AFRICAN ECONOMIC RESEARCH CONSORTIUM

Collaborative MA Programme in Economics for Anglophone Africa (Except Nigeria)

JOINT FACILITY FOR ELECTIVES
JUNE – OCTOBER 2005

ECONOMETRICS THEORY & PRACTICE

First Semester: Final Examination

Time: 09.00 AM – 12.00 Noon **Monday August 8, 2005**

INSTRUCTIONS: Answer FOUR Questions

Question 1.

Given the model

$$y_t = const. + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + \beta_0 x_t + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \varepsilon_t$$

where ε_t is a white noise process,

a) Explain how you would test for common factors in this model. ***(8 marks).***

b) Suppose that your test suggests presence of one common factor, show what modifications are required to estimate the static regression

$$y_t = const. + \beta x_t + u_t$$

where $u_t = \rho u_{t-1} + \varepsilon_t$ and $|\rho| < 1$. ***(7 marks).***

Question 2.

Suppose a random variable Y is sampled from a gamma distribution with the density function

$$f(y_i) = \frac{\lambda^p y_i^{p-1}}{\Gamma(p)} e^{-\lambda y_i} \qquad y>0,\ p>0,\ \lambda>0.$$

Use the generalised method of moments (GMM) to estimate the unknown population parameters λ and *p*, given the sample information $1/n\sum_{i=1}^{n} y_i = 31.28$ and $1/n\sum_{i=1}^{n} y_i^2 = 1453.96$. ***(15 marks).***

Question 3.

a) Use the order and rank conditions to determine identification of the equations in the simultaneous equations model

$$\begin{aligned} y_{1,t} &= \alpha_0 + \alpha_1 y_{2,t} + \alpha_2 y_{1,t-1} + u_{1,t} \\ y_{2,t} &= \beta_0 + \beta_1 y_{1,t} + \beta_2 y_{2,t-1} + \beta_3 y_{2,t-2} + \beta_4 y_{2,t-3} + u_{2,t} \end{aligned}$$

where $y_{1,t}$ and $y_{2,t}$ are both endogenous variables in period t. How would your identification change if the variable $y_{2,t-3}$ in the second equation was replaced by $y_{1,t-1}$? ***(5 marks).***

b) What is the reduced form of the above model? Give an interpretation of the parameters in the reduced form. ***(5 marks).***

c) In the general simultaneous equations model define the two- and three-stage least squares methods and show that they are instrumental methods. Under what assumptions the estimator of the two-stage least squares method reduces to the three-stage least squares estimator? ***(5 marks).***

Question 4.

a) Write down the three requirements for weak or covariance stationarity. ***(3 marks).***

b) Show that stationarity of the first-order autoregressive process

$$y_t = \alpha_1 y_{t-1} + \varepsilon_t$$

implies that the variance of the moving average representation is finite, while the finite moving average process

$$y_t = \varepsilon_t + \theta\varepsilon_{t-1}$$

is stationary regardless of the invertibility of its polynomial. Also show that stationarity of the autoregressive-moving average process

$$y_t = \alpha y_{t-1} + \varepsilon_t + \theta\varepsilon_{t-1}$$

requires satisfaction of the inversion condition for the polynomial of the autoregressive part coefficients. ***(7 marks).***

c) Discuss the basic steps in the Box-Jenkins approach to analyse and estimate autoregressive-moving average (ARMA) models. ***(5 marks).***

Question 5.

a) Write down the augmented Dickey-Fuller test equation for testing unit root. ***(3 marks).***

b) Unit root test for some variable y_t over the period 1953-1992 is conducted with a constant, a trend, and two lags using PcGive. The programme output is reported below. Interpret the results and determine the stationarity of *y*.

Augmented Dickey-Fuller test for y; regression of Dy on:

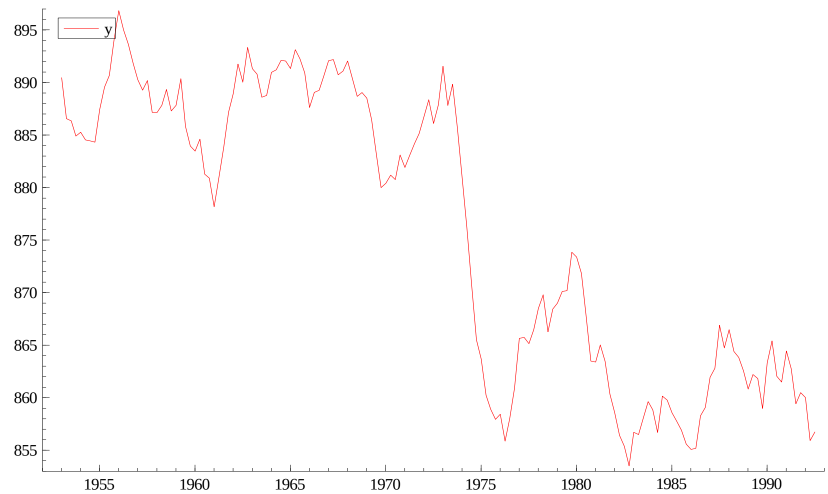
	Coefficient	**Std.Error**	**t-value**
y_1	-0.075370	0.024838	-3.0345
Constant	67.597	22.278	3.0343
Trend	-0.020836	0.0073486	-2.8354
Dy_1	0.18609	0.078881	2.3592
Dy_2	0.18115	0.079962	2.2654

sigma = 2.10837 DW = 2.051 DW-y = 0.02653 ADF-y = -3.034

Critical values used in ADF test: 5%=-3.439, 1%=-4.019

RSS = 671.2294174***. (6 marks).***

c) The time profile of y is plotted below. What peculiar behaviour you can detect from the graph? Does this behaviour affect the unit-root test results found above? If it does, what specification of the test you suggest that can account for such behaviour? ***(6 marks).***



Question 6.

Let y_t be an (px1) vector of variables observed in period t. Assume all p variables are integrated of order one.

a) Write down a general vector autoregressive (VAR) model for y_t and rewrite this in a vector error correction (VEC) form. What are the advantages of the VAR modelling over simultaneous equations modelling? ***(4 marks).***

b) Set out the Johansen procedure for testing for the number of cointegrating vectors in y_t. ***(5 marks).***

c) Discuss the implications of the orthogonalisation process in the context of the VAR modelling and then derive the impulse response functions assuming a two-equation VAR (1). ***(6 marks).***