time + \beta_{15} totacc_{t-1} + u_t,\ \ t = 2, ..., 108. \end{aligned}$$

Assume that the error term is a normally distributed random variable with mean zero and constant variance.

   a. Suppose one suspects that $u_t = \rho u_{t-1} + \varepsilon_t$, where ε_t satisfies all of the standard assumptions and $\mid \rho \mid < 1$. Use an appropriate method to test H_0: $\rho = 0$, H_1: $\rho \neq 0$ at the 5% level of significance. What can you conclude about the properties of OLS applied to the alternative traffic accident model?

   b. What do your results for the alternative model suggest about the source of the serial correlation in the original model in question 2? Explain.

   c. What do your results for the alternative model suggest about the properties of the $FGLS$ estimators of the original model in question 2? Explain.