Exercise Class 1

Solutions

BESS - FOUNDATIONS OF ECONOMICS - 30453

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Note: This document contains exercises relative to the program of Macroeconomics by Blanchard-Amighini-Giavazzi (ch. 2, 3). The program relies on the 3th edition of the book. Exercises are written by the author of the document or completely extrapolated from Ferraguto exercise textbook (5th edition).

Ch.2 - National Accounting

Short resume on GDP calculation

How to measure GDP. GDP measures the state of a given economy, but it could be defined in different ways.

1. GDP is the value of **final goods and services** produced in the economy during a given period.
   This measure of GDP is given by final goods and services, therefore those produced by firms and consumed by consumers. For **final** its meant the value of sales revenues. Intermediate goods, i.e. those produced by firms for other firms, are not included.

2. GDP is the **sum of value added** in the economy during a given period.
   This GDP measure is given by the value of production minus the value of intermediate goods used for the production. Here there is no distinction between intermediate or final producers, all the firms are included in the calculation.

3. GDP is the **sum of incomes** in the economy during a given period.
   This GDP measure is built upon the sum of capital (profits) and labour (wages) incomes. All the firms are included in the calculation. No final values of production taken into account.

Exercise 1

Consider an economy where there are only three firms. An agricultural firm grows **70 worth** of wheat paying **50 in wages** to peasants; the rest is profit. The agricultural firm sells its whole production to a baker. The baker's workers transform wheat in **200 worth of bread**: they are paid **100 in wages**. The baker sells 180 of bread to households for final consumption and 20 to a "restaurant". The cost of wheat and worker's wages are the only costs for the baker: the rest is profit. The "restaurant" serves the bread purchased by the baker with waiters paid **wages for 30**. The clients of the restaurant pay **bills for 60** allowing the restaurant a **profit of 10**. Show than the GDP of this economy can be calculated in three ways with the same result: sum of the values of final goods produced, sum of the value added of the three firms and sum of the incomes (wages and profits) earned by workers and firms' owners.

	Agricultural		Bakery		Restaurant	
	Revenues	Expenses	Revenues	Expenses	Revenues	Expenses
	70	50	200	170	60	50
Interm. Cost				70		20
Wages		50		100		30
Profits	20		30		10	

Table 1: Production Side Table - Ex.1

	Final Consumers	
	Revenues	Expenses
	240	240
Purchases (Bak.+Rest.)		180+60
Wages (Agr.+Bak.+Rest.)	50+100+30	
Profits (Agr.+Bak.+Rest.)	20+30+10	

Table 2: Consumption Side Table - Ex.1

Solution

- Value of final goods and services: $180 + 60 = 240$;
- Sum of value added: $70 + 130 + 40 = 240$
- Sum of incomes (capital+labour): $(20 + 30 + 10) + (50 + 100 + 30) = 60 + 180 = 240$

Exercise 2 - (Q3, pg.8 Ferraguto)

(a) Explain what is meant by: labour force, unemployment rate and participation rate. Moreover, give a math formula when needed.

Solution

- Labour force: sum of the number of people who are employed and those unemployed. It is usually indicated by $L = N + U$;

– Unemployment rate: percentage of unemployed people with respect to the overall labour force. Usually indicated with $u = \frac{U}{L}$;

– Participation rate: percentage of labour force with respect to the overall population of working age. Indicated with $p = \frac{L}{\text{POP}_{15-64}}$.

(b) Consider two periods of the economy (t, $t+1$). In $t+1$ GDP deflator has gone down by 4%, and the real GDP growth has been equal to -3%.

Compute the growth rate of nominal GDP for this economy in $t+1$.

Solution

$$g_{\text{NOM},t+1} = g_{\text{REAL},t+1} + g_{\text{DEFL},t+1}$$
$$g_{\text{NOM}} = -3 - 4 = -7\%$$

For a deep understanding of the math behind the relationship of GDP deflator and real GDP, read this note.

Ch. 3 - The Goods Market

Exercise 3 - pg.10 Ferraguto

The goods market of a country is described by the following equations:

$$C = c_o + c_1 Y_D$$
$$Y_D = Y - \bar{T}$$
$$Y = C + \bar{I} + \bar{G}$$

(a) Express the equilibrium level of income as function of the multiplier and the autonomous spending.

Solution

$$Y = \underbrace{\left(\frac{1}{1-c_1}\right)}_{\text{Multiplier}} \underbrace{[c_0 - c_1 T + \bar{I} + \bar{G}]}_{\text{Autonomous spending}}$$

Autonomous spending is the sum of all of those components of aggregate demand that do not depend on income. The **multiplier** is defined as the number by which the equilibrium level output change as a given change in the autonomous spending.

(b) Denote by $D = \bar{G} - \bar{T}$ the government deficit, and suppose $\bar{G}, \bar{T}$ are cut by the same amount, i.e $\Delta\bar{G} = \Delta\bar{T}$. Derive the expression of the change in equilibrium income given by a simultaneous change of both variables in Y. What happen to the equilibrium level of Y?

Solution Consider a positive effect of taxes and public expenditure on the equilibrium level of output (through partial derivatives); the effect of the reduction will be of opposite sign ($\Delta G < 0, \Delta T < 0$).

$$\Delta Y = -\frac{1}{1-c_1}\Delta G < 0$$
$$\Delta Y = \frac{c_1}{1-c_1}\Delta T > 0$$

Since $\Delta G = \Delta T < 0$, the compound effect $-(\Delta G + \Delta T)$ on the overall equilibrium level of output is given by:

$$\Delta Y = -\frac{1-c_1}{1-c_1}\Delta G$$

The overall level of output after the policy mix is lower because the decrease in taxes is "disturbed" by the factor $c_1 < 1$ and does not completely offset the reduction in government spending. Shortly, demand due to lower of level of taxes increase less than how it is reduced by lower government spending that works 1:1 with the change on the level of output.

Exercise 4 - Q5, pg.12 Ferraguto (revisited)

The goods market of a country is described by the following equations:

$$C = c_o + c_1 Y_D$$
$$Y_D = Y - T$$
$$T = \bar{T} + tY \qquad t \in (0,1)$$
$$Y = C + \bar{I} + \bar{G}$$

(a) Express the equilibrium level of income as function of the multiplier and the autonomous spending.

Solution

$$Y = \underbrace{\left(\frac{1}{1-c_1(1-t)}\right)}_{\text{Multiplier}} \underbrace{[c_0 - c_1\bar{T} + \bar{I} + \bar{G}]}_{\text{Autonomous spending}}$$

(b) What happens to the equilibrium level of income and the aggregate demand curve when there is an increase in government spending ($\Delta\bar{G} > 0$)? And what happens instead when there is a decrease in t? Draw the changes in 2 different graphs and comment on the relative differences.

Solution Derive the explicit form of the aggregate demand curve. It is useful to detect the differences among the two variations.

$$Z = [c_0 - c_1\bar{T} + \bar{I} + \bar{G}] + c_1(1-t)Y$$

$$\frac{\partial Z}{\partial G} = 1 > 0$$
$$\frac{\partial Z}{\partial t} = -c_1 Y < 0$$

These two variations induce a positive shift of the aggregate demand curve Z in the first case, and a positive rotation of the curve in the second case (recall that the desired change is a reduction in t, which gives the opposite effect given by the derivative). Look at the graph (fig.1) to understand the variation occurring. On the overall equilibrium of output, accordingly:

$$\frac{\partial Y}{\partial G} = \frac{1}{1-c_1(1-t)} > 0$$
$$\frac{\partial Y}{\partial t} = -[c_0 - c_1\bar{T} + \bar{I} + \bar{G}]\frac{c_1}{(1-c_1(1-t))^2} < 0$$

It follows that an increase of G has an effect equal to the multiplier $\frac{1}{1-c_1(1-t)} > 0$ on Y, while a reduction in t leads to a positive effect equal to $[c_0 - c_1\bar{T} + \bar{I} + \bar{G}]\frac{c_1}{(1-c_1(1-t))^2}$.

Exercise 5 - Paradox of Savings

Define whether the following statement is true or false.
Assume investment is fixed $I = \bar{I}$ and there is balanced budget $G = T$. If $(1 - c_1)$ increases, private saving must decrease.

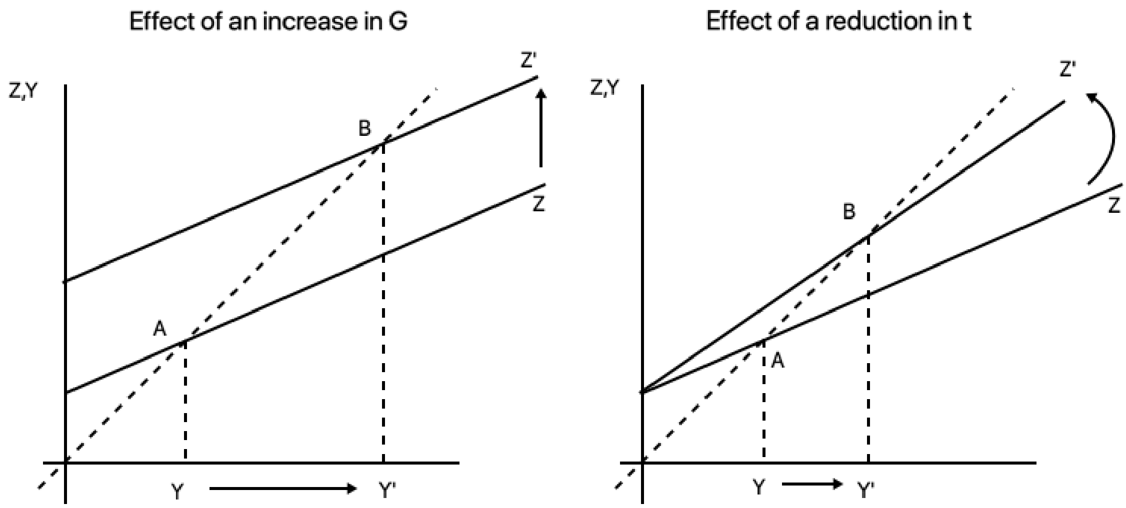

Figure 1: Effects on the aggregate demand and output deriving respectively from an increase in G and a reduction in t.

Solution Consider the following equations that give saving in terms of C, Y.

$$S = -c_o + \underbrace{(1 - c_1)}_{\substack{\text{Propensity} \\ \text{to save}}} \underbrace{(Y - T)}_{\substack{\text{Disposable} \\ \text{income}}} \tag{1}$$

$$\bar{I} = \underbrace{S}_{\substack{\text{Private} \\ \text{Saving}}} \underbrace{(T - G)}_{\substack{\text{Public} \\ \text{Saving}}} \tag{2}$$

Since here $G = T$ equation (2) becomes $\bar{I} = S$.
From this equilibrium equation we know that S cannot change since $\bar{I}$ is fixed. From equation (1), as the propensity to save increases, consumption decreases reducing aggregate demand production and income, hence leaving savings unchanged. Therefore the correct answer to the statement above is that savings does not change. Note that this is true in the short-run.