Democratic and popular Republic of Algeria

Ministry of Higher Education and Scientific Research

University of Setif 1 -FERHAT ABBAS-

Faculty of Economic, Commercial and Management Sciences

Macroeconomics I

Prepared for 2nd year students commoncore in Finance and Accounting

Dr. DOUDOU Nabila

Academic Year: 2025–2026

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Introduction

Introduction:

Through this publication aimed at students of the second year of finance and accounting, which was prepared in English, we aim to help students understand the theoretical aspects of macroeconomic phenomena, as well as the economic models of these phenomena, in addition to enabling students to have a good knowledge of macroeconomic analysis of mathematical models by including examples to simplify understanding, as well as a series of converted exercises at the end of each axis of the publication.

1. **Course Description:**

Macroeconomics I is a semester-long course that covers a set of key topics representing fundamental concepts in macroeconomic theory. The course first introduces economic theory through its two main branches — microeconomics and macroeconomics — and examines the construction of economic models as essential tools for explaining economic phenomena. It also addresses some core macroeconomic concepts and aggregates such as national income accounting and the main methods used to measure national output. In addition, the course explores the major theories explaining macroeconomic equilibrium, with particular emphasis on the Classical and Keynesian schools of thought.

2. **General Objectives of the Course:**

1. To develop an understanding of macroeconomic analysis and its key distinctions from microeconomic analysis.
2. To build and interpret macroeconomic models.
3. To become familiar with various methods for measuring national income and output.
4. To introduce the Classical and Keynesian theories, their main assumptions, and their respective explanations of macroeconomic equilibrium.

5. **Learning Outcomes:**

    1. Distinguish between macroeconomic and microeconomic analysis.

2. Analyze and interpret macroeconomic phenomena and represent them using economic models.
3. Identify and compute major macroeconomic aggregates such as Gross Domestic Product (GDP) and Gross National Product (GNP), among other key indicators that are essential for assessing a country's economic performance.
4. Understand the Classical and Keynesian schools and their contributions to the explanation of macroeconomic equilibrium.

4. Prerequisites:

1. Basic understanding of microeconomic theory to ensure a smooth transition from the micro to the macro level of analysis.
2. Fundamental mathematical skills, including linear functions, graphical representation of functions, and arithmetic sequences.
3. Basic knowledge of financial mathematics and project evaluation indicators.
4. General accounting principles, such as depreciation, profit calculation, and net income.
5. Preliminary theoretical understanding of economic schools of thought, particularly the Classical and Keynesian theories.

5- Course Outline by Topics:

- **Introduction of macroeconomic:**

- Circular flow of income model
- Building models
- Dynamic and static analysis
- Internal and external variables

- **Concepts and aggregates of the global economy:**

- Calculation of national product and income

- Calculation of gross domestic product and gross national product
- Calculation of national Net income
- Calculation of: national income/personal income/ disposable income.

- **global equilibrium according to the classical theory:**

- Assumptions of the classical school
- General equilibrium in classical theory

- **global equilibrium according to the Keynesian analysis:**

- Determination of national income in the presence of two sectors
- Effective demand and full utilization/ Consumption / saving
- Income level changes and the multiplier theory
- The occurrence of inflationary gap and deflationary gap

Chapter one :

Introduction to the macroeconomics

Preface :

Economics is the science that studies the economic problem that is represented in relative scarcity in the sense of how to meet increasing needs using limited resources, has come economic theory to explain economic phenomena and try to find the laws that govern these phenomena, and economic theory is divided into two parts, macroeconomic theory and microeconomic economic theory.

First: Macroeconomic Theory and microeconomic theory

- **Macroeconomic Theory:**

Macroeconomics is the branch of economics that studies the economic behavior of all the agents; it means study the economy as whole or study of aggregate outcomes of the decisions taken by the deferent agents in an economy. (H.C.Pokhriyal)

Macroeconomic Theory is concerned with addressing phenomena at the macro level (inflation, deflation, unemployment, economic crises, economic growth) and trying to find an explanation for these phenomena using macro variables such as (national income, total investment, amount of money...) In order to build a causal relationship between the variable and the phenomenon.

- **microeconomic theory:**

It is concerned with the study of phenomena at the micro level (production, competition, monopoly ...) Partial variables are used to explain these phenomena (a consumer's income, costs, profit, etc.).

- **Macroeconomic analysis before and after 1929:**

- **before 1929:**

The interest of economic thinkers in the classical school was the study of economic variables, where the law of ports "Say’s Law" is a conclusive evidence of this, which is based on the principle of supply creates its own demand, and thus achieve the

macroeconomic balance, while the neoclassics focused their analysis on small economic units, such as the study of consumer behavior as well as the behavior of the producer. the market equilibrium of a single product or
service, where they believe that when equilibrium is achieved in these small units of the economy it means that the total balance will be achieved directly

- **after 1929:**

  The Great Depression of 1929 , which lasted until 1933, showed that achieving balance at the micro level would not necessarily lead to a balance at the macro level, and the unemployment rate rose accordingly, proving the failure of classical thinking to solve this crisis. on the other hand, Keynesian thought emerged, which rejected the idea of price mechanism and market spontaneity and called for the need for state intervention in economic activity in order to influence the effective demand (demand + capacity to buy), which Keynes considered to be the determinant of national production, and identified the components of this demand (consumer demand + investment demand). these are important elements for determining macroeconomic balance.

  - **The role of Macroeconomic policy:**

  Governement has policies it can use to achieving the economic objectives, ther are two types of policies (Irvine, 2017) :

- **Fiscal policy :** Governement can use its fiscal policy to change the demand and eliminte an output gaps, the governement expenditures and tax policy that establish the governement's budjet and its effect on aggregate demand.
- **Monetary policy :** actions by the monetary authorities (central bank) designed to change aggregate denand and eliminate output gaps by changing interest rates, money supply, and availability of credit.

Both fiscal and monetary work to change aggregate demand and eliminate output gaps, which reduce the sandar of living the national economy provides for its citizens.

Through the application of macroeconomic policy, the State seeks to achieve Economic growth, Full employment (elimination of unemployment), Price stability, Achieving balance in the balance of payments, Equitable distribution of income.

- **The four macroeconomic sectors:**

- **The household sector:**

Is the consumers who consume the goods and services produced by firms and in return make payments for the same.

- **The firms sector :**

The function of this sector is to produce goods and services for sale in the market.

- **The government sector :**

The function of thid sector is to regulate the the functioning of the economy, the government earns revenue from tax and non-tax sources and incrus expenditure for provide essential public services to the people.

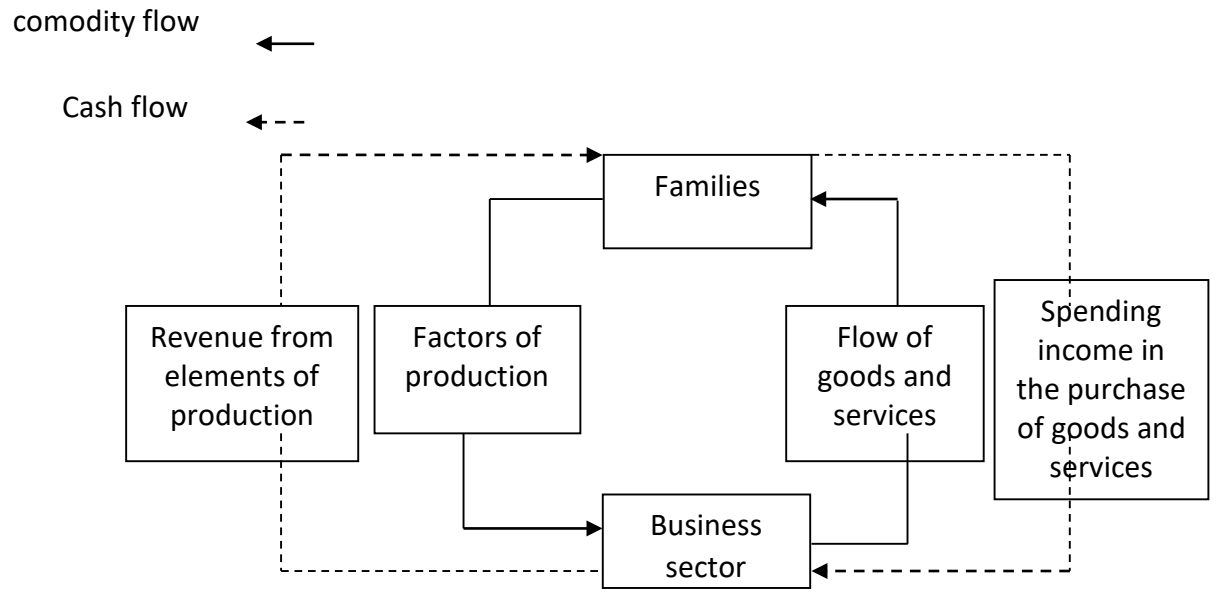
- **The foreign sector :**

This sector includes transactions withe the rest of the world, Exports include goods and services produced domestically and sold to the rest of the world, and imports include goods and services produced abroad and sold domestically.

- **The model used in macroeconomic theory:**

The model used in macroeconomics is called the circular flow of production and income model, which is simplified to illustrate the shape and direction of economic relations in the national economy, where these relations are in the form of interactions between sectors of the national economy, these interactions take the form of in-
kind (commodity) flows and cash flows. this model can be illustrated in a simple two-sector economic system (one that is devoid of government and foreign trade), through the following graph:

The circular flow of income in a two-sector model



In practice, the household sector does not spend all its income, it save a part of it, this saving w would imply monetary withdrawal from the circular flow of income, consequently the firms would decrease their production wich would lead to a fall in the income of household and so on (H.C.Pokhriyal).

The equilibrium condition for two sector model with saving and investment is follows:

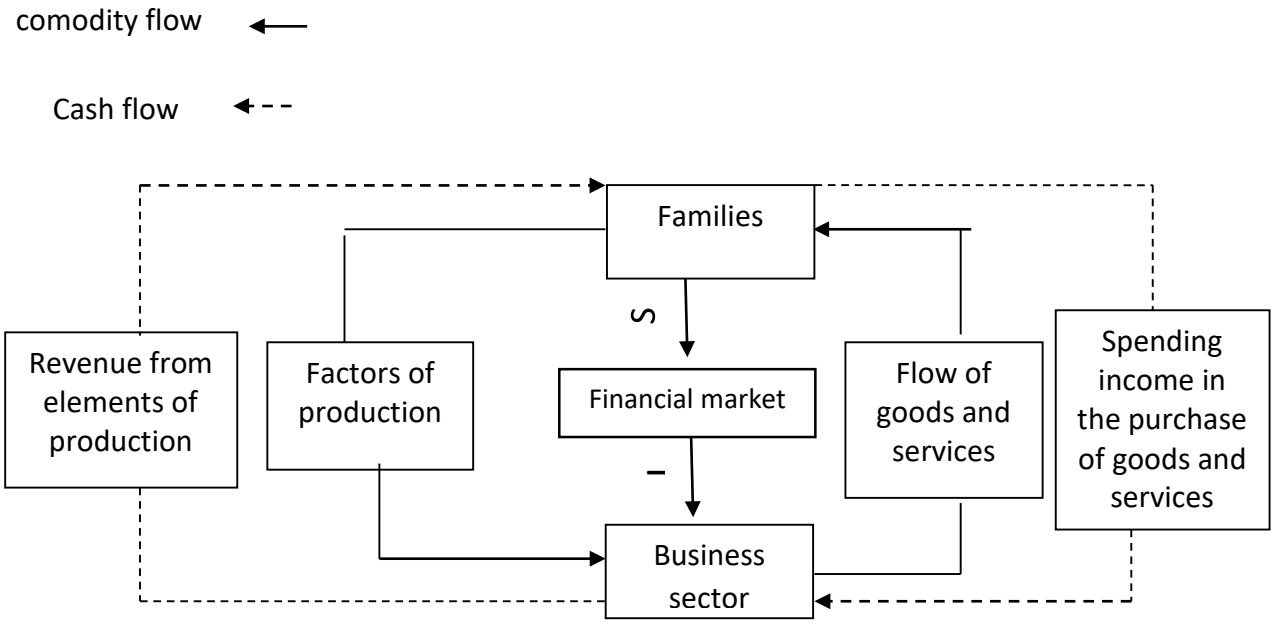
$Y=C+S$

$Y=C+I$

So $C+S=C+I \Longrightarrow S= I$

this model can be illustrated in a simple two-sector with saving and investment, through the following graph:

The circular flow of income in a two-sector model Withe saving and investment



Second: Basic concepts in macroeconomic analysis

1- The economic model:

- **Definition of the economic model:**

It is the process of converting economic behavior into mathematical equations and this is in order to simplify economic phenomena and the variables contained in these phenomena, expressed the economic model in several ways: Verbal analysis, quantitative tables, mathematical equations, graphic forms.

- **Internal and external variables:**

  - **Internal variables**

They are variables in witch their value must be define in the model and are divided into:

- **Dependent variables:**

we take the consumption function, which is a linear equation of the form($C=C_o+by$). The variable (C) represents total consumption and is a dependent variable, that is, its value depends on other variables.

- **Independent variables:**

They are the variables whose affects the dependent variables and they explain their behavior, for example (y) the total income, which is the independent variable.

- **External variables:**

Their value is determined outside the causal relationship, that is, outside the model, so they are called parameters, such as (Co) represents the minimum consumption imposed in the case of no income.

- **Behavioral transactions:**

These are parameters, which measure the response degree of the variable dependent on the independent variable, such as the (b) in the consumption function: C=Co+by

Behavioral factors: the degree of consumption to the changes in the income, mathematically is the tendency of the consumption function:

$0<b<1 \qquad C` = \Delta C/\Delta y = b$

3. Equations (relationships between variables)

There are three types of equations:

- **Definition Relationship:** They are equations that define a variable using other variables. For example, income (Y) is defined as the sum of consumption (C) and savings(S),Y =C +S, Or D=C+I
- **Equilibrium Relationship:** This relationship contains unknowns & causal relationship between variables, and often provides the condition to make the model in equilibrium, such as the total equilibrium equation : D=Y Or S=I

- **Behavioral Relationship:** It describes the behavior of the dependent variable as a result of the change in the independent variable, and it contains a behavioral factor such as the consumption function ($C=C_o+by$) and saving ($S= - C_o+ (1- b)y$), that is, consumption and saving behavior are greatly affected by income.

Third : Exercises on the Introduction to the macroeconomics

Exercise 1:

1. Indicate which of the following terms is macro economical and which is micro economical: Monopoly, Economic Crisis, Deflation, Unemployment, Inflation, Cost, Service, National Income, Commodity, Economic policy, Depression, Consumer, Economic Growth, Price, Investment
2. What is the model used in macroeconomics? Illustrate it in an economy consisting of two sectors?

Exercise 2:

1. What are the main differences between macroeconomic analysis and microeconomic analysis? (Give two examples for each type of analysis.)
2. What do we mean by the economic policy, and what are its main objectives?
3. Which of the following topics falls under macroeconomics and which under microeconomics:
    - The impact of oil prices on the balance of payments in Algeria
    - Price-setting decisions of a particular company
    - The inflation rate in Algeria for the year 2020
    - Household consumption behavior and saving behavior
    - Growth in the computer manufacturing industry
    - The economic growth rate in Algeria for the year 2019
4. Define the major sectors in the economy.

Exercise 3:

We assume that the required quantity of the commodity **A** linked to its price **PA** and to the consumers' income **Y; with** the stability of other factors, in the other side the produced (offered) quantity of the same commodity is also connected to its price **PA** and the price of another commodity (**PB**) which is used as an intermediate commodity.

1. Write the economic model for commodity A.
2. Illustrate internal and external variables in this model.
3. Mention an example of how external variables affect internal variables in this

Exercise 4:

If you have the following data about the economy of a certain country:

C=80+0.7yd I=0.2y S=-80 +0.3yd (y=yd)

1. Define the economic model provided.
2. Identify the internal and the external variables in this model.
3. Is this model complete, and correct? Justify your answer.
4. Explain how (external) exogenous variables affect (internal) endogenous variables in this model.

Solutions of Exercises

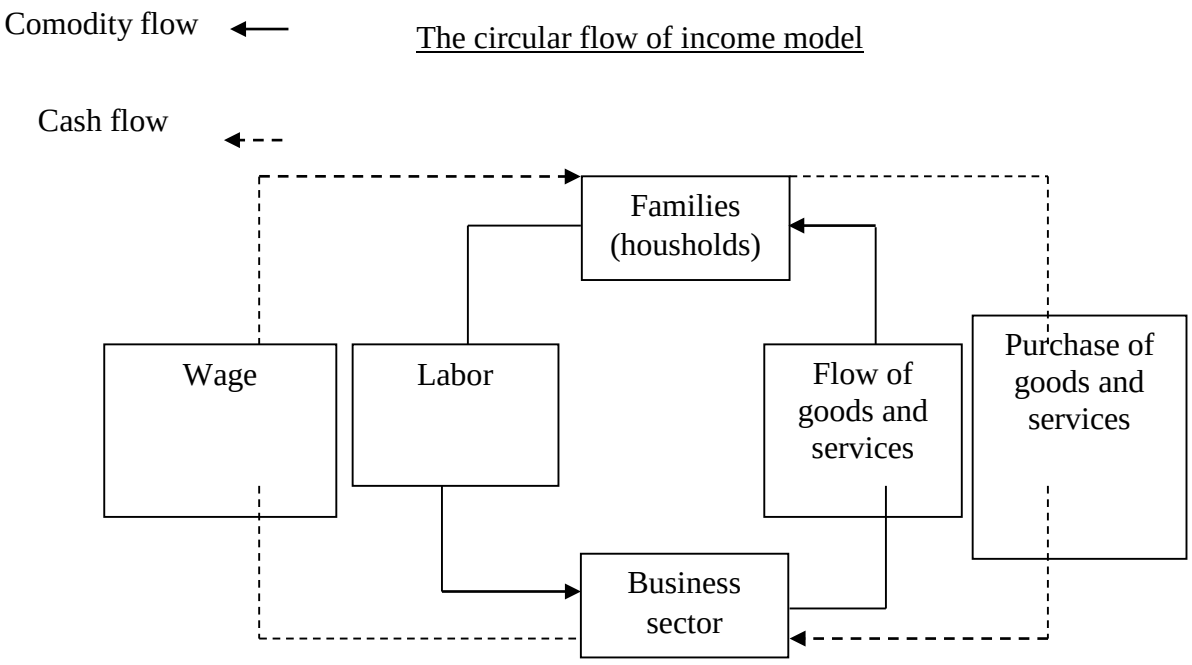
Exercise 1:

Macroeconomics terms	Microeconomics terms
Economic Crisis, Deflation, Unemployment, Inflation, National Income, Economic policy, Depression, Economic Growth, Investment	Monopoly, Cost, Service, Commodity, Consumer, Price

- The model used by Macroeconomics is **The circular flow model** which is an economic model that presents how money, goods, and services move between sectors in an economic system. The flows of money between the sectors are also tracked to measure a country's national income or GDP, so the model is also known as the circular flow of income.

The circular flow of income for a nation is said to be balanced when leakage equal injections.

- The level of injections is the sum of government spending (G), exports (X), and investments (I).
- The level of leakage or withdrawals is the sum of taxation (Tx), imports (Z), and savings (S).



Exercise 2:

1. What are the main differences between macroeconomic analysis and microeconomic analysis?

- Macroeconomic analysis focuses on the study of the economy as a whole by analyzing major variables such as inflation, unemployment, economic growth, and the role of government policies in addressing broad economic issues.
- Microeconomic analysis examines the behavior of individuals and firms under resource constraints, analyzing supply and demand mechanisms and how prices are determined in individual markets.

2. What do we mean by economic policy, and what are its main objectives?

- Economic policy is the set of rules, procedures and measures undertaken by the government, these rules aim to achieve specific economic goals using tools such as taxation, government spending, interest rates, and regulations.
- Types of Economic Policies:
  - Fiscal policy (government spending and taxation)
  - Monetary policy (control of money supply and interest rates)
  - Exchange rate policy
  - Trade policy
  - Income policy (e.g., wage controls)
- Main Objectives of Economic Policy:
  - Economic growth – Sustaining a high and stable rate of growth in GDP.
  - Full employment – Reducing unemployment to a minimum.
  - Price stability – Controlling inflation and deflation.
  - Balance of payments equilibrium – Ensuring stability in foreign trade and capital flows.
  - Equitable distribution of income – Reducing income and wealth inequalities.

Sustainable development – Balancing economic growth with environmental protection.

Macroeconomics terms	Microeconomics terms
- The impact of oil prices on the balance of payments in Algeria - The inflation rate in Algeria for the year 2020 - The economic growth rate in Algeria for the year 2019	- Price-setting decisions of a particular company - Household consumption behavior and saving behavior - Growth in the computer manufacturing industry

4- The economic sectors can be summarized into five sectors as follows:

- Households: They provide factors of production such as labour and capital, receive income in return (like wages), and use this income for consumption or saving.
- Firms: They produce goods and services using the factors of production, sell them to households or other sectors, and pay income to households for their contributions.
- Government: It collects taxes from households and firms, spends on public services like education and healthcare, and provides financial support and transfers.
- Foreign Sector: It handles international trade by exporting goods (bringing income into the country) and importing goods (causing income to flow out).
- Financial Sector: It acts as an intermediary between savers and investors, collecting savings and transferring them into investments through banks and financial institutions.

Exercise 3:

1. **Writing the economic model of the A commodity market**

- Required quantity of commodity **A**: $\mathbf{Q_D = f\ (P_A,\ Y)}$

Where:

- **PA** Price of Commodity **A**
- **Y** Consumer Income
- Quantity offered of commodity **A**: $\mathbf{Q_S=f\ (P_A, P_B)}$

Where:

- **PB**: Price of Intermediate Commodity **B**

The Equilibrium condition is equal to the quantity required with the quantity offered.

So the economic model is:

$\mathbf{Q_D=f\ (P_A\ ,\ y)}$

$\mathbf{Q_S=f(\ P_A\ ,\ P_B)}$

$\mathbf{Q_D= Q_S}$ **The** *Equilibrium Condition*

2. Identification of internal and external variables

- Internal variables are: $\mathbf{Q_D}$; $\mathbf{Q_S}$; **PA**

- External variables are : **PB ; y**

3. The impact of the external variable on the internal variable

For example, when the external variable **Y** changes, it affects the internal variable $\mathbf{Q_D}$ (the quantity required of **A** commodity) where:

- When consumer income **Y** rises: This leads to higher consumption and the $\mathbf{(Q_D)}$ demand for the commodity **A** will rise which also leads to a higher price of this commodity **PA.**

- When consumer income **Y** falls: This leads to lower consumption and the **(Q_D)** demand for the commodity **A** will decrease, which also leads to a lower price of this commodity **PA.**

Exercise 4:

1- The economic model: This is a simple macroeconomic model that describe relationships between major economic variables:

- Consumption (C) depends on disposable income (Yd).
- Investment (I) depends on total income (Y).
- Saving (S) also depends on disposable income.
- Additionally, it is given that Y = Yd, meaning total income equals disposable income (no taxes or transfers).
- These equations define how consumption, saving, and investment related with income.

2- Identify the internal and external variables in this model

Internal (Endogenous) Variables	External (Exogenous) Variables / Parameters
- Y, Yd (total/disposable income) - C (consumption) - S (saving) - I (investment) - *i* interest rate	- $-C_0 = 80 \rightarrow$ independent consumption (the constant in the consumption function) - $b = 0.7 \rightarrow$ marginal propensity to consume (sensitivity of consumption to income) - $(1-b) = 0.3 \rightarrow$ marginal propensity to saving - $m = 0.2 \rightarrow$ investment sensitivity to income

3- Model Solution

The model is incomplete because the number of unknowns (y. I. S, C) it's not equal to the number of equations.

C=80+0.7yd I=0.2y S=-80 +0.3yd

To solve the model the Equilibrium condition must be added as: S = I so we have:

$$\Rightarrow \begin{cases} S = -80 + 0.3yd \\ I = 0{,}2y \\ S = I \end{cases}$$

$$-80 + 0.3\ y = 0{,}2\ y$$

$$-80 = -0{,}1\ y \Rightarrow y = 800\ U$$

4- The external variables affect the internal variables in the following ways:

- Independent consumption (80):

  An increase in this value raises consumption at all income levels, which can lead to higher income.
- Marginal propensity to consume (0.7):

  Determines how much consumption changes when income changes. A higher value means consumption responds more strongly to income, affecting the levels of saving and total income.
- Investment sensitivity (0.2):

  If this value increases, investment becomes more responsive to income changes, which may influence overall economic activity.
- Marginal propensity to save(0.3):

  Complements the Marginal propensity to consume. A change in this parameter affects how much income is saved versus consumed, influencing both saving behavior and total spending.

Chapter two :

Concepts and aggregates of the global economy

Preface :

The economic activity of a country depends on economic resources (factors of production) and their transformation into goods and services to satisfy endless needs, which is called production. The value of this production is called national income (product).

First: Gross Domestic Product (GDP):

The measure of aggregate output is called the gross domestic product **(GDP)** (Olivier Blanchard), so GDP It is the market value of final goods and services produced by a country during a given period, usually a year, and it is the total market value of all final goods and services produced inside the country whether by national factors of production (citizens) or foreign factors of production (foreigners).

Example: if a car that is for 20000$ includes tiers that cost 1000$, than the value counted in the GDP is 20000$ not 20000$+1000$

$$\mathbf{GDP= \sum(Q\times P)}$$

Q: Quantity produced P: Prices

Once we count the production of cars, we do not want to count the production of goods that went into the production of these cars (intermediate good).

Intermediate Goods: produced by one firm to be used in the production by another firm, Intermediate Goods Are exclude from the GDP to avoid the double counting.

Real GDP and Nominal GDP

Since GDP is measured by the market prices of goods and services, GDP increase and when the outputs increase. In order to exclude the impact of inflation, economists separate real GDP from nominal GDP.

- **Nominal GDP**

Nominal GDP is the value of goods and services measured at current price, so it can increase either because prices rise or because quantities rise (Mankiw, 2010)

$$\textbf{Nominal GDP} = \sum(Qn \times Pn)$$

- **Real GDP**

Real GDP is the value of goods and services measured a constant set of prices, that is real GDP shows what would have happened to expenditure on output if quantities had changed but prices had not (Mankiw, 2010)

$$\textbf{Real GDP} = \sum(Qn \times Po)$$

A better measure of economic well-being would tally the economy's outputs of goods and services without being influenced by changes in price for this purpose, economists use real GDP.

The real GDP is a good measure for the performance of the economy than nominal GDP because it reflects only the change in quantity (removes the effect of inflation)

1.1. Growth rate of nominal and real GDP

The growth rate of GDP or percentage changes in GDP is expressed as the percentage change in its value between two periods. A distinction can be made between the growth rate of nominal GDP and the growth rate of real GDP, where:

* Nominal GDP Growth rate is calculated as follows:

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

*Real GDP growth rate is calculated as follows:

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

1.2. Measuring the change in GDP prices using 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:

GDP Price Deflator = (Nominal GDP ÷ Real GDP) × 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:

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

Example: Assume that a fictitious economy produces only two goods.

Nominal and real GDP are calculated. For the year 2020 as follows:(Base year is 2017).

Item 2		**Item 1**		
the price	Quantity	the price	Quantity	
1.5	8	1.5	4	**Base year 2017**
2	24	3	8	**Current year 2020**

$NGDP_{2020} = \sum(P_{2020} * Q_{2020}) = (3 \times 8) + (2 \times 24) = 72$

$RGDP_{2020} = \sum(P_{2017} * Q_{2020}) = (1.5 \times 8) + (1.5 \times 24) = 48$

$$\mathbf{NGDP}_{2020} = \mathbf{72}$$

$$\mathbf{RGDP}_{2020} = \mathbf{48}$$

$$\text{GDP price deflator} = \frac{\mathbf{NGDP}}{\mathbf{RGDP}} \times 100 = 150\%$$

We notice that there is an increase in prices during the year 2020 compared to 2017, it is estimated at 50%

150%-100%= 50 % (inflation rate).

Note:

GDP price deflator=100% (The prices have not changed.)

GDP price deflator>100% (The Prices increased by the difference of 100%)

GDP price deflator<100% (The Prices decreased by the difference of100%)

2- Gross National Product (GNP)

It expresses the total value of final goods and services produced during the year using national factors of production, whether they are resident inside or outside the country, and is calculated based on the gross domestic product:

GNP = GDP + Net Factor Income (returns from factors of production) from abroad

GNP = GDP + NFI

Net Factor Income = Returns of domestic factors of production abroad – Returns of foreign residents' factors of production

3- Net National Product (NNP)

Net national product is the gross national product minus depreciation (Dep) where depreciation is the decrease in the value of capital assets (capital productive goods) due to

their continued use or statute of limitations (useful life), and it is deleted because the depreciation of capital goods does not mean the production of new final goods or a real addition to the capital stock during the year.

$$NNP = GNP - Dep$$

Depreciation:

It is the decrease in the value of capital assets (productive capital goods) due to continued use or statute of limitations (useful life); where is calculated as:

$$\text{Annuel depreciation premium} = \text{asset value} \div \text{useful life}$$

Depreciation in accounting is recorded as fictitious expenses rather than cash expenses, as the higher the value of the depreciation as expenses, the higher the company's revenue (self-financing of the company).

1- National Income

It is the net national product evaluated by the cost of production factors. So, the National income is the net national product at the cost of production factors, and is calculated by subtracting direct taxes and adding production subsidies to the value of the net national product assessed at market prices.

National income (NI) = NNP at Factor Cost (NNP_f)

=NNP At market price - Indirect Taxes + Subsidies

= NNP At market price -Net indirect taxes

Where: Net indirect taxes = Indirect taxes - production subsidies

$$NI = NNP_f = NNP - Txi + Subs$$

Direct taxes are considered as market values that do not represent income for production factors, so they are excluded. At the same time, production subsidies provided by the government represent support for the cost of production, so they must be added when calculating the net national product at cost factors.

2- Personal Income (PI)

It is the income received, which is the national income after deducting the returns that the productive element did not receive.

Personal income (PI)= National Income – Legal deductions+ Transfers to individuals from the government or from abroad

Legal deductions: insurance, retained earnings, corporate profit tax**.**

3- Disposable income (Y_d)

It is the income that can be disposed of by spending it on consumption and saving.

Disposable income (Yd) = personal income – direct taxes on individual income + transfers of individuals abroad

Second : Methods of calculation GDP

The calculation of the national product carried out by the national accountant is either by the production, spending or income method, and all methods lead us to the same value of the national product.

1. Estimating GDP using the production method

This method involves determining the value of the GDP based on one of the following two methods:

1.1. Value added method

value Added mean the difference between the value of production at each stage of the goods production, and the value of the intermediate goods that enter into the composition of this good.

So the GDP is the sum of all values added in the production of goods and services:

$$\mathbf{GDP} = \sum_{\mathbf{i=1}}^{\mathbf{n}} \mathbf{VA} = \mathbf{VA1} + \mathbf{VA2} + \cdots + \mathbf{VAn}$$

1.2. Method of final products

The second is to collect the values of all final goods and services sold to consumers, to the government and to the other world, i.e. the sum of the monetary values of the final domestic product of goods and services in a period of time.

GDP = Units Quantity * Unit selling price

$$\boldsymbol{GDP} = \sum \boldsymbol{P_i} \times \boldsymbol{Q_i}$$

Note:

- If the accountant adds the intermediate goods to the final goods, he will make a repetition error because the intermediate goods are used in the production of the final goods, and thus the intermediate goods are recorded twice.
- The final goods and services that are included in the calculation of the GDP are those that are priced in accordance with market rates. Therefore, the GDP according to the production method is considered **to be valued at market price**.

2. The income method

The local income according to this method is the sum of the incomes, there for the GDP is calculated as below:

$$\mathbf{GDP = Y + Dep + Tx_i - Subs}$$

$$Y = Y_W + Y_I + Y_R + Y_P$$

Y = Total returns of production factors (Wages, benefits, revenue or rent, Gross Profit)

3. The expenditure method

GDP is the total demand for final goods and services produced during a specific period often a year.

$$\mathbf{GDP = C + I + G + (X - Z)}$$

where:

C: Consumption

I: Investment

G: Government spending

(X-M) Net external spending: It represents the difference between **X** exports, **M** imports.

NOTE:

When calculating the GDP according to the expenditure method, we obtain the GDP valued at market prices. ($\mathbf{GDP_M}$), in this case we found goods that are valued more than their real value as a result of the imposition of indirect taxes, and there are goods that are valued at less than their real value as a result of subsidies. So, to evaluate the GDP at the cost of the factors of production, the accountant must deduct indirect taxes and add subsidies.

$$\mathbf{GDP_F = C + I + G + (X - Z) - Txi + Subs}$$

Notes:

1-When we calculate GDP using the income method, we get **the Net Domestic Product at Factor Cost (NDPfc)**. This means the total income earned by the factors of production, excluding depreciation.

- Depreciation is not part of income; it's treated as a cost to replace old equipment or assets.
- To move from NDP at factor cost to GDP at market prices (GDPM), we must: Add depreciation, add indirect taxes, subtract subsidies (which reduce the price of some goods and services).

2- The two methods of production and expenditure produce a gross domestic product (GDP_M) at market price, while the income method provides net domestic product at factor cost (domestic income).

3- It is possible to move from national accounts at market prices to national accounts at cost prices by **subtracting** indirect taxes and **adding** production subsidies, and vice versa.

Third : Exercises on the Concepts and aggregates of the global economy

Exercise 1:

Answer the following questions:

1- What is the purpose of measuring economic activity?
2- Explain the following economic terms: production, output, domestic income, domestic expenditure.
3- What is the difference between final goods and intermediate goods?
4- define GDP and GNP, and what is the difference between them?
5- What is the meaning of GDP Price Deflator?
6- What do we mean by depreciation? And why is it self-financing for the company?

Exercise 2:

Suppose an economy produces two goods (A-B) And two services (C-D), the development of the quantities produced and their prices during two periods shown in the following table (monetary unit):

	-A-		-B -		-C-		-D -	
	P	**Q**	**P**	**Q**	**P**	**Q**	**P**	**Q**
2020	25	1000	15	700	5	2000	4	3000
2021	27	1200	13	600	5.5	2300	4	2900

1- Calculate the nominal and real GDP for the two years (assuming 2020 is the base year)? Which is better for assessing the economy, the nominal or the real? Justify your answer? then calculate the rate of change in the nominal and real GDP between the two years (percentage changes in the nominal and real GDP?

2- Calculate the **GDP Price Deflator** for the year 2021, then conclude the inflation rate for the same year.

Exercise 3:

Assume an economy produces three goods: wheat, iron, and steel. The quantities & the prices of these products during the years 2020 and 2021 are presented in the table below (base year 2020)

Year	Wheat		Iron		Steel	
	(Qty)	(Price)	(Qty)	(Price)	(Qty)	(Price)
2020	500 units	$20 per unit	800 units	$40 per unit	100 units	$20 per unit
2021	550 units	$28 per unit	800 units	$45 per unit	110 units	$25 per unit

1- In your opinion, what is the economic phenomenon that can be inferred from the provided data?

2- Based on this data, calculate the indicator that measures this phenomenon, then explain and justify your answer by calculating the various related indicators.

Exercise 4:

Fill in the table and calculate the inflation rate in 2021 and 2022:

year	Nominal GDP	Real GDP	GDP Deflator
2020	14000	13000	……..
2021	…….	15000	120
2022	22000	…….	130

Exercise 5 : If the Gross Domestic Product (GDP) of an economy composed of four main sectors is 1670$, complete the following table:

Production Sectors	Sales Value	Intermediate Consumption	Value Added
Agriculture Sector	600	0	؟؟؟؟؟
Trade Sector	؟؟؟؟؟	200	550
Industry Sector	500	؟؟؟؟	؟؟؟؟
Services Sector	270	100	؟؟؟؟
Total Value Added	—	—	؟؟؟؟؟؟

Exercise 6:

Assuming that country **X** produced **wheat** worth 6000 mu, which was turned into **flour** worth 8700 mu, and 3000 mu of flour was put into bread making, and 4000 mu was sold to a cake factory, and the rest of flour was sold in the markets.

The bread factory sold its production on the market for 6800 mu, while the cake factory sold its production for 8000 mu.

- Calculate GDP using the production method (using value-added and final production methods)?.

Exercise 7:

Suppose we have the following information about an economy where:

The company A: It produces 1000 tons of **iron** and sells it at a price of 5 DZD/ton.

The company B: It produces 1500 tons of **steel** and sells it at 10 DZD/ton.

First case: The two companies operate independently (there is no interchange);

The second case: The two companies exchange production; the company bought B 700 tons of iron from the company A;

The third case: The company A bought 4000 DZD worth of raw materials, and the company B bought 5500 DZD of raw materials and at the same time bought iron from the company A with 3500 DZD.

- Calculate the GDP of this economy in each of the previous cases?

Exercise 8:

If you have the following data about the economy of a certain country during a specific year:

Item	Value
Gross Domestic Product (GDP)	60,400
Net Factor Income (NFI)	1,000
Capital Depreciation (Consumption of Fixed Capital)	3,800
Indirect Taxes	4,000
Production Subsidies	2,000
Social Insurance Contributions	3,600
Retained Earnings	5,000
Transfers to Individuals (from Government or Abroad)	4,100
Savings (30% of Disposable Income)	30% of disposable income
Direct Taxes on Personal Income (20% of Personal Income)	20% of personal income

- calculate the following economic indicators: Gross National Product (GNP), Net National Product (NNP), National Income (NI), Personal Income (PI), Disposable Income (Yd), and Savings (S).

Solution of Exercises

Exercise 1:

1- Main Objectives of Measuring Economic Activity:

- **Assess societal welfare and economic growth**: By analyzing indicators like national income and expenditure over time.
- **Support economic planning and policy-making**: Helps governments and institutions develop informed economic policies.
- **Build and improve forecasting models**: Provides data for predicting future trends such as consumption and investment.
- **Compare economic performance between countries** :Enables benchmarking and evaluation of national economies.
- **Guide investment and business decisions**: Offers key insights for both public and private sector decision-making

2- Explain the following economic terms: production, output, domestic income, domestic expenditure.

- **Production:** is the process of creating goods and services that satisfy needs.. The production process involves combining several factors of production, such as: Natural resources، Labor, Means of production ،Capital

- **Output:** It represents the market value of all goods and services produced by a society during a specific period of time, usually one year.

- **Domestic income:** is the total revenue earned by a society as a result of economic activity during a specific period, usually one year.

- **Domestic expenditure:** refers to the total monetary value spent to meet the needs of various sectors within the national economy.

3- **Final goods** are goods that are intended for final use, whether for consumption or investment**; in the other side Intermediate goods** are goods produced by one firm to be used in the production process by another firm. **Intermediate goods are excluded from GDP to avoid double counting.**

4- **Gross Domestic Product GDP**

It is the market value of final goods and services produced by a country during a specific period, usually a year, it reflects also to the economic and service activity achieved by economic agents residing in the country regardless their nationalities (Regardless the nationality of the production factors, whether national or foreign, the most important thing is that the production is within the country's borders.).

$$\mathbf{GDP= \sum(Q\times P)}$$

- **Gross National Product (GNP)**

It expresses the total value of final goods and services produced during the year using national factors of production, whether they are resident inside or outside the country, and is calculated based on the gross domestic product:

GNP = GDP + Net Factor Income (returns from factors of production) from abroad

- **The difference between GDP and GNP** is in the factors of production used. GDP does not consider the nationality of the factors of production, but requires the country's geographical boundaries, while GNP must be calculated only with national factors of production regardless of geographical boundaries.

1. 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:

GDP Price Deflator = (Nominal GDP ÷ Real GDP) × 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

2. Depreciation:

It is the decrease in the value of capital assets (productive capital goods) due to continued use or statute of limitations (useful life); where is calculated as:

Annuel depreciation premium = asset value ÷ useful life

Depreciation in accounting is recorded as fictitious expenses rather than cash expenses, as the higher the value of the depreciation as expenses, the higher the company's revenue (self-financing of the company).

Exercise2:

1. Calculating: NGDP, RGDP, rate of change in the NGDP & RGDP

$NGDP_{2020} = \Sigma P_{2020} x Q_{2020}$= (25*1000) +(15*700) +(5*2000) +(3000*4) **=57500**

$NGDP_{2021} = \Sigma P_{2021} x Q_{2021}$= (27*1200) +(13*600) +(5.5*2300) +(4*2900) **=64450**

We note that nominal GDP increased in 2021 by 6950 compared to 2020, as a result of increase in the prices and the quantities.

$RGDP_{2020} = \Sigma P_{2020} x Q_{2020} = NGDP_{2020} = 57500$

$RGDP_{2021} = \Sigma P_{2020} x Q_{2021}$= (25*1200) +(15*600) +(5*2300) +(4*2900) **=62100**

We note that real GDP increased in 2021 by 4600 compared to 2020 due to the increase of quantities only (prices are constant).

Real valuation with constant prices is best because it excludes the effect of price changes (the effect of inflation).

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

$$= \frac{64450-57500}{57500} \text{x}100 = 12.08\%$$

We note that nominal GDP increased in 2021 by 12,08% compared to 2020.

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

$$= \frac{62100-57500}{57500} \text{x} 100 = 8\%$$

We note that real GDP increased in 2021 by 8% compared to 2020, which is lower than the rate of change in nominal GDP, because real GDP (valuation at constant prices) excludes the impact of inflation.

2. **Calculating the GDP Price Deflator & the inflation rate:**

$$\textbf{GDP price deflator} = \frac{\text{NGDP}}{\text{RGDP}} \times 100 = \frac{64450}{62100} * 100 = 103.78\%$$

We obtain the inflation rate by subtracting the deflator for the year from its value in the base year, which is equal to 100.

And from it: Inflation rate= 103.78%-100%= 3.78%

<u>Exercise 3:</u> By examining the price and quantity changes from 2020 to 2021:

- Prices increased for all three goods.
- Quantities increased slightly for wheat and steel, while iron quantity remained constant.

The economy is experiencing inflation (a general rise in prices), along with modest real output growth.

3. **The indicators that measure this phenomenon are: nominal GDP ,** realGDP,GDP Deflator & the inflation rate:

Calculating: NGDP, RGDP, rate of change in the NGDP & RGDP

A. <u>NGDP, RGDP</u>

$NGDP_{2020} = \Sigma P_{2020} x Q_{2020} = (20*500) + (40*800) + (20*100) = 44000$

$NGDP_{2021} = \Sigma P_{2021} x Q_{2021} = (28*550) + (45*800) + (25*110) = 54150$

We note that nominal GDP increased in 2021 by 10150 compared to 2020, as a result of increase in the prices and the quantities.

$RGDP_{2020}=\Sigma P_{2020}xQ_{2020} = NGDP_{2020} =44000$

$RGDP_{2021}=\Sigma P_{2020}xQ_{2021}= (20*550) +(40*800) +(20*110) =45200$

We note that real GDP increased in 2021 by 1200 compared to 2020 due to the increase of quantities only (prices are constant).

Real valuation with constant prices is best because it excludes the effect of price changes (the effect of inflation).

B. Rate of change in the NGDP & RGDP

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

$$= \frac{54150-44000}{44000} \text{x}100 = \mathbf{23.068\%}$$

We note that nominal GDP increased in 2021 by 23.06% compared to 2020.

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

$$=\frac{\mathbf{45200-44000}}{\mathbf{44000}}\mathbf{x100= 2.72\%}$$

We note that real GDP increased in 2021 by **2.72%** compared to 2020, which is lower than the rate of change in nominal GDP, because real GDP (valuation at constant prices) excludes the impact of inflation.

4. Calculating the GDP Deflator & the inflation rate:

$$\text{GDP deflator2020} = \frac{\text{NGDP2020}}{\text{RGDP 2020}} \times 100 = \frac{44000}{44000} *100=100\%$$

$$\text{GDP deflator2021} = \frac{\text{NGDP2021}}{\text{RGDP2021}} \times 100 = \frac{54150}{45200} *100=119.80\%$$

Inflation rate= 119.80%-100%= 19.80%

Note: "In the absence of a base year, the inflation rate can still be calculated using the percentage change in the GDP deflator between two years."

Exercise 4:

year	**Nominal GDP**	**Real GDP**	**GDP Deflator**
2020	**14000**	**13000**	**107,7**
2021	**18000**	**15000**	**120**
2022	**22000**	**16923**	**130**

$$\text{GDP deflator in}2020 = \frac{\text{NGDP}2020}{\text{RGDP }2020} \times 100 = \frac{14000}{13000} * 100 = 107{,}7\%$$

$$\textbf{N}\text{GDP in } 2021 = \frac{\text{RGDP}2021 \times \text{GDP deflator}2021}{100} = \frac{15000 \times 120}{100} = 18000$$

$$\text{RGDP in } 2022 = \frac{\text{NGDP}2022 \times 100}{\text{GDP deflator}2022} = \frac{22000 \times 100}{130} = 16923$$

- The inflation rate in 2021 = $\frac{\text{GDP deflator}2021 - \text{GDP deflator}2020}{\text{GDP deflator}2020} \times 100$

$$= \frac{120 - 107{,}7}{107{,}7} \times 100 = 11{,}42$$

- The inflation rate in 20**22** = $\frac{\text{GDP deflator}2022 - \text{GDP deflator}2021}{\text{GDP deflator}2021} \times 100$

$$= \frac{130 - 120}{120} \times 100 = 8{,}33$$

Exercise 5:

Production Sectors	Sales Value	Intermediate Consumption	Value Added
Agriculture Sector	600	0	600
Trade Sector	750	200	550
Industry Sector	500	150	350
Services Sector	270	100	170
Total Value Added	—	—	1670

We have :

- Value added $_{\text{Agriculture Sector}}$ = 600-0 = 600
- Sales value of the Trade Sector = 550 +200 = 750
- Value added $_{\text{Services Sector}}$ = 270-100 = 170
- Total Value Added = GDP = 1670 which mean:
  - Value added $_{\text{Industry Sector}}$= 1670-(170+550+600) = 350
  - Intermediate Consumption of the industry sector = 500-350=150

Exercise 6:

1.Calculating GDP by value added method:

GDP=∑AV = AV1+ AV2+ AV3+ AV4

AV = Value of total production - Production inputs

AV1= Wheat value – 0 = 6000 – 0 = 6000 mu

AV2= Value of flour - Value of wheat = 8700 - 6000 = 2700 mu

AV3= Value of bread - Value of flour = 6800 - 3000 = 3800 mu

AV4= Value of cake - Value of flour = 8000 - 4000 = 4000 mu

GDP = 6000 + 2700 + 3800 + 4000⇒ GDP =16 500

2. Calculating GDP by final production method:

GDP = Final production value

Final products are products that reach the market in a finished form.

GDP= Final production of sold flour + Final production of bread + Final production of cakes

GDP=6800 + 8000 + 1700

GDP= 16500

Exercise 7:

First case: Final production method

GDP= Final production of A+ Final production of B

GDP= (1000 x 5) + (1500 x 10)⇒GDP= 20000 DZD

The second case: Value added method

GDP= Total value added /Value added = Production of each branch - Intermediate consumption

GDP =∑AV = AV_A + AV_B

⇒GDP = (5000-0) +(15000-700 x 5) =16500

The third case: Value added method

GDP =∑AV = AV_A + AV_B

AV_A = 5000-4000 = 1000

AV_B = 15000 – (5500 + 3500) = 6000

GDP = 1000 + 6000 = 7000 DZD

Exercise 8:

Calculate gross national product (GNP):

GNP = GDP + NFI

GNP= 60400 +1000 = **61400**

- **Calculate the net national product:**

NNP = GNP - Dep

NNP = 61400 -3800 = **57600**

- **Calculate National income :**

National income is the net national product at **the cost of production factors**:

$NI=NNP_f$

$NI=NNP_f$= NNP At market price - Indirect Taxes + Production subsidies

NI=57600-4000+2000=**55600**

- **Calculate personl income :**

Personal income (PI) = National Income – Legal deductions+ Transfers to individuals from the government or from abroad

Legal deductions: insurance, retained earnings, corporate income tax.

PI= 55600-(3600+5000+0) +4100

PI= 51100

- **Calculate Disposable income (Y_d)**

Disposal income (Yd) = personal income – direct taxes on individual income + transfers of individuals abroad

Y_d= PI-(20% x PI) = 51100-(0.2 x 51100) = **10220**

Saving = 30% x 10220 = **3066**

Chapter three: global equilibrium according to the classical theory

Preface :

Classical economics is a broad term that refers to the dominant school of thought for economics in the 18th and 19th centuries.

Most consider Scottish economist Adam Smith the progenitor of classical economic theory. However, Spanish scholastics and French physiocrats made earlier contributions. Other notable contributors to classical economics include David Ricardo, Thomas Malthus….

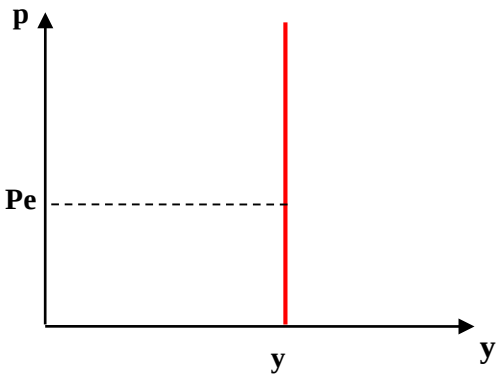
First: Classical school hypotheses

– **Free market mechanism** (**Invisible Hand):** classical economists assume the existence of natural forces that lead to the automatic equilibrium of the economy, which Adam Smith called the "invisible hand";

– **Private interest and public interest:** The classical economists believe that individuals, in their pursuit of achieving their private interests, are achieving the public interests.

– **Full employment:** The classical economists believe that the economy is in equilibrium in full employment; so there is no unemployment except within economically acceptable limits (voluntary unemployment);

- **Supply creates demand (Say's Law):** the production of goods and services creates equal incomes (there is no surplus in production and no shortage in consumption); so According to the classics, the total supply is not affected by the price and it is always constant (because everything that is supplied is demanded according to Say's law); therefore, it is represented graphically by a vertical line.



– **Laissez Faire**: Classical economists believed in the philosophy of 'laissez faire', which is a French term meaning 'leave alone' or 'let you do'. According to this view, there should be minimal intervention from the government in business affairs.

– **Neutrality of money:** money is just a medium of exchange; and it facilitates transactions among economic agents. Thus, increase in money supply does not affect the level of output it only leads to increase in prices

– **Maximizing profit and utility:** The producer seeks to maximize profit, while the worker seeks to maximize utility (utility of wages);

– **Flexibility of production factors:** the existence of a high degree of flexibility in the prices of production factors, and this flexibility plays an important role in achieving economic balance;

– **Perfect competition:** Classical economists assumed that there is perfect competition in the market so that markets function smoothly. As there is full employment (due to flexibility in wage rate), production is always at the full employment level.

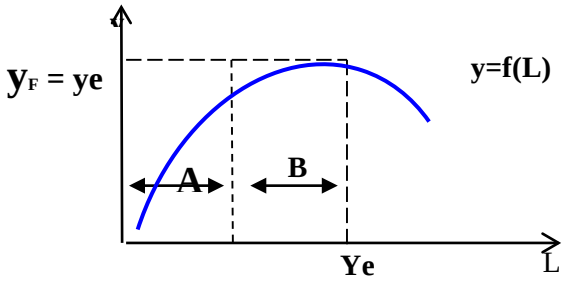
– Total output of the economy is divided between consumption and investment expenditures.

1- Production function according to classical analysis

- **definition**

Production volume **Y** is determined through the amount of labour **L in the short run,** which the classical considers it the main influence on the production volume, while the rest of the factors are constant, so the classical production function is written as follows:

Y = ∫ (L), once the equilibrium quantity of labour **Le** is determined, the equilibrium production volume **Ye** is directly determined, which is illustrated graphically by the production function curve. **Y = ∫(L)** It is divided into two parts: (Samari Ibtissam, 2020/2021)



- **Section A**: the Production increases with the rising of the employment volume at increasing values, it is called the zone of increasing returns.
- **Section B**: the Production increases with the rising of the employment volume at decreasing values, it is called the zone of falling returns.

- **The peak** is achieved at the equilibrium position, which is the state of full employment for the classical economy.

2-2- Marginal productivity

The marginal productivity of labour MPL represents the additional amount of production resulting from adding one unit of labour while keeping other factors the same, where:

$\boldsymbol{MP_L = \frac{dy}{dL}}$ Therefore, the marginal productivity of labour represents the first derivative of the production function in terms of labour.

2-3- Maximize profit

Producers seek to maximize profit when:

marginal revenue (MR)= marginal cost (MC), or **MPL=$\frac{W}{P}$**

Marginal revenue = value of marginal product **(MR =P$\frac{dy}{dN}$)** and

Marginal cost = nominal wage **(MC = W)**

(Marginal product = real wage) $\frac{dy}{dN}=\frac{W}{P}$ Or

(marginal revenue = marginal cost) $W = p\frac{dy}{dN}$ and at this level the producer stops employing,

Profit π It is the difference between marginal revenue and marginal cost and we write:

$$\pi = MR\text{-}MC$$

Classical economic analysis is a dual analysis because it separates real variables (such as: production, quantity of labour, real wage) from nominal variables expressed in terms of monetary values such as: the general price level, inflation rate, money wage. This duality is the basic pillar of classical theory, as it is concerned with studying real variables without resorting to nominal variables.

Second: total equilibrium according to the Classical school

The general equilibrium occurs in the classical system in two stages:

The first stage: in which the equilibrium is achieved in the real sector only (the labour market and the goods and services market).

The second stage: in which the equilibrium is achieved in the monetary sector, and in this stage the real sector is integrated into the monetary sector.

1- The Labour market equilibrium

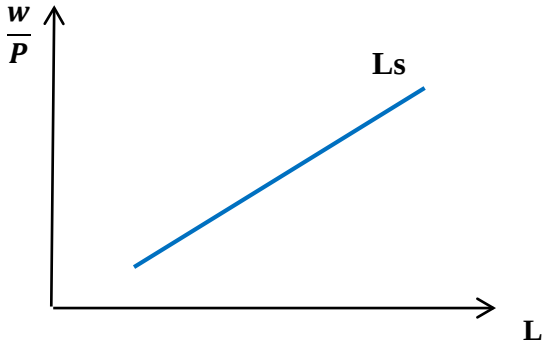
Equilibrium in the labour market occurs when the labour supply equals the demand for it:

- **The labour supply (Ls):**

labour supply is about individual's willingness to work, and it depends positively on real wage ($\frac{W}{P}$). So, if the real wage increases, the quantities of labour supplied increase, and if this real wage decreases the supply of the labour factor decreased. Therefore, the propensity **d** of the labour supply function **is positive**.

$$\mathbf{Ls= f\left(\frac{W}{P}\right) \quad , \quad Ls = \alpha + \beta\frac{W}{P} \quad L's = \frac{d\,Ls}{d\,\frac{W}{P}} = \frac{\Delta\,Ls}{\Delta\,\frac{W}{P}} > 0}$$

where:



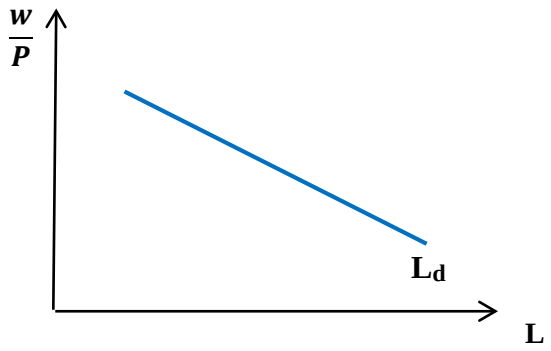
- **The labour demand Ld:**

labour Demand is about job opportunities available in institutions, and it also depends on real wage but with a negative (opposite) relationship, where if the real wage increases the quantities required of labour decreased, and if the real wage decreases the quantities required of labour increased.

$$\mathbf{L_d = f_2\left(\frac{W}{P}\right) , \quad L_d = \alpha - \beta\frac{W}{P}}$$

$$\mathbf{L'd = \frac{d\,Ld}{d\,\frac{W}{P}} = \frac{\Delta Ld}{\Delta\,\frac{W}{P}} < 0}$$

where:

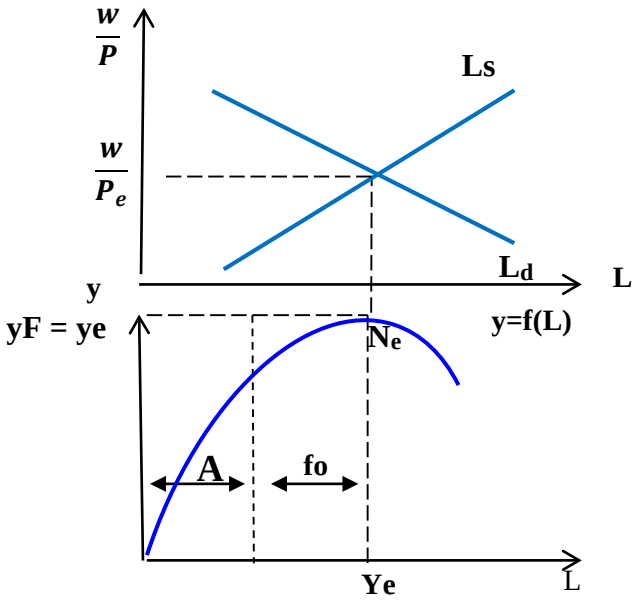


- **Labour market equilibrium:**

Equilibrium in the labour market is determined when the supply of labour equals the demand for it **Ls = Ld.** Graphically, is determined when the supply curve **LS** intersects with the demand curve **Ld**, as it shown in the following graph:

$LS=\alpha+\beta w/p$

$Ld=\alpha-\beta w/p$



- At the intersection point **E** Equilibrium quantities are determined: (Ld = Ls = Le) equilibrium quantity of labour, equilibrium real wage $\left(\frac{W}{P}\right)_e$ where **W** Nominal wage and **P** general price level:

- The supply and demand functions of labour are given as:

$L_S = ƒ1\ (\frac{W}{P})$ and: $L'S=\frac{N_S}{\frac{W}{P}} > 0$: the labour supply function has a positive propensity.

$L_d = ƒ2\ (\frac{W}{P})$ and: $L'd =\frac{N_d}{d\frac{W}{P}} < 0$: the labour demand function has a negative propensity.

- When equilibrium is determined in the labour market, the volume of production **Y** can be determined.

Example:

- If we have the following data related to a classical economics:

LS=80+5w/p

Ld=140-10w/p

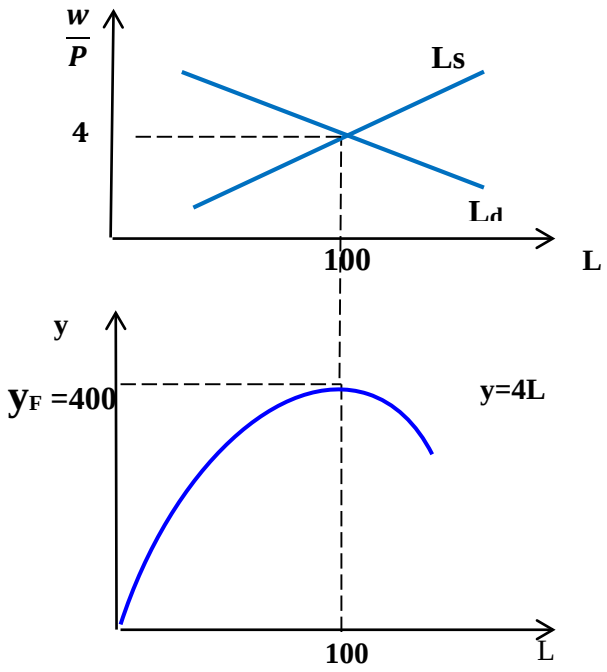
- Calculate the real wage and the employment level in the equilibrium situation, then illustrate with a graph the general equilibrium in the labour market and the production function.

the solution:

- **Calculating $\left(\frac{w}{p}\right)_e$ and Le:** Labour market equilibrium condition

LS=Ld$\Rightarrow$ 80+5w/p= 140-10w/p$\Rightarrow \left(\frac{w}{p}\right)_e = 4$ by substituting the equilibrium real wage into one of the two equations, we find: Le=LS=Ld= 80+5(4)= 100

Graphical representation:



- **Finding the labour demand function:**

In order for institutions to achieve the greatest amount of production, they increase the demand for labour until the marginal productivity of labour (the derivative of the production function) is equal to the real wage of the worker. Therefore, the demand function for labour can be found through the production function by equating the real wage with the marginal productivity of labour.

The demand function for labour is derived from the profit maximization condition for the firm: **MPL=W/P**

example:

If we have the following data:

- **Production fonction** $y= -0.05L^2+1000L$
- **Labour Supply function** $L_S= -8000+8\frac{W}{P}$

Find the demand labour function.

the solution:

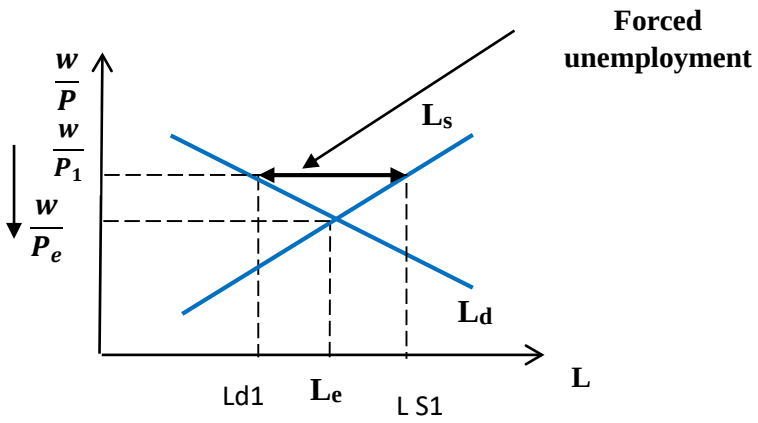
The labour demand function is derived from the profit maximization condition for the firm: $\mathbf{MPL=\frac{W}{P}}$

MPL= $\frac{\Delta Y}{\Delta L}$= (-0.05)2L+10000= -0.1L+10000

$\mathbf{MPL=\frac{W}{P}}$ $\Rightarrow$ -0.1L+10000= $\frac{\mathbf{W}}{\mathbf{P}}$ $\Rightarrow$ $\mathbf{L_d=100000-10\frac{W}{P}}$

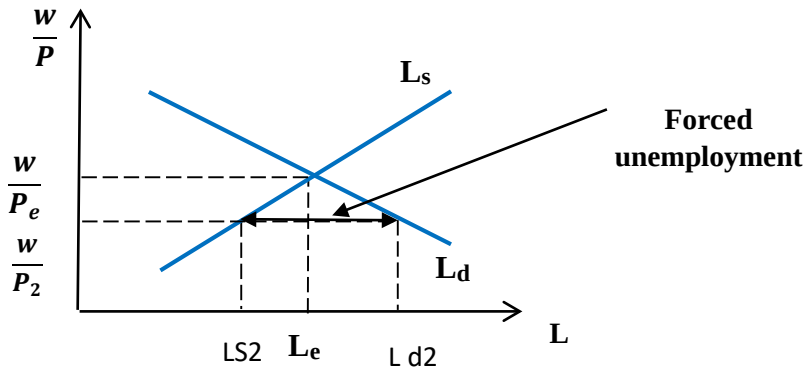
- Unemployment in the classical model

When the real wage rises to $\frac{\mathbf{W}}{\mathbf{P_1}}$, the labour supply is greater than the labour demand, which leads to **a forced unemployment (L_{S1}-L_{D1}), and** to eliminate it, workers must accept a reduction in the nominal wage, and with the price stable, the real wage decreases from $\frac{\mathbf{W}}{\mathbf{P_1}}$ to$\left(\frac{w}{p}\right)_e$, and thus the economy returns to equilibrium again. (As in the following figure)



If the real wage decreases to $\frac{\mathbf{W}}{\mathbf{P_2}}$, the labour demand by institutions will be greater than the labour supply, so, there is a shortage in the number of workers estimated by: $\mathbf{L_{d2}}$-$\mathbf{L_{S2}}$ and to treat this economic situation, producers compete to employ workers by raising

nominal wages, and with the price stable, the real wage rises from $\frac{w}{P_2}$ to$\left(\frac{w}{p}\right)_e$.Thus returning to equilibrium. (As in the following figure).

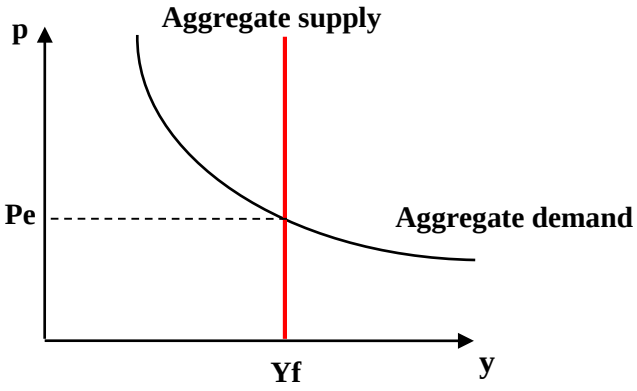


2- Equilibrium in the market for goods and services

According to the classics, equilibrium occurs in the goods and services market when there is a balance between total supply (production) and total demand (spending), with the condition that savings equal investment (S=I).

- **Aggregate supply equals aggregate demand:**

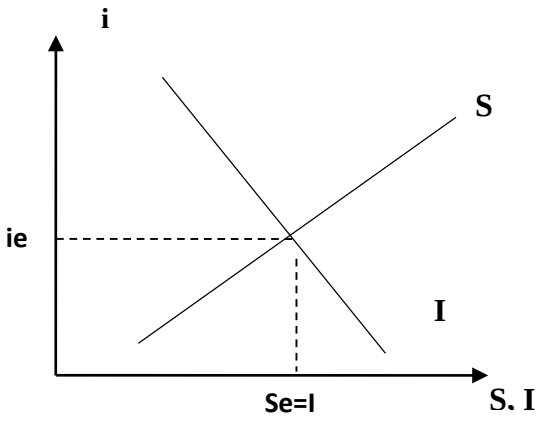
Equilibrium occurs at the intersection of the aggregate supply curve **(Y)** -which is a vertical line on the horizontal line indicating the stability of production at the full employment level ($\mathbf{Y_F}$)-, with the aggregate demand curve **(D)** -which indicates the inverse relationship between the required quantity and the price with the assumption of the consistency in the quantity of money supplied **M** and its velocity **V** (the aggregate demand curve is derived from the quantity theory of money) where production at equilibrium is ($\mathbf{Y_F}$) and the equilibrium price is (Pe) and at equilibrium, production and prices stabilize, which is the ideal state to which demand must return. (Samari Ibtissam, 2020/2021)



- **Saving equals investment**

Equilibrium happens when saving equal investment due to the flexibility of the interest rate (**i**) - interest rate has **a direct** effect **on saving** and **an inverse effect** on **investment**- .Where:

- Saving is positively related to interest rate according to the relationship: $S = \int (i)$; $S' = \frac{dS}{di} > 0$, because the rising in interest rates encourage saving -the saver maximizes utility-.
- Investment is negatively related to interest rates. $I = \int (i)$ / $I' = \frac{dI}{di} < 0$ because the rise in interest rates leads to an increase in the cost of financing investments through loans and a decrease in the return on capital,
- In the equilibrium situation S = I any change in the interest rate, up or down, leads to adaptation to the new situation and a return to equilibrium.



3- Equilibrium in the money market

The purpose of the money market study is to determine the price at which the production **Y** is sold. To determine the equilibrium in the money market, the classical relies on the quantity theory of money formulated by Fisher, and then developed by economists at the Cambridge School.

The text aims to provide a theoretical foundation for the quantity equation in order to better understand inflation. As a first step, the analysis is simplified by assuming the following:

- The velocity of money V is constant and does not change over time.
- Output Y is fixed and determined independently of the money supply or the price level.
- The central bank controls the money supply M, making the price level P the only variable that adjusts.

Given these assumptions, the quantity equation implies that the central bank has full control over the price level: any change in the money supply leads to a proportional change in the price level (Matthias Doepke, 1999).

- **Fisher's equation (exchange equation)**

The classic starts from the quantity theory of money, which Fisher formulated as: **MV = PT** where: **M** the amount of money, **V:** The velocity of money (which is constant in the short run), **T:** The volume of transactions which is also constant in the short run, **P:** General price level.

With the stability of both V and T the direct relationship between the general price level and the money supply and the value **P** is determined by:

$$P = M\frac{V}{T} \Rightarrow P = \int(M) \quad / \quad P' = \frac{dP}{dM} > 0$$

And with the knowledge of $\mathbf{P_e}$ we can determine the value of the cash wage $\mathbf{W_e}$ after extracting the real wage from the equilibrium in the labour market, which is equal to:

$$W_e = \left(\frac{w}{p}\right)_e \Rightarrow we = PW_e$$

- **Cambridge equation (cash balances approach)**

Fisher's equation was modified by economists at the Cambridge School to a new formula where **T** it has been compensated by **Y** due to measurement difficulties Thus, the demand for money became equal to:

$$MV=PY \Leftrightarrow M = \frac{1}{V} PY \Rightarrow \mathbf{Md = k\ PY}$$

Where **k** is called the liquidity preference factor, and it expresses the percentage of cash retention from income for transaction purposes, where the higher V, the lower k and vice versa (inverse relationship).

PY Nominal income (**output**).

The money supply is fixed because it is an external variable that is not affected by changes in nominal income PY , and its value is determined by the monetary authority represented by the central bank.

$M_S = M_O$ (money supply)

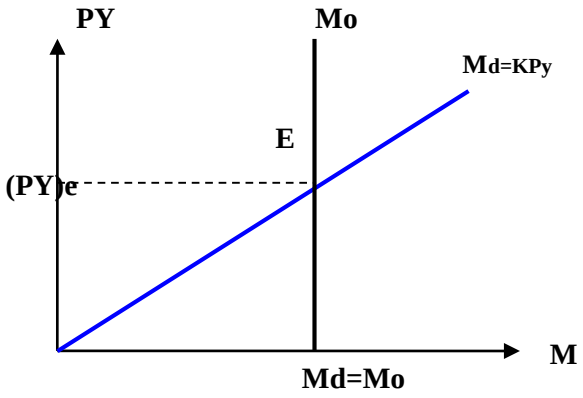
in equilibrium:

$$MS = Md \Leftrightarrow Mo=Md = k\ PY \text{ (Money supply = money demand)}$$

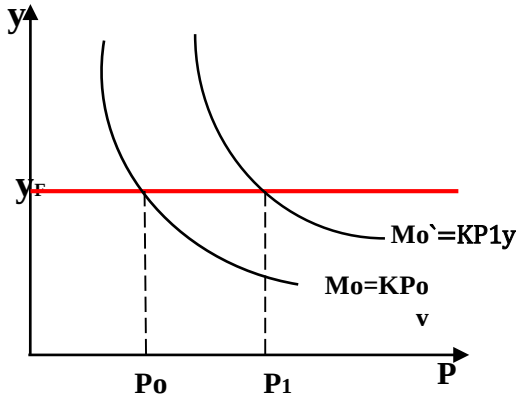
- **Graphical representation of equilibrium in the money market:**

The equilibrium in the money market can be represented by the following two graphs:

- **Intersection of the money supply and money demand functions**:



And it can be also represented by the money market equilibrium condition **Ms=Md=KPY** showing the general level of prices **P** and the equilibrium in the goods and services market (full employment output $\mathbf{Y_F}$): (Alain Luzi, 1996)



We note that assuming the stability of real income **Y** at the level of full employment (based on the fact that classical analysis assumes that equilibrium is achieved at the level of full employment and therefore production will not increase after this level no matter how prices change), any increase in the money supply (from Mo to M'_0) will lead to an increase in prices (from Po to P1) which expresses inflation. (Samari Ibtissam, 2020/2021).

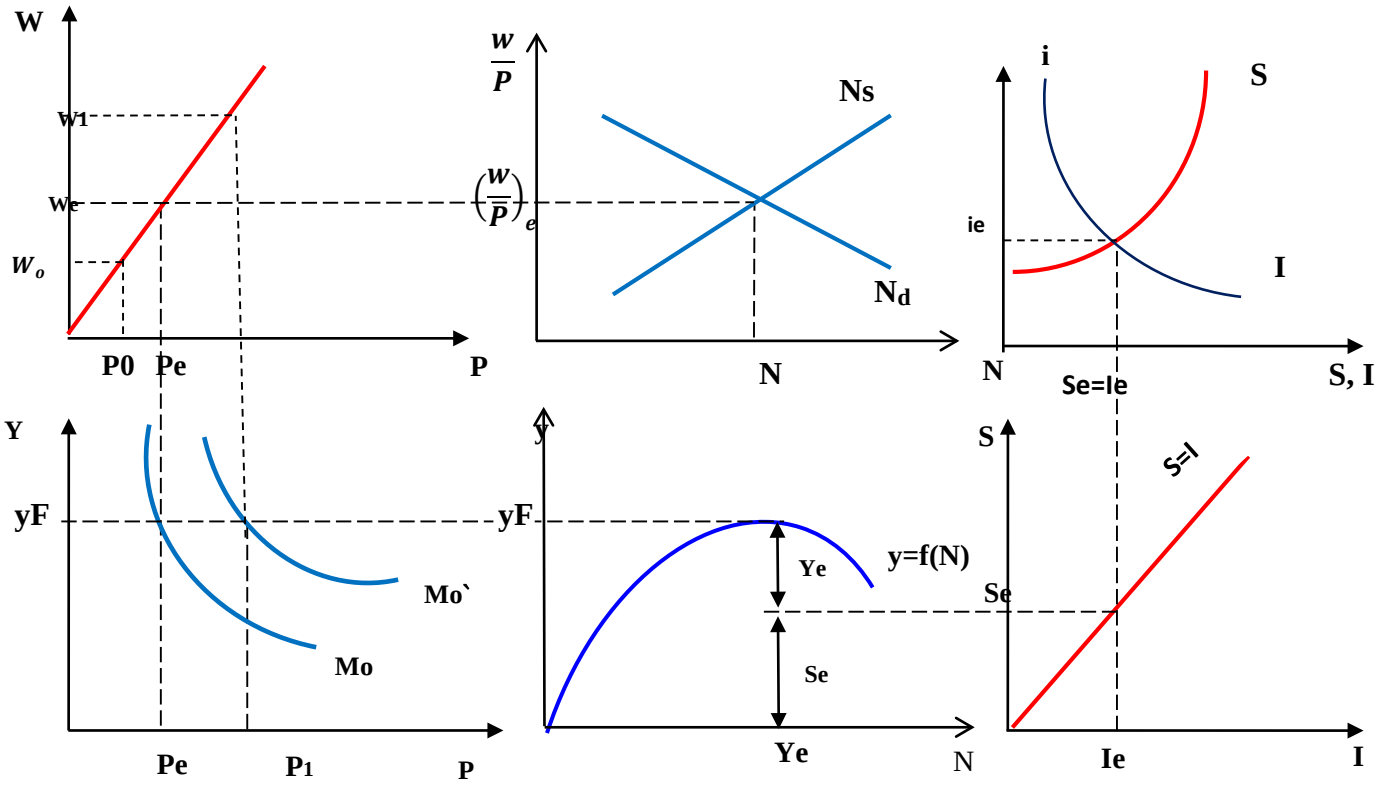
4- General balance

General equilibrium occurs in the classical period in two stages:

Stage 1: Equilibrium in the real sector (labour market and goods and services market)

Stage 2: Equilibrium in the monetary or nominal sector (money market)

Therefore, **the current equilibrium** in the three markets (labour market, goods and services market, money market) can be summarized in the following graphic representation



A formal classical macroeconomic model shows that money supply changes do not affect real economic activity under its assumptions, illustrating money neutrality and the absence of money illusion. However, issues remain regarding the natural rate of output and the potential impact of unanticipated changes in the money supply (John M. Barron, 2006).

Third : Exercises on Global Equilibrium According To The Classical Theory

Exercise 1:

Answer the following questions:

1- Explain why the aggregate supply curve is a vertical line in the classic model? Illustrate it graphically.
2- What is the opinion of the classic school about the relationship between money and real economy?
3- Classic analysis is called dual analysis, what does it mean?
4- How can the labour demand function be found under the classic model?
5- What happens to labour supply in the following cases:
   - A fall in the nominal wage level with fixed prices;
   - A rise in the general price level with a constant nominal wage level;
   - A rise in the nominal wage level at the same rate as a rise general price level;
   - A rise in the nominal wage level with a lower general price level.
6- What is meant by the marginal productivity of labour (MPL), and how is it calculated?
7- Explain the difference between increasing returns and diminishing (falling) returns in production function.

Exercise 2 :

The following table shows the production level of a commodity by number of workers:

number of workers L	1	2	3	4	5	6	7	8
Aggregate production Y	2750	3100	3400	3650	3750	3700	3600	3450

1- Calculate the marginal production, marginal revenue and profit (Arrange the answer in the table) ?

2- find the real wage if the price unit of the produced commodity is 10 and the rate of wages paid per worker is 1000.

3- If the company continues to employ additional workers to maximize profit, at what level of employment does it stop? And calculate the maximum profit achieved?

4- If the selling price per unit decreases by 60%, what will happen to the company's employment policy?

Exercise 3

If you have the following equations: $L= -12.5\frac{W}{P}+175$; $L= 5\frac{W}{P}+140$

1. Distinguish between the labour supply equation and the labour demand equation, with justification.
2. Is there equilibrium in the labour market if the nominal wage W=6 and the price level P=2?
3. What is required to achieve the equilibrium situation?
4. Define the equilibrium real wage and the equilibrium employment level?
5. Illustrate both situations (equilibrium and disequilibrium) on the same graph.

Exercice 4:

Suppose you have the following data related to classical economics:

$L_S=\frac{1}{16}(\frac{w}{p})^2$ $y=200L^{1/2}$ P=10 V=20

1- Extract the labour demand function.

2- Calculate the equilibrium real wage and employment level.

3- Calculate the nominal output.

4- Calculate the money supply and the nominal wage.

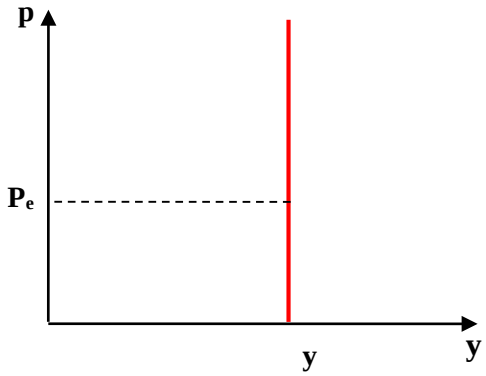
5- What happens when:

- Rise in Money supply by 10%
- Decrease in the money supply by 10%

Solution of Exercises

Exercise1:

1-According to the classics, the total supply is not affected by the price; because, it is always constant (everything that is supplied is demanded according to Say's law); therefore, it is represented graphically by a vertical line.



2- The classics believe that there is no relationship between money and the real economy, as money is only a medium of exchange (the principle of the neutrality of money).

3- Classical economic analysis is called a dual analysis because it separates between real variables (such as: production, quantity of labour, real wage) and nominal variables expressed in terms of monetary values such as: the general price level, inflation rate, nominal wage.

4- In order for companies to achieve the greatest amount of production, they increase the demand for labour until reaching the equality of the marginal productivity of labour (the derivative of the production function) with the real wage of the worker, and accordingly the demand function for labour can be found through the production function by equating the real wage with the marginal productivity of labour.

The demand function for labour is derived from the condition of maximizing the profit of the company: MPL=W/P

5- Labour supply in the following cases:

- A decrease in the nominal wage with stable prices; means a decrease in the real wage and thus a decrease in the labour supply.

- An increase in the general price level with stable nominal wage; means a decrease in the real wage and thus a decrease in the labour supply.

- The nominal wage rises at the same rate as the general price level rises; this means that the real wage remains stable and thus the labour supply remains stable.

- The nominal wage rises with a fall in the general price level; this means that the real wage rises and thus the labour supply increases.

6- The Marginal Productivity of Labour (MPL) measures the additional production produced by hiring one more unit of labour while keeping other inputs constant.
It is the first derivative of the production function with respect to labour (L or N):

MPL=dY/dL

8- The difference between increasing returns and diminishing (falling) returns in production function.

- Increasing Returns :
  Each additional unit of labour adds more to total production than the previous one - production increases at an increasing rate-. (Occurs when workers specialize and use resources more efficiently)

- Diminishing (Falling) Returns:
  Each additional unit of labour adds less to total production - production increases at

a decreasing rate. (Occurs when labour becomes excessive relative to fixed capital or resources)

Exercise 2:

1- Calculating the marginal production, marginal revenue and profit

Marginal product: MPL = $\frac{(\Delta Y)}{(\Delta L)}$

Marginal revenue (value of marginal product): MR = MPL* P

Profit: π= MR-MC where MC is marginal cost (nominal wage)

L	Y	MPL	P	MR	W	Π	MR’	Π'
1	2750	2750	10	27500	1000	26500	11000	**10000**
2	3100	350	10	3500	1000	2500	1400	**400**
3	3400	300	10	3000	1000	2000	1200	**200**
4	3650	250	10	2500	1000	1500	1000	**0**
5	3750	100	10	1000	1000	0	400	**-600**
6	3700	-50	10	-500	1000	-1500	-200	**-1200**
7	3600	-100	10	-1000	1000	-2000	-400	**-1400**
8	3450	-150	10	-1500	1000	-2500	-600	**-1600**

2- Finding the real wage:

w/P=1000/10=100

3- The company stops hiring when it hires 5 workers because:

MR = MPL. P =W =1000 Or equals the marginal product of labour with the marginal cost of labour represented by the real wage, MPL =W/P =5

- The maximum profit achieved in this case equal to 26500+2500+2000+1500=32500

4- Effect of 60% Price Decrease

- New Price = 10 × 0.4 = 4
- New MR = MP × 4
- So the company will reduce employment to 4 workers to maximize profit.

Exercise 3:

1- Define Ls & Ld

- Labor supply equation:

  Ls== 5 $\frac{W}{P}$+140 Since Ns′>0, the relationship between Ls and W/ P is positive (direct relationship)

- Labor demand equation:

  Ld=−12.5$\frac{W}{P}$+175 Since Nd′<0 the relationship between Ld and W /P is negative (inverse relationship)

2- Checking for equilibrium in the labour market:

- We check if Ls= Ld at W/P=3:

  Ls=5·3+140=155

  Ld=−12.5·3+175=137.5

  Ls> Ld

- This means there is no equilibrium in the labour market, because the quantity of labour supplied does not equal the quantity of labour demanded.
- The difference represents involuntary unemployment:

  Ls−Ld=155−137.5=17.5 units of labour

3- Correcting the situation:

To eliminate unemployment, the real wage must decrease, which will increase Ld and decrease Ls .

4- Calculating the equilibrium real wage:

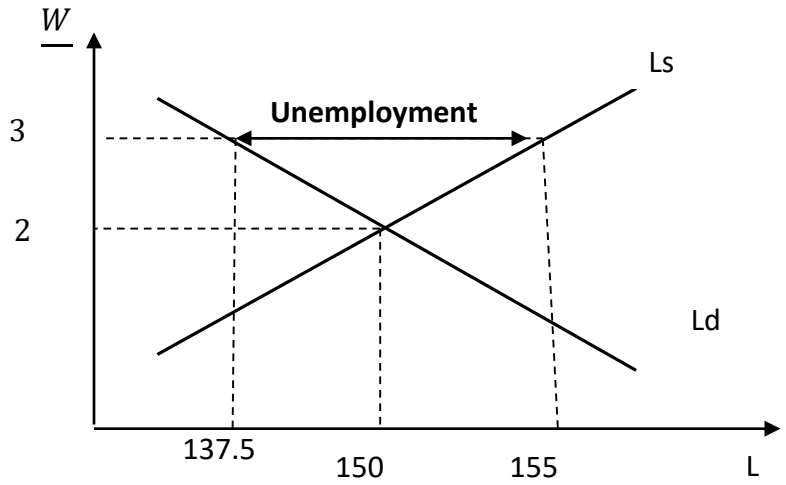
- $L_s = L_d \Longrightarrow 5W/P+140=-12.5W/P+175 \Longrightarrow W/P= 2$
- Substituting into Ls or Ld:

$L_s= 5W/P+140 \quad L_s= 5(2) +140 \quad L_s= 150$

$L_d= -12.5W/P+175 \quad L_d= -12.5(2)+175 \quad L_d= 150$

- Labor market is in equilibrium at W/P=2 and Le=150.

graphical represented



Exercise4:

1- Extracting the labour demand function

The demand function for labour is derived from the profit maximization condition for the firm.

$$MP_L = \frac{W}{P}$$

$MP_L = \frac{dy}{dN}$ = $(200L^{1/2})' = 100L^{-1/2}$

$100L^{-1/2} = \frac{W}{P}$

$\Rightarrow L^{-1/2} = \frac{100}{(\frac{W}{p})}$

Squaring both sides we find: $(L^{-1/2})^2 = (\frac{100}{(\frac{W}{p})})^2$

$$Ld = \frac{10000}{(\frac{W}{p})2}$$

2- Calculation of real wage and equilibrium employment:

$Ls = Ld \Rightarrow \frac{1}{16}(\frac{W}{p})^2 = \frac{10000}{(\frac{W}{p})2} \Rightarrow (\frac{W}{p})^4 = 160000 \Rightarrow \sqrt[4]{160000} = 20 \Rightarrow \left(\frac{W}{p}\right)_e = 20$

By substituting the equilibrium real wage into one of the two equations, we find:

$$Le = 25$$

3- Finding the value of nominal output

In compensation Ne in the production equation, we find the production level:

$$y = 200(25)^{1/2} = 1000$$

Then we find the value of the nominal output: PY = 10(1000) = 10000

4- Calculating the Money supply and the nominal wage:

- Money supply:

$MV = PY \Rightarrow M = \frac{py}{v} = \frac{(10)1000}{20} = 500$

- Nominal wage:

$\left(\frac{W}{p}\right)_e = 20 \Rightarrow w = 20p = 20(10) = 200$

5- When the money supply rises or falls, the real variables are not affected, but only the nominal variables are affected, and this is according to the economic Duality principal in classical economics.

- The money supply increased by 10%:

- Impact on the general price level:

M'= M+0.1(M) = 500+0.1(500) = 550

M'V=P'Y$\Rightarrow$P '=$\frac{M'V}{Y}$ = $\frac{550(20)}{1000}$ = 11

The general price level rises by 1 unit

- Impact on nominal output:

PY= 11(1000) = 11000

Nominal output increases by 1000 units.

- Impact on nominal wage:

$\left(\frac{W}{p}\right)_e$ ' =20 $\Rightarrow$ w'=20(11) =220

The nominal wage increased by 220 units

- Effects of a 10% decrease in the money supply:

When the money supply decreases, the nominal variables decrease by the same amount as the increase in the money supply by 10%

In the same way we find:

M'=M-0.1 M =500-0.1(500) =450

- The price decreases by 1(P'=9)
- Nominal output decreases by 1000 (PY=9000)
- The nominal wage decreases by 20 (w'=180)

Chapter Four :

The Keynesian Model Of Total Equilibrium

Preface :

Keynesian economics is a macroeconomic theory of total spending in the economy and its effects on income, employment, and inflation. It was developed by British economist John Maynard Keynes during the 1930s in an attempt to deal with the effects of the Great Depression.

First : The Keynesian model assumptions and consumption, saving, Investment functions

1- Keynesian school assumptions

- **Underemployment:** Keynes believed that the equilibrium could occur under underemployment (**Incomplete Employment**),
- **The need for the government intervention to stabilize the economy:** by activating aggregate demand to stimulate institutions to produce and thus encourage employment. **For effective demand** (demand + actual ability to purchase) where:

D = C+I.

- **Rejection of the idea of price and wage flexibility that ensures full employment:** Unlike the classical, Keynes sees that **Prices are inflexible due to monopoly** and Wages are inflexible because they are often set by employment contracts.
- **Stability of the general level of prices:** as an external variable, and thus changes in real income express changes in nominal income;
- Rejection of the idea of monetary neutrality: Keynes classified the demand for money 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 **Mt= f(y) .** and 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 **Ma= f(i).** So: **Md=Ma+Mt**

2- Consumption and saving functions

- **consumption function**

Consumption represents the sum of expenditures allocated by the household sector to purchase their needs of final goods and services.

- **Consumption determinants**

- **Disposable income(yd):** It is also called disposal income, and Keynes considered it the main determinant of consumption.
- **Subjective factors:** It is linked to the psychological motives of the consumer (innate and acquired), and it may lead to an increase or decrease in consumption, including: advertising, improvements in goods, price expectations, wars and crises, social status (trying to remain at the same level).
- **Objective factors:** It includes a group of economic factors that may affect the volume of consumption, including:
  - The availability of consumer credit
  - Wealth: It constitutes the consumer's financial assets, and the more it increases, the more consumption increases.
  - Interest rate: If the interest rate increases, consumption decreases and, in return, savings increase;
  - The government policy, as it may focus on promoting one sector at the expense of other sectors, so the wages of workers in this sector are high, and their consumption increases compared to workers in other sectors;
  - The behavior of shareholders and investors, sometimes investors may hold to part of shareholders' profits which leads to a reduction in consumption.

- **Keynesian consumption function form:**

The Keynes' consumption function can be expressed in the following form:

$$C=C_0+bYd$$

Where:

C: is the aggregate consumption

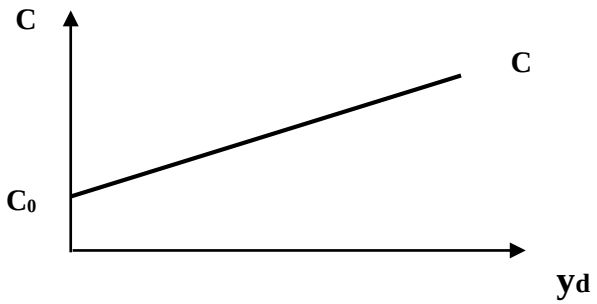
Yd: is the disposable income

C_0: the minimum level of consumption or the part of consumption who doesn't depend on income, which expresses other non-income factors affecting consumption (subjective and objective factors), which are fixed based on the assumption that other factors are constant. In the short period, C_0 It is always greater than zero (positive), as it represents the minimum necessary for living.

b: Marginal propensity to consume, which measures the change in consumption when disposable income changes by one unit.

- **Graph of consumption function:**

The consumption function curve takes the form of a straight line that starts from a point greater than zero on the vertical axis (intersects the vertical axis), as shown in the following figure:



- **Analytical tools for consumption function:**

Keynes used the concept of propensity to consume to describe the relationship between current household consumption and disposable income. This propensity can be marginal or average.

MPC marginal propensity to consume	APC Average propensity to consume
• **Represents the change in C due to the change in Yd** • **It is the first derivative of the C function to Yd (is the slope of the consumption function)** • **it is constant because the consumption function is linear** • **it is always positive, i.e. greater than zero and less than one**	• **It is the ratio between total consumption and disposable income.** • **is characterized by decreasing as available income increases** • **its value differs from the value of the marginal propensity to consume**
MPC = $\frac{\Delta C}{\Delta y} = \frac{C_2 - C_1}{y_2 - y_1} = \frac{C_3 - C_2}{y_3 - y_2} = b$	$\boldsymbol{APC = \frac{C}{yd}}$ **where MPC< APC**

Note: (Keynes's psychological law)

Since the marginal propensity to consume is constant and the average APC is decreasing, as income increases & knowing that APC > MPC, this indicates that the relationship between consumption and income is disproportionate, therefore as income increases, consumption increases by a smaller rate, i.e. $\Delta C < \Delta yd$, and this is consistent with the Keynesian consumption function.

- **Saving function**

Saving represents the portion of income remaining after spending on consumption, and it is considered a leakage factor.

S = f(yd)

Unlike the classicists who linked saving to the interest rate, Keynes link Saving with available income, meaning that the value of savings depends on the value of available income. The higher the income, the greater the tendency of individuals to save, and thus the relationship between them is directly proportional.

Saving is the deference between total income (Y) and the aggregate consumption: so S=C-Y

- **Savings function form:** it is calculated based on the following:

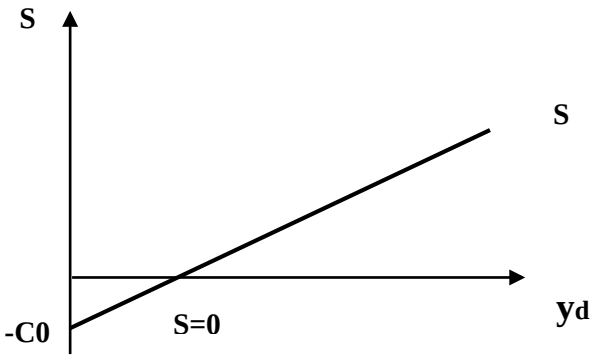
S = Yd-C
C = C0 + bYd / Y = Yd
S = Yd – C0 – b Yd
S = -C0 + (1 – b) Yd

where:

C_0: saving independent of income.

(1- b)**:** marginal propensity to save (**MPS)**, it measures the rate of change in savings when disposable income changes by one unit.

- Graph of the savings function: The savings function is represented by a straight line because it is a linear function, and this line starts from a point less than zero on the vertical axis.



- **Analytical tools for saving function:**

MPS **marginal propensity to save**	**APS** **Average propensity to save**
• **Represents the change in S due to the change in Yd** • **It is the first derivative of the S function to Yd (is the slope of the Saving function)** • **it is constant** • **it is always positive, i.e. greater than zero and less than one**	• **It is the ratio between total Saving and disposable income.** • **is characterized by increasing as available income increases** • **its value differs from the value of the marginal propensity to save**
MPS = $\frac{\Delta S}{\Delta y} = 1 - b$	$APS = \frac{S}{yd}$

- **Marginal propensity to save and its relationship to marginal propensity to consume:**

$MPS = \frac{\Delta S}{\Delta Y}/S = Y - C \Rightarrow \Delta S = \Delta Y - \Delta C$

$$MPS = \frac{\Delta Y - \Delta C}{\Delta Y} = \frac{\Delta Y}{\Delta Y} - \frac{\Delta C}{\Delta Y}$$

$MPS = 1 - \frac{\Delta C}{\Delta Y}$ / $MPC = \frac{\Delta C}{\Delta Y}$ **MPS + MPC = 1** so: **0<MPS<1**

It is noted that **MPS** and **MPC** they complete each other to the correct **1**.

- **Average propensity to save and its relationship to the average propensity to consume:**

$S = Yd - C$

$$\frac{S}{Yd} = \frac{Yd - C}{Yd} = 1 - \frac{C}{Yd}$$

APS = 1 – APC=>APC + APS = 1

Note:

We notice that **as income increases**:

- The average tendency to consume **APC** decreases
- The average propensity to save **APS** increases

because as the income increases, the tendency of individuals to consume falls and their tendency to save increases.

3- Investment function:

Investment refers to the total amount that investors spend on purchasing machinery and equipment necessary for the production of goods and services, Investment represents an essential component of aggregate demand (D), where D = C + I.

According to Keynes, investment is an exogenous (external) variable $I = I_0$.

- **Determinants of Investment (Investment Evaluation Criterion)**

Criterion 1: Net Present Value (NPV):

The NPV is the difference between the total present value of the expected net returns from a given investment and the cost of that investment:

$$NPV = V_0 - I_0$$

If NPV > 0 → the investment is profitable.

If NPV < 0 → the investment is not profitable.

So it is important to distinguish between the **future value** and the **present value** of money.

- **The future value of a present amount (the accumulated value)**

It is the value obtained after capitalization. In this process, the present value V0 (at period t) becomes the future value P1 (at period t+1). Capitalization is carried out through two basic operations performed by banks: saving (depositing) or lending money at interest.

- **Simple Interest**

If the deposit or loan operation does not exceed a single period—such as one year—then the process is evaluated over that one-year horizon.

Example: Suppose a bank lends an amount P0 (the principal) to a firm in exchange for an annual interest rate i. At the end of the first year, the bank will receive an amount P.

where: $P_1 = P_0 + P_0 i = P_0 (1 + i)$

P1 This amount is referred to as the future value calculated under the simple interest method.

- **Compound Interest:** (Badawi Muhammad, 2024,)

Interest is considered compound when the operation extends over more than one period (e.g., more than one year), meaning that interest is earned on previously accumulated interest. Under this system, the accumulated value at the end of the second year becomes:

$P2=P1(1+i)$

$P_2 = P_0 (1 + i) (1+i)$

$P_2 = P_0 (1+i)^2$

After *n* periods: $P_n = P_0(1 + i)^n$

Pn is referred to as the **future value under compound interest**.

- **Compound Interest Paid Multiple Times per Year (Periodic Compounding):**

Interest may also be paid several times within a single year—such as semi-annually or quarterly. In this case, the formula becomes: $P_n = P_0\left(1 + \frac{i}{m}\right)^{mn}$

Where:

- m= number of compounding periods per year
- n= number of years

2. The Present Value of a Future Amount

- In the case of a single future amount

In this case, we perform the reverse of the capitalization process. Instead of calculating the future value of a present amount, we determine the **present value** of an amount to be received in the future.

$$\boldsymbol{P_n = P_0(1+i)^n \Rightarrow P_0 = \frac{P_n}{(1+i)^n} = P_n(1+i)^{-n}}$$

However, in this situation, we replace the interest rate i with the discount rate r(the interest rate applied by the central bank to commercial banks for loans) Thus, the present value formula becomes: $P_0 = P_n(1+r)^{-n}$

If discounting is repeated during the year (periodic discounting):

In this case, the formula is adjusted as follows:

$$\boldsymbol{P_0 = P_n\left(1+\frac{r}{m}\right)^{-mn} \text{ or } P_0 = \frac{P_n}{\left(1+\frac{r}{m}\right)^{nm}}}$$

Where:

- m= number of discounting periods per year
- n= number of years

- **In the case of a multiple future amount**

When an investment generates payments at the end of each year for several years, we calculate the **present value** of all these expected amounts by discounting each one at the

appropriate interest (or discount) rate.

The total present value is called V_0.

These payments (returns) can appear in two forms :

Unequal payments $\mathbf{P_1 \neq P_2 \neq P_3}$	Equal payments $\mathbf{P_1 = P_2 = P_3}$
$$\mathbf{V_0 = \frac{P_1}{(1+r)^1} + \frac{P_2}{(1+r)^2} + \ldots + \frac{P_n}{(1+r)^n}}$$ **We use Financial Table No. 1 to compute the individual present values, as it provides the present value of 1 unit of currency received at the end of period n.**	$$\mathbf{V_o = \frac{P_n}{r}\left[1 - \frac{1}{(1+r)^n}\right]}$$ **We use Financial Table No. 2 to calculate the value** $$\mathbf{\frac{1}{r}\left[1 - \frac{1}{(1+r)^n}\right]},$$ **as this table provides the present value of 1 unit of currency received at the end of each period over nperiods.**

- **Criterion 2 : The Marginal Efficiency of Capital (MEC)**

The MEC, denoted by (r) or (MEC), represents the rate of return on investment. According to Keynes, it is the discount rate that equates the purchase cost of a capital asset (I_0) with the total expected future net cash flows over the asset's economic life (V_0).

Thus, MEC is the expected internal rate of return (IRR), determined internally by the firm, as opposed to the market interest rate (i), which is externally determined by the supply and demand for money.

Investment decisions are based on the comparison between (r) and (i):

- If r = i → investment is indifferent (break-even).
- If r > i → investment is accepted (profitable).
- If r < i → investment is rejected (not profitable).

Note :

Calculate Net Cash Flow Calculation:

Net cash flows = Total revenues – (Operating costs + Depreciation + Corporate tax) + Depreciation.

Depreciation is first deducted (as an accounting expense) before tax and then added back because it is a non-cash item representing internal self-financing.

Second:The equilibrium income in a two-sector model

Equilibrium means Any given level of income will determine a level of aggregate demand. If that level of aggregate demand does not exactly exhaust actual income, there is a tendency for output to change: (Barreto).

If Demand>actual income ==> depletion of inventories ==> increased Y next period

If Demand addition to inventories ==> decreased Y next period

If Demand=actual income ==> unchanged inventories ==> unchanged Y next period

The last case is equilibrium because there is no tendency to change-the economy will continue producing the same level of output in every time period.

1- Determining equilibrium income in a two-sectors model

The equilibrium in a two-sector economy (households and businesses) is determined by the aggregate supply **Y** and the aggregate demand **D**, where: $\mathbf{D = C+I}$

- Total supply: It is represented by income or output, which is spent on consumption and saving, and is obtained only by the family sector.

$$\mathbf{Y=Y_d=C+S}$$

- Total demand: It represents the total expenditure consisting of consumption and investment.

Therefore, at equilibrium: **Income = Total Expenditure**

$$Y=D \Rightarrow C + S = C + I$$
$$\Rightarrow \mathbf{S = I}$$

Thus, the equilibrium level of income is determined by the two conditions:

Aggregate supply/aggregate demand method	Saving /Investing Method
Supply (output)= Demand (planned aggregate expenditure) **Y=C+S** **D=C+I** **Y=D ⇒ y= C+I** **⇒ y= Co+ b yd+ Io** **⇒ y=Co +b y+ Io** **⇒ y- by=Co+ Io** **⇒ y(1-b) =Co + Io ⇒ ye=$\frac{C_o + I_o}{1-b}$**	**we have Y=D ⇒ C+S = C+I** **S=I** **Leakages S = Injection I** S=I⇒-Co+ (1-b)y= Io ⇒y(1-b) = co +Io **⇒ ye=$\frac{C_o + I_o}{1-b}$**

- **Derive the D function: (closed economy)**

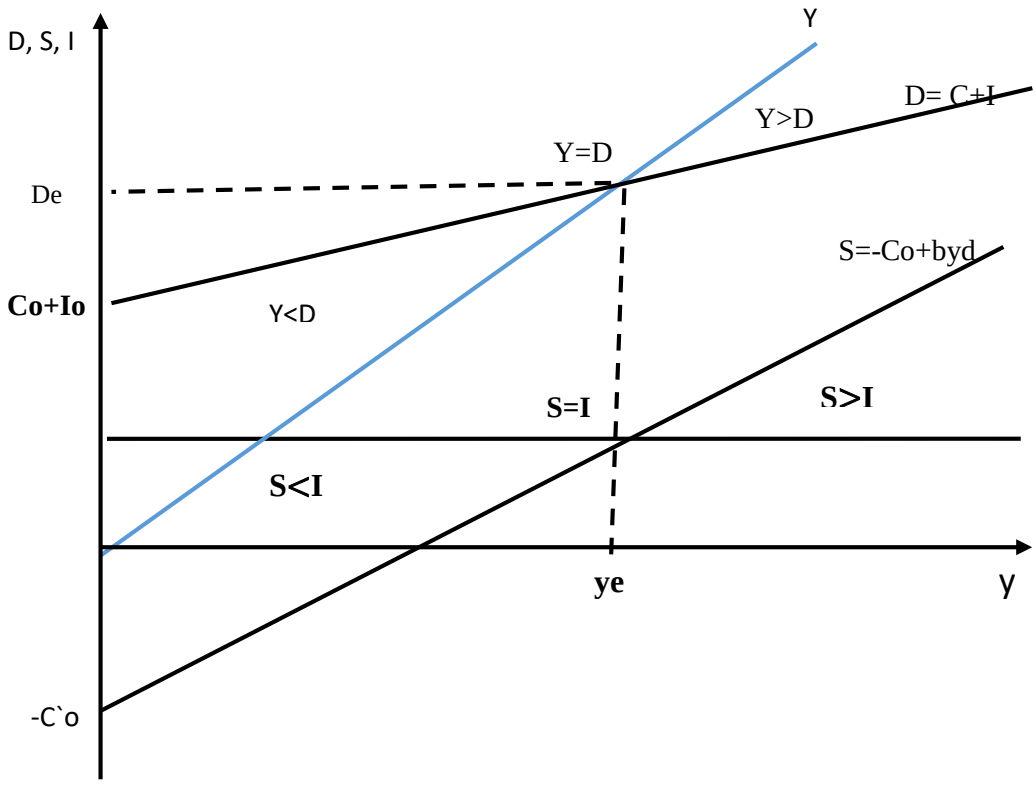
D=C+I= C_0+by+I_0

D=(C_0+I_0)+by ⇒ D=D_0+by

Note:

The total supply curve is represented by a line of 45° because it represents the levels that can be produced, that is, the producers produce what they expect to sell, so the slope of the total supply is equal to 1, which is the slope corresponding to the angle of 45°.

Graphical representation of the equilibrium situation in both ways



- **The graph shows three situations:**

First situation (Y<D) and (S<I) In this case, the stock of goods in the economy will decrease, leading to an increase in the general price level, i.e. **the problem of inflation** will appear.

Second situation (Y=D) and (S=I) it is the equilibrium situation, where the economy is balanced and prices are stable.

Third situation(S>I) and (Y>D) In this case, the stock of goods will increase, leading to a decrease in prices and a decrease in the profits of producers, Consequently, production stops, workers are laid off, and the economy enters a state of contraction (recession and depression) accompanied by unemployment.

Note:

- Y=D Supply =Demand The Equilibrium
- D>Y Demand >Supply Inflation
- D<Y Demand <Supply Depression and Unemployment

2- Multiplier theory

The multiplier can be defined as the value by which the Equilibrium income Ye changes as the independent total demand change by one unit, and we symbolize it as Ke. The multiplier has two types: static and dynamic.

- **Static multiplier:** Measures the final (direct) change in income resulting from the change in independent spending (**C_0 ; I_0**), **assuming no period of slowdown**.

Determine the static multiplier:

$$ye=\frac{C_0+I_0}{1-b}\ldots\ldots\ldots 1$$

$$y+\Delta y=\frac{C0+I0+\Delta I0}{1-b}=(C_0+I_0+\frac{1}{1-b}\Delta I_0)\ldots\ldots..2$$

Subtracting 1 from 2 we find: $\Delta I_0 \Delta y=\frac{1}{1-b}$ $Ke=\frac{1}{1-b}$

Note:

- The value of the multiplier depends on the value of the marginal propensity to consume b, The closer b is to 1, the greater the multiplier and thus the greater the effect on income (the effectiveness of the multiplier increases as consumption increases).
- Static multiplier of investment: KI $=\frac{\mathbf{1}}{\mathbf{1-b}}=\frac{\boldsymbol{\Delta y}}{\boldsymbol{\Delta I}}$
- Static multiplier of consumption: Kc$=\frac{\mathbf{1}}{\mathbf{1-b}}=\frac{\boldsymbol{\Delta y}}{\boldsymbol{\Delta C}}$

- **Dynamic multiplier:** We discuss about the dynamic multiplier when there is a delayed response between consumption and disposable income, and the effect of the multiplier in this case is indirect, and this is due to the existence of a slowdown period between the receipt and expenditure of income Ct=f (ydt +1).

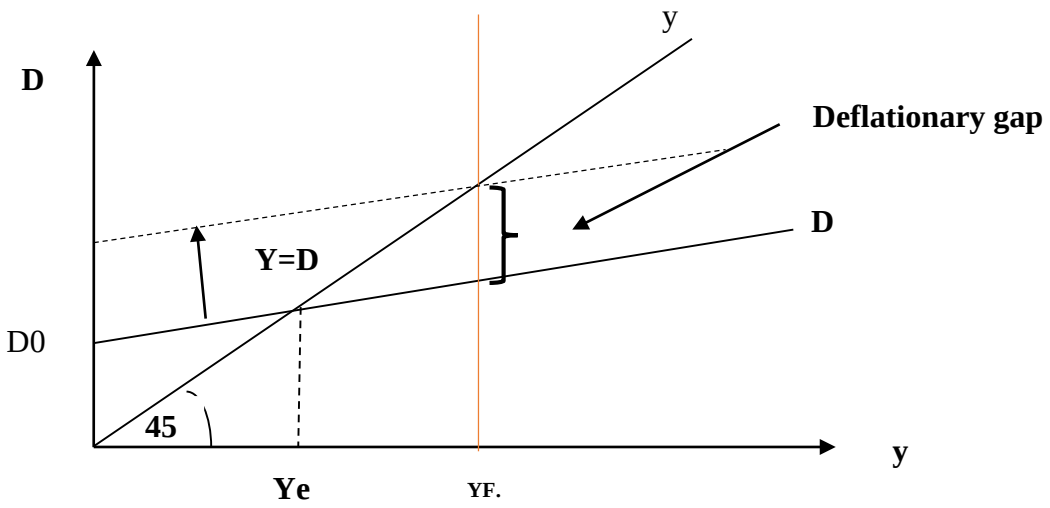
$$\mathbf{Kde=1+b+b^{2}+b^{3}+\ldots\ldots\ldots+b^{n-1}}$$

3-deflationary gap and inflationary gap : (Badawi Muhammad, 2024,)

- **Deflationary gap:** It is the amount of necessary spending that must be injected to bring the economy to full employment; it occurs when YF>Ye, and is calculated by the following relationship:

$$\textbf{Deflationary gap = production gap / multiplier=}\frac{\boldsymbol{YF-Ye}}{\boldsymbol{Ke}}$$

- **The treatment of the deflationary gap** is by the injection of additional demand into the economy through the application of an expansionary fiscal and monetary



- policy (increasing government spending and reducing taxes and interest rates), which leads to the **D** curve moving **upward.**
  - **Inflationary gap:** It is the amount of spending that must be pull out to return the economy to full employment; it occurs when Ye<YF is calculated by the following relationship:

$$\textbf{Inflationary gap = production gap / multiplier = } \frac{YF-Ye}{Ke}$$

- **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 (reducing government spending and raising taxes and interest rates), which leads to a shift in the demand **D** curve **down**.

Third : Exercises on The Keynesian model of total equilibrium

Exercise1:

1- What are the most important factors affecting consumption?

2- Why is the aggregate supply curve represented by line of 45^0 according to the Keynesian model?

Exercise2:

Disposable Income	**0**	**200**	**500**	**800**	**1100**
Consumption	**100**	**260**	**500**	**740**	**980**

1- Calculate both the marginal and the average propensity to consume? Then conclude both the marginal and the average propensity to save? Comment on the results.

2- Is the relationship between consumption and income proportionate?

3- Formulate the consumption function.

4- Calculate the savings for each period. Then conclude the savings function from the consumption equation. And calculate the aggregate saving ?

5- Graphically represent the savings function and the consumption function on the same parameter. Explain the meaning of the intersection point between the consumption curve and the aggregate supply curve?

Exercise3: If the average propensity to consume is 0.95 and the income is 400, calculate the level of consumption.

1. If the monthly income of an individual is 4750 and he spends 4037.5 of it on consumption, and after he gets a promotion, his income becomes 5248, and he spends 4336.6, calculate the marginal propensity to save.

2. If the saving function is equal to: S = -180 + 0.4 yd, and the average propensity to save in a certain period is estimated at APS = 0.22, determine the income at this period, then determine the savings and consumption corresponding to this income?

Exercise4: An individual lent an amount of 2000 DZD for a period of four years. Calculate the future value of this amount at the end of the fourth year, given that the annual interest rate is 10%.

1. An individual expects to receive a sum of 1000 DZD at the end of four years. Calculate the present value of this amount if the annual discount rate is 8%.
2. As a result of a particular investment, an individual expects to receive a net cash inflow of 4000 DZD at the end of each year for four years. Calculate the present value of this amount for the following annual discount rates: 6%, 8%, and 12%. What do you observe?
3. A production firm intends to purchase a machine whose offered price is 70000 DZD. This asset will have no residual value at the end of its useful life (3 years). The firm estimates that the net annual returns resulting from this asset will be equal to 30000 DZD at the end of each year. Determine whether the firm should decide to invest in purchasing this machine using the Net Present Value (NPV) criterion, knowing that the market interest rate is 15%.

Exercise5:

The firm aims to increase its turnover by acquiring a specific piece of equipment. It has received four technical offers from different suppliers. The offers are summarized below:

Supplier	Purchase Price	Year 1Return	Year 2 Return	Year 3 Return	Residual Value (at the end of 3rd Year)
Offer 1	**40000**	**6500**	**7300**	**7200**	**40% purchase price**
Offer 2	**28000**	**5000**	**6000**	**5400**	**30% purchase price**
Offer 3	**20000**	**5000**	**5200**	**5500**	**55% purchase price**
Offer 4	**50000**	**9500**	**11000**	**10500**	**60% purchase price**

Given a discount rate of 6%, answer the following:

1. Which offers should be accepted or rejected?

2. According to the Net Present Value (NPV) criterion, which offer is optimal?

Exercise6:

An investor intends to manufacture a specific product and is required to choose between two types of machinery:

First Type:

A machine with a purchase and installation cost of 30000$. It has an annual productivity of 3000 units; each sold at a price of 2,4 $. Its economic life is 12 years; operating costs are estimated at 1350$. In addition, the applicable income tax rate is 40%.

Second Type:

A machine with a purchase and installation cost of 22000 $, Its economic life is 8 years, and an annual production generating revenue amounting to 4903 $.

Required: By using the criterion of the Marginal Efficiency of Capital (MEC), determine which of the two machines is more needed to acquire, given that the usual market interest rate is 13%.

Exercise7:

We have an economy consisting of two sectors where: C=40+0.8yd I=60

1- Find the aggregate demand equation and conclude the saving function.

2- Calculate equilibrium income in two ways.

3- Calculate both consumption and saving at equilibrium.

4- Illustrate the equilibrium position in two ways on the same parameter.

5- Suppose that independent investment decreased by 10 units, what effect would this have on income?

6- Suppose that independent consumption increased by 40 units. What effect would this have on income?

Exercise8:

Suppose that a country's economy is characterized by unemployment, and the government wants to alleviate the phenomenon by a sustained increase in investment in certain sectors by an amount of $\Delta I = 10$, if you know that the income in the current year $y_t = 500$, and the marginal propensity to consume b = 0.75.

1. Find the value of the dynamic multiplier for 4 periods, specifying the amount of income needed to solve the unemployment problem?

2. Explain the difference between static multiplier and dynamic multiplier?

Exercise9:

If the consumption is given by the following function C=1000+0.6yd, and the independent investment is equal to I = Io= 200

1. Calculate the equilibrium income and corresponding consumption and saving.

2. If income at full employment level is 2800 mu, what is the state of the economy? determine the nature of the gap and calculate it.

3. Define the inflationary gap and the deflationary gap? With illustration in a graphic representation, and how to treat it.

Solutions of Exercises

Exercise1:

1- Keynes believes that consumption is affected by many factors, which are classified into:

- **Disposable income (yd):** Keynes considered it the main determinant of consumption.

- **Subjective factors:** They are related to the psychological motives of the consumer (innate and acquired) such as: advertising, technical improvements of goods, price expectations, wars and crises, social status (trying to stay at the same level).

- **Objective factors:** They include a group of economic factors that can affect the volume of consumption, including: consumer loans. Wealth.

The state's planning policy such as encouraging one sector instead of another, which leads to higher wages in the encouraging sector, which increases consumption.

2-Since Keynesian analysis is based on the assumption that demand creates supply, producers produce what they expect to sell, and therefore the slope of the aggregate supply curve is equal to 1, which is the slope corresponding to the angle of 45^0.

Exercise2:

Y	**0**	**200**	**500**	**800**	**1100**
C	**100**	**260**	**500**	**740**	**980**
MPC	**/**	**0.8**	**0.8**	**0.8**	**0.8**
APC	**/**	**1.3**	**1**	**0.925**	**0.890**
$MPS = \frac{\triangle S}{\triangle yd} = 1 - MPC$	**/**	**0.2**	**0.2**	**0.2**	**0.2**
$APS = \frac{S}{yd} = 1 - APC$	**/**	**-0.3**	**0**	**0.075**	**0.11**
y=C+S ⇒S=Y-C	**-100**	**-60**	**0**	**60**	**120**

- It is noted that the marginal propensity to consume is constant at the different levels of income.
- It is observed that the average propensity to consume decreases as income increases.
- It is noted that the MPS is constant at different income levels.
- It is noted that the APS increases as income increases.

2- MPC contant and APC decrease & knowing that APC > MPC, this indicates that the relationship between consumption and income is disproportionate, therefore as income increases, consumption increases by a smaller rate, i.e. $\Delta C < \Delta y_d$, and this is consistent with the Keynesian consumption function.

3- $C = C_0 + by_d$

b =MPC= 0.8

$C_o = C - by_d$

$C_1 - by_{d1} = 260 – 0.8 (200) = 100$

$C = 100 + 0.8\ y_d$

4- the saving function

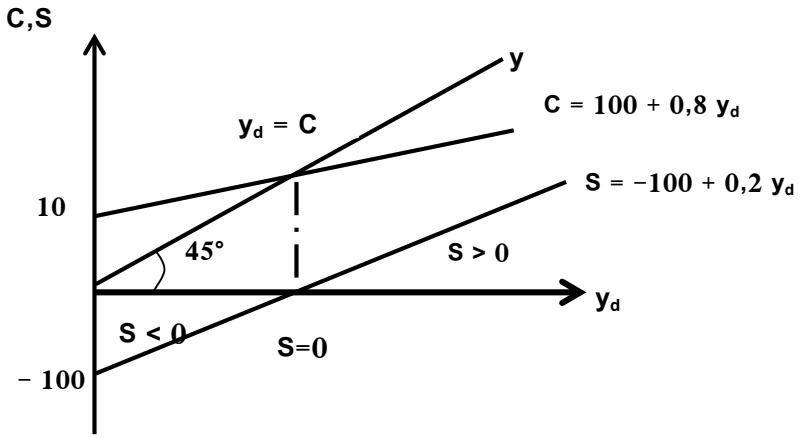
$y_d = C + S \Rightarrow S = y_d - C$

$S = y_d - C = y_d - (C_o + by_d)$

$S = y_d - C_o - by_d \Rightarrow S = -C_0 + (1 - b)\ y_d$

$S = -100 + 0{,}2\ y_d$

Graphical representation :



The point of intersection of the consumption curve and the aggregate supply curve represents the level at which all income is directed to consumption (Y=C) so there is no saving.

Exercise3:

Calculating consumption

$APC = \frac{C}{Y} = 0.95 \Longrightarrow$ C=0.95(400) = 380

2- Calculating the marginal propensity to save:

We calculate the marginal propensity to consume first:

$$\Delta C = 4336.6 - 4037.5 = 329.1$$

ΔY_d= 498

$$MPC = \frac{\Delta C}{\Delta Y_d} = 0.66$$

MPS = 1 – MPC =0.34

- Calculating income, consumption and saving

$$APS = \frac{S}{Y} = 0.22$$

$0.22 = \frac{-180+0.4Y}{Y} \Rightarrow$

$0.18Y = 180 \Rightarrow Y = \frac{180}{0.18} = 1000$

S= -180 + 0.4 Y_d ⇒ C= -180+0.4(1000) = 220

C=180 + 0.6 Y_d ⇒ C=180+0.6(1000)

<u>Exercise4 :</u>

1. **The future value Pn of a present amount P0 :** $P_n=P_0(1+i)^n$
   P4=2000(1+0.1)^4=2928.2 DZD
2. **The present value P0 of a future amount Pn: $P_o = P_n(1+r)^{-n}$**

P_4= 1000 (1+0.08)$^{-4}$ = 1000 × 0.735= 735 **DZD**

The factor $(1+r)^{-n}$ is typically obtained from Financial Table No. 1, at the intersection of the row corresponding to the number of periods n and the column representing the discount rate r.

3. **To calculate the present value V_0 of multiple future amounts Pn :**

- **Equal returns (P1=P2=P3=⋯= Pn)**

$V_o = \frac{P_n}{r}\left[1 - \frac{1}{(1+r)^n}\right]$

$\frac{1}{r}\left[1-\frac{1}{(1+r)^n}\right]$ ***represents the present value of 1 DZD received annually at the end of each year for n years at a discount rate r. This value is typically obtained from Financial Table No. 2.***

$$V_o = \frac{4000}{0.06}\left[1-\frac{1}{(1+0.06)^4}\right] = 4000(3.465) = 13860$$

r=8%

$$V_o = \frac{4000}{0.08}\left[1-\frac{1}{(1+0.08)^4}\right] = 4000(3.312) = 13248$$

r=12%

$$V_o = \frac{4000}{0.12}\left[1-\frac{1}{(1+0.12)^4}\right] = 4000(3.037) = 12148$$

There is an inverse relationship between the discount rate (interest rate) and the present value of expected future cash flows. As the discount rate decreases, the present value of future returns increases, making the investment more profitable. This explains the negative relationship between the interest rate and the value of an investment.

4. To determine the investment decision using the **Net Present Value (NPV)** criterion, we must first calculate the **present value of the total revenues (V_0)**. Since the annual revenues are equal :

$V_o=P_1(1+r)^{-1}+P_2(1+r)^{-2}+P_3(1+r)^{-3}$

$V_o=30000(1.15)^{-1}+30000(1.15)^{-2}+30000(1.15)^{-3}$

$V_o=30000(0,87)+30000(0,756)+30000(0,658)$

Or we use alternatively, the **shortcut annuity formula:**

$$V_o = \frac{P_n}{r}\left[1-\frac{1}{(1+r)^n}\right] = \frac{30000}{0.15}\left[1-\frac{1}{(1+0.15)^3}\right]$$

$$V_o = 30000\ (2.283) = 68490$$

$VAN=V_o - I_o$

VAN=68490 – 70000 = -1510 < 0

Since the **NPV is negative**, the investment in purchasing this machine is considered **unprofitable** for the firm. Therefore, it is better **not to proceed with the purchase**.

Exercise5:

Note 1 : According to the Net Present Value (NPV) criterion, acceptable projects are those for which the NPV is positive. Among all alternatives, the project with the highest positive NPV is considered the most favorable.

1- The Net Present Value is calculated as follows:

$NPV=V_0-I_0$

Project 01:

$\mathbf{V_0}= 6500/(1+0.6)^1 +7300/(1.06)^2 +7200/(1.06)^3 +(40000*0.4)/(1.06)^3$

V_0=32019.19

NPV = 32019.19 -40000 = - 7980.81 <0

Project 02:

$\mathbf{V_0}= 5000/(1+0.6)^1 +6000/(1.06)^2 +5400/(1.06)^3 +(28000*0.3)/(1.06)^3$

V_0=21643.69

NPV = 21643.69 -28000 = - 6356.31 <0

Project 03:

$\mathbf{V_0}= 5000/(1+0.6)^1 +5200/(1.06)^2 +5500/(1.06)^3 +(20000*0.55)/(1.06)^3$

V_0=23198.68

NPV = 23198.68 -20000 = + 3198.68 >0

Project 04:

$\mathbf{V_0}= 9500/(1+0.6)^1 +11000/(1.06)^2 +10500/(1.06)^3 +(50000*0.6)/(1.06)^3$

V_0=52756.79

NPV = 52756.76 -50000 = +2756.76 > 0

2- Since: NPV3> NPV4 Project 3 is the best project, as it produces the highest positive NPV among all alternatives.

Exercise6:

1. Calculating the Marginal Efficiency of Capital (MEC) for Each Machine

Machine 1: Calculation of the Annual Net Return

Description	**Value**
Total Revenue = 3000 units × 2.4	7200
(-) Operating Costs	1350
(-) Annual Depreciation = 30000 ÷ 12	2500
Profit Before Tax = Total Revenue − (Operating Costs + Depreciation)	**3350**
(-) Income Tax = 40% × 3350	1340
Profit After Tax = Profit Before Tax − Tax	**2010**
(+) Depreciation	2500
Annual Net Cash Flow	**4510**

Since the annual cash flows are equal over the machine's lifespan, the marginal efficiency of capital is calculated as follows:

$V_0 = I_0 \iff 30000 = 4510\left[\frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)\right]$

$$\left[\frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)\right] = \frac{30000}{4510}$$

$$\frac{1}{r}\left(1 - \frac{1}{(1+r)^{12}}\right) = 6,65$$

From the financial tables (02) , the implied rate of return is approximately 10 %.

Machine 2 : Since the annual cash flows are equal over the machine's economic life, the marginal efficiency of capital is calculated as follows:

$$22000 = 4903\left[\frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)\right]$$

$$\frac{22000}{4903} = \left[\frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)\right]$$

$$4.487 = \frac{1}{r}\left(1 - \frac{1}{(1+r)^{12}}\right)$$

From the financial tables, the implied rate of return is approximately 15 %.

Since this rate of return is greater than the prevailing market interest rate of 13 percent, the investment is considered acceptable.

Therefore, it is recommended that the investor choose the second machine.

Exercise7:

Finding the aggregate demand function

D=C+I

D= 40+0.8yd+60 D= 100+0.8yd

2- the saving function

$S = Y_d - C$

$C = C_0 + bY_d$ / $Y = Y_d$

$S = Y_d - C_0 - b\,Y_d$

S = -C0 + (1 – b) Yd

S=-40+0.2Yd

- aggregate supply /aggregate demand

Y=D⇒y= C+I

y=Co+byd+ Io⇒

y=Co+by+ Io⇒

y- by=co+ Io⇒

y(1-b) =co+Io⇒

ye=$\frac{C_0 + I_0}{1-b}$ ⇒ $ye = \frac{40+60}{1-b} = 500$

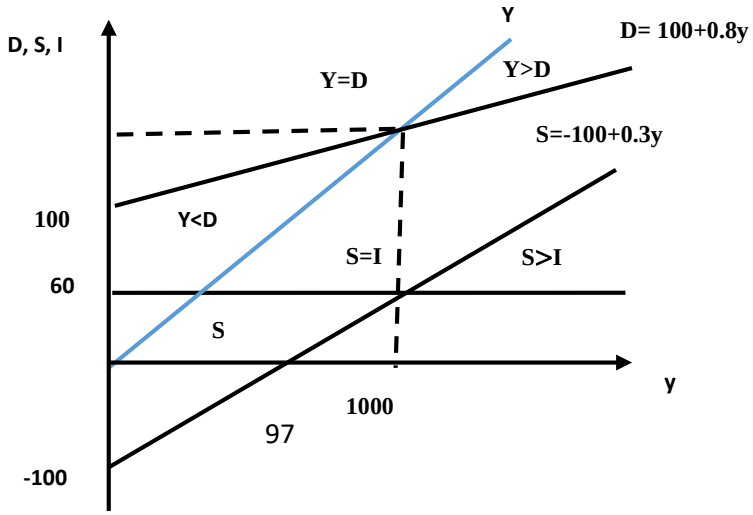
- investment/saving

S=I⇒-Co+(1-b)y= Io

y(1-b) =co+Io⇒

ye=$\frac{C_0 + I_0}{1-b}$ ⇒ $Ye = 500$

4- Graphical representation



5- A decrease in investment by 10 means ΔI= -10

$$K_{\mathrm{I}} = \frac{1}{1-\mathrm{b}} = \frac{1}{1-0.8} = 5$$

Δy = KIΔI = 5 × -10 =-50

Y'=500-50=450

The decrease of investment led to a fall in the income to 450.

6- Increase in consumption by 40 means Δc= 40

$$K_{\mathrm{C}} = \frac{1}{1-\mathrm{b}} = \frac{1}{1-0.8} = 5$$

Δy = KIΔC = 5 × 40 = 200

Y'=500+200=700

Increased consumption led to an increase in income to 700

Exercise8:

1/ To calculate the value of the dynamic multiplier for 4 periods (it is sufficient to calculate $\mathbf{K_{det+4}}$ but for clarification we calculate $\mathbf{K_{de}}$ for one period, two periods and three periods)

The dynamic multiplier of n periods estimated at:

$\mathrm{K}d_e = 1 + b + b^2 + \cdots + b^{n-1} = \frac{1}{1-b}$

The change in income is estimated at:$\mathrm{Kd}_{\mathrm{de\,t+n}} = \frac{\Delta \mathrm{y_{t+n}}}{\Delta \mathrm{I}} \Rightarrow \Delta \mathrm{y_{t+n}} = \mathrm{Kd_e}\Delta \mathrm{I}$

the dynamic multiplier of one Single period $\mathrm{Kd}_{\mathrm{e}_{t+1}}$ Estimated at:

$$\mathrm{Kd}_{\mathrm{e}_{t+1}} = \frac{\Delta \mathrm{y}}{\Delta \mathrm{I}} = 1 \Rightarrow \Delta \mathrm{y}_{t+1} = 1\,.\,\Delta I = 10$$

the dynamic multiplier of two periods is estimated at$\mathrm{Kd}_{\mathrm{e}_{t+2}}$:

$\mathrm{Kd}_{e_{t+2}} = 1 + \mathrm{b} \Rightarrow \mathrm{Kd}_{e_{t+2}} = 1 + 0{,}75 = 1{,}75$

$\Delta y_{t+2} = \mathrm{Kd}_{e_{t+2}}\, \Delta I \;\Rightarrow\; \Delta y_{t+2} = 1{,}75\ (10) = 17{,}5$

the dynamic multiplier of 3 periods is estimated at $\mathrm{Kd}_{e_{t+3}}$:

$\mathrm{Kd}_{e_{t+3}} = 1 + \mathrm{b} + \mathrm{b}^2 \Rightarrow \mathrm{Kd}_{e_{t+3}} = 1 + 0{,}75 + (0{,}75)^2 = 2{,}312$

$\Delta y_{t+3} = \mathrm{Kd}_{e_{t+3}}\, \Delta I \;\Rightarrow\; \Delta y_{t+3} = 2{,}312\ (10) = 23{,}12$

the dynamic multiplier of 4 periods is estimated at $\mathrm{Kd}_{e_{t+4}}$:

$\mathrm{Kd}_{e_{t+4}} = 1 + \mathrm{b} + \mathrm{b}^2 + \mathrm{b}^3 \Rightarrow \mathrm{Kd}_{e_{t+4}} = 1 + 0{,}75 + (0{,}75)^2 + (0{,}75)^3 = 2{,}73$

$\Delta y_{t+4} = \mathrm{Kd}_{e_{t+4}}\, \Delta I \;\Rightarrow\; \Delta y_{t+4} = 2{,}73\ (10) = 27{,}3$ ون

To solve the unemployment problem, income must be increased by 27.3%.

2/ The difference between the static multiplier and the dynamic multiplier:

Dynamic Multiplier	**Static Multiplier**
Takes time into account and assumes a slowdown period in spending.	- The time element is neglected and it is assumed that there is no lag or interval between the income assets and their expenditure.
The relationship between **C** and **yd is non-concurrent relationship** $C_t = \int (y_{t-1})$	- The relationship between C and yd is a **concurrent relationship**
Calculates the indirect change in the income.	- Calculates the final (direct) change in the income.

Exercise9:

Equilibrium income calculation y = D

y = C + I

y = Co + by + I0

y – by = C0 + I0

$y_e = \frac{C_0 + I_0}{1-b} = \frac{1000+200}{1-0,6} \Rightarrow$ye = 3000

1- Consumption and Savings Balance Calculation:

Ce = 1000 + 0.6 (3000) = 2800

Se = y – C = 3000 – 2800 = 200

3- Determine the state of the economy and calculating the gap:

It is noted that the achieved equilibrium income is greater than the potential income or full employment income, which means that the economy of this country suffers from an inflationary gap.

Inflationary gap =$\frac{\boldsymbol{Output\ gap}}{\boldsymbol{multiplier}}$ where:$K_e = \frac{1}{1-b} = \frac{1}{1-0.6} = 2.5$

I. Gap $= \frac{y_F - y_e}{K_e} = \frac{2800-3000}{2,5} = -80\ u$

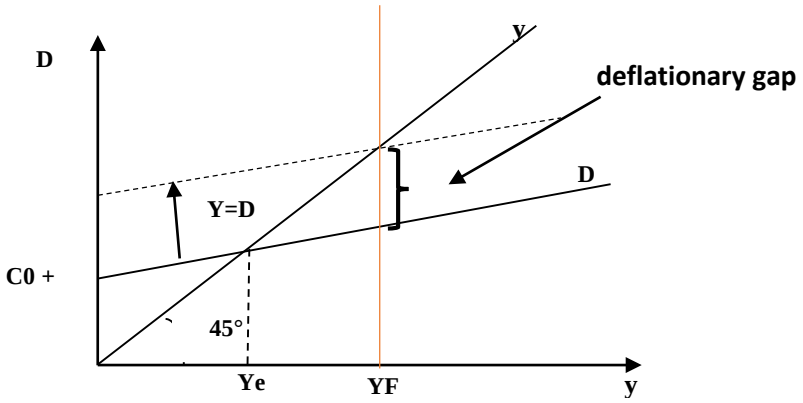
There is an excess of aggregate demand estimated at 80, which must be pull it out from the economy to return to full employment.

2- Definition of the inflationary gap and the deflationary gap and how to treat it:

- Deflationary gap: It is the amount of necessary spending that must be injected to bring the economy to full employment; it occurs when Y_F>Ye, and is calculated by the following relationship:

Deflationary gap = output gap / multiplier= $\frac{\mathbf{YF-Ye}}{\boldsymbol{Ke}}$

Graphic representation of the deflationary gap:



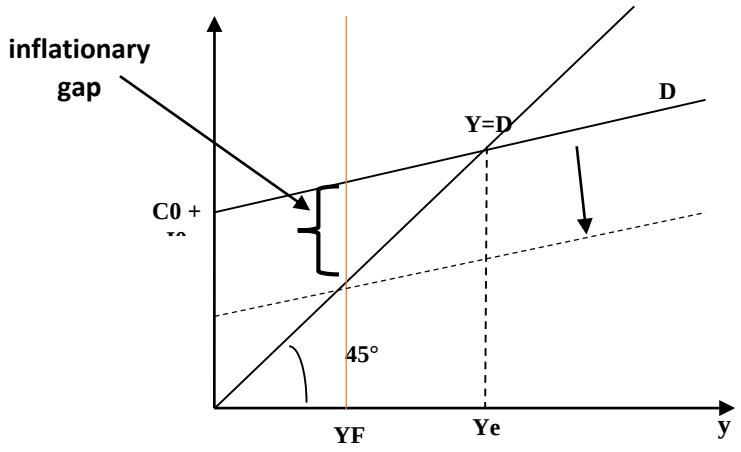
The treatment of the deflationary gap is by the injection of additional demand into the economy through the implementation of an expansionary fiscal and monetary policy (increasing government spending and reducing taxes and interest rates), which leads to the D curve moving upward.

- **Inflationary gap:**

It is the amount of spending that must be pull out to return the economy to full employment; it occurs when $Ye>Y_F$ is calculated by the following relationship:

Deflationary gap = output gap / multiplier **Gap=**$\frac{\mathbf{YF-Ye}}{\boldsymbol{Ke}}$

Graphic representation of the inflationary gap:



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 (reducing government spending and raising taxes and interest rates), which leads to a shift in the demand D curve down.

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