DOTTORATO DI RICERCA IN ECONOMIA POLITICA (XII CICLO)
Econometrics test (28/11/2011)

Nome: ______________________________

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) If x is a $n \times 1$ column vector, then the square symmetric matrix xx' has full rank.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (b) If $\varepsilon_t \sim WN(0, \Sigma)$, the covariance matrix Σ is diagonal.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (c) The White test for heteroskedasticity can be seen as a Lagrange Multiplier (LM) type test.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (d) The parameters for the logit model cannot be estimated by the OLS method.
   TRUE ○ FALSE ○ CAN'T SAY ○

   (e) The GLS estimator is generally more efficient than the OLS estimator.
   TRUE ○ FALSE ○ CAN'T SAY ○

2. All the production functions in a sample of $N = 500$ enterprises are given by the following Cobb-Douglas equation

$$Y_i = AL_i^{\alpha}K_i^{\beta},$$

in which we assume $A = 1$. The variable Y_i is the total amount of production by the i-th firm and the production factors are labour ($L_i > 0$) and capital ($K_i > 0$). The total sample is split into two subsamples containing $N_1 = 50$ large firms and $N_2 = 450$ small- and medium-size firms. Other data are provided in the following Table.

subsample	n	$\sum_{i=1}^{n} y_i^2$	$\sum_{i=1}^{n} l_i^2$	$\sum_{i=1}^{n} \kappa_i^2$	$\sum_{i=1}^{n} l_i y_i$	$\sum_{i=1}^{n} \kappa_i y_i$	$\sum_{i=1}^{n} l_i \kappa_i$
large	50	200000	80000	100000	64000	80000	40000
SMEs	450	300900	50000	80000	33000	42000	20000

$y_i = \ln Y_i$, $l_i = \ln L_i$ and $\kappa_i = \ln K_i$ for each i.

The OLS estimates for the entire sample are $\hat{\alpha} = 0.512$ and $\hat{\beta} = 0.508$, while the OLS estimates for the second subsample are $\hat{\alpha}_1 = 0.5$, and $\hat{\beta}_1 = 0.4$. The SSR for the whole sample is 28035.

(a) Compute the OLS estimator of α and β for the subsample 1.

(b) Calculate a suitable test for the presence of a break between different categories of enterprises. The SSR in sample 1 is 8000, while the SSR in sample 2 is 17000.

Test: ____________ Distribution: ________ Test stat.: ______________
Result: ACCEPT ○ REJECT ○

(c) Test the hypothesis of constant return to scale in subsample 2.

H_0 : ____

Test: ____________ Distribution: ________ Test stat.: ______________
Result: ACCEPT ○ REJECT ○

3. Let x_t, y_t and w_t be the 1-year, 5-year, and 10-year US Treasury Constant Maturity rates, respectively. Their time path is depicted in Figure 1 and a few results are reported in Tables 1 and 2. A dummy variable `crisis` is set in 2008:12 to account for some relevant effects of the subprime crisis.

(a) Write *Model 2* in ECM form (d_t contains the constant, the trend and the dummy).

$\Delta w = d_t +$ ____

(b) Test, if possible, the restrictions imposed by *Model 1* to *Model 2*.

○ NO: it is not possible to carry out a test statistic (provide a motivation)

○ YES: it is possible (carry out the test)

Test: ____________ Distribution: ________ Test stat.: ______________
Result: ACCEPT ○ REJECT ○

(c) Provide some comments on the estimates.

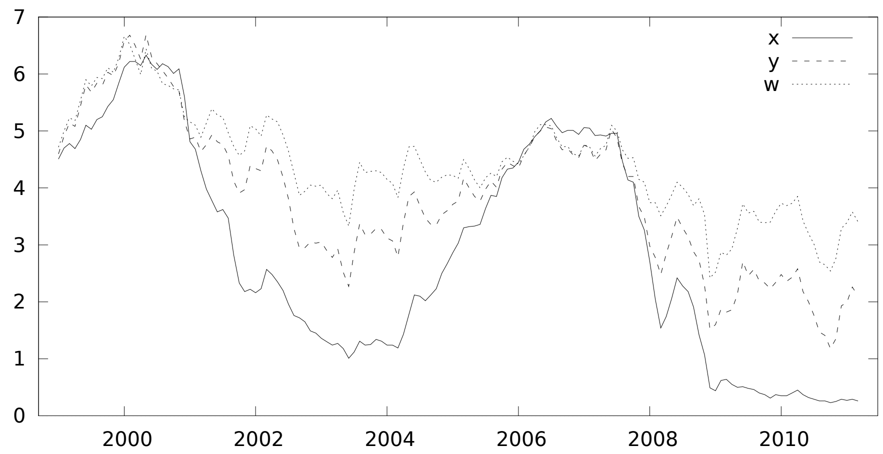

Figure 1: US rates

Table 1: Model 1

```
OLS, using observations 1999:01-2011:03 (T = 147)
Dependent variable: w

             coefficient   std. error    t-ratio    p-value
  ---------------------------------------------------------
  const       1.44620      0.13638       10.60     1.03e-19 ***
  time       -0.00049      0.00033      -1.470     0.1439
  crisis     -0.27283      0.10264      -2.658     0.0088   ***
  x          -0.24464      0.01494      -16.37     1.63e-34 ***
  y           0.99242      0.02640       37.59     1.11e-75 ***

Mean dependent var   4.432381   S.D. dependent var   0.906030
Sum squared resid    1.426852   S.E. of regression   0.100241
R-squared            0.988095   Adjusted R-squared   0.987759
F(4, 142)            2946.362   P-value(F)           1.7e-135
Log-likelihood       132.0857   Akaike criterion    -254.1714
Schwarz criterion   -239.2193   Hannan-Quinn        -248.0962
rho                  0.807056   Durbin-Watson        0.381588


Breusch-Godfrey test for autocorrelation up to order 4
  Test statistic: LMF = 73.364391, p-value = P(F(4,138) > 73.3644) = 3.32e-33
  Alternative statistic: TR^2 = 99.982630, p-value = P(Chi-square(4) > 99.9826) = 9.92e-21

Ljung-Box of order 4
  Test statistic Q' = 188.83, p-value = P(Chi-square(4) > 188.83) = 9.46e-40

Test for ARCH of order 4
  Test statistic: LM = 42.1923, p-value = P(Chi-square(4) > 42.1923) = 1.52183e-08

Test for normality of residuals:
x  Jarque-Bera test = 0.347175, p-value 0.840644

Augmented Dickey-Fuller test for residuals
including 12 lags - sample size 134
  Test with constant: tau_c(1) = -3.19336, asymptotic p-value 0.02041
  Test with constant and trend: tau_ct(1) = -4.28773, asymptotic p-value 0.003225

KPSS test for residuals (without trend)
T = 147 - Lag truncation parameter = 5
  Test statistic = 0.144621 (critical values: 0.349 [10%], 0.464 [5%], 0.737[1%])
```

Table 2: Model 2

```
OLS, using observations 1999:01-2011:03 (T = 147)
Dependent variable: x

             coefficient   std. error  t-ratio    p-value 
  ---------------------------------------------------------
  const       0.22712      0.09685      2.345     0.0204   **
  time        0.00001      0.00018      0.065     0.9479  
  crisis     -0.46914      0.05599     -8.379     5.26e-14 ***
  w_1         0.82859      0.04622      17.93     5.75e-38 ***
  x          -0.28031      0.03259     -8.602     1.49e-14 ***
  x_1         0.24014      0.03013      7.970     5.17e-13 ***
  y           1.00289      0.02740      36.61     3.00e-73 ***
  y_1        -0.83420      0.05143     -16.22     7.22e-34 ***

Mean dependent var   4.432381   S.D. dependent var   0.906030
Sum squared resid    0.390249   S.E. of regression   0.052986
R-squared            0.996744   Adjusted R-squared   0.996580
F(7, 139)            6078.499   P-value(F)           1.7e-169
Log-likelihood       227.3741   Akaike criterion    -438.7481
Schwarz criterion   -414.8247   Hannan-Quinn        -429.0278
rho                  0.076166   Durbin's h           1.109458

Godfrey test for autocorrelation up to order 4
  Test statistic: LMF = 0.935694, p-value = P(F(4,135) > 0.935694) = 0.445
  Alternative statistic: TR^2 = 3.965524, p-value = P(Chi-square(4) > 3.96552) = 0.411

Ljung-Box of order 4
  Test statistic Q' = 3.41761, p-value = P(Chi-square(4) > 3.41761) = 0.491

Test for ARCH of order 4
  Test statistic: LM = 6.71653, p-value = P(Chi-square(4) > 6.71653) = 0.151648

Test for normality of residuals:
 Jarque-Bera test = 3.38441, p-value 0.184113

Dickey-Fuller test for residuals
sample size 146
  Test with constant: tau_c(1) = -11.2196, p-value 2.334e-17
  Test with constant and trend: tau_ct(1) = -11.1819, p-value 2.702e-16

KPSS test for e2 (without trend)
T = 147 - Lag truncation parameter = 5
  Test statistic = 0.0890061 (critical values: 0.349[10%], 0.464[5%], 0.737[1%])
```