MACROECONOMETRÍA

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Excercise set 3

Question 1. Let y_t denote a stationary transformation of your consumption series, let z_t denote de-seasonalised log of consumption $c_t - c_{t-4}$ where $c_t = \log Consumption_t$, and let $q_{2,t}, q_{3,t}$ and $q_{4,t}$ be seasonal dummies for quarter 2, 3 and 4, respectively. Estimate the specifications

$$\begin{aligned} y_t &= \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \beta_3 y_{t-3} + \beta_4 y_{t-4} + \beta_5 q_{2,t} + \beta_6 q_{3,t} + \beta_7 q_{4,t} + e_{1,t} \\ z_t &= \beta_0 + \beta_1 z_{t-1} + \beta_2 z_{t-2} + \beta_3 z_{t-3} + \beta_4 z_{t-4} + e_{2,t} \end{aligned}$$

using the following code:

```
equation eq01.ls(h) y c y(-1) y(-2) y(-3) y(-4) @seas(2) @seas(3) @seas(4)

equation eq02.ls(h) z c z(-1) z(-2) z(-3) z(-4)
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Does the estimation output suggest that the residuals are White Noise?

Question 2. Let y_t denote a stationary transformation of your consumption series, and estimate the model (which contains an LSTAR term)

$$y_t = \beta_0 + \frac{\beta_1}{1 + \exp[-\beta_2(t - \beta_3)]} + \beta_4 y_{t-1} + \beta_5 y_{t-2} + \beta_6 y_{t-3} + \beta_7 y_{t-4} + \beta_8 q_{2,t} + \beta_9 q_{3,t} + \beta_{10} q_{4,t} + \epsilon_t$$

using the following code:

```
'create series called 'time':
series time = @trend + 1

equation eq03.ls(h) y = c(1) + c(2)*(1/(1 + exp(-c(3)*(time - c(4)))))
+ c(5)*y(-1) + c(6)*y(-2) + c(7)*y(-3) + c(8)*y(-4) + c(9)*@seas(2) +
c(10)*@seas(3) + c(11)*@seas(4)
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EViews makes use of a non-linear estimation algorithm. Does the iterative procedure converge? If so, on what date does the estimate of β_3 suggest there is a structural break in the intercept β_0? Do the estimates suggest the break is significant?

Question 3. Let y_t denote the percentage change in the Euro versus US Dollar exchange rate (the number of Euros per US Dollar) from the end of one day to another, let x_t denote the change in the main policy interest rate of the European Central Bank (ECB), and consider the following ARCH(1) model

$$\begin{aligned} y_t &= \beta x_t + e_t, \quad e_t = \sigma_t z_t, \quad z_t \sim IIN(0,1) \\ \sigma_t^2 &= \omega + \alpha e_{t-1}^2 + \delta x_t^2 \end{aligned}$$

a) Let $\omega > 0$, $\alpha = 0$ and $\delta > 0$. Are the errors $\{e_t\}$ conditionally heteroscedastic? Justify your answer. Give an economic interpretation of the values $\beta < 0$ and $\delta > 0$.

b) Let $\beta = 0$, $\omega = 0.1$, $\alpha = 0.6$, $\delta = 0$, $\sigma_{100} = 0.7$ and $z_{100} = 0.2$. Is the model covariance stationary?[1] Compute $Var(y_{100+L}|I_{100}, I_{99}, \ldots)$ for $L = 1$, $L = 2$ and $L = 4$, where $I_t = \{y_t, \sigma_t, z_t\}$. How much do the conditional forecasts differ from the unconditional forecast?

Question 4. Let y_t be quarterly real consumption (that is, $y_t = \frac{C_t}{P_t}$ where C_t is nominal consumption and P_t is a price index) and consider the GARCH(1,1) model

$$\begin{aligned} y_t &= \beta_0 + \beta_1 y_{t-1} + e_t, \quad e_t = \sigma_t z_t, \quad z_t \sim IIN(0,1) \\ \sigma_t^2 &= \omega + \alpha e_{t-1}^2 + \gamma \sigma_{t-1}^2 + \delta q_{4,t} \end{aligned}$$

where $q_{4,t}$ is a seasonal dummy for the fourth quarter.

a) Let $\omega > 0$, $\alpha = \gamma = 0$ and $\delta > 0$. Are the errors $\{e_t\}$ conditionally heteroscedastic? Justify your answer. Give an economic interpretation of the values $\beta_1 > 0$ and $\delta > 0$.

b) Let $y_{100} = 0.8$, $\beta_0 = 1$, $\beta_1 = 0.1$, $\omega = 0.3$, $\alpha = 0.2$, $\delta = 0$, $q_{4,102} = 1$, $\sigma_{100} = 0.6$ and $z_{100} = 0.4$. Is the model covariance stationary?[2] Suppose now that $\gamma = 0.3$ and that $\delta = 0.1$. Compute $E(y_{100+L}|I_{100}, I_{99}, \ldots)$ and $Var(y_{100+L}|I_{100}, I_{99}, \ldots)$ for $L = 1$, $L = 2$ and $L = 4$, where $I_t = \{y_t, \sigma_t, z_t\}$. How much do the conditional forecasts differ from the unconditional forecasts (where the unconditional forecasts assumes that $\delta = 0$)?

[1] In an ARCH/GARCH context this amounts to answering whether the unconditional variance of y_t is constant or not.

[2] Same as footnote 1.