Stationarity Tests

Dickey - Fuller test:

(1) $\Delta y_t = \gamma y_{t-1} + u_t$

$y_t - y_{t-1}$

$H_0: \gamma = 0 \Rightarrow RW$

↳ non-stationary

$H_a: \gamma < 0$

↳ stationary

(2) $\Delta y_t = \mu + \gamma y_{t-1} + u_t$

y - RW with drift

(3) $\Delta y_t = \gamma y_{t-1} + \beta t + u_t$

y - trend-stationary

DF-test

① t-test: $\Delta y_t = \gamma y_{t-1} + u_t$

$$\frac{\hat{\gamma}}{se(\hat{\gamma})} \neq t$$

Augmented DF - test

AR(p) :

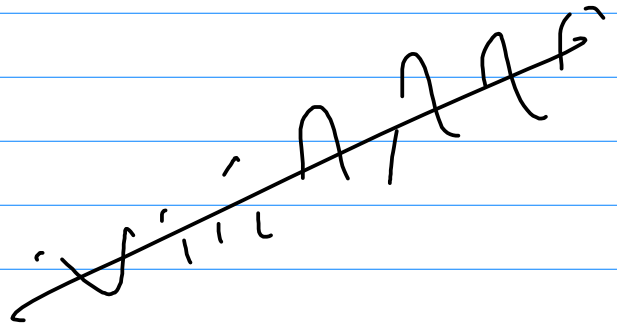
$$\Delta y_t = \mu + \alpha_0 y_{t-1} + \alpha_1 \Delta y_{t-1} + \dots + \alpha_{p-1} \Delta y_{t-(p-1)} + \varepsilon_t$$

$H_0 : \alpha_0 = 0 \Rightarrow$ non-Stationary

$H_a : \alpha_0 < 0 \Rightarrow$ stationary

$$\varepsilon_t = y_t - \hat{\alpha} - \hat{\beta} t$$

$$\underbrace{y_t}_{\hat{y}_t} = \alpha + \beta t + \varepsilon_t$$



Problem 10 (a) DF t-test

(1) $\hat{\Delta P_t} = 160.58 - 0.02 P_{t-1} \quad R^2 = 0.01$
$\quad\quad\quad\quad\quad\quad (134.00) \quad (0.014)$

(2) $\hat{\Delta DP_t} = -0.97 DP_{t-1} \quad R^2 = 0.487$
$\quad\quad\quad\quad\quad\quad\quad (0.075)$

(3) $\hat{\Delta VOL_t} = 1.48 \cdot 10^8 - 0.144 VOL_{t-1} - 0.224 \Delta(VOL_{t-1}) + 91320.24t \quad R^2 = 0.14$
$\quad\quad\quad\quad\quad\quad\quad\quad (871445.3) \quad (0.045) \quad\quad (0.073) \quad\quad (871445.3)$

(4) $\hat{\Delta VOL_t} = 1.55 \cdot 10^8 - 0.143 VOL_{t-1} - 0.224 \Delta(VOL_{t-1}) \quad R^2 = 0.14$
$\quad\quad\quad\quad\quad\quad\quad\quad (65210866) \quad (0.044) \quad\quad (0.073)$

(1) $DF = -\frac{0,02}{0,014} = -1,43 > -2,88$

$\Rightarrow$ non-stationary

(2) $DF = -\frac{0,97}{0,075} = -12,93 < -2,88$

$\Rightarrow$ stationary

(3) $V_t = \beta_1 + \beta_2 V_{t-1} + \beta_3 V_{t-2} + \beta_4 t + u_t$

$\Delta V_t = \beta_1 + (\beta_2 + \beta_3 - 1) V_{t-1} - \beta_3 \Delta V_{t-1} + \beta_4 t + u_t$

$H_0: \quad \beta_2 + \beta_3 - 1 = 0$

$t = -\frac{0,144}{0,045} = -3,2 > -3,43$