

Exercises (Chapters 8 – 9)

1. In the file pubexp.xlsx there are data for the per capita expenditure on education (EE) and the per capita gross domestic product (GDP) for 34 countries in the year 1980. We would like to examine how the per capita gross domestic product impacts the expenditure on education estimating the following linear regression model:

$$EE = \beta_1 + \beta_2 GDP + \varepsilon$$

- a. Estimate the model and comment on the results.
 - b. Plot a graph showing the least squares residuals with respect to the per capita GDP. Also conduct the White test. Is there any evidence of heteroskedasticity?
 - c. Estimate the model using: (a) White standard errors and (b) generalized least squares assuming that $Var(\varepsilon_i) = \sigma^2 GDP_i$. Comment on the results.
2. The file infl.xlsx includes quarterly time series data for the period 1970-2010 for the level of inflation and wage change. In order to study the relationship between these two variables we assume the following econometric model:

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

where y_t is the level of inflation at t and x_t is the quarterly percentage change in wages for the period $(t-1, t)$.

- a. Estimate the above model and comment on the results.
 - b. Test, with a 5% significance level, if the increase in wages by 1% will result in an increase in inflation equal to 1 percentage point.
 - c. Perform the Lagrange multiplier test for autocorrelation. What do you conclude?
 - d. Then add to the above model lags of the dependent variable. For each of these models conduct the Lagrange multiplier test for autocorrelation. Which model would you choose to describe the relationship between the two variables?
 - e. Using the model that you have selected in (d), repeat the test in (b). What do you conclude? How do salaries ultimately affect the level of inflation?
3. The file homes.xlsx includes monthly time series data for the period 1992-2010 for the interest rate of mortgage loans and demand in the real estate market. In order to study the relationship between these two variables we assume the following econometric model:

$$y_t = \beta_1 + \beta_2 x_{t-1} + \varepsilon_t$$

where y_t is the monthly change in the number of new houses purchased between the month $t-1$ and t and x_{t-1} is the monthly change in the mortgage rate for the period $(t-2, t-1)$.

- a. Estimate the model and comment on the results.
- b. If the mortgage rate decline in the last month by 0.5 percentage points, predict the change in the number of new homes to be purchased next month.
- c. Perform the Lagrange multiplier test for autocorrelation. Plot the correlogram of the least squares residuals. What do you conclude?

- d. Based on your answer in (c), are the results provided in (a) reliable? If not, estimate the model with a more reliable methodology that will include lags of the dependent variable. Interpret the results of the new model. Check to see if the new model encounters the potential problems you have detected in the original one.

The sample we are studying includes the period of the recent financial crisis. It is therefore interesting to study whether the above relationship between demand and interest rate has changed during the crisis.

- e. Perform the Chow test with changing point on July 2007. What do you conclude?
- f. If the answer in (e) is positive about the non-stability of the model parameters, estimate a new model that includes a dummy variable that takes a value of 1 if the observation is after July 2007 and 0 otherwise. This dummy variable should affect both the intercept and the slope coefficient of the mortgage rate. Interpret the results.
- g. Assess the effect of the change in interest rates on the creation of new houses only during the period of economic crisis. Is it statistically significant?