

Assignment Task 4

(with Python)

Deadline: 2018-04-18, 23:59

Do not forget to explain your answers!

Note: if you are generating data or carrying out some form of random sampling, use

```
import numpy as np
```

```
np.random.seed(student_code)
```

where `student_code` is your unique student code.

Part 1: Cointegration testing

Use the data where:

- Y = Longrate = long-term interest rates;
- X = Shortrate = short-term interest rates

```
import pandas as pd
```

```
url = "http://uosis.mif.vu.lt/~rlapinskas/(data%20R&GRET/interestrates.xls"
```

```
DT1 = pd.read_excel(url)
```

```
DT1.index = pd.date_range(start = "1954", periods = len(DT1.index), freq = "Q").to_period()
```

```
DT1 = DT1[["Longrate", "Shortrate"]]
```

Part 1.1

Use a sequential procedure (Procedure A) and/or the Dickey-Fuller tests (e.g. Procedure C) to verify that Y and X have unit roots.

Part 1.2

Run a regression of Y on X and save the errors. Is the coefficient of X significant? Examine the residual ACF - do the errors look stationary?

Part 1.3

Carry out a unit root test on the residuals using different lag order specification of Δe_t - i.e. create three different models when $p_{max} = \{1, 3, 4\}$ (this is the **Engle-Granger method** for a fixed order $AR(p)$).

Some notes:

- There is a difference between an AR(p) of e_t and an AR(p) of Δe_p - an AR(p) model of e_t can be rewritten as an AR(p-1) model for differences, Δe_p . For examples, see the last few 04 Time series with unit root lecture slides.
- Using standard DF or ADF tests, we may reject the null hypothesis of nonstationarity too often. As a result, the appropriate critical values are more negative than those for the standard Dickey-Fuller tests when testing for a unit root on the **cointegrating regression residuals**.

Part 1.4

What can you conclude about the presence of cointegration between Y and X based on the results from Part 1.3?

Part 1.5

Use Phillips-Ouliaris test to check whether Y and X are cointegrated.

Part 2: ECM

181 monthly data on the spot and forward rate of a certain currency:

```
import pandas as pd

url = "http://uosis.mif.vu.lt/~rlapinskas/(data%20R&GRET/forexN.xls"
DT2 = pd.read_excel(url)
DT2.index = pd.date_range(start = "1990-01-01", periods = len(DT2.index), freq = "M").to_period()
DT2.columns = ["spot", "forward"]
```

Part 2.1

Test for cointegration of spot and forward variables.

Hint: before testing for cointegration, what kind of time series must spot and forward be (do not forget to check this!)?

Part 2.2

Create an ECM.