FORMULAS

MACROECONOMICS

(FIRST PARTIAL)

EDITION A.A. 2020 - 2021

By Mario D. Russo, Matteo Giugovaz,
Margherita Sponza, Maria Mazza
Review by Federico Rovida

MACRO VARIABLES

GDP (GROSS DOMESTIC PRODUCT):

1) EXPENDITURE SIDE: final goods and servcies + exported intermediate goods at current prices

$$€Y \sum_{i=1}^{n} P_i Q_i$$

2) SUM OF VALUE ADDED: value of intermediate goods used by each form ("value-added" to the economy by each firm), as VA_{output} – $VA_{intermediate\ goods}$

$$€Y_t = \sum_{i=1}^{n} VA_i$$

3) INCOME SIDE: sum of incomes produced → labor income/Wages (W) + capital income/Profits (π) + tax income/Taxes (T) (+ rent income)

$$€Y = W + \pi + T$$

NOMINAL GDP:

$$€Y = \sum_{i=1}^{n} P_t^i Q_t^i$$

REAL GDP:

$$Y = \sum_{i=1}^{n} P_b^i Q_\tau^i$$

GDP DEFLATOR:

$$P_t = \frac{€Y_t}{Y_t}$$

CONSUMER PRICE INDEX (CPI):

$$CPI_t = 100 * \frac{\sum_{i=1}^{n} P_t^C * Q_t^C}{\sum_{i=1}^{n} P_b^C * Q_t^C}$$

INFLATION RATE:

1) Computed with GDP inflator:

$$\pi_p = \frac{P_t - P_{t-1}}{P_{t-1}}$$

2) With CPI:

$$\pi_{CPI} = \frac{IPC_t - IPC_t}{IPC_{t-1}}$$

3) With GROWTH RATE:

$$\pi = g_{€Y} - g_Y$$

Note that π_{CPI} can differ from π

UNEMPLOYMENT RATE:

$$u_t = \frac{U_t}{L_t}$$

With "U_t" = unemployed in year t and "L_t" = total labor force

PARTICIPATION RATE:

$$l_t = \frac{L_t}{POP_t^{>15}}$$

With "POP >15" = total working-age population t

EMPLOYMENT RATE:

$$n_t = \frac{N_t}{POP_t^{>15}}$$

With "N_t" = employment rate at t

THE GOODS MARKET

DOMESTIC DEMAND OF GOODS IN A CLOSED ECONOMY:

$$Z = C + I + G$$

CONSUMPTION FUNCTION:

$$C = c_0 + c_1(Y - T)$$

AUTONOMOUS SPENDING:

$$A = c_0 - c_1 T + I + G$$

MULTIPLIER OF STANDARD DEMAND:

$$m = \frac{1}{1 - c_1}$$

FIRST EQUILIBRIUM CONDITION (closed economy):

$$Y^* = \frac{A}{1 - C_1} = mA$$

PRIVATE SAVINGS:

$$S^P = Y - T - C$$

$$S^P = I + G - T$$

PUBLIC SAVINGS:

$$S^G = T - G$$

SECOND EQUILIBRIUM CONDITION (closed economy):

$$I = S^G + S^P$$

THE FINANCIAL MARKET

DEMAND FOR HIGH-POWERED MONEY:

$$H^d = [c + \theta(1 - c)]M^d$$

EQUILIBRIUM CONDITION OF FINANCIAL MARKETS ($H^S = H^D$):

1. $H = [c + \theta(1 - c)] * €YL(i)$
2. $H = CI^d + R^d$ with CI^d = currency demand and R^d = reserves demand
3. $€YL(i) = \frac{H}{c + \theta(1 - c)}$

MONEY MULTIPLIER:

$$m^m = \frac{1}{c + \theta(1 - c)}$$

SUPPLY MULTIPLIER:

$$M^S = \frac{H}{c + \theta(1 - c)}$$

COEFFICIENT c AND θ:

$$C = \frac{CI^d}{CI^d + D^d}$$

$$\theta = \frac{R^d}{D^d}$$

IS-LM MODEL

CONSUMPTION FUNCTION:

$$C = c_0 + c_1(Y - T)$$

INVESTMENT FUNCTION:

$$I = I + d_1 Y - d_2 i$$

IS FUNCTION:

$$Y = C + I + G$$

$$Y = [c_0 + c_1(Y - T)] + [I + d_1 Y - d_2 i] + G$$

➔ $Y = \frac{c_0 - c_1 T + I + G}{1 - c_1 - d_1} - \frac{d_2}{1 - c_1 - d_1} i$

➔ $i = \frac{A}{d_2} - \frac{1 - c_1 - d_1}{d_2} Y$

With d_1 = sensitivity of investments to income; d_2 = sensitivity of investment to the interest rate

MONEY DEMAND FUNCTION:

$$L(Y, i) = f_1 Y - f_2 i$$

With f_1 = sensitivity of money demand to income; f_2 = sensitivity of money demand to investment

LM FUNCTION:

$$\frac{M}{P} = f_1 Y - f_2 i$$

MONETARY POLICY MULTIPLIER (standard case):

$$m^{PM} = \frac{-d_2}{1 - c_1 - d_1}$$

FISCAL POLICY MULTIPLIER (standard case):

$$m^{PF} = \frac{1}{1 - c_1 - d_1}$$

FISCAL POLICY MULTIPLIER (exogenous M):

$$m^{PF} = \frac{1}{1 - c_1 - d_1 + d_2 \frac{f_1}{f_2}}$$

MONETARY POLICY MULTIPLIER (exogenous M):

$$m^{PM} = \frac{1}{(1 - c_1 - d_1)\frac{f_2}{d_2} + f_1}$$

THE FINANCIAL MARKET (2)

RELATION BETWEEN NOMINAL AND REAL INTEREST RATE:

$$1 + r_t = \frac{(1 + i_t)P_t}{P^e_{t+1}}$$

With i_t = nominal interest rate; r_t = real interest rate.

EXPECTED INFLATION:

$$\pi^e_{t+1} = \frac{P^e_{t+1} - P_t}{P_t}$$

RISK PREMIUM:

$$x = \frac{(1 + i)P}{1 - P}$$

THE LABOR MARKET

WAGE-SETTING CURVE (WS):

$$\frac{W}{P^e} = f\binom{u \quad z}{- \quad +}$$

Where "Pe" = expected price; "z" = catchall variable (employment protection and other)

PRICE SETTING CURVE (PS):

$$\frac{w}{P} = \frac{A}{1+\mu}$$

Where "A" = marginal productivity of labor and "μ" = markup level in the products market

NATURAL LEVEL OF UNEMPLOYMENT AS A FUNCTION OF Y_n

$$u_n = 1 - \frac{Y_n}{AL}$$

THE PHILIPS CURVE

PHILIPS CURVE:

$$\pi_T = \pi_T^e + (\mu + z) - \alpha u_T$$

Where
"π_T^e"$= \theta\pi_{t-1}$

1) Original (P = 0)

$$\pi_T = (\mu + z) - \alpha u_T$$

2) Modified / adaptive expectations (0< P <1)

$$\pi_T = \vartheta\pi_{t-1} + (1-\theta)\bar{\pi} + (\mu + z) - \alpha u_T$$

3) Accelerated /perfectly adapted / computed with regard to inflation (θ =1)

$$\pi_T = \pi_{t-1} + (\mu + z) - \alpha u_T$$

$$\rightarrow \Delta\pi_t = (\mu + z) - \alpha u_T$$

NATURAL UNEMPLOYMENT RATE:

$$u_n = \frac{\mu + z}{\alpha}$$

INFLATION VARIATION (if accepted):

$$\Delta\pi = -\alpha(u_T - u_n)$$

PHILLIPS CURVE WITH WAGE INDEXATION:

$$\Delta\pi = \frac{-\alpha}{1-\lambda}(u_T - u_n)$$

IN COLLABORATION WITH:

For doubts or suggestions on the handout:

MATTEO GIUGOVAZ

+39 3473900812

@Matteo_giugovaz

MARIA MAZZA

+39 3487319848

@Mariamazza_

FEDERICO ROVIDA

+39 3451234479

@Fede.rovida

For info about our teaching division:

LORENZO CUNDARI

+39 3920281217

@Lore.cundari_

MARTINA GARAVAGLIA

+39 3496362050

@Martina.garavaglia