Assignment Task 7

(with R)

Deadline: 2018-05-16, 23:59

Do not forget to explain your answers!

Note: when generating data use `set.seed(student.code)` where `student.code` is your unique student code.

```
suppressPackageStartupMessages({
  library(readxl)
  require(systemfit)
  require(AER)
})

txt1 <- "http://web.vu.lt/mif/a.buteikis/wp-content/uploads/2018/05/"
txt2 <- "loan_data.xls"
tmp = tempfile(fileext = ".xls")
download.file(url = paste0(txt1, txt2), destfile = tmp, mode = "wb")
loan.dt <- data.frame(read_excel(path = tmp, skip = 2, col_names = TRUE))
colnames(loan.dt) <- c("N", "Q", "R", "RD", "X", "RS", "Y")
loan.data <- ts(loan.dt, frequency = 12, start = 1979)
```

Monthly data are provided on commercial banks loans to business firms in the United States for 1979:01-1984:12:

- `Q` - total commercial loans (billions of dollars);
- `R` - average prime rate charged by banks;
- `RS` - 3-month Treasure bill rate (represents an alternative rate of return for banks);
- `RD` - AAA corporate bond rate (represents the price of alternative financing to firms);
- `X` - industrial production index and represents firms expectation about future economic activity;
- `Y` - total bank deposits (represents a scale variable) (billions of dollars);

Consider the following loan demand and supply regressions:

$$\begin{cases} Q_t = \beta_0 + \beta_1 R_t + \beta_2 RD_t + \beta_3 X_t + \epsilon_t^D, & \text{(loan demand by firms)} \\ Q_t = \alpha_0 + \alpha_1 R_t + \alpha_2 RS_t + \alpha_3 Y_t + \epsilon_t^S, & \text{(loan supply by banks)} \end{cases}$$

Part 1: General overview of the models

Part 1.1

- What variables in this system are endogenous and which are exogenous?
- Which of the variables could be used as instruments for the endogenous predictors?

Part 1.2

- Is the `demand` equation overidentified, underidentified, or exactly identified and why?
- Is the `supply` equation overidentified, underidentified, or exactly identified and why?

Part 1.3

What signs do you expect the coefficients of R_t to take in the `demand` and `supply` equations (are they the same)?

Note: The Prime Rate, R_t, is the interest rate, that commercial banks charge their customers with the highest credit ratings (usually large firms).

Part 2: Individual Model Estimation

- Estimate the `supply` and `demand` equations **individually**: using OLS (`lm`), and then using 2SLS (`ivreg`).
- Estimate the **equation system** using `systemfit`: via the `OLS` and `2SLS` methods (these methods do not take into account the possible correlation between separate equation disturbances/shocks, so the results should be the same as in the `lm()` OLS and 2SLS results).

Compare the results:

- Is the sign of the R_t predictor coefficient the same in both OLS and 2SLS cases in the `supply` equation? And what about in the `demand` ?
- Do the estimated coefficients have the expected sign(s) for R_t predictor from `Part 1.3` ? Are the coefficients statistically different from zero comparing OLS and 2SLS estimation methods?

Part 3: System of equations estimation

Estimate the equation system simultaneously in two ways:

- SUR (the disturbances are contemporaneously correlated but ignores the potential endogeneity problem)
- 3SLS [three-stage simultaneous estimation] (takes into account that the disturbances can be correlated, also allows to account for endogeneity by using instrumental variables)

Have the coefficients changed, compared to the single-equation 2SLS estimates from `Part 2`?

Part 4: Estimation method comparison

Compare the errors of the estimated model from `Part 3` with the errors from the single-equation 2SLS estimates in `Part 2` - which modelling technique is better?

Note: select to either compare coefficient standard errors or the model residuals.