Economics 413: Economic Forecast & Analysis

Department of Economics, Finance and Legal Studies
University of Alabama
Spring 2015

Final Exam

The exam consists of four questions on six pages. Each question is of equal value.

1. Consider the following model: $Y_t = c + \phi Y_{t-1} + \varepsilon_t$, where $c = 0$ and $\phi = 1$

   (a) What is the common name for this model?

   (b) Derive the expected value of this process.

   (c) Is this process stationary or non-stationary?

      i. If stationary, answer the following:

         A. Derive the variance of this process.

         B. Derive the covariance of this process for $j = 1, 2, \ldots$

         C. Draw the partial autocorrelation function

      ii. If non-stationary, answer the following:

         A. Use the Box-Jenkins methodology to make the series stationary.

         B. Using the result from step (A), derive the expected value of this process.

         C. Derive both the variance and covariance of this process.

2. Consider the model $y_t = c + \delta t + \gamma t^2 + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2}$, where ε_t is a white noise sequence.

   (a) Assuming that $\delta = \gamma = 0$, $\phi_1 = 0.4$ and $\phi_2 = 0.6$, what can be said about the series?

   (b) Under the assumptions in part (a), considering the Box-Jenkins methodology, what should be done to the series?

   (c) Write down the equation you would use to detrend the series y_t.

   (d) For the equation in part (c), write down the ordinary least-squares objection function used to estimate the parameters of the model.

   (e) For the detrended series, write down the log-likelihood function used to estimate the parameters of the model.

3. Consider the model $Y_t = c + \delta Z_t + \varepsilon_t$, where $\varepsilon_t \sim WN\left(0, \sigma_\varepsilon^2\right)$ is a white noise sequence and $Z_t = u_t + \psi u_{t-1}$ is a MA(1) process where $u_t \sim WN\left(0, \sigma_v^2\right)$. Assuming that ε_t and u_t are uncorrelated with one another and that the parameters of the model are known

   (a) Find the h-step ahead forecast for $h = 1, 2, \ldots$.

   (b) Find the h-step ahead forecast error for $h = 1, 2, \ldots$.

   (c) Find the h-step ahead forecast error variance for $h = 1, 2, \ldots$.

   (d) Find the h-step ahead interval forecast for $h = 1, 2, \ldots$.

   (e) Plot parts (a) and (d) in a single figure.

4. Consider the following model

$$y_t = c + \phi y_{t-1} + \delta_1 D_{1t} + \delta_2 D_{2t} + \varepsilon_t,\ t = 1901, 1902, \ldots, 2000$$

where we have two breaks in the data

$$\begin{aligned} D_{1t} &= \begin{cases} 1 \text{ if } t \leq 1926 \\ 0 \text{ if } t > 1926 \end{cases} \\ D_{2t} &= \begin{cases} 1 \text{ if } t \geq 1975 \\ 0 \text{ if } t < 1975 \end{cases} \end{aligned}$$

Considering the EViews output below, answer the following questions:

(a) Explain why the sample in the regression table goes from 1902 to 2000.

(b) In the regression table, what econometric approach is used to estimate this model? Write down the objective function for this estimation method.

(c) If we know the true values of c, ϕ, δ_1 and δ_2 and know that $|\phi|$ is less than one, what is the expected value of the series from 1901 to 1926, from 1927 to 1974, from 1975 to 2000 (hint, plug in the values of D_{1t} and D_{2t})?

(d) Using the estimates from the regression table, give the estimated mean of the series from 1901 to 1926, from 1927 to 1974, from 1975 to 2000 (hint, these are the empirical counterparts to part (c))?

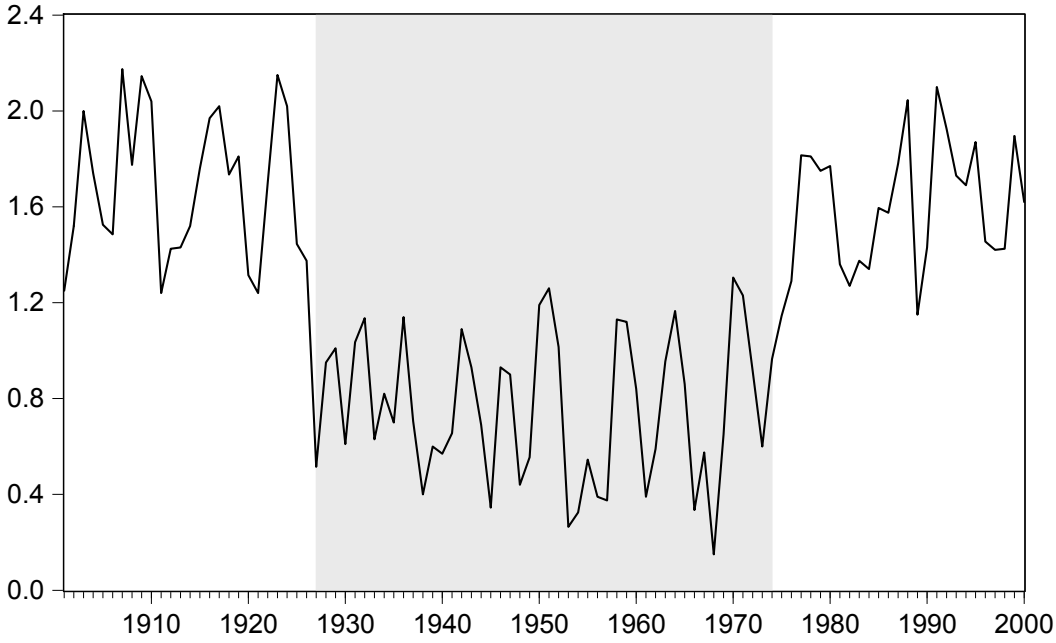
(e) Draw each mean from part (d) directly on the figure and label accordingly.

Dependent Variable: Y
Method: Least Squares
Date: 04/22/15 Time: 10:19
Sample (adjusted): 1902 2000
Included observations: 99 after adjustments
Convergence achieved after 5 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.768326	0.056518	13.59436	0.0000
D1	0.939438	0.096269	9.758448	0.0000
D2	0.820134	0.094323	8.694947	0.0000
AR(1)	0.278380	0.097454	2.856532	0.0053

R-squared	0.725224	Mean dependent var	1.219040
Adjusted R-squared	0.716546	S.D. dependent var	0.535710
S.E. of regression	0.285214	Akaike info criterion	0.368412
Sum squared resid	7.727972	Schwarz criterion	0.473265
Log likelihood	-14.23638	Hannan-Quinn criter.	0.410836
F-statistic	83.57856	Durbin-Watson stat	1.783056
Prob(F-statistic)	0.000000		

Inverted AR Roots .28


2.4
2.0
1.6
1.2
0.8
0.4
0.0
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000