

1 Questions about inequalities (30 points)

- 1 – Explain (in two sentences max) the difference between functional and personal inequality. (5 points)
- 2 – What do Thomas Piketty’s “two laws of capitalism” imply in terms of functional inequalities if the growth rate of the economy drops in the long run? (10 points)
- 3 – How would you characterise the concentration of pretax income in the two last decades in the US (in historical perspective and in comparison with Europe)? (5 points)
- 4 – What is the relationship between income and wealth inequalities? Quantitatively, is this relationship the same in Europe and the US? Explain. (10 points)

2 Questions about the liquidity trap (20 points)

- 1 – In Paul Krugman’s model of the liquidity trap, why is the cash-in-advance constraint binding when the nominal interest rate is strictly positive? (5 points)
- 2 – Under the assumption of fixed prices, explain under which conditions an increase in money supply by the Central Bank will allow agents to consume more. (15 points)

3 Fiscal Multipliers (60 points + 20 bonus points)

We consider a discrete time economy populated with a large number of infinitely-lived, identical agents. The representative household’s utility function is given by

$$\log(c_t^*) - \eta n_t \quad , \quad \eta > 0$$

where

$$c_t^* = c_t + \alpha_g g_{t-1}$$

The parameter α_g accounts for the complementarity/substitutability between private (real) consumption c_t and **lagged** government spending g_{t-1} . n_t denotes the labor supply. The time t budget constraint of the representative household is

$$c_t + T_t \leq w_t n_t + \Pi_t$$

where w_t is the real wage, T_t is a lump-sum tax and Π_t are the profits received from the firm.

The representative firm produces an homogeneous final good y_t using labor as the sole input, according to the following constant return-to-scale technology

$$y_t = a n_t$$

where $a > 0$ is the level of the technology. The profit function is given by:

$$\Pi_t = y_t - w_t n_t$$

Government spending is entirely financed by taxes,

$$T_t = g_t$$

The homogenous good can be used for private and public consumption. Accordingly, the market clearing condition on the goods market writes

$$y_t = c_t + g_t$$

For question 1–5, there is no need for log-linearization.

1. Comment the specification of the utility function **(10 points)**.
2. Determine the optimality condition of the households and then deduce the Marginal Rate of Substitution (MRS) **(10 points)**.
3. Determine the optimality condition of the firm **(10 points)**.
4. Determine the equilibrium output **(10 points)**.
5. Compute the output multipliers in periods t and $t + 1$, $\Delta y_t / \Delta g_t$ and $\Delta y_{t+1} / \Delta g_t$ and discuss the value of this multiplier with respect to α_g **(20 points)**.
6. **(Bonus Question)** Now consider that the utility function takes the form

$$\log(c_t^*) - \eta \frac{n_t^{1+\nu}}{1+\nu}, \quad \eta > 0$$

where

$$c_t^* = c_t + \alpha_g g_{t-1}$$

and $\nu > 0$ is the inverse of the elasticity of labor supply. Determine the value of the output multipliers $\Delta y_t / \Delta g_t$ and $\Delta y_{t+1} / \Delta g_t$ **(Use the log-linearization of the optimality and equilibrium conditions (20 bonus points))**

4 Monetary Policy (50 points)

Consider an economy summarized by a Fisher Equation and a Taylor Rule. The Fisher equation is given by

$$i_t = E_t \pi_{t+1}$$

where E_t is the conditional expectations operator. We assume that the real interest rate is constant and zero. The Taylor rule is given by

$$i_t = \alpha \pi_t + s_t$$

where $\alpha > 1$ and s_t is a shock to monetary policy. We assume two types of processes for s_t .

Unexpected monetary policy shock: $s_t = \rho s_{t-1} + \varepsilon_t$

Expected monetary policy shock: $s_t = \rho s_{t-1} + \varepsilon_{t-1}$

where $\rho \in [0, 1]$ and $E_t \varepsilon_{t+i} = 0, \forall i \geq 1$.

1. Solve for inflation π_t and nominal interest rate i_t when $s_t = \rho s_{t-1} + \varepsilon_t$. Report the reduced form when $\rho = 0$ and $\rho = 1$. Comment the results with respect to ρ **(25 points)**.
2. Solve for inflation π_t and nominal interest rate i_t when $s_t = \rho s_{t-1} + \varepsilon_{t-1}$. Report the reduced form when $\rho = 0$ and $\rho = 1$. Comment the results with respect to ρ . Explain the difference when monetary policy is unexpected and expected **(25 points)**.