

## Seminar 4. Problems with multipliers

### Solution to Problem 1

We write the general model for the case of a closed economy:

$$\begin{cases} Y = C + I + G \\ C = C_0 + c \cdot Y_{disp}, \quad c \in (0,1) \\ Y_{disp} = Y - T + TR \\ T = T_0 + t \cdot Y, \quad t \in (0,1) \end{cases}$$

We then bring the model to its final form, replacing step by step the dependent variables  $T$ ,  $Y_{disp}$  and  $C$  in the output equation.

$$\begin{cases} Y = C_0 + c \cdot (1-t)Y - cT_0 + cTR + G + I \\ C = C_0 + c \cdot (1-t)Y - cT_0 + cTR \\ Y_{disp} = (1-t)Y - T_0 + TR \\ T = T_0 + tY \end{cases} \quad \begin{matrix} \rightarrow \\ \rightarrow \\ \rightarrow \end{matrix}$$

The following final form of the equation is obtained:  $Y = \frac{1}{1-c(1-t)} [C_0 - cT_0 + cTR + G + I]$

a) The case when  $t=0$

From the last equation we get:

$$Y = \frac{1}{1-c} (C_0 + I + G) - \frac{c}{1-c} \cdot (T_0 - TR) = \frac{1}{1-0,9} (100 + 200 + 500) - \frac{0,9}{1-0,9} \cdot 400 = 4400 \text{ bil.lei}$$

$$C = 100 + 0,9(4400 - 400) = 3700 \text{ bil.lei}$$

$$T = T_0 = 400 \text{ bil. lei}$$

$$BD = G - T + TR = 500 - 400 = 100 \text{ bil. lei (budgetary deficit)}$$

b) The case when  $t=1/3$

$$Y = \frac{1}{1-c(1-t)} 440 = 1100 \text{ bil.lei}$$

$$BD = G - T_0 - tY + TR = 500 - 400 - 1/3 \cdot 1100 = -266,7 \text{ bil. lei (budgetary surplus)}$$

*How do you justify the decrease of the GDP and the budget deficit in case b) when a tax rate of 33.3% was introduced?*

### Solution to Problem 2

The general model is:

$$\begin{cases} Y = C + I + G + NX \\ C = C_0 + c \cdot Y_{disp} \\ Y_{disp} = Y - T + TR \\ T = T_0 + t \cdot Y \end{cases}$$

Since the variation of the budget deficit is defined by the relation:

$$\Delta BD = \Delta G - \Delta T,$$

It results:

$$\Delta BD = \Delta G - \Delta T = -100 \text{ mil. lei}$$

If we make the replacement  $\Delta T = t \cdot \Delta Y$  in the previous equation, we obtain:

$$\Delta BD = \Delta G - t \Delta Y = -100 \text{ mil. lei}$$

According to the multipliers theory, the relation by which we determine the variation of GDP ( $\Delta Y = Y_1 - Y_0$ ) caused by the variation in government spending ( $\Delta G = G_1 - G_0$ ) is:

$$\Delta Y = \frac{1}{1 - c(1 - t)} \cdot \Delta G$$

where  $\frac{\Delta Y}{\Delta G} = \frac{1}{1 - c(1 - t)}$  is the multiplier of government spending (or the multiplier of budgetary policy)

After making the necessary replacements we get:

$$\Delta Y = \frac{1}{1 - 0,9(1 - 1/3)} \cdot \Delta G = 2,5 \cdot \Delta G$$

$$\Delta BD = \Delta G - t (2,5 \cdot \Delta G) = (1 - 2,5/3) \cdot \Delta G = 1/6 \cdot \Delta G$$

Since  $\Delta BD = -100$ , government spending should drop by 600 mil. lei.

### ***Solution to Problem 3***

The null hypothesis:  $\Delta T_0 = 50 \text{ mil. €}$ .

$$\alpha_G = \frac{1}{1 - c(1 - t)} = 3,125$$

$$\Delta Y = -c \alpha_G \Delta T_0 = -0,9 \cdot 3,125 \cdot 50 = -125 \text{ mil. €}$$

$$\Delta BD = -\Delta T_0 - t \cdot \Delta Y = -50 + 0,15 \cdot 125 = -31,25 \text{ mil. €}$$

$$\Delta C = -c \Delta T_0 + c(1 - t)\Delta Y = -0,8 \cdot 50 + 0,8 \cdot (1 - 0,15) \cdot (-125) = -125 \text{ mil. €}$$

Alternatively, the variation in private consumption could also be determined by using the following relationship:

$$\Delta Y = \Delta C + \Delta I + \Delta G + \Delta NX.$$

Since investments, government spending and net exports do not change,  $\Delta I = \Delta G = \Delta NX = 0$ , then:

$$\Delta Y = \Delta C = -125 \text{ mil. €}$$

### ***Solution to Problem 4***

$$\Delta TR = -1 \text{ mil € and } \Delta G = 1 \text{ mil. €}$$

$$\Delta Y = \alpha_G [\Delta G + c \Delta TR] = \alpha_G [1 - c] \text{ mil. €} > 0 \Rightarrow \text{GDP will increase}$$

$$\Delta BD = \Delta G + \Delta TR - t \cdot \Delta Y = 1 - 1 - t \Delta Y = -t \Delta Y < 0 \Rightarrow \text{the budgetary deficit will drop}$$