School of Economics

College of Business and Economics

FINAL ASSESSMENT: JULY 2019

Course	:	Econometrics 4A (EKN4814, ECM8X01)
Moderator	:	Dr A Pholo
Date	:	July 2019
Time	:	180 minutes
Marks	:	100 points

Question 1 (10 pts)

Find the particular solution of the following equation $y_t = a_0 + a_1 y_{t-1} + \epsilon_t + \beta_1 \epsilon_{t-1}$ by the method of undetermined coefficients.

Question 2 (10 pts)

Consider the stochastic process $y_t = a_0 + a_2 y_{t-2} + \varepsilon_t$

1. Find the homogeneous solution and determine the stability condition.

2. Find the particular solution using the Method of Undetermined Coefficients.

3. Show that lag operators yield the same solution.

Question 3 (10 pts)

- Explain what is the conceptual difference between the partial autocorrelation function (PACF) and the autocorrelation function. How to formally derive the PACF of an AR(1) process?

- What is the expression of the Ljung-Box Q-statistic. Describe formally and intuitively what are the null and alternative hypothesis implied by this test statistic.

Question 4 (5 pts)

Regarding the Box-Jenkins approach:

1. What are the goodness of fit criteria recommended? Explain why;

2. Explain the Post-estimation Evaluation Procedure.

Question 5 (15 pts)

The file QUARTERLY.XLSX contains a number of series including the U.S. index of industrial production (*indprod*), unemployment rate (*unemp*), and the core CPI (*cpicore*). All of the series run from 1960Q1 to 2012Q4.

Exercise with *indprod* (4 pts)

1. Construct the growth rate of the series as $y_t = \log(indprod_t) - \log(indprod_{t-1})$.

2. Find the most suitable ARMA model for y_t.

Exercise with *unemp* (4 pts)

1. Construct the first difference of the series.

2. Find the most suitable ARMA model for the first difference of *unemp*.

Exercise with *cpicore* (7 pts)

1. Construct the inflation rate as measured by the core CPI as $dly_t = \log(cpicore_t) - \log(cpicore_{t-1})$. Form the ACF and PACF of the series. Would a Box–Jenkins modeler want to work with the first or the second difference of the logarithm of the core CPI?

2. Depending on your last answer, find the best ARMA model for either the first difference (dly_t) or the second difference ($d2ly_t$).

Question 6 (5 pts)

Define the general trend plus irregular model by its mathematical expressions. Describe and explain the different trend and stationary components of this model.

Question 7 (10 pts)

Using the data on the file RGDP.XLS test, test the stationarity of the logarithm of the real GDP (using the equation with an intercept and a time trend). Then, test the joint hypothesis that $\gamma = a_2 = 0$. Interpret your results.

Question 8 (10 pts)

The file Y-BREAK.XLS contains 150 observations of the simulated series $y_t = 1 + 0.5y_{t-1} + \varepsilon_t$ for $t < 101$ and $y_t = 2.5 + 0.65y_{t-1} + \varepsilon_t$ for $t \geq 101$. Using an AR(1) model, check the hypothesis of the occurence of a structural break:

1. with a Chow test. Is this approach relevant?

2. with an alternative test for structural change on the intercept and the slope parameter.

Question 9 (10 pts)

Derive formally the stability and the stationarity conditions of a bivariate VAR system in standard form.

Question 10 (15 pts)

In order to estimate the dynamic effects of aggregate demand and supply shocks on industrial production and the inflation rate, create from the file entitled QUARTERLY.XLS the logarithm change in the index of industrial production (indprod) as $\Delta lip_t = \ln(\text{indprod}_t) - \ln(\text{indprod}_{t-1})$ and the inflation rate (as measured by the CPI) as $\text{inf}_t = \log(\text{cpi}_t) - \log(\text{cpi}_{t-1})$.

1. Estimate the two-variable VAR using three lags of each variable and a constant. Determine the optimal lag length for the different criteria: AIC, SBC and the general-to-specific method.

2. Perform the Granger causality tests and discuss the results.

3. Using a Choleski decomposition such that Δlip_t is causally prior to inf_t: determine the impact of positive shocks to industrial production and inflation.