People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

Setif 1 University -FERHAT ABBAS-

Faculty of Economic, Commercial and Management Sciences

Department of Finance and Accounting

Course Handout for:

Macroeconomics II

Prepared for second-year students,
Common Core in Finance and Accounting

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PREFACE

1-1- Introduction

This Macroeconomics 2 handout is designed for second-year students in the common course of Finance and Accounting. It aims to deepen students' understanding of macroeconomic analysis by building upon the fundamental concepts studied in Macroeconomics 1. This material offers a systematic and analytical approach to understanding how macroeconomic variables interact to shape overall economic performance.

The handout is divided into seven interconnected chapters. Chapter 1 introduces Keynesian equilibrium in a three-sector economy, focusing on the interaction between consumption, investment, and government spending. Chapter 2 expands the scope of analysis to include a four-sector economy by incorporating the external sector, enabling students to understand the dynamics of an open economy.

Chapter 3 introduces the IS-LM model, a centralized framework that integrates the goods and money markets, providing essential tools for short-term macroeconomic analysis. Chapters 4 and 5 explore fiscal and monetary policy, as well as the determinants and mechanisms of economic growth.

Chapter 6 addresses unemployment, inflation, and business cycles, highlighting their importance in macroeconomic stability and policy design. The final chapter discusses the Phillips Curve and Okun's Law, emphasizing their role in understanding the trade-offs and relationships between key macroeconomic variables.

This Macroeconomics 2 handout aims to provide clear, structured, and academically rigorous content that supports students in developing a solid analytical and theoretical foundation in macroeconomic theory, thereby enhancing their understanding of contemporary economic issues and policy challenges.

1-2- Course description

Course title	Macroeonomics II
Education unit	Basic
Balance	4
Parameter	2
Time study per week	1.5 hours of lectures + 1.5 hours of tutorials
Target level	2^{SND} year of basic education
Required Prerequisites	Introduction to Economics, Microeconomics, History of Economic Thought, Macroeconomics 1, Mathematics
Learning methods followed	in-person classes and distance learning
Assessment method	Examination and continuous monitoring

1-3- Learning Outcomes

- **Primary objective:** Acquiring macroeconomic analysis skills.
- **Sub-objectives:** After studying the content of this handout course, the student will be able to:
  - Understand and analyze general economic equilibrium in both closed and open economies.
  - Distinguish between the instruments of fiscal policy and those of monetary policy.
  - Understand the mechanisms of economic policies and their effects on the national economy (fiscal and monetary).
  - Analyze the impact of external transactions with the rest of the world on the equilibrium of the national economy and its macroeconomic indicators.

1-4- Course content

Chapter	Chapter Title
Chapter 01	**The Keynesian model in a closed economy (three sectors)**
Chapter 02	**The Keynesian model in an open economy (four sectors)**
Chapter 03	**IS-LM Model**
Chapter 04	**Analysis of fiscal and monetary policies**
Chapter 05	**Business cycles**
Chapter 06	**Economic growth, unemployment, and inflation**
Chapter 07	**The Phillips Curve and The Okun's Law**

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Chapter 01: The Keynesian model in a closed economy (three sectors)

We have seen that the overall equilibrium in a simple model consists of two sectors; in fact, there are two other sectors in the economy: the government sector and the foreign trade sector.

The three-sector model enhances the fundamental Keynesian framework in macroeconomics by integrating the government sector with households and investment sector. This model offers a more accurate representation of the economy.

Through this chapter, the student will be able to:

1. ***Identify the fundamental variables introduced into the macroeconomic model with the inclusion of the government sector.***
2. ***Explain the effects of these variables on the model's behavior and on overall macroeconomic equilibrium.***
3. ***Calculate and graphically represent the equilibrium level of national income in light of these variables.***

Chapter 01: The Keynesian model in a closed economy (three sectors)

The three-sector model adds the government) public sector) as an essential participant that influences national income and overall economic activity.

The government enters the model through three components—taxes, government spending, and transfer payments. These elements affect aggregate demand and therefore play an important role in determining equilibrium income. By doing so, the government contributes to maintaining economic stability and reducing fluctuations that may arise from changes in private consumption or investment.

1- The government sector variables

The government sector affects the level of economic activity (production, employment, consumption) through its three tools (Yuldasheva & Artikov, 2021, p. 580) (Blanchard, 2017, pp. 475-479):

1-1- Government expenditure (G)

It represents the purchases of goods and services by the state, and local governments. The goods range from airplanes to office equipment. The services include services provided by government employees: In effect, the national income accounts treat the government as buying the services provided by government employees—and then providing these services to the public, free of charge.

It directly increases aggregate demand and is frequently used to stimulate the economy during recessions. Moreover, investment in infrastructure, education, and health contributes to long-term productivity and economic growth.

1-2- Taxes (Tx)

A tax is a compulsory payment imposed by the government on individuals and businesses to finance public expenditure and provide goods and services that promote societal welfare.

According to this definition, taxes constitute a major source of government revenue and serve as an important regulatory instrument for implementing economic and social policies. They also influence aggregate demand by affecting consumption and investment levels. Through appropriate tax adjustments, the government can promote macroeconomic stability and maintain overall economic equilibrium.

1-3- Transfers (Tr)

they are one-way flows of money from the government to individuals or other entities, with no direct exchange of a good or service in return. Their primary purpose is income

redistribution and social welfare. Examples include Social Security benefits, unemployment insurance, welfare, and subsidies. These payments are not included in the direct calculation of Gross Domestic Product (GDP) because they do not represent new production. Instead, they affect disposable income, which then influences consumer spending.

According to this definition, financial transfers are government expenditures used to redistribute income, thereby influencing the level of aggregate consumption in the economy. This boosts aggregate demand, and thus government financial transfers contribute to stabilizing and supporting macroeconomic equilibrium.

1-4- General budget balance

It is the balance between total government expenditure and revenue during a certain period of time, usually a year. The formula for calculating the budget balance is as follows:

$$GB = T_X - (G + T_R)$$

Where:

GB = General budget balance

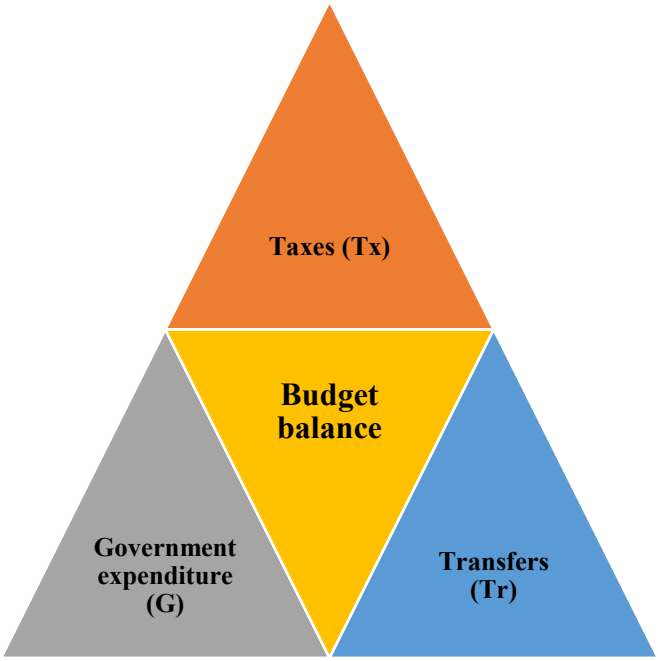
T_X = Taxes Revenue

G = Government Purchases of Goods and Services

TR = Transfer Payments

- **Budget balance positions:** The budget balance can take one of the following positions (Freitas, 2022):
  - GB>0 $\Rightarrow$ **A budget surplus** which occurs when government revenue is higher than government expenditure.
  - GB<0 $\Rightarrow$ **A budget deficit** which occurs when government revenue is lower than government expenditure.
  - GB=0 $\Rightarrow$ **A balanced budget** which occurs when government revenue is equal to government spending.

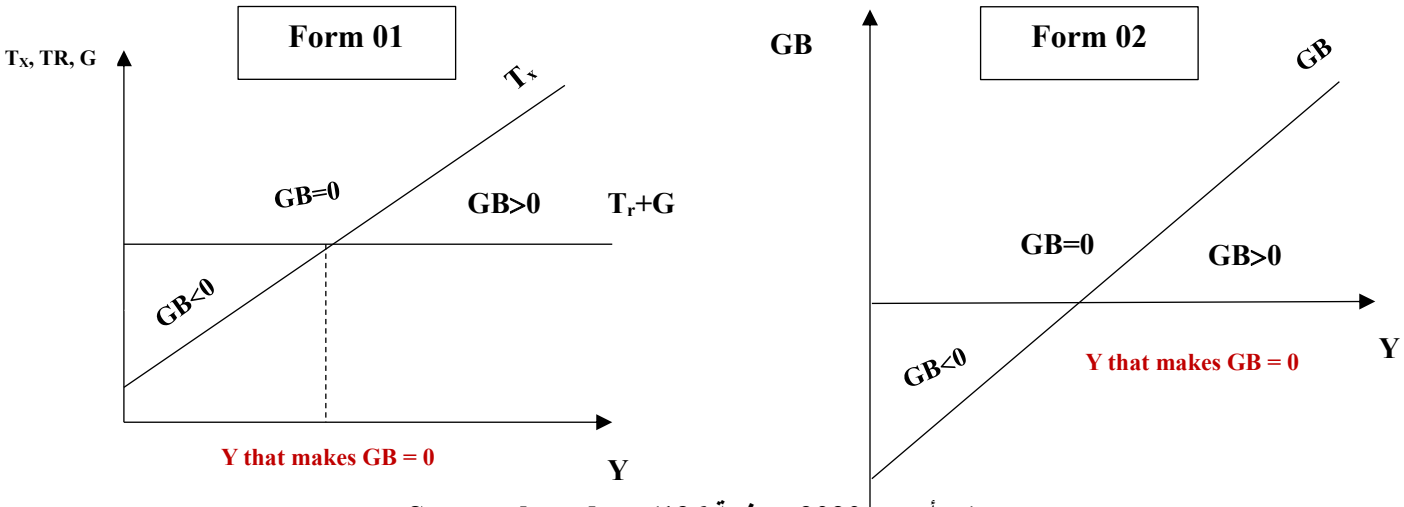
Figure (01): The government sector variables



Source: based on the previous data

- **General budget balance Graphs representation:** the General budget balance can be represented in one of the following two forms:
  - **Form 01:** this form focuses on budget items, where expenditures are presented separately, including government expenditures and transfers, while taxes are presented as an independent component of revenues.
  - **Form 02:** this form focuses on representing the government budget through macroeconomic equations.

Figure (02): General budget balance Graphs representation



Source: based on (بن أحمد ، 2020، صفحة 196)

2- Calculating Equilibrium Income in a Three-Sector Model

The equilibrium income in a three-sector macroeconomic model can be derived using two approaches: the first is the condition in which aggregate demand (D) equals aggregate supply (Y), and the second is the condition in which total expenditures equal total resources.

2-1- The model's behavioral equations

Before discussing how to determine the equilibrium income level in a three-sector model, it is necessary to understand the behavioral equations that will be used, these equations are summarized in the following table:

Table 01: The three model's behavioral equations

The behavioral equations	The formula	
The consumption equation	$C = C_0 + bY_d$	
The saving equation	$S = -C_0 + (1 - b)Y_d$	
The disposable income equation	$Y_d = Y - TX + TR$	
The investment equation	$I = I_0$	
The Government expenditure equation	$G = G_0$	
The taxes equation	Taxes not related to income	$TX = TX_0$
	Taxes related to income	$TX = TX_0 + tY$
The Transfers equation	$TR = TR_0$	

Source: based on (بن أحمد ، 2020، صفحة 188)

2-2- Derivation of the equilibrium income equation in a three-sector model

With the presence of the government sector, the definition of aggregate demand changes to include government expenditure. Therefore, aggregate demand for goods and services becomes:

$$D = C + I + G$$

where the consumption will be depended on disposable income which becomes:

$$Yd = Y - TX + TR$$

2-2-1- In case of taxes not related to income $TX = TX_0$

The equilibrium income equation in a three-sector model using the two conditions of equilibrium can be derived as below (Majerová, 2025):

2-2-1-1- Condition one: aggregate demand (D) equals aggregate supply (Y) (Y/D)

Y=D

$Y = C + I + G$

$Y = C_0 + by_d + I_0 + G_0$ note that $Yd = Y - TX + TR$

$Y = C_0 + b\,(y - Tx_0 + Tr_0) + I_0 + G_0$

$y = C_0 + by - bTx_0 + bTr_o + I_0 + G_0$

$y - by = C_0 - bTx_o + bTr_o + I_0 + G_0$

$y\,(1 - b) = C_0 - bTx_0 + bTr_o + I_0 + G_0$

$$\mathbf{Y_e = \frac{1}{(1-b)}(C_0 - bTx_0 + bT_{r_0} + I_0 + G_0)}$$

➢ **Graphical representation of the equilibrium by Y/D condition**

In order to represent the equilibrium situation by the condition of aggregate demand (D) equals aggregate supply (Y)**; first** we must find the aggregate demand equation D.

$$D = C + I + G$$

$$D = C_0 + byd + I_0 + G_0$$

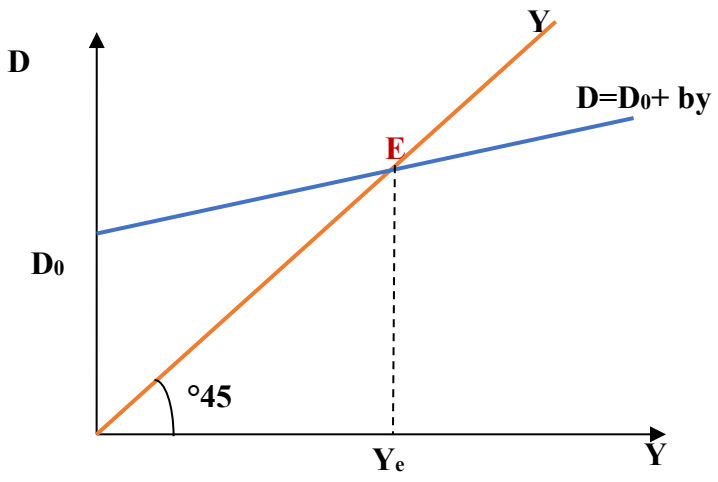
$$D = C_0 + by - bTx_0 + bTro + I_0 + G_0$$

$$D = (C_0 - bTx_0 + bTro + I_0 + G_0) + by$$

$$D = D_0 + by$$

The equilibrium can then be represented as follows, noting that the aggregate supply curve is represented by a 45° line.

Figure (03): **Representation of the equilibrium situation by Y/D condition**



The **E-point** represents the equilibrium point, i.e., the equilibrium points between total supply and total demand.

2-2-1-2- Condition two: total expenditures equal total resources (injections = leakages/ S=I)

Based on the equilibrium condition, the equilibrium income can be found as below:

$$S + Tx = G + I + Tr$$

where the saving equation will be depended on disposable income which becomes:

$$Yd = Y - TX + TR$$

S + Tx = G + I + Tr

$-C_0 + (1-b)\, y_d + Tx_0 = I_0 + G_0 + Tr_o$

$-C_0 + (1 + b)\,(y - Tx_0 + Tr_0) + Tx_0 = I_0 + G_0 + Tr_o$

$y - Tx_0 + Tr_0 + by - bTx_0 + b\,Tr_0 = C_0 - Tx_0 + I_0 + G_0 + Tr_o$

$$\left(y + by = C_0 - bT_0 + bT_{r_0} + I_0 + G_0\right)$$

$$\mathbf{Y_e = \frac{1}{(1-b)}\left(C_0 - bT_{x0} + bT_{r_0} + I_0 + G_0\right)}$$

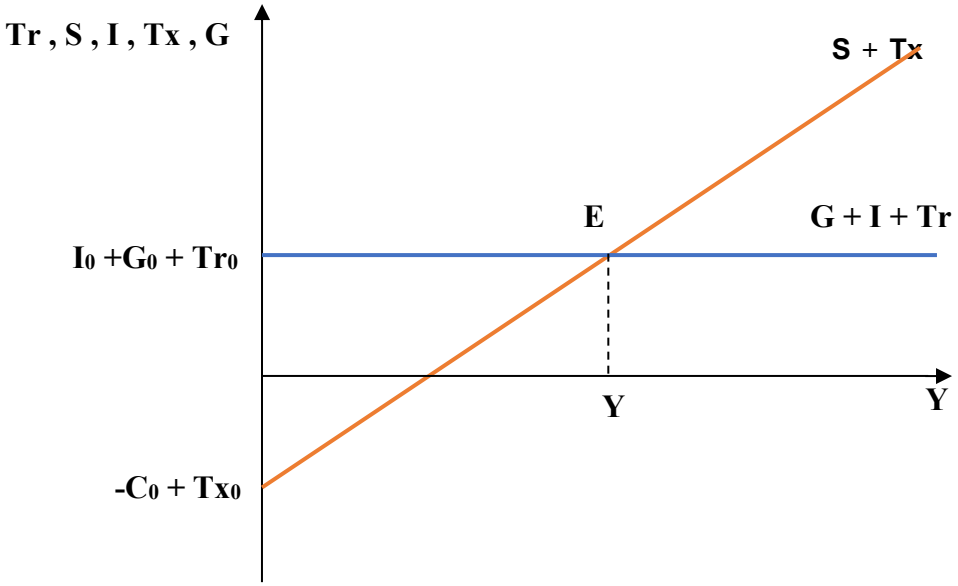
- **Graphical representation of the equilibrium by total expenditures equal total resources condition**

To represent the equilibrium situation according to this condition, **resources** and **expenditures** must first be calculated and then equated graphically:

Resources = **S + Tx**

Expenditures = **G + I + Tr**

Figure (04): Representation of the equilibrium situation by S/I condition



The **E- point** represents the point of equilibrium and is the point of equality between **Resources** and **Expenditures.**

2-2-1-3- Multipliers in a three-sector model (taxes not related to income)

The multiplier illustrates how a change in independent spending can lead to a larger change in national income. In a three-sector economy, which includes government spending and taxes, this effect becomes crucial because fiscal policy directly influences aggregate demand. The key multipliers in a three-sector model can be summarized as follows (Fairfield, 2025, p. 34):

- **Investment Multiplier:** $\mathbf{K_I = \frac{\Delta y}{\Delta I} = \frac{1}{1-b}}$

$$\Delta y = \frac{1}{1-b}\Delta I$$

- **Government Expenditure Multiplier:** $\mathbf{K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1-b}}$

$$\Delta y = \frac{1}{1-b}\Delta G$$

- **Taxes multiplier :** $\mathbf{K_{TX} = \frac{\Delta Y}{\Delta T_X} = \frac{-b}{1-b}}$

$$\Delta y = \frac{-b}{1-b}\Delta_{TX}$$

- **Transfers multiplier:** $\mathbf{KT_r = \frac{\Delta y}{\Delta T_r} = \frac{b}{1-b}}$

$$\mathbf{\Delta y = \frac{b}{1-b}\Delta_{T_r}}$$

- **Balanced Budget Multiplier:** The budget is balanced when **Resources** are equal to **Expenditures**: $\Delta G = \Delta Tx$.

The effect of the change in government expenditures on income is calculated as follows: $\Delta y = \Delta G \cdot \frac{1}{1-b}$

As for the effect of the change in taxes on income, it is calculated:

$$\Delta y = \Delta T_X \left(\frac{-b}{1-b}\right),$$

Thus, the net effect is calculated by adding the two effects:

$$\Delta y = \Delta G \frac{1}{1-b} + \Delta T_X \left(\frac{-b}{1-b}\right)$$

At an equal increase in government expenditures and taxes $\Delta G = \Delta T_X$ the change in income is given as follows:

$$\Delta y = \Delta G \frac{1}{1-b} + \Delta G \left(-\frac{b}{1-b}\right)$$

$$\Delta y = \frac{\Delta G - b\Delta G}{1-b} = \frac{\Delta G(1-b)}{1-b} \Rightarrow \Delta y = \Delta G$$

Any equal changes in both G and T_X have the same effect on income, so:

$$K_b = \frac{\Delta y}{\Delta G} = \frac{\Delta y}{\Delta TX} = 1 \text{ and } \frac{\Delta y}{\Delta G} = \frac{\Delta y}{\Delta TX} = 1$$

The balanced budget multiplier in the case of taxes not related to income is always equal to one.

2-2-2- In case of taxes related to income $T_X = T_{X0} + ty$ where $t = \frac{\Delta T_X}{\Delta y}$

When taxes turn out to be dependent to income, they become an additional source of leakage that increases with the rising of income. Therefore, the equilibrium income formula in a three-sector model will change to become as follows (AGARWAL, 2010, p. 79):

$T_x = T_{X0} + ty$ where "*t* " is the **first derivative** of the taxes equation and is called the **marginal slope** of the taxes.

The same as before There are two conditions to calculate the equilibrium income aggregate demand (D) equals aggregate supply (Y), and the second is the condition in which total expenditures equal total resources.

2-2-2-1- Condition one: Y/D

$y = C + I + G$

$y = C_0 + b\,[\,y - (\,T_{XO} + ty\,) + T_{ro}] + I_0 + G_o$

$y = C_0 + b\,[y - T_{XO\text{-}ty} + T_{ro}] + I_0 + G_0$

$y = C_0 + by - bT_{XO} - bty + bT_{ro} + I_0 + G_0$

$y - by + bty = C_0 - bT\,x_o + bT_{ro} + I_0 + G_0$

$y\,(1 - b + bt) = C_0 - bT_{XO} + bT_{ro} + I_0 + G_0$

$$ye = \frac{1}{1-b+bt}(C_0 - bT_{X0} + bt_{ro} + I_0 + G_0)$$

2-2-2-2- Condition two: I/S

$S + T_X = I + G + T_R$

$-C_0 + (1-b)\, yd + T_{XO} + ty = I_0 + G_0 + T_{r0}$

$-C_0 + (1-b)\,[\, y - (T_{XO} + ty) + Tr] + T_{XO} + ty = I_0 + G_0 + T_{r0}$

$-C_o + (1-b)\,(y - Tx_O - ty + Tr_0) + T_{XO} + ty = I_0 + G_0 + T_{ro}$

After deployment and simplification, we find:

$$\mathbf{ye = \frac{1}{1 - b + bt}(C_0 - bT_{X0} + bt_{ro} + I_0 + G_0)}$$

2-2-2-3- Multiples in a three-sector model in the case of taxes related to income

In case of taxes related to income the multipliers become:

- **Investment Multiplier:** $K_I = \frac{\Delta y}{\Delta I} = \frac{1}{1-b+bt}$

$$\Delta y = \frac{1}{1 - b + bt}\Delta I$$

- **Government Expenditure Multiplier:** $K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1-b+bt}$

$$\Delta y = \frac{1}{1-b+bt}\Delta G$$

- **Taxes multiplier :** $K_{TX} = \frac{\Delta y}{\Delta T_{X0}} = \frac{-b}{1-b+bt}$

$$\Delta y = \frac{-b}{1 - b + bt}\Delta T_{XO}$$

- **Transfers multiplier:** $K_{Tr} = \frac{\Delta y}{\Delta Tr_o} = \frac{b}{1-b+bt}$

$$\Delta y = \frac{b}{1 - b + bt}\Delta Tr_o$$

- **Balanced Budget Multiplier:** The budget is balanced when Resources are equal to Expenditures: $\Delta G = \Delta Tx$.

The effect of the change in government expenditures on income is calculated as follows: $\Delta y = \Delta G \,.\, \frac{1}{1-b+bt}$

As for the effect of the change in taxes on income, it is calculated: $\Delta y = \Delta T_X \left(\frac{-b}{1-b+bt}\right)$

The net effect is calculated by adding the two effects:

$$\Delta y = \Delta G \frac{1}{1-b+bt} + \Delta T_X \left(\frac{-b}{1-b+bt}\right)$$

At an equal increase in government expenditures and taxes $\Delta G = \Delta T_X$ the change in income is given as follows:

$$\Delta y = \Delta G \frac{1}{1-b+bt} + \Delta G \left(\frac{-b}{1-b+bt}\right)$$

$$\Delta y = \frac{\Delta G - b\Delta G}{1-b} = \frac{\Delta G(1-b)}{1-b+bt} \Rightarrow \mathbf{K_b = \frac{(1-b)}{1-b+bt}}$$

The balanced budget multiplier in the case of taxes related to income less than one.

Exercise 01 (2022-2021 ،دودو)

In a closed economy represented by the following data:

$C=75+0.75y_d$ $I=100$ $G=160$ $T_X=100$ $T_R=40$

1- Calculate the balance of the general budget. what do you notice?

2- Calculate the equilibrium income, the government expenditure multiplier, the independent tax multiplier, and the balanced budget multiplier.

3- If taxes change and become dependent on income according to the following equation: $T_X = 100 + 0.2y$

- Determine the equilibrium income equation, calculate it, and then calculate the budget balance in equilibrium.
- Graphically represent the balance of the budget in two ways.
- Calculate the following multipliers: government spending, taxes, and the balanced budget multiplier.

Solution exercise 01

1- Budget Balance:

$T_X-(G+T_R) = 100-(160+40) = -100 < 0$ **budget deficit**

2- Equilibrium income

$$\mathbf{Ye} = \frac{C0+I0+G0-bTx0+bTr0}{1-b} = \frac{75+100+160+(0.75x40)+(0.75x100)}{1-0.75} = \mathbf{1160}$$

- **Government Spending Multiplier:** $\mathbf{K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1-b} = \frac{1}{1-0.75} = 4}$

- **Tax multiplier:** $\frac{-0.75}{1-0.75} = K_{TX} = \frac{\Delta Y}{\Delta T_X} = \frac{-b}{1-b} = -3$

Balanced Budget Multiplier: Represents the change in income resulting from the change in taxes and government expenditures together. So, the net effect is calculated by adding the two effects:

$$\Delta y = \Delta G \frac{1}{1-b} + \Delta T_X \left(\frac{-b}{1-b}\right)$$

At an equal increase in government expenditures and taxes $\Delta G = \Delta T_X$ the change in income is given as follows:

$$\Delta y = \Delta G \frac{1}{1-b} + \Delta G \left(-\frac{b}{1-b}\right)$$

$$\Delta y = \frac{\Delta G - b\Delta G}{1-b} = \frac{\Delta G(1-b)}{1-b} \Rightarrow \Delta y = \Delta G$$

Any equal changes in both G and T_X have the same effect on income

$$K_b = \frac{\Delta y}{\Delta G} = \frac{\Delta y}{\Delta TX} = 1 \text{ and } \frac{\Delta y}{\Delta G} = \frac{\Delta y}{\Delta TX} = 1 \qquad K_b = 1$$

In the case of taxes not related income, the balanced budget multiplier equal one.

3- Taxes related to Income: Tx= 100 +0.2y

- **Equilibrium income**

$y = C + I + G$

$y = C_0 + b\,[\,y - (\,Tx_O + ty\,) + T_{ro}] + I_0 + G_o$

$y = C_0 + b\,[y - T_{XO-ty} + T_{ro}] + I_0 + G_0$

$y = C_0 + by - bT_{XO} - bty + bT_{ro} + I_0 + G_0$

$y - by + bty = C0 - bT_{xo} + bT_{ro} + I0 + G0$

$y\,(1 - b + bt) = C_0 - bT_{XO} + bT_{ro} + I_0 + G_0$

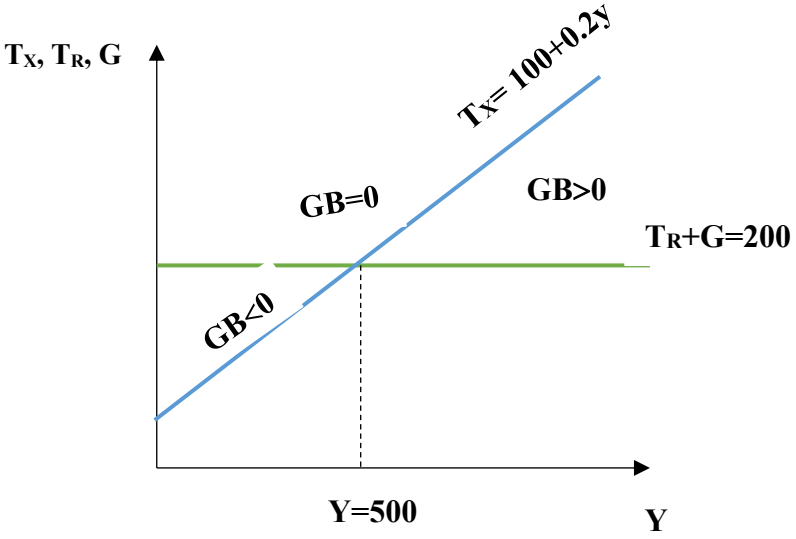
$$ye = \frac{C_0 - bT_{ro} + I_0 + G_0}{1-b+bt} \qquad ye = \frac{75+100+160-(0.75x100)+(0.75x40)}{1-0.75+0.75x0.2} = 725$$

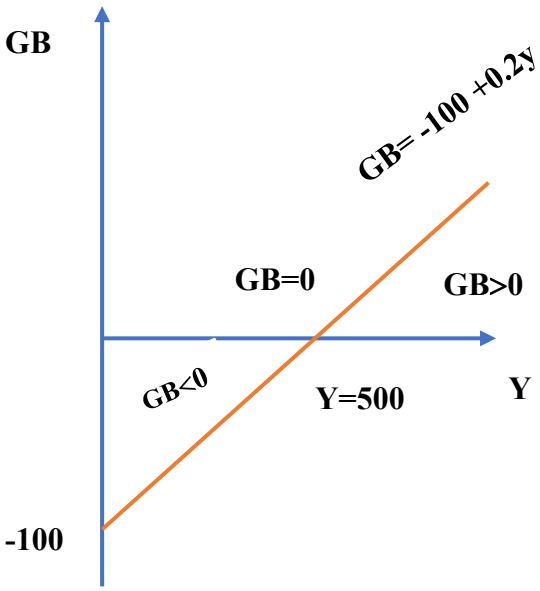
- **Budget Balance at equilibrium:**

GB= T_X-(G+T_R) = 100 +0.2(725) -(160 +40) =45 >0 **budget surplus**

- **Graphical representation of budget balance:**

GB= T_X-(G+T_R) = 100 +0.2 (y) - (160 +40) ⇒ **GB = -100+0.2y**





- **Government Spending Multiplier**

$$K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1-b+bt} = \frac{1}{1-0.75+0.75(0.2)} = 2.5$$

- **Tax multiplier:**

$$K_{TX} = \frac{\Delta y}{\Delta T_{X0}} = \frac{-b}{1-b+bt} = \frac{-0.75}{1-0.75+0.75(0.2)} = -1.875$$

- **Balanced Budget Multiplier**

The net effect is calculated by adding the two effects:

$$\Delta y = \Delta G \frac{1}{1-b+bt} + \Delta T_X \left(\frac{-b}{1-b+bt}\right)$$

At an equal increase in government expenditures and taxes $\Delta G = \Delta T_X$ the change in income is given as follows:

$$\Delta y = \Delta G \frac{1}{1-b+bt} + \Delta G \left(-\frac{b}{1-b+bt}\right)$$

$$\Delta y = \frac{\Delta G - b\Delta G}{1-b} = \frac{\Delta G(1-b)}{1-b+bt} \Rightarrow$$

$$K_B=\frac{(1-b)}{1-b+bt}=\frac{(1-0.75)}{1-0.75+0.75(0.2)}=0.625$$

The case of taxes related to income; the balanced budget multiplier is less than one.

Exercise 02

If you have an economy that can be expressed in the following equations:

$C=C_0+by_d$ $I=I_0$ $G=G_0$ $T_X=T_{X0}$ $T_R=T_{R0}$

1- find the equilibrium income in two ways.

2- If the value of the previous data is: $C_0=2400$ $b=0.75$ $I=4000$ $G_0=5000$ $T_{X0}=4400$ $T_R=2000$

- Determine the value of the equilibrium income and show it graphically according to the Y/D method

3- If you know that the income at full employment $Y_F=38000$:

- Determine the type of the gap, calculate it, and how to treat it?
- How to reach full employment using government spending, taxes and transfers?

Solution exercise 02

1- The equilibrium income statement in two ways

- **Aggregate Supply = Aggregate Demand**

$Y=D$

$D=C+I+G$ $Yd=Y-Tx+Tr$

$Y=C+I+G \Rightarrow Y=C_0+bYd+I_0+G_0$

$\Rightarrow Y=Co+b(Y-Tx+Tr)+I_0+Go$

$\Rightarrow Y=C_0+bY-bTx+bTr+I_0+G_0$

$\Rightarrow Y-by=C_0-bTx+bTr+I_0+G_0$

$\Rightarrow Y(1-b)=C_0-bTx+bTr+I_0+G_0$

$$Ye=\frac{C_0+I_0+G_0-bTx_0+bTr_0}{1-b}$$

- **Resources = Expenditures**

S + Tx = G + I + Tr

$-C_0 + (1-b)\, y_d + Tx_0 = I_0 + G_0 + Tr_o$

$-C_0 + (1+b)\,(y - Tx_0 + Tr_0) + Tx_0 = I_0 + G_0 + Tr_o$

$y - Tx_0 + Tr_0 + by - bTx_0 + b\,Tr_0 = C_0 - Tx_0 + I_0 + G_0 + Tr_o$

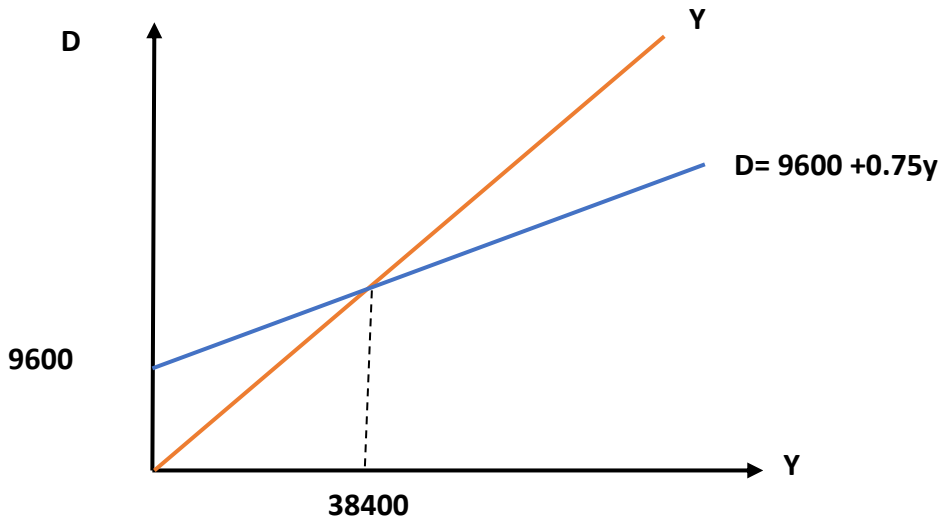
$(y + by = C_0 - bT_0 + bT_{r_0} + I_0 + G_0)$

$$Ye = \frac{C_0 + I_0 + G_0 - bTx_0 + bTr_0}{1-b}$$

2- the value of the equilibrium income

- $Ye = \frac{C0+I0+G0-bTx0+bTr0}{1-b} = \frac{2400+4000+5000-0.75(4400)+0.75(2000)}{1-0.75} = 38400$
- **Graphs**
  - **The aggregate demand equation**

$D = C + I + G = 2400 + 0.75\,(y - 4400 + 2000) + 4000 + 5000 \Rightarrow D = 9600 + 0.75y$



3. We have Yf <Ye inflationary gap

$IG = \frac{Yf-Ye}{ke} \quad \frac{38000-38400}{4} = -400$ $\qquad Ke = \frac{1}{1-b} = 4$

- ***Treatment of inflationary gap is done by pulling out the excess of the aggregate demand in the economy through implementing a contractionary monetary and fiscal policy by reducing government spending and raising taxes and interest rates.***

- **Government Expenditure:** Finding ΔG using the government expenditure multiplier

$$\Delta Y = KG\,\Delta G \Rightarrow \Delta G = \frac{\Delta Y}{KG} \quad / KG = \frac{1}{1-b} = \frac{1}{1-0.75} = 4 \quad / \Delta Y = 38000 - 38400 = -400$$

$$\Delta G = \frac{-400}{4} = -100$$

Government Expenditure must be reduced by 100 to reach full employment.

- **Taxes:** Using a tax multiplier

$$\Delta Y = KTX\,\Delta TX \Rightarrow \Delta TX = \frac{\Delta Y}{KTX} / \quad KTX = \frac{-b}{1-b}\frac{-0.75}{1-0.75} = -3 \quad / \quad \Delta Y = 38000 - 38400 = -400$$

$$\Delta TX = \frac{-400}{-3} = 133.33$$

Taxes should be raised by 133.33 to reach full employment

- **Transfers:** Using a transfer Multiplier

$$\Delta Y = KTR\,\Delta TR \Rightarrow \Delta TR = \frac{\Delta Y}{KTX} / \quad KTr = \frac{b}{1-b} = \frac{0.75}{1-0.75} = 3 \quad / \quad \Delta Y = -400$$

$$\Delta Tr = \frac{-400}{3} = 133.33$$

Transfers should be reduced by 133.33 to reach full employment.

Chapter 02: The Keynesian model in an open economy (four sectors)

When the foreign trade sector is added to an economy that consisted of three sectors- households, businesses, and government- we obtain a four-sector economic model.

This expanded model reflects a more realistic view of modern economies, where international trade plays a crucial role in determining income, output, and total equilibrium. By including exports and imports, the economy becomes open to the rest of the world, and its equilibrium depends not only on domestic activities but also on global economic interactions.

Through this chapter, the student will be able to:

1- ***Define a four-sector economic model and identify the role of each sector.***
2- ***Explain how foreign trade affects national income and equilibrium.***
3- ***Describe the components of aggregate expenditure in an open economy.***
4- ***Analyze how changes in exports, imports, or government policies affect equilibrium.***
5- ***Apply the equilibrium condition to simple numerical or graphical examples.***

Chapter 02: The Keynesian model in an open economy (four sectors)

When adding the foreign trade sector to an economy consisting of three sectors, we have a model consisting of four sectors.

The components of the foreign trade sector

The most important components of the foreign trade sector are the following **(Rodseth, 2004, pp. 166-169) (2022-2021 ،دودو):**

Exports (X): it works to raise the level of national income (injection element) and is considered as an external variable $X = X_0$ because it represents a foreign demand for local goods.

Imports (Z): it works to reduce the level of national income (a leakage element) and it is considered an internal variable (linked to national income) where $Z = Z_0 + \mathfrak{Z}\, y$ because it represents the purchase of goods and services from abroad. This demand rises with high national income and decreases with low national income, where $\mathfrak{Z}$ represents the marginal propensity of imports $\mathfrak{Z} = \frac{\Delta Z}{\Delta y}$.

Net Trade Balance TB: It equals the difference between exports and imports.

TB=X-Z

- **Trade Balance Positions:** The trade balance can take one of the following positions (Majerová, 2025, p. 11):

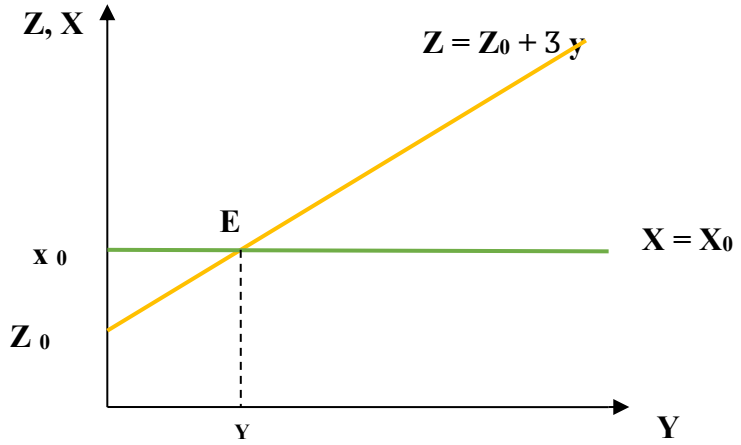
TB>0⇒ Trade Balance is in Surplus

TB<0 ⇒ Trade Balance is in Deficit

TB=0 ⇒ Balanced situation in the Trade balance

- **Graphical representation of the trade balance**: the trade balance can be represented as the following form:

Figure (05): Representation of the trade balance



The **E Point** represents the equilibrium point of the trade balance, at which exports are equal to imports.

1- Calculating Equilibrium Income in a Four-Sector Model

The equilibrium income in a four-sector macroeconomic model can be derived using the same previous two approaches: aggregate demand (D) equals aggregate supply (Y), and total expenditures equal total resources.

Noting that we are going to add two more equation:

$$X = X_0$$

$$Z = Z_0 + \text{ʒ}y$$

where the consumption remains depended on disposable income which becomes:

$$Yd = Y - TX + TR$$

And the aggregate demand for goods and services becomes:

$$D = C + I + G + (X - Z)$$

According to those new parameters the total equilibrium income can be derived using the two conditions of equilibrium as below **(St John, 2024, pp. 13-14)**:

1-2- Taxes not related to income ($T_X = T_{XO}$)

The model becomes composed of the following equations:

$$Z = Z_0 + 3\ y/ \qquad X = X_0/ \qquad T_R = T_{R0} \quad /T_{X_0} = T_{X_0} \quad /G = G_0/ \quad I = I_0/ \qquad y_d = y - T_{X_0} + T_{R_0}$$

$$C = C_0 + by_d$$

1-2-1- Condition one: Y/D

$$y = C + I + G + X\text{-}Z$$

$$y = C_0 + by_d + I_0 + G_0 + X_0 - (Z_0 + zy)$$

$$y = C_o + b\,(y - T_{x0} + T_{ro}) + I_0 + G_0 + X_0 - Z_0 - zy$$

$$\mathbf{Y_e = \frac{1}{1-b+z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{ro} + X_0 - Z_0)}$$

- **Graphical representation of the total equilibrium by Y/D condition**

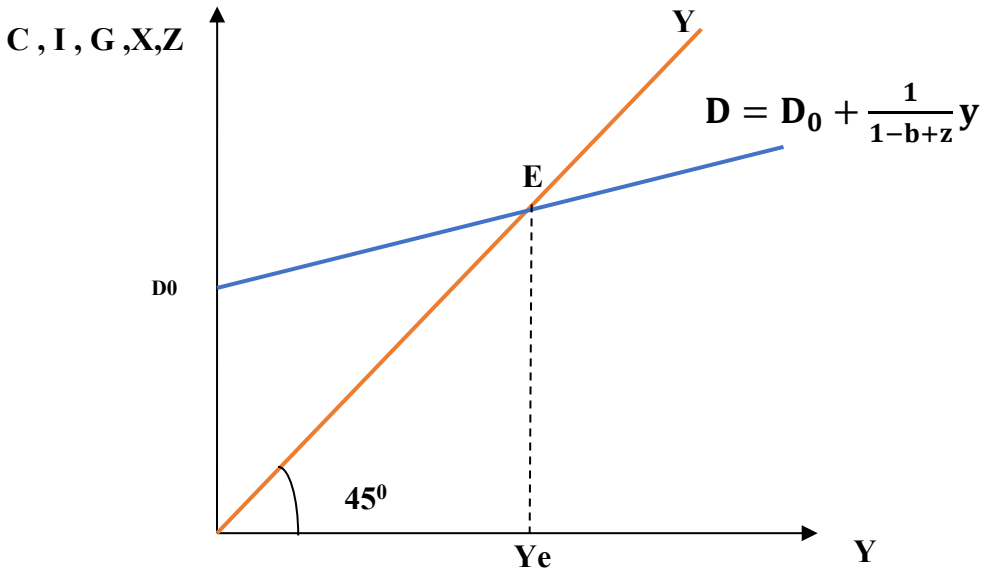
To represent the equilibrium situation, we must found the aggregate demand equation (D):

$$\mathbf{D=}\ G + I + G + X\text{-}Z = C_0 + by_d + I_0 + G_0 + X_0 - (Z_0 + zy)$$

$$\mathbf{D = (C_0 + I_0 + G_0 - bT_{X0} + bT_{ro} + X_0 - Z_0) + \frac{1}{1-b+z}y}$$

$$\mathbf{D = D_0 + \frac{1}{1-b+z}y}$$

Figure (06): Representation of the total equilibrium by Y/D condition



Source: (St John, 2024, p. 15)

1-2-2- Condition two: I/S condition

Based on the equilibrium condition, the equilibrium income can be found as below:

$$S + T_X + Z = G + I + T_r + X$$

$$- C_0 + (1-b)\, y_d + T_{Xo} + Z_0 + zy = G_0 + I_0 + T_{ro} + X_o$$

$$- C_o\ (1- b)\ (y - T_{XO} + T\ r_0) + T_{Xo} + Z_o + zy = G_0 + I_0 + T_{ro} + X_o$$

After simplification:

$$\mathbf{Y_e = \frac{1}{1 - b + z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{ro} + X_0 - Z_0)}$$

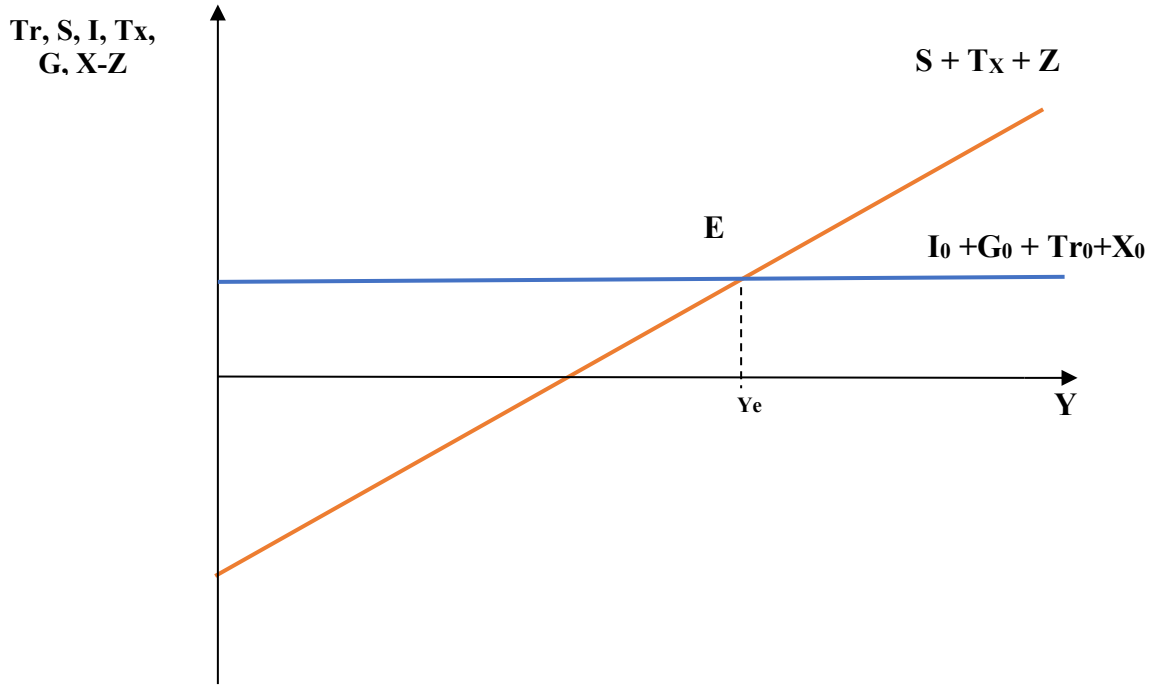
- **Graphical representation of the total equilibrium by I/S condition**

To represent the equilibrium situation according to this condition, **resources** and **expenditures** must first be calculated and then equated graphically:

Resources = **S + Tx +Z**

Expenditures = **G + I + T_r + X**

Figure (07): Representation of the total equilibrium by I/S condition



Source: (St John, 2024, p. 15)

1-2- Taxes related to income ($TX = T_{XO} + ty$)

The model becomes composed of the following:

$$Z = Z_0 + 3\,y/ \qquad X = X_0/ \qquad T_r = T_{r0} \quad /T_{xo} = T_{xo} + ty \quad /G = G_0/ \quad I = I_0/ \quad y_d = y - T_{xo} + T_{ro}$$

$$C = C_0 + by_d$$

1-2-1- Condition one: Y/D

$$Y = D$$

$$y = C + I + G + X - Z$$

$$y = C_0 + b\,[\,y - (\,T_{xo} + ty\,) + T_{ro}] + I_0 + G_0 + X_0 - (\,Z_0 + zy)$$

$$Y_e = \frac{1}{1 - b + bt + z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{ro} + X_0 - Z_0)$$

1-2-2- Condition two: I/S

$$S + T_X + Z = G + I + T_r + X$$

$$-C_0 + (1-b)\,[y - (\,T_{xo} + ty\,) + T_{ro}] + T_{xo} + ty + Z_0 + zy = G_0 + I_0 + T_{ro} + X_0$$

$$Y_e = \frac{1}{1 - b + bt + z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{ro} + X_0 - Z_0)$$

3- Multipliers in a four- sector model

In the four-sector Keynesian model, the basic concept of the multiplier remains unchanged; however, two additional multipliers are added: the export multiplier and the import multiplier. The following table summarizes all these multipliers in both cases: when taxes are independent of income and when taxes are dependent on income:

Table (02): The Multipliers in a four- sector model

The multiplier	Case of taxes related to income	Case of taxes not related to income
Government expenditure	$K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1 - b + z}$	$K_G = \frac{1}{1 - b + bt + z}$
Transfers	$KT_r = \frac{\Delta y}{\Delta T_{r0}} = \frac{b}{1 - b + z}$	$KT_r = \frac{b}{1 - b + bt + z}$
Taxes	$KT_x = \frac{\Delta y}{\Delta T_{x0}} = \frac{-b}{1 - b + z}$	$KT_x = \frac{-b}{1 - b + bt + z}$
Investment	$K_I = \frac{\Delta y}{\Delta I_0} = \frac{1}{1 - b + z}$	$K_I = \frac{1}{1 - b + bt + z}$
Exports	$K_X = \frac{\Delta y}{\Delta X_0} = \frac{1}{1 - b + z}$	$K_X = \frac{1}{1 - b + bt + z}$
Imports	$K_Z = \frac{\Delta y}{\Delta Z_0} = \frac{-1 +}{1 - b + z}$	$K_Z = \frac{-1}{1 - b + bt + z}$

Source: **(Jhingan, 2012, pp. 263-277)**

Exercise 01

If you have the following data about an economy that adopts Keynesian analysis:

$\boldsymbol{C = 90 + 0.8Y_d}$ $\boldsymbol{;Tx = 70 + 0.25y;}$ $\boldsymbol{Z = 70 + 0.10Y}$

$\boldsymbol{X = 150}$ $\boldsymbol{G = 120}$ $\boldsymbol{TR = 60}$ $\boldsymbol{I = 100}$

1. Determine the equilibrium income using the Aggregate Demand – Aggregate Supply condition.
2. Find the equilibrium values associated with the model.
3. Illustrate the equilibrium graphically.
4. If the government decides to

- Increase its expenditure by 50%. What is the effect of this on the equilibrium?
- Reduce independent taxes by 50%, what is the impact on equilibrium income?
- Which effect is better and why?

5. If the marginal propensity to import rises to 0.3 and the marginal propensity of tax falls to 0.125, what will be the new equilibrium income level?

Chapter 02: The Keynesian model in an open economy (four sectors)

Solution 01

1- Equilibrium Condition

- **Proceeding from the equilibrium equation Y=D**

$$Y = C+S+Tx \quad \Rightarrow \textbf{aggregate supply function}$$

$$D=C+I + G+X-Z \Rightarrow \textbf{aggregate demand function}$$

$$Y=D$$

$$Y = C+I + G+X-Z$$

$$Y=C_o+ b(Y-Txo-tY) + I_o+G_o +Xo-Zo-zY$$

$$(1-b +bt+z)Y=C_o- bTx_o+bTr_0+ I_o+G_o+X_o-Z_o$$

$$\mathbf{Ye = \frac{Co+ Io+Go-bTxo+bTro+Xo-Zo}{1-b+bt+z}}$$

- **Equilibrium Income Calculation**

$$\boldsymbol{Y_e = \frac{90 + 120 + 100 - 0.8(70) + 0.8\,(60) + 150 - 70}{1 - 0.8 + 0.8(0.25) + 0.1} = 764}$$

2- The equilibrium values associated with the model

$$\boldsymbol{Tx = 70 + 0.25y \rightarrow Tx = 70 + (0.25 * 764) = 191}$$

$$\boldsymbol{Y_d = Y - Tx + Tr = 764 - 191 + 60 = 633}$$

$$\boldsymbol{C = 90 + 0.8Y_d = 90 + (0.8 * 633) = 506.4}$$

$$\boldsymbol{Z = 70 + 0.10Y = 70 + (0.1 * 764) = 76.4}$$

3- Graphical representation

- **Aggregate demand equation**

$$\mathbf{D = C+I + G+X-Z}$$

$$Y=C_o+ b(Y-Txo-tY+Tr_0) + I_o + G_o +Xo-Zo-zy$$

$$\mathbf{D=}\ C_o+ I_o + G_o +Xo-Zo-zY+bY-bTx0-btY+bTr_0$$

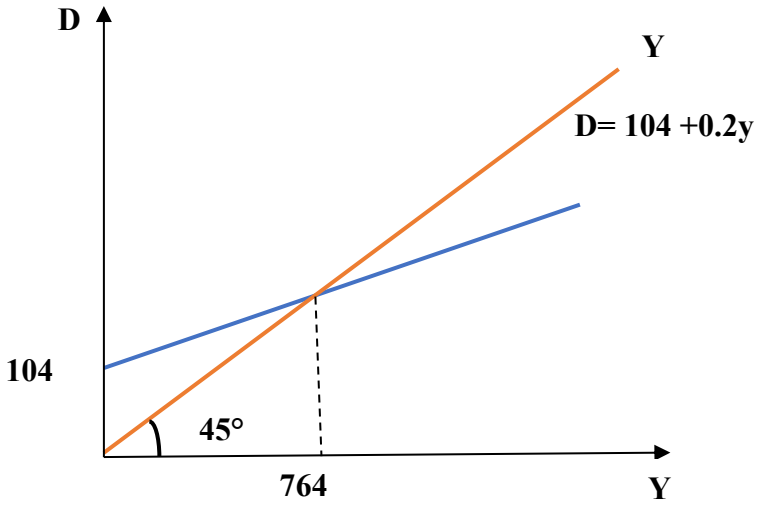
$$\mathbf{D=}\ C_o+ I_o + G_o +Xo-Zo-bTx0+bTr_0-zY+bY -btY$$

$$\mathbf{D=}\ C_o+ I_o + G_o +Xo-Zo-bTx0+bTr_0-(z+b-bt)\ Y$$

$$\mathbf{D=}\ C_o+ I_o + G_o +Xo-Zo-bTx0+bTr_0-(z+b-bt)\ Y$$

$$\mathbf{D=}\ 90+ 100+ 120+150-70-(0.8*70+0.8*60)-(0.1+0.8-(0.8*0.25))\ Y$$

$$\mathbf{D= 104-0.2\ Y}$$



4- The effect of the increase in the government expenditure by 20% on the equilibrium

$$K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1 - b + bt + z} = \frac{1}{1 - 0.8 + 0.8 * 0.25 + 0.1} = \frac{1}{0.5} = 2$$

$$\Delta G = 120 * 0.5 = 60$$

$$K_G = \frac{\Delta y}{\Delta G} \rightarrow \Delta y = K_G * \Delta G = 2 * 60 = 120$$

According to the multiplier theory increasing the government expenditure by 50% will increase the equilibrium income by 120 units.

- **The impact of reducing the independent taxes by 50% on equilibrium income and on aggregate demand**

$$KT_x = \frac{\Delta y}{\Delta T_{x0}} = \frac{-0.25}{1 - 0.8 + 0.8 * 0.25t + 0.1} = -0.5$$

$$\Delta T_{x0} = (70 * 0.5) = 35$$

$$KT_x = \frac{\Delta y}{\Delta T_{x0}} \rightarrow \Delta y = KT_x * \Delta T_{x0} = (-0.5) * (-35) = 17.5$$

According to the multiplier theory **reducing the independent taxes by 50%** ***will increase the equilibrium income by 17.5 units.***

- *We notice that both policies implemented by the government—whether increasing government spending or reducing taxes—had a positive effect on income. However, the impact of increasing government spending on equilibrium income was greater than the impact of reducing taxes. This is due to the fact that the government spending multiplier is larger than the tax multiplier.*
- **If the marginal propensity to import rises to 0.3 and the marginal propensity of tax falls to 0.125, the new equilibrium income level will be equal to:**

$$Y_e{}' = \frac{90 + 120 + 100 - 0.8(70) + 0.8\,(60) + 150 - 70}{1 - 0.8 + 0.8(0.125) + 0.3} = 636.67$$

Exercise 02

The following data represent the economy of a country:

C_0=400 I_0=150 Z_0=400 X_0=800 T_{X0}=400 T_{R0}=200 G_0=1000 b=0.75 z=0.1 t=0.2:

1- What are the behavioral relationships of this model? Find the equilibrium income using the revenue/expenditure method and then calculate the consumption and savings at the equilibrium level?
2- Represent the equilibrium graphically?
3- Calculate the budget balance?
4- Calculate the net trade balance? Represent it graphically?
5- If the Income at the full employment Represents The balanced budget situation:
   - Determine the situation of this economy?
   - Using the mechanisms of foreign trade, how can we achieve compatibility between the level of the equilibrium income and the level of full employment?
   - Find the amount of change in imports needed to remove the inequality situation? What is its impact on the trade balance?

Solution 02

1- The behavioral relationships of the model:

C=400+0.75yd S=-400+0.25yd TX=400+0.2y Z=400+0.1y

- **Equilibrium Income**

$S + T_X + Z = G + I + T_r + X$

$-C_0 + (1-b)\,[y - (T_{xo} + ty) + T_{ro}] + T_{xo} + ty + Z_0 + zy = G_0 + I_0 + T_{ro} + X_0$

$$Y_e = \frac{1}{1 - b + bt + z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{ro} + X_0 - Z_0)$$

$$Y_e = \frac{(400 + 150 + 1000 - 0.75 * 400 + 0.75 * 200 + 800 - 400)}{1 - 0.75 + 0.75 * 0.2 + 0.1}$$

$$Y_e = \frac{1}{0.5}(400 + 150 + 1000 - 0.75 * 400 + 0.75 * 200 + 800 - 400) = 3600$$

- **Calculation of C_e, S_e**

TX=400+0.2(3600) = 1120

Y_d=y-T_X+T_R= 3600 - 1120 +200= 2680

C=400+0.75yd = 400+ (0.75*2680) = 2410

S=-400+0.25yd = -400+(0.25*2680) = 270

2- Graph representation

- **Resources = S + Tx +Z**

$$S + Tx + Z = -400 + 0.25yd + 400 + 0.2y + 400 + 0.1y$$

$$S + Tx + Z = 0.25(y - 400 - 0.2y + 200) + 0.2y + 400 + 0.1y$$

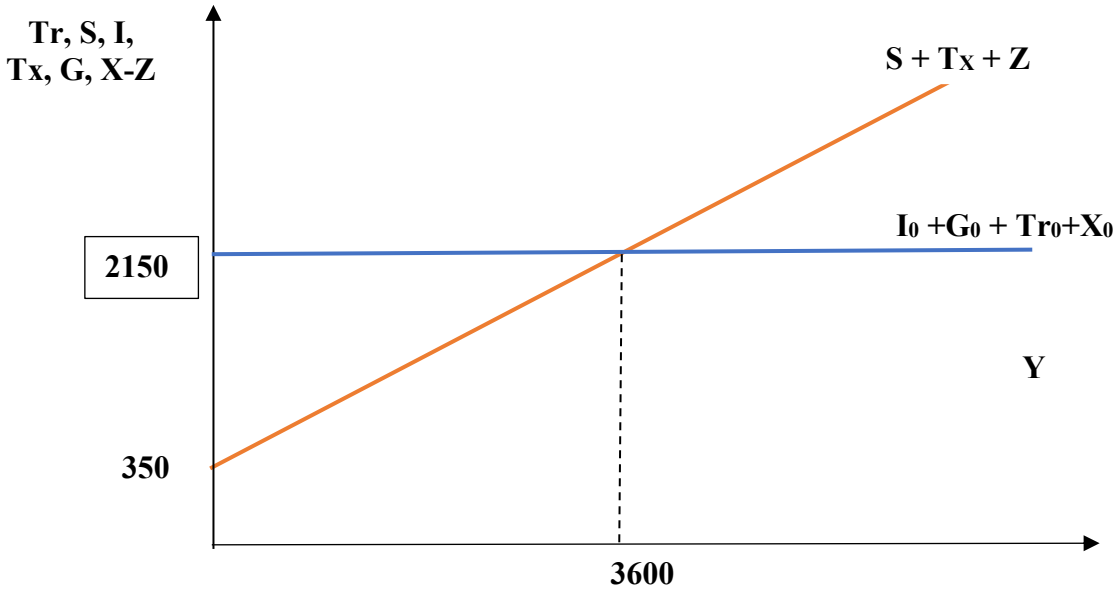
$$S + Tx + Z = 0.25y - 100 - 0.05y + 50 + 0.2y + 400 + 0.1y$$

$$S + Tx + Z = 350 + 0.5y$$

- **Expenditures = G + I + Tr + X**

$$G + I + Tr + X = 1000 + 150 + 200 + 800$$

$$G + I + Tr + X = 2150$$



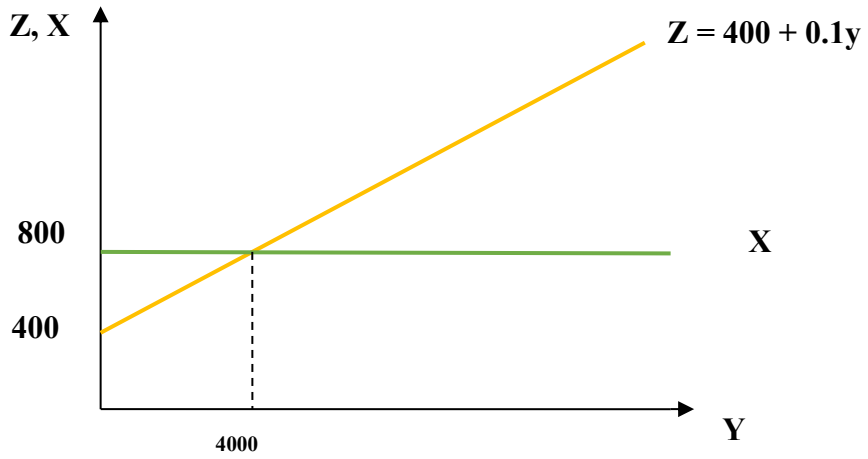
3- Budget balance

GB= T_X-(T_R+G) = 400 + 0.2(3600) -(1000 +200) =-80 **budget deficit**

4- TB Balance

- **TB=X_0- (Z_0+ zy) =800- (400 + 0.1 (3600) = 40** **Surplus in Trade Balance**
- **Graph representation**

800- (400 + 0.1y) = 0 ⟹ 800-400-0.1y=0 ⟹ y=4000



5- If the Income at the full employment Represents The balanced budget situation:

GB=0 ⇒ 400 + 0.2y -(1000 +200) = 0 ⇒ y=4000 ⇒ y_F=4000

- **We note that y_e<y_F from which the economy is in a deflationary gap**

$$\textbf{DEF GAP} = \frac{yf - ye}{Ke}$$

$$Ke = \frac{1}{1 - b + bt + z} = 2$$

$$\textbf{DEF GAP} = \frac{4000 - 3600}{2} = 200$$

- **Using foreign trade mechanisms to achieve compatibility between the level of balanced income and the level of full employment**

To achieve full employment through foreign trade policy, the government can stimulate aggregate demand by increasing net exports. This can be accomplished by encouraging export-oriented production, providing export subsidies, enhancing international competitiveness, or adopting exchange rate adjustments that make domestic goods cheaper

abroad. Alternatively, the government can reduce imports by imposing trade restrictions such as tariffs, quotas, or non-tariff barriers, thereby redirecting demand toward domestically produced goods. Both approaches—promoting exports and reducing imports—raise net exports, increase aggregate demand, and help push the economy toward full employment level **(Alassane & Deng, 2019, pp. 8-12)**.

- **Finding the amount of change in imports necessary to eliminate this imbalance (deflationary gap) and its impact on the trade balance**
  - **Amount of change in Z_0 (using import multiplier)**

$\Delta y = k_Z * \Delta Z_0$ / $KZ = \frac{1-}{1-b+bt+z} = -2$

$\Rightarrow \Delta Z0 = \frac{\Delta y}{Ke} = \frac{4000-3600}{-2} = \frac{400}{-2} = -200$ =

To achieve the equality between the equilibrium income and the full employment level, imports must be reduced by 200.

- **Impact of the change on the trade balance**

- Note that after reducing the imports by 200 we will achieve the level of full employment so ye = yf = 4000

TB=X-Z =800- (400+ΔZ_0 +0.1Y) = 800-400 +200-0.1(4000) =200

- Before achieving full employment, the trade balance was equal to 40 and after reducing imports by 200 to reach full employment, the trade balance increased to 200, so the impact of the change **is the increase in the trade balance by 160.**

Chapter 03: The Hicks–Hansen Model (IS-LM Model)

The IS-LM model is a fundamental macroeconomic framework that illustrates the interaction between interest rates and real output in the short run. This model combines two major market equilibriums: the goods market, represented by **the IS curve**, and the money market, represented by **the LM curve**. Through this combination, the model demonstrates how changes in spending, investment, and the demand for money affect overall economic activity.

Through this chapter, the student will be able to:

1- ***Understand the concept of equilibrium in the goods and services market, as represented by the IS curve, and identify the main factors that alter it.***
2- ***Explain equilibrium in the money market through the LM curve, focusing on the role of interest rates and the demand for money.***
3- ***Analyze how the interaction between the IS and LM curves affects macroeconomic equilibrium in terms of income and interest rates.***
4- ***4. Understand how fiscal and monetary policies affect equilibrium through shifts in the IS and LM curves.***
5- ***Interpret the short-term effects of policy changes within the IS-LM curve framework and relate them to real economic outcomes.***

Chapter 03: The Hicks–Hansen Model (IS-LM Model)

1- Introduction to IS-LM Model

1-1- Definition

The IS-LM model arose from the influence of **Keynes's General Theory of Employment, Interest, and Money**. Developed in the late 1930s, it became known as the Hicks-Hansen model, with further contributions from economists such as Harrod and Mead. The model aimed to give a simplified, more mathematical form to some of Keynes's key ideas.

By the 1950s and 1960s, the IS-LM framework had become widely accepted as a new approach to macroeconomic analysis. Today, it is not seen as a direct formalization of Keynesian theory but as an independent model inspired by it. For this reason, researchers often distinguish between 'economics of Keynes' for referring to **Keynes's General Theory** and derived developments, and 'Keynesian economics for the IS-LM construct and its derivatives **(Vergés-Jaime, 2023, p. 2)**.

The IS-LM model is a macroeconomic framework that links money, interest rates, and income by integrating the goods market and the money market into a combined equilibrium model. This model highlights how interest rates affect spending, and consequently national income, while also illustrating how financial market conditions depend on changes in income. In this model, interest rates and output are jointly determined by the interaction of the real and monetary sectors.

The IS curve reflects the equilibrium in the goods market, where investment equals saving, while the LM curve represents the equilibrium in the money market, where the demand for money equals the supply of money. The intersection of these two curves represents the overall equilibrium of the model, defining the point of equilibrium between the two markets at once and illustrating the short-run relationship between real output and interest rates.

1-2- The model assumptions

The IS-LM model is based on a set of short-run macroeconomic assumptions that link the goods market to the money market. These assumptions explain how income and interest rates are determined together in the economy. The main assumptions can be summarized as follows **(دودو، 2021-2022، صفحة 18)** :

- **A constant price level:** The general price level is assumed to be constant in the short run. This allows the model to focus on changes in real income and interest rates.
- **A two-market framework:** The model is based on two main markets:

- **The goods and services market (IS curve):** Equilibrium is achieved when planned investment equals saving.
- **The money market (LM curve):** Equilibrium is achieved when the demand for money equals the supply of money.

- **General equilibrium:** Macroeconomic equilibrium is achieved at the intersection of the IS and LM curves, where both the goods market and the money market are in equilibrium at once.
- **The interest rate as a key variable:** The interest rate adjusts to ensure equilibrium in both markets. It affects investment and consumption (especially interest-sensitive spending).
- **Investment depends on interest rates:** Lower interest rates stimulate investment, while higher rates discourage it. The demand for money depends on income and interest rates: The demand for money increases when income rises (transactional motive). The demand for money decreases when interest rates rise (opportunity cost of holding money).
- **Fiscal policy affects the IS curve.** Changes in government spending or taxes shift the IS curve because they affect aggregate demand.
- **Monetary policy affects the LM curve.** Changes in the money supply shift the LM curve and change the equilibrium interest rate.
- Expectations about future inflation, interest rates, or output are assumed to be fixed or irrelevant. Wages are fixed in the short run. This maintains a stable price level and prevents immediate adjustments in the labor market.
- **Policy changes change the curves:** Monetary and fiscal policies can shift IS or LM curves to the right or left, leading to changes in the equilibrium level of income and interest rates.

2- The goods & services market (IS equation & curve)

2-1- The IS equation

In the previous chapters, we define equilibrium in the goods market as the situation in which the aggregate supply (Y) equals the aggregate demand for goods (D). This situation is represented by the IS relation.

Aggregate Demand is defined as the sum of consumption (C), investment (I), government spending (G) and the net exports (X-Z). Initially, we take investment as a constant variable.

This simplification allows us to analyze a basic model of goods market equilibrium without additional complexities.

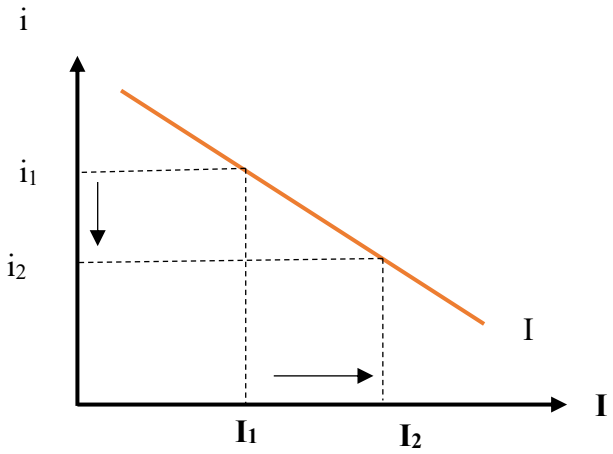
In the case of IS equation the investment will be considered as a function of interest rate **(Blanchard, 2017, p. 111)**:

$$I = I_0 - gi$$

where:

- **I** : total investment
- **I_0:** independent investment (the part of investment that does not depend on the interest rate)
- **i:** interest rate and
- **g:** sensitivity of investment to the interest rate (interest rate coefficient), ***knowing that there is an inverse relationship between investment I and interest rate i because the interest rate is the cost of borrowing to finance investment projects, an increase in the interest rate reduces planned investment. As a result, the investment function slopes downward as shown in the following figure:***

Figure (08): The relationship between investment I and interest rate



Source: (دودو، 2021-2022، صفحة 19)

- **Deriving the IS Equation**

According to the new changes the IS equation can be derived as follows (2 sectors):

$\Rightarrow$ Y=D

$\Rightarrow$ C+I

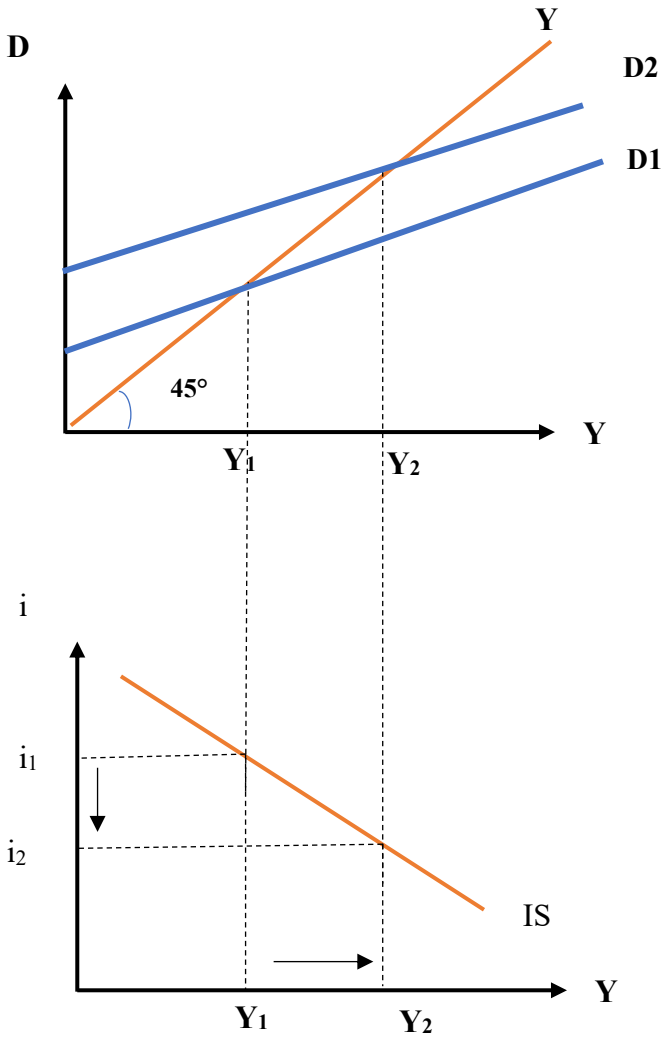
$\Rightarrow$ $Y= C_0+by_d+\mathbf{I_0-gi}$

$\Rightarrow$ $y(1-b) =C_0+ I_0-gi$

$$Y_{IS} = \frac{C0+I0}{1-b} - \frac{g}{1-b} i \ \ldots\ldots\ldots / \ Y_{IS} = f(i)$$

- This equation shows the relationship between income and the interest rate at which equilibrium is achieved in the goods market. Accordingly, each point on the IS curve reflects a specific equilibrium situation and shows the interest rate through which the equilibrium income level is determined.
- We can illustrate the IS curve graphically as in the following figure:

Figure (09): The IS curve

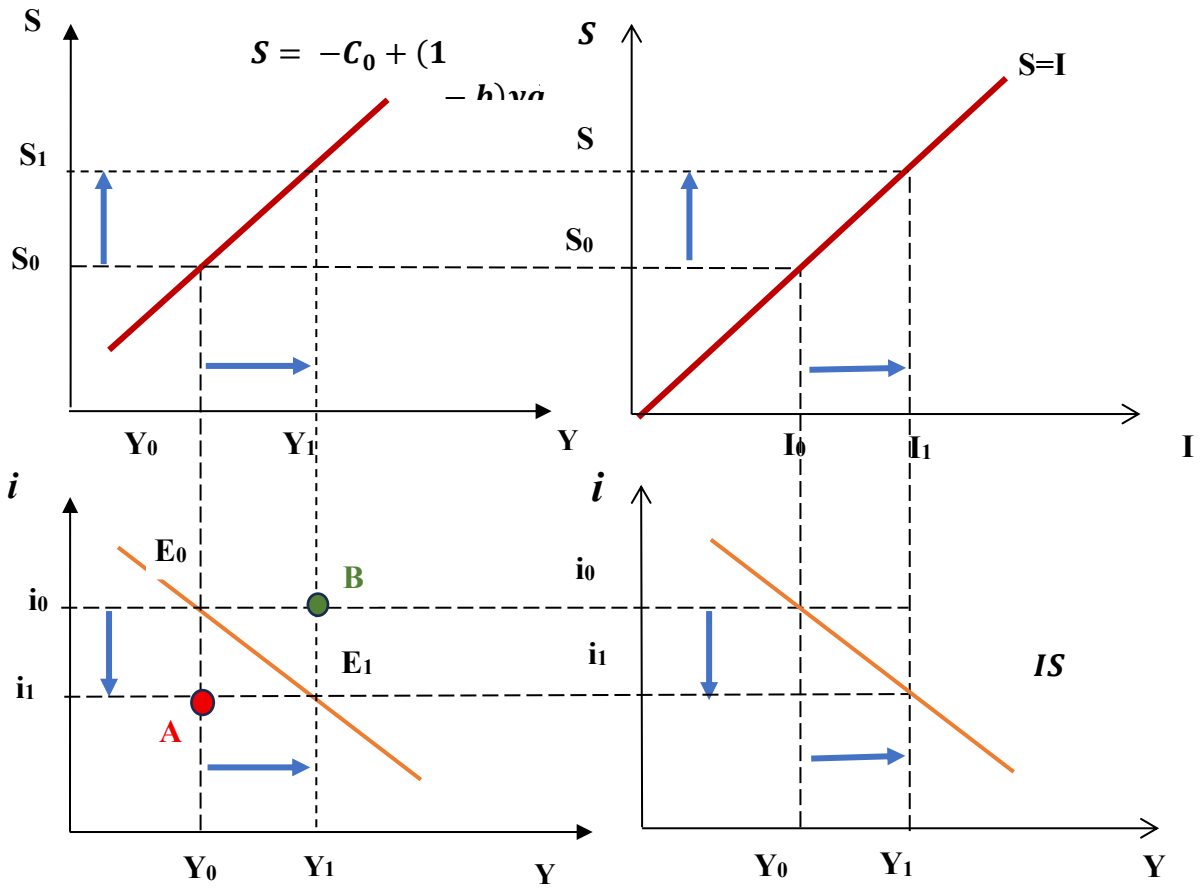


Source: (دودو، 2021-2022، صفحة 20)

Through the curve, we notice that **(Mankiw, 2010, p. 300)**:

- The IS curve illustrates the relationship between the interest rate and the income level in a goods market. When the interest rate rises, investment falls because borrowing costs increase. This decrease in investment reduces planned spending, which in turn lowers equilibrium income.
- Each point on the IS curve represents an income level at which the goods market is in equilibrium. Because higher interest rates lead to lower investment and income, the IS curve slopes downward, summarizing the inverse relationship between the interest rate and income.
- There is an inverse relationship between the interest rate and income, where the lower the interest rate from i_1 to i_2, the higher the income from y_1 to y_2, and the explanation for this is that the lower the interest rate leads to an increase in investment and thus an increase in income by a greater amount due to the multiplier.

Figure (10): The IS curve derivative



Source: (علاش ، 2010، صفحة 77)

2-2- IS equation in a three and four sector model

The IS equation can be derived in a three and four sector model taking into account the taxes situation independent or dependent on income, as shown below **(AGARWAL, 2010, p. 211)**:

2-2-1- IS equation in a three-sector model

Based on the two equilibrium conditions:

- **Aggregate demand (D) equals aggregate supply (Y)**

$$D = C + I + G$$

where the consumption is depended on disposable income:

$$Yd = Y - TX + TR$$

- **Total expenditures equal total resources**

$$\boldsymbol{S + Tx = G + I + Tr}$$

where the saving equation is depended on disposable income:

$$\boldsymbol{Yd = Y - TX + TR}$$

And in the both conditions investment will be depended to the interest rate:

$$\boldsymbol{I = I_0 - gi}$$

The equilibrium income can be found as below:

- **Taxes not related to income ($TX=TX_0$)**

$$y_{IS} = \frac{\mathbf{C_0 + I_0 + Go - bTxo + bTro}}{\mathbf{1 - b}} - \frac{g}{\mathbf{1 - b}}i$$

- **Taxes related to income ($TX=Tx_0+ty$)**

$$y_{IS} = \frac{\mathbf{C_0 + I_0 - bTxo + bTro + Go}}{\mathbf{1 - b + bt}} - \frac{\mathbf{g}}{\mathbf{1 - b + bt}}\mathbf{i}$$

2-2-2- IS equation in a four-sector model

Based on the two equilibrium conditions:

- **Aggregate demand (D) equals aggregate supply (Y)**

$$D = C + I + G + (X - Z)$$

where the consumption is depended on disposable income:

$$Yd = Y - TX + TR$$

- **Total expenditures equal total resources**

$$S + Tx + Z = G + I + Tr + X$$

where the saving equation is depended on disposable income:

$$Yd = Y - TX + TR$$

And in the both conditions investment will be depended to the interest rate:

$$I = I_0 - gi$$

The equilibrium income can be found as below:

- **Taxes not related to income (TX=TX₀)**

$$y_{IS} = \frac{C_0 + I_0 + Go - bTxo + bTro + Xo - Zo}{1 - b + z} - \frac{g}{1 - b + z} i$$

- **Taxes related to income (TX=Tx₀+ty)**

$$y_{IS} = \frac{C_0 + I_0 + Go - bTxo + bTro + Xo - Zo}{1 - b + bt + z} - \frac{g}{1 - b + bt + z} i$$

Example 01

If you have the following behavioral equations of a hypothetical economy:

- Consumption : C=20+0.85yd
- Investment: I=1700−235 i
- Taxes : Tx=20+0.12 y
- Government spending: G=50

1- Illustrate the investment function graphically for the two interest rates (i= 5% & i= 8%).

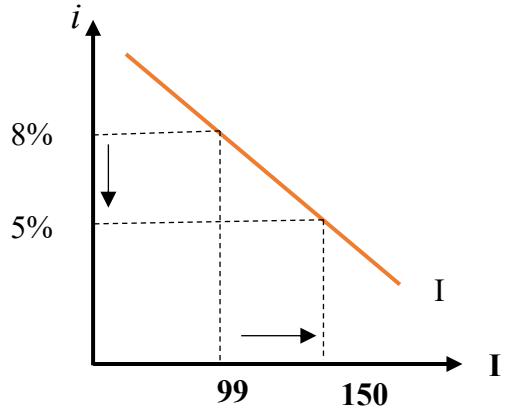
2- Derive the IS equation and calculate the equilibrium income for i=5% and i=8%.

3- Illustrate the IS curve graphically

Solution example 01

1- First, we must find the values of investment in the two level of the interest rate to represent the equation graphically:

- $I_1 = 1700 - 235\,(0.05) = 150$
- $I_2 = 1700 - 235\,(0.08) = 99$



2- The IS equation can be derived from:

Y=D

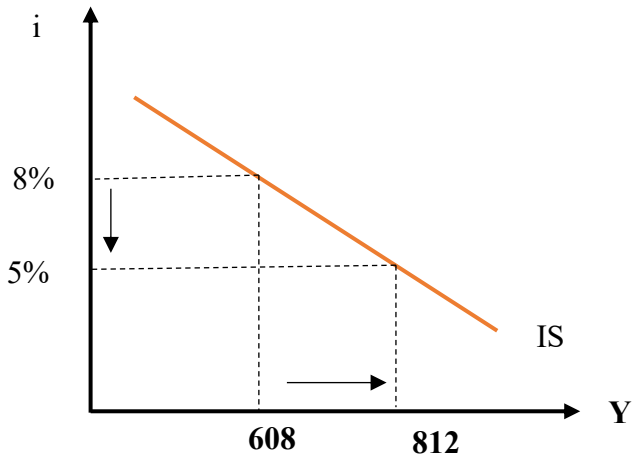
Y= C+I+G

$$y_{IS2} = \frac{C_0 + I_0 - bTxo + Go}{1 - b + bt} - \frac{g}{1 - b + bt} i = 1152 - 6800i$$

$$y_{IS1} = = 1152 - 6800(0.05) = 812$$

$$y_{IS2} = 1152 - 6800(0.08) = 608$$

3- The IS curve graphically:



3- The money market (LM equation & curve)

After presenting the main ideas behind the IS curve and its role in describing the equilibrium situation in the goods market, this section moves on to the monetary side of the economy.

Here, we focus on how income and interest rates are linked by the conditions that ensure equilibrium in the money market.

3-1- The equilibrium in the money market

According to the liquidity theory of money demand, the demand for money is classified into three forms:

- **Demand of money for transaction purposes + Demand of money for reserve purposes,** which they are related to income in a direct relationship:

$$\boldsymbol{Mt = f(y) = ky}$$

where k represents the liquidity preference factor

- **Demand of money for speculation in the financial market by buying stocks and bonds** which is linked to the interest rate through an inverse relationship:

$$\boldsymbol{Ma = f(i)}$$

$$\boldsymbol{Ma = L_0 - mi}$$

Where:

L_0 : Independent demand for money for speculative purposes

m : The sensitivity of speculative money demand to the interest rate

$$So: \boldsymbol{Md = Ma + Mt}$$

On the other side, the money supply $\boldsymbol{MS = M0}$ is an external variable because it is determined by the central bank according to the monetary policy followed.

Therefore, equilibrium is achieved in the money market when:

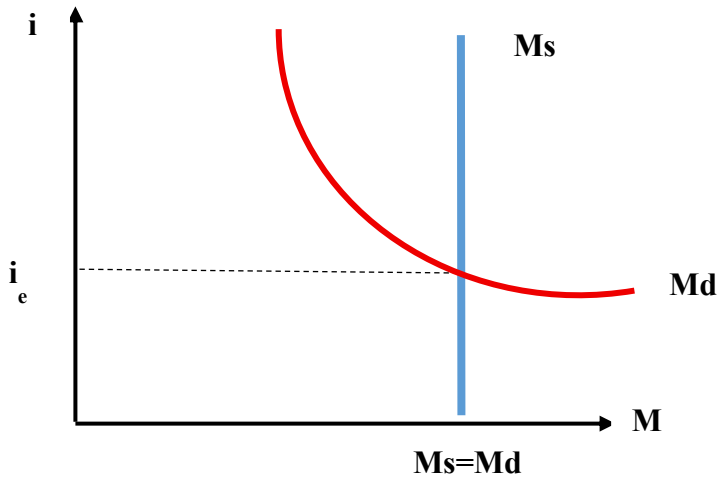
$$\boldsymbol{money\ supply = money\ demand}$$

$$\boldsymbol{Ms = M\,d}$$

$$\boldsymbol{Ms = M0 = Ma + Mt}$$

So according to this condition we can illustrate the equilibrium in the money market in the following figure:

Figure (11): The money market equilibrium



Source: (Surricchio, 2019, p. 13)

3-2- Deriving the LM equation

To derive the LM equation, we use the equilibrium condition in the money market **(Surricchio, 2019, pp. 13-14)**:

$Ms = M0 = Ma + Mt$ by substituting each equation with its equivalent:

$$M0 = Ma + Mt \Rightarrow M0 = Ky + L0 - mi$$

$$\Rightarrow \boldsymbol{y_{LM}} = \frac{\boldsymbol{M_0 - Lo + m\,i}}{\boldsymbol{k}}$$

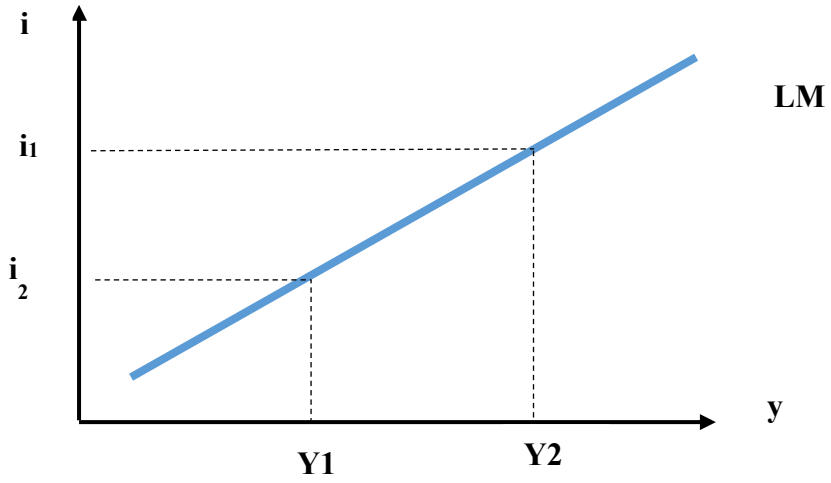
We note that the relationship between income and the interest rate in the money market is a direct relationship. When income (y) rises, the demand for money for transactions and hedging increases, creating an inequality in the money market (an increase in the demand for

money). Consequently, the interest rate (i) rises, which in turn leads to a decrease in speculative demand for money.

Accordingly, each value of interest rate (i) corresponds to a value of income (y), which represents the sum of the combinations between income and interest rate that ensure equilibrium in the money market.

The LM curve can be represented graphically as in the following figure:

Figure (12): The LM curve



Source: (دودو، 2021-2022، صفحة 26)

Example 02

Let the demand for money for transactions and **reserve** purposes be **Mt**, and the speculative demand for money be **Ma**:

- Mt = 0.10 Y
- Ma = 100 – 500i

1. Find the total demand for money **MD**.
2. Calculate the total demand for money when income is Y= 500 and the interest rate is i=0. 10.
3. If the money supply is Ms=200 and the money market is in equilibrium (money demand = money supply), determine $\mathbf{Y_{LM}}$ as a function of the interest rate i. Then draw the graph of this function (the LM curve).

Solution example 02

1. The total demand for money **MD**

$$\boldsymbol{Md = Ma + Mt}$$

$$\boldsymbol{Md} = 100 - 500\text{i} + 0.10\,\text{Y}$$

2. The total demand for money when income is Y= 500 and the interest rate is i= 0. 10

$$\boldsymbol{Md} = 100 - 500\text{i} + 0.10\,\text{Y}$$

$$\boldsymbol{Md} = 100 - 500(0.10) + 0.10\,(500)$$

$$\boldsymbol{Md = 100}$$

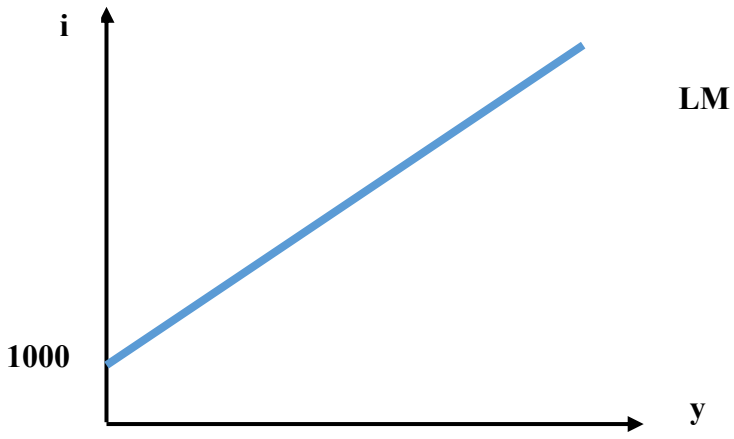
3. The LM equation

$$Ms = M0 = Ma + Mt$$

$$M0 = Ma + Mt \Rightarrow M0 = Ky + L0 - mi$$

$$\boldsymbol{y_{LM} = \frac{M_0 - Lo + m\,i}{k}}$$

$$\boldsymbol{y_{LM} = \frac{200 - 100 + 500\,i}{0.1} \Rightarrow y_{LM} = 1000 + 5000i}$$



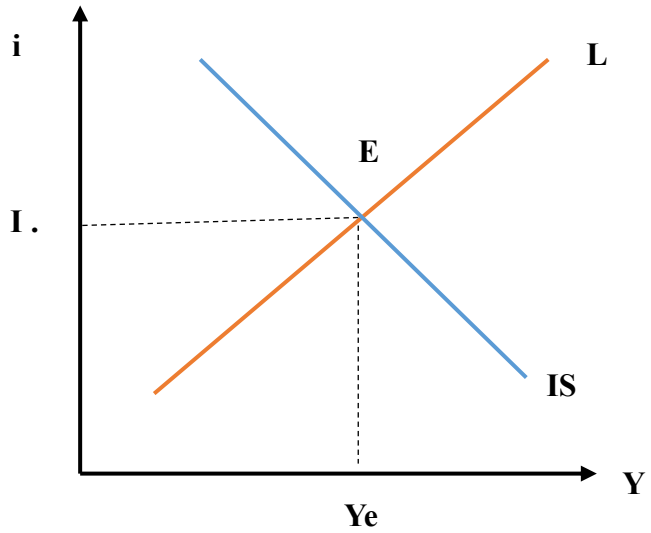
4- The general equilibrium (the current equilibrium in the two markets- ISLM-)

General economic equilibrium is achieved when both the goods and services market and the money market simultaneously meet their respective equilibrium conditions. Conversely, if equilibrium is achieved in one market but not the other, the economy is considered to be in macroeconomic disequilibrium because the decisions of economic actors are not mutually consistent across markets.

After having analyzed the mechanisms by which each market reaches equilibrium separately, the focus now shifts to their simultaneous equilibrium. This simultaneous equilibrium is represented by the point where the IS curve intersects the LM curve, producing a unique combination of income and interest rates that coordinates spending decisions in the goods market with liquidity preferences in the money market. This intersection reflects a coordinated equilibrium between the real and monetary sectors, ensuring consistency in overall macroeconomic behavior.

The general equilibrium determines the interest rate and income level that achieve equilibrium in both markets (IS=LM), as shown in the following figure (Sunday, 2023):

Figure (13): The IS-LM curve



Source: (Sunday, 2023, p. 259)

At equilibrium point E the equilibrium interest rate i_e and equilibrium income y_e are determined.

Example 03

Suppose you have the following data about an economy

$C = 200 + 0.8Y_d$

$Tx = 100 + 0.1y$

$Z = 80 + 0.12Y$

$X = 400$; $G = 300$; $TR = 60$

$I = 600 - 3000i$

$Ms = 1500$

$Mt = 0.5y$

$Ma = 400 - 2600i$

1- Find the equations of IS and LM and then calculate the value of the equilibrium income.

2- Represent the equilibrium graphically?

3- What is the meaning of X-Z? calculate it**?**

Solution example 03

1- Find the equations of IS and LM and then calculate the value of the equilibrium income.

a) **IS equation:**

Y = D

y = C + I + G+X-Z

$y = C_0 + by_d + I_0 - gi + G_0 + X_0 - Z_0 - \breve{z}Y$

$y = \frac{c_0 + I_0 + G_0 - bTx_{0+bTr0+X0-Z0}}{1-b+bt+\breve{z}} - \frac{g}{1-b+bt+\breve{z}} i$ … … IS

$y_{IS} = 3470 - 7500\ i$ … … IS

b) **LM equation**

$M_s = M_d \Rightarrow M_0 = M_t + M_a$

$y = \frac{M_o - L_o}{K} + \frac{m}{K} i \ldots\ldots \text{LM}$

$y_{LM} = 2200 + 5200i$

c) **Calculate the equilibrium:**

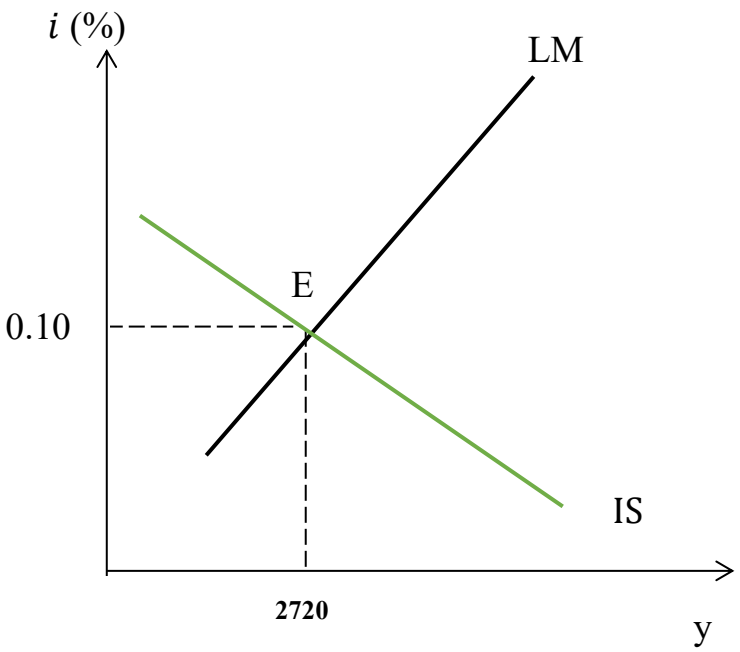
$Y_{IS} = Y_{LM}$

$3470 - 7500\,i = 2200 + 5200i$

$\boldsymbol{ie = 0.10}$

$\boldsymbol{y_{ISLM} = 1510 - 500\,(0,22) = 2720}$

2- Graph



3- The meaning of X-Z

- **X-Z:** means the trade balance
- **TB =X-Z** = 400 - (80 + 0.12 (2720)) = **-6.4 <0 deficit**

Example 04

Suppose you have the following data about an economy

$C = 60 + 0.8Y_d$

$I = 116 - 50i$

$Ms = 120$

$Md = 0.20\,Y - 200i$

1- Find the equations of IS and LM and then calculate the value of the equilibrium income.

2- Represent the equilibrium graphically?

3- What is the meaning of the intersection point between IS curve and LM curve?

Solution example 04

1- Find the equations of IS and LM and then calculate the value of the equilibrium income.

a) **IS equation:**

$Y = D$

$y = C + I$

$y = C_0 + by_d + I_0 - gi$

$y = \frac{c_0 + I_0}{1-b} - \frac{g}{1-b} i$ ... ... IS

$y_{IS} = 830 - 275\,i$ ... ... IS

b) **LM equation**

$M_s = M_d \Rightarrow M_0 = Md$

$120 = 0.20Y - 5i$

$y_{LM} = 600 + 25i$

c) **Calculate the equilibrium:**

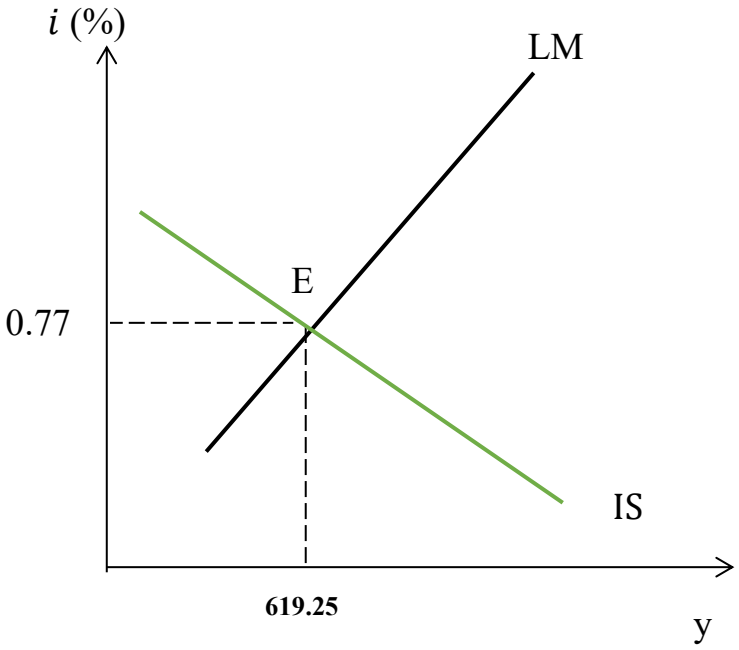
$Y_{IS} = Y_{LM}$

$830 - 275\,\mathrm{i} = 600 + 25i$

$\boldsymbol{ie = 0.77}$

$\boldsymbol{y_{ISLM} = 600 + 25(0.77) = 619.25}$

2- Graph



3- The meaning of the intersection point between IS curve and LM curve

The intersection of the IS and LM curves represents the general equilibrium in the economy, where total output equals total spending in the goods and services market, and the demand for money equals the supply of money in the money market. At this point, the equilibrium level of income and the equilibrium interest rate are recognized, any deviation from this point leads to a disequilibrium in one or both markets, causing changes in either the interest rate or the level of income.

Example 05

The following data represent the economy of a country:

C_0=30 ؛ I_0=150 ؛ Z_0=12 ؛ X_0=150 ؛ T_{X0}=20 ؛ G_0=200 ؛ b=0.9 ؛ z=0.22 ؛ t=0.2:

1- What are the behavioral relationships of this model?

2- calculate the equilibrium income and then calculate the consumption and savings at the equilibrium level?

3- Calculate the budget balance?

4- Calculate the net trade balance?

5- If the Income at the full employment equal 1100:

6- Determine the nature of the gap that the economy suffers from?

7- Find the amount of change in imports needed to remove the inequality situation? What is its impact on the trade balance?

Example 05 solution

1- The behavioral relationships of the model:

C=30+0.9yd S=-30+0.1yd TX=20+0.2y Z=12+0.22y

2- Equilibrium Income Calculation:

We have a model consisting of four sectors, of which the total equilibrium equation is:

$y = C + I + G + X-Z$

$y = C_0 + b\ [\ y- (\ T_{xo} + ty\ ) + T_{ro}] + I_0 + G_0 + X_{0-}\ (\ Z_0 + zy\ )$

we find:

$$\mathbf{Ye} = \frac{1}{1-b+bt+z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{ro} + X_0 - Z_0) = 1000$$

➢ **Calculation of C_e, S_e:**

- C=30+0.9yd
- TX=20+0.2(1000)= 220
- Y_d=y-T_X+T_R= 1000-220=780
- C_e= 30+0.9(780) =732
- S = -30 + 0.1 (780) =48

3- BUDGET balance

GB= T_X-(T_R+G) = 220 -(200) =+20 budget surplus

4- TB Balance

TB=X_0- (Z_0+ zy) =150- (12 + 0.22 (1000) = -82 DEFICIT in Trade Balance

5- If the Income at the full employment yf=1100:

➢ We note that $y_F > y_e$ from which the economy is in a deflationary gap

➢ Finding the amount of change in imports necessary to eliminate this gap and its impact on the trade balance:

- **Amount of change in Z_0 (using import multiplier)**

$$\Delta y = kz^* \Delta Z_0 \quad / \quad Kz\frac{1-}{1-b+bt+z} = -2$$

$$\Rightarrow \Delta Z_0 = \frac{\Delta y}{Ke} = \frac{1100-1000}{-2} = \frac{100}{-2} = -50$$

To achieve the agreement between the equilibrium income and the full employment level, imports must be reduced by 50.

- **Impact of the change on the trade balance:**

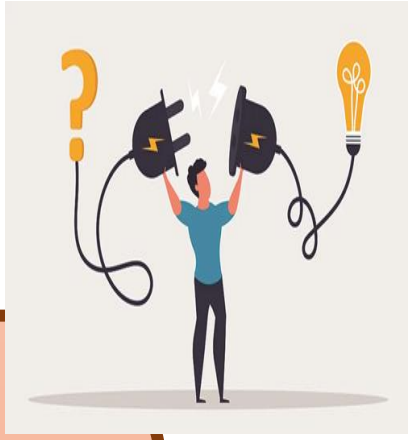
X-Z =150- (12+ΔZ0 +0.22Y) = 150-12 +50-0.22(1100) =-54

Before achieving full employment, the trade balance was equal to -82 and after reducing imports by 50 to reach full employment 0.5, The deficit in the balance decreased and became equal to -54 , so the impact of the change is the increase in the trade balance by (-54+82=+28).

Chapter 04: Analysis of fiscal and monetary policies

The interaction between fiscal and monetary policy plays a crucial role in shaping short-term macroeconomic equilibrium. Within the analytical framework of the IS-LM model, changes in government spending, taxes, and the money supply influence equilibrium income levels and the interest rate through their effects on the goods and money markets.

By examining how these two policies actions impact the IS and LM curves, this chapter highlights the mechanisms by which policymakers seek to stabilize economic activity, manage aggregate demand, and respond to macroeconomic fluctuations.



Through this chapter, the student will be able to:

1- ***Explain the fundamental roles of fiscal and monetary policy within the macroeconomic context.***
2- ***Identify the tools of each policy.***
3- ***Analyze how fiscal policy actions change the IS curve and affect macroeconomic equilibrium.***
4- ***Analyze how monetary policy actions change the LM curve and affect macroeconomic equilibrium.***
5- ***Explain the combined determination of income and interest rates through the intersection of the IS and LM curves.***
6- ***Understand the conditions under which policy effectiveness may differ within the model.***

Chapter 04: Analysis of fiscal and monetary policies

Fiscal policy and monetary policy are two fundamental tools used by governments and central banks to influence a country's economy.

1- The fiscal policy

1-1- Definition

The fiscal policy is the set of decisions that a government makes about government expenditure, taxation, and borrowing to influence general economic activity. It is formulated and implemented by the executive and legislative divisions, which determine how public resources and revenues are allocated. Through adjustments to government spending and tax structures, fiscal policy shapes the level of aggregate demand, affects household disposable income, and modifies the incentives faced by businesses and consumers **(Blanchard, 2017, p. 288)**.

1-2- Objectives

The main objectives of fiscal policy are **(Fairfield, 2025, p. 52) (unacademy, 2025):**

- **Achieving Economic Stability:** fiscal policy aims to stabilize the economy by limiting fluctuations in production and employment levels through adjustments in the government expenditure and taxes.
- **Encouraging Economic Growth:** by directing the government expenditure to infrastructure, education, and technological development, fiscal policy promotes long-term increases in productive capacity and economic development.
- **Reducing Unemployment (Full Employment Goal):** by increasing government spending or reducing taxes fiscal policy stimulates aggregate demand and helps reduce unemployment.
- **Maintaining Price Stability:** fiscal policy helps mitigate inflationary or deflationary pressures by influencing aggregate demand and correcting macroeconomic disequilibrium.
- **Income Redistribution:** by adjusting tax rates and increasing transfers, fiscal policy reduces income inequality and improves social welfare.
- **Resource Allocation:** fiscal tools direct resource allocation toward socially needed sectors (such as health, education, and public infrastructure) that the market may not provide.

- **Public Debt Management and Budget Balance:** fiscal policy ensures the long-term sustainability of public finances by controlling budget deficits and managing government debt levels.

1-3- Tools (instruments)

There are two main **fiscal policy instruments**, i.e., taxation and government expenditure **(unacademy, 2025)**:

- **Taxation:** it is a key fiscal policy tool, through which governments mobilize financial resources to fund public spending. While higher tax rates are often politically undesirable, societies generally demand increased public spending on essential sectors such as defense, education, healthcare, and social welfare.

  In addition to generating revenue, taxes are designed to influence economic behavior by encouraging private investment, reducing income inequality, regulating consumption patterns, and protecting domestic industries from foreign competition.
- **Government Expenditure:** it is the second key fiscal policy tool and plays an important role in shaping macroeconomic performance. government expenditure includes the provision of goods and services—such as infrastructure, public education, and national defense—and transfer payments to households and businesses. In many advanced economies, a significant share of government expenditure is allocated to social programs, including social security, unemployment benefits, and various healthcare programs. This spending not only supports vulnerable groups, but also stimulates aggregate demand, which affects output, employment and general economic stability.

In reality, achieving the optimal balance between tax revenue and government expenditure is a challenge, and many governments face persistent budget deficits when public spending exceeds tax revenue.

1-4- Types of fiscal policy

The main types of fiscal policy are expansionary and contractionary; we summarized them in the following table:

Table (03): Types of fiscal policy

Type of Fiscal Policy	Description	Main Tools
Expansionary Fiscal Policy	➢ Government increases expenditure or reduces taxes to increase the aggregate demand which increase production and income. ➢ It is used in case of recessions or periods of **deflation.**	➢ ↑ Government Spending ➢ ↓ Taxes
Contractionary Fiscal Policy	➢ Government decreases expenditure or raises taxes to decrease the aggregate demand and thus weakening the purchasing power of individuals. ➢ It is used in the case of **inflation**.	➢ ↓ Government Spending ➢ ↑ Taxes
Neutral Fiscal Policy	Government expenditure equals tax revenues; no active attempt to stimulate or restrain the economy.	➢ Balanced budget

Source: based on (Mankiw, 2010, p. 312)

2- The monetary policy

2-1- Definition

Monetary policy refers to the set of measures implemented by a country's **central bank** or monetary authority to regulate the money supply, credit conditions, and short-term interest rates, with the aim of achieving key macroeconomic objectives such as price stability, full employment, and sustainable economic growth **(Fairfield, 2025, p. 48)**.

By influencing the cost and availability of credit, monetary policy affects borrowing, consumption, investment, and aggregate demand, thereby contributing to the stabilization of economic fluctuations.

2-2- Objectives

Monetary and fiscal policy share several key objectives such as:

- Price stability
- Full employment
- Economic growth

Beside those mutual objectives monetary policy has many key objectives like **(Fairfield, 2025, p. 50)**

- **Exchange Rate Stability:** Monetary policy aims to maintain a relatively stable exchange rate to preserve international confidence in the domestic economy. By adjusting foreign exchange reserves, the central bank influences the supply and demand for foreign currencies to limit excessive volatility.
- **Balance of Payments Balance:** In countries facing persistent balance of payments imbalances, monetary policy helps restore equilibrium. A balance of payments surplus indicates an excess of the money supply, while a balance of payments deficit reflects tight monetary policy. By regulating the money supply and credit conditions, the central bank works to achieve overall balance in international payments.
- **Monetary Neutrality:** Some economists believe that money should be exclusively a medium of exchange and should not affect real economic activity. According to this view, monetary policy should regulate the money supply to prevent monetary disturbances. However, this objective is often criticized because maintaining a stable money supply may conflict with achieving price stability.

2-3- Tools (instruments)

Monetary policy relies on several key tools, including **open market operations**, **the discount rate**, and **reserve requirements**, which the central bank uses to regulate credit conditions and influence economic activity. However, in this section, we focus exclusively on the money supply in general, as it is the primary channel through which monetary authorities manage liquidity in the economy. By increasing or decreasing the money supply, the central bank directly influences interest rates, credit availability, and ultimately, aggregate demand.

In this context the money supply refers to the total amount of money available in an economy at a given time. This includes currency in circulation and various types of bank deposits that can be used for transactions. The central bank controls the money supply to influence liquidity, interest rates, and aggregate demand, which in turn affect economic activity such as consumption, investment, and price stability. Changes in the money supply

are a key monetary policy tool for stabilizing the economy and achieving macroeconomic objectives **(Mishkin , 2011, pp. 431-433)**.

2-4- Types of monetary policy

The main types of monetary policy are expansionary and contractionary; we summarized them in the following table:

Table (04): Types of fiscal policy

Type of Monetary Policy	Description	Main Tools
Expansionary Monetary Policy	➢ Aims to increase the money supply and encourage spending and investment ➢ It is used in case of recessions or periods of **deflation.**	- Lowering interest rates - Purchasing government bonds - Reducing the reserve requirement
Contractionary Monetary Policy	➢ Aims to reduce the money supply ➢ It is used in the case of **inflation**.	- Raising interest rates - Selling government bonds - Increasing the reserve requirement
Neutral / Accommodative Monetary Policy	Aims to maintain price stability and economic growth without strong stimulus or restraint	- Moderate adjustments to interest rates - Managing bank reserves moderately

Source: based on (Greenlaw & Taylor, 2017, pp. 344-350)

It should be noted that Fiscal policy affects the IS curve in the IS-LM model, while monetary policy affects the LM curve.

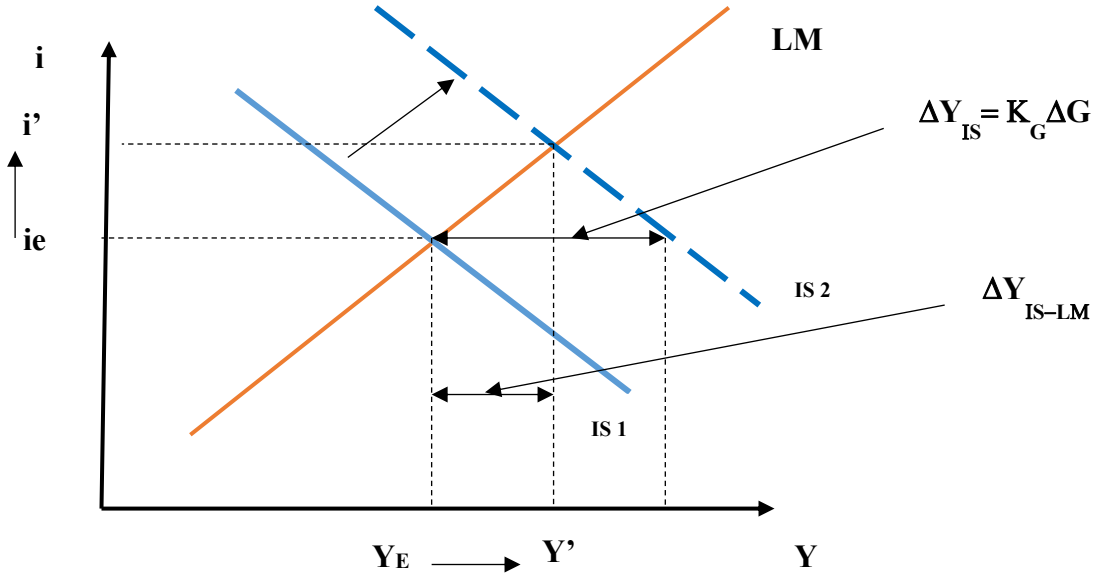
3- IS-LM Model Changes in Accordance with Fiscal Policy

3-1- IS curve transitions

3-1-1- The IS curve Shift to the right

In case of an expansionary fiscal policy by increasing government, expenditures or reducing taxes, this leads to the transition of the IS curve from **IS_1** to **IS_2** as shown in the following figure:

Figure (14): The shift of IS curve to the right



Source: (Sunday, 2023, p. 241)

From the figure above we note that **(Abel , Bernanke , & Croushore , 2011, p. 496)**

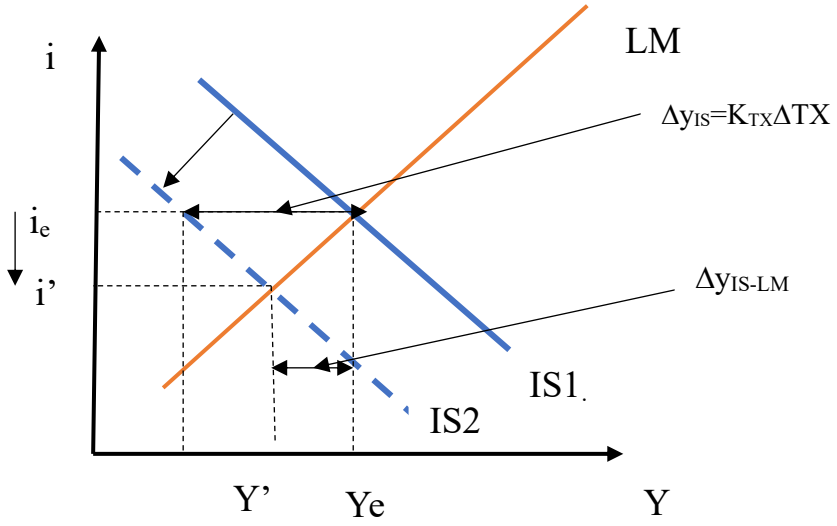
- The shift of the IS curve from IS_1 to IS_2 increases equilibrium income from Ye to Y' by: **$\Delta y_{IS} = K_G \, G\Delta$,** where **$K_G$** is the multiplier of government expenditure. This rise in income increases the money demand for transactions, creating excess demand in the money market at the initial interest rate i_e. Consequently, the interest rate rises to i', partially decreasing private investment. This mechanism is known as **the investment crowding-out effect**, where higher government expenditure pushes interest rates higher and discourages interest-sensitive private investment.
- Because of this **crowding-out effect**, the final increase in income is less than the initial prediction of the IS multiplier. Instead of rising by $y\Delta_{IS} = K_G \, \Delta_G$, it is **($\Delta y_{IS-LM}$)** which is less because the higher interest rate partially offsets the expansionary effect of fiscal policy. In other words, under IS-LM, fiscal expansion shifts the IS curve to the right, but the

internal rise in interest rates reduces investment and limits the overall increase in income ($\Delta y_{IS\text{-}LM} < \Delta y_{IS}$).

3-1-2- The IS Curve Shift to the Left

In the case of a contractionary fiscal policy by reducing government expenditure or raising taxes, the IS curve moves to the left from IS_1 to IS_2 as shown in the following figure:

Figure (15): The shift of IS curve to the left



Source: Prepared by the author

The increase in taxes leads to a decrease in income from Y_e to Y' by $\Delta y_{IS} = K_{TX}\,\Delta_{TX}$, but as a result of the decrease in the interest rate from i_e to i', the impact of the increase in taxes decreased; as investment increased, which led to a rise in income (income decreased by $\Delta y_{IS\text{-}LM}$ instead of $\Delta y_{IS} = K_{TX}\,{}_{TX}\Delta$) due to the impact of investment crowding.

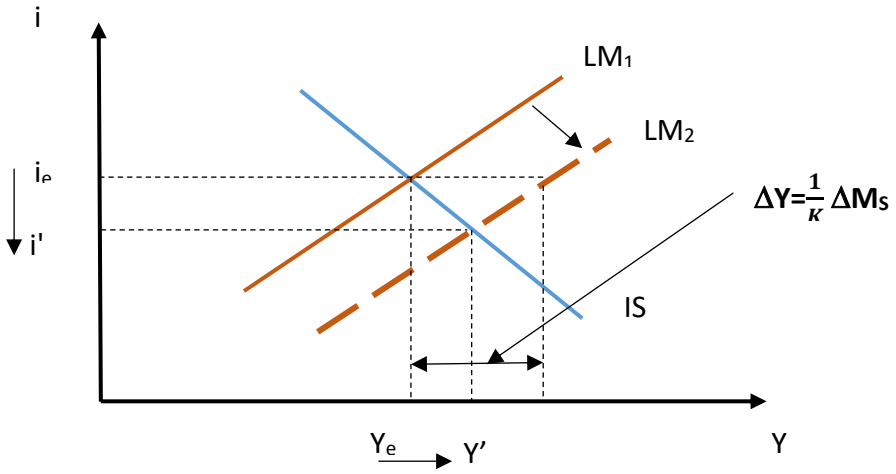
NOTE: ***The investment crowding-out effect refers to the decline in private investment that occurs when expansionary fiscal policy raises the equilibrium interest rate in the loanable money market or within the IS-LM framework. As the government increases its demand for funds (or pushes the IS curve to the right), the resulting rise in interest rates makes borrowing more expensive for firms, thus discouraging interest-rate-sensitive private investment. This effect partially offsets the expansionary impact of fiscal policy on aggregate demand and income.***

4- IS-LM model changes according to monetary policy

4-1- The LM curve shift to the right

The LM curve moves to the right in the case of an increase in the money supply MS (expansionary monetary policy) from LM1 to LM2 as shown in the following figure:

Figure (16): The shift of LM curve to the right



Source: (Sunday, 2023, p. 248)

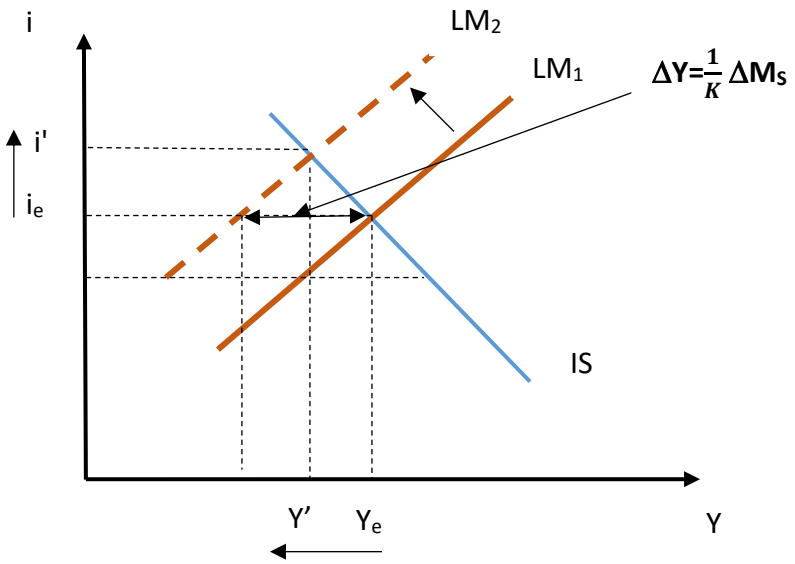
From the figure above we note that **(Blanchard, 2017, p. 118)**;

- The increase in the money supply leads to an increase in income by $\Delta YLM = \frac{1}{k}\ \Delta MS$; where $\frac{1}{k}$ is the money multiplier and K is **the liquidity preference factor** (the correlation coefficient of income with the money demand for transactions and reserve's purpose) **(Mt=KY)**.
- In addition, monetary expansion policy lowers interest rates from i_e to i', which stimulates interest rate-sensitive private investment. This increase in investment further amplifies the expansionary effect of the rising money supply, leading to a greater overall increase in income through investment channels within the IS-LM model.

4-2- The LM curve shift to the left

The LM curve moves to the left in the case of a decrease in the money supply M_S (contractionary monetary policy) from LM_1 to LM_2 as shown in the following figure:

Figure (17): The shift of LM curve to the left



Source: Prepared by the author

We note that the shift of the LM curve from LM_1 to LM_2 due to the reduction of the money supply leads to a decrease in income, on the other hand, the rise in the interest rate from i_e to i' resulted in a decrease in investment and a decrease in income (the absence of the impact of investment crowding out).

Note: When monetary policy is applied, whether expansionary or contractionary, the investment displacement effect does not occur. This is because the displacement phenomenon arises specifically from fiscal policy measures—such as changes in government spending or taxes—which directly affect the demand for lendable funds. On the other hand, monetary policy primarily operates by shifting the money supply curve through changes in the money supply, which indirectly affects interest rates and investment. Therefore, while monetary policy can stimulate or restrict investment by changing interest rates, it does not produce the traditional displacement effect associated with fiscal policy.

Example 06

Suppose you have the following data about an economy

C=55+0.75Yd ; Tx=250; Z=300+0.25Y ; X=500 ; G=250 ; TR=250 ; I=250-250i Ms=300 ; Mt=0.2y ; Ma=75-250i:

1- Find the equations of IS and LM?
2- Calculate the equilibrium income and interest rate? The represent the equilibrium situation graphically?
3- In the case of a decrease in taxes by 10

- What type of policy is being implemented?

- What is the effect of this policy on the IS and the LM curve?

- Find the new equilibrium position? Explain it graphically.

- Did the taxes achieve their full impact on income? Justify?

Solution example 06

d) **IS equation:** **Y = D**

$y = C + I + G+X-Z$

$y = C_0 + by_d + I_0 - gi + G_0+X_0-Z_0-\zeta Y$

$$y = \frac{c_0+ I_0+ G_0-bTx_{0+bTr0+X0-Z0}}{1-b+\zeta} - \frac{g}{1-b+\zeta} i \dots\dots IS$$

$$y_{IS} = 1510 - 500\, i \dots\dots IS$$

e) **LM equation:**

$$0.5M_s = M_d \Rightarrow M_0 = M_t + M_a$$

$$y = \frac{M_o-L_o}{K} + \frac{m}{K} i \dots\dots LM$$

$$y_{LM} = 1125 + 1250i$$

2- Calculate the equilibrium income and interest rate? The represent the equilibrium situation graphically?

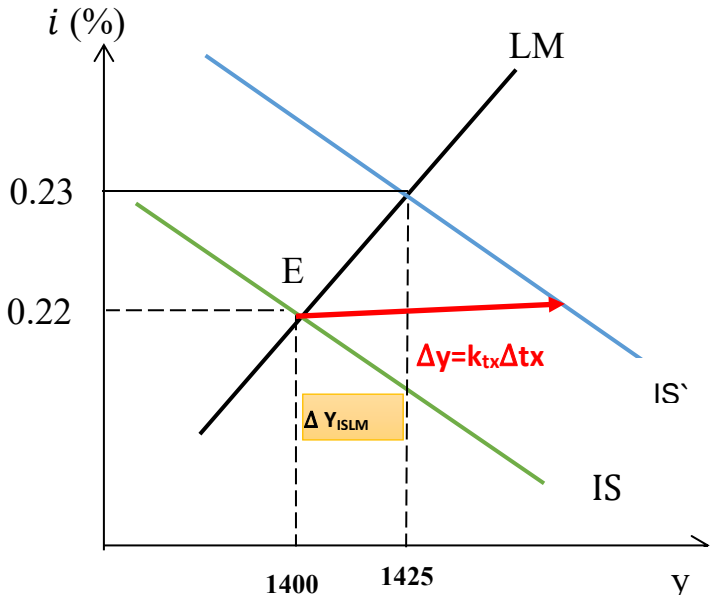
a) Calculate the equilibrium: $Y_{IS} = Y_{LM}$

$$1510 - 500\,i = 1125 + 1250i$$

$ie = 0.22$ 0.5

$y_{ISLM} = 1510 - 500\,(0,22) = 1400$

b) Graph:



3- In the case of a decrease in taxes by 10:

- What type of policy is being implemented?

- The type of policy applied is an expansionary fiscal policy**.**
- **the application of this policy will lead to:** the IS curve shifts to the right, LM remains the same. ΔYIS = KTx *ΔTx

- Find the new equilibrium position? Explain it graphically.

- **New IS' equation :**
- **ΔYIS = KTx *ΔTx = (-0.75/0.5) * (-10) = 15**
- $y_{IS''} = 1510 - 500\,i + 15 = 1525 - 500i$
- **IS'= LM** $\rightarrow$ $1525 - 500i = 1125 + 1250i$
- **ie'= 0.228/0.23→** $y_{ISLM'} = 1411/1410$

- Did the taxes achieve their full impact on income? Justify?

- ***Taxes did not achieve the full impact on income because $\Delta Y_{ISLM} < \Delta Y_{IS}$ This is due to the impact of investment crowding, as the high interest rate leads to a decline in investment and income, which leads to a decrease in the impact of taxes on income***

Example 07

Suppose you have the following data about an economy:

C= 60+0.6Yd ; I=60-300i ; G=30 ; T=10+0.1Y ; X=20 ; Z=5+0.1Y ; Ms=110 ; Mt=0.4y ; Ma=12-5i

1- Find the equations of IS and LM?
2- Calculate the equilibrium income and interest rate? The represent the equilibrium situation graphically?
3- In the case of an **increase the government spending by 20**
   - What type of policy is being implemented?
   - What is the effect of this policy on the IS and the LM curve?
   - Find the new equilibrium position? Explain it graphically.
   - Did the taxes achieve their full impact on income? Justify?

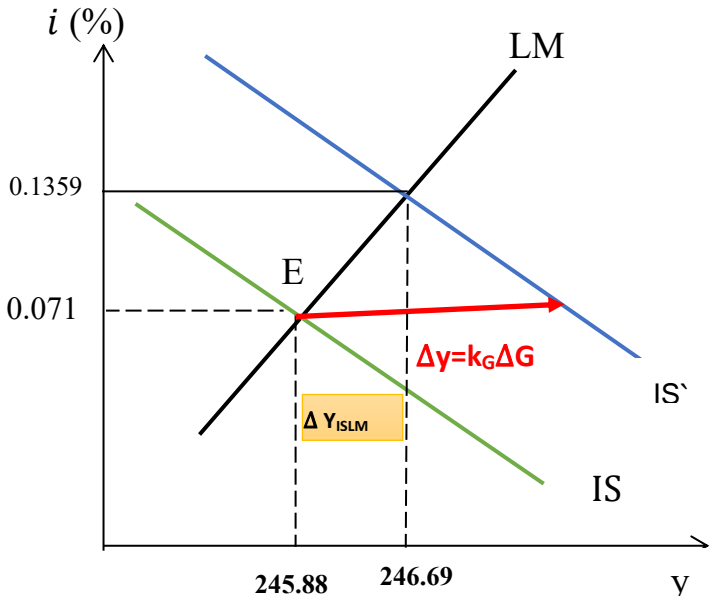
Example 07 solution

1- Find the equations of IS and LM?

- IS equation: $Y_{IS} = 283.93 - 535.7i$
- LM equation: $Y_{LM} = 245 + 12.5i$

2- Calculate the equilibrium income and interest rate? The represent the situation graphically?

- IS=LM
- $283.93 - 535.7i = 245 + 12.5i$
- $i=0.071$; $Ye= 245.88$



3- if we increase the government spending by 20

- What type of policy is being implemented?

- The type of policy applied is an expansionary fiscal policy.

- What is the effect of this policy on the IS and the LM curve?

- the application of this policy will lead to: the IS curve shifts to the right, LM remains the same. ΔYIS = KG*ΔG

- Find the new equilibrium position? Explain it graphically.

- **<u>New IS' equation :</u>**
- **ΔYIS = KG *ΔG = (1.78) * (20) = 35.6**
- $\mathbf{y_{IS"} = 283.93 - 535.7i + 35.6 = 319.53 - 535.7i}$
- **IS'= LM → ie'= 0.1359→** $\mathbf{y_{ISLM'} = 246.69}$

- Did the taxes achieve their full impact on income? Justify?

- ***Taxes did not achieve the full impact on income because*** $\Delta Y_{ISLM} < \Delta Y_{IS}$ ***This is due to the impact of investment crowding, as the high interest rate leads to a decline in investment and income, which leads to a decrease in the impact of taxes on income***

5- The IS-LM Model and the Effectiveness of Fiscal and Monetary Policy

The effectiveness of fiscal and monetary policy is determined by the slope of both the IS and LM curve (Blanchard, 2017)

5-1- Determinants of the slope of IS & LM curve

5-1-1- Determinants of the IS slope

According to the IS equation the slope of the IS curve is determined by the investment elasticity of the interest rate g and the marginal propensity of consumption b:

$$\textbf{\textit{The IS slope}} = \left(\frac{\mathbf{1-b}}{\boldsymbol{g}}\right)$$

- **The investment elasticity of the interest rate g**
  - As $\mathbf{g \to \infty}$ the IS slope becomes very small (≈0) which makes the IS curve a horizontal curve.
  - As **g→0** the IS slope to approach **infinity**, and the curve becomes **vertical**.

- **The marginal propensity to consume b**
  - As $\mathbf{b \to 0}$ the IS slope approach **infinity, and the curve becomes vertical.**
  - As **b** takes the biggest possible value the IS slope becomes very small (≈0) which makes the IS curve a horizontal curve.

Note: Although the slope of the IS curve is jointly determined by the interest-rate elasticity of investment and the marginal propensity to consume, the elasticity of investment to the interest rate remains the dominant factor in interpreting the behavior of the IS curve. It serves as the essential condition for determining its overall disposition.

5-1-2- Determinants of the IS slope

According to the LM equation the slope of the LM curve is determined by the response of the demand for money for the purpose of speculation to the changes in the interest rate m & liquidity preference coefficient K. we will focus on m as it is the most important determined in our case.

$$\textbf{\textit{The LM slope}} = \frac{\boldsymbol{K}}{\boldsymbol{m}}$$

- **As m** takes the lowest possible value the LM slope to approach **infinity**, and the curve becomes **vertical**.
- As **m** takes the biggest possible value the LM slope becomes very small (≈0) which makes the LM curve a horizontal curve.

5-2- The effectiveness of the fiscal policy

The effectiveness of fiscal policy denotes the extent to which variations in fiscal instruments—most notably government expenditure and taxation—translate into significant and measurable changes in aggregate income within the economy **(Abel , Bernanke , & Croushore , 2011, p. 491).**

To illustrate the effectiveness of fiscal policy using IS & LM curve, we will present the following figure. where Figure A and B represent the implementation of **an expansionary fiscal policy** that has shifted the IS curve to the right.

Figure (18): Graphical illustration of the correlation of the effectiveness of fiscal policy with the IS & the LM slope

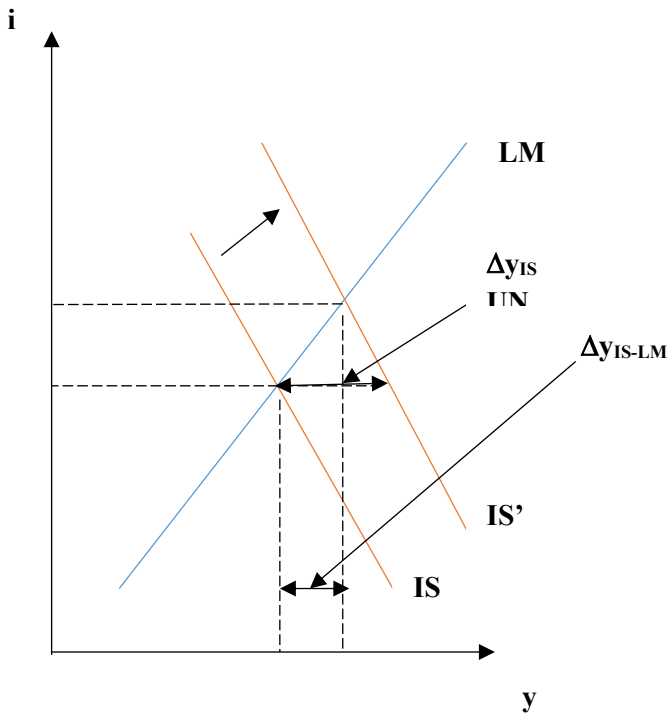


Fig. B

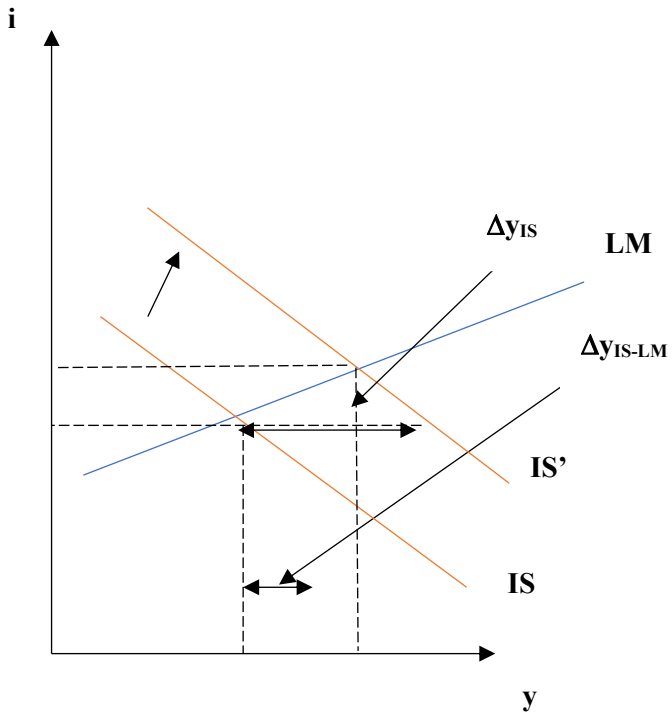


Fig. A

Source: (دودو، 2021-2022، الصفحات 37-39)

We note that the effectiveness of fiscal policy depends on the slope of the IS curve. In Figure B, we observe that the change in income in the IS-LM model (Δy_{IS-LM}) approaches the change in (Δy_{IS}), meaning that the expenditure multiplier reaches its full effect as the IS curve becomes nearly vertical. ***which means that the Fiscal policy is fully effective i.e. $\Delta y_{IS-LM}=\Delta y_{IS}$ when IS is vertical (slope IS=∞).***

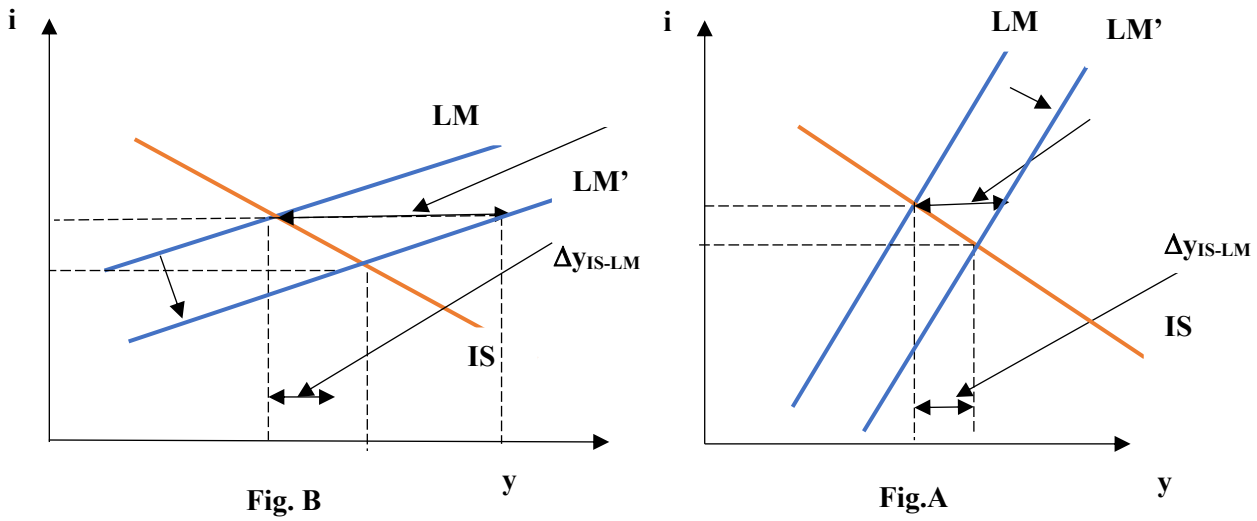
We note that the effectiveness of fiscal policy also depends on the slope of the LM curve; in Figure A we note that Δy_{IS-LM} devolves to Δy_{IS} when the LM curve was slightly sloping (approaching the horizontal position). **So the Fiscal policy is fully effective i.e. $\Delta y_{IS-LM}=\Delta y_{IS}$ when the LM is horizontal (slope LM=0)**

5-3- The effectiveness of the monetary policy

The effectiveness of monetary policy means the extent to which the effect of the change in the money supply on income is achieved.

Figure A and B represent the implementation of an expansionary monetary policy that led to the shift of the LM curve to the right.

Figure (19): Graphical illustration of the correlation of the effectiveness of monetary policy with the IS & the LM slope



Source: (41-40 الصفحات ،2022-2021 ،دودو)

We note that monetary policy has been most effective in Figure A because $\Delta y_{IS\text{-}LM}$ devolves to Δy_{IS} where the tendency of LM is greatest. ***which means that the*** **Monetary policy is *fully* effective i.e. $\Delta y_{IS\text{-}LM}=\Delta y_{IS}$ when the LM is vertical (LM slope $=\infty$).**

We note that monetary policy has been more effective in Figure B because $\Delta y_{IS\text{-}LM}$ devolves to Δy_{IS} where the slope of IS is small. ***which means that the*** **Monetary policy is fully effective i.e. $\Delta y_{IS\text{-}LM}=\Delta y_{LM}$ when IS is horizontal (slope IS=0).**

Conclusion

- **Regarding the IS curve**

The slope of the IS curve is closely related to the flexibility of investment. Flexibility here means how sensitive investment is to changes in the interest rate. There is an inverse relationship between flexibility and slope: the less flexible investment is (meaning investment does not respond much to interest rate changes), the steeper the IS curve becomes. The slope of the IS curve also affects the effectiveness of fiscal policy: the steeper the IS curve, the more effective fiscal policy is. Therefore, there is an inverse relationship between flexibility and the effectiveness of fiscal policy**.**

In the other side, if investment is very sensitive to interest rate changes (high flexibility), fiscal policy becomes less effective. This is because higher interest rates caused by increased government expenditure can reduce private investment, a phenomenon known **as crowding-out,** which lowers the overall impact of government expenditure or tax changes on total income. On the other hand, when investment is very sensitive, monetary policy becomes more powerful, since changes in interest rates have a stronger effect on investment and income.

- **Regarding the LM curve**

The slope of the LM curve is determined by the flexibility of money demand, which measures how the money demand is sensitive to changes in the interest rate. There is also an inverse relationship between flexibility and slope: the less responsive money demand is to interest rate changes, the steeper the LM curve becomes. The steeper the LM curve, the more effective monetary policy is, and vice versa.

In simple terms, if money demand is very sensitive to interest rate changes (high flexibility), monetary policy becomes less effective. Changes in the money supply have a smaller effect on interest rates and thus on investment and output. However, in this situation, fiscal policy becomes more effective, because changes in government spending or taxes can influence income more strongly when interest rate effects on money demand are high.

Comprehensive Practice Exercises for Chapters 03 and 04

Exercise 01

Answer the following questions:

1- How can a deflationary gap be treated using monetary policy? How can an inflationary gap be treated using fiscal policy?

2- What is **the impact of the preference for liquidity increases with interest rates expected to fall** on the effectiveness of financial and monetary policy, as well as the shifts of the IS curve and LM curve?

3- Explain the nature of the relationship between the sensitivity of investment to the interest rate and the crowding-out effect?

4- How is the effectiveness of fiscal policy related to the slope of the IS curve and the slope of the LM curve?

5- Explain the following terms: Trade balance; Budget balance; Expansionary fiscal policy.

6- When is monetary policy fully effective and when is it completely ineffective? Describe the corresponding shape of the LM curve in each case.

Exercise 01 solution

- A deflationary gap can be treated using monetary policy by increasing money supply.
- An inflationary gap can be treated using contractionary fiscal policy by **decreasing government spending 1** and **increasing taxes.**

2) the impact of the preference for liquidity increases at low interest rates on the effectiveness of financial and monetary policy, as well as on the shifts of the IS curve and LM curve

- This case means that the demand for speculative money (Ma) increases as interest rates are expected to fall sharply, (**i.e., people's propensity to hold cash increases as interest rates fall)**. This situation affects both policy effectiveness and curve shift as follows:

- Monetary policy becomes less effective because people hold cash instead of spending or investing (liquidity trap.
- Fiscal policy becomes more effective because increased government spending does not raise interest rates significantly (resulting in minimal shifts).
- The LM curve flattens when interest rates fall, becoming horizontal in a liquidity trap.
- The IS curve may shift to the left if uncertainty leads to lower investment and consumption.

3) Explaining the nature of the relationship between the sensitivity of investment to the interest rate and the crowding-out effect.

➢ Crowding-out effect: Happens when increased government spending raises interest rates, which then reduces private investment (inverse relationship):

- **If investment is highly sensitive to interest rates:** A small increase in interest rates leads to a large decrease in investment (Stronger crowding-out effect).
- **If investment is not very sensitive:** Interest rate changes have little impact on investment. Weaker or minimal crowding-out effect.

4) The effectiveness of fiscal policy related to the slope of the IS curve and the slope of the LM curve by:

- slope of IS=$\frac{1-b}{g}$ When the value of the marginal propensity to consume b decreases or the investment flexibility of the interest rate g decreases, the slope of IS rises then the IS curve is steeper, leading to higher fiscal policy effectiveness; and vice versa. (a direct relationship between effectiveness and the IS slope)
- The slope of LM = $\boldsymbol{K/m}$ When the liquidity preference coefficient K rises or the monetary demand flexibility of the interest rate m decreases, the LM slope rises, leading to a decrease in the effectiveness of fiscal policy (an inverse relationship between effectiveness and the LM slope);

5) Explain the following terms:

- **Trade balance:** is the difference between a country's exports (what it sells to other countries) and imports (what it buys from other countries).

  Trade Balance = Exports – Imports. Its types are:

  TB>0 Surplus

TB<0 Deficit

TB=0 Balance of Trade

- **Budget balance:** The budget balance refers to the difference between a government's revenue (mostly from taxes) and its spending.
  Budget Balance = TX – (TR+G). Its types are:

  GB>0 Surplus

  GB<0 Deficit

  GB=0 Balance
- **Expansionary fiscal policy:** It is used in case of deflation by increasing government spending or reducing taxes. This policy increases the aggregate demand which increase production and income.

6) Monetary policy is fully effective if the ΔyLM= ΔyIS-LM or the LM curve is vertical, that is, its slope = ∞, and monetary policy is ineffective if the LM curve is horizontal, that is, its slope =0

Exercise 02

Answer true or false, explaining the correct answer and correcting the incorrect ones:

1- When applying fiscal policy, an increase in interest rates leads to an increase in investment and production, so we achieve the full effect on income. This is known as the investment crowding effect.
2- when taxes are independent, if the government increases taxes and government spending by the same amount, the income level increases by the same amount as the increase in taxes and the government spending.
3- The deflationary gap can be treated using fiscal policy by increasing taxes and reducing government spending.
4- The inflationary gap can be treated using monetary policy by reducing the money supply.
5- Imports are considered as a leakage factor and are positively related to the income level.

Chapter 04: Analysis of fiscal and monetary policies

Exercise 02 solution

1- **False:** When applying fiscal policy, an increase in interest rates leads to a decrease in investment and production, thus not achieving the full impact on income. This is called the investment crowding effect.

2- **True:** This is known as **the balanced budget multiplier.**

$$\Delta y = \Delta G\, KG + \Delta T_X KTX \;\Delta y = \Delta G\, \frac{1}{1-b} + \Delta T_X \left(\frac{-b}{1-b}\right)$$

$$\Rightarrow \Delta y = \Delta G = \Delta T_X$$

3- False: A deflationary gap can be treated using fiscal policy by reducing taxes and increasing government spending.

4- **True**: because by reducing the money supply we pulling out the excess of demand and the economy will return to the full employment level ye=yf.

5- **True:** Because it represents domestic demand for foreign goods Z=Z0+zY.

Exercise 03

Answer with "True" or "False," With the correction for false one:

1. When the sensitivity of investment to the interest rate decreases, the investment crowding effect increases and thus the effectiveness of fiscal policy decreases

2. The investment crowding effect appears when the central bank adopts a contractionary fiscal policy.

3. If the central bank reduces the money supply, the LM curve will shift to the left while the IS curve remain stable.

4. When the LM curve is perfectly vertical, it is better to follow a fiscal policy because it will be more effective on income.

5. When the budget is balanced, this indicates that a general economic equilibrium has been achieved.

6. In the case of an increase in the sensitivity of money demand and thus the effectiveness of monetary policy increases and the effectiveness of fiscal policy decreases.

Chapter 04: Analysis of fiscal and monetary policies

Exercise 03 solution

1. False: When the sensitivity of investment to interest rates decreases, it means that investment is less responsive to interest rate changes. Therefore, the investment crowding effect decreases, making fiscal policy more effective.

2. False: The investment crowding effect appears when the government adopts an expansionary fiscal policy.

3. True

4. False: When the IS curve is perfectly vertical, it is better to follow a fiscal policy because it will be more effective on income. Or keeping the same sentence & change fiscal with monetary.

5. False: A balanced budget only means that Tx = (G+Tr) Equality between government expenditures and revenues, but it doesn't imply macroeconomic equilibrium (i.e., Ye = Yf). The economy could still be in recession or inflation.

6. False: In a liquidity trap, the sensitivity of money demand increases, and thus the slope of LM decreases, making monetary policy less effective while fiscal policy becomes more effective.

Exercise 04

If you have the following data about an economy:

S=-245+0.25yd , I=200-1450i , G=200 , TX= 160+0.3y , X =500, Z= 300+0.25Y

MS= 400 , Ma= 50-200i , Mt=0.5y

<u>Part One:</u>

1) Find the equations of IS and LM, finding the equilibrium interest rate and income.

2) Graphically represent the general equilibrium situation.

<u>Part Two:</u> If the full employment income YF=1000

2) Is the economy in full employment equilibrium? (instant equilibrium)

3) How can full employment be achieved using: (Explain this policy)

- Government Spending

- Taxes
- Imports

4) Graphically represent the situation of the government spending on the same graph of part one?

Exercise 04 solution

Part one:

1- IS equation:

A. IS equation representing the equilibrium at the goods & services market.

Y = D

Y= C + I + G+X-Z

$$y = \frac{c_0 + I_0 + G_0 - bTx_{0+bTr0} + X0 - Z0}{1 - b + bt + z} - \frac{g}{1 - b + bt + z} i \dots\dots IS$$

$$y_{IS} = 1000 - 2000\, i \dots\dots IS$$

2- LM equation:

A. LM equation representing the equilibrium at the money market.

$$M_s = M_d \Rightarrow M_0 = M_t + M_a$$

$$y = \frac{M_o - L_o}{K} + \frac{m}{K} i \dots\dots LM$$

$$y_{LM} = 700 + 400i$$

2- Equilibrium level

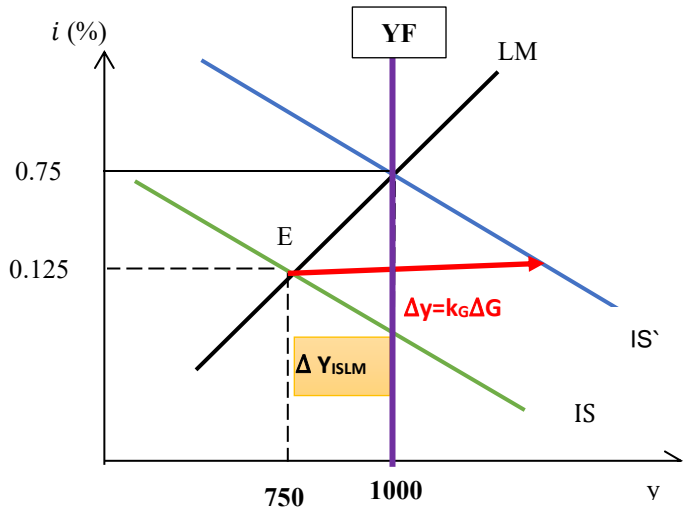
$$Y_{IS} = Y_{LM}$$

$$1000 - 2000\, i = 700 + 400i$$

$$ie = 0.125$$

$$y_{ISLM} = 700 + 400\,(0,125) = 750$$

4-Graph:



Part two: If the full employment income YF=1000

1- We have YF ≠Y_{ISLM} SO The is no full employment equilibrium and the economy is in the situation of underemployment equilibrium

2- Using the government spending & taxes to correct the situation:

A. The type of policy applied is an expansionary fiscal policy 0.25 which led to a shift in the IS curve to the right by ΔYIS = KG *ΔG or ΔYIS = KTX *ΔTX or ΔYIS = Kz *ΔZ 0.5 While the LM curve remains the same.

B. **YIS=1000 − 2000 i +Δy /Δy=KGΔG / KG=$\frac{1}{1-b+bt+Z} = \frac{1}{0.725} = 1.3793$**

YLM = 700+400i

The new interest rate (i'):

- We substitute the value of YF into the LM equation because it has not changed.

1000=700+400i

i'= 0.75

- We substitute i' into the new IS equation to extract the change in government spending

1000=1000-2000(0.75) +1.3793 ΔG ⟹ ΔG= 1087.5081

To reach full employment, government spending must be raised by 1087.5081 which leads to the shift of the IS curve to the right

C. Using taxes:

- We substitute i' into the new IS equation to extract the change in taxes:
- **Ktx=$\frac{-b}{1-b+bt+Z} = \frac{-0.75}{0.725} = -1.0344$**
- **1000=1000-2000(0.75) -1.0344* ΔTX ⟹ ΔTX= -1450.1160**

To reach full employment, taxes must be decreased by 1450.1160 which leads to the shift of the IS curve to the right

D. Using imports:

- **The type of policy applied is a contractionary foreign trade policy aim to reducing imports which led to a shift in the IS curve to the right by ΔYIS = KX *ΔX While the LM curve remains the same.**
- We substitute i' into the new IS equation to extract the change in imports**:**
- **Kz=$\frac{-1}{1-b+bt+Z} = -1.3793$**
- **1000=1000-2000(0.75) -1.3793 ΔZ ⟹ ΔZ= -1087.5081**

To reach full employment, taxes must be decreased by 1087.5081 which leads to the shift of the IS curve to the right

Exercise 05

If you have the following data about an economy:

S=-66+0.12yd , I=220-1008i , G=117.2 , TX= 0.15y MS= 198 Md= 0.4y-2420i

Part One:

1) What does the IS equation represent? find it.
2) What does the LM equation represent? find it.
3) Find the equilibrium interest rate and income.

Part Two: If the full employment income YF=1752.73

1- Is the economy in full employment equilibrium? (instant equilibrium)
2- How can full employment be achieved using government spending? Explaining the applicable policy

3- Represent graphically the general equilibrium and the situation after using government spending?

Part Three: If the investment becomes more sensitive to the interest rate, and the investment equation is now: I=220−2000i

- What is the effect of this change on the effectiveness of monetary and fiscal policies? (Explain without calculations.)

Exercise 05 solution

Part one:

1- IS equation:

A. IS equation representing the equilibrium at the goods & services market.

Y = D

Y= C + I + G

$$y = \frac{c_0 + I_0 + G_0 - bTx_{0+bTr0}}{1 - b + bt} - \frac{g}{1 - b + bt} i \dots\dots IS$$

$$y_{IS} = 1600 - 4000\,i \dots\dots IS$$

2- LM equation:

B. LM equation representing the equilibrium at the money market.

$$M_s = M_d \Rightarrow M_0 = M_t + M_a$$

$$y = \frac{M_o - L_o}{K} + \frac{m}{K} i \dots\dots LM$$

198=0.4Y-2420i

$$y_{LM} = 495 + 6050i$$

3- Equilibrium level

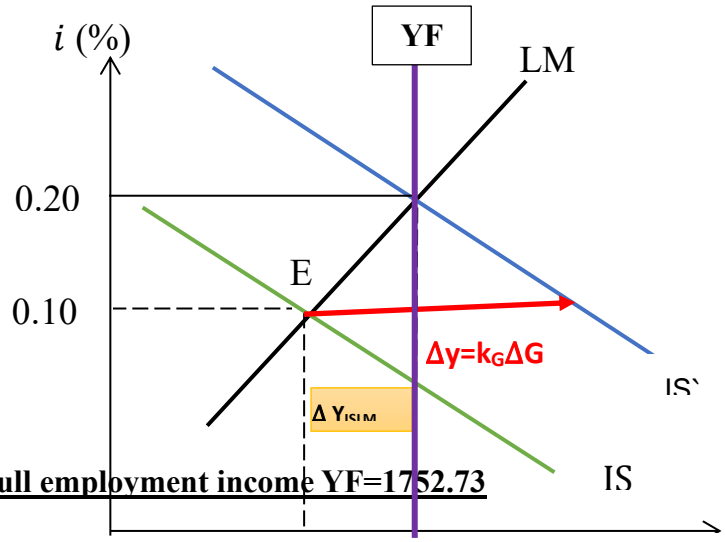
$Y_{IS} = Y_{LM}$

$$1600 - 4000\,i = 495 + 6050i$$

$$\boldsymbol{ie = 0.10}$$

$y_{ISLM} = 495 + 6050\,(0{,}1) = 1100$ /1200

4-Graph:



Part two: If the full employment income YF=1752.73

3- We have YF ≠Y_{ISLM} SO The is r equilibrium at e economy is in the situation of underemployment equilibrium.

4- Using the government spending to correct the situation:

- The type of policy applied is an expansionary fiscal policy which leads to a shift in the IS curve to the right by ΔYIS = KG *Δ G . While the LM curve remains the same.
- **YIS=1600-4000i +Δy /Δy=KGΔG**
- **KG=** $\frac{1}{1-b+bt} = \frac{1}{1-0.88+(0.88*0.15)} = 3.96$
- **YLM = 495+6050i**

The new interest rate (i'):

We substitute the value of YF into the LM equation because it has not changed.

1752.73=495+6050i

i'= 0.20

- We substitute i' into the new IS equation to extract the change in government spending

1752.73=1600-4000(0.20) +3.96 ΔG

ΔG= 240.58

To reach full operation, government spending must be raised by 240.58 which leads to the shift of the IS curve to the right.

Chapter 05: Business Cycles

Understanding the dynamics of modern economies requires a careful study of the recurring fluctuations that shape economic activity over time. These fluctuations, known as business cycles, reflect the alternating periods of expansion and contraction that characterize market-based economic systems. While cyclical patterns have existed throughout history, their complexity increased significantly after the Industrial Revolution in Europe, when market economies became more interconnected and production processes more sophisticated.

Through this chapter, the student will be able to:

1. ***Defining business cycles and distinguishing them from other types of economic fluctuations.***
2. ***Identifying and describing the main phases of business cycles along with the economic indicators that characterize each phase.***
3. ***Explaining the main theoretical frameworks that explain business cycles.***
4. ***Evaluating the role of economic policies—monetary and fiscal—in stabilizing fluctuations and mitigating the negative effects of cyclical downturns.***

Chapter 05: Business Cycles

Today, business cycles remain one of the most prominent forms of economic instability at both national and global levels. Alongside seasonal and long-term fluctuations, they represent a persistent challenge for policymakers and economic institutions. Variations in output, employment, and the general price level typically accompany these cycles, which may range from mild adjustments to severe disruptions. A solid understanding of these cyclical movements is essential for analyzing macroeconomic performance, designing stabilization policies, and anticipating future economic trends.

1- Definition and Concept

Business cycles are recurring and irregular fluctuations in overall economic activity observed in market-based economies. They consist of broad and simultaneous expansions across multiple sectors, followed by general periods of stagnation and contraction, after which economic activity recovers and enters a new phase of expansion. Although the duration and intensity of these cycles vary—typically ranging from slightly over a year to more than a decade—their basic structure, characterized by alternating periods of economic growth and decline, as measured primarily by real GDP, remains constant across all national economies **(Abel , Bernanke , & Croushore , 2011, p. 275)**.

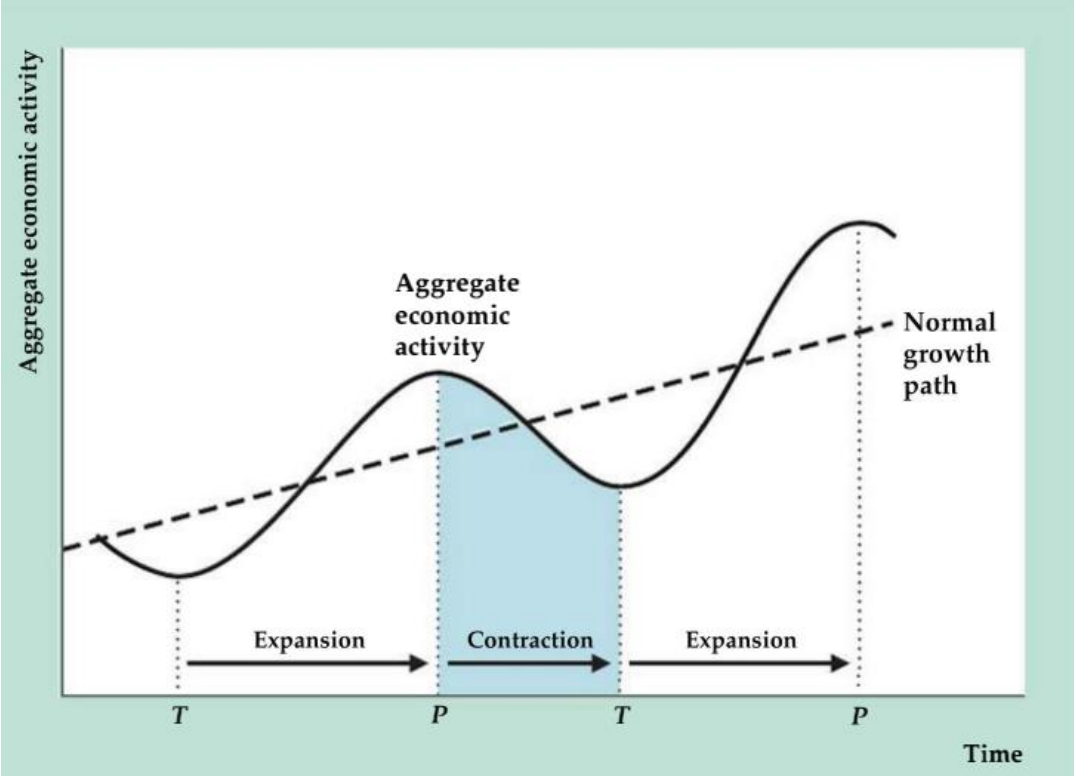
Key characteristics in this definition should be clarified and emphasized.:

- Recurrence, but not strict periodicity
- Broad impact across economic sectors
- Measurement through macroeconomic indicators (GDP, employment, industrial production)

2- Phases of the Business Cycle

The business cycle typically consists of four main phases that reflect changes in overall economic activity. These phases describe how the economy expands, peaks, contracts, and eventually recovers, which we will explain as follows **(Abel , Bernanke , & Croushore , 2011, p. 276)**:

Figure (20): Phases of the Business Cycle



source: (Abel , Bernanke , & Croushore , 2011, p. 276)

Figure (20) illustrates the phases of by the Business Cycle comparing he normal growth trend (the dashed line) with actual economic fluctuations (the solid line)

A. **Contraction (Recession):** A contraction occurs when aggregate economic activity begins to decline. Output, employment, and income fall as the economy moves below its normal growth path. If the downturn is exceptionally severe, it is classified as a depression. This declining phase continues until the economy reaches its lowest level of activity.
B. **Trough (T):**The trough marks the lowest point in the contraction phase. At this stage, economic activity is at its minimum, and pressures that caused the recession begin to ease. The trough represents the turning point at which the economy transitions from decline to renewed growth.
C. **Expansion (Boom):** An expansion begins once aggregate economic activity starts to increase after the trough. During this phase Output, employment, investment, and income rise. Confidence improves, and the economy moves back toward—and possibly above—its normal growth path. A strong and sustained expansion is often referred to as a boom

D. **Peak (P):** The peak represents the highest point of economic activity in the cycle. At this stage Output and employment reach maximum levels, rising costs, and inflationary pressures typically emerge.

E. ***After the peak, economic activity begins to decline again, marking the start of the next contraction.***

Note: The full business cycle consists of the complete movement from one peak to the next peak or from one trough to the next trough. It captures the economy's recurring deviations from its long-term growth path.

Economists analyze the phases of the business cycle—contraction, trough, expansion, and peak—by relying on a set of quantitative indicators that reflect the overall condition of the economy. Real GDP serves as the primary measure of aggregate economic activity and helps identify whether output is rising or falling across phases. The unemployment rate provides insight into labor market performance, revealing how employment levels respond to cyclical movements. Inflation rates are monitored to assess price stability, particularly during peaks and expansions when inflationary pressures may intensify. Additionally, the industrial production index tracks changes in manufacturing activity, offering a timely indicator of shifts in output across different stages of the cycle. Together, these measures allow economists to determine the economy's position within the business cycle and evaluate the intensity and duration of each phase **(Burns & Mitchell, 2025)** .

3- Types of Business Cycles

Business cycles vary according to their time duration and fall into three types **(عون الله، 2022-2023، صفحة 116)**:

- **Short-term cycles:** These cycles last approximately 40 months and are known as Kitchen cycles, named after their founder, Joseph Kitchen. He argued that economic variables consist of three main components: short-term cycles lasting approximately 40 months, and long-term cycles comprised of three short-term cycles.
- **Investment cycles:** These are known as Guglar cycles, named after the economist Clement Guglar, and last approximately 10 years. According to Guglar, each cycle consists of four phases: expansion, crisis, recession, and recovery.
- **Long-term cycles:** These are known as Kondratiev cycles, named after the Russian economist Nikolai Kondratiev, and their duration ranges from 48 to 60 years.

Kondratiev believed that the main determinants of these cycles are the Gross Domestic Product (GDP) and the general price level.

4- Theoretical Explanations of Business Cycles

Economists have, over time, attempted to explain the cyclical fluctuations of economic activity through various theories, each highlighting specific causes of recession and recovery, ranging from natural factors to structural contradictions within the capitalist system.

Below we will summarize the most important theories explaining economic cycles **(عون الله، 2022-2023، الصفحات 122-125)** :

A. **Monetarist Theory:** the Monetarist theory, associated with Milton Friedman, highlights the importance of money supply fluctuations in generating economic cycles. Unexpected changes in the money supply can trigger inflation, deflation, and variations in output. From this perspective, the primary cause of cyclical fluctuations lies in monetary instability, rather than real shocks or inherent market failures. Monetarists advocate that stabilization should be achieved by controlling the growth of money supply systematically, rather than relying on direct government spending or fiscal interventions, as predictable monetary policy can prevent large swings in economic activity.

B. **Climatic Theory:** This theory suggests that economic fluctuations are influenced by climatic cycles. Certain years' experience favorable climate conditions, leading to high agricultural production, followed by years of adverse conditions and poor harvests. Agricultural production cycles, in turn, generate cycles in broader economic activity.

C. **Sismondi's Theory:** Sismondi attributed economic crises to weak consumption or the failure to satisfy it. He emphasized that production should align with consumption, as production is determined by income. Crises occur when production exceeds consumption, leading to imbalances. Although his theory highlighted the mismatch between production and consumption, it did not fully address causes of wage stagnation or income inequality that underlie insufficient demand.

D. **Marxist Theory:** Marx explained economic crises as inherent contradictions within capitalist production. The main contradiction lies between the **social nature of production** and **private capitalist ownership**, rather than between production and consumption. Analyzing these contradictions reveals how periodic crises emerge inevitably under capitalism, highlighting their systemic and structural roots.

E. **Keynesian Theory:** Keynes argued that market forces alone are insufficient to stabilize the economy, which naturally oscillates between recession and inflationary booms. Small changes in aggregate demand are amplified through the **multiplier effect**, and fluctuations in investment are further intensified by the **accelerator effect**. Investment is the key driver of the cycle, while insufficient aggregate demand explains economic crises. Keynes stressed the importance of government intervention to achieve **full employment**, using fiscal and monetary policies to regulate consumption, income, and investment.

F. **Modern Multiplier–Accelerator Interaction:** This theory extends Keynesian ideas, showing that the interaction between the multiplier and the accelerator generates regular cyclical fluctuations in output and investment. Initial changes in investment trigger cumulative changes in income, which then influence other sectors, creating systematic cycles. This approach also incorporates independent factors affecting investment, such as technological progress, population growth, and government policies.

G. **Real Business Cycle (RBC) Theory:** The Real Business Cycle theory emphasizes the role of real shocks to the economy, such as technological innovations, changes in productivity, or variations in resource availability. According to this perspective, business cycles are not failures of the market but rather efficient and natural responses to these shocks. Fluctuations in output, employment, and investment are therefore seen as the economy adjusting optimally to changing conditions. Because these cycles reflect normal economic adaptation, policy intervention is generally considered unnecessary, as attempts to smooth the cycle may disrupt the natural adjustment process.

5- Business Cycles in Contemporary Economies

In contemporary economies, business cycles continue to play a central role in shaping economic activity. Modern economies experience fluctuations in output, employment, and investment due to a combination of structural, monetary, technological, and policy-related factors. Unlike in the past, where cycles were often driven primarily by agricultural production or seasonal factors, today's cycles are influenced by financial markets, global trade, technological innovations, and government policies.

Chapter 05: Business Cycles

Economic expansions are typically characterized by rising investment, higher consumer spending, and increasing employment, whereas recessions involve declines in production, layoffs, and reduced income levels. Contemporary economic analysis often uses a combination of theoretical approaches, such as Keynesian, Monetarist, and Real Business Cycle (RBC) models, to understand the causes and dynamics of these fluctuations.

Policy interventions, including monetary and fiscal measures, are frequently employed to moderate severe downturns, stabilize financial markets, and support employment. Moreover, globalization and interconnected markets have made modern cycles more synchronized across countries, amplifying both expansions and contractions in the global economy.

Based on the above, we can summarize the most important causes of Business cycles and strategies for addressing them in the following table:

Table (05): Causes and strategies of Business cycles

Causes of Business Cycles	
Economic Factors	- Fluctuations in aggregate demand (consumption, investment, government spending) - Changes in money and credit supply / monetary disturbances - Changes in productivity or technology (supply shocks) - Fluctuations in investment caused by profit expectations, credit conditions, etc. - Variations in government fiscal activity (spending, taxation) which affect total demand
Non-Economic / External & Structural Factors	- External global shocks: changes in international trade, foreign investment flows, exchange-rate shifts, global recessions or booms - Structural or institutional constraints (e.g. rigid labour markets, income distribution issues) that reduce effective demand or investment capacity - Climate, agricultural or natural-resource shocks (in economies dependent on agriculture or natural resources) — in classical literature some business-cycle theories mention such "non-economic" environmental or exogenous shocks.
Strategies for addressing Business Cycles	
Active Stabilization Strategies (Policy-driven)	- **Monetary policy**: regulating money supply and credit conditions; adjusting interest rates to smooth out booms and busts. - **Fiscal policy**: government spending increases, tax cuts or social transfers during downturns to boost aggregate demand. - **Coordinated monetary + fiscal policy** when shocks are large or structural (to buffer cycles). - **Regulation of credit markets** / financial sector oversight to prevent "credit-driven" booms and excessive leverage, thereby reducing severity of cycles. (This is especially relevant when business cycles are intensified by financial shocks.
Passive (Non-Active) / Automatic or Structural Strategies	- Allowing natural market adjustments: letting prices/wages adjust, ensuring flexible markets that absorb shocks over time rather than over-reacting with heavy intervention. - Structural reforms that increase resilience: improving labour-market flexibility, diversifying the economy to reduce dependence on volatile sectors, improving productivity and innovation capacity to buffer supply shocks. - Building buffers or stabilization funds (so that in case of global/external shock — e.g. commodity price drop — economy is more resilient). - Encouraging long-term investment in human capital, infrastructure and diversified productive capacity: although this is not immediate "active" policy, it creates structural stability.

Source: **(بن قدور، 2018) (بوداب، 2021).**

Chapter 06: Economic growth, unemployment, and inflation

Economic growth, unemployment, and inflation are three of the most important macroeconomic variables that shape the overall performance of modern economies. These variables are closely interconnected, directly impacting living standards, economic policies, and social stability. Understanding the behavior and interactions of these indicators is essential for analyzing economic fluctuations and designing effective policy responses.

In contemporary economies, policymakers closely monitor these variables because changes in one often affect the others. For example, rapid economic growth may reduce unemployment, while high inflation may distort investment decisions and slow economic activity. Therefore, studying these indicators provides a comprehensive understanding of macroeconomic stability and long-term development.

Through this chapter, the student will be able to:

1. ***Define and explain the concepts of economic growth, unemployment, and inflation.***
2. ***Identify the relationships and interactions between these key macroeconomic variables.***
3. ***Analyze the effects of changes in growth, unemployment, and inflation on economic performance.***
4. ***Evaluate policy tools, such as fiscal and monetary policies, used to stabilize the economy.***

Chapter 06: Economic growth, unemployment, and inflation

1- Economic Growth

1-1- Definition

Economic growth is the sustained increase in an economy's productive capacity, reflected in a long-term rise in the real output of goods and services, and is typically measured by the real GDP growth rate. This growth indicates improved production efficiency, technological advancements, and rising living standards over time **(Mankiw, 2010, p. 191)**.

1-2- Types of Economic Growth

Understanding the types of economic growth helps explain how an economy increases its output over time. Some forms of growth come from using more resources, while others result from using resources more efficiently.

- **Extensive Growth:** Output increases because more labor, capital, or natural resources are used.
- **Intensive Growth:** Output rises due to better technology, skills, and productivity.
- **Balanced Growth:** All sectors of the economy grow at similar rates.
- **Unbalanced Growth:** Growth is driven by rapid expansion in specific key sectors.
- **Sustainable Growth:** Growth that continues without harming future generations

1-3- factors affecting economic growth

A set of factors affecting economic growth can be summarized as follows **(Silaban, 2025):**

- **Human Capital**: The skills, education, and health of the workforce that raise productivity and innovation.
- **Physical Capital**: Investments in machinery, infrastructure, and technology that enhance production capacity.
- **Technology and Innovation**: Technological progress that improves efficiency, reduces costs, and increases output.
- **Natural Resources**: The availability and efficient use of natural inputs such as land, minerals, and energy.
- **Institutional Quality**: Stable political systems, effective governance, property rights, and transparent regulations.

- **Investment and Savings:** Higher investment rates that support capital accumulation and long-term growth.
- **Trade Openness**: Access to international markets, which promotes efficiency, competition, and technology transfer.
- **Macroeconomic Stability**: Low inflation, stable fiscal policy, and predictable economic conditions that encourage investment.

1-4- Methods of Measuring Economic Growth

Many indicators are widely used to capture the different dimensions of the economic growth, the most important of which are **(COCCIA, 2017, p. 7)**:

- **Growth rate of real GDP:** is the percentage changes in GDP is expressed as the percentage change in its value between two periods, which Reflects the **actual increase in economic output** over a period of time. Real GDP growth rate is calculated as follows:

$$percentage\ changes\ in\ RGDP = \frac{RGDP\ \text{current year} - RGDP\ \text{base year}}{RGDP\ \text{base year}} \times 100$$

Note: real GDP is the sum of goods and services produced during a specific period of time, valued at constant prices (base year prices (Po)) after excluding price effects, and is calculated by: **RGDP = ∑(Qn × Po)**

- **Real GDP per Capita:** measures the average income of each person in the economy, adjusted for inflation. It is a useful indicator for evaluating changes in living standards and for comparing economic well-being across different countries or over time**.** it is calculated as follows:

$$real\ GDP\ per\ Capita = \frac{RGDP}{n°\ of\ population} \times 100$$

2- Unemployment

2-1- Definition

Unemployment is the condition in which an individual is willing and able to work but cannot find suitable employment within the available labor force. It serves as a key indicator of a country's economic and social health, affecting national income, living standards, and social stability **(ILO, 2025).**

2-2- Types of Unemployment

The main types of unemployment can be summarized as follows **(Mankiw, 2010, pp. 167-169)**:

A. **Frictional Unemployment**
   a. Short-term unemployment that occurs when people are **between jobs** or **entering the labor force** for the first time.
   b. Example: A recent graduate looking for their first job.

B. **Structural Unemployment**
   a. Occurs when there is a **mismatch between workers' skills and the needs of employers**, often due to technological changes or shifts in the economy.
   b. Example: Factory workers replaced by automation.

C. **Cyclical Unemployment**
   a. Caused by **economic downturns** or recessions when total demand in the economy falls.
   b. Example: Job losses during a recession.

D. **Natural Rate of Unemployment (u*)**
   a. The sum of frictional and structural unemployment when the economy is at **full employment** (no cyclical unemployment).

2-3- Measuring Unemployment

Among the indicators used to measure unemployment are the following**: (Mankiw, 2010, pp. 165-166) :**

- **Unemployment Rate (u):**

$$Unemployment\ Rate\ (u) = \frac{Number\ of\ Unemployed\ People}{Labor\ Force} \times 100$$

- **Labor Force Participation Rate:**

$$Participation\ Rate = \frac{Labor\ Force}{Labor\ Working\ Age\ Population} \times 100$$

Notes: The labor force includes all employed individuals and those who are unemployed and actively seeking work.

3- Inflation

3-1- Definition

Inflation is a sustained and general increase in the overall price level of goods and services in an economy over a period of time. Inflation reduces the purchasing power of money, affecting the cost of living, savings, and investment decisions **(Abel , Bernanke , & Croushore , 2011, p. 441)**.

3-2- Types of Inflation

The types of inflation can be summarized in the following table:

Table (06): Types of inflation

Type of Inflation	Cause / Explanation	Example
Demand-Pull Inflation	Aggregate demand exceeds aggregate supply; too much spending chasing too few goods.	Rapid economic growth leading to higher consumer spending.
Cost-Push Inflation	Rising production costs (wages, raw materials, supply shocks) cause firms to raise prices.	Increase in oil prices driving up transportation and production costs.
Built-In Inflation (Wage-Price Spiral)	Inflation expectations cause workers to demand higher wages; firms increase prices accordingly.	Workers negotiate higher wages anticipating future price increases.
Hyperinflation	Extremely rapid and uncontrolled price increases, often due to excessive money supply.	Zimbabwe in the late 2000s.
Stagflation	Combination of high inflation and high unemployment with stagnant economic growth.	Oil shocks in the U.S. during the 1970s.

source: based on (Abel , Bernanke , & Croushore , 2011, pp. 441-459)

Note: Moderate inflation can be beneficial because it encourages investment and production, while high inflation is harmful because it reduces purchasing power and creates economic instability.

3-3- Inflation Measurement Indicators

Key Inflation Indicators are **(Riley, 2023, pp. 2-3):**

A. **The GDP price deflator:** The implicit deflator of GDP prices is a type of price index that is used to measure the inflation rate in GDP prices and economists used it to exclude the effect of inflation from the product and is calculated as follows:

$$\text{GDP Price Deflator} = (\text{Nominal GDP} \div \text{Real GDP}) \times 100$$

- When the deflator value exceeds 100%, this means that prices are on average higher than they were in the base period, and this increase expresses the inflation rate in GDP prices.
- The value of real GDP is calculated after excluding price effects as follows:

$$\text{RGDP} = \frac{\text{NGDP}}{\text{GDP PRICE Def}} \times 100$$

B. **Consumer Price Index (CPI) :** The Consumer Price Index (CPI) measures the average change over time in the prices paid by consumers for a fixed "market basket" of goods and services. It is a widely used indicator of inflation and reflects changes in the cost of living. CPI is calculated using the following formula:

$$\text{CPI} = \frac{\text{Cost of Market Basket in Current Year}}{\text{Cost of Market Basket in base Year}} \times 100$$

Conclusion

Economic growth, unemployment, and inflation are three of the most important macroeconomic indicators, and they are closely interconnected. When economic growth is high, unemployment tends to decrease because more jobs are created, but this often leads to higher inflation due to increased demand for goods and services. Conversely, during an economic slowdown, unemployment rises as businesses reduce production, and inflation typically falls because of weaker demand. Economic policies play a crucial role in balancing these variables. **Fiscal policy,** which includes government spending and taxation, directly affects economic growth and employment levels. **Monetary policy**, through instruments such as interest rates and money supply management, primarily controls inflation. Policymakers aim to use these tools to achieve a balance between growth, employment, and price stability. Maintaining this balance is essential for ensuring economic stability and promoting sustainable

long-term development, as it allows an economy to grow without creating excessive inflation or unemployment pressures.

Chapter 07: The Phillips Curve and The Okun's Law

Macroeconomics seeks to understand how key variables—such as inflation, unemployment, and output—interact. Two foundational empirical relationships help economists interpret these interactions: **the Phillips Curve**, which links **inflation** and **unemployment**, and **Okun's Law**, which connects **unemployment** with **output growth**. Although neither relationship is considered perfectly stable, both remain essential tools for policy analysis and macroeconomic forecasting.

Through this chapter, the student will be able to:

1. ***Understand the key relationships between inflation, unemployment, and economic growth through the Phillips Curve and Okun's Law.***
2. ***Analyze the impact of economic policies—monetary and fiscal—on inflation, unemployment, and output.***
3. ***Differentiate between the two models in terms of their variables, interpretations, and roles in macroeconomic analysis.***

Chapter 07: The Phillips Curve and The Okun's Law

1- The Phillips Curve

1-1- Definition and Origins

The **Phillips Curve** is an empirical relationship that suggests an inverse correlation between **inflation** and **unemployment**. First introduced by A. W. Phillips (1958), it was based on historical data from the United Kingdom that showed that lower unemployment rates were associated with higher wage inflation **(OpenStax, 2025)**.

The **Philip curve** illustrates the inverse relationship between the unemployment rate and the inflation rate. In the short run, when unemployment decreases, inflation tends to increase, and vice versa.

The general equation for the Phillips curve in the short-run is **(Abel , Bernanke , & Croushore , 2011, p. 441)**:

$$\boldsymbol{\pi t = \pi te - \beta(ut - u*)} \ \ where:$$

πt: actual inflation rate at time t

πte: expected inflation rate

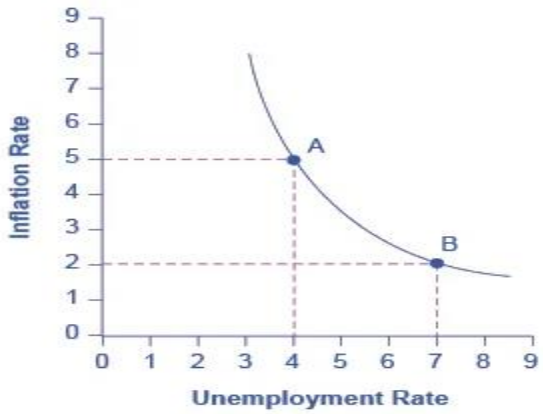
β: The inverse relationship between inflation and unemployment coefficien

ut: unemployment rate at time t

u $*$: natural rate of unemployment

The following figure illustrates the Phillips curve in its simplest form:

Figure (21): The Phillips curve in its simplest form



Chapter 07: The Phillips Curve and The Okun's Law

Source: (OpenStax, 2025)

The Phillips Curve represents the inverse relationship between unemployment and inflation. The different points along the curve reflect various combinations of the unemployment rate and the inflation rate. Governments can choose among these combinations when designing policies aimed at economic stability and employment at the national level. For example, a government may maintain low unemployment rates, but this choice typically comes at the cost of higher inflation. Conversely, reducing inflation may require accepting higher unemployment.

This inverse relationship between inflation and unemployment (or output) has helped to establish the missing link in macroeconomic analysis between production and price levels. Traditional IS-LM analysis, for instance, assumed stable prices, but the Phillips Curve introduced a framework that incorporates inflation and unemployment interactions.

This relationship presents policymakers with a set of trade-offs between inflation and unemployment. Some economists argue that balancing these two variables is a key challenge for governments: if inflation is very high, reducing it may require accepting a rise in unemployment, whereas if unemployment is high, lowering it may necessitate tolerating higher inflation.

1-2- The Philips curve forms

the main forms of the Philips curve are **(Blanchard, 2017)**:

A. Short-Run Phillips Curve (SRPC)

The short-run Phillips curve shows an inverse relationship between unemployment and inflation in the short run. During this period, policymakers can reduce unemployment by accepting higher inflation, as lower unemployment leads to increased demand and wages, which in turn pushes prices up. However, this trade-off is temporary because inflation expectations adjust over time.

B. Long-Run Phillips Curve (LRPC)

The long-run Phillips curve takes a vertical direction at the natural rate of unemployment (also called NAIRU). This means there is no long-term trade-off between inflation and unemployment. Trying to reduce the unemployment rate below its natural rate only leads to higher inflation without sustainably improving employment levels

C. Expectation-Boosted Phillips Curve

This model of the Phillips curve incorporates expected inflation into the short-run relationship. When workers and businesses expect inflation to rise, wages and prices adjust accordingly, causing the short-run curve to shift upwards. This explains why the short-term balance between unemployment and inflation can change based on people's expectations.

1-3- Impact of Monetary and Fiscal Policy on the Phillips Curve

The Phillips Curve can be affected by both Monetary and Fiscal Policy as below **(OpenStax, 2025)**:

A. Monetary Policy and the Phillips Curve

Monetary policy, implemented by central banks, primarily affects the economy through interest rates and the money supply. In the short term, expansionary monetary policy—such as lowering interest rates or increasing the money supply—can stimulate demand, leading to lower unemployment. However, this often comes at the cost of higher inflation. Conversely, contractionary monetary policy—such as raising interest rates or reducing the money supply—can lower inflation but may temporarily increase unemployment. Changes in inflation expectations resulting from monetary policy can also alter the Phillips Curve in the short term, illustrating how policy affects both inflation and unemployment.

B. Fiscal Policy and the Phillips Curve

Fiscal policy, which includes government spending and taxes, also influences the position of the Phillips Curve by affecting aggregate demand. Expansionary fiscal policy—such as increasing government spending or tax cuts—can lower unemployment in the short term but may raise inflation as demand increases. On the other hand, contractionary fiscal policy—through spending cuts or tax increases—can help control inflation, but it may also increase unemployment. Essentially, fiscal policy sets the course of the economy along the short-term Phillips curve at any given moment.

C. Policy Implications and Trade-offs

Both monetary and fiscal policies allow policymakers to manage the short-term trade-off between unemployment and inflation. In the long run, the Phillips curve is vertical at the normal rate of unemployment, indicating that attempts to reduce unemployment below this level only lead to higher inflation without a sustained decrease in unemployment. Therefore,

policymakers must carefully balance these tools to achieve economic stability and sustainable growth.

Conclusion

The Phillips Curve is a fundamental tool in macroeconomics, illustrating the short-term inverse relationship between unemployment and inflation. This helps policymakers understand the trade-offs between these two key variables.

Central banks widely use the curve to guide monetary policy, as adjustments to interest rates or the money supply can affect both unemployment and inflation in the short run.

Governments also use the Phillips Curve to predict the effects of fiscal measures, such as changes in taxes or public spending, on employment and price levels.

Economists use the curve for economic forecasting and planning, anticipating inflation and unemployment trends under various scenarios to support short-term stabilization policies.

However, the Phillips Curve highlights an important limitation: the short-term trade-off between unemployment and inflation is temporary, and in the long run, unemployment tends toward its natural rate (NAIRU) regardless of inflation levels. Furthermore, inflation expectations can alter the short-term curve, underscoring the dynamic nature of the relationship.

In general, the Phillips Curve serves as a practical framework for analyzing, predicting, and managing the interaction between unemployment and inflation, while acknowledging the inherent compromises and limitations faced by policymakers.

2- Okun's Law

2-1- Definition and Concept

Okun's Law, proposed by Arthur Okun (1962), Okun's Law is an empirical relationship in macroeconomics that links changes in unemployment to changes in real GDP. This law states that when unemployment falls below its natural rate, the economy grows faster than its potential, and when unemployment rises, economic output grows slowly or contracts. Essentially, the law defines the trade-off between unemployment and economic growth, providing a general rule for the amount of GDP growth needed to reduce unemployment **(Kenton, 2025)**.

Chapter 07: The Phillips Curve and The Okun's Law

Okun's Law is widely used by economists and policymakers to estimate the impact of unemployment on economic growth, forecast GDP, and design stabilization policies. It is considered a practical tool, although it is empirical and may vary between countries and over time.

The general equation for the **Okun's Law** is **(OpenStax, 2025):**

$$(\boldsymbol{u} - \boldsymbol{u}*) = -\boldsymbol{\beta}(\boldsymbol{Y} - \boldsymbol{Y}*) \quad where:$$

$\boldsymbol{u}$: actual unemployment rate

$\boldsymbol{u}*$: natural rate of unemployment

$\boldsymbol{\beta}$: Okun coefficient, representing how sensitive GDP is to changes in unemployment

$\boldsymbol{Y}$: actual real GDP

$\boldsymbol{Y}*$: potential GDP

Explanation

- A positive output gap occurs when unemployment is below its natural rate often leading to inflationary pressures.
- A negative output gap occurs when unemployment is above the natural rate reflecting underutilized resources in the economy.

This model is based on the assumption of a relationship between output and employment, expressed as:

$$\frac{\Delta Y}{Y} = -KU$$

Where:

Y: level of production

U: unemployment rate

This formulation of **Okun's Law** can be represented as a production function, from which an **employment function** can be derived:

$$U = -\frac{1}{K} * \frac{\Delta Y}{Y}$$

Okun demonstrated the existence of a positive correlation between economic growth and employment, and a negative correlation between growth and unemployment. However, in general, the increase in national output is larger than the corresponding decrease in unemployment. The coefficient *k*

k was empirically determined by Okun to be approximately 3. This means that a 1-percentage-point reduction in the unemployment rate corresponds roughly to a 3% increase in real GDP, with typical unemployment levels ranging between 3% and 7.5%.

The law is widely used in macroeconomic analysis and policy-making. It allows economists to estimate how changes in unemployment affect GDP and vice versa, helping to assess the performance of the economy. Okun's Law is particularly useful for forecasting economic growth, planning fiscal and monetary policies, and understanding short-term fluctuations in the business cycle. While it is empirical and may vary across countries and over time, it remains a practical tool for illustrating the link between labor market conditions and overall economic output.

2-2- The Economic Interpretation of Okun's Law

The economic interpretation of Okun's Law is based on the quantitative relationship between changes in real GDP and changes in the unemployment rate. Empirical studies originally conducted by Okun showed that **a 1% decrease in the unemployment rate requires a 2% to 3% increase in real GDP**. This occurs because part of GDP growth is not directly linked to employment, as an economy can expand output through **higher productivity**, **longer working hours**, or **more efficient use of capital**, without necessarily adding new workers. Therefore, reducing unemployment requires economic growth that exceeds the normal rate associated with productivity gains, making the relationship between growth and unemployment asymmetric. Evidence from many advanced economies also indicates that the effect of growth on unemployment is most notable when the unemployment rate lies within the range of **3% to 7.5%**, which is the interval identified by Okun in U.S. data. Thus, Okun's Law serves as an important tool for understanding how the labor market responds to economic fluctuations and for evaluating the effectiveness of policies aimed at achieving growth accompanied by improved employment levels **(Blanchard, 2017)**.

2-3- Types of Okun's Law

Okun's Law exists in several forms that describe the relationship between unemployment and output. The **gap version** links the output gap to the unemployment gap, comparing actual and potential levels to analyze business cycles. The **difference version** relates changes in unemployment to percentage changes in real GDP, showing that a 1-point drop in unemployment generally requires about 2–3% GDP growth. A third form, the **productivity or hours version**, incorporates changes in productivity and working hours to explain situations where output rises without a proportional improvement in employment. These variations allow economists to choose the most suitable formulation depending on data availability and the economic context **(Kenton, 2025).**

3- Comparison between Phillips curves and Okun's law

Based on the above, we have prepared the following table to compare the Phillips curve and Okun's law.

Table (07): Comparison between Phillips curves and Okun's law

Aspect	Phillips Curve	Okun's Law
Main Relationship	It indicates a short-term trade-off where lower unemployment is associated with higher inflation, highlighting the tension between price stability and employment. (inverse relationship in the short run)	It shows that higher economic growth is necessary to reduce unemployment, while emphasizing the role of GDP growth in job creation. (inverse relationship in the medium- to long-run)
Economic Insight	Lower unemployment may cause higher inflation	Higher GDP growth reduces unemployment
Policy Use	Helps central banks to balance between inflation and employment	The government uses Okun's law to estimate the GDP needed to reduce unemployment

Source: made by the author.

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