Toulouse School of Economics
École d'économie de Toulouse

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Session 1

Semestre 1

Master 1 Econometrics, Statistics, Economics

Epreuve : Macroeconomics

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Macroeconomics – Patrick Fève & Franck Portier

Final Exam (December 2016)

Questions (4 pts)

1) What is the excess smoothing puzzle for aggregate consumption? Which modelling choice can solve that puzzle? (*You have seen in tutorials two modeling strategies. Discuss one of them.*) (1 pt)

2) What are news shocks? What are the consequence of such shocks on current decisions when agents are forward-looking? (1 pt)

3) In tutorials, you have studied problems in which optimal consumption follows a random walk. What are the fundamental assumptions behind this result, and what do you think of these? (1 pt)

4) What is the *Lucas Critique*? (1 pt)

Problem I: Quadratic Adjustment Costs on Labor with a Linear Technology (6pts + 2 bonus points)

Let's define the value of a firm $\mathcal{V}_t$ as the expected discounted sum of profit:

$$\mathcal{V}_t = E_t \sum_{i=0}^{\infty} \left(\frac{1}{1+r}\right)^i \Pi_{t+i}$$

where E_t is the conditional expectations operator. $r > 0$ (the constant real interest rate) and the instantaneous profit is given by:

$$\Pi_t = Y_t - w_t L_t - \frac{b}{2}\left(L_t - L_{t-1}\right)^2$$

where w_t is a stochastic real wage and $b \geq 0$ is the adjustment cost parameter. We assume that w_t can be decomposed as follows:

$$w_t = \bar{w} + \tilde{w}_t$$

where $\bar{w} > 0$ and $\tilde{w}_t$ follows an AR(1) process:

$$\tilde{w}_t = \rho_w \tilde{w}_{t-1} + \varepsilon_t^w$$

where $|\rho_w| \leq 1$. The random variable ε_t^w satisfies $E\varepsilon_t^w = 0$ and $E_{t-1}\varepsilon_t^w = 0$, where E_{t-1} is the expectation operator conditional on the information set in period $t-1$.
The production function is given by:

$$Y_t = (\bar{a} + a_t) L_t$$

where $\bar{a} > 0$ is a scale parameter and a_t a technology shock. This stochastic variable evolves according to:

$$a_t = \rho_a a_{t-1} + \varepsilon_t^a$$

where $|\rho_a| \leq 1$. The random variable ε_t^a satisfies $E\varepsilon_t^a = 0$ and $E_{t-1}\varepsilon_t^a = 0$.

1. Determine the first order condition of the firm's optimization problem (2 pts).
2. Compute the solution, i.e. express the the choice variable L_t in terms of the pre-determined variable L_{t-1} and the exogenous variables $\tilde{w}_t$ and a_t. (2 pts)
3. Show that the solution illustrates the *Lucas critique.* (2 pts)
4. Assume now a new process for a_t:

$$a_t = \rho a_{t-1} + \varepsilon_{t-1}$$

Discuss this specification for the technology shock. Find the solution for labor demand under this new specification. (Bonus, 2 pts)

Problem II : Labor Supply and Government Spending
(6 pts + 2 bonus points)

Consider a two–period production economy with three agents: one representative household, one representative firm and a Government. The economy is deterministic.
The inter-temporal utility of the representative household is given by:

$$\log(c_1) + \beta \log(c_2) - \beta n_2$$

where $\beta \in (0, 1)$ is the discount factor. Here, we assume that the representative household can only supply labor (n_2) in second period at a wage w. The household receives an endowment $\bar{y} > 0$ in first period, but no endowment in the second period. The representative household owns the firm. Let Π be profits that the representative household receives from owning the firm. These profits are taken as given by the household. The household must also pay lump-sum taxes in first and second periods (denoted t_1, t_2). Then the household chooses consumptions c_1 and c_2 (at given prices p_1 and p_2) and labor supply n_2 in second period (at a given wage denoted w) to maximize the utility subject to the intertemporal budget constraint:

$$p_1c_1 + p_2c_2 = p_1\bar{y} - p_1t_1 + wn_2 - p_2t_2 + \Pi$$

The firm uses the labor input n_2 and pays a wage w. The firm's production function is given by:

$$y_2 = n_2$$

The firm chooses optimally the level of labor (n_2) in period 2 such that it maximizes the profit:

$$\Pi = p_2y_2 - wn_2$$

where p_2 is the price of output in period 2 and w the nominal wage (given).
Finally, the government spends g_2 in second period (at a price p_2) and collects taxes t_1 and t_2 (notice that $g_1 = 0$). In addition, the government must satisfy the intertemporal budget constraint:

$$p_2 g_2 = p_1 t_1 + p_2 t_2$$

It follows that the market clearing condition on goods market in period 1 is:

$$c_1 = \bar{y},$$

and in period 2:

$$c_2 + g_2 = y_2 (= n_2)$$

1. Define a competitive equilibrium of this economy (1 pt).
2. Solve for the competitive equilibrium. First solve the household problem (i.e. find the optimal consumptions c_1, c_2 and labor supply n_2, for given prices). Next, determine the optimal labor demand, for given prices. What can you say about profits? After, use the equilibrium conditions on goods market (in period **1** and **2**), on labor market and combine them with the optimality conditions in order to obtain the equilibrium allocations and prices. (2 pts).
3. Solve the central planner problem and compare the obtained solution to the one of the competitive equilibrium. Comment (1 pt).
4. What is the effect of an increase in public spending g_2 on output, consumption and employment (in period **2**) ? Comment. (2 pts)
5. Show that the Ricardian equivalence holds in this economy (Bonus, 2 pts).

Problem III: Technology Shocks and Employment (4 pts)

Consider a one period economy populated with a large number of identical agents. The representative household seeks to maximize the utility function:

$$U(c,n) = \log(c - \bar{c}) - \gamma n_t \quad , \quad \gamma > 0$$

subject to the budget constraint:

$$c = wn + \Pi$$

The variable c is the private (individual) consumption, n is the labor supply, w is the real wage rate, and Π denotes profits received from the firm (considered as given by the household). The parameter $\bar{c} \geq 0$ represents the minimal consumption.
The representative firm produces a homogeneous final good y using labor as the sole input, according to the constant returns-to-scale technology

$$y = zn,$$

where z is labor productivity.
Finally, the market clearing condition on the goods market writes:

$$y = c$$

1. Determine the optimal consumption–labor supply decision at individual level (1 pt).
2. Compute the equilibrium output, i.e. determine the level of output as a function of the technological level z (1 pt).
3. Determine the effect of z on labor n. Discuss and interpret the results (2 pts).