Middle East Technical University **Spring 2014**
Department of Economics
ECON 301 - 01

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PROBLEM SET – MODEL SELECTION

QUESTION[1] (30 Points)

The specification of the *General Unrestricted Model (GUM)* from which reductions commence is crucial to the properties of any *General-to-specific* approach (Hendry, 2000, p. 482) since a poorly specified GUM stands little chance of leading to a 'good' final specific model. The aim is to start off with a congruent model, evaluated by applying a battery of mis-specification tests, and maintain congruence by applying the same tests, as diagnostic tests, through every stage of the simplification process (Owen, 2003).

a) (15 points) An economist claims that for the period of 1978-2008, Equation (1) can be adopted as the *General Unrestricted Model (GUM)*. Carry out necessary misspecification tests[2] and evaluate her claim: Do you agree or not?
   [You can simply use the p-values given in brackets for necessary tests, i.e., you do not need to look at statistical tables if you know how you use given p-values]

b) (15 points) Suppose that as a result of a sequential testing procedure, Equations (2) and (3) are selected. Choose between Equation (2) and (3) by carrying out possible tests and using possible criteria.

*Note that the values given in brackets [.] are corresponding *p-values* of the test: for example, *JB*=20.5 [p=0.00]. **The null hypotheses of the provided tests are as follows: (1) For JB, H_0: u_t has a normal distribution, (2) For RESET test, H_0: no omitted variables and no model misspecification, (3) For $CHOW_{Predictive}$ test, H_0: no prediction failure for last two years, (4) For $CHOW_{ANCOVA}$ test, H_0: no structural change at the sample mid-point.

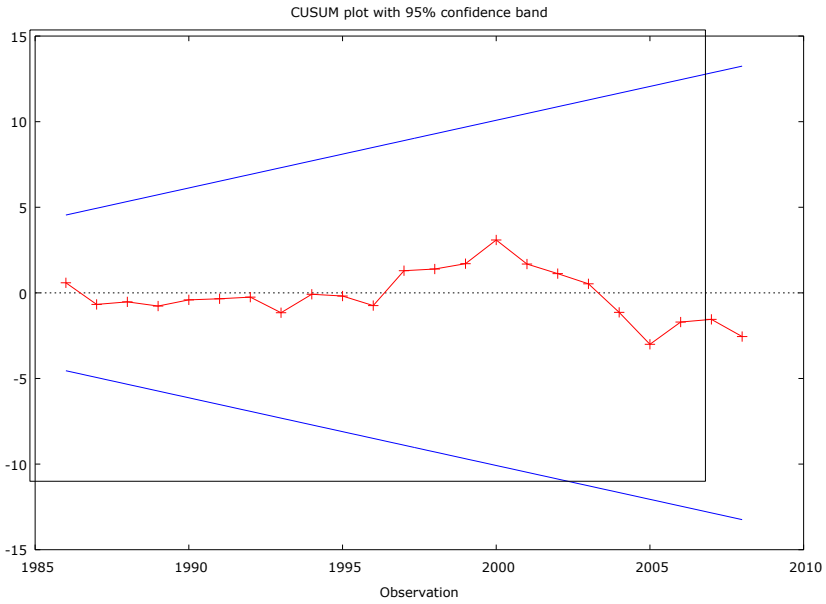
[1] Final Exam, ECON 301, 2012-2013 Spring, METU, Department of Economics.

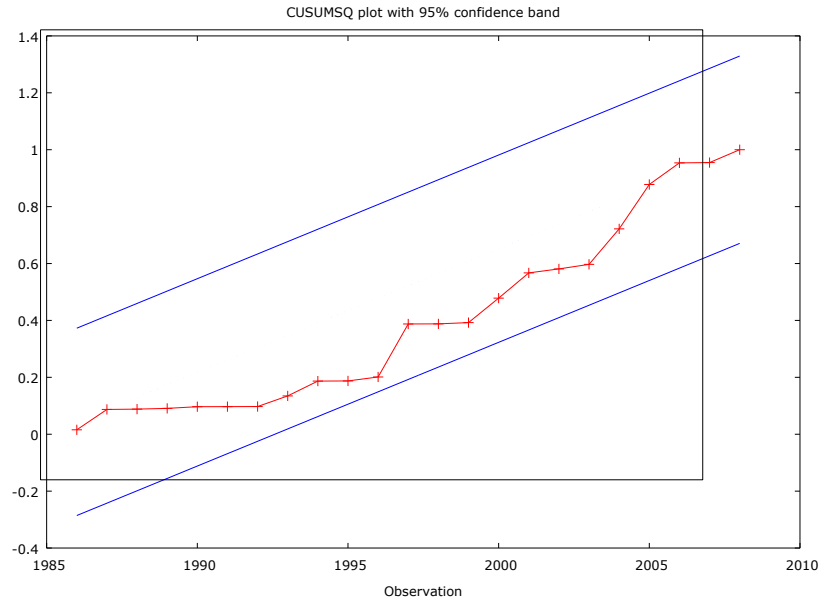
[2] ***Attention*** Although heteroscedasticity, autocorrelation and Autoregressive conditional heteroscedasticity (ARCH) topics are the subjects of ECON 302, in order to follow a general-to-specific model selection process these misspecification tests are crucial: the models must be *homoscedastic (no heteroscedasticity)*, *non-autocorrelated (no autocorrelation)* and the presence of *ARCH* effect should be rejected. Therefore, the estimation results given in the question also represent these statistics, however, the findings of the tests (i.e., no autocorrelation, no heteroscedasticity, etc.) are also provided since these subjects are not covered in ECON 301. When evaluating models, you need to take into account these findings (DW for autocorrelation, White test for heteroscedasticity and LM test for ARCH) together with Jarque-Berra (JB) normality test, RESET test for misspecification, in-sample stability test (Chow ANCOVA) and out-of-sample stability test (Predictive Chow).

Equation (1)

$$\ln \hat{Y}_t = \underset{(4.25)}{6.69} + \underset{(0.14)}{0.02} \ln Y_{t-1} + \underset{(2.92)}{0.20} \ln X_t - \underset{(-1.70)}{0.13} \ln X_{t-1} + \underset{(6.60)}{0.71} \ln Z_t - \underset{(-0.37)}{0.06} \ln Z_{t-1} - \underset{(-5.36)}{0.69} \ln W_t - \underset{(-1.25)}{0.23} \ln W_{t-1}$$

SSR=6.5, *JB*=1.09 [p=0.58], *RESET*=0.827 [p=0.37], *t*=1978-2008
$CHOW_{Predictive}$= 0.54 [p=0.59], $CHOW_{ANCOVA}$=0.64 [p=0.74]
R^2=0.84, $\bar{R}^2$ =0.80, Akaike IC=55.51, Schwarz IC=66.98
DW=2.22 [p=0.70, hence no autocorrelation at 0.05]
White=15.02 [p=0.38, hence no heteroscedasticity at 0.05]
$ARCH_{LM}$=1.12 [p=0.29, hence no ARCH effect is present at 0.05]





Equation (2)

$$\ln \hat{Y}_t = \underset{(31.6)}{5.88} + \underset{(2.05)}{0.12}(\ln X_t - \ln W_t) + \underset{(8.40)}{0.72}(\ln Z_t - \ln W_t)$$

SSR=8.970, *JB*=0.748 [p=0.69], *RESET*=1.40 [p=0.25], *t*=1978-2008
$CHOW_{Predictive}$= 0.301 [p=0.74], $CHOW_{ANCOVA}$= 1.21 [p=0.33]
R^2=0.78, $\bar{R}^2$ =0.77, Akaike IC=55.53, Schwarz IC=59.83
DW=2.14 [p=0.63, hence no autocorrelation at 0.05]
White=6.53 [p=0.26, hence no heteroscedasticity at 0.05]
$ARCH_{LM}$=0.15 [p=0.70, hence no ARCH effect is present at 0.05]

Equation (3)

$$\ln \hat{Y}_t = \underset{(6.90)}{5.64} + \underset{(7.25)}{0.81}\ln Z_t - \underset{(-5.62)}{0.74}\ln W_t$$

SSR=9.997, *JB*=0.306 [p=0.86], *RESET*=0.08 [p=0.78], *t*=1978-2008
$CHOW_{Predictive}$= 0.577 [p=0.57], $CHOW_{ANCOVA}$= 0.386 [p=0.76]
R^2=0.76, $\bar{R}^2$ =0.74, Akaike IC=58.89, Schwarz IC=63.19
DW=1.94 [p=0.44, hence no autocorrelation at 0.05]
White=5.65 [p=0.34, hence no heteroscedasticity at 0.05]
$ARCH_{LM}$=0.014 [p=0.91, hence no ARCH effect is present at 0.05]

Equation (4)

$$\ln \hat{Y}_t = \underset{(-0.28)}{-3.79} + \underset{(1.91)}{0.13}(\ln X_t - \ln W_t) - \underset{(-0.30)}{0.55}(\ln Z_t - \ln W_t) + \underset{\substack{(0.71)\\ [\,p=0.49]}}{1.62}\left[\ln \hat{Y}_t\right]^{Eq.3}$$

SSR=8.81, *t*=1978-2008, R^2=0.79

$\left[\ln \hat{Y}_t\right]^{Eq.3}$ is the fitted values from Equation (3)

Equation (5)

$$\ln \hat{Y}_t = \underset{(-0.25)}{-0.87} + \underset{(0.02)}{0.008}\ln Z_t + \underset{(0.24)}{0.11}\ln W_t + \underset{\substack{(1.91)\\ [\,p=0.07]}}{1.05}\left[\ln \hat{Y}_t\right]^{Eq.2}$$

SSR=8.81, *t*=1978-2008, R^2=0.79

$\left[\ln \hat{Y}_t\right]^{Eq.2}$ is the fitted values from Equation (2)