TOPICS IN MACROECONOMICS: MODELLING INFORMATION, LEARNING AND EXPECTATIONS

HOMEWORK 2

Answer all questions using MatLab. Write up your answers and how they were derived and submit in pdf form together with supporting m-files by Monday October 27th to kni-mark@crei.cat. Where possible, please use notation established in lecture notes.

Question 1 A Noisy RBC model

Consider a "noisy" version of the log-linearised RBC model of Campbell (1993). Output is given by

$$y_t = \alpha a_t + (1-\alpha) k_t \tag{0.1}$$

where productivity a_t follows the AR(1) process

$$a_t = \rho a_{t-1} + u_t \tag{0.2}$$

$$u_t \sim N\left(0, \sigma_u^2\right) \tag{0.3}$$

The capital stock evolves according to

$$k_{t+1} = \lambda_1 k_t + \lambda_2 a_t + (1-\lambda_1-\lambda_2) c_t \tag{0.4}$$

and consumption is given by

$$c_t = g' X_{t|t} \tag{0.5}$$

$$g' = \begin{bmatrix} g_1 & g_2 & 0 \end{bmatrix} \tag{0.6}$$

where $X_{t|t} = E\left[X_t \mid z^t\right]$ and $X_t = \begin{bmatrix} k_t & a_t & v_t \end{bmatrix}$. The variable z_t is a noisy measure of output, given by

$$z_t = y_t + v_t \tag{0.7}$$

$$v_t \sim N\left(0, \sigma_v^2\right) \tag{0.8}$$

Parameter values: $\{\alpha, \rho, \sigma_u^2, \sigma_v^2\} = \{0.3, 0.9, 1, 1\}, \{\lambda_1, \lambda_2\} = \{1.01, 0.08\}, \{g_1, g_2\} = \{0.62, 0.16\}$

a) Solve the model by the method outlined in Lecture Notes 4. Report the matrices W and V. (Note that model is slightly different from lecture notes.)

b) Compute impulse responses of consumption, capital, productivity and agent's estimate of productivity a_t to a unit shock ($u_0 = 1$) to true productivity and to a unit measurement error shock ($v_0 = 1$).

c) Compute the variance of consumption, capital, productivity and agent's estimate of productivity and capital.

d) Redo b) and c) with $\sigma_v^2 = 0.1$. Discuss.

Question 2 Information and Prices in G&S (1980)

Check numerically whether the following conjectures hold in the context of the model of Grossman and Stiglitz (1980). Discuss.

Benchmark parameters: $\{R, a, \sigma_\theta^2, \sigma_\varepsilon^2, \sigma_x^2\} = \{1.1, 2, 1, 1, 1\}$

a) The price is more informative with $\lambda = 1$ than with $\lambda = 0$, that is,

$$\begin{aligned} E\left[u - E\left(u \mid P_{\lambda=1}\right)\right] &\equiv \sigma^2_{u|P\lambda=1} \\ &< \sigma^2_{u|P\lambda=0} \equiv E\left[u - E\left(u \mid P_{\lambda=0}\right)\right]. \end{aligned}$$

b) If the signal of the informed agents become more precise, the price becomes more informative (use $\lambda = 1, \sigma_\varepsilon^2 \in \{0.5, 1\}$).

c) When the variance of supply falls, the price becomes more informative. In the limit, the price reveals the same information as θ (use $\lambda = 1\sigma_x^2 \in \{0, 0.5, 1\}$).

d) An increase in risk aversion decreases the information conveyed by prices (use $\lambda = 1, a \in \{2, 5\}$).