CUHK | Dept. of Economics
Fall 2011 | ECON 4120 | Sung Y. Park

Problem Set 3

1. Construct the impulse response function for a third order difference equation:

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \phi_3 y_{t-3} + w_t, \quad 1 < t < n,$$

where it is assumed that $\{w_t\}_{t=1}^n$ is a sequence of deterministic numbers, say generated from $N(0,1)$.

   (a) Set $\phi_1 = 1.1$, $\phi_2 = 0.8$, $\phi_3 = 0.1$, $y_0 = y_{-1} = y_{-2} = 0$, and $n = 150$. Generate y_t using a third order difference equation for $1 < t < n$.

   (b) Check whether impulse response function are converging or explosive?

   (c) Construct the impulse response function for the generated y_t. Set the number of periods in the impulse response function to $P = 25$. Comment your results.

   (d) Set $\phi_1 = 1.71$ and repeat steps (a)-(c). Comment your results.

2. [Thurman and Fisher (1988, AJAE)] This problem is about "which came first: the chicken or the egg?" The data for the problem set was originally provided by Thurman and secondly by Roger Koenker, consists of annual time series 1930-1983 for U.S. egg production in millions of dozens and the December 1 USDA estimate of the US chicken population, (excluding broilers) (`eggchicken.txt`). However, the data seems to be a little different than that analyzed by original paper.

   (a) `R` code for the Granger causality is provided below. Write down the exact mathematical explanation for the code.

```
Thurman<-read.table("C:/eggchiken.txt", header=T)
year<-Thurman$year
egg<-Thurman$egg
chic<-Thurman$chic
library(ts)
year<-ts(year)
chic<-ts(chic)
egg<-ts(egg)
```

```
"granger" <-function(d, L, k = 1) {
names.d <- dimnames(d)[[2]]
D <- d
for(i in 1:L) {
D <-ts.intersect(D, lag(d,  - i))
}
dimnames(D)[[2]] <- paste(rep(names.d, L + 1), "_",
rep(0:L, times = rep(2, L + 1)), sep = "")
y  <- D[, k]
n  <- length(y)
x1 <- D[, -(1:2)]
x0 <- x1[, ((1:L) * 2) - (k %% 2)]
z1 <- lm(y ~ x1)
z0 <- lm(y ~ x0)
S1 <- sum(z1$resid^2)
S0 <- sum(z0$resid^2)
ftest <- ((S0 - S1)/L)/(S1/(n - 2 * L - 1))
list(ftest = ftest, p.val = 1 - pf(ftest, L, n - 2 * L - 1),
R2 = summary(z1)$r.squared) }

granger(cbind(egg,chic), L=1)
granger(cbind(chic, egg), L=1)
```

(b) Determine the causal relationship between eggs and chickens using the above R code. Note that VAR model should be stationary.

(c) Perform the impulse response analysis and the forecasting error variance decomposition. Interpret the results.

3. Consider the OverSea Services Shipping Volume data (p.268). The data file is `fcst12input.dat` and has been uploaded in the course web pages. There are three time-series: (i) weekly realized volume; (ii) weekly 2-week-ahead quantitative forecasts (VOLQ); (iii) weekly 2-week-ahead judgemental forecasts (VOLJ).

   (a) Test whether VOLQ and VOLJ are unbiased or not. Note that the error term in the regression equation can be serially correlated.

   (b) Using Mincer-Zarnowitz regression test the optimality of the forecasts.

   (c) Test the equal accuracy hypothesis for VOLQ and VOLJ.

   (d) What are RMSEs of VOLQ and VOLJ?

   (e) Construct a new forecast using the forecasting combination. What is its RMSE? Compare this with those in (c).