4620620056/460152E006 Applied Econometric Methods II

Aarhus University, Business and Social Sciences

February, 2016

- The exam consists of two problems. To each problem a weight is given. You may consider these weights as rough guidelines.
- This is an open-book examination, i.e., all supplementary material (textbook, handouts, etc.) is allowed.
- Handwritten attachments are allowed.

Problem 1 (weight=80%).

In the EViews workfile sp500.wf1, you can find two series. *div* is dividends paid out on the S&P 500 index, whereas *e* is earnings on the S&P 500 index. Both series are in logs. The annual sample period is from 1871 to 2014.

a) Run the following regression:

$$div_t = \alpha + \beta t + \gamma t^2 + \varepsilon_t$$

where t is a linear time trend. Based on a plot of the residuals from the regression, explain whether it is likely that *div* is trend stationary.

b) Run the regressions:

$$\begin{aligned} \Delta div_t &= \alpha + \rho div_{t-1} + \sum_{i=1}^{2} \beta_i \Delta div_{t-i} + \varepsilon_t \\ \Delta^2 div_t &= \alpha + \rho \Delta div_{t-1} + \beta \Delta^2 div_{t-1} + \varepsilon_t \end{aligned}$$

In both cases, test the null hypothesis that $\rho = 0$. Explain whether *div* is I(0) or I(1).

c) Assume that both *div* and *e* are I(1). Regress *div* on a constant and *e*. Then test whether they are cointegrated.

d) Run the following two regressions:

$$\begin{aligned} \Delta div_t &= \alpha + \beta coin_{t-1} + \varepsilon_t \\ \Delta e_t &= \alpha + \beta coin_{t-1} + \varepsilon_t \end{aligned}$$

where *coin* is the cointegrating residual from question c. Carefully explain the implications of the regression results.

e) Suggest an appropriate ARMA(p,q) model for *coin*. Explain whether *coin* is slow or fast to mean revert.

f) Use the Q-statistic to test for ARCH effects in your suggested model from question e.

g) Run the following command in EViews: genr y = d(div) < 0. This will generate a variable, y, that is equal to 1 if the log change in dividends is negative and 0 otherwise. Then run the regression:

$$y_t = \beta_1 + \beta_2 \Delta div_{t-1} + \beta_3 \Delta e_{t-1} + \varepsilon_t$$

Make a plot of the fitted and actual values of y_t. Comment on the results.

h) Estimate the following model:

$$P\left(y_t = 1 \mid x_{t-1}\right) = F\left(x_{t-1}'\beta\right)$$

where $x_{t-1} = \left(1, \Delta div_{t-1}, \Delta e_{t-1}\right)'$, $\beta = \left(\beta_1, \beta_2, \beta_3\right)'$, and $F(\cdot)$ is the standard logistic distribution function. Comment on the signs of the estimated coefficients. What is the pseudo R^2 of the model?

i) Write down the loglikelihood function of the model from question h.

j) Explain whether the model in h was able to predict the drop in dividends in 2009.

k) Based on the model in h, compute the marginal effect of a change in Δdiv_{t-1}.

l) Based on the model in h, what is the probability that the log change in dividends is positive in 2015?

Problem 2 (weight=20%).

Consider the data generating process:

$$z_i = \left(1 + w_i\right)^{-\gamma} + u_i$$

where the variable w_i is iid $N\left(0, 0.05^2\right)$, the error term u_i is iid $N(0,1)$, and the parameter γ is equal to 25.

a) Write down a program that simulates 10000 observations from the model.

b) Run the program and use the simulated data to estimate γ using GMM. As moment condition, you should use $E\left(u_i\right) = 0$. Comment on the value of the J-statistic.

c) Explain whether it is possible to estimate γ using OLS and maximum likelihood.