

## Macroeconomic Analysis

Miguel Lebre de Freitas, André Nunes

**Final exam** (Dec 12, 2022)

*Notes: This exam has 3 groups. Please solve groups I and IV directly on the question sheet. For group II, use draft paper for calculations and show only the key steps to obtain the results.*

### I (4.5)

Define **three** of the following concepts (3-5 lines each):

- (i) Say's law in reverse
  
  
  
  
  
  
  
  
  
  
- (ii) Financial accelerator
  
  
  
  
  
  
  
  
  
  
- (iii) Push factors driving capital flows
  
  
  
  
  
  
  
  
  
  
- (iv) Inflation tax Laffer curve
  
  
  
  
  
  
  
  
  
  
- (v) Holdout creditors

## IV (2.0)

*In the following questions, choose the only correct answer. Answering correctly yields 0.5 points, wrongly -0.5/4. Please solve directly on this sheet.*

1. In the two-period closed economy with sticky prices, departing from an equilibrium where the rate of time preference is equal to the real interest rate, the following shock will not cause unemployment to increase today: **(i) Permanent fiscal contraction;** (ii) Anticipated productivity fall; (iii) Expansion of the labour force in period 1; (iv) none of the above.
2. Consider an economy where the inflation rate is 3%, real output growth is 2%, the nominal interest rate is 5% , and government debt amounts to 60% of GDP. In this economy: (i) a primary surplus of 3% will keep the debt ratio constant over time; (ii) a government deficit equal to zero will stabilize the debt ratio; **(iii) government debt will be stabilized with a total deficit equal to 3% of GDP;** (iv) none of the above.
3. All else equal, the snow-ball effect will evolve favourably when: (i) inflation unexpectedly increases and debt bonds are indexed; (ii) inflation is decreasing as previously anticipated; (iii) there is an unexpected decrease in the inflation rate and the average maturity of debt is long **(iv) none of the above.**
4. Comparing to the well-functioning case, the adjustment to a sudden stop will necessarily come along with an increase in unemployment when: (i) nominal wages are sticky and the exchange rate is flexible; (ii) nominal wages are indexed to the exchange rate; (iii) labour is immobile across sectors and wages are flexible; **(iv) none of the above.**

## II (13.5)

In this group, questions (a), (c) and (e) are mandatory. Among the other 3, choose 2.

**III.A. (Sticky Prices)** Consider a two-period closed economy with no initial assets or liabilities, where the preferences of the representative consumer are  $U = \ln C_1 + \ln C_2$ . In this economy, full employment output is  $Q_1^n = 75$ . In this economy, the labour force is constant over time at  $N = 1$ . Future output depends on current investment, according to  $Q_2 = 10N_2^{0.5}K_2^{0.5}$ . Capital depreciates fully each year.

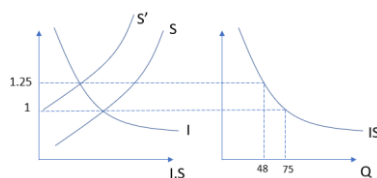
- a) **(The IS curve)** (a1) Find out the optimal investment as a function of the interest rate; (a2) Find out the expression of the consumer's lifetime wealth as a function of the interest rate. (a3) Find out the expression for optimal savings, as a function of  $r_1$ . (a4). Quantify and describe graphically the IS curve of this economy (a5) Find out the natural interest rate.

$$\begin{aligned} \text{(a1)} \quad \max V_1 &= -I_1 + \frac{10\sqrt{I_1}}{1+r} \Rightarrow I = \frac{25}{(1+r)^2} \\ \text{(a2)} \quad \Omega &= Q_1 + V_1 = Q_1 + \frac{25}{(1+r)^2} = 75 + \frac{25}{(1+r)^2} \\ \text{(a3)} \quad S_1 &= Q_1 - C_1 = Q_1 - \frac{1}{2}\Omega = \frac{1}{2}Q_1 - \frac{12.5}{(1+r)^2} \\ \text{(a4)} \quad S &= I \Leftrightarrow \frac{1}{2}Q_1 - \frac{12.5}{(1+r)^2} = \frac{25}{(1+r)^2} \Leftrightarrow Q_1 = \frac{75}{(1+r)^2} \\ \text{(a5)} \quad Q_1^n &= 75 \Rightarrow 1+r = 1 \end{aligned}$$

- b) **(Money tightening)** Departing from (a), suppose that, due to a central bank intervention, the real interest rate increases to  $1+\bar{r}_1 = 1.25$ . (b1) Explain how this can be possible. (b2) Describe graphically the macroeconomic adjustment, referring to savings, investment, and the IS locus. (b3) Quantify the policy effects on current consumption, investment, current output and future output; (b4) Considering the following production function for period 1  $Q_1 = 75N_1^{0.5}$ , explain the adjustment in the labor market, represent graphically, and characterize the type of unemployment generated.

(b1) Sticky prices

(b2)



$$\text{(b3)} \quad Q_1 = 48, I_1 = \frac{25}{1.25^2} = 16, Q_2 = 10\sqrt{16} = 40, C_1 = Q_1 - I_1 = 32, C_2 = 40$$

(b4) Effective labor demand; Keynesian unemployment = 0.5904

Nr: \_\_\_\_\_ Name:

Time: 1h45

**II.B (TNT)** Consider a small open economy under fixed exchange rates, where initially  $e = P_T^* = 1$ . In this economy, labour is perfectly mobile across sectors, and the total labour supply is  $\bar{L} = 108$ . The production functions for T and N are  $Q_T = 10L_T^{0.5}$  and  $Q_N = L_N$ . The demand curves are  $C_T = 0.5A$  and  $C_N = 0.5\lambda A$ , where A is absorption in units of T, and  $\lambda$  is the price of tradables relative to non-tradables.

- c) **(Baseline)** (c1) Show that the optimal supply functions of T and N are  $Q_T = 50\lambda$  and  $Q_N = 108 - 25\lambda^2$ . Find out the combinations of A and  $\lambda$  that are consistent with: (c2) external balance; (c3) internal balance. (c4) Display the two curves in a diagram. (c5) In this diagram, identify and characterize, in terms of internal and external balance, the following points: X ( $\lambda = 1.2, A=120$ ); Y ( $\lambda = 1.2, A=166$ ); Z ( $\lambda = 1, A=166$ ).

$$(c1) T: \max \pi_T = P_T Q_T - w L_T \Leftrightarrow w = 5P_T L_T^{-0.5} \Rightarrow L_T^{0.5} = 5\lambda \Leftrightarrow Q_T = 50\lambda$$

$$N: L_N = 108 - L_T \Leftrightarrow Q_N = 108 - \frac{Q_T^2}{100} = 108 - 25\lambda^2$$

$$(c2) Q_T = C_T \Leftrightarrow A = 100\lambda$$

$$(c3) Q_N = C_N \Leftrightarrow 108 - 25\lambda^2 = 0.5\lambda A$$

(c5) Internal and external balance: Point X

- d) **(Capital inflow)**: Departing from internal and external balance, assume that the economy faced a sudden capital inflow amounting to 33 units of the tradable good. (d1) If prices were flexible, what would be the resulting values of A,  $\lambda$  and  $P_N$ ? (d2) Explain the intuition of the price adjustment (d3) Describe, quantifying, the adjustment in the Swan diagram and (d4) in the labor market. (d5) Should a government be concerned with such a development? In which circumstances? Explain.

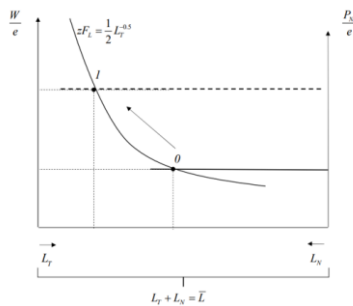
$$(d1) CA = -33 \Leftrightarrow Q_T - C_T = -33 \Leftrightarrow 50\lambda = 0.5A - 33$$

Flexible prices implies internal balance. ( $108 - 25\lambda^2 = 0.5\lambda A$ ).

Solve to obtain:  $\lambda = 1, A = 166, P_N = 1$

(d2/d3) Aggregate demand expands ahead of income for  $\lambda = 1.2$  (Point Y). This creates an external deficit and inflationary pressures. Excess demand for N causes  $W/e$  to increase and the real exchange rate to appreciate ( $P_N$  increases).

(d4)



(d5) Fixed exchange rate: Adjustment towards external balance with wage rigidity and/or supply side rigidities.

**II.C. (Government Debt)** Consider an infinitely lived sovereign borrower whose current debt amounting to  $D=100$ bn pesos (100% of GDP) matures today. Further assume that in this economy there is no growth and that the inflation rate is zero. The opportunity cost of funds to investors is  $i=10\%$ .

- e) **(Debt dynamics):** (e1) Find out the average primary surplus that would be required for the government to stabilize the debt ratio. (e2) Explain with the help of a graph. Suppose that the maximum possible primary surplus this sovereign could generate each year was  $S_{max} = 50$  with probability  $p=20\%$  and zero otherwise. (e3) Would the sovereign be solvent? (e4) How much would be the required interest rate in a new loan? (e5) What would be the required interest rate if  $p=80\%$ ?

(e1)  $s' = 10\%$

(e2) Graph

(e3) It is expected to be solvent because  $D_{max} = \frac{E(s)}{i} = 100$

(e4)  $pR + (1 - p)0 = 10\% \times 100 \Leftrightarrow 20\%R = 10 \Leftrightarrow R = 50 \Rightarrow r = \frac{R}{D} = 50\%$

(e5)  $pR + (1 - p)0 = 10\% \times 100 \Leftrightarrow 80\%R = 10 \Rightarrow R = 12.5 \Rightarrow r = \frac{R}{D} = 12.5\%$

- f) **(Debt crisis):** (f1) Represent in a graph the required interest rate by investors on the new loan,  $i^s$ , as a function of  $p$ ; (f2) Suppose now that the maximum possible revenue each year was a random variable with uniform probability distribution within the range  $[0, 62.5]$ . Find out the probability  $p = \text{PROB}[S > i^s D]$  as a function of the interest rate in the new loan,  $i^s$ ; (f3) Would this sovereign be able to borrow at the risk-free rate? Why? (f4) Find out, quantifying, the possible equilibria of this model, and represent in the graph. (f5) If the sovereign was found in a bad equilibrium, what kind of crisis would that be? Which mechanisms could be used to solve it?

IGNORE