

# Advanced Quantitative Methods

## Lab 3: Regression diagnostics

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1. Open the `uswages.dta` data set. Check the teaching data page for more information on the variables.

```
library(rio)
```

```
us <- import("http://www.joselkink.net/wp-content/uploads/2013/01/uswages.dta")
```

- (a) Regress  $\log(\text{wage})$  on `educ`, `exper` and `race`.
- (b) Interpret all test results in the standard output.
- (c) Check for leverage, outliers, influential points and nonlinearities.

2. Open the `demdev.dta` data set and consider:

```
dd <- import("http://www.joselkink.net/wp-content/uploads/2013/01/demdev.dta")
```

$$\text{polity2}_i = \beta_0 + \beta_1 \text{cwar}_i + \beta_3 \text{laggdppc}_i + \beta_4 \text{propdem}_i + \beta_5 \text{energy2}_i + \varepsilon_i.$$

- (a) Check whether there are any multicollinearity problems.  

```
help(vif, package = "car")
```

3. Open the `demdev.dta` data set and consider:

$$\text{polity2}_i = \beta_0 + \beta_1 \text{cwar}_i + \beta_3 \text{laggdppc}_i + \varepsilon_i,$$

- (a) Select only cases from 1998.  

```
dd98 <- subset(dd, year == 1998)
```
- (b) Run the Breusch-Pagan test for heteroscedasticity.  

```
help(bptest, package = "lmtest")
```
- (c) Run the Goldfeld-Quand test for heteroscedasticity.  

```
help(gqtest, package = "lmtest")
```
- (d) Run the White test for heteroscedasticity.  
Hint: note that the White test is a variation on the Breusch-Pagan test.

4. Open the `demdev.dta` data set and consider:

$$\text{polity2}_i = \beta_0 + \beta_1 \text{cwar}_i + \beta_3 \text{laggdppc}_i + \beta_4 \text{propdem}_i + \varepsilon_i.$$

- (a) Calculate normal OLS standard errors.
- (b) Calculate standard errors using the four HCCM variations.  

```
help(hccm, package = "car")
```
- (c) **(Extra)** Calculate standard errors using bootstrapping.

5. Using `unemployment.dta`, regress `unemployment` on the log of the ratio of `money` and `deflator`, the log of `purchases`, the log of `exports`, and `year`.

```
unempl <- import("http://www.joselkink.net/wp-content/uploads/2013/01/unemployment.dta")
```

- (a) Test for heteroscedasticity and calculate corrected standard errors.
- (b) Perform diagnostics checks for autocorrelation on this regression.