Time Series

- Cross-Sectional Data
- Panel Data

ADL (ARDL)

ADL (p, q)

Problem 1.

(a) $HOUS_t = \beta_0 + \beta_1 \cdot DPI_t + \varepsilon_t$

(b) $HOUS_t = \beta_0 + \beta_1 DPI_t + \beta_2 DPI_{t-1} + \varepsilon_t$

Problem 2

ADL (1,0)

$y_t = \beta_1 + \beta_2 \cdot X_t + \beta_3 y_{t-1} + u_t$

$Ly_t = y_{t-1}$

$L^2 y_t = y_{t-2}$

$\vdots$

$y_t = \beta_1 + \beta_2 \cdot X_t + \beta_3 Ly_t + u_t$

$(1 - \beta_3 L) y_t = \beta_1 + \beta_2 X_t + u_t$

$$y_t = \frac{1}{1-\beta_3 L}\beta_1 + \frac{\beta_2}{1-\beta_3 L} X_t + \frac{u_t}{1-\beta_3 L}$$

$|\beta_3| < 1$

$$y_t = \frac{\beta_1}{1-\beta_3} = \beta_1^* + \beta_2 X_t + \beta_2 \beta_3 L X_t + \beta_2 \beta_3^2 L^2 X_t \dots + u_t^*$$

$$y_t = \beta_1^* + \beta_2 X_t + \beta_2 \beta_3 X_{t-1} + \beta_2 \beta_3^3 X_{t-2} + \dots + u_t^*$$

AR (1)

$$y_t = \beta_1 + \beta_2 \cdot X_t + \beta_3 y_{t-1} + u_t$$

$$u_t = \varepsilon_t + \rho \varepsilon_{t-1}$$

$$y_{t-1} = \beta_1 + \beta_2 \cdot X_{t-1} + \beta_3 y_{t-2} + \varepsilon_{t-1} + \rho \varepsilon_{t-2}$$

autocorrelation of error term

Can lead to inconsistency (endogeneity)

Short term :

$$y_t = \beta_1 + \beta_2 \cdot X_t + \beta_3 y_{t-1} + u_t$$

↑ Short-term marginal effect

$$\bar{y} = \beta_1 + \beta_2 \bar{X} + \beta_3 \bar{y}$$

$$(1 - \beta_3)\bar{y} = \beta_1 + \beta_2 \bar{X}$$

$$\bar{y} = \frac{\beta_1}{1 - \beta_3} + \frac{\beta_2}{1 - \beta_3} \bar{X}$$

Long-term marginal effect of X

$$|\beta_3| < 1$$

$$\frac{\beta_2}{1 - \beta_3} = \beta_2 + \beta_2 \beta_3 + \beta_2 \beta_3^2 \cdots$$

$$\frac{0,03}{1-0,85}$$ – long. fem. effekt