Econometrics-Damodar N. Gujarati / Chapter 17

Furkan Zengin

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Dynamic Econometric Models: Autoregressive and Distributed-Lag Models

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + u_t \qquad \text{(Distributed-Lag Model)}$$

$$Y_t = \alpha + \beta X_t + \gamma Y_{t-1} + u_t \qquad \text{(Autoregressive Model)}$$

Estimation of Distributed-Lag Models

```
#We can use the data in Table17_2

options(scipen = 999)

library(gujarati)

fix(Table17_2)

library(dynlm)

library(lmtest)

library(sandwich)

library(stargazer)

library(car)


MODEL1 = dynlm(ts(Table17_2$PPCE)~  ts(Table17_2$PPDI) ,data = Table17_2)


MODEL1_1 = dynlm(ts(Table17_2$PPCE)~  ts(Table17_2$PPDI)+ L(ts(Table17_2$PPDI))
                 ,data = Table17_2)


MODEL1_2 =dynlm(ts(Table17_2$PPCE)~  ts(Table17_2$PPDI)+ L(ts(Table17_2$PPDI))+
                  L(ts(Table17_2$PPDI,2)) ,data = Table17_2)
```

```
MODEL1_3 = dynlm(ts(Table17_2$PPCE)~  ts(Table17_2$PPDI)+ L(ts(Table17_2$PPDI))+
                  L(ts(Table17_2$PPDI,2))+ L(ts(Table17_2$PPDI,3))  ,data = Table17_2)


stargazer(list(MODEL1,MODEL1_1,MODEL1_2,MODEL1_3),type = "text")
```

The Koyck Approach to Distributed-Lag Models

$$\beta_k = \beta_0 \lambda^k \tag{17.4.1}$$

$$\sum_{k=0}^{\infty} \beta_k = \beta_0 (\frac{1}{1-\lambda}) \tag{17.4.2}$$

```
MODEL2 =  dynlm(ts(Table17_2$PPCE)~  ts(Table17_2$PPDI) + L(ts(Table17_2$PPCE))
                ,data = Table17_2)

summary(MODEL2)

func = function(lambda,beta0) {beta0*(1/(1-lambda))}

func(0.797150,0.21389)
```

Koyck (17.4.7)

$$Y_t = \alpha(1-\lambda) + \beta_0 X_t + \lambda Y_{t-1} + v_t$$

Adaptive expectations (17.5.5)

$$Y_t = \gamma\beta_0 + \gamma\beta_1 X_t + (1-\gamma)Y_{t-1} + [u_t - (1-\gamma)u_{t-1}]$$

Partial adjustment (17.4.7)

$$Y_t = \delta\beta_0 + \delta\beta_1 X_t + (1-\delta)Y_{t-1} + \delta u_t$$

Detecting Autocorrelation in Autoregressive Models: Durbin h Test

$$h = \hat{\rho}\sqrt{\frac{n}{1 - n[var(\hat{\alpha}_2)]}} \tag{17.10.1}$$

```
MODEL2 =  dynlm(ts(Table17_2$PPCE)~  ts(Table17_2$PPDI) + L(ts(Table17_2$PPCE))
                ,data = Table17_2)

dwtest(MODEL2)

func2 = function(n,rho,var) {rho* sqrt(n/(1-n*var))}

1- (0.95862/2) # 1 - d/2 = rho

func2(47,0.52069,0.0053)




NW <- NeweyWest(MODEL2,
 lag = 3)
coeftest(MODEL2, vcov = NW)
```

17.11 The Demand for Money in Canada

$$M_t^* = \beta_0 R_t^{\beta_1} Y_t^{\beta_2} + e_t^{u_t} \tag{17.11.11}$$

```
options(scipen = 999)

fix(Table17_5)

MODEL3 = dynlm(ts(log(Table17_5$M1)) ~ log(ts(Table17_5$R)) + log(ts(Table17_5$GDP))+
                 L(log(ts(Table17_5$M1))))

summary(MODEL3)
```

Causality in Economics: The Granger Causality Test

$$GDP_t = \sum_{i=1}^{n} \alpha_i M_{t-i} + \sum_{j=1}^{n} \beta_j GDP_{t-j} + u_{1t} \tag{17.14.1}$$

$$M_t = \sum_{i=1}^{n} \lambda_i M_{t-i} + \sum_{j=1}^{n} \delta_j GDP_{t-j} + u_{2t} \tag{17.14.2}$$

```
MODEL2_a =  dynlm(ts(Table17_5$M1) ~  ts(Table17_5$R), data = Table17_5)



gt1 = grangertest(ts(Table17_5$M1) ~  ts(Table17_5$R),order = 2)
gt2 = grangertest(ts(Table17_5$M1) ~  ts(Table17_5$R),order = 4)
gt3 = grangertest(ts(Table17_5$M1) ~  ts(Table17_5$R),order = 6)
gt4 = grangertest(ts(Table17_5$M1) ~  ts(Table17_5$R),order = 8)

rgt1 = grangertest(ts(Table17_5$R) ~  ts(Table17_5$M1),order = 2)
rgt2 = grangertest(ts(Table17_5$R) ~  ts(Table17_5$M1),order = 4)
rgt3 = grangertest(ts(Table17_5$R) ~  ts(Table17_5$M1),order = 6)
rgt4 = grangertest(ts(Table17_5$R) ~  ts(Table17_5$M1),order = 8)

Fgt1 = gt1$F
Fgt2 = gt2$F
Fgt3 = gt3$F
Fgt4 = gt4$F

Frgt1 = rgt1$F
Frgt2 = rgt1$F
Frgt3 = rgt1$F
Frgt4 = rgt1$F


df = data.frame(Fgt1,Frgt1,Fgt2,Frgt2,Fgt3,Frgt3,Fgt4,Frgt4)
df
```