

Homework 9

Eco 4306 Economic and Business Forecasting

Spring 2019

Due: Tuesday, May 14, 11:55pm

Problem 1

Obtain monthly time series for Crude Oil Prices: Brent, code **MCOILBRETEU** on FRED, and the monthly time series for US Regular Conventional Gas Price, code **GASREGCOVM** on FRED.

- Create a time series plot for the two log prices $\log p_t^{GAS}$ and $\log p_t^{OIL}$ for the sample 1995M1:2019M3.
- Perform unit root tests to determine whether $\log p_t^{GAS}$ and $\log p_t^{OIL}$ are $I(0)$ or $I(1)$.
- Determine the number of lags to include in cointegration analysis using Schwarz information criterion sample 1995M1:2010M12.
- Run the Johansen's trace and maximum eigenvalue cointegration tests for $(\log p_t^{GAS}, \log p_t^{OIL})$ using the number of lags from (c). Use 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, or Case 4 cointegration test).
- Interpret the results of the tests in (d).
- Based on your results in (d), use the sample 1995M1:2010M12 sample to estimate the VEC model

$$\begin{aligned}\Delta \log p_t^{GAS} &= \gamma_1 z_{t-1} + \kappa_{11} \Delta \log p_{t-1}^{GAS} + \dots + \kappa_{1p} \Delta \log p_{t-p}^{GAS} + \phi_{11} \Delta \log p_{t-1}^{OIL} + \dots + \phi_{1p} \Delta \log p_{t-p}^{OIL} + \varepsilon_{1,t} \\ \Delta \log p_t^{OIL} &= \gamma_2 z_{t-1} + \kappa_{21} \Delta \log p_{t-1}^{GAS} + \dots + \kappa_{2p} \Delta \log p_{t-p}^{GAS} + \phi_{21} \Delta \log p_{t-1}^{OIL} + \dots + \phi_{2p} \Delta \log p_{t-p}^{OIL} + \varepsilon_{2,t}\end{aligned}$$

where the number of lags p is the same as in (c) and (d), and $z_{t-1} = \log p_{t-1}^{GAS} - \beta_1 \log p_{t-1}^{OIL} - \beta_0$ is the error term measuring the deviation in period $t-1$ from the long run equilibrium.

- Are γ_1 and γ_2 statistically significant? Are the signs of γ_1 and γ_2 in the estimated VEC model in (f) consistent with error correction mechanism that moves the system back to the long run equilibrium, whenever there is a disruption and $z_{t-1} \neq 0$?
- Reestimate the VEC model with a restriction $\gamma_2 = 0$. Recall that to do so in the VEC restriction window you need to enter $B(1,1)=1$, $A(2,1)=0$.
- What is the intuition for imposing the restriction in (h)? Explain how under this restriction $\log p_t^{GAS}$ and $\log p_t^{OIL}$ will change over time in response to a disruption such that $z_{t-1} > 0$.
- Use the restricted VEC model from (h) to create a sequence of one month ahead forecasts for the period 2011M1:2019M3. Report the RMSE for the forecast of the gas price, p_t^{GAS} .