# VECM model

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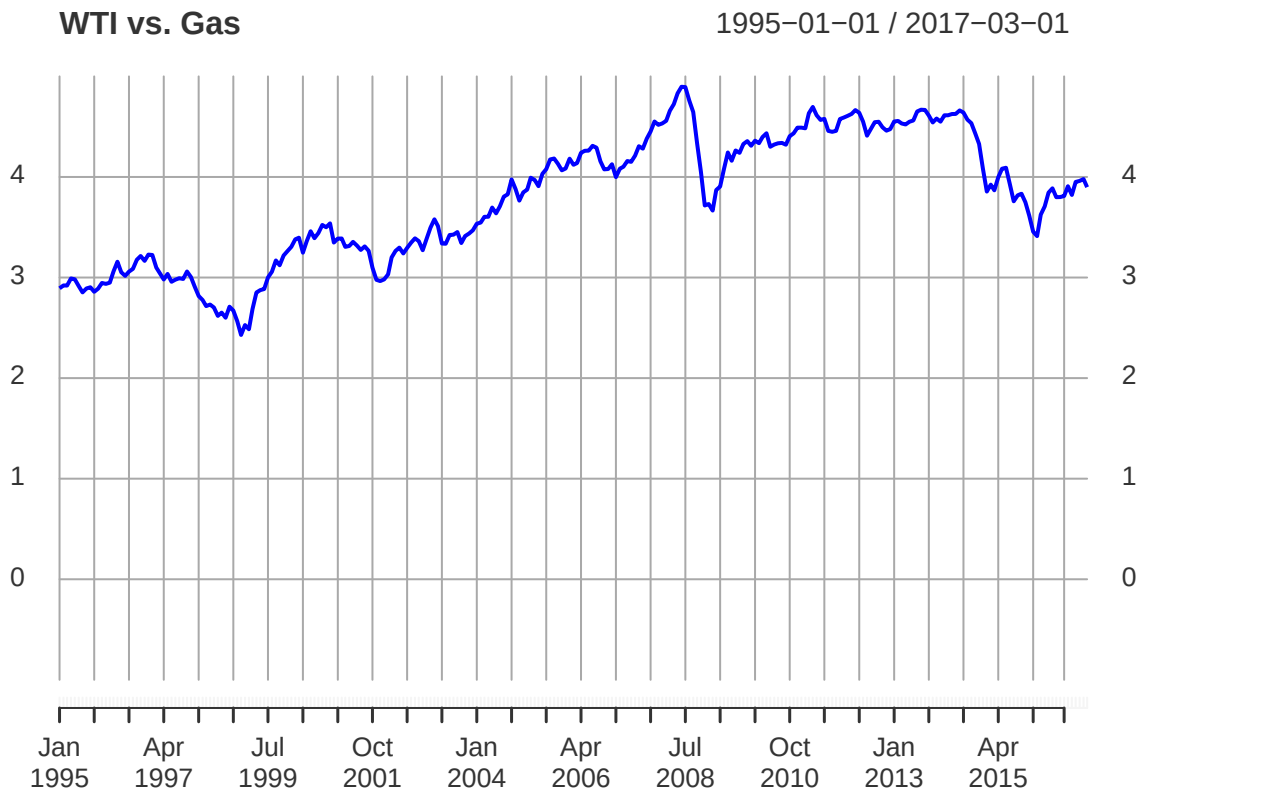
2022-04-25

- Goal: To estimate the VEC model, to forecast the price of the gas and compare the predictability of VEC model with those of forecasts using AR/MA/ARMA model.
- Data:
  - Crude Oil price (FRED/MCOILWTICO);
  - US Regular conventional gas price: (FRED/GASREGCOVM)

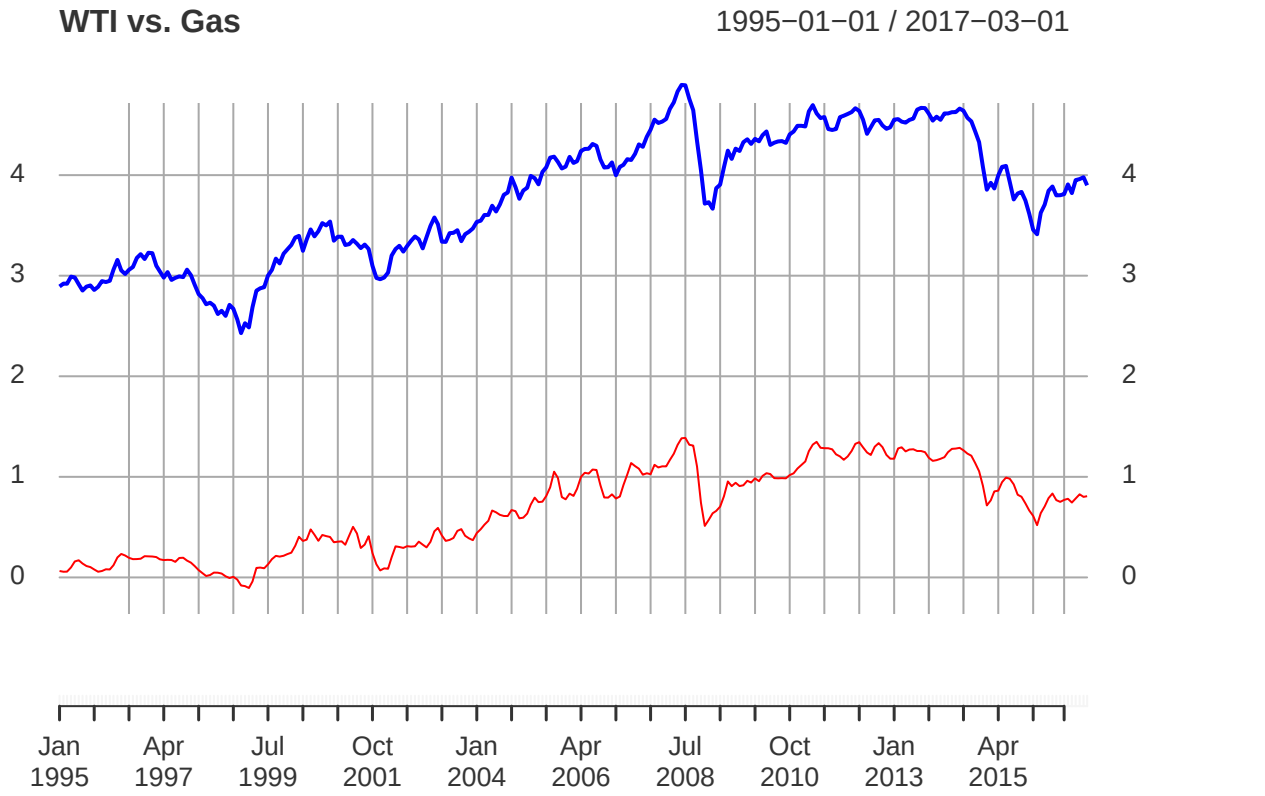
```
knitr::opts_chunk$set(echo = TRUE, tidy.opts = list(width.cutoff = 50), tidy = TRUE)
library(FinMetric)
library(xts)
oil <- fred("MCOILWTICO", "1995-01-01", "2017-03-12")
gas <- fred("GASREGCOVM", "1995-01-01", "2017-03-12")

loil <- as.xts(oil$MCOILWTICO, order.by = oil$date) %>%
    log()
lgas <- as.xts(gas$GASREGCOVM, order.by = gas$date) %>%
    log()
```

## (a) Create a single time series plot with two log prices logpGASt and logpOILt for the sample 1995M1-2017M4.

```
# (a)
par(mfrow = c(1, 1))
plot(loil, type = "l", main = "WTI vs. Gas", col = "blue",
    ylim = c(-1, 5))
```




```
lines(lgas, col = "red")
```



**(b) Perform unit root tests to determine whether logpGASt and logpOILt are I(0) or I(1).**

```
# (b)
library(urca)
ur.ers(loil, type = "P-test", model = "trend") %>%
    summary()
```

```
##
## ###############################################
## # Elliot, Rothenberg and Stock Unit Root Test #
## ###############################################
##
## Test of type P-test
## detrending of series with intercept and trend
##
## Value of test-statistic is: 9.6438
##
## Critical values of P-test are:
##                 1pct 5pct 10pct
## critical values 3.96 5.62  6.89
```

```
ur.ers(lgas, type = "P-test", model = "trend") %>%
    summary()
```

```
##
## ###############################################
## # Elliot, Rothenberg and Stock Unit Root Test #
## ###############################################
##
## Test of type P-test
## detrending of series with intercept and trend
##
## Value of test-statistic is: 8.3139
##
## Critical values of P-test are:
##                 1pct 5pct 10pct
## critical values 3.96 5.62  6.89
```

```
# both series could be I(1) or more

doil <- diff(loil)
dgas <- diff(lgas)

ur.ers(doil, type = "P-test", model = "trend") %>%
    summary()
```

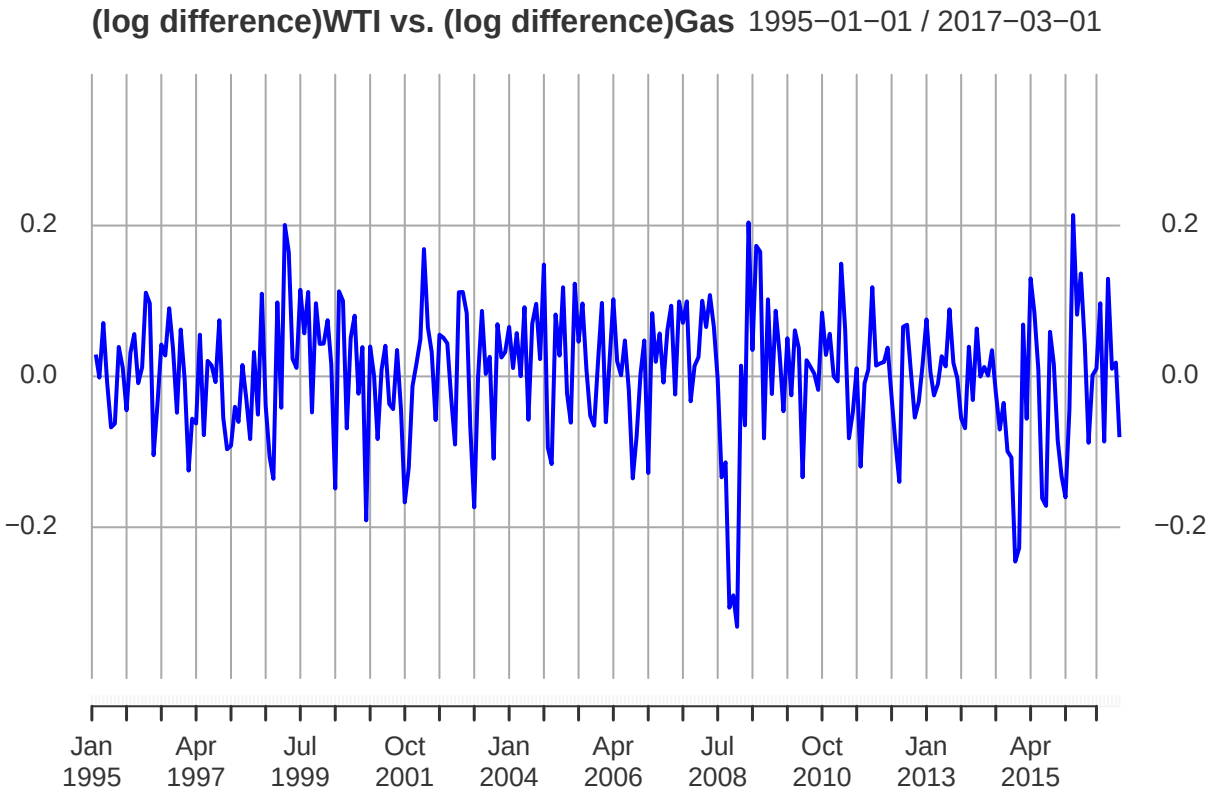
```
##
## ###############################################
## # Elliot, Rothenberg and Stock Unit Root Test #
## ###############################################
##
## Test of type P-test
## detrending of series with intercept and trend
##
```

```
## Value of test-statistic is: 0.8329
##
## Critical values of P-test are:
##                 1pct 5pct 10pct
## critical values 3.96 5.62  6.89
```

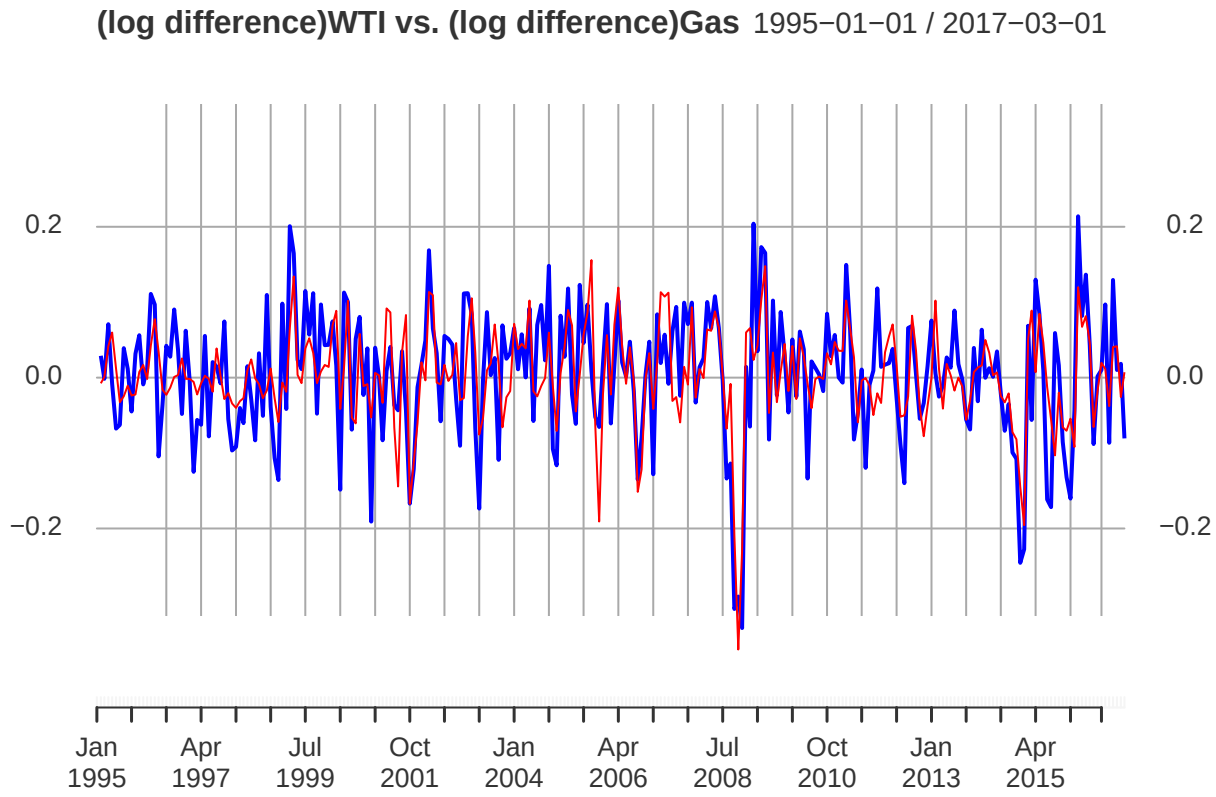
```
ur.ers(dgas, type = "P-test", model = "trend") %>%
    summary()
```

```
##
## ###############################################
## # Elliot, Rothenberg and Stock Unit Root Test #
## ###############################################
##
## Test of type P-test
## detrending of series with intercept and trend
##
## Value of test-statistic is: 0.4757
##
## Critical values of P-test are:
##                 1pct 5pct 10pct
## critical values 3.96 5.62  6.89
```

```
# now we cannot reject the null hypothesis that
# no unit root problem.

par(mfrow = c(1, 1))
plot(doil, type = "l", main = "(log difference)WTI vs. (log difference)Gas",
    col = "blue", ylim = c(-0.4, 0.4))
```



```
lines(dgas, col = "red")
```




**(c) Determine the number of lags to include in cointegration analysis using Schwarz information criterion. Run the Johansen's trace and maximum eigenvalue cointegration tests for ( logpGASt and logpOILt ) using the sample 1995M1-2010M12. Use time series plots from (a) as a guide to determine the specification of the deterministic components in the cointegration test (i.e. whether to use Case 2, Case 3, of Case 4 cointegration test).**

```
# (c)
```