KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2017/2018
FIRST SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF ECONOMICS

EES 804: MACROECONOMETRICS

DATE: Monday, 27th November, 2017 TIME: 2.00 p.m. - 5.00 p.m.

INSTRUCTIONS: Answer **ALL** questions.

Question 1

A. What is a VAR model? ***(1 Mark)***

B. Consider a first order vector autoregression denoted VAR(1) written as:

$$x_t = A_0 + A_1 x_{t-1} + e_t$$

$E(e_t) = 0, E(\varepsilon_t \varepsilon_t') = \begin{Bmatrix} \Omega & for\ t \sim \tau \\ 0 & otherwise \end{Bmatrix}$, Ω is symmetric positive definite matrix

Where,

x_t= an (n×1) vector of n variables

A_0= an (n×1) vector of intercept terms

A_1 = n×n matrices of coefficients

e_t = an (n×1) vector of error termsthat may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables

Illustrate that under stationarity, the first order vector autoregression above can be written as a vector moving average ***(6 marks)***

C. The vector moving average(VMA) representation is an essential tool to examine interaction among the variables. Letting Y_t to be Consumption and Z_t to be income, the VAR(p) model may be written as:

$$\begin{bmatrix} Y_t \\ Z_t \end{bmatrix} = \begin{bmatrix} \bar{y} \\ \bar{z} \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \phi_{11}^{(i)} & \phi_{12}^{(i)} \\ \phi_{21}^{(i)} & \phi_{22}^{(i)} \end{bmatrix} \begin{bmatrix} e_{yt-i} \\ e_{zt-i} \end{bmatrix}$$

Derive the n-step ahead forecast variance of Y_t sequence. ***(5 Marks)***

D. The variance decomposition percentage for a ten year forecasting horizon are reported below. The numbers in parenthesis indicate the significance level for the joint hypothesis that all lagged coefficients of the variable in question can be set to zero.

Percent forecast error variance in	Typical shock in		
	Financial Deepening	Interest rates	Financial savings
Financial Deepening	96.03(0.001)	25.65(17.23)	9.51(0.0002)
Interest rates	1.22(93.9)	71.18(0.207)	5.82(0.000)
Financial savings	2.76(0.109))	3.17(0.000)	84.68(20.2)

i) Interpret the variance decomposition results for the financial deepening series **(2 marks)**

ii) What can you conclude about the effects of financial savings on financial deepening and financial deepening on financial savings? **(2 marks)**

Question 2

A. What do you understand by the term stationarity and strict stationarity in a stochastic process? ***(4 marks)***

B. Show how DF unit root test is derived using the random walk process hypothesis***(5 Marks)***

C. Consider the following second order stochastic difference equation:

$$y_t = 1.5y_{t-1} - 0.5y_{t-2} + \varepsilon_t \qquad (1)$$

where ε_t is a white noise process.

Given the initial conditions for y_0 and y_1, find the solution for y_t in terms of the current and past values of the ε_t sequence **(6 marks)**

Question3

A. Given $\varepsilon_t = v_t\sqrt{\alpha_0 + \alpha_1\varepsilon_{t-1}^2}$

where v_t is white noise, E(v_t)=0, var(v_t) = σ_v^2 =1

v_t is independent of ε_{t-1}, α_0 and α_1 are constants such that $\alpha_0 > 0$ and $0 < \alpha_1 > 1$

i) Derive the unconditional expectation of ε_t ***(2 Marks)***

ii) Derive the unconditional variance **(3 Marks)**

B. The equations below models the logarithmic change of Africa's stock exchange composite index. h_t is the variance of the white noise disturbance term ε_t. I_{t-1} is a dummy variable that takes the value of 1 if $\varepsilon_{t-1} \angle 0$ 0 if $\varepsilon_{t-1} \geq 0$.

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \lambda_1 I_{t-1} \varepsilon_{t-1}^2 + \beta_1 h_{t-1} \quad (1)$$

$$ln(h_t) = \alpha_0 + \alpha_1 (\varepsilon_{t-1} / h_t^{0.5}) + \lambda_1 \left| \varepsilon_{t-1} / h_t^{0.5} \right| + \beta_1 ln(h_{t-1}) \quad (2)$$

The estimated regression for the above models are as follows.

$$h_t = \underset{(6.48)}{1.81E-6} - \underset{(-0.662)}{0.0064}\, \varepsilon_{t-1}^2 + \underset{(12.33)}{0.1947}\, I_{t-1} \varepsilon_{t-1}^2 + \underset{(96.85)}{0.8937}\, h_{t-1} \quad (1a)$$

$$ln(h_t) = \underset{(-9.61)}{-0.4321} - \underset{(-13.71)}{0.1553} (\varepsilon_{t-1} / h_t^{0.5}) + \underset{(7.72)}{0.1263} \left| \varepsilon_{t-1} / h_t^{0.5} \right| + \underset{(230.71)}{0.9646}\, ln(h_{t-1}) \quad (2a)$$

i) Why is Model 1 unsatisfactory? ***(1 mark)***

ii) Is it possible to re-estimate Model 1 without the variable ε_{t-1}^2? Explain. ***(2 marks)***

iii) What does the value of λ_1 coefficient in Model 1 imply?. ***(2 marks)***

iv) What would you conclude about the data based on model 1 results? Explain ***(2 marks)***

v) Is model 2 satisfactory? Explain ***(2 marks)***

vi) An analyst found that the test restriction $\alpha_1 + \lambda_1 = 0$ in Model 2 had a *probability*-value of 0.991. What does this imply? ***(1 marks)***

Question 4

A. For a financial development indicator autoregressive distributed lag model (ARDL), the error correction form is given by:

$$\Delta \log FD_t = b_{10} + \sum_{i=1}^{n} b_{1i} \Delta \log FD_{t-1} + \sum_{i=1}^{n} b_{2i} \Delta logR + \sum_{i=1}^{n} b_{3i} \Delta logGDP + \gamma ECT_{t-1} + u_t$$

where ECT_{t-1} is the lagged error correction term derived from the long-run co-integration model, Δ denotes the first difference operator, FD is a financial development indicator, GDP is economic growth and R is real interest rate. Applying annual data from Kenya National Bureau of Statistics over the period 1972–2008, the following ARDL cointegrating and long run form was estimated:

ARDL Cointegrating And Long Run Form
Dependent Variable: LOG_FD
Selected Model: ARDL(1, 0, 4)

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ(LOG_R)	-0.043586	0.052929	-0.823475	0.4180
Δ (LOG_GDP)	-0.482054	0.147765	-3.262303	0.0032
Δ (LOG_GDP(-1))	0.209551	0.155495	1.347638	0.1899
Δ (LOG_GDP(-2))	0.385934	0.187647	2.056698	0.0503
Δ (LOG_GDP(-3))	0.394184	0.246498	1.599134	0.1224
ECT(-1)	-0.539584	0.120832	-4.465573	0.0001

Cointegrating equation = LOG_FD - (-0.1137*LOG_R + 0.0529*LOG_GDP -0.7036)

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_R	-0.113681	0.057062	-1.992227	0.0574
LOG_GDP	0.052872	0.019341	2.733702	0.0113
C	-0.703648	0.089605	-7.852815	0.0000

i. What does the γ-coefficient indicate? ***(1 mark)***

ii. Does the γ-coefficient have the expected sign in the estimated model ? ***(2 marks)***

iii. Interpret the error correction term coefficient for the model ***(2 marks)***

iv. Does the model demonstrate an error correction mechanism? Justify your answer . ***(2 marks)***

v. An analyst carried out an ARDL bounds test for the estimated model and obtained the following results:

ARDL Bounds Test
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K(Restrictions)
F-statistic	4.950297	2
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.63	3.35
5%	3.1	3.87
1%	4.13	5

Does the model exhibit a long run relationship? Justify your answer ***(3 marks)***

B. In a study of the demand for money in Sub-Saharan Africa, the following equation was estimated:

$$m_t = u + \emptyset m_{t-1} + \partial_1 I_t + \partial_2 r_{bt} + \partial_3 r_{ct} + \varepsilon_t$$

where;

m_t = Logarithm of real money holdings

I_t = Logarithm of aggregate real income

r_{bt} = Interest rates on bank accounts

r_{ct} = Logarithmof interest rates on commercial paper (T bills and bonds)

ε_t = Error term

Using quarterly data, the estimated function was as follows:

$$m_t = 0.27 + 0.72m_{t-1} + 0.19I_t - 0.45r_{bt} - 0.019r_{ct}$$

What will happen to the money demand two quarters from now, if current income were to increase by one unit with future income $I_{t+1}$and I_{t+2}unaffected? ***(5 marks)***