Democratic and Popular Republic of Algeria

Ministry of Higher Education and Scientific Research

University of Setif 1 - Ferhat Abbas

Faculty of Economics, Commerce & Management Sciences

Principles of Macroeconomics

Course Handout

2nd Year Finance and Accounting

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Preface

Macroeconomics investigates economic phenomena at the aggregate level, specifically focusing on the overall economic scenario of a country. This entails a thorough examination of various economic activities, including consumption, investment, and saving. The analysis extends to entities participating in these activities, such as households, businesses, government, and international relationships. By scrutinizing the levels and fluctuations of these activities, macroeconomics aims to identify critical issues and obstacles impeding economic development, such as unemployment, inflation, and recession.

Macroeconomics also seeks to propose effective solutions through economic policy interventions, drawing on classical and Keynesian theories. This module comprises a series of lectures tailored for second-year students in economic, commercial, and management sciences. The content aligns with the curriculum established by the Algerian Ministry of Higher Education and Scientific Research.

Course definition:

This module aims to provide a comprehensive introduction to the primary theoretical and practical foundations of macroeconomic analysis. The course is structured around two key components:

1. **Theoretical Course Sessions**: These sessions will delve into the core areas of macroeconomic analysis within a unified analytical framework. Emphasis will be placed on elucidating the significance of concepts in the analysis and formulation of public policies.

2. **Practical In-Depth Sessions**: This segment will involve exercises and student presentations, offering hands-on experience and familiarity with contemporary issues such as economic crises, unemployment, inflation, and more.

Upon completion of this module, students will possess a solid understanding of macroeconomic principles, enabling them to proficiently analyze and address challenges in the field of macroeconomics.

Prerequisites:

Students are expected to possess fundamental knowledge of economic thought and the concepts of microeconomics. This foundation is essential to differentiate between macroeconomic and microeconomic analyses.

Course objectives:

- Define fundamental concepts in macroeconomics.
- Acquire proficiency in utilizing tools and aggregates for measuring economic activity.
- Comprehend the interconnections among various actors in the economic circuit.
- Analyze key considerations in economic policies.
- Interpret and analyze major macroeconomic imbalances.
- Introduce students to Keynesian macroeconomics, including its principles, foundations, and theories.
- Identify key instruments of economic policy.

- Empower students with the skills to construct a comprehensive macroeconomic analysis.

Skills and Learning Outcomes (Expected Skills and Attitudes) :

- Proficiently grasp the fundamental concepts and phenomena in macroeconomics.
- Demonstrate a clear understanding of the interactions among various actors in the economic circuit.
- Recognize the primary instruments utilized in economic policy.
- Acquire knowledge about the characteristics and challenges associated with foreign trade.

Content of the course:

Chapter 1. Introduction to Macroeconomics (Basic Concepts of Macroeconomics)

Chapter 2. National Income

Chapter 3. Consumer Price index (CPI)

Chapter 4. Circular Flow of Income

Chapter 5. The classical model of Income output and employment

Chapter 6. Keynesian Theory of Income, output and employment

Chapter 7: Equilibrium in a two-sector Keynesian model

Chapter 8: Changes in Equilibrium Level and the Multiplier Theory

Chapter 9: Equilibrium in a three & four-sector Keynesian model

Chapter 10: Equilibrium in the Goods and Services Market and in the Money Market (ISLM Model)

Chapter 11. Changes in the IS-LM model according to the fiscal and monetary policies

Chapter 1. Introduction to Macroeconomics (Basic Concepts of Macroeconomics)

1. Introduction

Economics is the study of the allocation of SCARCE resources to meet unlimited human wants. In other words, economics is the study of human behavior as it pertains to the material well-being of people (as either individuals or societies).

It is the organized examination of how, why and for what purposes people conduct their day-today activities, particularly as relates to the production of goods and services, the accumulation of wealth, earning incomes, spending their resources, and saving for future consumption.

2. Major Economic Problems

Economic problem is caused by the scarcity of means at our disposal and the multiplicity of ends we seek to achieve. The economic problem lies in making the best possible use of our resources so as to get maximum satisfaction in case of a consumer and maximum output or profit for a producer

3. Macro Vs. Micro economics

Economics can be classified into two general categories: Microeconomics and Macroeconomics.

Microeconomics: It is the study of how individual households and firms make decisions and how they interact with one another in markets. In other words, microeconomics is concerned with the behavior of individuals or groups organized into firms, industries, unions, and other identifiable agents.

“Macro Economics deals with the functioning of the economy as a Whole” (Shapiro)

Macroeconomics: It is concerned with the aggregate performance of the entire economic system.

Unemployment, inflation, growth, balance of trade, and business cycles are some topics that are discussed under macroeconomics.

Macroeconomics deals with the economy as a whole. It studies the behavior of economic aggregates such as aggregate income, consumption, investment, and the overall level of prices.

4. Importance of Macro Economics

It explains the working of the economy as a whole and how the level of national income and employment is determined

It helps us understand the functioning of a complicated modern economic system.

It examines the aggregate behavior of macroeconomic entities like firms, households and the government.

It is very useful to the planner, for preparing economic plans for the country's development.

Its knowledge is indispensable for the policy-makers for formulating macro-economic policies such as monetary policy, fiscal policy, industrial policy, exchange rate policy, income policy, etc.

It explains the interrelationship among macroeconomic variables, such as price level, income, output and employment.

5. Scope of Macro Economics

Macroeconomics studies the concept of national income, its methods and measurement.

Macroeconomics studies the problems related to employment and unemployment.

It is also concerned with the problems of economic fluctuations, inflation or deflation, international trade and economic growth, etc.

Macroeconomics studies functions of money and theories relating to it. Banks and other financial institutions are also a part of its study.

6. key macro-economic variables

macroeconomics deals with many topics, amongst, we will briefly deal with the following: Unemployment, Inflation, Economic growth, National Income

International Trade, Balance of Payment, Monetary Policy, Fiscal Policy, Interest Rate, Exchange Rate

6.1. Unemployment

Unemployment refers to the situation where the population of a country do not find work to earn their livelihood.

Unemployment represents that ratio of labor force which fails to get employment.

The unemployment rate is a key indicator of the economy's health.

The existence of unemployment seems to imply that the aggregate labor market is not in equilibrium.

The Unemployment Rate: to be unemployed, a person must want to work and be actively looking for a job (but have not yet found one)

The labor force consists of those who are employed and those who are unemployed

The unemployment rate is equal to the number of unemployed people divided by the labor force

6.2. Inflation

Inflation is an increase in the overall price level.

Hyperinflation is a period of very rapid increases in the overall price level. Hyperinflations is a rare phenomenon

Deflation is a decrease in the overall price level. Prolonged periods of deflation can be just as damaging for the economy as sustained inflation.

When the general price level rises, each unit of currency buys fewer goods and services. Thus, inflation results in loss of value of money. Another popular way of looking at inflation is "too much money chasing too few goods".

Inflation is caused when goods and services are in high demand, creating a drop in availability. Consumers are willing to pay more for the items they want.

6.3. Output and Economic Growth

Growth refers to change in the level of economic activity from one year to another year.

Economic growth is the increase in the market value of the goods and services produced by an economy over time.

Aggregate output is the total quantity of goods and services produced in an economy in a given period. The aggregate output is the main measure to see how well an economy is doing.

6.4. National Income

National Income is the total value of all goods and services produced within a nation over a specified period of time, representing the sum of wages, profits, rents, interest and pension payments to residents of the nation.

It gives correct picture of the economy and purchasing power of people in the country.

6.5. International trade

International trade is the exchange of goods and services between countries. This type of trade gives rise to a world economy, in which prices, or supply and demand, affect and are affected by global events.

International trade allows to expand markets for both goods and services that otherwise may not have been available to all. It is the reason why you can pick between a Japanese, German or American car.

As a result of international trade, the market contains greater competition and therefore more competitive prices, which brings a cheaper product home to the consumer.

6.6. Balance of Payment

The balance of payments (BOP) of a country is the record of all economic transactions between the residents of a country and the rest of the world in a particular period (over a quarter of a year or more commonly over a year).

These transactions are made by individuals, firms and government bodies. Thus the balance of payments includes all external visible and non-visible transactions of a country during a given period, usually a year.

It represents a summation of country's current demand and supply of the claims on foreign currencies and of foreign claims on its currency.

6.7. Monetary policy

Monetary policy is the process by which the monetary authority of a currency controls the supply of money, often targeting an inflation rate or interest rate to ensure Price stability and general trust in the currency.

Further goals of a monetary policy are usually to contribute to economic growth and stability, to low unemployment, and to predictable exchange rates with other currencies.

6.8. Fiscal Policy

Fiscal policy is the means by which a government adjusts its spending levels and tax rates to monitor and influence a nation's economy.

It is the sister strategy to monetary policy through which a central bank influences a nation's money supply. These two policies are used in various combinations to direct a country's economic goals.

6.9. Interest Rate

• An interest rate is the rate at which interest is paid by borrowers (debtors) for the use of money that they borrow from lenders (creditors). Specifically, the interest rate is a percentage of principal paid a certain number of times per period for all periods during the total term of the loan or credit.

6.10. Exchange Rate

The Exchange Rate between two currencies is the rate at which one currency will be exchanged for another. It is also regarded as the value of one country's currency in terms of another currency.

National Incomer currency.

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EXERCISES

Part1: Answer the following questions:

Q1. What is the difference between macroeconomics and microeconomics?

Q2. What is the example of Microeconomics and Macroeconomics?

Q3. How do Microeconomics and Macroeconomics are interrelated?

Q4. What are the two fields of Economics?

Part2: Choose the right answer:

1. **Which person makes macroeconomic decisions?**

A. a bank manager
B. a government finance minister
C. a shareholder in a firm
D. a worker

2. **Microeconomics focuses on the study of:**

A. The overall economy and its output
B. Individual consumers and firms
C. Government policies and regulations
D. Global trade and international relations

3. **Macroeconomics deals with the:**

A. Detailed analysis of individual markets
B. Interactions between individual consumers and firms
C. The behavior of the overall economy
D. Microscopic factors influencing economic decisions

4. **Microeconomics analyses:**

A. The overall economic growth and development of a country
B. The behavior of industries and firms
C. The impact of fiscal and monetary policies on the economy
D. The relationships between different countries' economies

5. **Which area of economics is concerned with the overall performance and behavior of the entire economy?**

A. Microeconomics
B. Macroeconomics
C. International economics
D. Environmental economics

SOLUTIONS & ANSWERS

Part1:

Q1. What is the difference between macroeconomics and microeconomics?

Microeconomics is the study of economics at an individual, group, or company level. Whereas, macroeconomics is the study of a national economy as a whole. Microeconomics focuses on issues that affect individuals and companies. Macroeconomics focuses on issues that affect nations and the world economy.

Q2. **What is the example of Microeconomics and Macroeconomics?**

Unemployment, interest rates, inflation, GDP, all fall into Macroeconomics. Consumer equilibrium, individual income and savings are examples of microeconomics.

Q3. **How do Microeconomics and Macroeconomics are interrelated?**

Microeconomics and macroeconomics are interrelated as both the strategies focus on improving the economy of their certain fields and branches.

Q4. **What are the two fields of Economics?**

The field of economics is divided into microeconomics, i.e., the study of individual markets, and macroeconomics, i.e., the study of the economy as a whole.

Part2: Choosing the right answer:

1. **Which person makes macroeconomic decisions?**

Answer is: B. a government finance minister

2. **Microeconomics focuses on the study of:**

Answer is: B. Individual consumers and firms

3. **Macroeconomics deals with the:**

Answer is: C. The behavior of the overall economy

4. **Microeconomics analyses:**

Answer is: B. The behavior of industries and firms

5. **Which area of economics is concerned with the overall performance and behavior of the entire economy?**

Answer is: B. Macroeconomics

CHAPTER 2. NATIONAL INCOME

Lecture Plan

Introduction to National Income

Concepts of National Income

Real and Nominal GDP

Methods for Measuring National Income

Uses of National Income Data

Difficulties in Measurement of National Income

Learning objectives

To understand various concepts of national income, like GDP, GNP, NDP and NNP.

To understand the different methods of measuring National Income.

To understand the importance of national income calculations.

To understand the difficulties involved in the calculation of national income.

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1. Definition

National income is defined as the money value of all the **final** goods and services produced in an economy during an accounting period of time, generally one year. (Accounting Year= 1st April-31st March)

2. Gross Domestic Product (GDP) (Produit Intérieur Brut PIB)

GDP is the sum of money values of all final goods and services produced within the domestic territories of a country during an accounting year. **GDP =C+I+G+(X-M)**

- **GDP at market price:** includes the final value of goods and services also includes **indirect taxes** and excludes the **subsidies** given by the government.
- **GDP at factor cost** is the money value of final goods and services based on the cost involved in the process of production.
- **Gross Domestic Product at factor cost** = GDP at Market Prices –Indirect Taxes+ Subsidies
- = GDPmp – (Indirect Taxes- Subsidies) = GDPmp – (**Net** Indirect Taxes)

3. Gross National Product (GNP) (Produit National Brut (PNB)

Gross National Product (GNP) is the aggregate final output of citizens and businesses of an economy in a year.

GNP may be defined as the sum of Gross Domestic Product and **Net Factor Income from Abroad (NFIA)**.

GNP = GDP + NFIA

GNP = C+I+G+(X-M)+NFIA

3.1. Net Factor Income from Abroad (NFIA):

Net factor income from abroad is used to differentiate between **National** income and **Domestic** income. By adding NFIA to domestic income, we get national income.

NFIA = Factor income earned from abroad by residents – Factor income of non-residents in domestic territory.

3.2. Components of Net Factor Income from Abroad (NFIA):

Following are its three main components:

- **Net compensation of employees:** Income from work can be earned by working in the domestic territories of other countries earning thereby wages and salaries (or compensation of employees)
- **Net income from property and entrepreneurship (rent, interest, profit).** by owning property (Like buildings, shops, factories, financial assets like bonds and shares in foreign countries) earning thereby rent and interest. Also, profit is earned for undertaking entrepreneurial activities of producing goods and services.
- **Net retained earnings of resident companies abroad.** Retained earnings of a company are in fact its undistributed profit

Net factor income = Net compensation of employees + Net income from abroad from property and entrepreneurship + Net retained earnings of resident companies abroad.

Example

Suppose in 2018-2019, Algerian resident scientists, engineers, doctors, masons, carpenters, etc. employed abroad earned factor income of 10,000 DZD whereas similar payments made to non-resident workers employed in domestic territory of Algeria was to the tune of 8,000 DZD.

***Net compensation of employees from abroad** to Algeria would be 2,000(= 10,000-8,000) DZD.

• Suppose in 2018-2019, normal residents of Algeria living temporarily abroad earned 25,000 DZD by way of rent, interest and profit and similar payments made to the rest of world were, say 20,000 DZD.

***Net income from property and entrepreneurship from abroad** would be 5,000 (= 25,00020,000) DZD.

• Suppose in 2018-2019, Algerian companies working abroad, after paying profit tax and distributing dividend out of their total profits, retained the balance profit (known as Reserve or Undistributed profit) of 50,000 DZD and foreign companies in Algeria retained similar profit of 65,000 DZD.

***Net retained earnings of resident companies abroad** would be -15,000 (= 50,000-65,000) DZD.

From the above-mentioned data, Net factor income from abroad in 2018-2019 would be equal to 8,000 DZD [= 2,000 + 5,000 + (-15,000)].

4. Net Domestic Product (NDP) and Net National Product (NNP) (Produit Intérieur Net (PIN) & *Produit national net PNN*)

Net Domestic Product = GDP-Depreciation

Net National Product (NNP) = GDP–Depreciation +NFIA, OR

NNP = GNP – Depreciation = C+I+G+(X–M) – Depreciation + NFIA

NNP is the actual addition to a year's wealth and is the sum of consumption expenditure, government expenditure, net foreign expenditure, and investment, less depreciation, plus net income earned from abroad.

NNP at Factor Cost is the sum total of income earned by all the people of the nation, within the national boundaries or abroad. It is also called National Income.

NNP at Factor Cost (NNP_{FC}) = NNP at Market Prices –Indirect Taxes+ Subsidies

5. Per Capita Income & Personal Income

- **Per capita income** is the average income of the people of a country in a particular year.

Per Capita Income = National Income / Total Population

- **Personal income** is the total income received by the individuals of a country from all sources before direct taxes in one year.

Personal Income = National Income –Undistributed Corporate Profits – Corporate Taxes – Social Security Contributions + Transfer Payments + Interest on Public Debt

Personal Disposable Income is the income which can be spent on consumption by individuals and families.

Personal Disposable Income = Personal Income – Personal Taxes

6. Real GDP and Nominal GDP

- Nominal GDP = National income estimated at the prevailing prices (current prices).
- Real GDP=National income measured on the basis of some fixed price, say price prevailing at a particular point of time, or by taking a base year, is known as national income at constant prices, or Real GDP

GDP Deflator =Nominal GDP X 100 / Real GDP

GDP deflator (*Déflateur du PIB*) is the ratio of nominal GDP in a year to real GDP of that year

GDP deflator measures the change in prices between the base year and the current year.

7. GDP and Economic Well-Being

GDP is the best single measure of the economic wellbeing of a society.

GDP per person tells us the income and expenditure of the average person in the economy.

- Higher GDP per person indicates a higher standard of living.
- GDP is not a perfect measure of the happiness or quality of life, however.
- Some things that contribute to well-being are not included in GDP:
  - The value of leisure.
  - The value of a clean environment.
  - The value of almost all activity that takes place outside of markets, such as the value of the time parents spend with their children and the value of volunteer work.

8. Methods of measuring national income

There are three methods to measure the national income: Product (or Output) Method, Income Method & Expenditure Method

8.1. Product (or Output) Method

Product method is also called Value Added Method or Industrial Origin Method. It is the market value of all the goods and services produced in the country by all the firms across all industries.

8.1.1. Steps of Value Added or Product Method:

Step 1: Identification and Classification of Producing Enterprises

a) Primary Sector: refers to that sector wherein goods are produced by exploiting natural resources

b) Secondary Sector: This is also called manufacturing sector. Enterprises of this sector transform one type of good into another type.

c) Tertiary Sector: provides services, and so is called service sector. It includes trade, hotels, transport and communication, financing, insurance.

- Services alone are provided by this sector.
- Public administration and defense and other services also form part of it.

Step 2: Estimation of Value Added

Value added is the difference between value of output of an enterprise and the value of its intermediate consumption (non-factor inputs).

Value added = Value of output - Intermediate consumption

• Value of Output= Sales + Change in stock (C.S – O.S)

• C.S: Closing stock

• O.S: Opening stock

8.1.2. Distinction between value of output and value added:

The difference between value of output and value added is intermediate consumption which is included in value of output but excluded from value added. Intermediate consumption means expenditures incurred on secondary inputs like raw materials, power, etc. by a producing unit.

Obviously, there is always possibility of **double counting** if value of intermediate consumption is not excluded from value of output.

Example of Estimating Value Added

Item Producing Enterprise	Value of Output	Cost of Intermediate Goods	Value Added
Farmer (*Fermier*)	600	200	400
Flour Mill (Moulin à farine)	800	600	200
Baker (Boulanger)	1000	800	200
Shopkeeper (*Commerçant*)	1200	1000	200
Total	3600	2600	1000

Value added may be of the following kinds:

- The total values added up. (GDP at market price)
- The indirect taxes are subtracted and the subsidies are added. (GDP at factor cost)
- Net value is calculated by subtracting **depreciation** from the total value (NDP at factor cost).

8.1.3. Limitations of Product Method

Problem of Double Counting: Unclear distinction between a final and an intermediate product.

Not Applicable to Tertiary Sector: This method is useful only when output can be measured in **physical terms**

Exclusion of Non-Marketed Products: (E.g. outcome of hobby)

Self-consumption of Output: Producer may consume a part of his production

8.2. Income Method

The net income received by all citizens of a country in a particular year, i.e. total of net rents, net wages, net interest and net profits. (GDP at factor cost).

It is the income earned by the factors of production of a country.

If we add the money sent by the citizens of the nation from abroad and deduct the payments made to foreign nationals (individuals and firms) we will get the GNP at factor cost or Gross National Income (GNI).

8.2.1. Process of calculation:

- Economy is divided on basis of income groups, such as wage/salary earners, rent earners, profit earners etc.
- Income of all the groups is added, including income from abroad and undistributed profits.

- The income earned by foreigners and transfer payments made in the year are subtracted.

GNI = Rent + Wage + Interest +Profit + Net Income from A21broad- Transfer payments

Step-I

Identification and classification of producing enterprises (Primary Sector, Secondary Sector, Tertiary sector)

STEP-II

Classification of ***factor income.*** Factor income: a factor income refers to income earned by a person as *a reward for rendering his factor services*.

Factor income are only earned incomes. It does not include that income which is not earned.

STEP-III

National income= sum of all the factor incomes

8.2.2. Classification of factor incomes

Compensation of employees: wages and salaries, payment in kind (PIK), employers' contribution to social security schemes, pension on retirement.

Operating surplus: it is the income from the *property and entrepreurship*. E.g. Rent, interest, profit etc

Mixed income= it refers to the income of the self-employed persons using their labor land capital.

8.2.3. Precautions while estimating factor income

- Transfer payment (Social Security, unemployment insurance, etc. are not included)
- Income from illegal activities
- Sale proceeds of second-hand goods
- The sale proceeds of shares and bonds are not included in national income
- Windfall gains (*Gains exceptionnels*) should not be included.
- Imputed rent (*Loyer fictif*) of owner houses is included in NI
- Indirect taxes like sales tax, excise duty (alcohol, tobacco...) tend to increase the market price of goods and services. These are included in the estimation of national income at market prices but are not added while calculating national income at factor cost
- Income tax is paid out of compensation of employees.[24]It should not be added separately in the estimation of national income.

8.2.4. Limitations of Income Method

- **Exclusion of non-monetary income:** Ignores the nonmonetized section of economic activities **(**The accounts only measure paid activities)
- **Exclusion of Non Marketed Services:** People undertake a particular activity that are difficult to ascertain (*difficile à déterminer*) in money value. E.g. mother's services to the family.
- **The 'black economy' is not included**. This is the name given to work that is not reported to the authorities.

8.3. Expenditure method

One man's income is another man's expenditure. Therefore, national income can be arrived at (calculated) by adding the total expenditure of individuals and business firms during a year

Expenditure or outlay on final products takes place in four ways:

- Expenditure by consumers on goods and services (Consumption Expenditure)
- Expenditure by entrepreneurs on capital or investment goods (Investment Expenditure)
- Expenditure by government on consumption and capital goods (Government Expenditure)
- Net Exports

The formula for this method is

$Y = C + I + G + (X-M)$

Here:

Y: stands for total expenditure **C:** stands for consumption expenditure

I: stands for investment expenditure **G:** stands for Government expenditure

(X-M) Difference between exports and imports

8.3.1. Limitations of the Expenditure method

- It Neglects Barter System (*Système de troc*).
- Ignores over consumption
- Affected by Inflation

8.3.2. Difficulties in the computation of National Income

- In backward economies like Algeria, particularly in the rural sector, the cultivators and small producers are illiterate and they do not keep books of account. This is a serious difficulty in the calculation of national income.
- Avoidance of double counting becomes complicated.
- Existence of non-monetized sector is dominant
- The village money lenders maintain absolute secrecy of their transactions

9. Uses of National Income Data

- National income is the most dependable indicator of a country's economic health.
- Difference between GDP and GNP indicates the contribution of net income earned abroad
- Necessary for Economic planning: useful aid in judging which sectors should be given more emphasis
- A measure of economic welfare.
- higher aggregate production implies more and more goods and services being available to people
- Helps in determining the regional disparities, income inequality and level of poverty in a country.
- Helps in comparing the situations of economic growth in two different countries.

Summary

- GDP is the sum of money values of all final goods and services produced within the domestic territories of a country during an accounting year. It can be measured at current or constant prices.
- GNP is the aggregate final output of citizens and businesses of an economy in one year. NNP is GNP less depreciation.
- The average income of the people of a country in a particular year is per capita income for that year.
- National income can be measured by product method, income method and expenditure method.
- National income accounting data are of utmost importance for the economy of any country; such data reveal the aggregate production of the economy and also help to determine the total expenditure and total income of that country.
- Difficulties in measuring national income include multiple counting, exclusion of non-market transacted services, self-consumption of output, inflation or deflation, confusion about informal sector, etc.
- National income is considered as a measure of economic welfare. As national income rises, the aggregate production of goods and services rises. Therefore, there is a positive relation between increase in national income and welfare.

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EXERCISES ON NATIONAL INCOME AND RELATED AGGREGATES

1. **Calculate NDP_{FC} from the following: (In USD)**

   i. Gross national product at MP 68,400

   ii. Depreciation 4,300

   iii. Indirect taxes 9,000

   iv. Subsidies 1,000

   v. Net factor income from abroad 1,340

2. **From the data given below, calculate:**

   (a) GDP_{MP} (b) NNP_{FC}

   (i) Net domestic products at MP 64,800

   (ii) Net Indirect taxes 6,833

   (iii) Net factor income from abroad (-) 32

   (iv) Depreciation 4,367

3. **Calculate Notional Income and GNP from the given data.**

Data	(In 100 Billion)
NDP_{MP}	114
Net indirect taxes	12
Consumption of fixed capital (depreciation)	13
Net factor income from abroad	-1

4. **Calculate NDPfc and NNPfc from the given data.**

Data	(In 100 Billion)
GNP_{MP}	200
Net factor income from abroad	-4
Depreciation	10
Indirect Taxes	20
Subsidies	4

5. **Calculate GNPfc and NDPmp from the given data.**

Data	(In 100 Billion)
Factor income received from abroad	20
Depreciation	30
Subsidies	10
Indirect Taxes	40
Factor income paid to abroad	30
NDP_{FC}	250

EXERCISES ON NATIONAL INCOME AND RELATED AGGREGATES -PART 2

1. **From the following data about a firm 'X' calculate gross value added at factor cost**

(i)	Gross national product at MP	68,400
(i)	Sales	500
(ii)	Opening stock	30
(iii)	Closing stock	20
(iv)	Purchase of intermediate products	300
(v)	Subsidy	40
(vi)	Purchase of machinery	150

2. **Calculate 'intermediate consumption' from the following data:**

(i)	Value of output	200
(ii)	Net Value added at factor cost	80
(iii)	Sales tax	15
(iv)	Subsidy	5
(v)	Depreciation	20

3. **Calculate 'Sales' from the following data:**

(i)	Net Value added at factor cost	300
(ii)	Intermediate consumption	200
(iii)	Indirect tax	20
(iv)	Depreciation	30
(v)	Change in slock	(-)50

ANSWERS OF EXERCISES ON NATIONAL INCOME AND RELATED AGGREGATES

Q.1. Calculate NDP_{FC} from the following: (In USD)

$NDP_{FC} = GNP_{MP}$-Depreciation-NFIA-I.T. +Subsidies

$NDP_{FC} = (i) - (ii) - (v) - (iii) + (iv)$

NDP_{FC}= 68,400-4,300-1,340-9,000 +1,000

$NDP_{FC} = 54{,}760$ USD

Q.2. From the data given above, calculate:

(a) GDP_{MP} (b) NNP_{FC} (in USD)

(i) GDP_{MP}= NDP + Depreciation

GDP_{MP}=(i) +(iv)

GDP_{MP}= 64,800= 4,367

GDP_{MP}= 69,167

(ii) $NNP_{FC} = NDP_{MP} + NFIA - NIT$

$NNP_{FC} = (i) + (iii) - (ii)$

NNP_{FC}= 64,800+ (-132) – 6,833

NNP_{FC}= 57,835 USD

Q.3. Solution:

We know that NNPfc = National Income

It can be calculated as:

NDPfc = NDPmp – Net Indirect Taxes

NDPfc = 114-12 = 102

NDPfc + NFIA = NNPfc

NNPfc =102+ (-1) = 101

GNPmp = NDPmp +Consumption of Fixed Capital+ NFIA

GNPmp = 114+13+ (-1) = 126

Q.4. Solution:

NDPfc = GNPmp – Depreciation – NFIA – Indirect Taxes + Subsidies

= 200 – 10 – (-4) -20 + 4

NDPfc = 178

NNPfc = NDPfc +NFIA = 178 + (-4) = 174

(NNPfc can also be calculated as = GNPmp Depreciation-Indirect Faxes +Subsides)

Q.5. Solution:

GNPfc = NDPfc + Depreciation+ Factor income received from abroad – Factor income paid to abroad

= 250 + 30 + 20 – 30

= 270

NDPmp = NDPfc + Indirect taxes – Subsidies

= 250 + 40 – 10 = 280.

ANSWERS -PART II

Q.6. From the following data about a firm 'X' calculate gross value added at factor cost

		(₹ in 000's)
(i)	Gross national product at MP	68,400
(i)	Sales	500
(ii)	Opening stock	30
(iii)	Closing stock	20
(iv)	Purchase of intermediate products	300
(v)	Subsidy	40
(vi)	Purchase of machinery	150

Ans.

Value of output = Sales + Change in Stock
(Closing stock–Opening Stock)

V.O.O. = (i) + {(iii)-(ii)}

V.O.O. = 500 + (20-30)

V.O.O. = 490 thousands

GVA_{MP}/GDP_{MP} = V.O.O. - Intermediate cost

GVA_{MP}/GDP_{MP} = 490-(iv)

GVA_{MP} = 490-300

GVA_{MP} = 190 thousands

GDP_{FC} = GDP_{MP}+Subsidy

GDP_{FC} = 190+(v)

GDP_{FC} = 190+40

GDP_{FC} = 230 Thousand

Q.7. Calculate 'intermediate consumption' from the following date:

(i)	Value of output	200
(ii)	Net Value added at factor cost	80
(iii)	Sales tax	15
(iv)	Subsidy	5
(v)	Depreciation	20

Ans.

NVA_{FC} = Value of output-Intermediate Consumption.-Net Indirect Tax depreciation

Intermediate Consumption = Value of output -NVA_{FC}-Net Indirect Tax depreciation

Intermediate Consumption = (i)-(ii)-(iii)+(iv)-(v)

Intermediate Consumption = 200-80-15+5-20

Intermediate Consumption = 205-115

Intermediate Consumption = 90

Q.8. Calculate 'Sales' from the following data:

(i)	Net Value added at factor cost	300
(ii)	Intermediate consumption	200
(iii)	Indirect tax	20
(iv)	Depreciation	30
(v)	Change in slock	(-)50

Ans.

$$NVA_{FC} = (\text{Sales} + \Delta \text{ Stock}) - \text{I.C.} - \text{NIT} - \text{dep}$$

$$(i) = \text{Sales} + (v) - (ii) - (iii) - (iv)$$

$$300 = \text{Sales} + (-50) - 200 - 20 - 30$$

$$300 = \text{Sales} - 300$$

$$\text{Sales} = 600$$

EXERCISES ON NATIONAL INCOME AND RELATED AGGREGATES -PART III

Exercise1:

Let us have a hypothetical economy that produces three commodities: A, B, and C. The following table provides the quantities produced (million units) and the price of each unit (DZD) during the years 2010 and 2012.

commodities	2010		2012	
	Price	Qty	Price	Qty
A	10	100	12	120
B	70	50	80	70
C	20	80	23	100

Questions:

1. Calculate the GDP at current prices for the two years? Then calculate the change rate between the two years? what do you notice?

2. Calculate the GDP at constant prices for the two years (considering 2010 as the base year)? Then calculate the change rate in it between the two years? what do you notice?

3. Calculate the GDP deflator (*le déflateur du PIB*) for the years 2010 and 2012, then calculate the real GDP?

Exercise2:

Let's have the following data about a country's economy during a particular year:

Government spending: 570 million DZD. Wages and salaries: 400 million DZD.

Household spending: 740 million DZD. Dividends: 260 million DZD.

Total investment: 300 million DZD. Income of owners: 200 million DZD.

Exports: 260 million DZD. Retained earnings: 190 million DZD.

Imports: 180 million DZD. Taxes on corporate profits: 120 million DZD.

Indirect taxes: 120 million DZD. Rent: 300 million DZD.

Production subsidies: 50 million DZD. Interests: 90 million DZD.

Capital depreciation: 60 million DZD. Net ownership of income from abroad: 100 million DZD.

Questions:

1. Calculate the Gross Domestic Product (GDP), the Gross National Product (GNB), and the Net National Product (NNP), using: expenditure method & income method.

2. Calculate the national income NI (*Revenue National RN*).

SOLUTIONS (NATIONAL INCOME AND RELATED AGGREGATES -PART II)

Exercise1:

Calculating the Gross Domestic Product at current prices (Nominal GDP) for the two years:

$$GDP_{N2010} = \sum(P_{2010} \times Q_{2010})$$

$$GDP_{N2012} = \sum(P_{2012} \times Q_{2012})$$

Commodities	2010			2012		
	P	Q	P*Q	Price	Qty	P*Q
A	10	100	1000	12	120	1440
B	70	50	3500	80	70	5600
C	20	80	1600	23	100	2300
GDP_{N2010}			6100	GDP_{N2012}		9340

We note that the nominal GDP increased by 3,240 in 2012 compared to 2010, as a result of the increase in **prices and quantities**.

Calculate the change rate (Growth Rate GR) in it between the two years? what do you notice?

$$GR = \%\,\Delta GDPn = \frac{GDPn\ (\text{Current}) - PIBn\ (\text{Base})}{PIBn\ (\text{base})} \times 100$$

$$GR = \frac{GDPn2012 - GDPn2010}{GDPn2010} \times 100 = \frac{9340 - 6100}{6100} \times 100 = 53{,}11\,\%$$

We note that the nominal GDP increased in 2012 by 53.11% compared to the 2010 GDP.

Calculating the GDP at constant prices for the two years (considering 2010 as the base year)?

$$GDP_{R2010} = \sum(P_{2010} \times Q_{2010}) = GDP_{N2010} = 6100$$

$$GDP_{R2012} = \sum(P_{2010} \times Q_{2012}) = 10(120) + 70(70) + 20(100) = 8100$$

We notice that the real GDP increased by 2000 DZD in 2012 compared to 2010, due to the increase in quantities only because prices are fixed.

Calculating the change rate in it between the two years? what do you notice?

$$GRr = \frac{GDPr2012 - GDPr2010}{GDPr2010} \times 100 = \frac{8100 - 6100}{6100} \times 100 = 32{,}78\,\%$$

We note that the real GDP rose in 2012 by 32.78% compared to the 2010 GDP, which is less than the nominal growth rate, because the real GDP (evaluated at constant prices) excludes the effect of inflation.

Calculating the GDP deflator for the years 2010 and 2012, then calculate the real GDP?

Year 2010: GDP deflator$=\frac{GDPn_{2010}}{GDPr_{2010}} * 100\% = \frac{6100}{6100} * 100\% = \mathbf{100}\%$

Year 2012: GDP deflator$=\frac{GDPn_{2012}}{GDPr_{2012}} * 100\% = \frac{9340}{8100} * 100\% = \mathbf{115.3}\ \%$

Calculating the real GDP 2012:

$GDPr_{2012} = \frac{GDPn_{2012}}{\text{GDP deflator}} * 100\% = \frac{9340}{\mathbf{115.3}\ \%} * 100\% = \mathbf{8100}$

Exercise2:

Calculating both the Gross Domestic Product (GDP), the Gross National Product (GNB), and the Net National Product (NNP):

Income Method:

A- Calculating the Domestic Income (Net Domestic Product at factor cost)

Y= Yw + Yi + YR + **YP**

Y = 400+90+300+(**200+260+120+190**) =1560

B- Calculating GDP (at market price):

GDP = Yw + Yi + YR + YP + **D + Indirect Taxes- Subsidies** = 1560 + 60 + 120 - 50=1690

C- Calculating the Gross National Product:

GNP = GDP + NFIA

GNP = 1690 + 100 = 1790

NNP = GNP – **D** =1790 -60 = 1730

Expenditure Method

A- Calculating Domestic Income (Net Domestic Product at factor cost)

GDP = C + I + G + (X - Z)

GDP = 740 + 300 + 570 + (260 - 180) = 1690

B- Calculating GNP:

GNP = GDP + NFIA

GNP = 1690 + 100 = 1790

C- Calculating the Net National Product:

NNP = GNP – **D** =1790 -60 = 1730

2. Calculate the National Income NI (Revenue National RN).

National Income is the Net National Product at factor cost, i.e.:

NI=NNPfc

NI = NNPfc = NNP -Ind. Taxes + Sub

NI =1730-120+50=1660

Exercise3: (balance in the market for goods and services):

1. Calculate the output in full employment equilibrium?

According to Classic equilibrium condition in the market of goods and services:

S=I

200 000-1000i = -40 000 + 5000 i

$$i = \frac{240\,000}{6000} = 40$$

S=I=200 000-1000(40) =160000

The economy is in equilibrium, so aggregate supply = aggregate demand

y=D ⇒ y = C+I

y =840 000 + 160 000 = 1 000 000

2. Calculate employment in the case of full employment?

$y = 0.25\ N^2$

$1000\,000 = 0.25\ N^2$ ➔ $N = 2000$

3. Calculate the real wage W / P corresponding to the equilibrium condition.

Upon full employment, the producer fulfills the condition of maximizing profit, based on this condition:

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

$$MP_L = \frac{dy}{dN} = 0.5\ N \Rightarrow 0.5\ N = \frac{W}{P}$$

$$\frac{W}{P} = 0.5\ (2000) = 1000$$

Exercise4: (balance in the money market):

1. Define and calculate the liquidity preference coefficient (k)?

Liquidity preference coefficient: It expresses the proportion of income held in the form of liquidity for transactions.

$$K = \frac{1}{V} = \frac{1}{4} = 0{,}25$$

2. Determine the price level in the money market at equilibrium? Then calculate the value of the demand for money?

The price level in the money market at equilibrium

$Ms = Md \Rightarrow Mo = kPY$

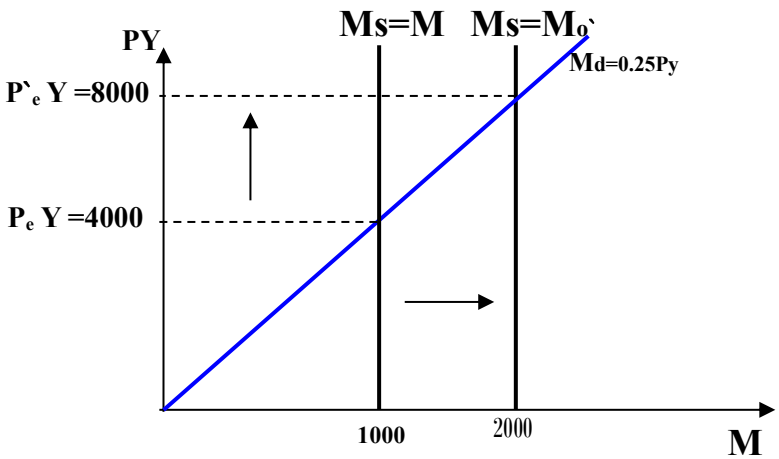
$$P = \frac{Mo}{kY} = \frac{1000}{0{,}25(2000)} = 2$$

The value of the demand for money

$Md = kPY = (0.25)(2)(2000)$

$Md = 1000$

3. Mention Graphically the money market in equilibrium?



4. Explain the effect of doubling the monetary supply on the general price level? What are the other variables that may be affected accordingly?

$$P` = \frac{Mo`}{kY} = \frac{2000}{0{,}25(2000)} = 4$$

We notice that doubling the monetary mass causes a doubling of nominal income (py) by doubling the general price level from 2 to 4 with the volume of production remaining constant.

In addition to its effect on the general level of prices, the increase in the money supply (which is a nominal variable) only affects the nominal variables. When the general level of prices (inflation) rises, the nominal wage, nominal income and nominal interest rate also change, while the real variables remain the same (volume of output y and employment N). The real wage is W / P, and the real interest rate), according to the principle of classical economic duality.

CHAPTER 3. CONSUMER PRICE INDEX (CPI)

1. Introduction

The Consumer Price Index (CPI) is a measure that examines the average of prices of a basket of consumer goods and services, such as transportation, food, and medical care, etc. It is calculated by taking price changes for each item in the predetermined basket of goods and averaging them. Changes in the CPI are used to assess price changes associated with the cost of living. The CPI is one of the most frequently used statistics for identifying periods of inflation or deflation.

2. Differences Between the GDP Deflator and CPI

Although at first glance it may seem that CPI and GDP Deflator measure the same thing, there are a few key differences.

The first is that GDP Deflator includes only domestic goods and not anything that is imported. This is different because the CPI includes anything bought by consumers including foreign goods.

The second difference is that the GDP Deflator is a measure of the prices of all goods and services while the CPI is a measure of only goods bought by consumers. The GDP price deflator is a more comprehensive inflation measure than the CPI index because it isn't based on a fixed basket of goods.

3. Types of Consumer Price index:

There are 4 types of CPI: simple price index, Paasche Price Index, Laspeyres Price Index, Fisher Price Index

3.1. The simple price index:

It is the sum of the commodity prices in the comparison year divided by the total commodity prices in the base year

simple CPI $= (\sum \boldsymbol{Pn})/(\sum \boldsymbol{P0})*100\%$

3.2. Paasche Price Index

The Paasche Price Index is a price index used to measure the general price level and cost of living in the economy and to calculate inflation. The index commonly uses a base year of 100, with periods of higher price levels shown by an index greater than 100 and periods of lower price levels by indexes lower than 100.

$$\text{Paasche Price Index} = \frac{\Sigma (Pi,t) \times (Qi,t)}{\Sigma (Pi,0) \times (Qi,t)} \times 100$$

Where:

•Pi,0 is the price of the individual item at the base period and Pi,t is the price of the individual item at the observation period.

•Qi,t is the quantity of the individual item at the observation period.

3.3. Laspeyres Price Index

The Laspeyres Price Index is a price index used to measure the economy's general price level and cost of living and to calculate inflation. The index commonly uses a base year figure of 100, with periods of higher price levels shown by an index greater than 100 and periods of lower price levels by indexes lower than 100.

A key differentiator between the Laspeyres Price Index and other indices (Paasche Price Index, Fisher Price Index, etc.) is that it uses weights taken from a base period.

$$\text{Laspeyres Price Index} = \frac{\text{Sum of [Price at Observation Period x Base Quantity]}}{\text{Sum of [Price at Base Period x Base Quantity]}} \times 100$$

Where:

•Pi,0 is the price of the individual item at the base period and Pi,t is the price of the individual item at the observation period.

•Qi,0 is the quantity of the individual item at the base period.

3.4. Fisher Price Index

Similar to other consumer price indices, the Fisher Price Index is used to measure the price level and cost of living in an economy and to calculate inflation. The index corrects for the upward bias of the Laspeyres Price Index and the downward bias of the Paasche Price Index by taking the geometric average of the two weighted indices.

$$\text{Fisher Price Index} = (\text{Laspeyres Price Index} \times \text{Paasche Price Index})^{0.5}$$

•**Pi,t** is the price of the individual item at the observation period

•**Pi,0** is the price of the individual item at the base period

•**Qi,t** is the quantity of the individual item at the observation period

•**Qi,0** is the quantity of the individual item at the base period

Fisher PI Calculation Steps

Step 1: Calculate the Laspeyres Price Index for each period. Remember that the Laspeyres Price Index uses **observation price** and **base quantities** in the **numerator** and base price and base quantities in the denominator.

Step 2: Calculate the Paasche Price Index for each period. Remember that the Paasche Price Index uses **observation price** and **observation quantities** in the **numerator** and base price and base quantities in the denominator.

Step 3: Take the geometric average of the Laspeyres and Paasche Price Index in each period to determine the Fisher Price Index for the corresponding period.

Example

The following information regarding the change in prices and quantities of each individual good in a hypothetical economy is provided.

Determine the Fisher Price Index for Year 0, Year 1, and Year 2, using Year 0 as the base year.

What do you conclude?

Year 0	**Item A**	**Item B**	**Item C**
Price	2	1	1,5
Quantity	15	20	25
Value	30	20	37,5
Year 1	**Item A**	**Item B**	**Item C**
Price	2,25	1,1	2,1
Quantity	20	20	17
Value	45	22	35,7
Year 2	**Item A**	**Item B**	**Item C**
Price	2,35	1,14	2,4
Quantity Value	23	25	14
	54,05	28,5	33,6

Answers

- **Year 0**

Laspeyres Price Index$=\frac{30+20+37,5}{30+20+37,5}*100=100$

Paasche Price Index$=\frac{30+20+37,5}{30+20+37,5}*100=100$

Ficher Price Index$=\sqrt{(100*100)}=100$

- **Year 1 :**

Laspeyres Price Index$=\frac{\mathbf{(2,25*15)+(1,10*20)+(2,10*25)}}{\mathbf{30+20+37,5}}*100=123,71$

Paasche Price Index$=\frac{\mathbf{45+22+35,7}}{\mathbf{(2,00*20)+(1,00*20)+(1,50*17)}}*100=120,12$

Ficher Price Index$=\sqrt{(123,71*120,12)}=121,90$

- **Year 2 :**

Laspeyres Price Index$=\frac{\mathbf{(2,35*15)+(1,13*20)+(2,40*25)}}{\mathbf{30+20+37,5}}*100=134,69$

Paasche Price Index$=\frac{\mathbf{54+28+33,6}}{\mathbf{(2,00*23)+(1,00*25)+(1,50*14)}}*100=126,25$

Ficher Price Index$=\sqrt{(134,69*126,25)}=130,40$

- **Results of the 3 Years**

Price Index	Year 0	Year 1	Year 2
Laspeyres	100	123,71	134,69
Paasche	100	120,12	126,25
Ficher	100	121,90	130,40

As we can see, the Fisher Index number lies between the Laspeyres and Paasche Price Index numbers!

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EXERCISES ON CONSUMER PRICE INDEX (CPI

Exercise 1:

Consider the following table for the economy of a nation whose residents consume 3 Products during 2020 (Base Year) and 2021:

Products	2020		2021	
	Q	P	Q	P
X	100	20	200	22
Y	150	30	51.5	38
Z	300	40	280	37.5

Required: Calculate for the year 2021:

1. Simple Price Index
2. Laspeyres Price Index?
3. Paasche Price Index?
4. Fisher Price Index?
5. According to each price index, is there inflation or deflation?

Exercise2:

The table below displays economic data for a nation in which residents consume three products during the period between 2022 (base year) and 2023:

Products	**2022**		**2023**	
	Q	**P**	**Q**	**P**
A	150	80	300	90
B	300	90	650	75
C	600	70	500	60

Required: Determine the following for the year 2023:

A. Simple Price Index?
B. Laspeyres Price Index?
C. Paasche Price Index?
D. Fisher Price Index?
E. According to each price index, is there inflation or deflation?

SOLUTIONS

Exercise1

Consider the following table for the economy of a nation whose residents consume 3 Products during 2020 and 2021:

Products	2020		2021	
	Q	P	Q	P
X	100	20	200	22
Y	150	30	51.5	38
Z	300	40	280	37.5

Required: Calculate for the year 2021:

A. Simple Price Index 108,33

B. Laspeyres Price Index? 103,51

C. Paasche Price Index? 100,67

D. Fisher Price Index? 102,08

According to each price index, is there inflation or deflation?

A. Simple Price Index 108,33 inflation

B. Laspeyres Price Index? 103,51 inflation

C. Paasche Price Index? 100,67 inflation

D. Fisher Price Index? 102,08 inflation

Exercise2:

Year 2023:

A. Simple Price Index 93,750

B. Laspeyres Price Index? 88,889

C. Paasche Price Index? 90,000

D. Fisher Price Index? 89,443

According to each price index, is there inflation or deflation?

A. Simple Price Index 93,750 Deflation

B. Laspeyres Price Index? 88,889 Deflation

C. Paasche Price Index? 90,000 Deflation

D. Fisher Price Index? 89,443 Deflation

CHAPTER 4. CIRCULAR FLOW OF INCOME

Learning Objectives

To explain the circular flow of economic activity and income:

- Two- Sector Model
- Three- Sector Model
- Four- Sector Model

To understand Injections and Leakages in the circular flow of economic activity.

*****

1. Introduction

The simple model of the circular flow assumes two players:

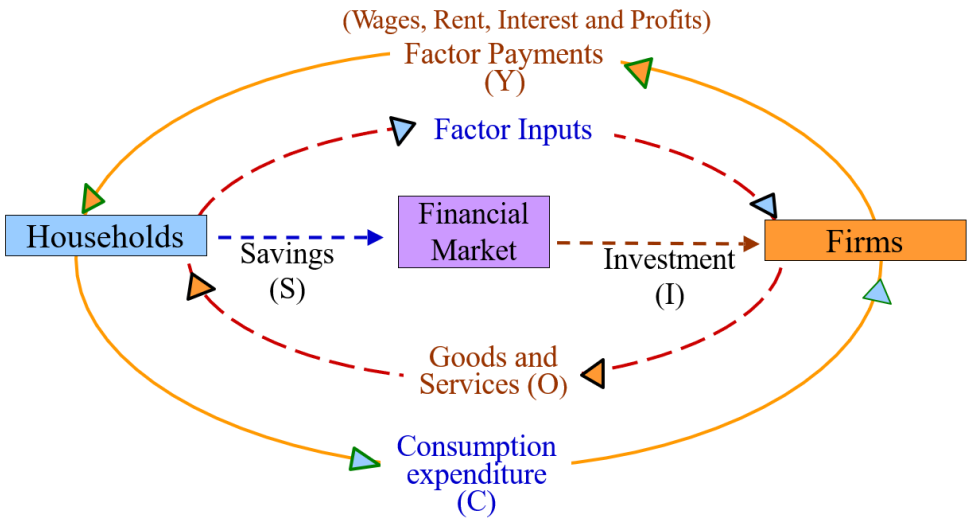
1.1. Firms:

- Produce and supply the goods and services.
- Require various factors of production to produce these goods and services.

1.2. Households:

- Include a set of individuals living in the same house
- Take joint decision about the consumption of goods and services.
- Provide services in terms of factor inputs to the firms
- Get paid for these services by firms which households spend on consumption.
- Money flows from firms to households as factor payments, and from households to firms as expenditure on goods and services.

It is a circular flow of money or income



In the equilibrium Y= C+S = C+I = E = 0

2. Circular Flow of Economic Activities and Income

Value of output produced (Y) = value of output sold (0)

Value of output sold = Sum of consumption expenditure (C) and investment expenditure (I).

- Y=0=C+I=E.....(1)

Income is either consumed or saved (S).

- Y=C+S.....(2)
- C+I=Y=C+S.....(3)
- Therefore: I = S.....(4)

Savings are withdrawal of money from the circular flow

Investment is injection of money into the circular flow

For equilibrium, savings should be equal to investments

Hence Y=0=E

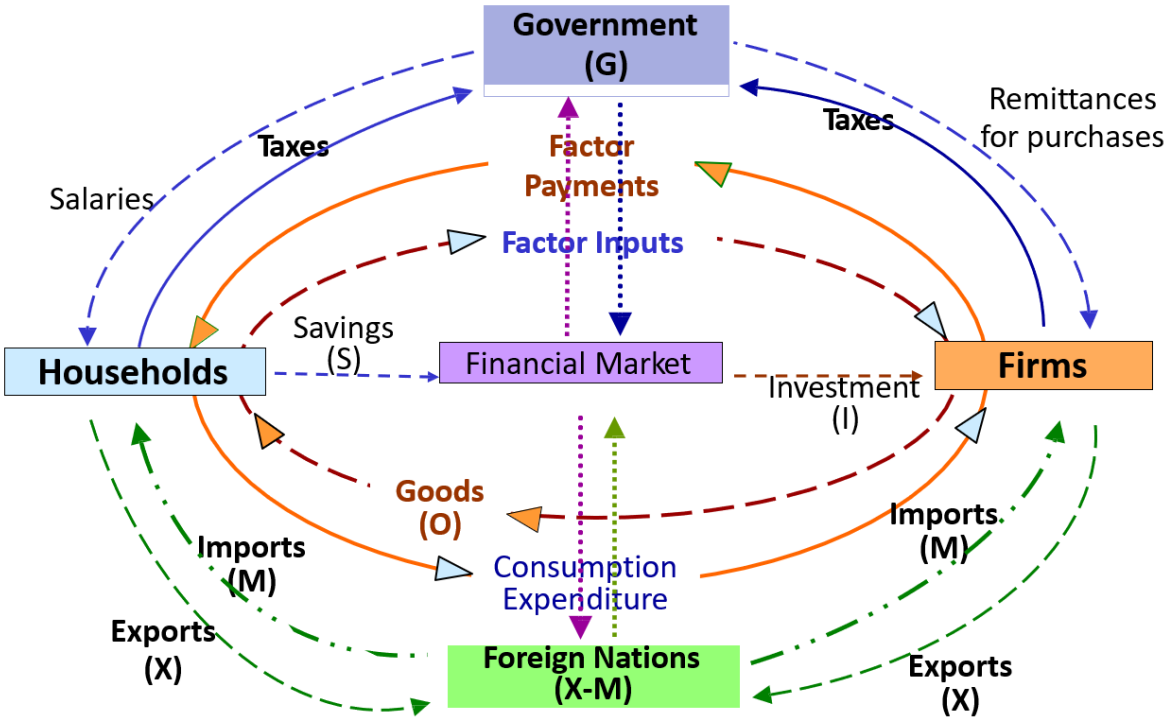
3. Circular Flow of Income in three & Four Sector Economy

The third sector is **Government (G)**

- Government Spending
    - On provision of public utility goods and services.
    - Provides salaries to the households
    - Pays to firms for purchases of goods and services
- Government Revenue
    - Households and firms pay various taxes and other payments and provide factor inputs to the government.
    - Government borrows from the financial market to fill revenue gap.

The fourth sector is the **external sector (X-M)**

- Imports (M): Outflow of income occurs when the domestic firms buy goods and services from foreign ones.
- Exports (X): Inflow of income takes place when foreign firms buy goods and services from domestic ones



National income includes expenditures on consumption investment, government and net of exports (X-M)

National Income=C+I+G+(X-M)

Since national income can either be consumed, or saved, or paid as tax to the government:

C+I+G+(X-M) = C+S+T ⇒ **I+G+(X-M) =S+T**

Sum of private investment, government expenditure and expenditure on net exports is equal to the sum of savings and tax revenue. Thus:

$$I+G+X = S+T+M$$

Therefore, J=W (At equilibrium, total injections are equal to total withdrawals.)

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https://open.lib.umn.edu/macroeconomics/chapter/10-2-the-building-blocks-of-the-classical-model/

EXERCISES:

Choose the right answer:

1. Who earns money and spends their income on goods and services?

a) Firms
b) Businesses
c) Households
d) Schools

2. What is the role of firms in the circular flow of income?

a) To purchase goods
b) To produce goods
c) To earn income through wages
d) To provide capital

3. What is an expenditure?

e) Land
f) Labor
g) Schools
h) Money

4. The two primary players in the circular flow model are

a) People and Stores
b) Households and Businesses
c) Businesses and People
d) Households and Schools

5. What are injections in the following statements:

a) Investment, Government expenditure and Exports
b) Savings, Taxes and Import.
c) Consumption, Investment, Government expenditure and Net Exports

6. What are leakages in the following statements?

a) Investment, Government expenditure and Exports
b) Savings, Taxes and Import.
c) Consumption, Investment, Government expenditure and Net Exports

7. What drives the circular flow model?

a) Success
b) Taxes
c) Monetary policy

d) profit

8. What do businesses provide for consumers according to the circular flow model?

a) Goods and services
b) Only goods
c) Only services
d) Taxes

9. Which of the following is not an injection into the circular flow of national income?

e) The purchase of a domestically produced good by a foreign company
f) Government salaries paid to civil servants
g) Government expenditure
h) Government salaries paid to civil servants

10. Which of the following does not represent a leakage or a withdrawal in the circular flow of income?

a) Taxes
b) Imports
c) Savings
d) Government expenditures

ANSWERS:

Questions	1	2	3	4	5	6	7	8	9	10
Answers	c	b	h	b	a	b	d	a	a	c

CHAPTER 5. THE CLASSICAL MODEL OF INCOME OUTPUT AND EMPLOYMENT

Learning Objective

In this topic we will discuss about how nations decide their Income, Output and Employment level on the basis of the following theories

1. The methodology of macroeconomic analysis

An economic model is a representation of a theory or a part of a theory, often used to gain insight into cause and effect.

Q =f (x1, x2, x3, xp)

Variables and Parameters in equations

Variables: something that can take different values (e.g.: price, profit, revenue, cost, savings, consumption, etc.).

Constants/Parameters: magnitude that does not change, Parameters: are usually represented by a symbol (symbolic constant)

2. Exogenous & endogenous variables

In an economic model, an exogenous variable is one whose value is determined outside the model and is imposed on the model, In contrast, an endogenous variable is a variable whose value is determined by the model

Exogenous variables…

- are fixed when they enter the model.
- are taken as a "given" in the model.
- influence endogenous variables in the model.
- are not determined by the model.
- are not explained by the model.

3. Equations

Definitional equation (Identities): defines an identity, i.e., 2 alternative expressions that have same meaning (ex: y = c + s)

Behavioral equation: explains how a variable behaves in response to changes in other variables

Example : Y=a + bX

Y: endogenous variable

X : endogenous variable

a : constant (exogenous)

b: parameter (coefficient of independent variable X)

4. Classical Theory & employment hypothesis

According to the Classical Theory, Full employment is a natural phenomenon. In a case of unemployment, demand for labor is less than their supply. Due to low demand, money wages of the laborers will fall. Low wage rate, in its turn, will raise the demand for laborers. As a consequence, unemployment is removed and **full employment is restored**.

- **Absence of Involuntary Unemployment:**

There are different types of unemployment:

- Voluntary unemployment (a situation in which someone chooses to not work)
- Frictional unemployment (Workers choosing to leave their jobs in search of new ones and workers entering the workforce for the first time constitute frictional unemployment)
- Seasonal unemployment (seasonal unemployment occurs when people are unemployed at particular times of the year when demand for labour is lower than usual.)
- Technical unemployment (Technological unemployment is the loss of jobs caused by technological change. It is a key type of structural unemployment.)
- Disguised unemployment (Disguised unemployment exists when part of the labor force is either left without work or is working in a redundant manner such that worker productivity is essentially zero. It is unemployment that does not affect aggregate output.)

- **Assumptions of the classical macro model**
  - Laissez faire policy: Laissez-faire policies need three components to work: capitalism, the free market economy, and rational market theory
  - Equality between saving and investment
  - Closed economy
  - Flexibility of prices, wage and rate of interest.
  - Rational man: The term "economic man" (also referred to as "homo economicus") refers to an idealized person who acts rationally, with perfect knowledge and who seeks to maximize personal utility or satisfaction
  - Perfect competition
  - Constant technology
  - Law of diminishing returns

4.1. The supply side of the real economy

factors determining the economy's total supply of goods and services – i.e.

how are labor, land and capital owners compensated

4.2. The demand side of the real economy

factors determining the demand for goods and services, by households, firms and the govt.

Equilibrium is what ensures that total supply = total demand; how equilibrium in the goods market is achieved

The economy's total supply of goods and services/ total income is determined by:

- the economy's supply of inputs/factors of production
- available technology: the form of the production function

5. Factors of production:

- K= capital: Tools, machines, and structures used in production
- L= labor: The physical and mental efforts of workers
- *N* = land: All non-renewable resources

6. Determination of income and employment

According to classical economists, income and employment is determined by production function and equilibrium of demand for and supply of labor.

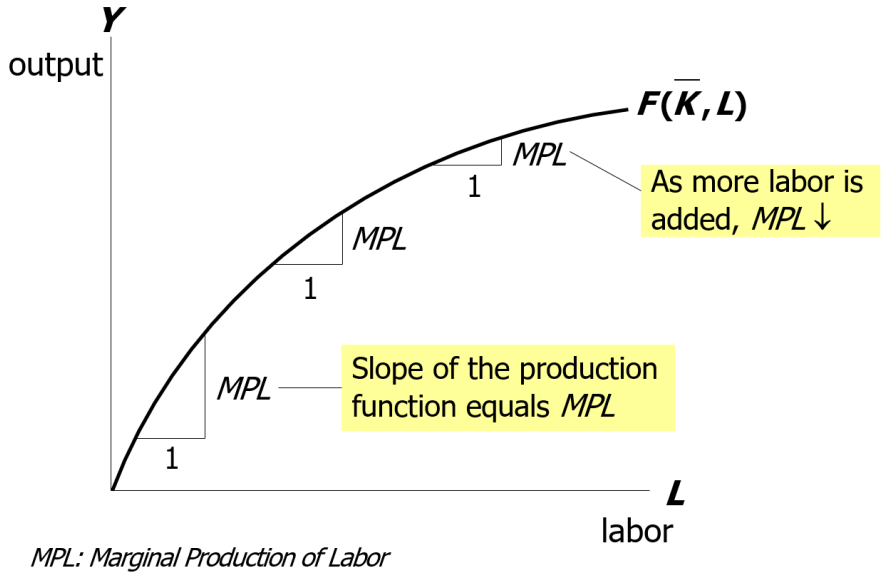
7. The production function and its properties:

Represented as Y = F (K, L), N (land) being fixed is ignored. This function shows how much output (Y) the economy can produce from K units of capital and L units of labor.

F reflects the economy's level of technology (technological progress affects the function F).

In short period, capital and technology remains constant and employment can be increased by increasing labor only and the result is *diminishing returns to output*.

Diminishing marginal returns and the production function



MPL: Marginal Production of Labor

The reasons for the diminishing Returns are:

Technology is given.

The economy's supplies of capital and labor are fixed at $K = \bar{K}$ and $L = \bar{L}$

Output is determined by the fixed factor supplies and the fixed state of technology: $Y = f(\bar{K}, \bar{L})$

Factor markets are assumed to be competitive. Hence, factor prices are determined by supply and demand of factor services.

Supply of each factor=Demand for factor inputs

7.1. Demand for labor

Demand for labor is diminishing function of wage. It means: with rise in wage rate, demand for labor falls and with fall in wage rate, demand for labor rises:

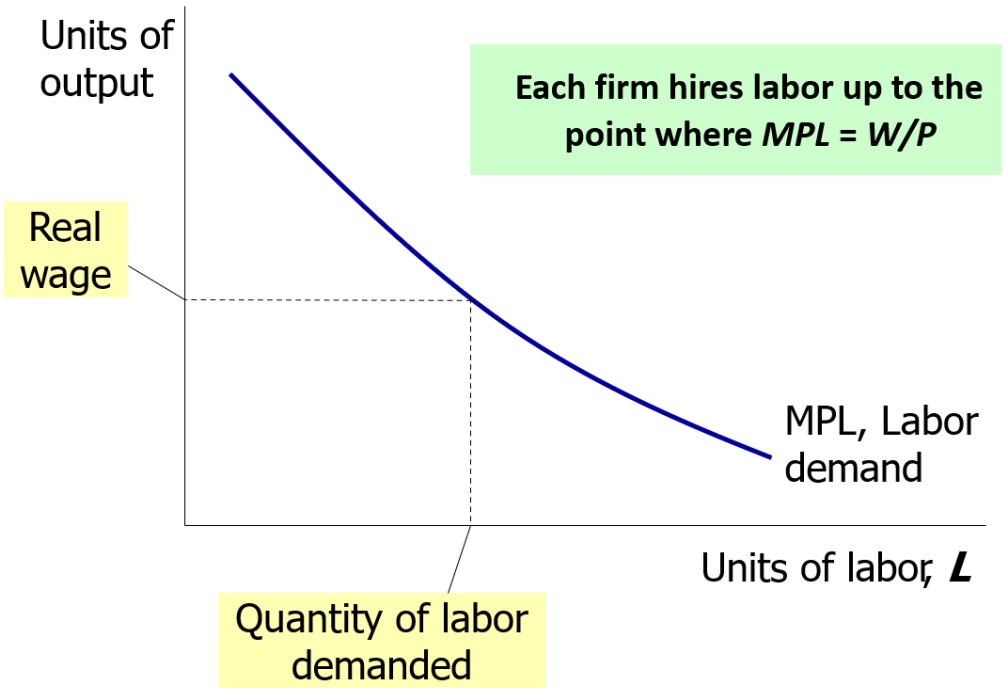
W= MRP=P x MPL

MRP: Marginal Return Price P: Price MPL: Marginal Production of Labor W/p=MPL

7.2. Supply of labor:

Supply of labor therefore increases with rise in real wage and falls with fall in wage rate.

The demand for labor curve is the same as the MPL curve:



8. Says law of market: « Supply creates its own demand»:

Say's Law of Markets was developed in 1803 by the French classical economist and journalist, Jean-Baptiste Say. Say was influential because his theories address how a society creates wealth and the nature of economic activity. To have the

means to buy, a buyer must first have sold something, Say reasoned. So, the source of demand is prior to the production and sale of goods for money, not money itself. In other words, a person's ability to demand goods or services from others is predicated on the income produced by that person's own past acts of production.

9. Flexibility of wages and rate of interest & Equilibrium in factor market:

Demand and supply of labor through wage rate determines the equilibrium in the labor market, while Flexibility in Rate of interest determines the equilibrium in money market

In money market: S=I (I-investment, S-Saving), knowing that:

I=f(i) S=f(i)

10. Flexibility of prices level or equilibrium in money market

Aggregate demand=Aggregate supply ⇒ **MV=PT**

M-money supply V-velocity of money P-price level

T-trade transactions P=f (Money supply)

11. Points to remember in Classical Model

Y=f (Employment)

Demand for labor=f(w/p)

Supply of labor =f(w/p)

S=f (i) I=f (i)

$$MV=PTk=1/V$$

K -Liquidity preference

$$Md=K*P*Y$$

Md -money Demand P-price level Y-trade transactions

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Exercises on the Classical Model of Income Output and Employment

Exercise1:

Consider the following equations:

$C = Co + byd$ $I = jy\text{-}vi$ $Md = g\text{-}\alpha i$ $y = C + S$

Define the internal and external variables with examples.

Explain in a table, for the above equations: the dependent variables, the independent variables, the parameters, the behavioral coefficients, the internal (endogenous) and the external(exogenous) variables.

What kind of relationships between the variables in these equations?

Exercise2: (Equilibrium in the labor market)

In an economy that adopts classical analysis, a labor market has the following characteristics:

$N_1 = 4000 - (W / P)$ $N_2 = 2999 (W / P) - 2000$

The output function is: $y = 4000N\text{-}1/2\ N^2$

Questions:

Determine the labor supply function and the labor demand function, justify?

What is the real wage level at equilibrium?

If the price level is $P = 2$, what is the money wage (nominal wage) level?

What is the output value (production value) at equilibrium?

If the money wage increases to $W = 6$, how many unemployed workers are there? Explain that graphically?

Exercise3: (balance in the market for goods and services):

Let us have the following data about a hypothetical economy subject to the classical analysis of the goods and services market:

$I = 200\ 000 - 1000\ i;$ $S = -40\ 000 + 5000\ i;$ $C = 840\ 000;$ $y = 0.25\ N^2$

Questions:

1. Calculate the output in full employment equilibrium?

2. Calculate employment in the case of full employment?

3. Calculate the real wage (W / P) corresponding to the equilibrium condition.

Exercise4: (balance in the money market):

If the money mass supplied by the monetary authority is equal to 1000 DZD, and the speed of money circulation is 4 times, and the volume of production at full employment is equal to 2000 DZD.

Questions:

1. Define and calculate the liquidity preference coefficient (k)?

2. Determine the price level in the money market at equilibrium? Then calculate the value of the demand for money?

3. Mention Graphically the money market in equilibrium?

4. Explain the effect of doubling the monetary supply on the general price level? What are the other variables that may be affected accordingly?

SOLUTIONS

Exercise1:

1. Definition of Internal and External Variables:

- **Internal Variables:**

The variables of the causal relationship represent the basic parties on which these relationships are based. Their value within the model is determined after solving its equations, and they are two types: **dependent and independent** variables.

Dependent variables: Its behavior is dependent on the behavior of other variables; the individual's spending depends on his income, so he is dependent on it.

Independent variables: Its behavior affects the behavior of the dependent variables and it interprets it, (an individual's income affects his spending, so it is explained to him (independent).

- **External Variables:**

Their value is determined outside the causal relationship (outside the model), because they are subject to factors not related to the model, their value is fixed and their quantities are known and given, the parameters are examples of it. Non-income factors affecting consumption are expressed by parameter "C_0" in the consumption equation $C = C_0 + by_d$

2. Defining the types of variables:

We have the following equations:

$C = C_0 + by_d$ $Md = g - \alpha I$ $I = jy - Vi$ $y = c + s$

Variables / Equations	Dependent Var	Independent Var	Behavioral factor	Parameter	Internal Var	External Var
$C = C_0 + by_d$	C	y_d	$+ b$	C_0 , b	C , yd	C_0
$I = jy - Vi$	I	y , i	$j , -V$	j , V	I , y , i	/
$Md = g - \alpha i$	Md	i	$-\propto$	$g , \propto$	Md , i	g

Exercise2:

1. Determine the labor supply function and the labor demand function, with justification?

N1: it is the labor demand function because it is a diminishing function of real wages.

N2: it is the labor supply function because it is an increasing function of real wage.

2.What is the real wage equilibrium level?

Labor market equilibrium condition $Ns = Nd$

$$2999\ \left(\frac{W}{P}\right) - \ 2000 = 4000 - \frac{W}{P}$$

$$6000 = 3000\,\frac{W}{P} \Rightarrow \left(\frac{W}{P}\right)_e = 2 \text{ mu}$$

If the price level is P = 2, what is the money wage (nominal wage) level?

$$\boldsymbol{\omega} = \frac{W}{\mathrm{p}} \Rightarrow \mathrm{W} = \ \omega\ \mathrm{P} = 2 \times 2$$

W_e= 4 mu

3. What is the output value (production value) at equilibrium?

At equilibrium Ne = Ns = Nd

$$N_e = 2999\ \left(\frac{W}{P}\right)_e - \ 2000 = 4000 - \left(\frac{W}{P}\right)_e$$

$$N_e = 2999\ (2) - \ 2000 = 4000 - 2$$

N_e = 3998

$$Y = 4000\ N - \frac{1}{2}(N)^2$$

$$Y = 4000\ (3998) - \frac{1}{2}(3998)^2$$

Y_e = 7999998

4. If the nominal wage increases to W = 6, how many unemployed workers are there? Explain that graphically?

The real wage becomes: $\frac{W}{\mathrm{P}} = \frac{6}{2} = 3$

$$N_d = 4000 - \frac{W}{P}\ = \ 4000 - 3$$

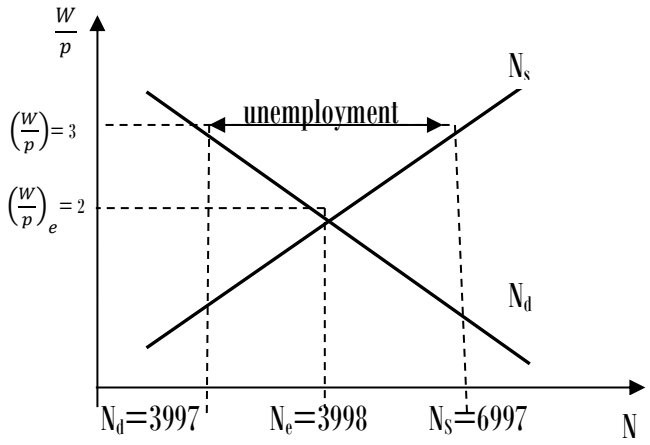
N_d= 3997 Lu

$$N_s = 2999\ \frac{W}{P} - \ 2000 = 2999\ (3) - 2000$$

N_s = 6997 Lu

Number of non-employed workers: $N_s - N_d$= 6997−3997=**3000 Lu**

5. Graphic representation:



Exercise3: (balance in the market for goods and services):

1. Calculate the output in full employment equilibrium?

According to Classic equilibrium condition in the market of goods and services:

$$S=I$$

$200\,000-1000i = -40\,000 + 5000\,i$

$$i = \frac{240\,000}{6000} = 40$$

$S=I=200\,000-1000(40) = 160000$

The economy is in equilibrium, so aggregate supply = aggregate demand

$y=D \Rightarrow y = C+I$

$y = 840\,000 + 160\,000 = 1\,000\,000$

2. Calculate employment in the case of full employment?

$y = 0.25\,N^2$

$1000\,000 = 0.25\,N^2$ ➔ $N = 2000$

3. Calculate the real wage W / P corresponding to the equilibrium condition.

Upon full employment, the producer fulfills the condition of maximizing profit, based on this condition:

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

$$MP_L = \frac{dy}{dN} = 0.5\,N \Rightarrow 0.5\,N = \frac{W}{P}$$

$$\frac{W}{P} = 0.5\ (2000) = 1000$$

Exercise4: (balance in the money market):

1. Define and calculate the liquidity preference coefficient (k)?

Liquidity preference coefficient: It expresses the proportion of income held in the form of liquidity for transactions.

$$K = \frac{1}{V} = \frac{1}{4} = 0{,}25$$

2. Determine the price level in the money market at equilibrium? Then calculate the value of the demand for money?

The price level in the money market at equilibrium

$Ms = Md \Rightarrow Mo = kPY$

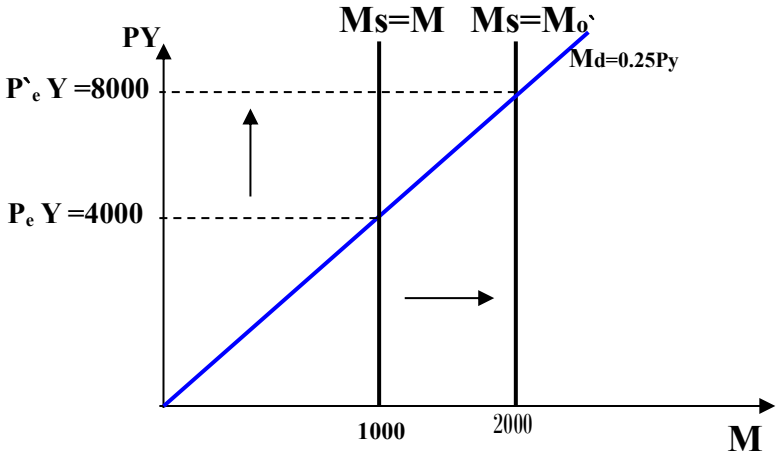
$$P = \frac{Mo}{kY} = \frac{1000}{0{,}25(2000)} = 2$$

The value of the demand for money

$Md = kPY = (0.25)(2)(2000)$

$Md = 1000$

3. Mention Graphically the money market at equilibrium?



4. Explain the effect of doubling the monetary supply on the general price level? What are the other variables that may be affected accordingly?

$$P` = \frac{Mo`}{kY} = \frac{2000}{0{,}25(2000)} = 4$$

We notice that doubling the monetary mass causes a doubling of nominal income (py) by doubling the general price level from 2 to 4 with the volume of production remaining constant.

In addition to its effect on the general level of prices, the increase in the money supply (which is a nominal variable) only affects the nominal variables. When the general level of prices (inflation) rises, the nominal wage, nominal income and nominal interest rate also change, while the real variables remain the same (volume of output y and employment N). The real wage is W / P, and the real interest rate), according to the principle of classical economic duality.

CHAPTER 6. KEYNESIAN THEORY OF INCOME, OUTPUT AND EMPLOYMENT

Lecture plan:

- Simple economy model- two sectors model (household, firms' sector)
- Closed economy model- three sectors model (household, firms and government sector)
- Open economy model- four sectors model (household, firms, government and foreign sector)

*****

1. Introduction:

According to Keynes- there is not always full employment in a developed economy as a matter of fact there can be unemployment in the economy.

The main reason for the unemployment is the is deficiency of aggregate demand.

Unemployment can be removed by increasing the aggregate demand in the economy.

According to classical thought the problem of unemployment can be solve by lowering the wage rate,

2. Assumptions or postulates of Keynesian Model in a two-sector model of the goods market in the economy

No government sector, no foreign trade (Closed economy)

Diminishing marginal productivity

Labor is the only factor of production

No time lags

Say's Law cannot hold. ("Supply creates its own demand."): If spending constraints are in effect, then there will be a difference between (unlimited) demand and "effective demand".

Actual (effective) demand will usually be "deficient" to purchase total output.

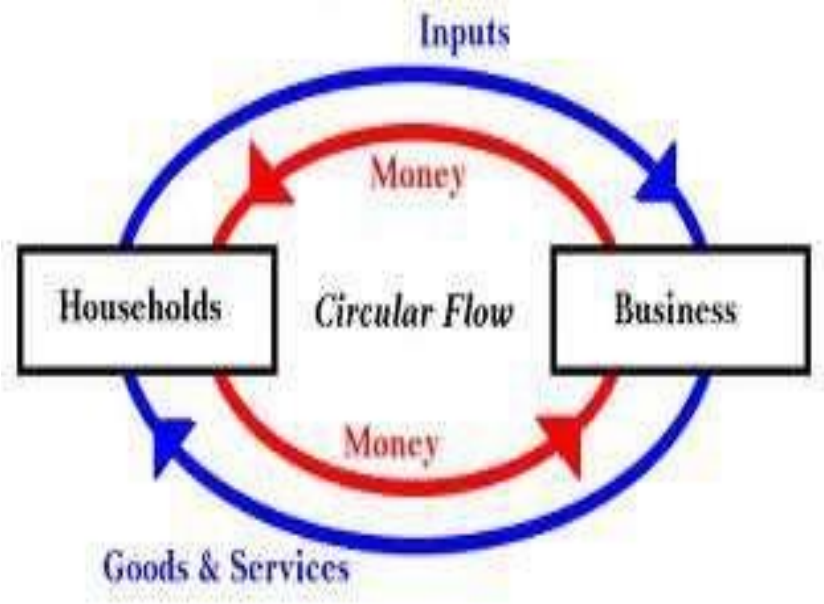
Using Effective Demand: (AD=AS) (Aggregate Demand=Aggregate Supply)

Therefore, consumption depends primarily upon income, not interest rates. i.e., $C \neq C(r)$, but rather $C = C(Y)$

"People don't change their standard of living simply because the interest rate changes a few points."

'The fundamental psychological law, upon which we are entitled to depend with great confidence . . . is that men are disposed, as a rule and on average, to increase their consumption as their income increases, **but not by as much as the increase in their income**'

Circular flow of income according to Keynes



3. Consumption function

The amount of money people spend out of national income on the purchase of the goods and services for the direct satisfaction of their wants is called aggregate consumption expenditure or consumption.

Example: Total income of economy 5000 DZD, people spend 4000 DZD. on goods and service

The most important function of consumption is income. It means consumption is a function of income.

Relationship between consumption and income: C = f (Y), Where: C = consumption, f = function

In economics, the consumption function is a single mathematical function used to express consumer spending. It was developed by John Maynard Keynes and detailed most famously in his book The General Theory of Employment, Interest, and Money. The function is used to calculate the amount of total consumption in an economy. It is made up of autonomous consumption that is not influenced by current income and induced consumption that is influenced by the economy's income level. This function can be written in a variety of ways:

The simple consumption function is shown as: $C = C_0 + bY_d$ where:

C: total consumption, c_0: autonomous consumption ($c_0 > 0$),

b: is the marginal propensity to consume (i.e the induced consumption) ($0 < b < 1$), and

Y_d: disposable income or income after government intervention (benefits, taxes and transfer payments) or $Y + (G - T)$).

Induced consumption is consumption expenditure by households on goods and services that varies with income. Such consumption is considered *induced* by income when expenditure on these consumables varies as income changes.

Induced consumption contrasts with autonomous consumption, which is expenditures that do not vary with income.

For example, expenditure on a consumable that is considered a normal good would be considered to be induced.

Autonomous Consumption:

The minimum level of consumption that would still exist even if a consumer had absolutely no income. This contrasts with discretionary (optional) consumption, which is used for non-essential items. When combined with discretionary income, a person's autonomous consumption determines his or her real income, or real wages.

Certain bills and expenses are deemed to be autonomous (or independent), such as electricity, food and rent, because these expenses cannot ever be entirely eliminated whether you have money or not. Even in the worst-case financial scenario, you would still need to eat and have a place to live. If a consumer's income were to disappear for a time, he or she would have to dip into savings or increase debt in order to pay these expenses, which is also known as being in a dissaving mode.

4. Average Propensity to Consume (APC)

The average propensity to consume (APC) refers to the percentage of income that is spent on goods and services rather than on savings. One can determine the percentage of income spent by dividing the average household consumption (what is spent) by the average household income (what is earned). The inverse of the average propensity to consume is the average propensity to save (APS).

Economic periods where consumers are spending can boost the economy: more goods are purchased (high demand for goods and services); keeping more people employed and more businesses open. Periods where the tendency to save is increased can have a negative effect on the economy as people purchase fewer goods and services (low demand for goods and services), resulting in fewer jobs and increased business closures.

The average propensity to consume is the ratio of consumption to income. It can be expressed as under: APC = C/Y

For example, if total income is 500 DZD and total consumption is 200 DZD, then: $APC = 200 / 500 = 0.4$

5. Marginal Propensity to Consume (MPC):

It is a component of Keynesian theory. MPC represents the proportion of an aggregate raise in pay that is spent on the consumption of goods and services, as opposed to being saved. It is the ratio of change in consumption to change in income is known as marginal propensity to consume. Symbolically, change (Δ) in the income is denoted as ΔY and change in consumption as ΔC. Hence: $MPC = \frac{\Delta C}{\Delta Y}$

Example: Suppose you receive a bonus with your paycheck, and it's $500 on top of your normal annual earnings. You suddenly have $500 more in income than you did before. If you decide to spend $400 of this marginal increase in income on a new business suit, your marginal propensity to consume will be 0.8 ($400 divided by $500).

5.1. Characteristics of MPC:

It is always positive

MPC is greater than zero but less than one.

The value of MPC always greater than zero because Option expenditure must increase with the increase in income, less than one, because the total increase in income is not consumed; a part of it is saved. Thus, this characteristic can be symbolically stated as 0<MPC<I where MPC is always positive but less than one

MPC of the poor class is higher

Constant MPC in the long run

Falling MPC in the short run

MPC can be greater than one in case of abnormal conditions.

5.2. Causes of the fall in MPC with the increase in Income:

Fulfilment of basic and important needs

Constant habits in the short period

Consumption expenditure and level of income in the past

Uncertainty of future

6. Relation between APC and MPC:

APC and MPC are closely related to each other.

- APC refers to the ratio of absolute consumption to absolute income at a particular point of time. On the other hand, MP represents the ratio of change in consumption to change in income; MPC is the rate of change in APC.
- As income rises both APC and MPC declines, but the decline in MPC is more than the decline in APC, as income falls both APC and MPC rises but APC rises at a slower, rate than MPC.
- MPC is useful in short-period where as APC is useful in long period. In the short period there is no change in MPC and MPC<APC. In the long period APC=MPC.

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https://www.coursera.org/lecture/macroeconomics/keynesian-economics-GzE6I

CHAPTER 7: EQUILIBRIUM IN A TWO-SECTOR KEYNESIAN MODEL

1. Basic concepts related to aggregate supply and demand

Aggregate supply Y: It is the income or the output that will be spent on Consumption and Saving, and only the households sector gets it. In the two-sector model, and with the absence of Government, the national income Y is equal to the disposable income Yd.

$$Y = Y_d = C + S$$

Aggregate demand D: It is the aggregate spending, which includes Consumer and Investment spending: $D = C + I$

At equilibrium, aggregate income or output = aggregate spending

$$Y = D \Rightarrow C + S = C + I \Rightarrow S = I$$

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

- Aggregate supply equals aggregate demand, i.e., Income =Spending $Y = D$
- Saving equals Investment: $S = I$

Model variables:

- **Consumption**: It is an income function of the form: $C = C_0 + by_d$
- **Saving**: an income function of the form: $S = -C_0 + (1 - b)\, y_d$
- **Investment**: In the Keynesian model, investment is assumed to be an external variable; it is a fixed amount that does not change with the change of income i.e., it is independent of income: $I = I_0$

2. Equilibrium income Determination mathematically and graphically:

a. Aggregate supply / aggregate demand method:

The equilibrium income is calculated as follows:

$$Y = D \Rightarrow y = C + I$$

$$\Rightarrow y = C_o + by_d + I_o$$

$$\Rightarrow y = C_o + by + I_o$$

$$\Rightarrow y - by = c_o + I_o$$

$$\Rightarrow y^* = \frac{C_o + I_o}{1 - b}$$

b. The saving / investing method

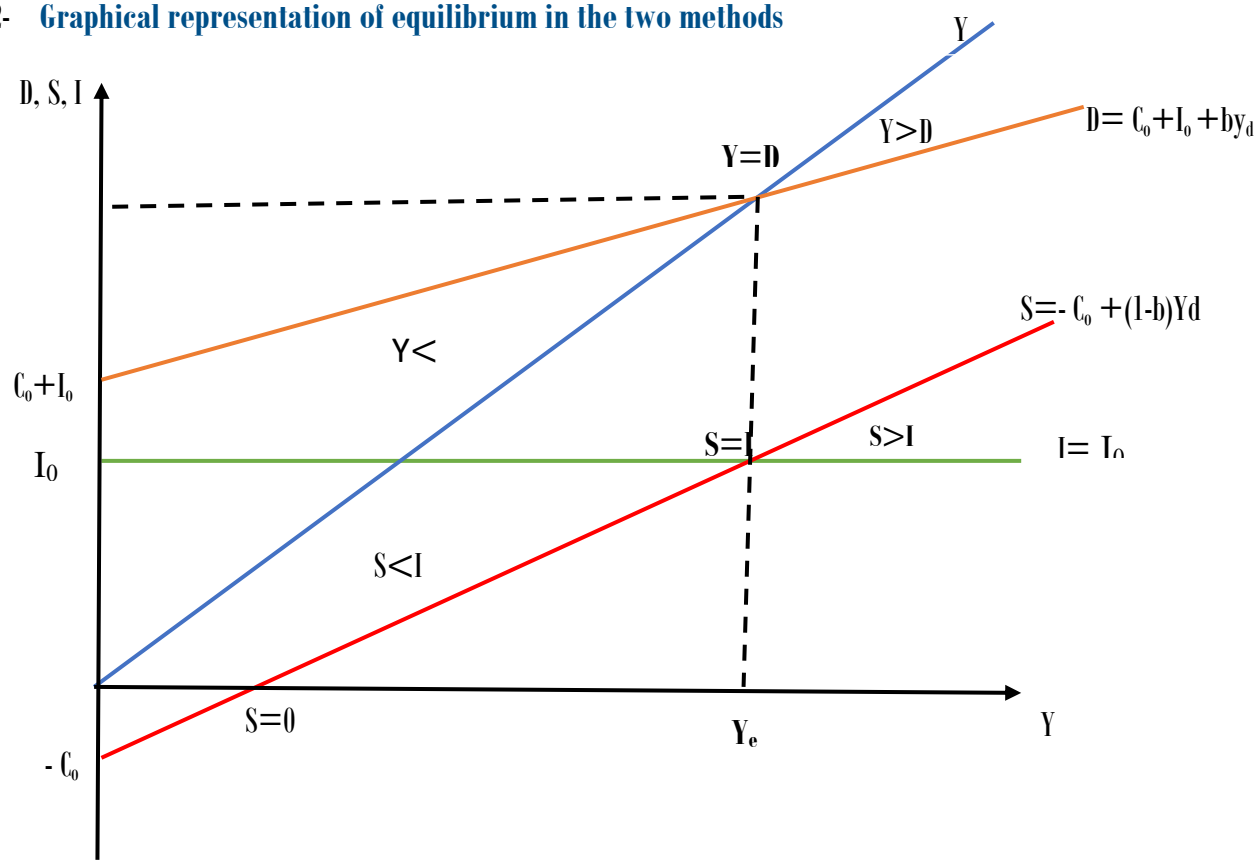
The equilibrium income is calculated as follows:

$$S = I \Rightarrow -C_o + (1-b)\, y = I_o$$

$$\Rightarrow y(1-b) = C_o + I_o$$

$$\Rightarrow y_e = \frac{C_0 + I_0}{1 - b}$$

2- Graphical representation of equilibrium in the two methods



Note that the total Supply Curve (Y) is represented by a line of 45 degrees because it represents the desired and possible levels of production, meaning that the **producers produce what they expect to sell**, and therefore the slope of the total supply is equal to 1, which is the slope corresponding to the angle of 45 degrees.

Explanation of the graphical representation: The graph shows the existence of three modes:

- **The first situation S<I & Y<D:** In this case, the commodities in the economy are less than the demand, which will lead to an increase in the general level of prices, i.e., the inflation problem appears.

This situation pushes the producers to increase their production to cover the deficit in demand in order to achieve the equilibrium situation. The increase in production causes the income to rise, and thus saving also, as saving is a function of income, until it equals investment and the equilibrium is achieved

- **The second position S=I & Y=D:** which is the equilibrium position
- **The third situation S>I & Y>D:** In this case, the commodities in the economy are more than the demand, which will lead to lower prices and lower profits for firms, thus stopping production and laying off workers, and the economy will enter a state of deflation accompanied by unemployment.

This situation pushes the producers to reduce the surplus in production in order to equalize demand and supply, i.e., achieve balance. The decline in production leads to a decline in income and savings, until it equals investment and the equilibrium is achieved.

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Exercises on The equilibrium in the Keynesian model with two sectors

Exercise1:

Let's have following aggregate consumption function: $C = 20 + 0.9\ Yd$

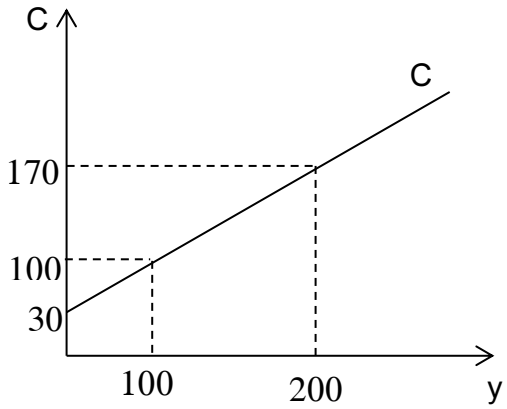
1. Using this formula, create a consumption table for five periods, at these disposable income levels: 200, 250, 300, 350, 400.

2. Represent this function graphically.

3. How do consumer loans affect the consumption function?

Exercise2:

Let's have the following graph:



1. Deduce the consumption equation on the basis of the following chart.

2. Deduce the saving function on the basis of the consumption equation.

3. Calculate savings with income of $Yd = 200$?

Exercise3:

Let's have the following data about the aggregate consumption, income, and investment of a community over five periods:

Y	0	2000	5000	8000	11000
C	1000	2600	5000	7400	9800

1. Calculate the marginal propensity to consume (MPC) and average propensity to consume (APC)? Then deduce the marginal propensity and the average propensity to save?

2. Prove that the data above correspond to the Keynesian consumption function? Then build this function?

3. Calculate savings for each period? Then deduce the saving function from the consumption equation?

5. Represent the saving function and the consumption function on the same graph? Explain what does represent the intersection point between the aggregate consumption curve and the aggregate supply curve?

Exercise4: Let the following data be about the aggregate consumption, income and investment of a community over six periods

Y	400	500	600	700	800	900
C	290	360	430	500	570	640
I	200	200	200	200	200	200

1. Calculate saving at each level of income, and then calculate aggregate demand?

2. Determine, based on the data of the table, the equilibrium position in two different ways? What is equilibrium income?

3. construct the Consumption, Saving and Investment equations?

4. Determine mathematically the Equilibrium Income in two ways; demand - supply method and investment -saving method?

SOLUTIONS

(The equilibrium in the Keynesian model with two sectors)

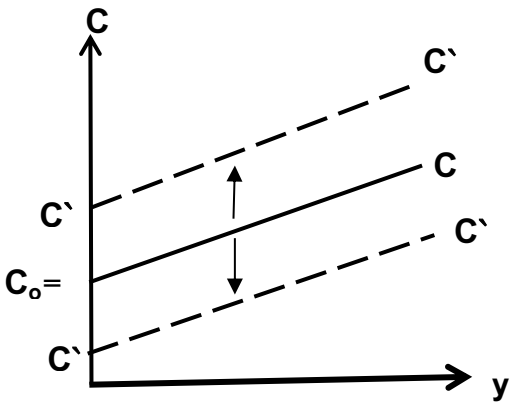
Exercise1:

1. Consumption table:

By substituting the various values of disposable income into the consumption function we obtain the following consumption schedule:

y_d	200	250	300	350	400
C	200	245	290	335	380

2. Consumer loans are one of the objective factors affecting consumption independently from income, which Keynes considered as insignificant determinants of consumption expressed by the external variable Co in the consumption function, where the change in these factors leads to the shift in the consumption function parallel to the up or down due to the change in the value of Co; the consumption function shifts up in the case of large availability of consumer loans at a lowest cost, by the value of the change in independent consumption and the transition is at the same previous income levels, and vice versa.



Exercise2:

1. Inferring the consumption equation from the graph:

The consumption function is linear and takes the general form $C = C0 + by_d$

Based on the graph, we note that the value of consumption when there is no income is equal to: $C0 = 30$

$$b = MPC = \frac{\triangle C}{\triangle yd} = \frac{C_2 - C_1}{C_2 - y_1} = \frac{C_3 - C_0}{y_3 - y_0} \ldots.$$

$$b = \frac{170 - 100}{200 - 100} = \frac{100 - 30}{100 - 0} = 0{,}7$$

Consumption function: **C = 30 + 0,7 yd**

2. Inferring the saving function on the basis of the consumption function:

$$y = C + S \Rightarrow S = y - C \quad / \quad y = yd$$

$S = y - (C_0 + by)$

$S = - C_0 + (1 - b)\, y \,/\, yd = y$

$S = -30 + 0{,}3\ yd$

3. **Saving at y = 200**

S = −30 + 0,3 (200) S = −30 + 60 =30

Exercise 3:

1) Calculating the marginal propensity and the average propensity to consume and save.

Total income y	0	2000	5000	8000	11000
Total consumption C	1000	2600	5000	7400	9800
$MPC = \frac{\triangle C}{\triangle yd}$	-	0.8	0.8	0.8	0.8
$APC = \frac{C}{yd}$	-	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
$y = C + S \Rightarrow S = Y - C$	-1000	-600	0	600	1200

2) Calculating the marginal propensity and the average propensity to consume and save:

a) Marginal propensity to consume:

$$MPC = \frac{\Delta C}{\Delta Y_d} \Rightarrow MPC = \frac{C_2 - C_1}{y_{d_2} - y_{d1}} = \frac{2600 - 1000}{2000 - 0} = \frac{1600}{2000} = 0{,}8$$

We notice that the marginal propensity to consume is constant at different income levels.

b) Average propensity to consume $APC = \frac{C}{y_d}$

$$APC_1 = \frac{C_1}{y_{d1}} = \frac{2600}{2000} = 1.3$$

$APC_2 = \frac{C_2}{y_{d2}} = \frac{5000}{5000} = 1$ (The rest of the values are in the table)

We notice that the average propensity to consume decreases as income increases.

c) Deducing the marginal propensity to save and the Average propensity to save:

MPS = 1 − MPC = 1 − 0,8 = 0,2

MPS is constant at different levels of income.

APS = 1 − APC $APS_1 = 1 - 1.3 = -0.3$ (The rest of the values are in the table)

We notice that the average propensity to save increases as income increases.

3) Proving that the data correspond to the Keynesian consumption function:

Since the marginal propensity to consume is constant and the APC is decreasing, and knowing that APC> MPC, this indicates that the relationship between consumption and income is disproportionate, that is, as income increases, consumption increases by less than the increase in income i.e., C <yd and this corresponds to Keynesian consumption function.

4) Calculating the consumption and saving functions:

a) The consumption function:

The consumption function is of the form: $C = C_0 + by_d$ / $b = 0.8$

Based on the table note that the value of consumption when there is no income is equal to: $C_0 = 1000$

$C = 1000 + 0.8\ y_d$

b) Calculating Savings and deducing saving function:

i) **Calculating Savings**: (see table above)

ii) **Deducing saving function:**

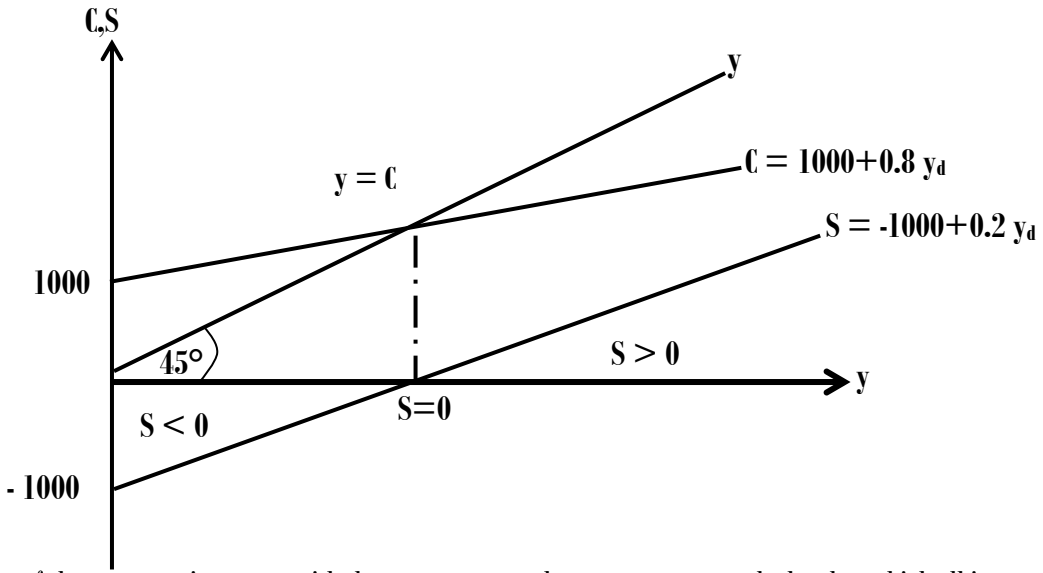
$y_d = C + S \Rightarrow S = y_d - C$

$S = y_d - C = y_d - (C_0 + by_d)$

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

$S = -1000 + 0{,}2y_d$

5) Graph of the C and S functions:



The point of intersection of the consumption curve with the aggregate supply curve represents the level at which all income is directed to consumption, i.e., saving is zero.

Exercise 4:

1) Calculating Savings and aggregate demand:

y aggregate income	400	500	600	700	800	900
C aggregate consumption	290	360	430	500	570	640

I Total investment	200	200	200	200	200	200
$y = C + S \Rightarrow S = Y - C$	110	140	170	200	230	260
Aggregate demand D = C + I	490	560	630	700	770	840

2) **Based** on the table, the total equilibrium is achieved according to the method of aggregate Supply/ aggregate demand at Y = D = 700 or according to the method of saving / investment by achieving the equilibrium condition S = I = 200. And the equilibrium income is Ye = 700 according to two methods

3) **Calculation of the consumption, saving, and investment equation:**

a) **Consumption equation:**

The consumption function is of the form: $C = C_0 + by_d$

$$b = MPC = \frac{\triangle C}{\triangle yd} = \frac{360 - 290}{500 - 400} = 0.7$$

$C_0 = C\text{-}by_d \Rightarrow C_0 = 290 - 0.7(400) = 10$

$C=10+0.7\ y_d$

b) **Savings equation:**

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

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

$S=-10 + 0.3\ y_d$

c) **Investment equation:**

Investment is an external variable $I=I_0=200$

4) **Calculating the equilibrium income in two ways:**

Method1: Total supply/ total Demand

$Y=D \Rightarrow y= C+I$

$\Rightarrow y=Co +byd + Io$

$\Rightarrow y=Co +by + Io$

$\Rightarrow y- by = co + Io$

$\Rightarrow y(1-b) = co +Io$

$\Rightarrow y_e=\frac{C_o+ I_o}{1-b} = \frac{10+ 200}{1-0.7}$

$y_e= 700$

Method2: Savings/ Investments

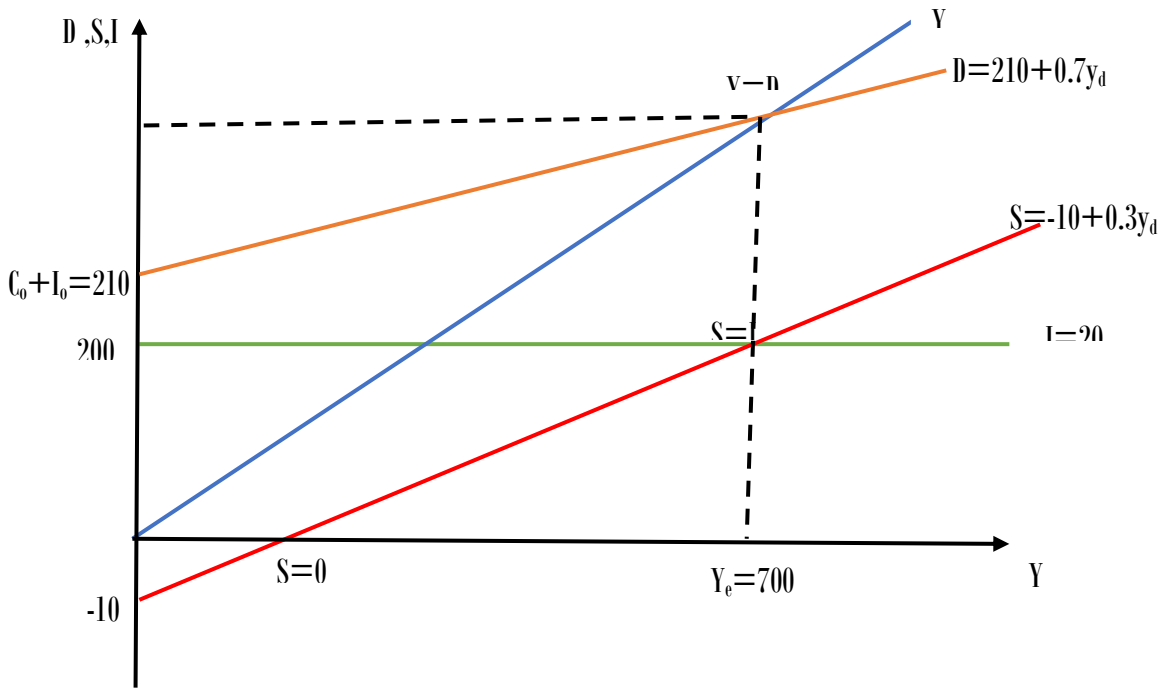
$S=I \Rightarrow -Co+ (1-b)y= Io$

$\Rightarrow y(1-b) = c_0 + I_0$

$\Rightarrow y_e = \frac{C_0 + I_0}{1-b} = \frac{10+200}{0.3}$

$\Rightarrow y_e = 700$

5) Graphical representation of equilibrium position by two methods (Y / D and S / I):

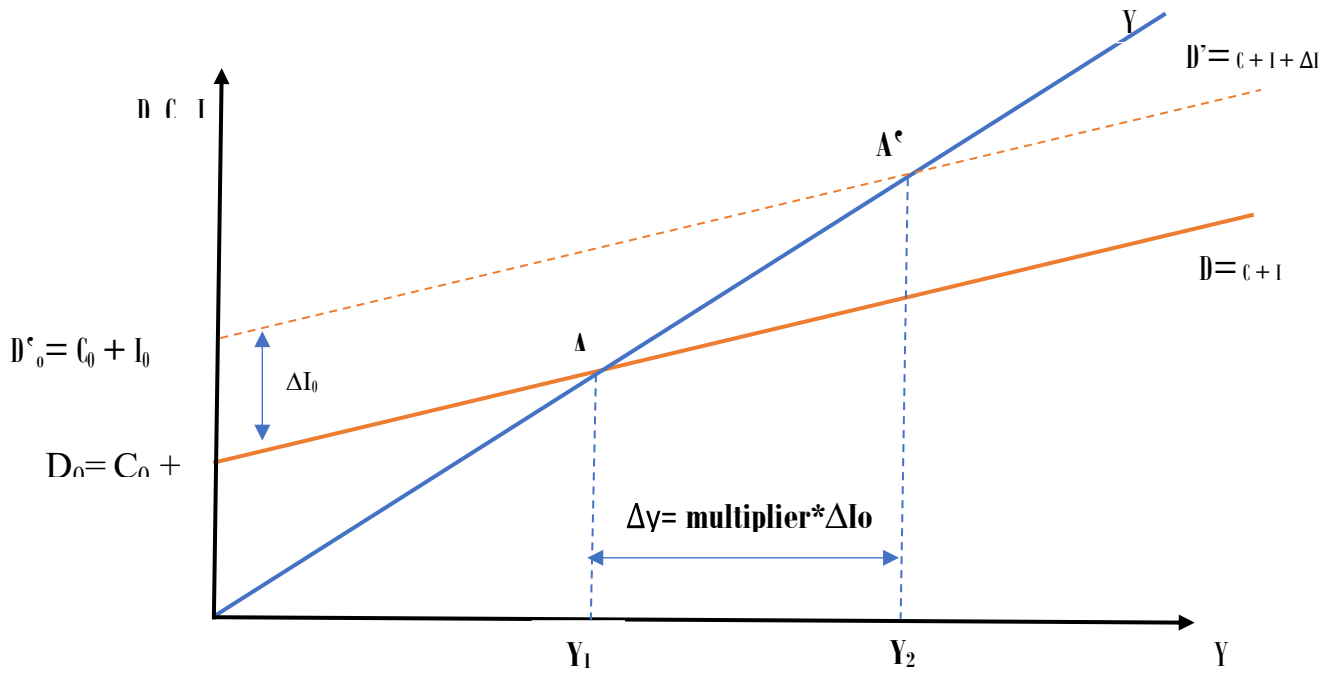


CHAPTER 8: CHANGES IN EQUILIBRIUM LEVEL AND THE MULTIPLIER THEORY

1. Definition of the multiplier

The equilibrium level of income seldom stabilizes, **there are factors that lead to a change in it** and the imbalance (**Disequilibrium**) of the economy (for example from point A to A' in the following graph). Among these factors, changes in the independent spending, that is, changes in C_0 and I_0, especially I_0, as consumption is more stable.

We define the **multiplier** as the value by which the equilibrium output changes when the total independent demand increases by one unit, it is the coefficient that shows the amount of the **increase** in national income resulting from the **increase** in one of the elements of independent spending:



We notice from the graph that $\Delta I_0 < \Delta Y$ Because the independent change in spending has a multiplier effect on income (cumulative effect on income) by its effect on consumption because the latter is related to income, and this is called the multiplier effect, so we say that the effect of the multiplier is the effect that generates income and consumption, that is:

$$\Delta I + \Delta C = \Delta y$$

Initial investment — Generated consumption — Final income

Therefore, the $\Delta y > \Delta I$, so the value of the multiplier is greater than 1. For this reason, Keynes considers spending a fundamental factor that must be supported to raise the level of income. the multiplier is very linked to consumption, and in particular to the marginal propensity to consume.

2. Static Multiplier and Dynamic Multiplier

2.1. Definition of Static Multiplier

In the static case, there is a coincidence between the period of receiving and spending the income, so the static multiplier measures the final or direct change in income resulting from the change in autonomous spending assuming **no slowdown**

The formula for the static Multiplier:

If the linear equation of consumption is $C=C_0+by_d$ and autonomous investment is given by the formula $I=I_0$, and assuming a change in I_0 by ΔI_0, then this will lead to a change in income by Δy. Using the static equilibrium formula, we find:

$$y_e = \frac{C_0 + I_0}{1-b} \quad \text{..... ①}$$

$$y + \Delta y = \frac{C_0 + Io + \Delta I_0}{1-b} \Rightarrow y + \Delta y = \frac{1}{1-b}(C_0 + Io + \Delta I_0) \text{..... ②}$$

Subtracting (1) from (2): $\Delta y = \frac{1}{1-b}\Delta I_0$

$\frac{1}{1-b}$: *Multiplier* K_E

If consumption C_0 changes by the value of ΔC_0, the income y will change by the value of ΔC_0 multiplied by the Multiplier. In the same way, we extract the formula for the consumption Multiplier, where:

$K_E = K_C = \frac{\Delta y}{\Delta Co} = \frac{1}{1-b}$

That is, if the autonomous consumption C_0 changes with the value of ΔC_0, the income will change with the value of ΔC_0 multiplied by the Multiplier K_C, and its value is related to the value of the marginal propensity to consume: the higher the marginal slope, the higher the multiplier with it. As long as $0<b<1$, the multiplier is >1, the value of the Multiplier is greater than 1, and then the Multiplier is more effective as the tendency to consume increases.

2.2. Dynamic Multiplier:

In the dynamic model, the time element is entered in the analysis, as the variables are dated to distinguish between their values from one period to another. The dynamic multiplier exists when there is a late response between consumption and available income, and the effect of the multiplier in the case of the dynamic multiplier is an indirect effect, and this is due to the presence of a slowdown period between Receiving and Spending Income:

$C_{t+1} = f(Y_{dt})$ for example: $C_{t+1} = 40 + 0{,}8\ y_t$

- **The Dynamic Multiplier formula:**

Assuming a sustained increase in investment ΔI starting from the period $t+1$, and this increase is supposed the same for all periods, we extract the dynamic multiplier formula as follows:

Periods	Change in income	Dynamic multiplier
t+1	At equilibrium: $y_{t+1} = C_{t+1} + I$ When investment changes by ΔI, income changes by Δy: $\Delta y_{t+1} = \Delta C_{t+1} + \Delta I$ .....(1) As $C_{t+1} = Co + byt$ ➔ $b = \frac{\Delta C_{t+1}}{\Delta Yt} \Rightarrow \Delta C_{t+1} = b\,\Delta yt$ $\Delta y_t = 0$ as change in investment starts at (t+1) so, $\Delta C_{t+1} = 0$ Substituting in 1, we find: $\Delta y_{t+1} = \Delta I$ .....(2)	$\Delta y_{t+1} = \Delta I$ $K_{t+1} = \frac{\Delta y_{t+1}}{\Delta I}$ $= 1$

t+2	$\Delta y_{t+2} = \Delta C_{t+2} + \Delta I$ $\Delta y_{t+2} = b\,\Delta y_{t+1} + \Delta I$ .....(3) Substituting 2 in 3, we find: $\Delta y_{t+2} = b\,\Delta I + \Delta I$ $\Delta y_{t+2} = (1+b)\,\Delta I$ .....(4)	$\Delta y_{t+2} = (1+b)\,\Delta I$ $K_{t+2} = \frac{\Delta y_{t+2}}{\Delta I}$ $= 1+b$
t+3	$\Delta y_{t+3} = \Delta C_{t+3} + \Delta I$ $\Delta y_{t+3} = b\,\Delta y_{t+2} + \Delta I$.....(5) Substituting 4 in 5, we find: $\Delta y_{t+3} = b\,(1+b)\,\Delta I + \Delta I$ $\Delta y_{t+3} = (1 + b + b^2)\,\Delta I$	$K_{t+3} = \frac{\Delta y_{t+3}}{\Delta I}$ $= 1 + b + b^2$
...	...	...
t+n	$\Delta y_{t+n} = \Delta I(1 + b + b^2 + \cdots + b^{n-1})$	$K_{t+n} = \frac{\Delta y_{t+n}}{\Delta I}$ $= 1 + b + b^2 + \cdots + b^{n-1}$

We note that the dynamic multiplier operations form a decreasing geometric progression, and the increase in income in period $t+n$ is given by the following formula: $\Delta y_{t+n} = \Delta I(1 + b + b^2 + \cdots + b^{n-1})$

When all the effect of the multiplier is realized, it becomes equal to the static multiple, i.e.:

$$K_{t+n} = \frac{\Delta y_{t+n}}{\Delta I}(1 + b + b^2 + \cdots + b^{n-1}) = \frac{1}{1-b}$$

Example:

If during the period t the consumption function is equal to C=40 + 0.8 yd, and the investment is equal to I=Io=50. starting from period t+1, there has been a permanent increase in investment estimated at $\Delta I = 10$

Calculate the static multiplier and the dynamic multiplier for three periods, as well as the change in income in both cases:

Solution:

Calculating the static multiplier: $Ke = \frac{\Delta y}{\Delta Co} = \frac{1}{1-b} = \frac{1}{1-0.8} = 5$

$\Delta y = K_e * \Delta I = 5 \times 10 = 50$

Calculating the dynamic multiplier for three periods: $K_{de\ t+3} = \frac{\Delta y_{t+3}}{\Delta I} = 1 + b + b^2 = 1 + 0.8 + 0.8^2 = 2.44$

$\Delta y_{t+3} = (1 + b + b^2)\,\Delta I = 2.44 * 10 = 24.4$

In the static case, we notice that the income multiplied by 5 times the value of the increase in investment. When the coincidence between income and spending, the effect of the multiplier **is total and direct**.

In the dynamic case, in each interval, only part of the value of the multiplier is realized. In this case, the effect of the multiplier will be an **indirect effect,** and it will be achieved gradually. When you continue in the operations of the dynamic multiplier until the period (t+n), 100 % of the value of the dynamic multiplier will be achieved, and then it becomes: $K_{de} = K_e = 5$

3. Disequilibrium and the occurrence of an inflationary gap and a deflationary gap

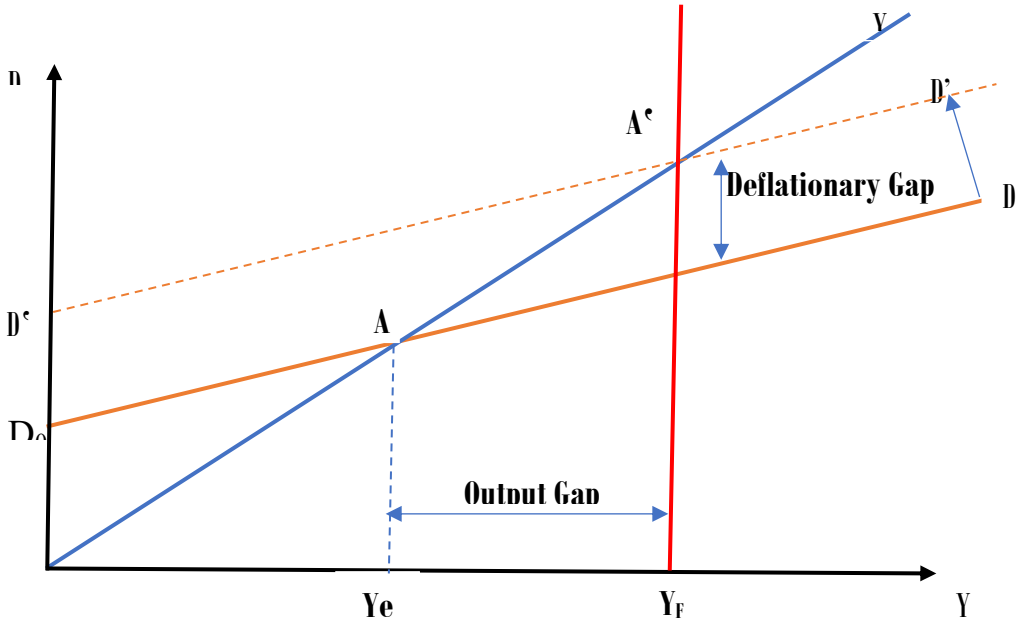
3.1. Deflationary or Contractionary Gap

If the aggregate demand is less than what is required to operate all available resources, then the national income or national product in equilibrium will be less than the potential national product (full employment product) which is the maximum volume of the real national product that can be achieved by using all the available resources: In this case, the output gap will be equal to Y_f-Y_e and thus the deflationary gap appears: it shows that amount of independent spending necessary to bring the economy to a state of full employment, and it can be calculated as follows

Deflationary Gap = Output gap / Multiplier

$$CG = \frac{y_F - y_e}{K_e} \qquad Y_f - Y_e > 0$$

The treatment of the deflationary gap is by implementing an expansionary **fiscal and monetary policy** by raising government spending and interest rates, which causes an increase in aggregate demand and a shift in the **D** curve to the top by the value of the gap, so that the economy achieves a total equilibrium in light of full employment at point A' in the following graph:



3.2. Inflationary Gap:

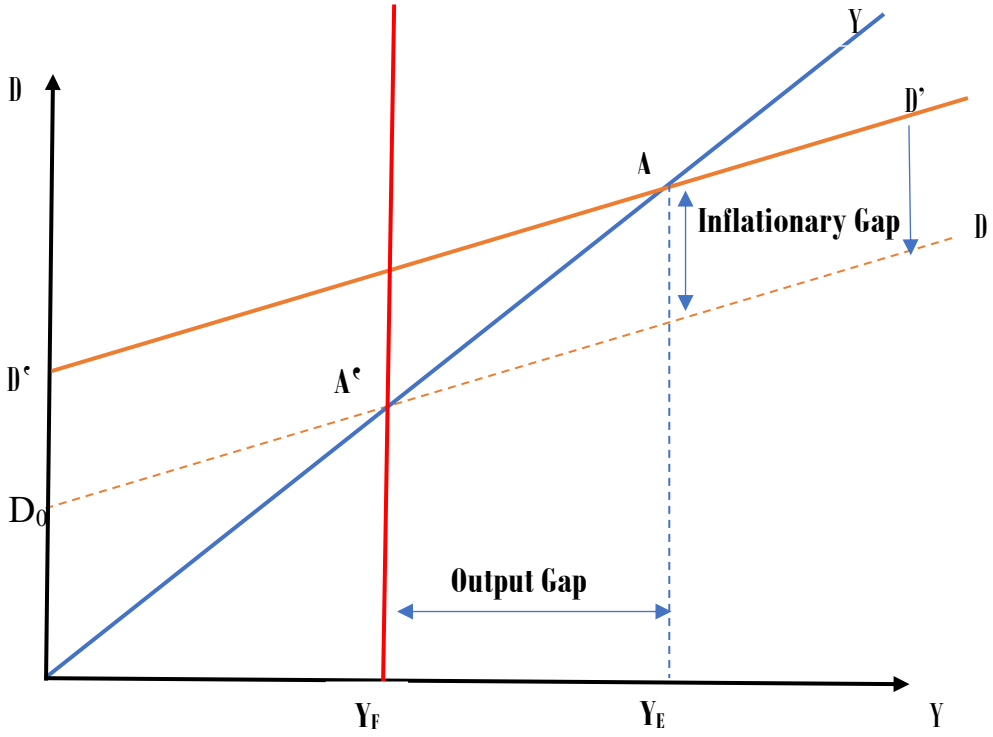
In the opposite case, if the aggregate demand is greater than it should be to achieve full employment, where the national product at equilibrium (Ye) is greater than the potential national product (Y_f), the economy will suffer from inflation, and this will result in an **inflationary gap**, which indicates the amount of independent spending that must be withdrawn to restore Economy to full employment. The gap is calculated as follows:

Inflationary Gap = Output gap / Multiplier

$$IG = \frac{y_F - y_e}{K_e} \qquad /y_F - y_e < 0$$

The treatment for the inflationary gap is by the application of a contractionary **fiscal and monetary policy by the government** by reducing **government spending** and raising taxes and interest rates, which causes the surplus to be absorbed

from Aggregate demand and the D curve shift downwards by the value of the gap, thus achieving a total balance under full employment at point A' .



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EXERCISES ON MULTIPLIER THEORY (STATIC AND DYNAMIC MULTIPLIER)

Exercise 01:

Assume that we have the following data for an economy suffering from unemployment

APC = 0.94 MPC = 0.75 y =7600

Questions:

1. Find consumption level?

2. If investment increases by 300 DZD, calculate the investment multiplier and the change in income?

3. Calculate the change in consumption associated with the change in income?

4. As for the average propensity to save, will it increase, decrease, or remain stable?

Exercise 02:

Assume that the household sector consumption is represented by the following behavioral equation:

$C = 50 + 0.75Yd$, and that firms invest an amount estimated at $I = 20$.

Questions:

1. Calculate income, consumption and savings at equilibrium?

2. If the autonomous investment rose by 10 DZD, what effect would that have on the previous equilibrium values?

3. If the marginal propensity to consume changes and becomes b=0.8, what is the effect of this on the multiplier and the previous equilibrium values?

Exercise 03:

Assume that a country's economy is under unemployment, and the government wants to alleviate the phenomenon by a constant increase in investment by $\Delta I=10$. Suppose that income in current year is y=500, and marginal propensity to consume b= 0.75.

Questions:

1. Find the value of the 4-period dynamic multiplier and determine the amount of income needed to solve the unemployment problem?

2. Explain the difference between static and dynamic multiplier?

Exercise 04:

Assume that consumption is a function of disposable income with a single slowdown period and that there is a constant increase in investment.

Questions: How many periods are needed to achieve a change in the income level by 50% in both cases:

1- b=0.5 2- b=0.9

Exercise 05:

If the consumption function is given by the formula: C = 1000 + 0.6Yd, and autonomous investment is I=I0=200

Questions:

1. Calculate the corresponding equilibrium income, consumption and savings?
2. If the full employment income is 2,800 DZD, what is the state of the economy? determine the nature of the gap and calculate it?
3. Define the inflationary gap and deflationary gap and how to address them?

SOLUTIONS OF EXERCISES

Exercise 01:

1. Finding the level of consumption:

$$APC = \frac{C}{y_d} \quad / \quad y = y_d$$
$$C = APC\ (y) \Rightarrow C = 7600\ (0{,}94)$$
$$C = 7144$$

2. Calculating the investment multiplier

$$K_I = \frac{\Delta y}{\Delta I} = \frac{1}{1-b} \Rightarrow K_I = \frac{1}{1-0{,}75} = \frac{1}{0{,}25} = 4$$
$$\Delta_y = K_I . \Delta I = 4\ (300) = 1200 \text{ ون} \Rightarrow \Delta_y = 1200$$
$$y' = y + \Delta y = 7600 + 1200 \Rightarrow \hat{y} = 8800$$

3. Calculating the change in consumption associated with the change in income:

$$b = \frac{\Delta C}{\Delta y} \Rightarrow \Delta C = b\Delta y_d$$
$$\Delta C = 0{,}75\ (1200) \Rightarrow \Delta C = 900$$
$$\hat{C} = C + \Delta C = 7144 + 900 \Rightarrow \hat{C} = 8044$$

4. Explaining the effect of the change in income due to the investment multiplier on the average propensity to save (APS)

a- Before the increase in income:

$$APS = \frac{S}{yd} = \frac{y-C}{yd}$$
$$APS = \frac{7600-7144}{7600} = 0{,}06$$
$$APS = 1 - APC = 1 - 0{,}94 = 0{,}06$$

B- After the increase in income:

$$APS' = \frac{S'}{y'} = \frac{y'-C'}{y'} = \frac{8800-8044}{8800}$$
$$APS' = 0{,}086$$

We notice that with the increase in income, the average propensity to save increases, and this is explained according to Keynes's psychological law: The higher the income, the less consumption increases, due to the emergence of the saving tendency (the tendency to save), so the average propensity to save **increases**.

Exercise 02:

1- Calculating income, consumption and saving at equilibrium:

$$y_e = \frac{C_0 + I_0}{1-b} = \frac{50+20}{1-0{,}75} = \frac{70}{0{,}25} = 280$$

$$C_e = 50 + 0{,}75\,(280) = 50 + 210 = 260$$
$$S_e = y_e - C_e = 280 - 260 = 20$$

2- Explaining the effect of increase in I_0 by 10 DZD:

a- On income equilibrium

$$\Delta y = K_I \,.\, \Delta I_0 = 4 \times 10 = 40$$

$$K_I = \frac{\Delta y}{\Delta I_0} = \frac{1}{1-b} = \frac{1}{0{,}25} = 4$$

$$y` = y + \Delta y = 280 + 40 = 320$$

b- On consumption:

$$b = \frac{\Delta C}{\Delta y} \Rightarrow \Delta C = b.\Delta y$$
$$\Delta C = 0{,}75\,(40) = 30$$
$$C` = C + \Delta C = 260 + 30 = 290$$

c- On saving:

$$S` = y` - C` = 320 - 290 = 30$$

$$\Delta S = 10$$

3- Explaining the effect of increasing b:

a - On the multiplier and income Equilibrium:

$$b = 0{,}8 \Rightarrow K_e = \frac{1}{1-b}$$
$$K_e = \frac{1}{1-0{,}8} = 5$$
$$y_e = \frac{C_0 + I_0}{1-b} = \frac{50+20}{1-0{,}8} = 350$$
$$\Delta y = 350 - 280 = 70$$

b- On consumption and savings

The raise in the marginal propensity to consume caused an increase in the impact of the investment multiplier from K = 4 to K = 5 due to the direct relationship between the marginal propensity to consume and the multiplier, which led to a rise in primary equilibrium income by 70 DZD, as well as a rise in consumption due to its association with income:

$C_e = 50 + 0{,}8\,(350) = 330 \Rightarrow \Delta C = 330 - 260 = 70$

$S_e = y_e - C_e = 350 - 330 = 20 \Rightarrow \Delta S = 0$

(We notice that savings remain stable despite the increase in income due to a declining marginal propensity to save with a higher marginal propensity to consume).

Remark: In this case, and assuming an increase in investment accompanied by an increase in the value of the multiplier, its effect on the equilibrium values will be greater than its effect before the multiplier increases.

Exercise 03:

1. Calculating dynamic multiplier value for 4 periods

(It is sufficient to calculate Kde_{t+4} but, for better understanding, we will calculate $\mathbf{K_{de}}$ for one, two and three periods)

Dynamic multiplier for n periods: $Kd_e = 1 + b + b^2 + \cdots + b^{n-1} = \frac{1}{1-b}$

And the change in income: $Kd_{de\ t+n} = \frac{\Delta y_{t+n}}{\Delta I} \Rightarrow \Delta y_{t+n} = Kd_e \Delta I$

Dynamic multiplier for one period Kde_{t+1}: $Kd_{e_{t+1}} = \frac{\Delta y}{\Delta I} = 1 \Rightarrow \Delta y_{t+1} = 1\,.\,\Delta I = 10$

The dynamic multiplier for two periods Kde_{t+2}: $Kd_{e_{t+2}} = 1 + b \Rightarrow Kd_{e_{t+2}} = 1 + 0{,}75 = 1{,}75$

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

The dynamic multiplier for tree periods Kde_{t+3}: $Kd_{e_{t+3}} = 1 + b + b^2 \Rightarrow Kd_{e_{t+3}} = 1 + 0{,}75 + (0{,}75)^2 = 2{,}312$

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

The dynamic multiplier for four periods Kde_{t+4}:

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

$$\Delta y_{t+4} = Kd_{e_{t+4}}\,\Delta I \Rightarrow \Delta y_{t+4} = 2{,}73\,(10) = 27{,}3$$

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

2- The difference between static and dynamic multiplier:

Static Multiplier	Dynamic Multiplier
- Neglects time and assumes no slowdown or lag between income acquisition and its spending	It takes time into account and assumes a slowdown in spending
- The relationship between C and Yd is simultaneous	The relationship between C and Yd is asynchronous $C_t = f(Y_{t-1})$
- Calculates the final (direct) change in income.	Calculates The progressive (indirect) change in income.

Exercise 04:

1- Identifying the number of periods necessary to achieve the multiplier effect when b=0.5

The consumption function is characterized by the existence of one slowing-down period $C_t = C_0 + by_{t-1}$

The change in income (or percentage of multiplier achieving effect) is defined as the ratio of dynamic multiplier to static multiplier: $\frac{Kd_e}{K_e}$

$$\frac{Kd_e}{K_e} = 50\ \% = 0{,}5 \Rightarrow Kd_e = 0{,}5\ K_e$$
$$Kd_e = 0{,}5\frac{1}{1-b} = 0{,}5\ \frac{1}{1-05}$$
$$Kd_e = 0{,}5(2) = 1$$

* If b=0, 5 we notice that 50% of multiplier effect is achieved during the first period (t+1)

2- determining number of periods necessary to achieve the multiplier effect for b = 0.9

$$Kd_e = 0{,}5\ K_e$$
$$Kd_e = 0{,}5\ \frac{1}{1-0{,}9} = 0{,}5\ (10)$$
$$Kd_e = 5$$
$$Kd_{e_{t+n}} = 1 + b + b^2 + \cdots b^{n-1}$$
$$Kd_{e_{t+7}} = 1 + 0{,}9 + 0{,}9^2 + \cdots + 0{,}9^6 = 5$$

for b=0.9, we notice that **multiplier effect is achieved** during seventh period (t+7). We conclude that the higher the value of the marginal propensity to consume b, the greater the number of periods during which the dynamic multiplier is achieved

Exercise 05:

1 - Calculating equilibrium income

$$y = D$$
$$y = C + I$$
$$y = C_0 + by + I_0$$
$$y - by = C_0 + I_0$$
$$y_e = \frac{C_0 + I_0}{1-b} = \frac{1000+200}{1-0{,}6} \Rightarrow \quad y_e = 3000$$

2 - Calculating consumption and saving at equilibrium

$$C_e = 1000 + 0{,}6\ (3000) = 2800$$
$$S_e = y - C = 3000 - 2800 = 200$$

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

We notice that the achieved equilibrium income is greater than Potential income or full employment income, meaning that the economy of this country is suffering from un inflationary gap:

The inflationary gap $= \frac{\Delta y}{K_e}$ where: $K_e = \frac{1}{1-b} = \frac{1}{1-0.6} = 2.5$

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

There is a surplus in aggregate demand of 80 DZD, which must be withdrawn from the economy to return to full employment.

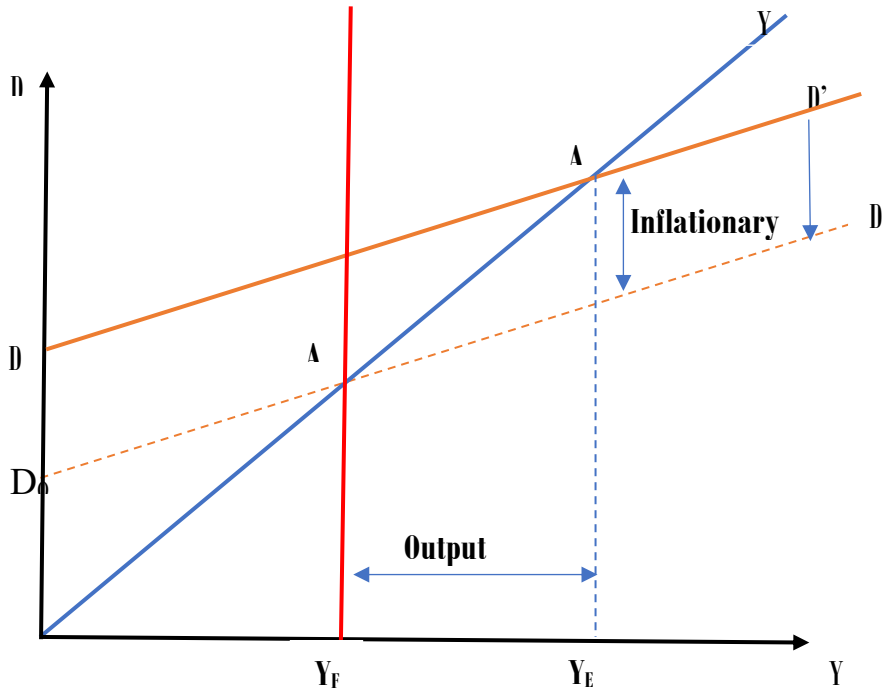
4- Defining the inflationary gap:

It represents the amount of independent spending (I_0+ C_0) that must be withdrawn to restore the economy to a state of full employment, it appears when aggregate demand exceeds production at full employment: $y_e > y_F$

Its solution is by reducing (shrinking) this demand by applying Contractionary monetary and fiscal policy.

The gap formula: $\text{gap} = \frac{\text{The production or } \textbf{Output gap}}{\text{Multiplier}}$ /

Equilibrium Income Y_e - Full employment Income Y_f= **Output Gap**



5- Deflation of deflationary gap:

It represents the amount of independent spending (I_0+ C_0) that must be added to the economy to reach full employment, it appears when there is a lack of total demand, i.e., $y_e < y_F$

Its treatment is by pumping additional market demand by applying an expansionary fiscal and monetary policy.

CHAPTER 9: EQUILIBRIUM IN A THREE & FOUR-SECTOR KEYNESIAN MODEL

1. Introduction

A **closed economy** is one that has no trading activity with outside economies. The closed economy is therefore entirely self-sufficient, which means no imports come into the country and no exports leave the country. This is a hypothetical case; in reality, there are no nations that have economies that are completely closed. By dropping this hypothesis, the model becomes of 4 sectors, known as **open economy**.

The foreign trade sector has a great influence on the level of the country's economic activity represented in employment, production and consumption. The following are the most important advantages of this sector:

- Specialization, that is, the global division of labor, as each country has a comparative advantage that qualifies it for specialization which maximizes profits,

- It effects the level of national income by maximizing exports, and thus gaining surpluses in foreign exchange reserves,

- Its positive effect on employment by encouraging exports.

2. Types of deals with the outside world:

Deals with the outside world are divided into current deals (trade in goods and services) and capital deals (outflow of capital). The trade balance records current deals that are divided into two parts:

A- Exports: We denote them by (X), They raise the level of national income (injection component). They are considered as an external variable $X = X0$ because they represent foreign demand for local goods.

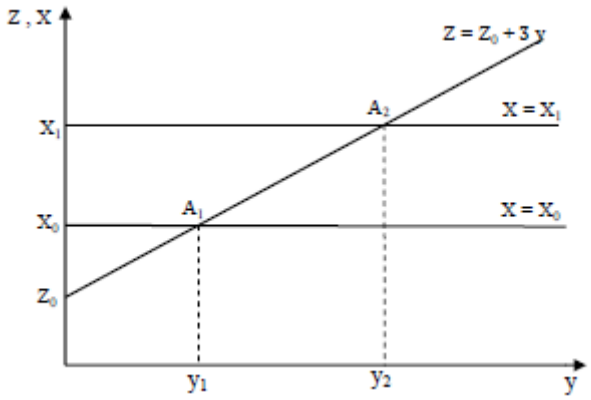
B. Imports: We denote them by (Z). They reduce the level of national income (leakage element). They are considered as an internal variable (linked to the national income), because they represent a national demand for foreign goods, this demand rises with the increase in the national income and decreases with the decrease in the national income: $z = z_0 + \delta y$

δ represents the marginal propensity of imports $\delta = \frac{\Delta z}{\Delta y}$

3. Balance of Trade (BOT):

The trade balance or Balance of Trade is measured as the total value of exported goods and services minus the total value of imported products. If it is positive, there is a surplus in the trade balance (trade surplus), if it is negative, there is a deficit in the trade balance (trade deficit). IF X=Z, then the trade balance is zero

The trade balance is represented graphically As follows:



A- The first equilibrium position:

At point A: equilibrium in the balance of trade Z= X

To the left of A: there is a surplus in exports Z<X (surplus in the trade balance).

To the right of A: there is a surplus in imports X< Z (deficit in the trade balance).

B. The second equilibrium situation:

Equilibrium with the rise in exports to X_1, we move to a new position in the trade balance, represented by point A_2, the surplus of exports rises and the surplus of imports shrinks, this leads to an increase in income from y1 to y2, because the rise in exports brings advantages to the national economy in terms of maximizing the proceeds from foreign exchange and thus improving the national product.

4. Calculation of equilibrium income in a 4 sectors model:

4.1. The case of tax independent of income (Tx = Tx0)

Model data: $Z = Z_0+3y \quad / X = X_0 \quad /T_r = T_{r0} \quad /T_{xo} = T_{xo} \quad /G = G_0 \quad /I=I_0$

$$y_d=y-T_{xo}+T_{ro} \quad /C = C_0+by_d$$

Balance is achieved in a model consisting of 4 sectors according to two methods:

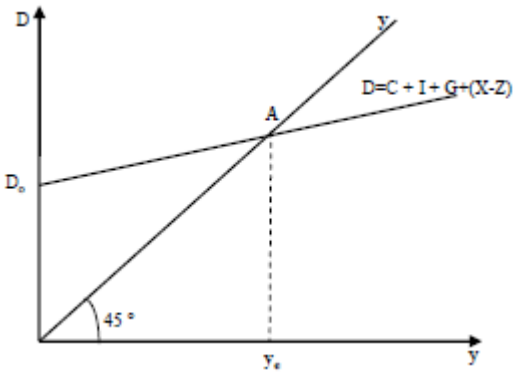
A- Aggregate Demand/ Aggregate Supply Method:

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

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

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

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



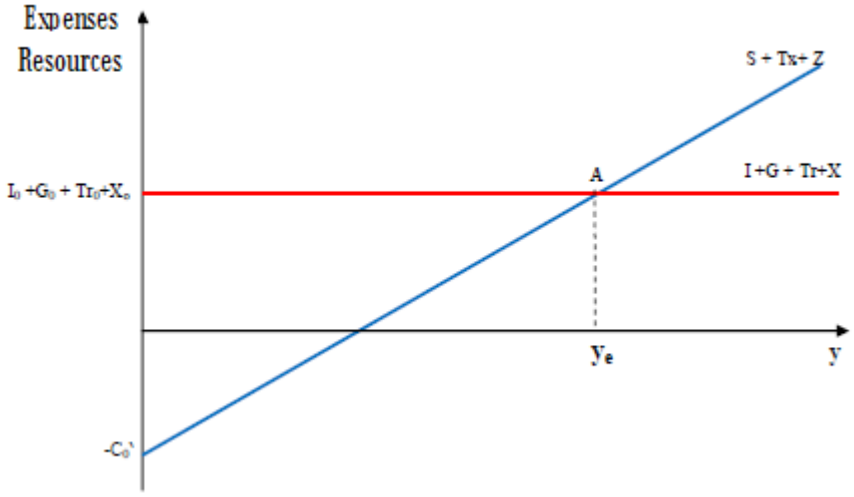
B- Expenses/Resources Method:

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

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

$$-C_o\ (1 - b)\,(y - T_{XO} + T_{r0}) + T_{X_o} + Z_o + zy = G_0 + I_0 + T_{ro} + X_o$$

$$y^* = \frac{1}{1-b+z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{r0} + X_0 - Z_0)$$



4.2. Tax as function of income $(T_X = T_{XO} + ty)$

a) Total Demand/Total Supply Method:

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

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

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

b) Expenses/ Resources Method:

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

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

$$y_e = \frac{1}{1-b+bt+z}(C_0 + I_0 + G_0 - bT_{X0} + bT_{r0} + X_0 - Z_0)$$

5. Multiplier in a four-sector model

Tax dependent of income	Tax independent of income
$K_G = \frac{\Delta y}{\Delta G_0} = \frac{1}{1-b+bt+z}$	$K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1-b+z}$
$K_I = \frac{\Delta y}{\Delta I_0} = \frac{1}{1-b+bt+z}$	$K_I = \frac{\Delta y}{\Delta I_0} = \frac{1}{1-b+z}$
$K_{Tr} = \frac{\Delta y}{\Delta T_{r0}} = \frac{b}{1-b+bt+z}$	$KT_r = \frac{\Delta y}{\Delta T_{r0}} = \frac{b}{1-b+z}$
$K_{Tx} = \frac{\Delta y}{\Delta T_{X0}} = \frac{-b}{1-b+bt+z}$	$KT_x = \frac{\Delta y}{\Delta T_{x0}} = \frac{-b}{1-b+z}$
$K_X = \frac{\Delta y}{\Delta X_0} = \frac{1}{1-b+bt+z}$	$K_X = \frac{\Delta y}{\Delta X_0} = \frac{1}{1-b+z}$

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6. Federal Reserve Education Keynesian Theory

https://www.federalreserveeducation.org/about-the-fed/structure-and-functions/keynesian-theory

7. OpenStax Principles of Macroeconomics

https://openstax.org/books/principles-macroeconomics-2e/pages/24-2-keynesian-economics-in-the-1960s-and-1970s

8. Coursera Keynesian Economics and Macroeconomic Models

https://www.coursera.org/lecture/macroeconomics/keynesian-economics-GzE6I

Exercises on Keynesian equilibrium in an economic model of 3 and 4 sectors

Exercise 01: Let's have the following data about an economy

$Tr = Tr_0 = 100$ $Tx = Tx_0 = 600$ $I = I_0 = 200$ $C = 1000 + 0.6Yd$ $G = G_0 = 500$

Questions:

1. When is equilibrium achieved in this economy, determine the equilibrium income term using the demand/supply method?
2. Calculate the corresponding equilibrium income, consumption and savings? represent the equilibrium position graphically?
3. Calculate the balance of the budget and then comment on it?
4. If the income in full employment is equal to 2,800 dzd, what is the state of the economy? Determine the nature of the gap, calculate it and then represent it in the same previous graph?

Exercise 02: Let's have the following data on an economy consisting of three sectors

$Tx = Tx_0 = 1500$ $G = G_0 = 800$ $I = I_0 = 1110$ $S = -2000 + 0.3\ Yd$ $Tr = Tr_0 = 200$

Questions:

1/ Deduce then calculate the equilibrium income According to the resources/expenditures method? represent the equilibrium position graphically?

2 / Calculate the balance of the budget?

3 / If G increases by 300, what is the effect of this on the equilibrium income? Explain this effect on the same previous chart?

4 / If taxes and government spending increase by 300, what would be the impact on income and budget? How do we call this?

5 / If transfers and taxes rose by an equal amount of 30, what effect would this have on the equilibrium income?

Exercise 03: Let's have the following data on an open economy:

$X = 6000$ $Tr = 3000$ $I = 1525$ $C = 3000 + 0{,}75Yd$ $Tx = 900 + 0{,}2Y$

$G = 3500$ $Z = 600 + 0{,}1Y$ Full employment income is: 30,000 dzd.

Questions:

1 / Calculate the equilibrium level of income by the two methods of Supply/Demand and Resource/Expenditures?

2 / Mention the different variables at equilibrium according to the two methods graphically?

3 / Determine the equilibrium values of the internal variables of the model in addition to savings?

4 / Comment on the trade balance and represent it graphically?

5 / Calculate the multiplier, the change in income and the change in imports in the following two cases:

A- If independent investment increases by 200 dzd?

B- If independent exports increase by 200 dzd?

6 / As a result of the country's joining a regional conglomerate, the marginal tendency to import changed and became (0.2).

A- What is the effect of this on the equilibrium level of income?

B- What is the effect of this on the net transactions with the outside world?

C- Determine the state of the economy and calculate the value of the gap between the realized equilibrium income (Ye) and full employment income (Y_f)?

SOLUTIONS OF EXERCISES ON KEYNESIAN EQUILIBRIUM IN AN ECONOMIC MODEL OF 3 & 4 SECTORS

Exercise 01:

1- Balance is achieved in this economy (a three-sector model) when:

Aggregate supply = aggregate demand: $y=D \Rightarrow y=C+I+G$

Or when total equilibrium condition is fulfilled (resources = expenditures): $S + Tx = G + I + Tr$

Extraction of the Equilibrium Income formula by Total Supply / Total Demand method:

$y = C + I + G \Rightarrow y = C_0 + by_d + I_0 + G_0$ / $y_d=y-T_X+T_R$

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

$y = C_0 + by - bTx_0 + bTr_0 + I_0 + G_0$

$y - by = C_0 - bTx_0 + bTr_0 + I_0 + G_0$

$y\,(1 - b) = C_0 - bTx_0 + bTr_0 + I_0 + G_0$

$$y_e = \frac{1}{1-b}(C_0 - bTx_0 + bTr_0 + I_0 + G_0)$$

-Calculating ye , Ce , Se:

$$y_e = \frac{1}{1-0.6}(1000 - 0.6(600) + 0.6(100 + 200 + 500)) \Rightarrow \quad y_e = 3500$$

$C_e=1000+0.6y_d$ / $y_d=y-T_X+T_R=3500-600+100=3000$

$C_e=1000+0.6(3000)=2800$

$S_e=y_d-C_e=3000-2800=200$

2- Graphic representation of equilibrium position by Y / D method:

Finding the aggregate demand function D.

$D= C + I + G \Rightarrow y = C_0 + by_d + I_0 + G_0$ / $y_d=y-T_X+T_R$

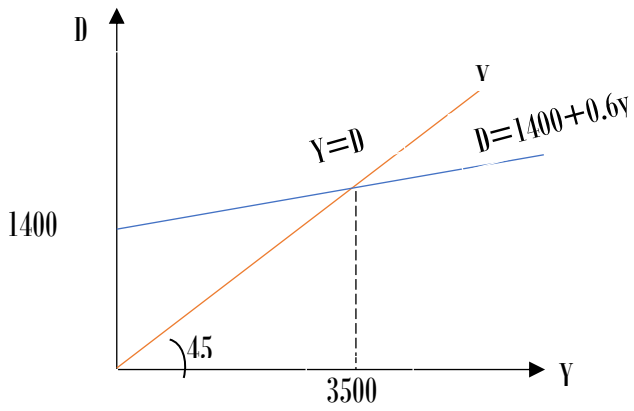
$D = C_0 + b\,(y - Tx_0 + Tr_0) + I_0 + G_0$

$D = C_0 + by - bTx_0 + bTr_0 + I_0 + G_0$

$D= (C_0+ I_0+ G_0- bTx_0 + bTr_0)+by \Rightarrow D=D_0+by$

$D= (1000+200+500-0.6(600)+0.6(100)+0.6y$

$D= 1400+0.6y$



3- Budget balance calculation:

$BS= T_X-(T_R+G) =600-(500+100) =0$

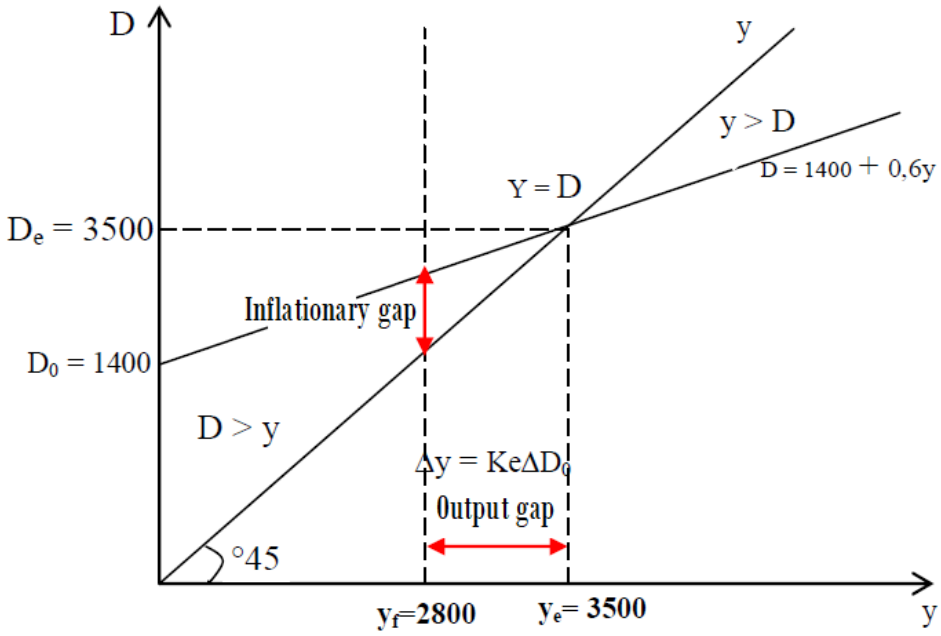
Comment: The budget is **in equilibrium**

The state of the economy at $Y_F = 2800$:

we note that $Ye > Y_F \Longrightarrow$ the economy is in **an inflationary state** (the gap is inflationary)

Inflationary gap = (output gap) / multiplier

$$\text{I. Gap} = \frac{y_F - y_e}{K_e} = \frac{2800 - 3500}{2{,}5} = -280 \textbf{ DZD}$$



5- The tax become related to income at a rate of one sixth (6/1) $\Longrightarrow$ $T_X = T_{X0} + 1/6y$

Calculation of the new equilibrium income:

$y = C + I + G$

$y = C_0 + b\,[\,y - (\,T_{X0} + ty\,) + T_{r0}\,] + I_0 + G_0$

$y = C_0 + b\,[\,y - T_{X0} - ty + T_{r0}\,] + I_0 + G_0$

$y = C_0 + by - bT_{X0} - bty + bT_{r0} + I_0 + G_0$

$y - by + bty = C_0 - bT_{x0} + bT_{r0} + I_0 + G_0$

$y\,(1 - b + bt\,) = C_0 - bT_{X0} + bT_{r0} + I_0 + G_0$

$$y_e = \frac{1}{1-b+bt}[C_0 - bT_{r0} + I_0 + G_0]$$

$$y_e = \frac{1}{0.5}[1400] = 2800$$

And from that, the economy is in a state of full employment because ye = Y_F

Calculating the balance of the budget:

BS= T_X-(T_R+G) / T_X= T_{X_0}+1/6y=600+1/6(2800) =1066.66
BS=1066.667-(500+100) =466.6667

Exercise 02:

a. Calculating the equilibrium income using the investment saving method:

The equilibrium is achieved if the following condition is met:

Total resources= Total expenditures

$$S + T_x = I + G + T_r$$
$$-C_0 + (1-b)\,yd + T_{x_0} = I_0 + G_0 + T_{r_0}$$
$$-C_0 + (1-b)(y - T_{x_0} + T_{r_0}) + T_{x_0} = I_0 + G_0 + T_{r_0}$$
$$y - by = C_0 - bT_{x_0} + bT_{r_0} + I_0 + G_0$$
$$y_e = \frac{1}{1-b}(C_0 - bT_{x_0} + bT_{r_0} + I_0 + G_0)$$
$$y_e = \frac{1}{(1-07)}(2000 - 0{,}7\,(1500) + 0{,}7\,(200) + 1110 + 800)$$

Ye =10000 DZD

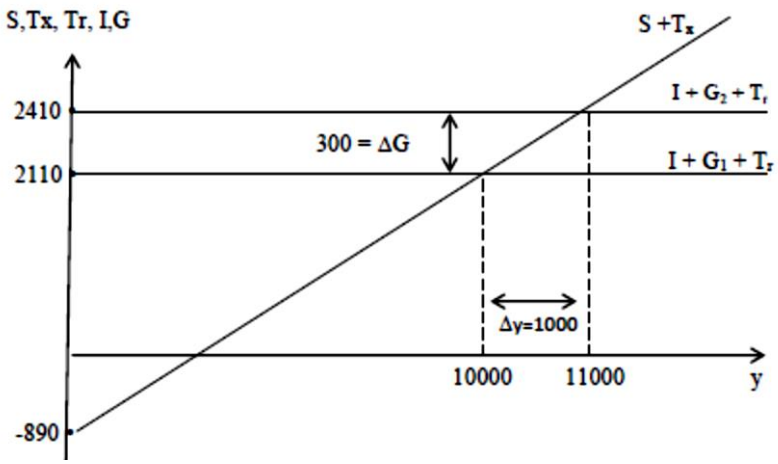
b. The graph of the equilibrium position + the effect of the multiplier:

* Determining the formula for the sum of expenditures:

$$I_0 + G_0 + T_{r_0} = 1110 + 800 + 200 = 2110$$

* Determining the formula for the sum of savings:

$$S + T_x = -C_0 + (1-b)(y - T_{x_0} + T_{r_0}) + T_{x_0}$$
$$S + T_x = [-C_0 + T_{r_0} + bT_{x_0} - bT_{r_0}] + (1-b)y$$
$$S + T_x = [-2000 + 200 + 0{,}7\,(1500) - 0{,}7\,(200)] + 0{,}3y$$
$$S + T_x = -890 + 0{,}3y$$



2) Calculate the net budget:

Be = Tx - (G + Tr)

500 = 1500 - (200 + 800) = 500 DZD

The budget is in **surplus** because revenues outweigh expenses.

3) Computing Δy when ΔG = 300

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

$$\Delta y = \frac{1}{1-b}.\Delta G \Rightarrow \Delta y = \frac{1}{1-0,7}(300) = 1000$$

The increase in government spending by 300 leads to a rise in income of 1,000 DZD, so the new equilibrium income becomes

$$y_2 = y_1 + \Delta y = 11000$$

4) Calculating ΔY when ΔG=ΔTx= 300

$$\Delta y = K_G.\Delta G + K_{T_x}\Delta T_x$$

$$\Delta y = \frac{1}{1-b}.\Delta G_0 - \frac{b}{1-b}.\Delta T_{x_0}$$

$$\Delta y = \frac{1}{1-0,7}\ 300\ - \frac{0,7}{1-0,7}.300$$

$$\Delta y = 300$$

We note that Δy = ΔG = ΔTx, that is, income increased by the value of one of the changes in government spending or taxes, this effect is called **the effect of the balanced budget multiplier**, where this multiplier is equal to a model of three sectors (independent tax) $K_b = \frac{\Delta y}{\Delta G} = \frac{\Delta y}{\Delta T_x} = 1$

The budget was not affected by this change in government expenditures and taxes because the increase in expenditures They correspond to the increase in revenue

5) Calculating Δy at n 30 =AT = AT

$$\Delta y = K_{T_x}.\Delta T_x + KT_r.\Delta T_r$$

$$\Delta y = \frac{-b}{1-b}\ \Delta T_x + \frac{b}{1-b}\ \Delta T_r$$

$$\Delta y = 0$$

We note that there is no change in income because the change in taxes cancels out the same effect as the change in transfers.

CHAPTER 10: EQUILIBRIUM IN THE GOODS AND SERVICES MARKET AND IN THE MONEY MARKET (ISLM MODEL)

1. Introduction to the ISLM Model

In the previous lectures about the Keynesian theory, determining the equilibrium level of income (expenditure-income model) was **separate from the theory of money and interest rate**, and it was assumed that the interest rate does not change during the steps of determining the equilibrium level of income. Therefore, the equilibrium in the market for goods and services has been separated from the money market. In fact, both markets are connected to each other; the interest rate and income are linked, and the equilibrium in the market for goods and services is achieved at certain levels for both interest rate and income, the same thing for the equilibrium in the money market. The equilibrium in the national economy is achieved when the two markets together are in balance at the same certain level of income and interest rate.

2. Definition of ISLM model:

The ISLM model determines the general instant equilibrium in both goods and services market and money market; the Equilibrium in the goods market is reached when saving equals investment (S=I), and equilibrium in the money market is achieved when L=M (liquidity = quantity of money) or money demand = money supply, and the general equilibrium is achieved by the equilibrium of the two markets together (LM = IS).

3. IS curve in a two-sector model:

3.1. Determining the IS equation mathematically and graphically:

The IS curve refers to all combinations between interest rate and income at which equilibrium is achieved in the market for goods and services. The equilibrium in the goods market for a two-sector model is achieved when Aggregate supply equals aggregate demand (y = C + I), or when savings = investment (S=I).

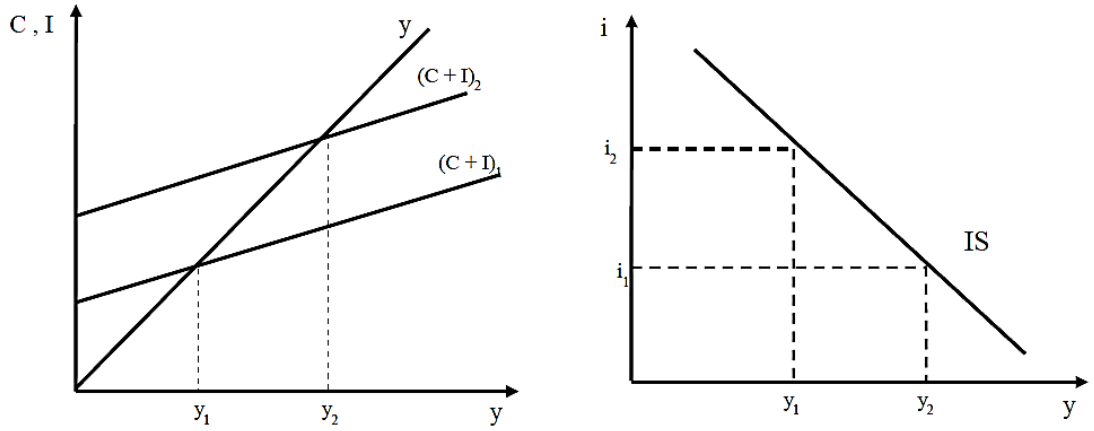
Model data: $C = C0 + bYd$ $I = I_0 - gi$ $y = yd$

i: the interest rate, g: the interest rate coefficient, g<0 because of the inverse relationship between I and i.

By substituting the two equations into the overall equilibrium equation y=C+I, we will get the following formula:

$$y_{IS} = \frac{C_0 + I_0 - gi}{1 - b}$$

y changes inversely with i, and the various combinations between Y and i represent the IS curve in a two-sector model:



The curve is decreasing because as the interest rate falls, investment rises, causing income to rise.

3.2. IS equations in 3 and 4-sector models:

We deduce the IS function in a three-sector model in the same previous way:

In the case of income-independent taxes: $y_{IS} = \frac{C_0 + I_0 - bTxo + bTro + Go - gi}{1-b}$

In the case of income-related taxes: $y_{IS} = \frac{C_0 + I_0 - bTxo + bTro + Go - gi}{1-b+bt}$

Likewise, the IS equation in a 4-sector model:

In the case of income-independent taxes: $y_{IS} = \frac{C_0 + I_0 - bTxo + bTro + Go + Xo - Zo - gi}{1-b+z}$

In the case of income-related taxes: $y_{IS} = \frac{C_0 + I_0 - bTxo + bTro + Go + Xo - Zo - gi}{1-b+bt+z}$

3.3. Changes in the IS curve:

The IS Curve shifts to the right by the amount of change in income resulting from an increase in an element of expenditures that raises income such as a rise in investment, government expenditures G, etc; or a decrease in an element of expenditures that diminishes income such as lower taxes Tx.

The IS curve moves to the left by the amount of decrease in income caused by a decrease in one of the elements of expenditures that raise income (G, I,...) or by the an increase in one of the elements that reduce income (like Taxes).

4. LM Curve

4.1. Determining the LM Curve Mathematically and Graphically:

The LM equation refers to all the combinations between the interest rate and income at which equilibrium occurs in the money market. The equilibrium occurs in the money market when the demand for liquidity is equal to the money supply L=M or Md=Ms

A - Demand for liquidity (Md): It is determined by 3 motives:

-Transaction and reserve motive: they are Positively linked to income $M_t = f(y)$, where: $M_t = k\ y$

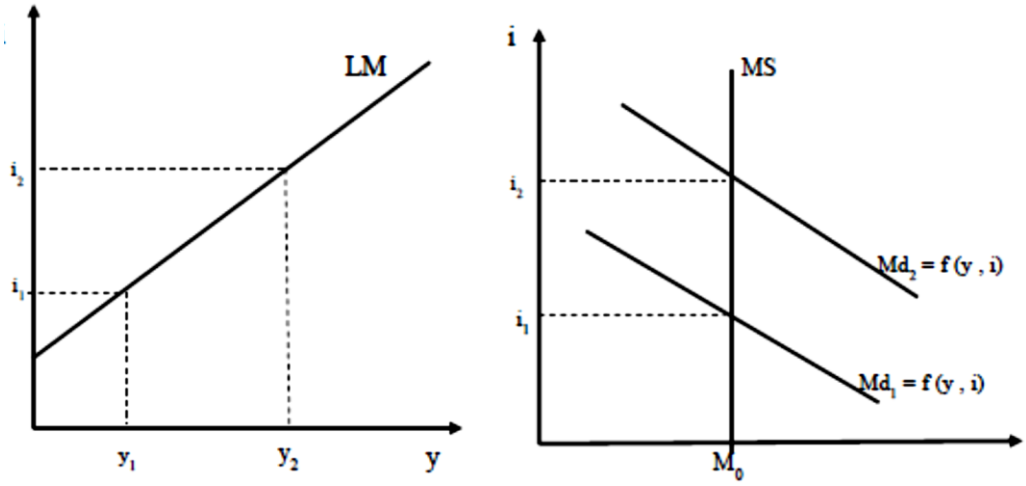
- Speculative motive: it is linked to the interest rate with a negative correlation: $Ma = f(i)$, where: $Ma = L_0 - mi$

So, the money Demand function is equal to: $Md = Mt + Ma$, which is a function of income and interest rate.

B- Liquidity supply (Ms): It is an external variable, which is fixed by the central bank in accordance with the monetary policy of the state: $Ms = M_0$

Equilibrium is achieved when: $Md = Ms$ or $Mt + Ma = M_0$

By Substituting the previous equations in money market balance equation, we find the income equilibrium: $y_{LM} = \frac{M_o - Lo + m\,i}{k}$



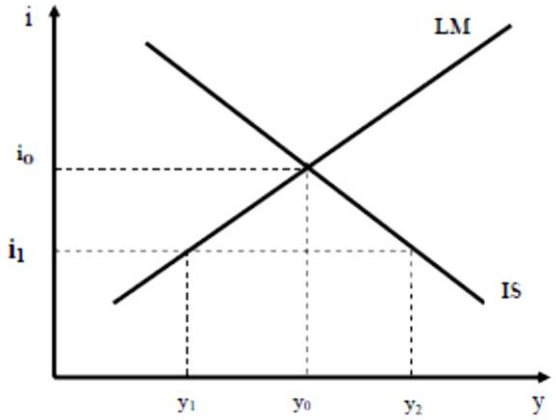
The cure is growing (LM is positive) because of the positive relationship between income and interest rate: the higher interest rate (i), the lower demand for money for speculative purposes Ma, which leads to a higher demand for money for transactions and reserve purposes Mt, which leads to higher income y.

4.2. Changes in LM curve:

LM curve moves to the right if cash supply Ms increases or demand for money Md decreases, while LM moves to the left if Ms decreases or Md increases.

5. General equilibrium IS LM:

the instantaneous equilibrium in the money market and the commodity market requires equilibrium in both markets at the same level of income y and interest rate i.



We notice that at an interest rate (i_1), equilibrium occurs in the money market at $y=y_1$, while equilibrium in the market for goods and services (IS)occurs at an income level of y=y2. Thus, at (i_1), instantaneous equilibrium does not occur, and the equilibrium interest rate in the two markets is (i_0).

Example: Let us have the following data:

$C = 100 + 0.8yd$ $I = 150 - 600i$ $yd = y$ $Ms = 200$ $Mt = 0{,}2y$ $Ma = 50 - 400i$

Required: Determine each of the equations IS and LM, then determine the general equilibrium.

Solution:

1- Determining the LM equation:

equilibrium is achieved in the money market at: $Ms = Md$

$Ms = Mt + Ma \Longrightarrow 200 = 0,2\,y + 50 - 400\,i \Longrightarrow 0,2\,y = 150 + 400\,i$

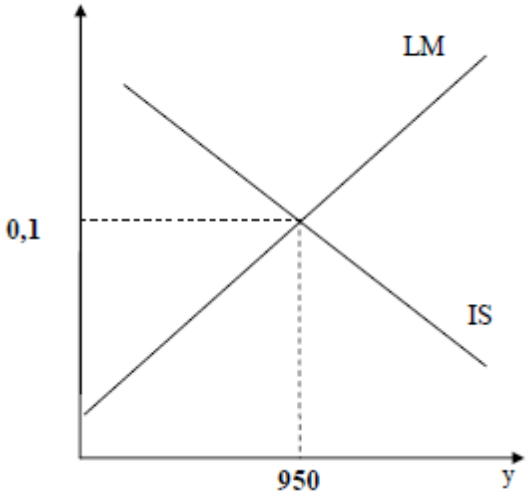
$Y = 750 + 2000\,i$ .....LM

2- Determining the IS equation:

Equilibrium is achieved in the commodity market at: $y = C + I$

$y = 100 + 0,8\,y + 150 - 600\,i \Longrightarrow y - 0,8\,y = 250 - 600\,i$

$y = 1250 - 3000\,i$ .....IS



3- General equilibrium IS = LM:

$1250 - 3000\,i = 750 + 2000\,I \Longrightarrow 500 = 5000\,i$

$i = 0,1$

By substitution in the IS or LM equation, we find the value of y:

$Y = 1250 - 3000(0,1) = 950 \Longrightarrow Y = 950$

By substitution in the rest of the equations, we find the values of: Ma, Mt, C, I:

$C = 860,$ $I = 90,$ $Ma = 10,$ $Mt = 190$

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EXERCISES ON THE IS-LM MODEL

Exercise 01: Let's have the following data:

S = - 40 + 0.25yd I = 45 - 120i

The interest rate i takes the following values: 10%; % 8; 6%; 4%

Required: 1- Find the equilibrium income for each given value of the interest rate i.

2- represent the combinations of income and interest rate graphically.

Exercise 02: Let's have the following data

Ma = 30 – 150 i Mt = 0.2y Ms = 150

Required: 1- Determine the LM equation.

2- Calculate the equilibrium income for the following interest rates; 10%; % 8; 6%; 4%.

3- Draw the LM curve.

Exercise 03: Let's have the following data related to an economy during a certain period of time:

C = 80 + 0,8yd I = 320-400i G = 310 Tx = -50 + 0,25y

Mt = 0,4y Ma = 600-600i Ms = 1200

Required: 1- Calculate the IS and LM equations, then calculate the equilibrium income?

2- Assume an increase in government spending by 40 DZD, does this policy have the same effect on the shift of the IS curve as the policy of reducing taxes by 40 DZD? Justify your answer?

3- Calculate the new equilibrium in case of an increase in government spending by 40 DZD. what do you notice?

Exercise 04: Let's have the following data about a given economy:

C= 2000+0.75yd I=4500 - 2000i Tx = 4500 +0.2 y Z = 3000 + 0.1y X = 4000

G = 1000 Tr = 6500 Mt = 7000 + 0.5Y Ma = 9000-500i Ms = 21000

Required:

First: 1- Formulate the equilibrium equation in the goods and services market (IS). Then extract the equilibrium equation in the money market (LM).

2- Calculate the equilibrium income and interest rate, then represent it graphically. Calculate the levels of consumption and investment corresponding to this income.

Second: Assuming that the money supply has raised to 23,500 DZD.

1- Determine the direction and magnitude of the shift in the IS and LM curves.

2- What is the effect of the increase in the monetary mass on the general balance? Explain this graphically.

3- Explain what would happen to both consumption and investment?

SOLUTIONS OF EXERCISES

Exercise 01:

Determining the IS equation

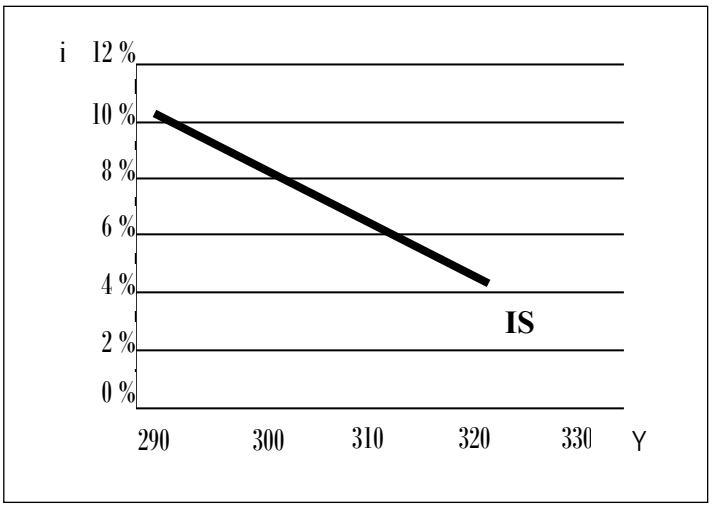
In the commodity market, equilibrium is achieved when: I = S

$45 - 120\,i = -40 + 0{,}25\,y_d$

$0{,}25y = 85 - 120i$

$$Y = \frac{85-120i}{0{,}25} \Rightarrow \boldsymbol{Y_{IS} = 340 - 480\,i}$$

I	%4	%6	%8	10%
Y	320,8	311,2	301,6	292



- These combinations represent the IS curve, meaning that each point of this curve satisfies the condition S = I.

- We notice through this curve that, with a decrease in the interest rate, the equilibrium income increases, this is because the decrease in the interest rate encourages investment and thus the latter increases, which leads to an increase of income.

Exercise 02:

Determining the LM equation

- Equilibrium in the money market is achieved when $M_s = M_d$

Ms = Md => Ms = Ma + Mt

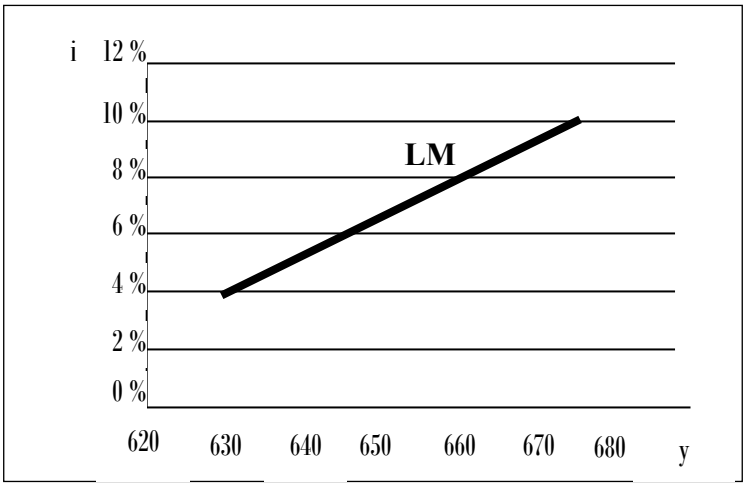
$150 = 30 - 150i + 0{,}2Y$

$120 = 0{,}2Y - 150i$

$0{,}2Y = 120 + 150i$

$Y_{LM} = 600 + 750i$

I	%4	%6	%8	10%
Y	630	645	660	675



- These combinations represent the LM curve, meaning that each point of this curve represents a situation where Ms=Md.
- We notice through this curve that with the rise in the interest rate, the equilibrium income increases (a positive relationship between them); the rise in the interest rate leads to a decrease in Ma, causing a rise in Mt in order to maintain the equilibrium position in the money market, which leads to a rise in the equilibrium income Y.

Exercise 03:

1 /The equations for IS and LM:

* **The IS equation**: it is derived from the condition of market equilibrium for goods and services: $Y = D$.

$$y = C + I + G$$

$$y = C_0 + by_d + I_0 - gi + G_0$$

$$y = C_0 + b\,(y - Tx_0 - ty) + I_0 - gi + G_0$$

$$y = C_0 + by - bTx_0 - bty + I_0 - gi + G_0$$

$$y - by + bty = C_0 - bTx_0 + I_0 + G_0 - gi$$

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

$$y = \frac{c_0 - bTx_0 + I_0 + G_0}{1 - b + bt} - \frac{g}{1 - b + bt}\,i \ldots \ldots \text{IS}$$

$$y = \frac{80 - 0{,}8\,(-50) + 320 + 310}{1 - 0{,}8 + 0{,}8\,(0{,}25)} - \frac{400}{0{,}4}\,i$$

$$y_{IS} = 1875 - 1000\,i \ldots \ldots \text{IS}$$

* **The LM equation** is derived from the condition of money market equilibrium: $M_s = M_d \Rightarrow M_0 = M_t + M_a$

$$M_0 = K\,y + L_o - m\,i$$

$$k\,y = M_o - L_o + m\,i$$

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

$$y = \frac{1200-600}{0,4} + \frac{600}{0,4}\, i$$

$$y_{LM} = 1500 + 1500i \dots\dots\dots LM$$

* Calculate national income equilibrium

$$Y_{IS} = Y_{LM} \Rightarrow Y_{IS} - Y_{LM} = 0$$

$$y_{IS} = 1875 - 1000\, i$$

$$- \; y_{LM} = 1500 + 1500\, i$$

$$0 = 375 - 2500\, i$$

$$\Rightarrow i = \frac{375}{2500} = 0,15$$

$$y_{IS} = 1875 - 1000\,(0,15) = 1725$$

$$y_{LM} = 1500 + 1500\,(0,15) = 1725$$

$$y_e = 1725\ DZD \qquad i_e = 15\ \%$$

The State budget position:

$B_S = Tx - (G + Tr)$ / $Tr = 0$

$B_S = -50 + 0,25\,(1725) - 310$

$B_S = 71,25 \quad > 0$

The State budget is in a surplus position

2 / Explaining the effect of increase in government spending and a decrease in taxes on the shifting of the IS curve:

* Government spending increase: $\Delta G = 40$ DZD

An increase in G causes the IS curve to shift to the right as a result of an increase in equilibrium income by: $\Delta y = K_G\, \Delta G$

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

$$\Delta y_{IS} = \frac{1}{0,4}(40) = 100 \Rightarrow y' = y_e + \Delta y_{IS} = 1725 + 100 = 1825$$

* Tax decrease: $\Delta Tx = -40$

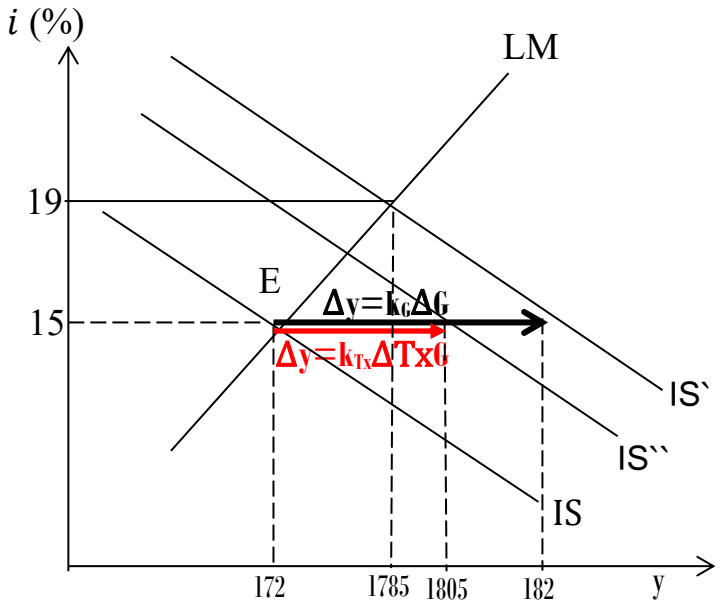
A decrease in TX also causes the IS curve to shift to the right as a result of increasing equilibrium income by:

$$\Delta y = K_{Tx}\ \Delta Tx$$

$$K_{Tx} = \frac{-b}{1-b+bt}$$

$$\Delta y = \frac{-b}{1-b+bt}\,(-40) \Rightarrow \quad \Delta y_{IS}` = \frac{-0,8}{0,4}\,(-40) = 80$$

$$y`` = y_e + \Delta y_{IS}` = 1725 + 80 = 1805$$



It can be said that both the policy of increasing government spending and reducing taxes lead to an increase in income, but not by the same amount because the effect of the government spending multiplier outweighs the effect of the tax multiplier.

3/ Calculate the new general equilibrium after increasing G by $\Delta G = 40$

A- Calculating the new IS equation:

$y_{IS}` = y_{IS} + \Delta y_{IS} \quad \Rightarrow \quad y_{IS}` = 1875 - 1000i + 100 \quad \Rightarrow \quad y_{IS}` = 1975 - 1000i$

B- General Equilibrium:

$y_{IS}` = 1975 - 1000i \quad \Rightarrow \quad y_{LM} = 1500 + 1500i \quad \Rightarrow \quad 475 = 2500i \quad \Rightarrow i_e` = 0.19 \;, \; y_e` = 1785$

$\Delta y_{ISLM} = y_e` - y_e = 1785 - 1725 = 60$

We notice that $\Delta Y_{IS} > \Delta Y_{ISLM}$ (100> 60) and this is due to the effect of crowding out: the effect of investment crowding out means the decrease in the effect of the fiscal policy variables (government spending, taxes) on income as a result of the effect of the interest rate on investment: the increase in government spending caused an increase in income by the value of ΔY_{IS}=100, while the rise in the interest rate from 0.15 to 0.19 upon the occurrence of the new general equilibrium led to a decline in investment, which led to a decline in income, achieving $\Delta Y_{ISLM} = 60$ only (i.e. the effect of income-stimulating by government spending was restrained).

Exercise 04:

1 / The IS equation: $y = D = C + I + G + X - Z$

$$y = \frac{C_0 - bTx_0 + bTr_0 + I_0 + G_0 + X_0 - Z_0}{1 - b + bt + z} - \frac{g}{1 + b + bt + z}\, i$$

$$y = \frac{2000 - 0{,}75\,(4500) + 0{,}75\,(6500) + 4500 + 1000 + 4000 - 3000}{1 - 0{,}75 + 0{,}75\,(0{,}2) + 0{,}1} - \frac{2000}{0{,}5}\, i$$

$$y = \frac{10000}{0{,}5} - \frac{2000}{0{,}5}\, i \quad \Rightarrow \quad y_{IS} = 20000 - 4000\, i \quad \ldots\ldots\ldots IS$$

2 / LM equation:

* Demand for money for speculation: Ma = 9000 - 500i because it shows the existence of an inverse relationship between the demand for money and the interest rate.

* Demand for money for transactions and reserves: Mt = 7000 + 0,5 y because it shows the existence of a positive relationship between the demand for money and income.

* LM equation: $M_s = M_0 \Leftrightarrow M_0 = M_t + M_a$

$y = \frac{M_0 - L_0}{K} + \frac{m}{k} i \quad \Rightarrow \quad y = \frac{21000-(7000+9000)}{0,5} + \frac{500}{0,5} i$

$Y = \frac{5000}{0,5} + \frac{500}{0,5} i \quad \Rightarrow \quad Y_{LM} = 10000 + 1000\, i \ldots\ldots LM$

3 / Equilibrium income and interest rate: **IS = LM**

$y_{IS} = 20000 - 4000\, i$

$y_{LM} = 10000 + 1000\, i$

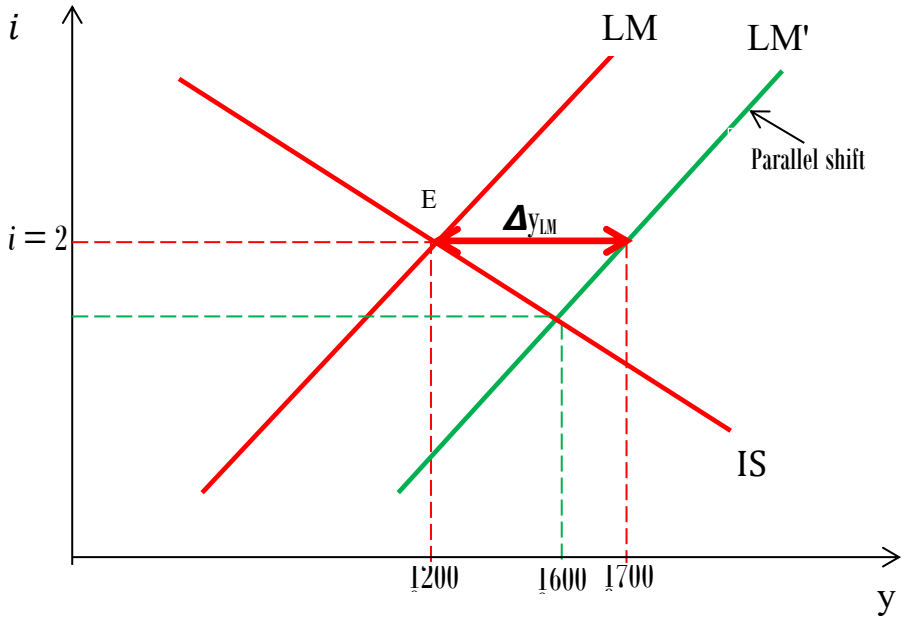
$0 = 10000 - 5000\, i \Rightarrow i = \frac{10000}{5000} = 2$

$y = 20000 - 4000\,(2) = 12000$

$y = 10000 + 1000\,(2) = 12000$

$y_e = 12000 \qquad i_e = 20\%$

Graphic representation:



2-c/ Consumption and investment levels corresponding to equilibrium income:

C = 2000 + 0,75 yd

$yd = y - Tx + Tr = 12000 - (4500 + 0{,}2\,(12000)) + 6500$ $\quad Tx_e = 6900$ DZD

$yd = 12000 - 6900 + 6500 = 11600$ $\quad yd_e = 11600$ DZD

$C = 2000 + 0{,}75\,(11600) = 10700$ $\quad C_e = 10700$ DZD

$I = 4500 - 2000\,(2) = 500$ $\quad I_e = 500$ DZD

Second: Ms = 23500

1 / Determine the direction and amount of transition in both IS and LM:

An increase in the money supply affects only the LM curve and the IS curve is unaffected.

The LM curve shifts to the right by $\Delta y = k_M \,.\, \Delta M$

The money multiplier equals: $k_M = \frac{1}{K}$

$$\Delta y = \frac{1}{0{,}5}(23500 - 21000) \implies \Delta y_{LM} = 5000 \text{ DZD}$$

$$y' = y_e + \Delta y_{LM} = 12000 + 5000 = 17000$$

2 / The effect of increasing money supply on the general equilibrium

*** Calculating y_e and i_e(equilibrium income and interest rate)**

The IS equation does not change $y_{IS} = 20000 - 4000\,i$

LM equation (DEDUCED) $y_{LM} = 10000 + 1000\,i$

$Y`_{LM} = Y_{LM} + \Delta Y_{LM} \implies Y`_{LM} = 10000 + 1000\,i + 5000$

$Y`_{LM} = 15000 + 1000\,i$

$Y_{IS} - Y`_{LM} \Leftrightarrow \quad y = 20000 - 4000\,i$

$-\,y = 15000 + 1000\,i$

$0 = 5000 - 5000\,i \implies i = 1 \quad \Rightarrow y = 20000 - 4000\,(1) = 16000$

$i_e` = 1 \quad y_e` = 16000$ dzd

Graphic illustration: (see previous graph)

3 / Effect of Ms increase on C and I:

As y rises and i decreases, both C and I will increase:

$C' = 2000 + 0{,}75\,(y - Tx + Tr) = 2000 + 0{,}75\,(y - (Tx_0 + ty) + Tr)$

$C' = 2000 + 0{,}75\,[16000 - (4500 + 0{,}2\,(16000)) + 6500]$

$C' = 2000 + 0{,}75\,(16000 - 7700 + 6500) = 2000 + 0{,}75\,(14800) =$ 13100 DZD

$I' = 4500 - 2000\,(1) =$ 2500 DZD

CHAPTER 11. CHANGES IN THE IS-LM MODEL ACCORDING TO THE FISCAL AND MONETARY POLICIES

1. Introduction:

Monetary policy and **fiscal policy** refer to the two most widely recognized tools used to influence a nation's economic activity. Monetary policy is primarily concerned with the management of **interest rates** and the **total supply of money** in circulation and is generally carried out by **central banks**, such as the U.S. Federal Reserve and the central bank of Algeria (Bank of Algeria).

Fiscal policy is a collective term for the **taxing** and **spending** actions **of governments**.

- Both monetary and fiscal policy are macroeconomic tools used to manage or stimulate the economy.
- Monetary policy addresses interest rates and the supply of money in circulation, and it is generally managed by a central bank.
- Fiscal policy addresses taxation and government spending, and it is generally determined by government legislation.

2. The change in IS curve according to the fiscal policy

2.1. The concept of fiscal policy:

The **fiscal policy** is a set of measures at the level of **public expenditures and taxes** aiming to maintain the macroeconomic balance and the stability of the general level of prices:

- In an inflation situation, the state applies contractionary policy through: **reducing public spending**, **raising taxes**, to absorb the additional purchasing power of individuals.

- In a deflation situation, an expansionary fiscal policy is applied through: **raising public expenditures**, **reducing taxes**. Thus, raising the purchasing power of individuals.

2.2. Right shift of the IS curve:

The IS curve shifts whenever an autonomous (unrelated to Y or i) change occurs in C, I, G, T, X or Z.

According to the fiscal policy, the IS curve shifts right (up) in case of **increase** in **government spending** (G) or **reduction** of **taxes** (Tx), i.e., an **expansionary fiscal policy** which results in a new general equilibrium.

Example: The applied expansionary policy consists of raising government spending by (**ΔG=10**). The other data of the model are as follows: (the same previous Lecture example)

I=150-600i Y=Yd; C=100+0.8Yd; Ms=200; Ma=50-400i; Mt=0.2Y

Required:

1- Determining the shift value of the IS curve;

2- Determining the change in equilibrium income due to this raise in government spending.

Solution :

1- According to the multiplier effect of government spending, the IS curve shifts right with $\Delta Y = K_G * \Delta G$ ➔

$$\Delta Y = \frac{1}{1-b}\Delta G = \frac{1}{0.2}10$$

$\Delta Y_{IS} = 50$

2- To get the new general equilibrium, we calculate the new IS equation after the occurrence of $\Delta G = 10$, while the LM equation remains the same: $Y = 750 + 2000i$ ..... LM.

Thus, we will recalculate the new IS equation based on the formula:

$Y = C + I + G \Rightarrow Y = 100 + 0.8Y + 150 - 600i + 10 \Rightarrow Y_{IS}' = 1300 - 3000i$.....IS'

Or using another method: $Y_{IS}' = Y_{IS} + \Delta Y_{IS}$

$Y_{IS}' = 1250 - 3000i + 50 \Rightarrow Y_{IS}' = 1300 - 3000i$.....IS'

Calculating the New General equilibrium (using the subtraction method) IS = LM

$Y = 1300 - 3000\ i$.....IS'

$y = 750 + 2000i$ .....LM

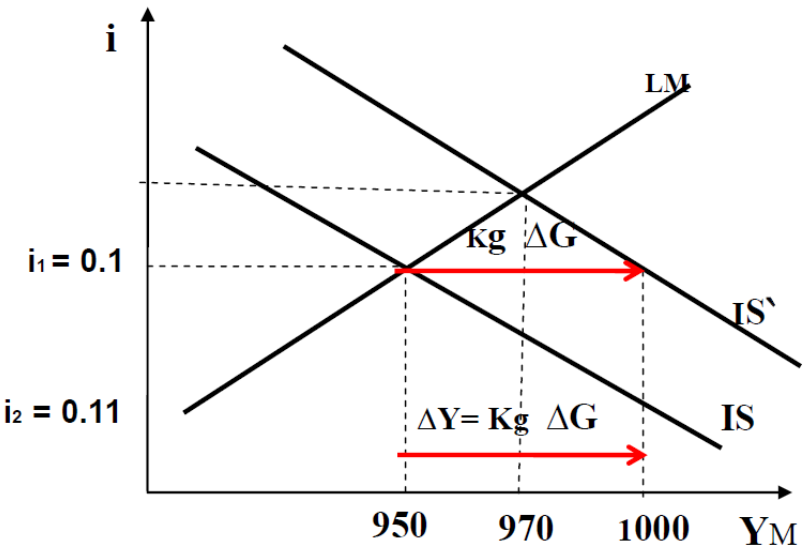
$0 = 550 - 5000i \Rightarrow \mathbf{i_e = 0.11 = 11\%}$ (it was 10% before)

By substituting in IS or LM equation, we find $Ye = 970$ (it was 950 before)

By substituting in the rest of the model variables we find:

Ma = 6; Mt = 194; C = 876; I=84

$\Delta Y_{ISLM} = Ye' - Ye \Rightarrow \Delta Y_{ISLM} = 970 - 950 \Rightarrow \Delta Y_{ISLM} = 20$



We notice that $\Delta Y_{ISLM} < \Delta Y_{IS}$. This is due to the fact that the increase in the **interest rate** from 0.1 to=0.11 **reduced** the stimulating effect of the increase in government expenditures estimated at 10 DZD on national income: the interest rate increase led to a decrease in investment from 90 to 84 DZD (-6) and thus income declined ($\Delta Y = \Delta I * KI = -6 * 5 = -30$). This

is called **the displacement effect, or the investment Crowding Out effect**, which means the **decrease in the impact of fiscal policy variables (government spending or taxes) on income due to the effect of the interest rate on investment.**

2.3. Left shift of the IS curve:

The IS curve shifts left (down) if government spending is reduced (G) or taxes are raised (Tx), i.e., if it is a contractionary policy.

Example: The contractionary policy applied in this example is **raising taxes** by a value of ($\Delta T_X = 20$) while maintaining the same data of the previous example (Lecture 1):

I=150-600i; Mt=0.2Y; Yd=Y-Tx; C=100+0.8Yd; Ms=200; Ma=50-400i; Mt=0.2Y

Required

Determine the shift value in the IS curve?

Determine the change in equilibrium income due to this increase in taxes?

Solution:

1- The IS curve shifts left by the value of $\Delta Y = k_{tx} * \Delta Tx$

According to the tax multiplier effect:

$$\Delta Y = \frac{-b}{1-b}\Delta TX = \frac{-0.8}{0.2}20$$

$$\Delta Y_{IS} = -80$$

2- To calculate the new general equilibrium, the new IS equation must be calculated after the occurrence of $\Delta TX=20$, while the LM equation remains the same Y= 750+2000i .....LM

Thus, we will recalculate this equation from the formula:

Y = C + I⇒

$$Y = 100 + 0.8Yd + 150 - 600\,i$$
$$Y = 100 + 0.8\,(Y - 20) + 150 - 600\,i$$
$$Y_{IS}` = 1170 - 3000i.....IS`$$

Nb: We can also use the method used in the previous example:(YIS' = YIS+ΔYIS)

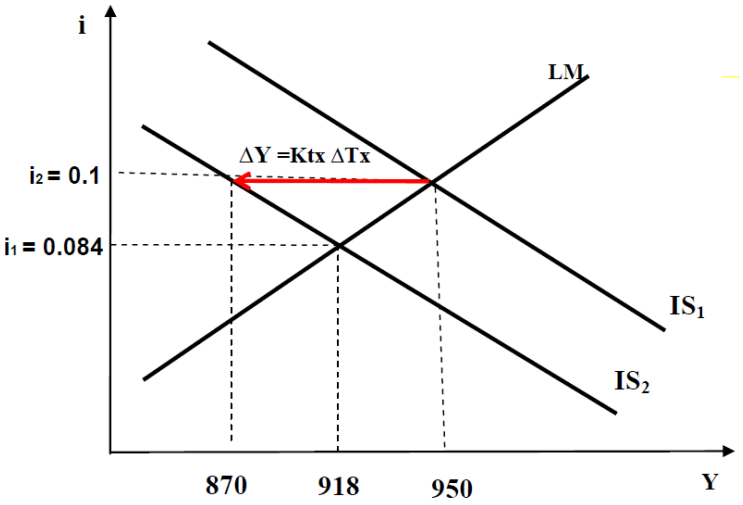
* Calculate the general equilibrium IS = LM (using the subtraction method)

Y=750 + 2000 i .....LM`
Y = 1170 – 3000i.....IS`
0 = 420 – 5000i
i_e=0.084

substituting in IS or LM we find the value of Ye=918

substituting in Investment equation, we find the value of I=99.6

$\Delta y_{ISLM} = 918\text{-}950 = -32$



We notice that $\Delta Y_{ISLM} > \Delta Y_{IS}$ because the decrease in the interest rate from 0.1 to 0.084 has partially reduced the income effect of taxes, as the decrease in the interest rate led to an increase in investment from 90 to 99.6 and consequently an increase in income, depending on the effect of displacement or the effect of crowding out investment.

3. The change in the LM curve according to monetary policy

3.1. The concept of monetary policy:

Monetary policy is the various **procedures applied by the monetary authorities** represented by the Central Bank in order to control the money supply and maintain the stability of the general level of prices in cases of inflation and deflation.

A - In the case of inflation:

the state applies a **contractionary** monetary policy with the aim of reducing the money supply, and this is by using various monetary policy tools:

- Raising rediscount rates, which causes higher bank interest rates.
- Implementation of the **open market policy**, by entering the central bank as a seller of securities (selling of short-term bonds).
- Raising the legal reserve of commercial banks to reduce the ability of banks to grant loans.
- Supervision of consumer loans

B. In the case of deflation:

An expansionary monetary policy is applied with the aim of increasing the money supply through the use of measures opposite to the monetary policy tools applied in the event of inflation.

3.2. Shift of the LM curve to the right:

The LM curve shifts to the right in the event of an increase in the money supply **(Ms), i.e. the application of an expansionary monetary policy in a contractionary situation.**

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EXERCISES ON THE IS-LM MODEL AND ITS CHANGES ACCORDING TO THE FISCAL AND MONETARY POLICIES

Exercise 01: Let's have the following data:

$S = -40 + 0.25yd$ $I = 45 - 120i$

The interest rate i takes the following values: 10%; % 8; 6%; 4%

Required: 1- Find the equilibrium income for each given value of the interest rate i.

2- represent the combinations of income and interest rate graphically.

Exercise 02: Let's have the following data

$Ma = 30 - 150\ i$ $Mt = 0.2y$ $Ms = 150$

Required: 1- Determine the LM equation.

2- Calculate the equilibrium income for the following interest rates; 10%; % 8; 6%; 4%.

3- Draw the LM curve.

Exercise 03: Let's have the following data related to an economy during a certain period of time:

$C = 80 + 0{,}8yd$ $I = 320\text{-}400i$ $G = 310$ $Tx = -50 + 0{,}25y$

$Mt = 0{,}4y$ $Ma = 600\text{-}600i$ $Ms = 1200$

Required: 1- Calculate the IS and LM equations, then calculate the equilibrium income?

2- Assume an increase in government spending by 40 DZD, does this policy have the same effect on the shift of the IS curve as the policy of reducing taxes by 40 DZD? Justify your answer?

3- Calculate the new equilibrium in case of an increase in government spending by 40 DZD. what do you notice?

Exercise 04: Let's have the following data about a given economy:

$C = 2000 + 0.75yd$ $I = 4500 - 2000i$ $Tx = 4500 + 0.2\ y$ $Z = 3000 + 0.1y$ $X = 4000$

$G = 1000$ $Tr = 6500$ $Mt = 7000 + 0.5Y$ $Ma = 9000\text{-}500i$ $Ms = 21000$

Required:

First: 1- Formulate the equilibrium equation in the goods and services market (IS). Then extract the equilibrium equation in the money market (LM).

2- Calculate the equilibrium income and interest rate, then represent it graphically. Calculate the levels of consumption and investment corresponding to this income.

Second: Assuming that the money supply has raised to 23,500 DZD.

1- Determine the direction and magnitude of the shift in the IS and LM curves.

2- What is the effect of the increase in the monetary mass on the general balance? Explain this graphically.

3- Explain what would happen to both consumption and investment?

Exercise 05: Consider an economy consisting of a Keynesian three sectors with the following data:

- Tax function: $Tx = Tx_0 = 1500$
- Government expenditure: $G = G_0 = 800$

- Investment: $I = I0 = 1110$
- Saving function: $S = -2000 + 0.3Yd$
- Transfers: $Tr = Tr0 = 200$

Questions:

1. Deduce and calculate the equilibrium income using the resources/expenditures method.
2. Calculate the government budget ($GB = Tx - (G + Tr)$).
3. If government expenditure (G) increases by 300, what is its effect on the equilibrium income?
4. If both taxes (Tx) and government spending (G) increase by 300, what is the impact on income and the budget?
5. If both transfers (Tr) and taxes (Tx) increase by an equal amount of 30, what is the effect on the equilibrium income?

Exercise 06:

Consider the following data:

- Speculative demand for money: $Ma = 30 - 150i$
- Transaction demand for money: $Mt = 0.2Y$
- Money supply: $Ms = 150$

Required:

1. Determine the LM equation.
2. Calculate the equilibrium income for the following interest rates: 10%, 8%, 6%, and 4%.
3. Draw the LM curve.

SOLUTIONS OF EXERCISES

Exercise 01:

Determining the IS equation

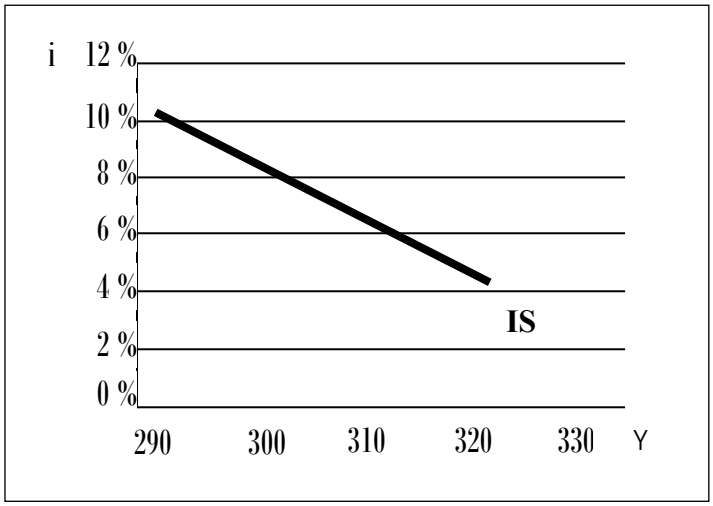
In the commodity market, equilibrium is achieved when: I = S

$45 - 120\,i = -40 + 0{,}25\,y_d$

$0{,}25y = 85 - 120i$

$$Y = \frac{85-120i}{0{,}25} \Rightarrow \boldsymbol{Y_{IS} = 340 - 480\,i}$$

10%	%8	%6	%4	I
292	301,6	311,2	320,8	Y



- These combinations represent the IS curve, meaning that each point of this curve satisfies the condition S = I.
- We notice through this curve that, with a decrease in the interest rate, the equilibrium income increases, this is because the decrease in the interest rate encourages investment and thus the latter increases, which leads to an increase of income.

Exercise 02:

Determining the LM equation

- Equilibrium in the money market is achieved when $M_s = M_d$

Ms = Md => Ms = Ma + Mt

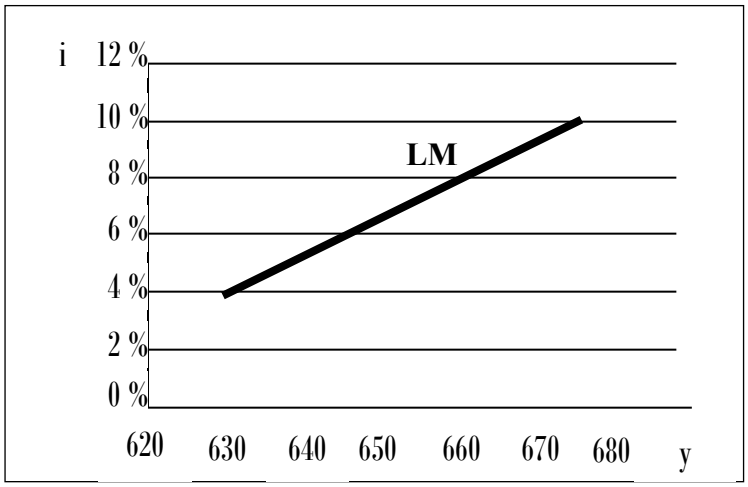
$150 = 30 - 150i + 0{,}2Y$

$120 = 0{,}2Y - 150i$

$0{,}2Y = 120 + 150i$

$Y_{LM} = 600 + 750i$

I	%4	%6	%8	10%
Y	630	645	660	675



- These combinations represent the LM curve, meaning that each point of this curve represents a situation where Ms=Md.

- We notice through this curve that with the rise in the interest rate, the equilibrium income increases (a positive relationship between them); the rise in the interest rate leads to a decrease in Ma, causing a rise in Mt in order to maintain the equilibrium position in the money market, which leads to a rise in the equilibrium income Y.

Exercise 03:

1 /The equations for IS and LM:

* **The IS equation**: it is derived from the condition of market equilibrium for goods and services: Y = D.

$y = C + I + G$

$y = C_0 + by_d + I_0 - gi + G_0$

$y = C_0 + b\,(y - Tx_0 - ty) + I_0 - gi + G_0$

$y = C_0 + by - bTx_0 - bty + I_0 - gi + G_0$

$y - by + bty = C_0 - bTx_0 + I_0 + G_0 - gi$

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

$$y = \frac{c_0 - bTx_0 + I_0 + G_0}{1 - b + bt} - \frac{g}{1 - b + bt} i \ldots \ldots \text{IS}$$

$$y = \frac{80 - 0{,}8\,(-50) + 320 + 310}{1 - 0{,}8 + 0{,}8\,(0{,}25)} - \frac{400}{0{,}4}\, i$$

$$y_{IS} = 1875 - 1000\ i \ldots \ldots \text{IS}$$

* **The LM equation** is derived from the condition of money market equilibrium: $M_s = M_d \Rightarrow M_0 = M_t + M_a$

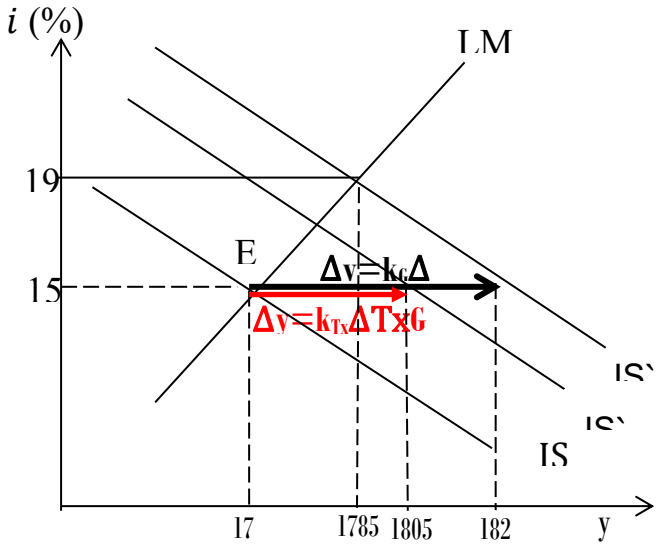
$M_0 = K y + L_o - m i$

$k y = M_o - L_o + m i$

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

$$y = \frac{1200-600}{0,4} + \frac{600}{0,4} i$$

$$y_{LM} = 1500 + 1500i \ \ldots\ldots\ldots \text{LM}$$



* Calculate national income equilibrium

$$Y_{IS} = Y_{LM} \Rightarrow Y_{IS} - Y_{LM} = 0$$

$$y_{IS} = 1875 - 1000\, i$$

$$-\ y_{LM} = 1500 + 1500\, i$$

$$0 = 375 - 2500\, i$$

$$\Rightarrow i = \frac{375}{2500} = 0,15$$

$$y_{IS} = 1875 - 1000\,(0,15) = 1725$$

$$y_{LM} = 1500 + 1500\,(0,15) = 1725$$

$$y_e = 1725\ DZD \qquad i_e = 15\ \%$$

* The State budget position: (not asked in questions)

$$B_S = Tx - (G + Tr) \ / \ \ Tr = 0$$

$$B_S = -50 + 0,25\,(1725) - 310$$

$$B_S = 71,25 \quad > 0$$

The State budget is in a surplus position

2 / Explaining the effect of increase in government spending and a decrease in taxes on the shifting of the IS curve:

* Government spending increase: $\Delta G = 40$ DZD

An increase in G causes the IS curve to shift to the right as a result of an increase in equilibrium income by: $\Delta y = K_G \Delta G$

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

$$\Delta y_{IS} = \frac{1}{0,4}(40) = 100 \Rightarrow y' = y_e + \Delta y_{IS} = 1725 + 100 = 1825$$

* Tax decrease: $\Delta Tx = -40$

A decrease in TX also causes the IS curve to shift to the right as a result of increasing equilibrium income by:

$$\Delta y = K_{Tx} \Delta Tx$$

$$K_{Tx} = \frac{-b}{1-b+bt}$$

$$\Delta y = \frac{-b}{1-b+bt}(-40)$$

$$\Delta y_{IS}` = \frac{-0,8}{0,4}(-40) = 80$$

$$y`` = y_e + \Delta y_{IS}` = 1725 + 80 = 1805$$

It can be said that both the policy of increasing government spending and reducing taxes lead to an increase in income, but not by the same amount because the effect of the government spending multiplier outweighs the effect of the tax multiplier.

3/ Calculate the new general equilibrium after increasing G by $\Delta G = 40$

A- Calculating the new IS equation:

$y_{IS}` = y_{IS} + \Delta y_{IS}$

$y_{IS}` = 1875\text{-}1000i + 100$

$y_{IS}` = 1975\text{-}1000i$

B- General Equilibrium:

$y_{IS}` = 1975\text{-}1000i$

$y_{LM} = 1500 + 1500i$

$475 = 2500i$

$i_e` = 0.19$

$y_e` = 1785$

$\Delta y_{ISLM} = y_e` - y_e = 1785\text{-}1725 = 60$

We notice that $\Delta Y_{IS} > \Delta Y_{ISLM}$ (100> 60) and this is due to the effect of crowding out: the effect of investment crowding out means the decrease in the effect of the fiscal policy variables (government spending, taxes) on income as a result of the effect of the interest rate on investment: the increase in government spending caused an increase in income by the value of ΔY_{IS}=100, while the rise in the interest rate from 0.15 to 0.19 upon the occurrence of the new general

equilibrium led to a decline in investment, which led to a decline in income, achieving $\Delta Y_{ISLM} = 60$ only (i.e. the effect of income-stimulating by government spending was restrained).

Exercise 04:

First :

1 / The IS equation: $y = D = C + I + G + X - Z$

$$y = \frac{C_0 - bTx_0 + bTr_0 + I_0 + G_0 + X_0 - Z_0}{1 - b + bt + z} - \frac{g}{1 + b + bt + z}\, i$$

$$y = \frac{2000 - 0{,}75\,(4500) + 0{,}75\,(6500) + 4500 + 1000 + 4000 - 3000}{1 - 0{,}75 + 0{,}75\,(0{,}2) + 0{,}1} - \frac{2000}{0{,}5}\, i$$

$$y = \frac{10000}{0{,}5} - \frac{2000}{0{,}5}\, i \quad \Longrightarrow \quad y_{IS} = 20000 - 4000\, i \quad \ldots\ldots\ldots IS$$

2 / LM equation:

* Demand for money for speculation: Ma = 9000 - 500i because it shows the existence of an inverse relationship between the demand for money and the interest rate.

* Demand for money for transactions and reserves: Mt = 7000 + 0,5 y because it shows the existence of a positive relationship between the demand for money and income.

* LM equation: $M_s = M_0 \Leftrightarrow M_0 = M_t + M_a$

$$y = \frac{M_0 - L_0}{K} + \frac{m}{k}\, i$$

$$y = \frac{21000 - (7000 + 9000)}{0{,}5} + \frac{500}{0{,}5}\, i$$

$$Y = \frac{5000}{0{,}5} + \frac{500}{0{,}5}\, i \quad \Rightarrow \quad Y_{LM} = 10000 + 1000\, i \quad \ldots\ldots LM$$

3 / Equilibrium income and interest rate: IS = LM

$y_{IS} = 20000 - 4000\, i$

$y_{LM} = 10000 + 1000\, i$

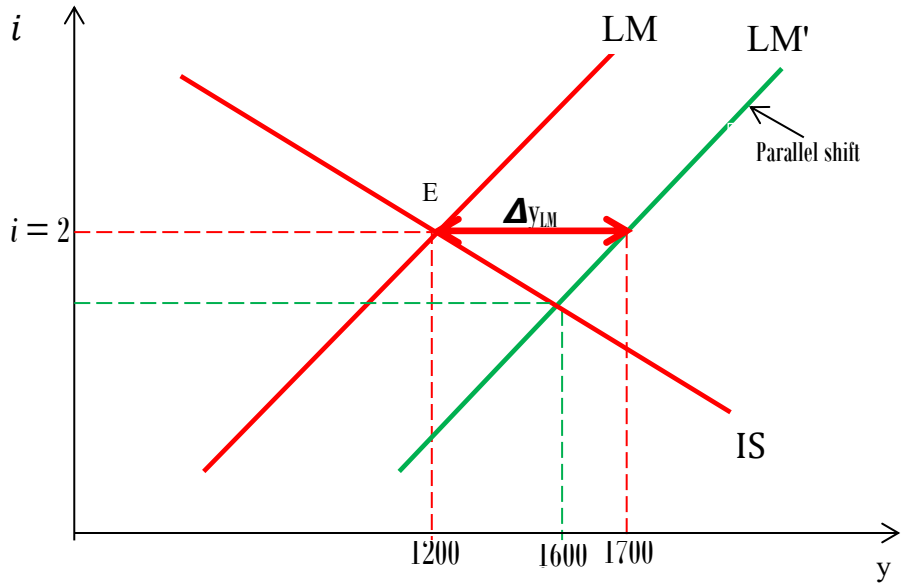
$$0 = 10000 - 5000\, i \Rightarrow i = \frac{10000}{5000} = 2$$

$y = 20000 - 4000\,(2) = 12000$

$y = 10000 + 1000\,(2) = 12000$

$y_e = 12000 \qquad i_e = 20\%$

Graphic representation:



2-c/ Consumption and investment levels corresponding to equilibrium income:

C = 2000 + 0,75 yd

yd = y – Tx + Tr = 12000 – (4500 + 0,2 (12000)) + 6500 $\quad Tx_e$ = 6900 DZD

yd = 12000 – 6900 + 6500 = 11600 $\quad yd_e$ = 11600 DZD

C = 2000 + 0,75 (11600) = 10700 $\quad C_e$ = 10700 DZD

I = 4500 – 2000 (2) = 500 $\quad I_e$ = 500 DZD

Second: Ms = 23500

1 / Determine the direction and amount of transition in both IS and LM:

An increase in the money supply affects only the LM curve and the IS curve is unaffected.

The LM curve shifts to the right by $\Delta y = k_M \,.\, \Delta M$

The money multiplier equals: $k_M = \frac{1}{K}$

$$\Delta y = \frac{1}{0{,}5}(23500 - 21000) \implies \Delta y_{LM} = 5000 \text{ DZD}$$

$$y' = y_e + \Delta y_{LM} = 12000 + 5000 = 17000$$

2 / The effect of increasing money supply on the general equilibrium (equilibrium income and interest rate)

* Calculating **y_e and i_e**

The IS equation does not change $\quad y_{IS} = 20000 - 4000\, i$

LM equation (DEDUCED) $\quad y_{LM} = 10000 + 1000\, i$

$Y`_{LM} = Y_{LM} + \Delta Y_{LM} \implies Y`_{LM} = 10000 + 1000\, i + 5000$

$Y`_{LM} = 15000 + 1000\ i$

$Y_{IS} - Y`_{LM} \Leftrightarrow \quad y = 20000 - 4000\ i$

$-\ y = 15000 + 1000\ i$

$0 = 5000 - 5000\ i \Rightarrow \quad i = 1$

$y = 20000 - 4000\ (1) = 16000$

$i_e` = 1 \qquad y_e` = 16000$ dzd

Graphic illustration: (see previous graph)

3 / Effect of Ms increase on C and I:

As y rises and i decreases, both C and I will increase:

$C' = 2000 + 0{,}75\ (y - Tx + Tr) = 2000 + 0{,}75\ (y - (Tx_0 + ty) + Tr)$

$C' = 2000 + 0{,}75\ [16000 - (4500 + 0{,}2\ (16000)\ ) + 6500]$

$C' = 2000 + 0{,}75\ (16000 - 7700 + 6500) = 2000 + 0{,}75\ (14800) =$ 13100 DZD

$I' = 4500 - 2000\ (1) =$ 2500 DZD

Exercise 5:

1) A-Calculating the equilibrium income using the <u>resource/expenditure method</u>:

The equilibrium is achieved if the following condition is met: Total resources= Total expenditures

$$S + T_x = I + G + T_r$$
$$-C_0 + (1-b)\ yd + T_{x_0} = I_0 + G_0 + T_{r_0}$$
$$-C_0 + (1-b)(y - T_{x_0} + T_{r_0}) + T_{x_0} = I_0 + G_0 + T_{r_0}$$
$$y - by = C_0 - bT_{x_0} + bT_{r_0} + I_0 + G_0$$
$$y_e = \frac{1}{1-b}\ (C_0 - bT_{x_0} + bT_{r_0} + I_0 + G_0)$$
$$y_e = \frac{1}{(1-07)}\ (2000 - 0{,}7\ (1500) + 0{,}7\ (200) + 1110 + 800)$$

Ye =10 000 DZD

2) Calculating the budget: $GB = Tx - (G + Tr)$

$500 = 1500 - (200 + 800) = 500$ DZD

There is a surplus in the budget because revenues (resources) outweigh expenses.

3) Computing Δy when $\Delta G = 300$

$$K_G = \frac{\Delta y}{\Delta G} = \frac{1}{1-b}$$
$$\Delta y = \frac{1}{1-b}\ .\Delta G \ \Rightarrow\ \Delta y = \frac{1}{1-0{,}7}(300) = 1000$$

The increase in government spending by 300 leads to an increase in income by 1,000 DZD, so the new equilibrium income becomes $y_2 = y_1 + \Delta y = 11000$

4) Calculating ΔY when ΔG=ΔTx= 300

$$\Delta y = K_G.\Delta G + K_{T_x}\Delta T_x$$
$$\Delta y = \frac{1}{1-b}.\Delta G_0 - \frac{b}{1-b}.\Delta T_{x_0}$$
$$\Delta y = \frac{1}{1-0,7}\ 300\ - \frac{0,7}{1-0,7}.300$$
$$\Delta y = 300$$

We note that Δy = ΔG = ΔTx, that is, income increased by the value of one of the changes in government spending or in taxes, this effect is called **the effect of the balanced budget multiplier**, where this multiplier will be equal to the multiplier in three sectors model (independent tax) $K_b = \frac{\Delta y}{\Delta G} = \frac{\Delta y}{\Delta T_x} = 1$

The budget was not affected by this change in government expenditures and taxes because the increase in expenditures correspond to the increase in revenues

5) If transfers and taxes raise by an equal amount of 30, what is the effect on the equilibrium income?

Calculating Δy knowing that: ΔTx = ΔTr=30

$$\Delta y = K_{T_x}.\Delta T_x + KT_r.\Delta T_r$$
$$\Delta y = \frac{-b}{1-b}\ \Delta T_x + \frac{b}{1-b}\ \Delta T_r$$
$$\Delta y = 0$$

We note that there is **no change in income** because the change in taxes cancels out the same effect of the change in transfers.

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