ECO5185 A

Assignment 4

K. Day Fall 2013

Be sure to state the null and alternative hypotheses for all hypothesis tests and indicate the level of significance you are using.

1. Derive the matrix cov $\left[\hat{\boldsymbol{\beta}}, \hat{\boldsymbol{\beta}} - \mathbf{b}\right]$, where $\hat{\boldsymbol{\beta}} = (\mathbf{X}'\Omega^{-1}\mathbf{X})^{-1}\mathbf{X}'\Omega^{-1}\mathbf{y}$ is the GLS estimator of $\boldsymbol{\beta}$ in the general linear regression model, and $\mathbf{b} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{y}$, the OLS estimator of $\boldsymbol{\beta}$. (Hausman used this result in deriving his famous specification test.)

2. For this question you will use the data file that you used for Assignments 1 and 2.

   (a) Use the *summarize* command to compute descriptive statistics for the sample. What proportion of the sample lives in urban areas (*urban*)? in the southern United States (*south*)?

   (b) Estimate a human capital model of earnings in which the dependent variable is *lwage* and the explanatory variables are experience (*exper*), education (*educ*), job tenure (*tenure*), a dummy variable indicating whether the individual is married (*married*), a dummy variable indicating residence in the south of the United States (*south*), a dummy variable indicating residence in an urban area (*urban*), and a dummy variable indicating whether or not the individual is black (*black*). Carry out a test of overall significance (i.e., a test of the null hypothesis that all the slope coefficients are zero). Does the model have explanatory power?

   (c) Carry out both versions of the Breusch-Pagan-Godfrey test for heteroskedasticity under the assumption that the heteroskedasticity is related to the explanatory variables of the regression model. (See the Stata handout for the appropriate commands.) Do they lead to the same conclusion?

   (d) Carry out White's test for heteroskedasticity. Does it lead to the same conclusion as the BPG test?

   (e) Economists regularly use 0.01, 0.05, or 0.10 as the level of significance for hypothesis tests. How do your conclusions in parts (c) and (d) depend on the level of significance chosen to carry out the test? Which level of significance do you think is best for these diagnostic tests?

   (f) Re-estimate the regression model using the option *vce(robust)*. Do any conclusions regarding the statistical significance of individual coefficients change?

3. In this question you will estimate a simple Phillips curve equation using data retrieved from Statistics Canada's CANSIM database and stored in the Stata data file

phillips_curve_data_can.dta. The data are quarterly and cover the time period 1984Q1 to 2013Q2. The variables in the file are the average weekly wage for hourly workers, including overtime (aww), the all-items CPI (cpi), the unemployment rate for the population 15 and over (ur), a measure of labour productivity ($prodl$), and variables indicating the year and the quarter.

(a) Read the data.

(b) Tell Stata that the data are quarterly time-series data and set the starting date using the following commands:

```
generate t=tq(1983q1)+ _n -1
tsset t, quarterly
```

(c) Create some variables that will be required for estimation: the rate of wage inflation ($winf$) and the rate of price inflation($pinf$). A simple percentage change, as in the following example, will be sufficient:

```
generate winf=(aww-L.aww)*100/L.aww
```

In addition, create a variable that is a one-period lag of the rate of the rate of price inflation, and call it $expinf$. This will be your measure of expected inflation.

(d) Use the *summarize* command to compute descriptive statistics for all the variables. What is the sample size?

(e) Estimate the following simple expectations-augmented wage Phillips curve:

$$winf_t = \alpha + \beta ur_t + \gamma expinf_{t-1} + \varepsilon \ . \tag{1}$$

using OLS. Include the appropriate commands to carry out the Durbin-Watson test and the Breusch-Godfrey test for first-order autocorrelation. Also carry out a Breusch-Godfrey test for second-order autocorrelation. What conclusions do you draw from these tests?

(f) The data included in the data file are not seasonally adjusted. One approach to controlling for seasonality in the data would be to include quarterly dummies. Create quarterly dummies for the first, second, and third quarters. A possible way to create a quarterly dummy is to use the commands

```
generate dq1=0
replace dq1=1 if quarter=="Q1"
```

Once again, repeat all three tests for autocorrelation and interpret the results. Does the addition of quarterly dummies change your conclusions regarding autocorrelation?

(g) Use the command *newey* to re-estimate the model using the Newey-West estimator of the asymptotic variance of $\mathbf{b}$. Discuss any changes you observe in the interpretation of the coefficient estimates.

This assignment is due at the beginning of class on Tuesday, November 26, 2013. Do not forget to hand in your Stata output as well as your written answers. I recommend that you write a separate Stata program for each question.