DOTTORATO DI RICERCA IN ECONOMIA POLITICA (XII CICLO)
Econometrics Test (19/07/2011)

Name: ____________________

1. Say if the following statements are unambiguously true (TRUE), unambiguously false (FALSE) or impossible to classify the way they are stated (CAN'T SAY). Write the motivations to your answers **only** in the space provided. Answers with no motivations will not be considered.

   (a) In instrumental variable estimation, you should always use as many instruments as possible.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (b) The OLS and ML estimators can be seen as a special case of the GMM estimator.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (c) For the probit model, the ML estimator always exists.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (d) In the Heckman sample selection model, the explanatory variables used in the selection equation should not be used in the main equation.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (e) The stationarity of the GARCH(1,1) process $h_t = \alpha_0 + 0.15\varepsilon^2_{t-1} + 0.8h_{t-1}$ does not depend on the value of α_0.
   TRUE ○ FALSE ○ CAN'T SAY ○

2. Suppose you observe an iid sample of variables y_i whose Data Generating Process is as follows: with probability p, $y_i \sim N(0,1)$; otherwise, $y_i \sim N(\mu, 1)$. Alternatively, you may think y_i as

$$y_i = d_i \cdot \mu + \varepsilon_i$$

where d_i is an unobservable Bernoulli rv, ε_i is a standard normal rv and ε_i and d_i are independent.

(a) Show that the density function for y_i can be written as

$$f(y_i; p, \mu) = p\varphi(y_i) + (1-p)\varphi(y_i - \mu)$$

where $\varphi(x) = \frac{\exp\{-x^2/2\}}{\sqrt{2\pi}}$.

(b) Find analytical expressions for $E(y_i)$ and $V(y_i)$.

(c) Find method-of-moments estimators for μ and p.

(d) Find the first-order conditions for the maximisation of the likelihood.

(e) Can you think of any problems in testing the hypothesis $\mu = 0$? (*Hint: show that under H_0 the information matrix becomes singular*).

3. The estimates below refer to to a VAR(2) model with constant for the log of oil price (`oil`) and the log of the price of Diesel fuel (`diesel`). The series are shown in figure 1.

(a) Discuss the model as a statistical representation of the data.

(b) Assuming that the model is statistically valid, discuss its economic implications.

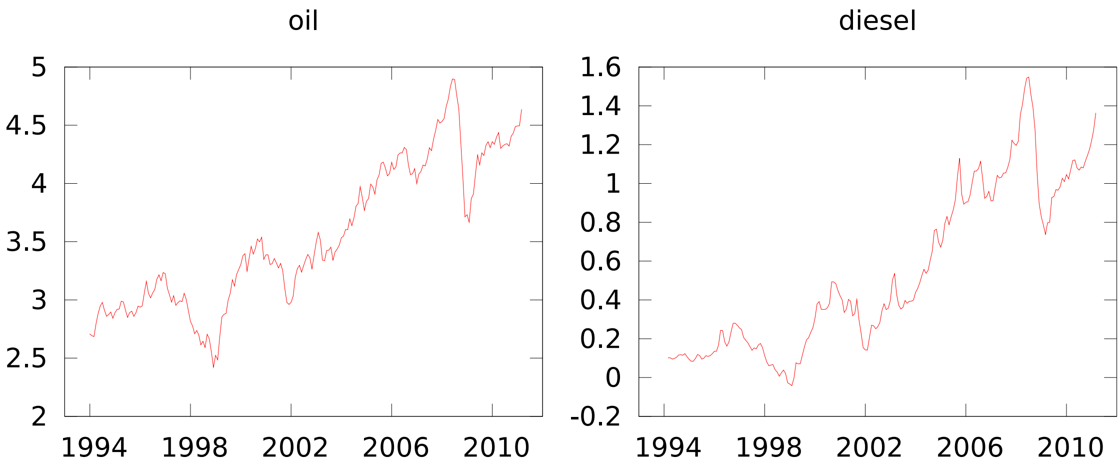

Figure 1: Oil and diesel data

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Johansen test: number of equations = 2, lag order = 2
Estimation period: 1994:05 - 2011:03 (T = 203)
Case 3: Unrestricted constant

Rank Eigenvalue Trace test  p-value  Lmax test  p-value
   0    0.11392     25.599 [0.0008]     24.552 [0.0006]
   1  0.0051425     1.0466 [0.3063]     1.0466 [0.3063]
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VECM system, lag order 2
Maximum likelihood estimates, observations 1994:05-2011:03 (T = 203)
Cointegration rank = 1, Case 3: Unrestricted constant
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beta (cointegrating vectors, standard errors in parentheses)

diesel      -1.0000
            (0.0000)
oil          0.70875
          (0.019297)

Equation 1: d_diesel

              coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------
  const        -0.377182     0.0917641    -4.110    5.77e-05 ***
  d_diesel_1    0.0687502    0.0748036     0.9191   0.3592
  d_oil_1       0.220719     0.0480009     4.598    7.57e-06 ***
  EC1           0.192819     0.0465174     4.145    5.02e-05 ***

Mean dependent var   0.006210   S.D. dependent var   0.049330
Sum squared resid    0.301077   S.E. of regression   0.038897
R-squared            0.387507   Adjusted R-squared   0.378273
rho                 -0.003854   Durbin-Watson        1.979415

Ljung-Box Q' = 18.8874 with p-value = P(Chi-square(12) > 18.8874) = 0.0913

Test for ARCH of order 1:
Test statistic: LM = 4.42087, p-value = P(Chi-square(1) > 4.42087) = 0.0355019

Equation 2: d_oil

              coefficient   std. error   t-ratio   p-value
  --------------------------------------------------------
  const        -0.144920     0.194381     -0.7455   0.4568
  d_diesel_1   -0.129578     0.158454     -0.8178   0.4145
  d_oil_1       0.254695     0.101679      2.505    0.0131  **
  EC1           0.0771496    0.0985362     0.7830   0.4346

Mean dependent var   0.009055   S.D. dependent var   0.084498
Sum squared resid    1.350948   S.E. of regression   0.082393
R-squared            0.063318   Adjusted R-squared   0.049197
rho                 -0.032623   Durbin-Watson        2.046421

Ljung-Box Q' = 12.2832 with p-value = P(Chi-square(12) > 12.2832) = 0.423

Test for ARCH of order 1:
Test statistic: LM = 16.741, p-value = P(Chi-square(1) > 16.741) = 4.28454e-05
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Test of restrictions on cointegrating relations
Restriction set
 1: b[1] = -1
 2: b[2] = 1

Unrestricted loglikelihood (lu) = 660.22865
Restricted loglikelihood (lr) = 651.57702
2 * (lu - lr) = 17.3033, P(Chi-square(1) > 17.3033) = 3.18638e-05
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