Economics 413: Economic Forecast & Analysis

Department of Economics, Finance and Legal Studies
University of Alabama
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Midterm II

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

1. Consider the following data generating process

$$Y_t = \blacklozenge + \varepsilon_t$$

where $\blacklozenge$ is a known constant (intercept) parameter and ε_t is a white noise process. Answer the following:

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

   (b) What conditions must be shown to show that this model is covariance stationary?

   (c) Derive the expected value of this process.

   (d) Derive the variance of this process.

   (e) Derive the covariance of this process for $j = 1, 2, \ldots$. Note that j represents the number of periods between Y_t and Y_{t-j}.

2. Consider the model $y_t = c + \phi y_{t-1} + \varepsilon_t + \theta \varepsilon_{t-1}$, where $\varepsilon_t \sim WN\left(0, \sigma_\varepsilon^2\right)$ is a white noise sequence.

   (a) Write the log-likelihood function needed to estimate this model.

   (b) Why do we want to maximize the funciton in part (a) as opposed to minimizing a function as we did with OLS?

   (c) Consider the null hypothesis $H_0 : \theta = 0$. Write the log-likelihood function needed to estimate the model under the null hypothesis.

   (d) Consider the null hypothesis $H_0 : c = \theta = 0$, write down the objective function for OLS estimation.

   (e) For the objective function in part (d), derive the OLS estimator of ϕ.

3. Consider the model $Y_t = \mu + \beta X_t + \varepsilon_t$, where *both* $\varepsilon_t \sim WN\left(0, \sigma_\varepsilon^2\right)$ and $X_t \sim WN\left(0, \sigma_x^2\right)$ are white noise sequences. Assuming that ε_t and x_t are uncorrelated 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. Suppose we are interested in modeling the federal funds rate (FFR). FFR is the interest rate at which private depository institutions lend balances at the Federal Reserve to other depository institutions, usually overnight. In other words, it is the interest rate banks charge each other for loans. We have a tenative model in mind and want to perform diagnostic checks to make sure the model is correctly specified. Consider the two EViews regression output tables listed below.

   (a) For the information in the EViews output, write out the null hypothesis for this test.

   (b) Give a brief explanation why this test is being performed?

   (c) If you fail to reject the null of this test, what do you conclude?

   (d) If you reject the null of this test, what do you conclude?

   (e) What is the next step in the Box-Jenkins methodology for parts (c) and (d)?

Dependent Variable: FFR
Sample (adjusted): 1960Q3 2005Q3
Included observations: 181 after adjustments
Convergence achieved after 54 iterations
Backcast: 1960Q1 1960Q2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.132360	1.432081	4.282132	0.0000
AR(1)	0.682867	0.471074	1.449597	0.1490
AR(2)	0.241307	0.432481	0.557961	0.5776
MA(1)	0.606427	0.473688	1.280225	0.2022
MA(2)	-0.045276	0.229946	-0.196898	0.8441

R-squared	0.923025	Mean dependent var	6.155470
Adjusted R-squared	0.921276	S.D. dependent var	3.337739
S.E. of regression	0.936499	Akaike info criterion	2.733898
Sum squared resid	154.3573	Schwarz criterion	2.822255
Log likelihood	-242.4178	F-statistic	527.6141
Durbin-Watson stat	2.002453	Prob(F-statistic)	0.000000

Dependent Variable: FFR
Sample (adjusted): 1960Q3 2005Q3
Included observations: 181 after adjustments
Convergence achieved after 39 iterations
Backcast: 1959Q1 1960Q2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.187277	0.923243	6.701676	0.0000
AR(1)	0.444451	0.186926	2.377689	0.0185
AR(2)	0.289135	0.177090	1.632700	0.1044
MA(1)	0.864227	0.174338	4.957204	0.0000
MA(2)	0.311643	0.122266	2.548898	0.0117
MA(3)	0.315123	0.107523	2.930739	0.0038
MA(4)	0.336925	0.103580	3.252812	0.0014
MA(5)	0.433578	0.101742	4.261547	0.0000
MA(6)	0.398218	0.074247	5.363396	0.0000

R-squared	0.929635	Mean dependent var	6.155470
Adjusted R-squared	0.926362	S.D. dependent var	3.337739
S.E. of regression	0.905738	Akaike info criterion	2.688312
Sum squared resid	141.1022	Schwarz criterion	2.847353
Log likelihood	-234.2922	F-statistic	284.0499
Durbin-Watson stat	2.035376	Prob(F-statistic)	0.000000