

Economics 413: Economic Forecast & Analysis

Department of Economics, Finance and Legal Studies

University of Alabama

Spring 2015

Midterm I

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

1. Consider the following data generating process

$$Y_t = c + \varepsilon_t$$

where 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 $j = 1, 2, \dots$. Note that j represents the number of periods between Y_t and Y_{t-j} .

2. Consider the following data generating process

$$Y_t = c + \phi_2 Y_{t-2} + \varepsilon_t$$

where ε_t is a white noise process. Assuming $0 < \phi_2 < 1$, answer the following:

- (a) Derive the expected value of this process.
- (b) Derive the variance of this process.
- (c) Derive the covariance of this process for $j = 1, 2, \dots$. Note that j represents the number of periods between Y_t and Y_{t-j} .
- (d) Derive the autocorrelation function of this process for $j = 1, 2, \dots$.
- (e) Plot the autocorrelation function with the information you derived above.

3. Consider the stability conditions for higher-order difference equations discussed in lecture. Specifically, consider the p th order difference equation

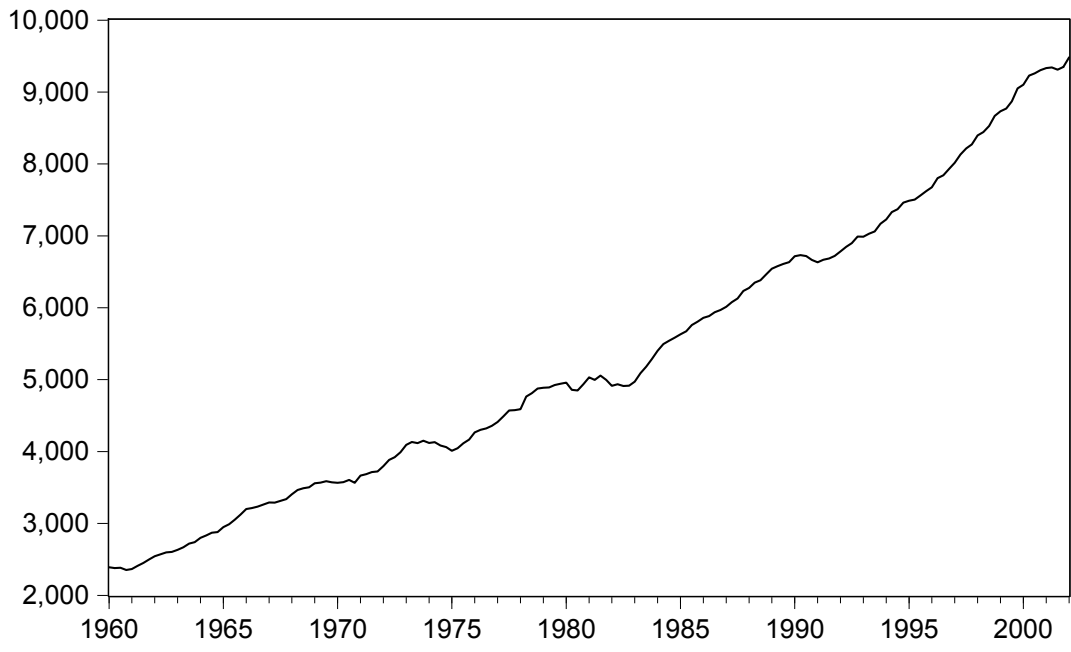
$$Y_t = c + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \cdots + \phi_p Y_{t-p} + \varepsilon_t.$$

With this model in mind, answer the following:

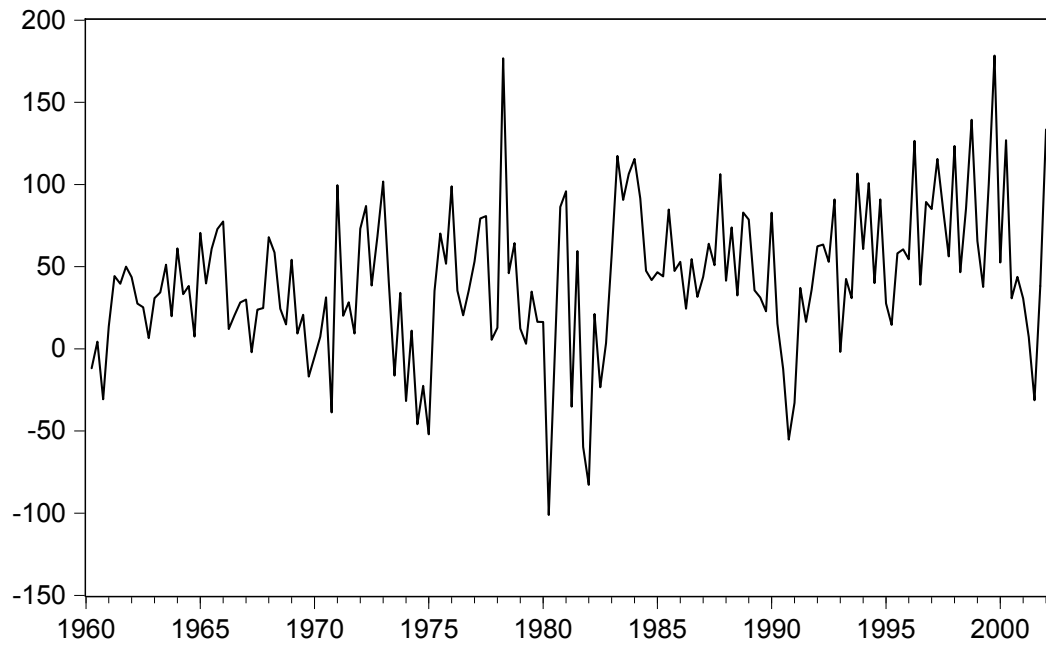
- (a) State the necessary condition for stability (i.e., stationary).
- (b) State the sufficient condition for stability (i.e., stationary).
- (c) State the sufficient condition for a unit root (i.e., nonstationary).
- (d) Give an example for case (a) *or* (b).
- (e) Give an example for case (c).

4. Consider the five pieces of EViews output below. Answer the following
- (a) Does the first time series appear stationary? Why or why not?
 - (b) Does the second time series appear stationary? Why or why not?
 - (c) The first correlogram corresponds to the time series in part (b). What type of underlying model does this suggest?
 - (d) What does the correlogram of the residuals (second correlogram) from the regression suggested in part (c) tell us about the assumptions of our model?
 - (e) Given your answer in part (d), what step is next in the Box-Jenkins methodology?

GDP



GDP1



Correlogram of GDP1

Date: 02/23/15 Time: 14:33
 Sample: 1960Q1 2002Q1
 Included observations: 168

| Autocorrelation | Partial Correlation | AC | PAC | Q-Stat | Prob |
|-----------------|---------------------|-----------|--------|--------|-------|
| | | 1 0.344 | 0.344 | 20.210 | 0.000 |
| | | 2 0.270 | 0.172 | 32.716 | 0.000 |
| | | 3 0.161 | 0.030 | 37.206 | 0.000 |
| | | 4 0.140 | 0.047 | 40.603 | 0.000 |
| | | 5 0.014 | -0.083 | 40.638 | 0.000 |
| | | 6 0.040 | 0.022 | 40.921 | 0.000 |
| | | 7 0.003 | -0.011 | 40.922 | 0.000 |
| | | 8 -0.064 | -0.083 | 41.663 | 0.000 |
| | | 9 0.128 | 0.208 | 44.610 | 0.000 |
| | | 10 0.111 | 0.057 | 46.851 | 0.000 |
| | | 11 0.038 | -0.069 | 47.109 | 0.000 |
| | | 12 -0.074 | -0.136 | 48.116 | 0.000 |
| | | 13 -0.006 | 0.003 | 48.123 | 0.000 |
| | | 14 -0.035 | 0.019 | 48.354 | 0.000 |
| | | 15 -0.095 | -0.085 | 50.044 | 0.000 |
| | | 16 0.070 | 0.171 | 50.956 | 0.000 |
| | | 17 -0.019 | -0.021 | 51.024 | 0.000 |
| | | 18 0.054 | 0.042 | 51.576 | 0.000 |
| | | 19 0.046 | -0.018 | 51.977 | 0.000 |
| | | 20 0.122 | 0.036 | 54.848 | 0.000 |
| | | 21 0.021 | 0.015 | 54.930 | 0.000 |
| | | 22 0.083 | 0.051 | 56.288 | 0.000 |
| | | 23 0.008 | -0.057 | 56.299 | 0.000 |
| | | 24 0.061 | 0.101 | 57.046 | 0.000 |
| | | 25 0.010 | -0.053 | 57.065 | 0.000 |
| | | 26 -0.057 | -0.127 | 57.711 | 0.000 |
| | | 27 -0.034 | -0.011 | 57.951 | 0.000 |
| | | 28 -0.009 | 0.070 | 57.967 | 0.001 |
| | | 29 0.033 | 0.037 | 58.196 | 0.001 |
| | | 30 -0.068 | -0.112 | 59.164 | 0.001 |
| | | 31 0.077 | 0.157 | 60.413 | 0.001 |
| | | 32 0.056 | 0.047 | 61.079 | 0.001 |
| | | 33 0.038 | -0.060 | 61.382 | 0.002 |
| | | 34 0.058 | 0.014 | 62.104 | 0.002 |
| | | 35 -0.038 | -0.085 | 62.415 | 0.003 |
| | | 36 -0.033 | 0.041 | 62.646 | 0.004 |

Correlogram of RESID

Date: 02/23/15 Time: 14:35
 Sample: 1960Q1 2002Q1
 Included observations: 166

| Autocorrelation | Partial Correlation | AC | PAC | Q-Stat | Prob | |
|-----------------|---------------------|----|--------|--------|--------|-------|
| | | 1 | 0.001 | 0.001 | 0.0002 | 0.990 |
| | | 2 | -0.011 | -0.011 | 0.0211 | 0.990 |
| | | 3 | 0.011 | 0.011 | 0.0429 | 0.998 |
| | | 4 | 0.039 | 0.038 | 0.2990 | 0.990 |
| | | 5 | -0.074 | -0.074 | 1.2476 | 0.940 |
| | | 6 | 0.007 | 0.008 | 1.2571 | 0.974 |
| | | 7 | -0.027 | -0.030 | 1.3877 | 0.986 |
| | | 8 | -0.161 | -0.161 | 5.9440 | 0.654 |
| | | 9 | 0.147 | 0.158 | 9.7967 | 0.367 |
| | | 10 | 0.123 | 0.117 | 12.493 | 0.253 |
| | | 11 | 0.036 | 0.044 | 12.732 | 0.311 |
| | | 12 | -0.124 | -0.124 | 15.518 | 0.214 |
| | | 13 | 0.029 | -0.010 | 15.673 | 0.267 |
| | | 14 | -0.022 | -0.009 | 15.760 | 0.328 |
| | | 15 | -0.122 | -0.126 | 18.523 | 0.236 |
| | | 16 | 0.113 | 0.126 | 20.876 | 0.183 |
| | | 17 | -0.047 | -0.010 | 21.297 | 0.213 |
| | | 18 | 0.026 | 0.056 | 21.427 | 0.258 |
| | | 19 | 0.023 | -0.006 | 21.526 | 0.308 |
| | | 20 | 0.120 | 0.031 | 24.259 | 0.231 |
| | | 21 | -0.028 | 0.020 | 24.408 | 0.274 |
| | | 22 | 0.078 | 0.080 | 25.574 | 0.270 |
| | | 23 | -0.036 | -0.054 | 25.826 | 0.309 |
| | | 24 | 0.063 | 0.128 | 26.598 | 0.324 |
| | | 25 | 0.015 | 0.012 | 26.640 | 0.374 |
| | | 26 | -0.081 | -0.103 | 27.940 | 0.361 |
| | | 27 | -0.036 | -0.064 | 28.199 | 0.401 |
| | | 28 | -0.005 | 0.031 | 28.204 | 0.454 |
| | | 29 | 0.056 | 0.042 | 28.839 | 0.473 |
| | | 30 | -0.127 | -0.142 | 32.157 | 0.360 |
| | | 31 | 0.103 | 0.122 | 34.345 | 0.310 |
| | | 32 | 0.048 | 0.075 | 34.819 | 0.335 |
| | | 33 | 0.010 | -0.016 | 34.838 | 0.381 |
| | | 34 | 0.077 | 0.055 | 36.082 | 0.371 |
| | | 35 | -0.056 | -0.090 | 36.748 | 0.388 |
| | | 36 | -0.043 | 0.022 | 37.142 | 0.416 |