## Homework assignment in May

Deadline is 30th of May 17:00

(1) Try to write your answer in your own word.
(2) Make your own tables to show the estimated results as Example 11.6 (11.26 and 11.27) or Table 12.1. Don't paste the tables made by the software.

1. State whether the following statement are true or false. Briefly justify your answer.
   (a) When autocorrelation is present, OLS estimators are biased as well as inefficient.
   (b) Even if the variance of the error term $u_t$ is heteroscedastic, we can perform the Durbin-Watson d test.
   (c) The first-difference transformation to eliminate autocorrelation assumes that the coefficient of autocorrelation $\rho$ is 0.
   (d) The $R^2$ values of two models, one involving regression in the first difference form and another in the level form, are not directly comparable.
   (e) A significant Durbin-Watson d always mean there is autocorrelation of the first order.
   (f) Even in the presence of autocorrelation, conventionally computed variances and standard errors of forecast values are efficient.
   (g) The exclusion of an important variable(s) from a regression model may give a significant d value.
   (h) Despite perfect multicollinearity, OLS estimators are BLUE.
   (i) In multiple regression inclusion of irrelevant explanatory variable causes biased estimator.
   (j) In cases of high multicollinearity, it is not possible to assess the individual significance of one or more partial regression coefficient

2. Okun's Law—see, for example, Mankiw (1994, Chapter 2)—implies the following relationship between the annual percentage change in real GDP, $pcrgdp$, and the change in the annual unemployment rate, $cunem$:
   $$pcrgdp_t = 3 - 2 \cdot cunem_t$$
   If the unemployment rate is stable, real GDP grows at 3% annually. For each percentage point increase in the unemployment rate, real GDP grows by two percentage points less. (This should not be interpreted in any causal sense; it is more like a statistical description.)

To see if the data on the U.S. economy support Okun's Law, we specify a model that allows deviations via an error term, $pcrgdp_t = \beta_0 + \beta_1 cunem_t + u_t$

(1) Use the data in OKUNto estimate the equation. Do you get exactly 3 for the intercept and -2 for the slope? Did you expect to?

(2) Find the t statistic for testing $H_0$: $\beta_1 = -2$. Do you reject $H_0$ against the two-sided alternative at any reasonable significance level?

(3) Find the t statistic for testing $H_0$: $\beta_0 = 3$. Do you reject $H_0$ at the 5% level against the two-sided alternative? Is it a "strong" rejection?

(4) Find the F statistic and p-value for testing $H_0$: $\beta_0 = 3, \beta_1 = -2$ against the alternative that $H_0$ is false. Does the test reject at the 10% level? Overall, would you say the data reject or tend to support Okun's Law?

3. Using the data for SalesInventory, estimate the model

$$y_t = \beta_1 + \beta_2 x_t + u_t$$

where $y$ = inventories and $x$ = sales, both measured in billions of dollars.

(1) Estimate the preceding regression.

(2) From the estimated residuals find out if there is positive autocorrelation using the Durbin–Watson test and AR(1) test.

(3) If you suspect that the autoregressive error structure is of order p, how would you choose the order of p?

(4) On the basis of the results of this test, how would you transform the data to remove autocorrelation? Take the appropriate corrective action, present the revised results, and compare this with the previous one.

(5) Use log form such as

$$\log(y_t) = \beta_1 + \beta_2 \log(x_t) + u_t$$

and try (1)-(4).

4. Use the data in MURDER for this exercise.

(1) Using the years 1990 and 1993, estimate the equation

$$mrdrte_{it} = \delta_0 + \delta_1 d93_t + \beta_1\, exec_{it} + \beta_2 unem_{it} + a_i + u_{it}, t = 1, 2$$

by pooled OLS and report the results in the usual form. Do not worry that the usual OLS standard errors are inappropriate because of the presence of $a_i$. Do you estimate a deterrent effect of capital punishment?

(2) Compute the FD estimates (use only the differences from 1990 to 1993; you should have 51 observations in the FD regression). Now what do you conclude about a deterrent effect?

(3) In the FD regression from part (ii), obtain the residuals, say, $\hat{e}_i$. Run the Breusch-Pagan regression $\hat{e}_i^2$ on $\Delta\ exec_{it}$ , $\Delta\ unem_{it}$ and compute the F test for heteroskedasticity. Do the same for the special case of the White test [that is, regress $\hat{e}_i^2$ on $\hat{y}_i$, $\hat{y}_i^2$, where the fitted values are from part (2)]. What do you conclude about heteroskedasticity in the FD equation?

(4) Run the same regression from part (2), but obtain the heteroskedasticity-robust t statistics. What happens?

(5) Which t statistic on $\Delta exec_{it}$ do you feel more comfortable relying on, the usual one or the heteroskedasticity-robust one? Why?

5. Baltagi and Griffin considered the following gasoline demand function using the dataset Gasoline.

$$\log(y_{it}) = \beta_1 + \beta_2 \log(x_{2it}) + \beta_3 \log(x_{3it}) + \beta_4 \log(x_{4it}) + u_{it}$$

where y = gasoline consumption per car; $x_2$ = real income per capita, $x_3$ = realgasoline price, $x_4$ = number of cars per capita, i = country code, in all 18 OECDcountries, and t = time (annual observations from 1960–1978). Note: Values in table are logged already.

(1) Estimate the above demand function pooling the data for all 18 of the countries (a total of 342 observations).

(2) Estimate a fixed effects model using the same data.

(3) Estimate a random effects model using the same data.

(4) From your analysis, which model best describes the gasoline demand in the 18 OECD countries? Justify your answer