Number: **Name:**

International Macroeconomics

Nova SBE – Fall 2024

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Midterm Assessment 11/10/2024 – Duration: 2h00

I (4.5)

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

i. Global Imbalances

ii. Financial Openness

iii. PPP Exchange Rate

iv. Short-Term Deviations from the Law of One Price

v. The Long Run Monetary Policy Dilemma

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IV (2)

In each question, choose one (correct answer: +0.5; wrong answer: -0.125):

1. In a two-period world with two large economies (with similar preferences) and no investment, the world interest rate will decrease if, all else equal, (i) the rate of time preference increases; (ii) output in the second period increases in one of the countries; (iii) output in the first period falls in one of the countries; (iv) none of the above.

2. In the two-period, optimal investment increases when (i) the rate of time preference decreases, in the open economy; (ii) current output increases, in the closed economy; (iii) current output decreases, in the open economy; (iv) none of the above.

3. International portfolio diversification does not help mitigating risk when (i) cross-country shocks are symmetric and affect capital incomes, only; (ii) cross-country shocks are asymmetric and affect labour incomes, only; (iii) cross-country shocks are symmetric and affect both capital and labour incomes; (iv) all the above.

4. Exchange rate targeting will fail to stabilise prices if (i) relative PPP does not hold; (ii) absolute PPP does not hold; (iii) money velocity is unstable, (iv) all the above.

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II (13.5)

Please present the results with, at most, 3 decimal places.

Each subgroup (2A, 2B and 2C) must be answered in a different sheet.

II.A. Consider Font-Aines D.C., an economy with a single, homogeneous, good. In this economy, the production function is given by $Q_t = 10K_t^{0.5}$, the initial capital level is $K_1 = 100$, and $\delta = 1$. The representative consumer lives for two periods, with preferences represented by $U = C_1C_2$. Further assume that there are no initial assets nor liabilities. This economy is open to capital flows and faces a world interest rate of $r^* = 25\%$.

a) Considering the information regarding Font-Aines D.C., determine:
   (a1) The optimal investment in period 1
   (a2) The net present value of investment
   (a3) The lifetime wealth
   (a4) The optimal consumption path
   (a5) The trade balance in periods 1 and 2
   (a6) The NFIA in periods 1 and 2
   (a7) The current account in periods 1 and 2

b) Unexpectedly, a release of a new technology – ROMance – caused a **productivity surge** and the production function in Font-Aines D.C. is now given by $\boldsymbol{Q_t = 30K_t^{0.5}}$. Find the new values for:
   (b1) The optimal investment in period 1
   (b2) The lifetime wealth
   (b3) The optimal consumption path
   (b4) The trade balance in periods 1 and 2
   (b5) Represent graphically

c) After adopting the new technology, residents from Font-Aines D.C. decided to close the border, afraid foreigners would steal their beloved ROMance, and so they became a **closed economy**. **Departing from b)**, determine:
   (c1) The production possibilities frontier
   (c2) The optimal consumption path
   (c3) The optimal investment in period 1
   (c4) The autarky interest rate
   (c5) Is the economy better off compared to b)? Mention some of the reasons that can be driving the difference in welfare.

II.A

a)

a.1) Investors solve $\max_{\{K_2\}} V_1 = -K_2 + \frac{Q_2}{1+r^*} = -K_2 + \frac{Z\sqrt{K_2}}{1+r^*}$

F.O.C: $\frac{\partial V_1}{\partial K_2} = 0 \Leftrightarrow -1 + \frac{Z}{1+r^*} \cdot \frac{1}{2\sqrt{K_2}} = 0 \Leftrightarrow \frac{1}{2\sqrt{K_2}} = \frac{1+r^*}{Z} \Leftrightarrow 2\sqrt{K_2} = \frac{Z}{1+r^*} \Leftrightarrow$

$\Leftrightarrow \sqrt{K_2} = \frac{1}{2} \cdot \frac{Z}{1+r^*} \Leftrightarrow K_2 = \left(\frac{1}{2} \cdot \frac{Z}{1+r^*}\right)^2$

for $Z = 10$, $r^* = 0.25$, $K_2 = \left(\frac{1}{2} \cdot \frac{10}{1.25}\right)^2 = 16$

Since $S = 1$, $I_1 = K_2 = 16$

a.2) $V_1 = -K_2 + \frac{Z\sqrt{K_2}}{1+r^*} = -16 + \frac{10\sqrt{16}}{1.25} = 16$

a.3) $\Omega = Q_1 + NPV = 10\sqrt{100} + V_1 = 100 + 16 = 116$

a.4) Consumers solve $\max_{\{C_1, C_2\}} U = C_1 C_2$ s.t. $C_1 + \frac{C_2}{1+r^*} = \Omega$

at the optimum, $C_1 = \frac{\Omega}{2} = \frac{116}{2} = 58$ $C_2 = (1+r^*)C_1 = 1.25 \times 58 = 72.5$

a.5) $TB_1 = Q_1 - C_1 - I_1 = 100 - 58 - 16 = 26$

$TB_2 = Q_2 - C_2 = 10\sqrt{16} - 72.5 = -32.5$

a.6) $b_0 = 0$ $b_1 = TB_1 = 26$

$NFIA_1 = r^* b_0 = 0$ $NFIA_2 = r^* b_1 = 0.25 \times 26 = 6.5$

a.7) $CA_1 = TB_1 = 26$

$CA_2 = TB_2 + NFIA_2 = -32.5 + 6.5 = -26$

b)

b.1) As seen in a.1), under optimality, $K_2 = \left(\frac{1}{2}\frac{Z}{1+r^*}\right)^2$

for $Z=30$ ^ $r=0.25$, $K_2 = \left(\frac{1}{2}\cdot\frac{30}{1.25}\right)^2 = 144 = I_1$

b.2) $V_1 = -144 + \frac{30\sqrt{144}}{1.25} = 144$ $\quad \Omega = \underbrace{300}_{Q_1 = 30\sqrt{100} = 300} + \overbrace{144}^{V_1} = 444$

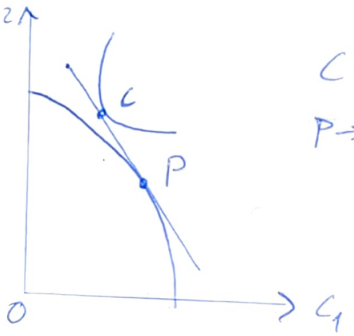
b.3) Consumer's solve $\max_{C_1, C_2} U = C_1 C_2$ s.t. $C_1 + \frac{C_2}{1+r^*} = \Omega$

Under optimality, $C_1 = \frac{\Omega}{2} = 222$ $\quad C_2 = (1+r^*)C_1 = 277.5$

b.4) $TB_1 = Q_1 - C_1 - I_1 = 300 - 222 - 144 = -66$

$TB_2 = Q_2 - C_2 = 30\sqrt{144} - 277.5 = 82.5$

b.5)



C -> Consumption point

P -> Production point

c)

c.1) $Q_1 = C_1 + I_1 \Leftrightarrow I_1 = Q_1 - C_1 \overset{S=I}{\Leftrightarrow} K_2 = Q_1 - C_1 \Leftrightarrow K_2 = 300 - C_1$

$Q_2 = 20\sqrt{K_2} = 30\sqrt{300 - C_1}$ $\quad C_2 = Q_2 \Leftrightarrow \boxed{C_2 = 30\sqrt{300 - C_1}}$ PPF

c.2) $\max_{C_1, C_2} U = C_1 C_2$ s.t. $C_2 = 30\sqrt{300 - C_1} \Leftrightarrow \max_{C_1} C_1 30\sqrt{300 - C_1}$

$\frac{\partial U}{\partial C_1} = 0 \Leftrightarrow 30\sqrt{300 - C_1} + C_1 \cdot 30 \cdot \frac{-1}{2\sqrt{300 - C_1}} = 0 \Leftrightarrow 30\sqrt{300 - C_1} = \frac{15}{\sqrt{300 - C_1}} \cdot C_1 \Leftrightarrow$

$\Leftrightarrow 30(300 - C_1) = 15C_1 \Leftrightarrow 45C_1 = 9000 \Leftrightarrow C_1 = 200$ $\quad C_2 = 30\sqrt{300 - 200} = 300$

c.3) $I_1 = 300 - 200 = 100$

c.4) $1 + r^A = MPK \Leftrightarrow r^A = \frac{\partial Q_2}{\partial K_2} - 1 \Leftrightarrow$

$\Leftrightarrow r^A = \frac{15}{\sqrt{K_2}} - 1 \Leftrightarrow r^A = \frac{15}{\sqrt{100}} - 1 \Leftrightarrow$

$\Leftrightarrow r^A = \frac{15}{10} - 1 = 0.5$

c.5) $U_{b)} = 222 \times 277.5 = 61605$

$U_{c)} = 200 \times 300 = 60000$

Economy is better off in b)

Possible reasons: -> openness to capital flows
-> separate C and I decisions
-> borrow to finance spending

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II.B. The small open economy of Scranton has two sectors, a **tradable** (T) and a **non-tradable** (N). The production functions are given as: $Y_T = L_T$ and $Y_{NT} = 4L_{NT}$, with a=1 and b=4. Furthermore, assume that each price weights 50% in the consumer price index [the CPI is given by $P = P_T^a P_N^{1-a}$], that $P^* = 4$ and $P_T^* = 1$.

d) Suppose that, initially, $P_{NT} = 1$. Find:

(d1) The labour demand equations for both sectors.

↳ $\max \pi_i = \max P_i z_i L_i - w L_i$

$\pi_{L_i}' = 0 \Leftrightarrow P_i z_i - w = 0 \Leftrightarrow \frac{w}{P_i} = z_i$

↳ Then, $\frac{w}{P_T} = a \Leftrightarrow w = P_T$ and $\frac{w}{P_{NT}} = b \Leftrightarrow w = 4P_{NT}$

(d2) The nominal wage rate.

↳ $w = 4P_{NT} = 4 \cdot 1 = 4$

(d3) The price of tradables.

↳ $P_T = w = 4$

(d4) The price level.

↳ $P = P_T^{1/2} P_{NT}^{1/2} = \sqrt{4} \cdot \sqrt{1} = \sqrt{4} = 2$

(d5) The nominal and the real exchange rate.

↳ $eP_T^* = P_T \Leftrightarrow e = \frac{P_T}{P_T^*} \Leftrightarrow e = \frac{4}{1} \Leftrightarrow e = 4$

↳ $\theta = \frac{eP^*}{P} = \frac{4 \cdot 4}{2} = \frac{16}{2} = 8$

e) Michael Scott, the prime minister of Scranton, has a unique style of leadership, and, under his guidance, the productivity in the tradable sector of Scranton has increased to $a = 4$. Find:

(e1) The price of tradables and the nominal wage rate.

↳ Now, $w = 4P_T$ $(a=4)$

↳ $P_T = eP_T^* = 4 \cdot 1 = 4$ $(=)$

↳ $w = 4P_T = 4 \cdot 4 = 16$ $(\uparrow)$

(e2) The price of non-tradables.

↳ $P_{NT} = \frac{w}{4} = \frac{16}{4} = 4$ $(\uparrow)$

(e3) The price level.

↳ $P = \sqrt{P_T} \cdot \sqrt{P_{NT}} = \sqrt{4} \cdot \sqrt{4} = 4$ $(\uparrow)$

(e4) The real exchange rate. Does the relative and/or the absolute PPP hold in this case? Why?

- The absolute PPP theory states that $eP^* = P$, meaning that $\theta = 1$ at all times. In this case, the real exchange rate is never 1, and so **absolute PPP does not apply**.

- The relative PPP theory allows for eP* to be different from P but requires that such difference is the same over time. This means that θ has to be constant. In this case, the real exchange rate was originally 8 (d) and then became 4 (e). Therefore, **relative PPP does not apply**. This makes sense, as asymmetric real shocks (such as this change in productivity) affect the real exchange rate, and so the relative PPP is not supposed to hold.

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(e5) The real wage rate. Are Scranton's workers better off after this shock?

- 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 after the productivity change.
- Before the shock, $\frac{W}{P} = \frac{4}{2} = 2$.
- After the shock, $\frac{W}{P} = \frac{16}{4} = 4$.
- Given that the real wages are now higher (which aligns with the idea that real shocks have an effect on real variables), workers are better off after the shock.

(e6) If the central bank targeted the price level with the goal of obtaining zero inflation, which alternative adjustment would occur?

Note → $\Pi = 0 \Rightarrow P = 2$ and e must change to ensure that the price level does not change

→ $P = P_T^{1/2} P_{NT}^{1/2}$

$\frac{W}{P_T} = 4(=)$

$(=)\ W = 4P_T(=)$

$(=)\ W = 4eP_T^*$

$\frac{W}{P_{NT}} = 4\ (=)$

$(=)\ P_{NT} = \frac{W}{4}$

$(=)\ 2 = \sqrt{eP_T^* \cdot \frac{W}{4}}\ (=)$

$(=)\ 2 = \sqrt{e \cdot 1 \cdot \frac{4eP_T^*}{4}}\ (=)$

$(=)\ 2 = \sqrt{e \cdot e \cdot 1}\ (=)$

$(=)\ 4 = e^2\ (=)$

$(=)\ e = 2$

$(e > 0)$

f) Departing from d), suppose that the Dwight Schrute, the assistant to the prime minister, presents an alternative plan that would make productivity rise in both sectors, so that $a = 4$ and $b = 16$.

(f1) Find the labour demand equations for both sectors.

→ $\frac{W}{P_i} = Z_i$ and so $\frac{W}{P_T} = 4 \wedge \frac{W}{P_{NT}} = 16$ } $W = 4P_T$, $W = 16P_{NT}$

(f2) Find the nominal wage rate and P_T. Compare with the result of (e1). What can you conclude?

→ $P_T = eP_T^* = 4 \cdot 1 = 4$

→ $W = 4P_T = 4 \cdot 4 = 16$

→ Therefore, the wages are equal in this case, compared with when the shock was only on the productivity of the tradable sector. this means that nominal wages are only impacted by the tradable sector.

(f3) Find the price level and the real exchange rate.

→ $P = \sqrt{P_T} \cdot \sqrt{P_{NT}} = \sqrt{4} \cdot \sqrt{\frac{W}{16}} = \sqrt{4 \cdot 1} = 2$

→ $\theta = \frac{eP_T^*}{P} = \frac{4 \cdot 4}{2} = 8$

(f4) Comparing with d), does the relative and/or the absolute PPP hold? Why?

- In this case, the real exchange rate is never 1, and so **absolute PPP does not apply**.
- In this case, the real exchange rate was originally 8 (d) and after the productivity shocks is still 8 (f). Therefore, **relative PPP applies**.

(f5) Compare your answers in (e4) and (f4), explaining why the conclusions are different even though both questions refer to productivity shocks. In your answer, you should refer to the underlying effect.

- In question e4, we have concluded that relative PPP fails after an asymmetric productivity shock (one of the sectors became more productive, whilst the other remained with the same productivity level). In question f4, we have concluded that relative PPP still applies when there are symmetric productivity shocks (both sectors increase their productivity in the same proportion).

- Therefore, we can conclude that relative PPP fails under productivity shocks, unless they are proportional. This arises from the Balassa-Samuelson Effect.

- Note that if we assume that foreign productivities are both 1 (that is, a* = b* = 1) we have that $\theta = \left(\frac{b}{a}\right)^{1-\alpha}$, meaning that the real exchange rate depends on the ratio of the domestic productivities, not on the individual productivities.

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II.C. Consider the open economy of Lageball, where the central bank follows a flexible exchange rate regime. In Lageball, the real money demand is given by $m^D = \frac{Y}{20i}$, the foreign price level is $P^* = 1$, the real interest rate is 5% , both the Fisher principle and PPP hold in each moment in time, and the money supply grows at 20% every year. At time t, consider that both M and Y are equal to 100.

g) Considering that output grows at 20% every year, find, for time t:

(g1) The inflation rate and the nominal interest rate.

↳ $\pi = \%\Delta - g = 20\% - 20\% = 0\%$

↳ $i = r + \pi = 5\% + 0\% = 5\%$

(g2) The real money demand and the velocity of money.

↳ $m^D = \frac{y}{20i} = \frac{100}{20 \cdot 0{,}05} = 100$

↳ $MV = PY \Leftrightarrow V = \frac{PY}{M} \Leftrightarrow V = \frac{P}{M} \cdot Y \Leftrightarrow V = \frac{1}{m^D} \cdot Y \Leftrightarrow V = \frac{100}{100} \Leftrightarrow V = 1$

(g3) The nominal exchange rate depreciation rate.

↳ $e_{DR} = \pi = 0\%$

(g4) The nominal exchange rate and the price level.

↳ $\frac{M}{P} = m^D \Leftrightarrow \frac{100}{P} = 100 \Leftrightarrow P = 1$

↳ $eP^* = P \Leftrightarrow e = \frac{P}{P^*} \Leftrightarrow e = 1$

h) Departing from g, suppose that output stopped growing when it reached Y=100. Still considering that the money supply grows at 20%, find, for time t:

(h1) The new real money demand and the new nominal exchange rate depreciation rate.

↳ $\pi = \%\Delta - g = 20\% - 0\% = 20\%$

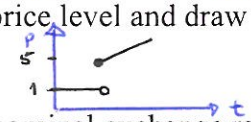
↳ $i = r + \pi = 5\% + 20\% = 25\%$

↳ $m^D = y/20i = 100/20 \cdot 0{,}25 = 20$

↳ $e_{DR} = \pi = 20\%$

(h2) Find the new value for the price level and draw the time path for P.

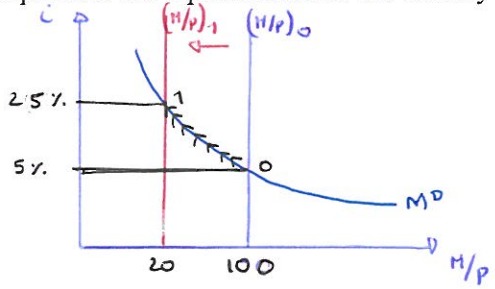
↳ $P = \frac{M}{m^D} = \frac{100}{20} = 5$



(h3) Find the new value for the nominal exchange rate.

↳ $eP^* = P \Leftrightarrow e = P/P^* \Leftrightarrow e = 5$

(h4) Represent the equilibrium in the money market, departing from g).



i) Departing from h), suppose that the central bank of Lageball has decided to stop inflation, and, for that end, it fixed the money supply at 100.

(i1) Explain why fixing the money supply would stop inflation.

↳ Knowing that M is fixed, $\%\Delta = 0\%$.

↳ $\%\Delta = \pi - g$. If $g = 0$ and $\%\Delta = 0$, π will also have to be 0%.

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(i2) Explain the adjustment process, finding the required value for the price level.

↳ $\mu = 0\% \Rightarrow \pi = 0\% \Rightarrow i = r + \pi = 5\% \Rightarrow m^D = \frac{y}{20i} = 100$

↳ $H = 100 \wedge m^D = 100 \Rightarrow P = 1$

↳ Therefore, the adjustment is done with prices, which will fall from 5 to 1 and then stay constant at 1.

(i3) Suppose that the price level in Lageball did not fall to balance the money market after the policy was implemented, remaining constant at the level found in (h2). Explain, quantifying, how the economy would adjust.

↳ $\bar{H}$ and P is fixed at 5.

↳ If M is fixed, $\pi = 0\%$ and $i = 5\%$

↳ $\left.\begin{matrix} H = 100 \\ P = 5 \end{matrix}\right\} \frac{M}{P} = 20$ and so $m^D = 20$

The adjustment has to be done through y:

$\frac{y}{ai} = 20 \; (=) \; \frac{y}{20 \cdot 0{,}05} = 20 \; (=) \; y = 20$ (↓)

j) Departing from h), suppose, instead, that the central bank of Lageball decides to stop inflation by fixing the nominal exchange rate at the value found in (h3). *[Note: assume that e=5 if you have not done h3]*

(j1) Explain why fixing the nominal exchange rate would stop inflation.

↳ By PPP, $eP^* = P$.

↳ P^* is exogenous and assumed constant.

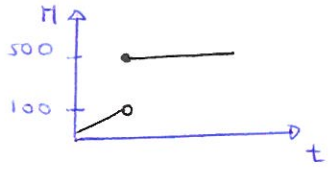
↳ Therefore, $e_{GR} = P_{GR} \; (=) \; e_{GR} = \pi \; (\Rightarrow) \text{If } e_{GR} = 0, \pi = 0$

(j2) Find the endogenous money supply, drawing the time path for M.

↳ $\pi = 0\% \Rightarrow i = 5\% \Rightarrow m^D = 100$

↳ Prices are fixed at 5 (the adjustment is through M)

↳ $M = P \cdot m^D = 5 \cdot 100 = 500$



(j3) Given your answers in questions i) and j), explain why exchange-rate based stabilization could be preferred over money-based stabilization, presenting, as well, one limitation of the policy in j).

- Exchange-rate based stabilization may be preferred over money-based stabilization because it is not subject to downwards stickiness of prices. In fact, if prices are sticky downwards, the necessary fall in prices that is needed to end inflation in money-based stabilization will not take place. In this case, the adjustment is done through output, which has to fall. Therefore, there will be a recession (i3). By not having the possible consequence of a recession, exchange-rate stabilization may be preferred over money-based stabilization.

- However, exchange-rate based stabilization is also subject to failures. Among these are the following: (1) money is required to increase, which may harm the credibility of the central bank, that is trying to end with inflation, (2) failure under productivity shocks, and (3) possibility of imported inflation.