NOVA SCHOOL OF BUSINESS & ECONOMICS

Number: **Name:**

The Global Economy II

Nova SBE – Fall 2023/2024

Miguel Lebre de Freitas, Diogo Lima, Pedro Sousa Coelho

Mid-term assessment 03/11/2023 – Duration: 2h00

II (13.5)

II.A. Consider a one-good economy where NIIP is initially zero. The representative consumer lives for two periods and has a lifetime utility function given by: $U = Ln(C_1) + \frac{Ln(C_2)}{1+0.5}$. In both periods there is a pre-determined amount of output, equal to $Q_1 = 200$ and $Q_2 = 180$. Further assume that this economy is closed to capital flows.

a) Compute (a1) the optimal consumption path

→ The economy is closed and has no investment ⇒ $C_t = Q_t$

→ then, $C_1 = Q_1 = 200$

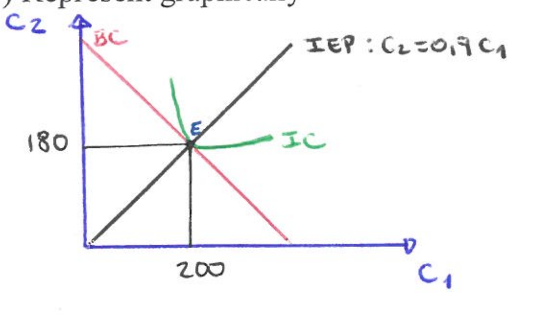
$C_2 = Q_2 = 180$

(a2) the autarky interest rate

→ The Euler Equation will still hold, so r adjusts to ensure the equality

→ $\frac{C_2}{C_1} = \frac{1+r^A}{1+\rho} \Leftrightarrow 1+r^A = \frac{C_2(1+\rho)}{C_1} \Leftrightarrow 1+r^A = \frac{180 \cdot 1,5}{200} \Leftrightarrow r^A = 35\%$

(a3) Represent graphically



$\frac{C_2}{C_1} = \frac{1+r^A}{1+\rho} \Leftrightarrow C_2 = \frac{1,35}{1,5} C_1 \Leftrightarrow C_2 = 0,9 C_1$

BC : $C_1 + \frac{C_2}{1,35} = \Omega$

b) Suppose now that the economy opens to international flows of capital and that the world interest rate is $r^* = 20\%$.. Find out:

(b1) the life-time wealth

→ $\Omega_1 = Q_1 + \frac{Q_2}{1+r^*} = 200 + \frac{180}{1,2} = 350$

$[S_0^t = 0]$

(b2) the optimal consumption path

→ max U s.t BC ⇒ max $\ln C_1 + \frac{\ln C_2}{1+\rho}$ s.t $C_1 + \frac{C_2}{1+r^*} = \Omega$

→ This yields the Euler Equation : $\frac{C_2}{C_1} = \frac{1+r^*}{1+\rho} \Leftrightarrow \frac{C_2}{C_1} = \frac{1,2}{1,5} \Leftrightarrow \boxed{C_2 = 0,8 C_1}$ new income expansion path

→ Replacing in the BC :

$C_1 + \frac{0,8C_1}{1,2} = 350 \Leftrightarrow 1,2C_1 + 0,8C_1 = 350 \cdot 1,2 \Leftrightarrow$

$\Leftrightarrow 2C_1 = 420 \Leftrightarrow$

$\Leftrightarrow C_1 = 210$ $C_2 = 0,8C_1 = 0,8 \cdot 210 = 168$

(b3) the trade balance (for periods 1 and 2)

$\rightarrow TB_t = Q_t - C_t$

$\rightarrow TB_1 = Q_1 - C_1 = 200 - 210 = -10$ $\quad TB_1 = -10$

$\rightarrow TB_2 = Q_2 - C_2 = 180 - 168 = 12$ $\quad TB_2 = 12$

(b4) the current account (for periods 1 and 2)

$\rightarrow CA_t = \Delta b_t^+$ $\quad \hookrightarrow CA_1 = b_1^+ - b_0^+ = -10 - 0 = -10$ $\quad CA_1 = -10$

$\rightarrow b_1^+ = TB_1 + (1+r^+) b_0^+ = -10$ $\quad \hookrightarrow CA_2 = b_2^+ - b_1^+ = 0 - (-10) = 10$ $\quad CA_2 = 10$

$\rightarrow b_0^+ = b_2^+ = 0$

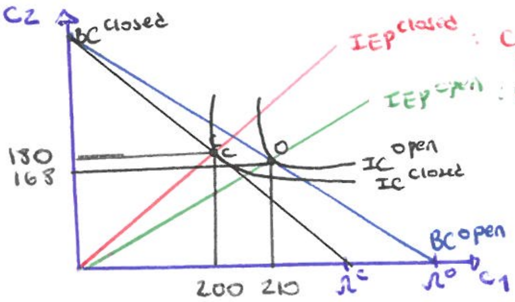
(b5) gross national income (for periods 1 and 2)

$\rightarrow GNI_t = Q_t + NFIA_t = Q_t + r^+ b_{t-1}^+$ $\quad GNI_1 = 200$

$\rightarrow GNI_1 = Q_1 + r^+ b_0^+ = 200 + 0{,}2 \cdot 0 = 200$ $\quad GNI_2 = 178$

$\rightarrow GNI_2 = Q_2 + r^+ b_1^+ = 180 + 0{,}2 \cdot (-10) = 180 - 2 = 178$

(b6) Will the economy be better off than when it was closed? Illustrate with a graph.



C = closed economy equilibrium

O = open economy equilibrium

The utility is higher in the open economy (we achieve a higher Indifference curve)

$U^{closed} = \ln(200) + \frac{\ln(180)}{1{,}5} = 8{,}7603$

$U^{open} = \ln(210) + \frac{\ln(168)}{1{,}5} = 8{,}7631$

c) Assume now that the world is composed by two economies: the Home Economy, which was analysed in questions a) and b), and the Foreign Economy, which has the following endowments: $Q_1^F = 150$; $Q_2^F = 100$. Representative agents in both economies have the same preferences. Find, **for period 1:**

(c1) the current account functions for both economies

$\hookrightarrow CA_1 = Q_1 - C_1$ $\quad \hookrightarrow C_1 = \frac{1+\rho}{2+\rho} \Omega_1 = \frac{1{,}5}{2{,}5}\left[Q_1 + \frac{Q_2}{1+r}\right] = 0{,}6\left[Q_1 + \frac{Q_2}{1+r}\right]$

$\hookrightarrow CA_1^{Home} = Q_1^{Home} - C_1^{Home} = 200 - 0{,}6\left(200 + \frac{180}{1+r}\right) = 80 - \frac{108}{1+r}$

$\hookrightarrow CA_1^{Foreign} = Q_1^{Foreign} - C_1^{Foreign} = 150 - 0{,}6\left(150 + \frac{100}{1+r}\right) = 60 - \frac{60}{1+r}$

(c2) the world interest rate

$\hookrightarrow \sum CA_1 = 0 \Leftrightarrow CA_1^H + CA_1^F = 0$

$\hookrightarrow CA_1^H + CA_1^F = 0 \Leftrightarrow 80 - \frac{108}{1+r} + 60 - \frac{60}{1+r} = 0 \Leftrightarrow 140 = \frac{168}{1+r} \Leftrightarrow r = 20\%$

(c3) the current account for both economies

$\hookrightarrow CA_1^H\,[r = 20\%] = 80 - \frac{108}{1{,}2} = -10$

$\hookrightarrow CA_1^F\,[r = 20\%] = 60 - \frac{60}{1{,}2} = 10$

Number: Name:

II.B. Consider two small open economies with two sectors, a **tradable (T)** and a **non-tradable (N)**. The production functions are given as: $Y_T = 2L_T$ and $Y_N = 2L_N$ for the domestic economy, and, for the foreign economy, as $Y_T^* = 2L_T^*$ and $Y_N^* = 32L_N^*$. Further assume that in both economies each price weights 50% in the consumer price index (the CPI is $P = P_T^a P_N^{1-a}$), that the prices abroad are fixed at $P^* = \frac{1}{4}$ and at $P_T^* = 1$, and that the price of foreign currency in terms of domestic currency is $e = 1$.

d) Assuming that firms maximize profits find:

(d1) the labour demand of each of the sectors in the domestic and in the foreign economy

↳ $\max \Pi_i = \max P_i Q_i - wL_i = \max P_i z_i L_i - wL_i$

↳ Then, $\frac{w}{P_i} = z_i$ and $\frac{w^*}{P_i^*} = z_i^*$ $\Bigg\}$ $\frac{w}{P_T} = a = 2$ $\quad \frac{w^*}{P_T^*} = a^* = 2$

$\frac{w}{P_{NT}} = b = 2$ $\quad \frac{w^*}{P_{NT}^*} = b^* = 32$

(d2) the domestic price of tradables

↳ $P_T = eP_T^* = 1.1 = 1$

(d3) the nominal wage rate in both economies

↳ $w = 2P_T = 2.1 = 2$

↳ $w^* = 2P_T^* = 2.1 = 2$

(d4) the price of non-tradables in the domestic economy

↳ $w = 2P_{NT} \Leftrightarrow 2 = 2P_{NT} \Leftrightarrow P_{NT} = 1$

(d5) the consumer price index in the domestic economy

↳ $P = P_T^{1/2} P_{NT}^{1/2} = \sqrt{1} . \sqrt{1} = 1$

(d6) the real exchange rate

↳ $\theta = \frac{eP^*}{P} = \frac{1 . 1/4}{1} = \frac{1}{4}$

e) Assume now that there was an exchange rate depreciation in the home economy to $e' = 2$. Find the impacts on the home economy, namely:

(e1) the price of tradables

↳ $e = 2$

↳ $P_T = eP_T^* = 2.1 = 2$ (↑)

(e2) the nominal wage rate

↳ $w = 2P_T = 2 . 2 = 4$ (↑)

(e3) the price of non-tradables

↳ $w = 2P_{NT} \Leftrightarrow 4 = 2P_{NT} \Leftrightarrow P_{NT} = 2$ (↑)

(e4) the consumer price level

↳ $P = P_T^{1/2} P_{NT}^{1/2} = \sqrt{2} . \sqrt{2} = 2$ (↑)

(e5) the real exchange rate

↳ $\theta = \frac{eP^*}{P} = \frac{2 . 1/4}{2} = \frac{1}{4}$ (=)

(e6) would the absolute and/or relative PPP theories apply in this case? Justify.

- The absolute PPP theory states that eP* = P at any point in time. This implies that the real exchange rate has to be permanently equal to 1.
- Therefore, the absolute PPP theory **does not apply** in this case, given that the real exchange rate was equal to 0,25, both before and after the shock.
- The relative PPP theory states that eP* and P change in the same proportion, meaning that the real exchange rate has to be constant, though it can be different from 1.
- Therefore, the relative PPP theory **applies** in this case, given that the real exchange rate was always constant, and equal to 0,25. In fact, the exchange rate depreciation is a nominal shock, and so it does not change the relation between prices abroad and at the domestic country (that is, both eP* and P will change in the same proportion when the shock is nominal).

(e7) are the workers in the domestic economy better off after this shock? Justify.

- In the TNT Model, the living standards for workers are measured with the economy's real wages (and not with the sectoral real wages). Therefore, our goal is to see how $\frac{W}{P}$ has changed when the nominal exchange rate depreciated.
- Before the shock, $\frac{W}{P} = \frac{2}{1} = 2$.
- After the shock, $\frac{W}{P} = \frac{4}{2} = 2$.
- Given that the real wages are the same (which aligns with the idea that nominal shocks have no effect on real variables), workers are as well off as they were before the shock.

f) Departing from d), compare the two economies in terms of

(f1) purchasing power of workers

↳ we need to compare real wages

↳ $\frac{w}{P} = \frac{2}{1} = 2$ ↳ $\left(\frac{w}{P}\right)^* = \frac{2}{1/4} = 8$

↳ Purchasing power is higher abroad

(f2) nominal wages expressed in the same currency unit

↳ $w = 2$

↳ Foreign wages in domestic currency = $ew^* = 1 \cdot 2 = 2$

↳ Nominal wages are equal in both economies

(f3) Explain the difference in the results

- The difference in the results arises from the fact that the real wages, unlike the nominal wages, account for the price level of each country.
- In fact, the price level is lower in the foreign country, which means that even though workers receive the same wage they can buy more goods with such wage (higher purchasing power). The lower price level in the foreign country is the result of a higher productivity in the non-tradable sector (comparing with the domestic country).

NOVA NOYA SCHOOL OF BUSINESS & ECONOMICS **Number:** **Name:**

II.C. Consider an economy under float exchange rate, where money demand is given by $m^D = \frac{Y}{i}$,

where i is the nominal interest rate. The foreign price level is $P^* = 2$, the real interest rate is 5% , both the Fisher principle and PPP hold each moment in time, and the economy is always at full employment, with $Y^f = 1\ 000$. Initially, the money supply is constant and equal to: $M = 20\ 000$.

g) Find out the money market equilibrium, quantifying: (g1) the real money demand; (g2) the price level; (g3) the exchange rate; (g4) the velocity of money. (g5) describe the equilibrium in a graph.

h) Due to a liquidity crisis, there's a shift in real money demand to $m^D = \frac{Y}{0{,}8i}$. (h1) without a change in money supply, what would be the implications for the price level and for the exchange rate? (h2) Assuming instead that the central bank adjusts the quantity of money to ensure price stability, what will be the required money supply? (h3) Compare the two cases, describing the adjustment with the help of a graph.

i) Departing from g), imagine that the central bank wants to finance a "once-and-for-all" government deficit by extending 5 000 in credit. Analyse the central bank's ability to stick with price stability in the two following scenarios, by quantifying and explaining carefully, showing the evolution in the central bank's balance sheet: (i1) the central bank has no foreign reserves; (i2) the central bank has the following amount in reserves: $eB_c^* = 7500$. (i3) based on the results from questions i1 and i2, justify why it is important for the central bank to hold foreign reserves. You should look at the impacts on the nominal exchange rate in each of the cases.

I c $m^D = Y/i$ $P^* = 2$ $R = 0,05$ $i = R + \pi^e$ $e = P/P^*$ $Y^F = 1\,000$ $M = 20\,000$

g)

g1) The money supply is initially constant: $\mu = 0$. We are always at full-employment: $g = 0$. $\pi = \mu - g = 0 - 0 = 0$ Fisher principle: $i = R + \pi^e = 0,05 + 0 = 0,05$

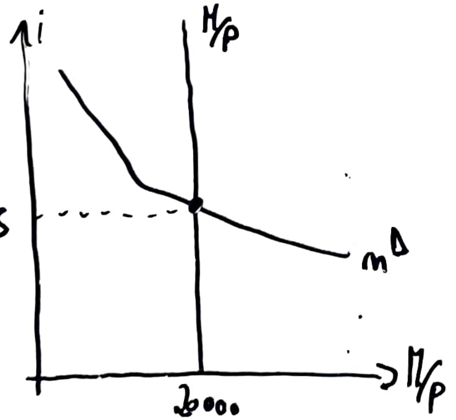
$m^D = Y/i = \frac{1\,000}{0,05} = 20\,000$

g2) Money market equilibrium: $m^D = M/P \Leftrightarrow P = M/m^D = \frac{20\,000}{20\,000} = 1$

g3) $e = P/P^* = 1/2$

g4) Quantity Theory of Money: $MV = PY \Leftrightarrow V = \frac{PY}{M} = \frac{1 \times 1\,000}{20\,000} = 1/20 = 0,05$

g5)



h) $m^{D'} = \frac{Y}{0,8i}$

h1) No change in μ and g, so: $\bar{i} = R + \pi^e = 0,05$. $m^{D'} = \frac{Y}{0,8i} = \frac{1\,000}{0,8 \times 0,05} = 25\,000$

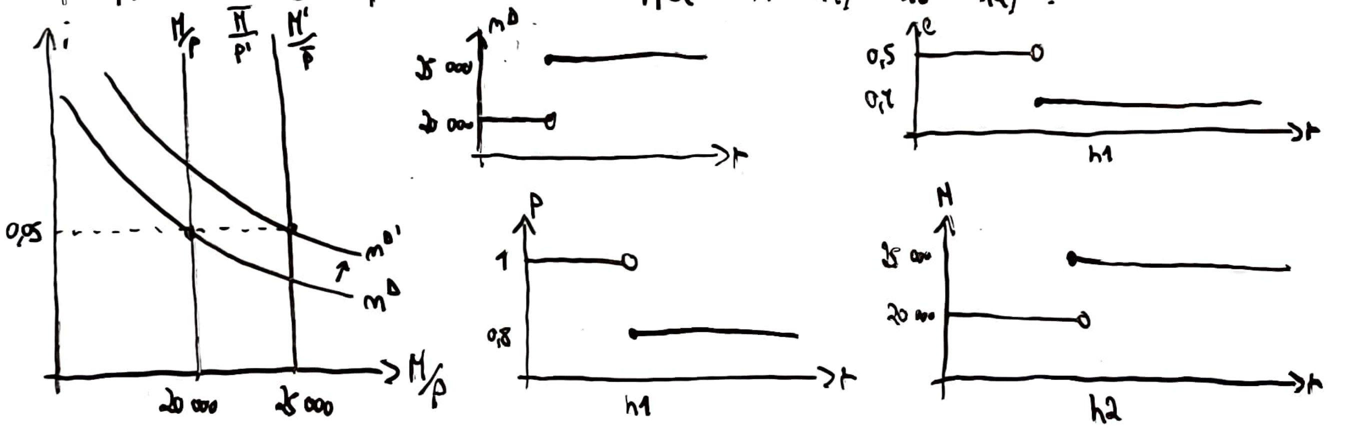
With no intervention from the central bank in the money market, the price level will have to adjust: $P' = \frac{\bar{M}}{m^{D'}} = \frac{20\,000}{25\,000} = 0{,}8$

$e' = \frac{P'}{p^*} = \frac{0{,}8}{2} = 0{,}4$

h2) In order to ensure price stability, the central bank will have to change the money supply: $M' = \bar{P} \times m^D = 1 \times 25\,000 = 25\,000$
The central bank will have to increase M to $25\,000$.

$\bar{e} = \frac{\bar{P}}{\bar{p}^*} = 1/2$

h3) With a surge in liquidity (that is, an increase in m^D), either the price level adjusts, in order to re-establish an equilibrium in the money market with $i = 0{,}05$, or the central bank intervenes to prevent the price level from changing. All in all, we will arrive at the same equilibrium point, with the same value for the M/P ratio, but the specific values of M and P differ in h1) and h2).



i) $\Delta B_c = 5\,000$

ii) $eB_c^* = 0 \Rightarrow M = B_c$ Without foreign reserves, the central bank is unable to sterilize the credit it extends to the government. So, the money supply will change, causing an adjustment from both P and e.

$P' = \frac{M'}{m^D} = \frac{25\,000}{20\,000} = 1{,}25$

CB

$B_c = 20\,000$	$M = 20\,000$
$eB_c^* = 0$	

$\longrightarrow$

CB

$B_c = 25\,000$	$M = 25\,000$
$eB_c^* = 0$	

$e' = \frac{P'}{p^*} = \frac{1{,}25}{2} = 0{,}625$

In this case, the central bank is unable to stick with price stability.

12) $eB_c^* = 7\ 500$ With foreign reserves, the central bank can sterilize the increase in domestic credit, such that the money supply is unchanged.

CB	
$B_c = 12\ 500$	$M = 20\ 000$
$eB_c^* = 7\ 500$	

$\longrightarrow$

CB	
$B_c = 17\ 500$	$M = 20\ 000$
$eB_c^* = 2\ 500$	

$\bar{M} \Rightarrow \bar{P} = \bar{M}/\overline{m^D}$ $\quad \bar{e} = \bar{P}/\overline{P^*}$

$B_c = M - eB_c^* = 20\ 000 - 7\ 500 = 12\ 500$

$\Delta eB_c^* = -\Delta B_c = -5\ 000$

$\Rightarrow eB_c^{*'} = 2\ 500 \ \wedge \ B_c' = 17\ 500$

With the ability to alter the composition of the asset side of its balance sheet, the central bank does not need to expand the money supply, and so is able to stick with price stability.

13) With the two scenarios above, we can see that foreign reserves allow central banks to finance ocasional government deficits, and face shocks, without having to give up on price stability. This is so because the central bank can sterilize its operations, and thus prevent the money supply from changing.