Computer Handout 10: Forecasting Cycles
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Econ 3342

This Computer Handout 10 will cover an empirical application on how to forecast cycles. We will replicate figures in section 5 of chapter 9.

The variable we want to forecast is the Canadian employment.

Moving Average

Before we estimate the models, let's make sure we all have the same sample:

```
smpl 1962q1 1993q4
```

The preferred MA model is an MA(4), so the E-Views command is:

```
ls caemp c ma(1) ma(2) ma(3) ma(4)
```

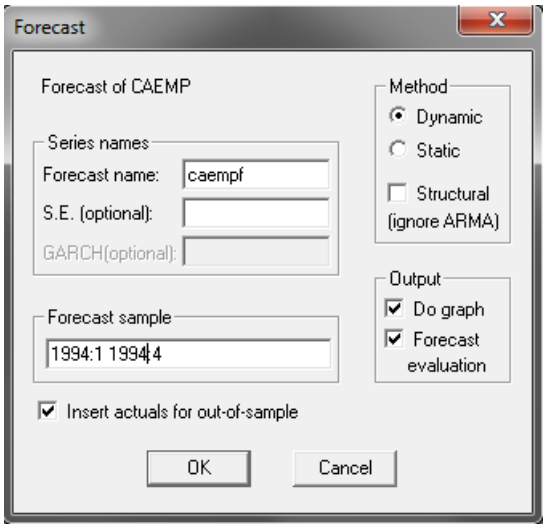
Dependent Variable: CAEMP
Method: Least Squares
Date: 11/11/10 Time: 16:26
Sample: 1962:1 1993:4
Included observations: 128
Convergence achieved after 18 iterations
Backcast: 1961:1 1961:4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	101.0740	1.017602	99.32569	0.0000
MA(1)	1.633177	0.075945	21.50477	0.0000
MA(2)	1.716449	0.121543	14.12210	0.0000
MA(3)	1.227286	0.121236	10.12313	0.0000
MA(4)	0.515270	0.076067	6.773914	0.0000

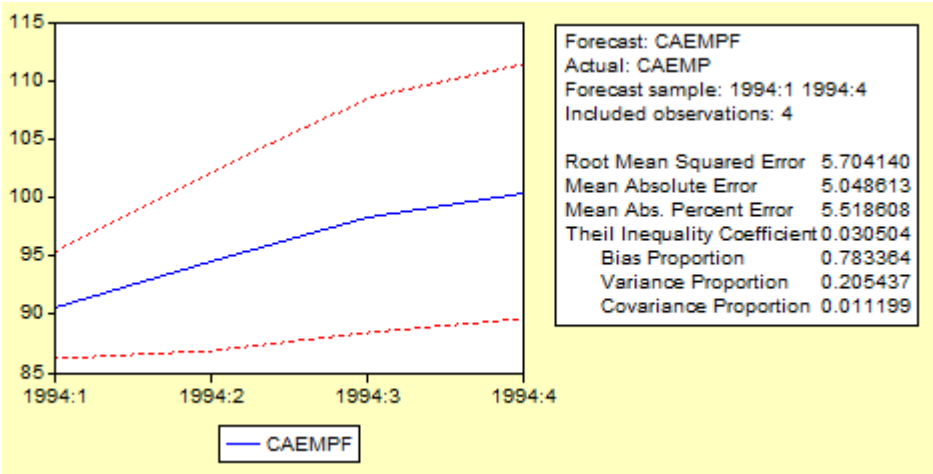
R-squared	0.938449	Mean dependent var	101.0176
Adjusted R-squared	0.936448	S.D. dependent var	7.499163
S.E. of regression	1.890508	Akaike info criterion	4.149847
Sum squared resid	439.6046	Schwarz criterion	4.261255
Log likelihood	-260.5902	F-statistic	468.8382
Durbin-Watson stat	1.695716	Prob(F-statistic)	0.000000

Inverted MA Roots	-.10+.87i	-.10 -.87i	-.72 -.40i	-.72+.40i

The simplest way to forecast the values between the first quarter of 1994 and the fourth quarter of 1994 is to go to click on the icon "forecast" and then choose the correct forecast sample:



This will yield the following forecast:



Notice that this is the shaded area of the Figure 9.1 in your textbook.

A second more interesting way to obtain the same forecast is to follow these steps:

1) Select the sample to estimate the model:

   smpl 1962q1 1993q4

2) Estimate the model:

   equation ma4.ls caemp c ma(1) ma(2) ma(3) ma(4)

3) Generate a variable with the historical values:

   genr history = caemp

4) Modify the your sample to include the period you want to forecast:

smpl 1994:1 1996:4

5) Forecast your values (stored in yhat) and the standard errors (stored in se):

   ma4.forecast yhat se

6) Generate the variable that will store the forecasted values:

   genr fcst=yhat

7) Generate the 95% confidence intervals:

   genr yhatplus=yhat+1.96*se

   genr yhatminus=yhat-1.96*se

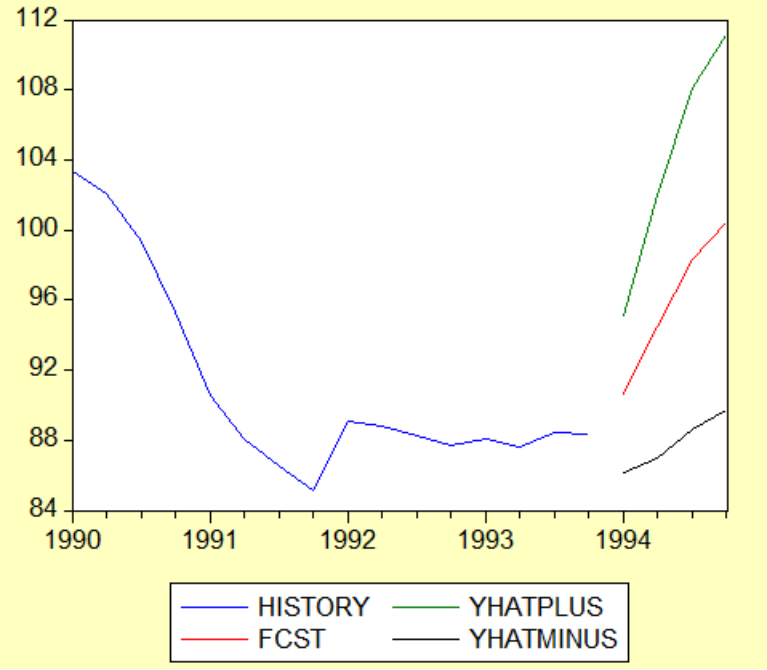
8) Modify the sample to include what you want to see in the graph:

   smpl 1990:1 1994:4

9) Open the history, the forecast and the lower and upper limits all in one group:

   group group01 history fcst yhatplus yhatminus

10) Just open the group and graph them all together:



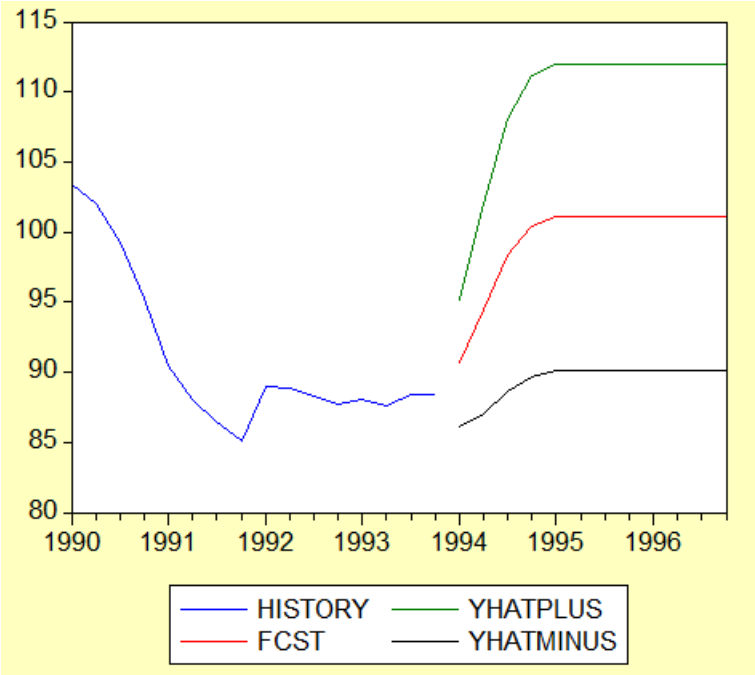
Notice that this is Figure 9.1 in your textbook.

What if we want to forecast all the values until the fourth quarter of 1996?

11) Just select the sample for your graph:

    smpl 1990:1 1996:4

12) Open the group you produced in step (9) and graph it.



What if you want to compare the actual values with the forecast? Remember that we do have the data for the following years.

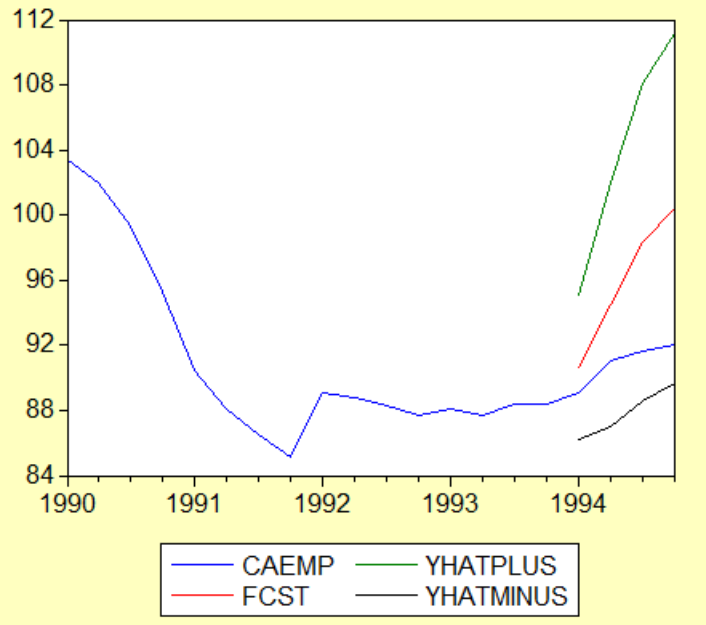
13) Modify the sample again to cover the periods of the forecast and where we have actual data:

    smpl 1990:1 1994:4

14) Create another group. This time with the actual data (caemp) intead of the history.

    group group02 caemp fcst yhatplus yhatminus

15) Then open the group and graph:



This is Figure 9.4 in your textbook. Notice that the actual values for the 1994 data fall inside the 95% confidence interval forecasted with the MA(4) model with data prior 1994.

Autoregressive

Before we start, let's make sure we have the correct sample we will use to estimate the model:

```
smpl 1962:1 1993:4
```

Recall that our preferred AR model was an AR(2) model:

```
ls caemp c ar(1) ar(2)
```

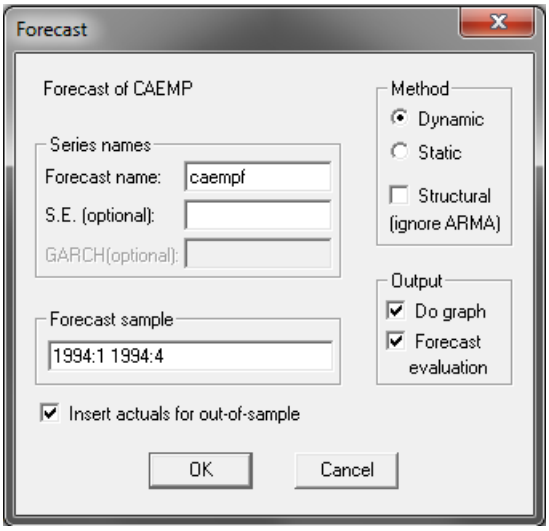
Dependent Variable: CAEMP
Method: Least Squares
Date: 11/11/10 Time: 16:59
Sample: 1990:1 1994:4
Included observations: 20
Convergence achieved after 3 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	89.31536	2.226978	40.10608	0.0000
AR(1)	1.225823	0.206639	5.932207	0.0000
AR(2)	-0.390205	0.177897	-2.193431	0.0425

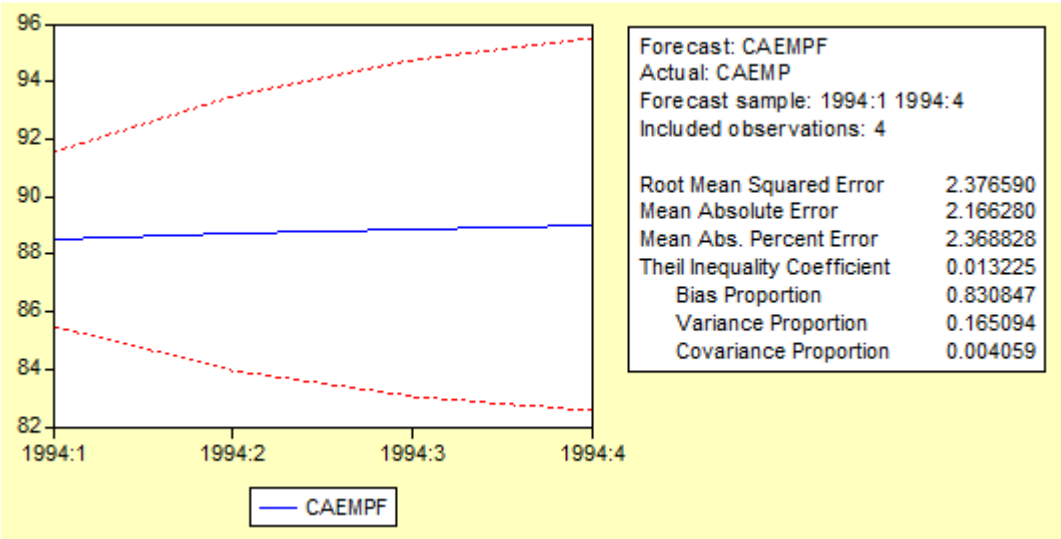
R-squared	0.925389	Mean dependent var	91.01688
Adjusted R-squared	0.916611	S.D. dependent var	5.082799
S.E. of regression	1.467765	Akaike info criterion	3.742839
Sum squared resid	36.62366	Schwarz criterion	3.892199
Log likelihood	-34.42839	F-statistic	105.4244
Durbin-Watson stat	2.232747	Prob(F-statistic)	0.000000

Inverted AR Roots	.61 -.12i	.61+.12i

The simplest way to forecast the values between the first quarter of 1994 and the fourth quarter of 1994 is to go to click on the icon “forecast” and then choose the correct forecast sample:



This will yield the following forecast:



Notice that this is the shaded area of the Figure 9.4 in your textbook.

A second more interesting way to obtain the same forecast is to follow these steps:

1) Select the sample you want to use for your model:

   smpl 1962:1 1993:4

2) Estimate the AR(2) model and store your estimation under the name ar2

   equation ar2.ls caemp c ar(1) ar(2)

3) Select the sample you want to include in your forecast:

   smpl 1994:1 2010:4

4) Generate the forecast and the standard error of the forecast:

   ar2.forecast yhat se

5) Generate the variable that will store the forecasted values:

   genr fcst2=yhat

6) Generate the upper and lower levels for your 95% confidence interval:

   genr yhatplus2=yhat+1.96*se

   genr yhatminus2=yhat-1.96*se

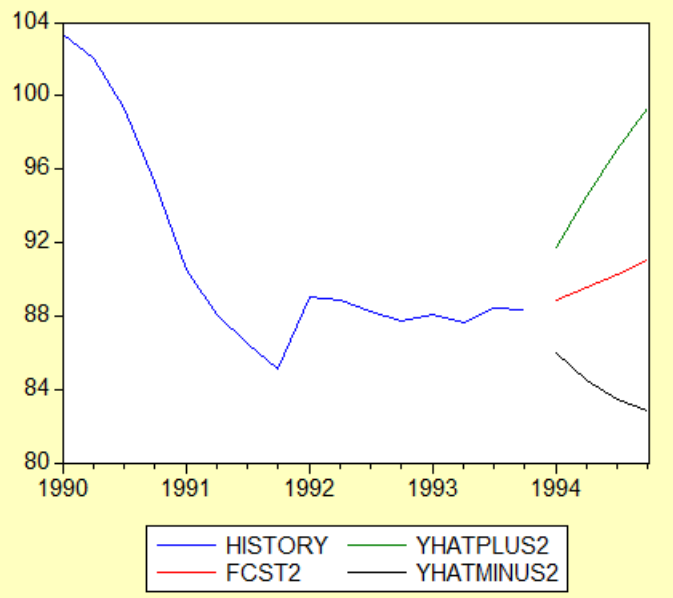
7) Select the sample you want to see in your forecast graph:

   smpl 1990:1 1994:4

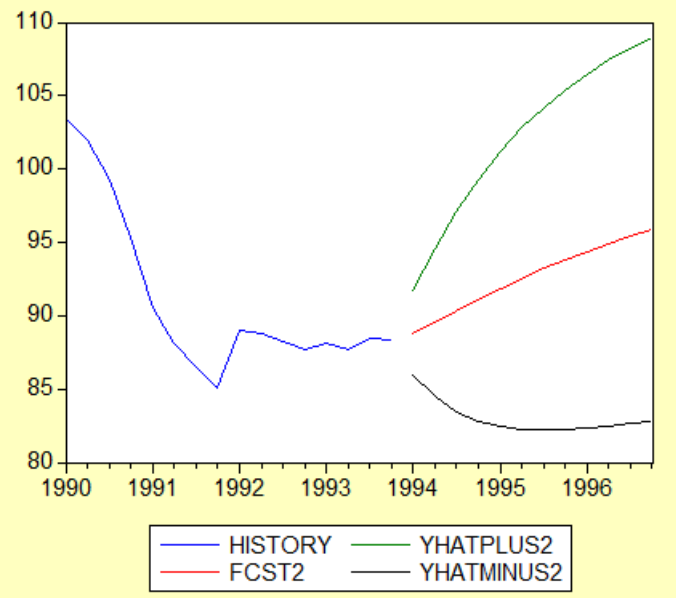
8) Create a group of all the variables you want to include in your graph:

   group group03 history fcst2 yhatplus2 yhatminus2

9) Open the group and graph all variables together:

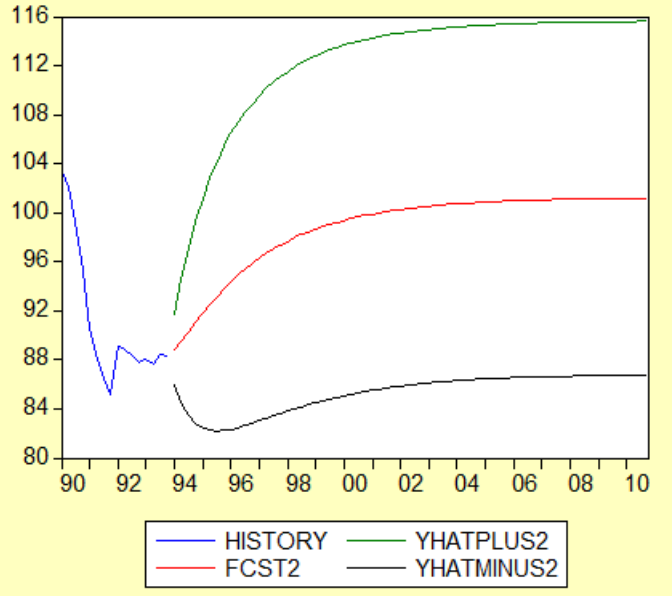


10) If you want to see the forecast all the way until the end of 1996, just modify the sample size:
    smpl 1990:1 1996:4



This is figure 9.5 in your tectbook.

11) For the forecast that includes the values until 2010.
smpl 1990:1 2010:4



This is figure 9.6 in your textbook.

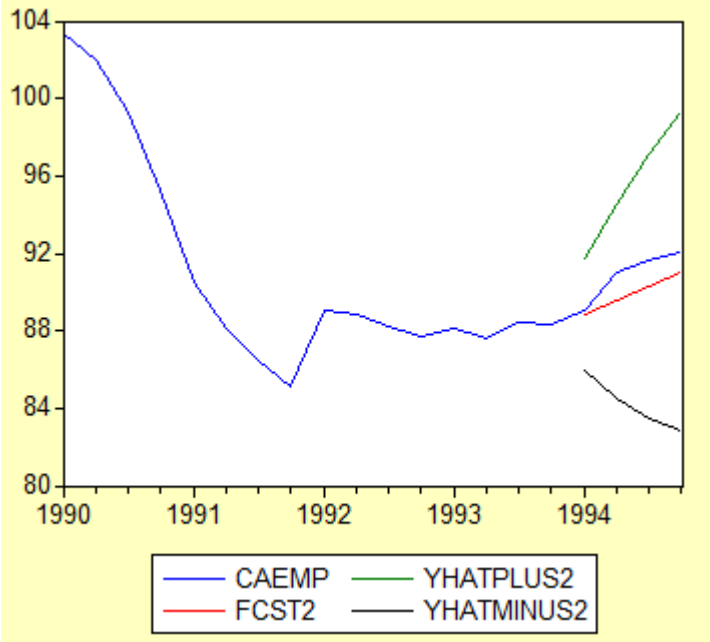
12) If you want to include the actual values in the forecast, select the sample that contains actual values first:

smpl 1990:1 1994:4

13) Then create a group with the actual values (caempl), the forecast and the 95% upper and lower confidence intervals:

    group group04 caemp fcst2 yhatplus2 yhatminus2

14) Finally, open the group and generate the line graph will all the variables:

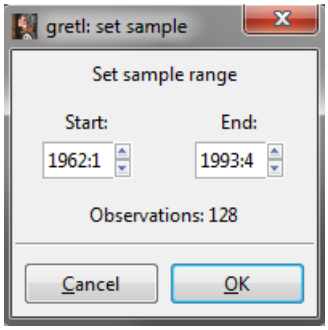


This is 9.7 in your textbook.

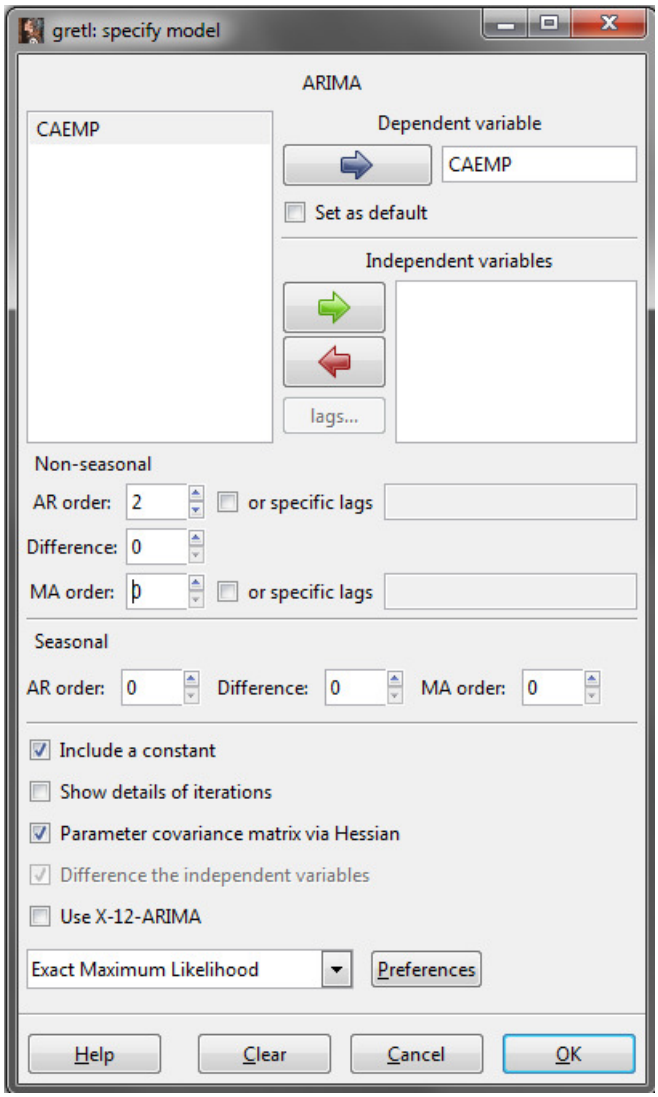
Notice that the forecast lies very close to the actual values. This AR(2) model appears to be a better forecasting model than the MA(4) model discussed earlier.

gretl

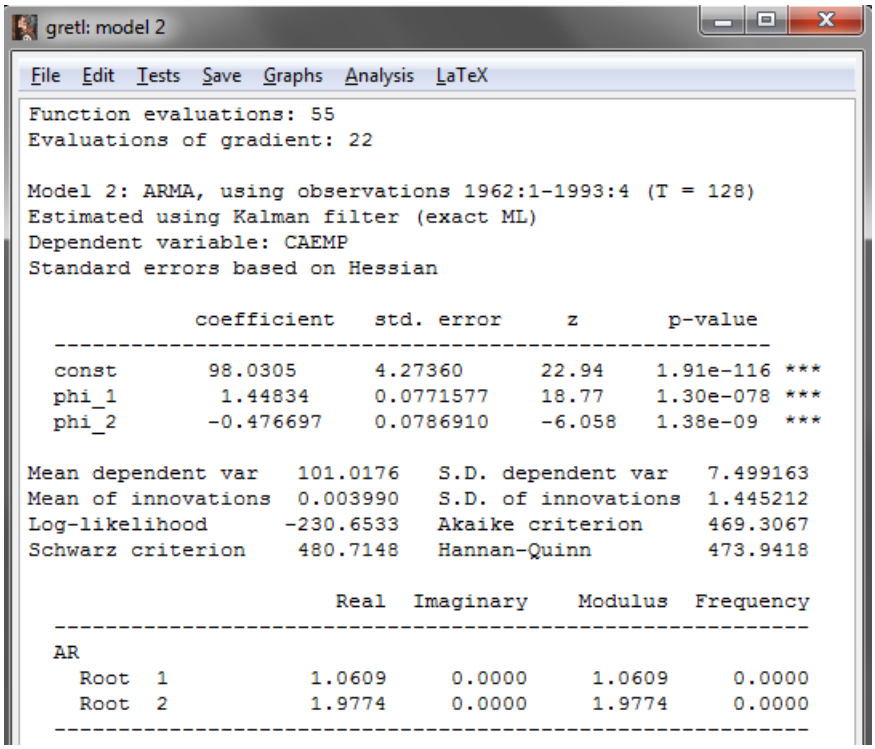
Open the data. Select the sample:



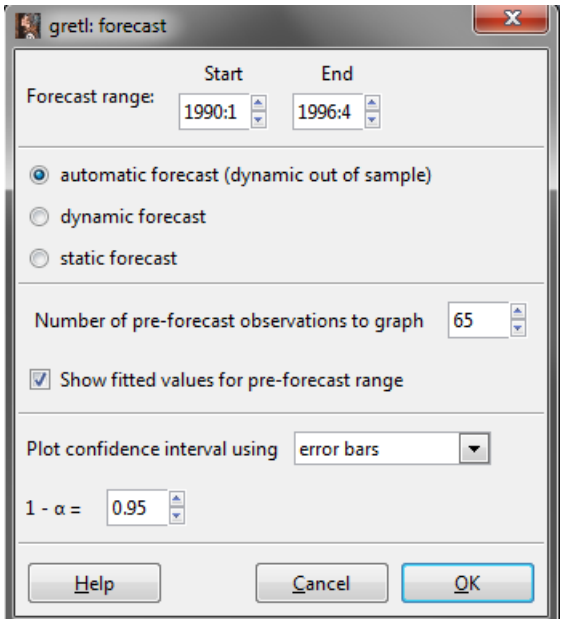
To estimate the AR(2) model, just go to “Model” then “Time Series” and select “ARIMA”:



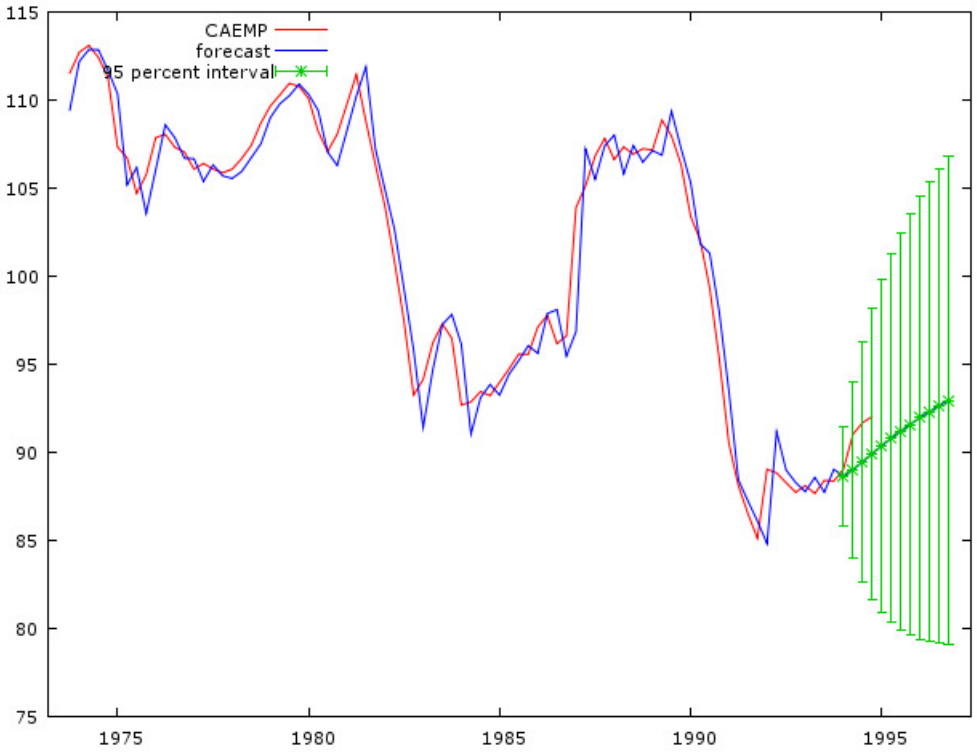
Select the options for an AR(2) model as shown above. You will get the following output:



To obtain the forecast just go to “Analysis” then “Forecast” and select the sample of your choice:



Gretl will generate the following beautiful graph:



This graph corresponds to a combination of figures 9.5 and 9.7 in your text. This graph shows the actual values, the in-sample forecasted values, the actual values for 1994, the out-of-sample forecast for 1994 through 1996 and the 95% confidence intervals for the out-of-sample forecast.